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17 MONSANTO COMPANY

18 **SUPERIOR COURT OF THE STATE OF CALIFORNIA**

19 **COUNTY OF SAN FRANCISCO**

20 DEWAYNE JOHNSON,

Case No. CGC-16-550128

21 Plaintiff,

Exhibit 1012, Part 2 of 2

22 vs.

**AFFIDAVIT AND SWORN REPORT OF
SYLVIA D. HALL-ELLIS, Ph.D.**

23 MONSANTO COMPANY,

24 Defendant.

Trial Date: June 18, 2018
Time: 9:30 a.m.
Department: 504

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ELECTRONICALLY
FILED
*Superior Court of California,
County of San Francisco*
06/19/2018
Clerk of the Court
BY:RONNIE OTERO
Deputy Clerk

Exhibit 1012 – Part 2 of 2

Table X.2 Fate and Behaviour of Glyphosate, its Transformation Product AMPA and the Formulant POEA in the Aquatic Environment

Property	Test Substance	Material	D ₁₀ (Days)	D ₅₀ (Days)	Rep _{t_{1/2}} (Days)	Kinetic Models	Transf. Prod.	Comments ¹
Hydrolysis	Glyphosate	Sterile water, pH 5 Sterile water, pH 7 Sterile water, pH 9	> 30.0 1627.0 3476.0	NR NR NR	NR SFO SFO	None None None	None	Stable, not a major route of transformation
	AMPA	NR	NR	Assumed to be stable based on the hydrolysis of the parent glyphosate.				
	POEA	Sterile Clam lake, water system, WI, USA, pH 4.6 Sterile Balmor Farm, water system, MO, USA, pH 7.4 Sterile Mississippi river water system, MO, USA, pH 5.7	< 21-28.0 < 21-28.0 < 21-28.0	NR NR NR	NR NR NR	NR NR NR	NR NR NR	Slightly persistent
Phototransformation in Water	Glyphosate	Water pH 7.5 at 22°C	216.0	NR	NR	SFO	AMPA	Not a major route of transformation in the environment
	AMPA	Water pH 7.3	NR	AMPA accumulated in irradiated samples until study termination which would suggest that it is not subject to phototransformation				
		Water pH 7.0	NR					
Aerobic Aquatic Biotransformation	Glyphosate	Silty clay loam, pH 6.6, O.M. 0.9%	7.1	90.8	27.3	IORE	AMPA	Non-persistent
		Sandy sediment, pH 7.8, O.M. 1.17%	18.7	533	267	DFOP	AMPA	Slightly persistent
		Loamy sediment, pH 7.7, O.M. 7.24%	135.0	1339	518	DFOP	AMPA	Moderately persistent
	AMPA	Water compartment Whole system	1-4 27-146	N/A N/A	N/A N/A	N/A N/A	NR	Non-persistent Slight to moder persistent
		Silty clay loam, pH 6.6, O.M. 0.9%	83.4	277.0	83.4	SFO	CO ₂	Moderately persistent
		Sandy sediment system, pH 7.8, O.M. 1.17%	32.0	72.3	21.8	IORE	Unknown	Slightly persistent
		Loamy sediment II system, pH 7.7, O.M. 7.24%	10.0	33.1	10.0	SFO	Unknown	Slightly persistent

Property	Test Substance	Material	DT ₅₀ (Days)	DT ₉₀ (Days)	Rep. t _{1/2} (Days)	Kinetic Models	Transf. Prod.	Comments
		Water compartment Whole system	2-5.0 19-45.0	NR NR	NR NR	NR NR	NR NR	Non-persistent Non-persistent Slightly persistent
		Clam lake, water system, WI, USA, pH 4.6 Balmor Farm, water system, MO, USA, pH 7.4 Mississippi river water system, MO, USA, pH 5.7	< 21- 28.0 < 21- 28.0 < 21- 28.0	NR NR NR	NR NR NR	NR NR NR	NR NR NR	Slightly persistent
	POEA	Missouri sandy clay loam water/sediment system, pH 7.3, O.M. 1.4%	< 28.0	NR	NR	NR	AMPA	Slightly persistent
Anaerobic Aquatic Biotransformation	Glyphosate	Kentucky pond, silty clay loam water/sediment system, pH 6.6, O.M. 0.9%	7.0	569	273	DFOP	AMPA	Non-persistent
		Ohio clay loam water/sediment system, pH 7.7, O.M. 3.4%	209.0	NR	NR	SFO	AMPA	Persistent
		Ohio pond clay loam water/sediment system, pH 7.7, O.M. 3.4%	199.0	NR	NR	NR	AMPA	Persistent
		Ephemeral wetland , Brandon, Canada, pH 7 Semi permanent wetland, Brandon, Canada, pH 7.9	1.3 4.8	NR NR	NR NR	SFO SFO	AMPA AMPA	Non-persistent in water Non-persistent in water
Agricultural Aquatic Field Dissipation Studies (Equivalent Canadian Ecoregion)	Glyphosate	Chassell, pond water and sediment, MI, USA	7-14.0	NR	NR	SFO	NR	Non-persistent in water, declining in sediment after 30 days but still detected at 335 days
	AMPA	Mesocosm Shallow water, Manitoba, Canada, pH 4.7-8.1, TOC 1.9-7.5% Sediment, Manitoba, Canada, pH 4.7-8.1, TOC 1.9-7.5%	0.04- 0.7 8.5-9.6	NR NR	NR NR	SFO SFO	NR NR	Non-persistent in water Non-persistent in sediment
	POEA	Hike pond water, Winnipeg, Canada, pH 7.7 Spruce pond water, Winnipeg, Canada, pH 8.1 Birch pond water, Winnipeg, Canada, pH 7.2	1.9 3.5 1.5	NR NR NR	NR NR NR	SFO SFO SFO	AMPA AMPA AMPA	Non-persistent in water
Forestal Aquatic Field Dissipation Studies	Glyphosate							

Property	Test Substance	Material	DT ₅₀ (Days)	DT ₅₀ (Days)	Rep t _{1/2} (Days)	Kinetic Models	Transf. Prod.	Comments
(Equivalent Canadian Ecoregion)		Manfor pond water, Winnipeg, Canada, pH 7.0	2.0	NR	NR	SFO	AMPA	
		Microcosm tested water, Winnipeg, Canada	5.8	NR	NR	SFO	NR	
		Hike pond water, Winnipeg, Canada, pH 8.1	3.5	NR	NR	SFO	AMPA	
		Spruce pond water, Winnipeg, Canada, pH 8.2	10.0	NR	NR	SFO	AMPA	Non-persistent in water
		Tamarack pond water, Winnipeg, Canada, pH 7.9	11.2	NR	NR	SFO	AMPA	
		Flowing stream system, Chassell, MI, USA	< 7.0	NR	NR	NR	AMPA	Non-persistent in water
		Non-flowing pond system, Chassell, MI, USA	< 7.0	NR	NR	NR	AMPA	Non-persistent in water, present in sediment after 1 yr
Foreign Agricultural Aquatic Field Dissipation Studies (Non-Equivalent Canadian Ecoregion)	Glyphosate	Clarence water, MO, USA	7.5	NR	NR	SFO	AMPA	Non-persistent in water
		Clarence sediment, MO, USA	120	NR	NR	SFO	AMPA	Moderately persistent in sediment
	AMPA	Clarence farm pond, MO, USA	7-14	NR	NR	NR	NR	
		Cuthbert pond, GA, USA	7-14	NR	NR	NR	NR	
		Ephrata irrigation ditch, WA, USA	7-14	NR	NR	NR	NR	Non-persistent in water
	POEA	Microcosm Water/sediment system A, MO, USA, pH 8.3, TOC 1.5%	0.5	NR	NR	SFO	NR	
		Water/sediment system B, MO, USA, pH 8.3, TOC 3.0%	0.8	NR	NR	SFO	NR	Non-persistent in water
Foreign Forestal Aquatic Field Dissipation Studies (Non-Equivalent Canadian Ecoregion)	Glyphosate	Corvallis Stream and pond water, OR, USA	≤ 0.4- < 7.0	NR	NR	SFO	AMPA	
		Cuthbert Stream and pond water, GA, USA	≤ 0.4- < 7.0	NR	NR	SFO	AMPA	Non-persistent in water
	AMPA	Corvallis forest pond, OR, USA	7-14	NR	NR	NR	NR	Non-persistent in water
Bioaccumulation	Glyphosate	Log K _{ow} -2.8 to -0.67						Not expected to bioaccumulate

Property	Test Substance	Material	DT ₅₀ (Days)	DT ₅₀ (Days)	Rep. t _{1/2} (Days)	Kinetic Models	Transf. Prod.	Comments
	AMPA	BAF:0.03-42.3 Log K _{ow} : -2.36to -1.61						Not expected to bioaccumulate
	POEA	Log K _{ow} : 2.2-5.89 BAF of 150 mL/kg						Due to their nature, POEA compounds (a complex mixture of as many as 100 discrete tertiary amine molecules) may have the potential for bioaccumulation. Log K _{ow} and BAF were obtained from the BCF/BAF v 3.0 model of EPIWIN v. 4.0. However, given that the components of these compounds are easily broken down and that it is not persistent in soil and water, significant bioaccumulation under field conditions is unlikely. POEA does not meet Track-1 criteria.

= Persistence classification of pesticides in soil according to Goring et al. (1975), Persistence classification of pesticides in water according to McEwen and Stephensen (1979), Adsorption/desorption mobility class according to McCall et al. (1981), TLC mobility class according to Helling and Turner (1968), Leaching potential based on the criteria of Cohen et al. (1984), and Ground Ubiquity Score (GUS) based on Gustafson (1989).

Table X.3 Estimated Environmental Concentrations Based on Crop and Maximum Application Rates of Canadian Registered Products Containing Glyphosate

Crop	Rate of Application (g AMPA/ha) ^a	Application Type	Interval Between Application	Soil DT ₅₀ (Days)	EEC Soil at 15 cm Depth (mg a.e./kg soil)	Refined EEC Soil at 15 cm Depth with Drift (mg a.e./kg soil)
Apple	4320 + 4320 + 3960	Ground	14	32.6	4.24	0.13 (3% drift)
Canola	4320 + 4320 + 902	Ground	10	32.6	3.47	0.10 (3% drift)
Canola	4320 + 4320 + 902	Aerial	10	32.6	3.47	0.59 (17% drift)
Corn	4320 + 4320 + 903 + 903	Ground	14	32.6	3.35	0.10 (3% drift)
Potato	4320	Ground	—	32.6	1.92	0.06 (3% drift)

Table X.4 Maximum Estimated Environmental Concentrations in Vegetation and Insects after Direct Coarse Droplet Applications of Glyphosate at Maximum Rates on Apples ($2 \times 4320 \text{ g ae/ha} + 1 \times 3960 \text{ g ae/ha}$ at 14-day Intervals and a 14.4 day Foliar DT₅₀)

Matrix	EEC (mg a.c./kg fw) ¹	Fresh/Dry Weight ratios	EEC (mg a.e./kg dw)
Short range grass	1559	3.3 ²	5144.79
Long grass	714	4.4 ²	3141.30
Broadleaf plants	881	5.4 ²	4760.04
Pods with seeds	95	3.9 ³	369.35
Insects	612	3.8 ³	2325.38
Grain and seeds	95	3.8 ³	359.88
Fruit	95	7.6 ³	719.76

¹ Based on correlations reported in Hoerger and Kenaga (1972) and Kenaga (1973).

² Fresh/dry weight ratios from Harris (1975).

³ Fresh/dry weight ratios from Spector (1956).

Table X.5 Refined Estimated Environmental Concentrations in Vegetation and Insects after Direct Coarse Droplet Applications of Glyphosate at Maximum Rates on Apples ($2 \times 4320 \text{ g ae/ha} + 1 \times 3960 \text{ g ae/ha}$ at 14-day Intervals, 14.4 day Foliar DT₅₀ and 3% drift)

Matrix	EEC (mg a.i/kg fw)	Fresh/Dry Weight Ratios	EEC (mg a.i./kg dw)
Short range grass	47	3.3 ²	154.34
Long grass	21	4.4 ²	94.24
Broadleaf plants	26	5.4 ²	142.80
Pods with seeds	3	3.9 ³	11.08
Insects	18	3.8 ³	69.7
Grain and seeds	3	3.8 ³	10.80
Fruit	3	7.6 ³	21.59

¹ Based on correlations reported in Hoerger and Kenaga (1972) and Kenaga (1973).

² Fresh/dry weight ratios from Harris (1975).

³ Fresh/dry weight ratios from Spector (1956).

Table X.6 The Estimated Environmental Concentration of Glyphosate in Water (mg a.e./L) at 15 and 80 cm Depth as a Result of Direct Application from Uses on Various Crops

Crop	Rate of Application (g a.e./ha)	Interval Between Application	Aerobic Water DT ₅₀ (Days)	Maximum Cumulative Application Rate (g a.e./ha)	EEC in 15 cm Water Depth (mg a.e./L)	EEC in 80 cm Water Depth (mg a.e./L)
Apple	4320 + 4320 + 3960	14	413.6	12302	8.2	1.5
Canola	4320 + 4320 + 902	10	413.6	9328	6.2	1.2
Corn	4320 + 4320 + 903 + 903	14	413.6	9934	6.6	1.2
Potato	4320	—	413.6	4320	2.9	0.5

Table X.7 Refined Estimated Environmental Concentration of Glyphosate in Water (mg a.e./L) at 15 and 80 cm Depth as a Result of Direct Application from Uses on Various Crops

Crop	Rate of Application (g a.e./ha)	Application Type	EEC in 15 cm Water Depth (mg a.e./L)	EEC in 80 cm Water Depth (mg a.e./L)	Refined EEC in 15 cm Water Depth (mg a.e./L)	Refined EEC in 80 cm Water Depth (mg a.e./L)
Apple	4320 + 4320 + 3960 at 14-day intervals	Groundboom (3%)	8.20	1.54	0.25	0.05
Canola	4320 + 4320 + 902 at 10-day intervals	Groundboom (3%)	6.22	1.17	0.19	0.03
Canola	4320 + 4320 + 902 at 10-day intervals	Aerial (17%)	6.22	1.17	1.06	0.20
Corn	4320 + 4320 + 903 + 903 at 14-day intervals	Groundboom (3%)	6.62	1.24	0.20	0.04
Potato	4320	Groundboom (3%)	2.88	0.54	0.09	0.02

Table X.8 Toxicity Values of Glyphosate Technical, Glyphosate Formulations and the Transformation Product AMPA to Earthworms and the Collembolan *Folsomia candida*

Species Name or Taxon	Formulation Type	Reported Endpoint	Value	Comment	Degree of Toxicity
Acute Toxicity					
Glyphosate Technical					
Earthworm <i>Eisenia foetida</i>	Glyphosate Technical (98.7%)	LC ₅₀	> 1000 mg a.e./kg soil	NR	NA
	Glyphosate (N-(phosphonomethyl)-glycine	LC ₅₀	> 480 mg a.e./kg soil	NR	NA
	Glyphosate Technical 95%	48-hr LD ₅₀ 7-d LC ₅₀ 14-d LC ₅₀	566.1 µg a.e./cm ² 345.8 mg a.e./kg soil 327.8 mg a.e./kg soil	(Filter paper test) (Soil toxicity test) (Soil toxicity test)	Moderately toxic ¹
	Technical Grade	48-hr LC ₅₀	> 2000 mg a.e./kg soil	Highest test concentration	NA
Glyphosate Formulation (With POEA)					
Collembola <i>Folsomia candida</i>	Montana® (30.8)	48-hr EC ₅₀	1.13 mg a.e./kg soil	Mortality	NA
Earthworm <i>Eisenia foetida</i>	MON 78568, monoammonium salt	14-d LD ₅₀	> 4257 mg a.e./kg soil	NR	NA
	MON 0139 (Glyphosate IPA salt)	28-d LC ₅₀	>28.79 mg EUP/kg soil >21.3 mg a.e./kg soil	No effect on adult survival at highest test concentration.	NA
Earthworm <i>Eisenia andrei</i>	Roundup® FG	28-d LC ₅₀	> 1.440 kg EUP/ha > 1.066 kg a.e./ha >0.47 mg a.e./kg soil ²	Adult survival. No mortality at tested rate of application.	NA

Species Name or Taxon	Formulation Type	Reported Endpoint	Value	Comment	Degree of Toxicity
Glyphosate Formulation (POEA Unknown)					
Earthworm <i>Eisenia foetida</i>	Glyphosate (360 g/L) IPA salt	14-d LC ₅₀	> 1000 mg a.e./kg soil	7% mortality at highest test concentration.	NA
	YF 11087 – Glyphosate-potassium salt (513 g a.e./L)	14-d LC ₅₀ NOEC:	> 1000 mg a.e./kg soil 1000 mg a.e./kg soil	NOEC based on highest test concentration.	NA
Transformation Product AMPA					
Earthworm <i>Eisenia andrei</i>	AMPA	14-d LC ₅₀ 14-d EC ₅₀ 14-d NOEC	> 1000 mg/kg soil > 1000 mg/kg soil 100 mg/kg soil	Effect on biomass at the highest test concentration.	NA
Acute Avoidance					
Glyphosate Technical					
Earthworm <i>Eisenia andrei</i>	Glyphosate IPA	48-hr AC ₅₀	>8.49 kg a.e./ha or >46.7 mg a.e./kg soil	No avoidance effect at highest test concentration.	NA
Earthworm <i>Eisenia andrei</i>	Spasor® IPA salt 41.5% and 165 surfactant	48-hr AC ₅₀	>120 mg a.e./kg soil >10.9 kg a.e./ha	NR	NA
Reproduction					
Glyphosate Formulation (With-POEA)					
Collembola <i>Folsomia candida</i>	Montana® (30.8)	28-d EC ₅₀	0.54 mg a.e./kg soil	Reproduction	NA
Earthworm <i>Eisenia andrei</i>	Montana® (30.8)	56-d LC ₅₀	Not determined	Significant increase of juveniles in 50% dilution test (around 0.41 mg a.e./kg soil).	NA
	Roundup® FG	56-d LC ₅₀	> 1.440 kg EUP/ha > 1.066 kg a.e./ha > 0.47 mg a.e./kg soil ²	Effect on hatchability: 41% of control at tested rate of application. NOEC not reported.	NA

Species Name or Taxon	Formulation Type	Reported Endpoint	Value	Comment	Degree of Toxicity
Earthworm <i>Eisenia foetida</i>	MON 0139 (Glyphosate IPA salt)	56-d NOEC	28.79 mg EUP/kg soil 21.3 mg a.e./kg soil or 30240 g a.e./ha	No effect on reproduction at highest test concentration.	NA
Transformation product AMPA					
Earthworm <i>Eisenia foetida</i>	AMPA (99.1%)	56-d NOEC	28.12 mg/kg soil	No effect on reproduction at high test concentration.	NA

1 = The 48-hr filter paper test toxicity is based on the classification of Roberts and Durrough (1983).

2 = Calculated by the PMRA, where endpoint value = 1 067 000 mg a.e./ha / (0.15 m [soil depth] × 100 m × 100 m × 1500 kg/m³ [soil bulk density]).

ND = Not detected.

NR = Not reported.

NA = Not available.

End-points in bold are to be used in risk assessment.

Table X.9 Toxicity Values of Glyphosate Technical and its Formulations to Honeybees

Formulation Type	Reported Endpoint	Toxicity Value	Degree of Toxicity
Acute Oral			
Glyphosate Technical			
Glyphosate Technical (98.5%)	48-hr LD ₅₀	> 100 µg/bee	Relatively non-toxic
Glyphosate Technical (98.5%)	LD ₅₀ NOEL	> 182 µg ae/bee 182 µg ae/bee (highest concentration tested)	Relatively non-toxic
CP67573 Technical	LD ₅₀	> 100 µg ae/bee	Relatively non-toxic
Glyphosate Formulation (With POEA)			
Glyphosate IPA salt, MON 2139 (36%)	LD ₅₀	> 100 µg/bee	Relatively non-toxic
MON 77360 (30% w/w glyphosate a.e.)	LD ₅₀ NOEL	> 30 µg ae/bee (> 100 µg EUP/bee) 15 µg ae/bee	Relatively non-toxic
MON 78568 monoammonium salt (65.6% a.e.)	LD ₅₀ NOEL	> 100 µg /bee 100 µg ae/bee	Relatively non-toxic
MON 2139 (36% a.e.)	LD ₅₀	> 100 µg a.e./bee	Relatively non-toxic

Formulation Type	Reported Endpoint	Toxicity Value	Degree of toxicity ¹
Glyphosate Formulation (POEA Unknown)			
Glyphosate 360 g/L	LD ₅₀ NOEL	> 86.3 µg ae/bee (> 317 µg EUP/bee) 86.3 µg ae/bee (317 µg EUP/bee) (high concentration tested)	Relatively non-toxic
Acute Contact			
Glyphosate Technical			
Glyphosate Technical (97.6%)	48-hr LD ₅₀	> 100 µg/bee	Relatively non-toxic
Glyphosate Technical (98.5%)	LD ₅₀ NOEL	> 182 µg ae/bee 182 µg ae/bee (highest concentration tested)	Relatively non-toxic
CP67573 Technical	LD ₅₀	> 100 µg ae/bee	Relatively non-toxic
Glyphosate Formulation (With POEA)			
Glyphosate IPA salt, MON 2139 (36%)	LD ₅₀	> 100 µg/bee	Relatively non-toxic
MON 77360 (30% w/w glyphosate a.e.)	LD ₅₀ NOEL	> 30 µg ae/bee (> 100 µg EUP/bee) 30 µg ae/bee (highest concentration tested)	Relatively non-toxic
MON 78568 monoammonium salt (65.6% a.e.)	LD ₅₀ NOEL	> 76.23 µg /bee 76.23 µg ae/bee (highest concentration tested)	Relatively non-toxic
MON 6500 (31.32% a.e.)	48-hr LD ₅₀ NOAEL	> 31.3 µg ae/bee 31.3 µg ae/bee ² (highest concentration tested)	Relatively non-toxic
MON 2139 (36% a.e.)	LD ₅₀	> 100 µg a.e./bee	Relatively non-toxic
Glyphosate Formulation (POEA Unknown)			
Glyphosate 360 g/L	LD ₅₀ NOEL	> 116 µg ae/bee (> 426 µg EUP/bee) 116.3 µg ae/bee (426 µg EUP/bee) (highest concentration tested)	Relatively non-toxic

¹ = Acute and oral toxicity classification based on Atkins et al. 1981.

² This value was reported as 319 µg ae/bee, which has been deemed to be a typo. No effects were observed up to 100 µg EUP/bee, corresponding to 31.3 µg ae/bee based on the purity of 31.32%.

Table X.10 Toxicity Values of Glyphosate Technical and its Formulations to Beneficial Insects

Species Name or Taxon	Formulation Type	Exposure	Reported Endpoint	Toxicity Value	Measurement Endpoint
Glyphosate Technical					
Western bigeyed bug, <i>Geocoris pallens</i>	Glyphosate NOS	Leaf substrate at rates up to 6.7 kg/ha	LD ₅₀	280 g a.e./ha (Duration and routes of exposure are unclear) ¹ ; dose-response increases in survival and also in egg viability compared to controls	Mortality, fecundity
Glyphosate Formulation (WITH POEA)					
Predatory mite, <i>Typhlodromus pyri</i>	MON 78568, monomammonium salt	Glass plates	7-d LR ₅₀	1200 g a.e./ha; NOAER: 216 g a.e./ha	Mortality, fecundity
		Leaf substrate	7-d LR ₅₀ NOAER	> 4320 g a.e./ha; 216 g a.e./ha	Mortality, fecundity
Parasitic wasp, <i>Aphidius rhopalosiphi</i>	MON 78568, monomammonium salt	Glass plates	48-hr LR ₅₀ 13-d LR ₅₀ NOAER:	> 108 g a.e./ha > 4320 g a.e./ha 4320 g a.e./ha	Mortality, fecundity
		Leaf substrate	48-hr LR ₅₀ 13-d LR ₅₀ NOAER:	> 4320 g a.e./ha > 4320 g a.e./ha; 4320 g a.e./ha	Mortality, fecundity
Lacewing, <i>Chrysoperla carnea</i>	MON 78568, monomammonium salt	Glass plates	10-d LR ₅₀	> 4320 g a.e./ha; NOAER: 4320 g a.e./ha	Mortality, fecundity
Predatory mite, <i>Euseius victoriensis</i>	Roundup (360 g/L)	Leaf substrate	48-h and 7-d	At 787 g a.i./ha, 2-3% mortality between 48-h and 7-d; fecundity reduced by 15.5%	Mortality and fecundity
Glyphosate formulation (POEA UNKNOWN)					
Predatory mite, <i>Typhlodromus pyri</i>	Glyphosate 360 g/L, SL di-ammonium salt	Glass plates	7-d LR ₅₀ NOER	161.9 g a.e./ha 120 g a.e./ha (fecundity)	Mortality, fecundity
		Leaf substrate	7-d LR ₅₀ NOER	1567 g a.e./ha; 720 g a.e./ha	Mortality, fecundity
Parasitic wasp, <i>Aphidius rhopalosiphi</i>	Glyphosate 360 g/L, SL di-ammonium salt	Glass plates	48-hr LR ₅₀ NOER	2267 g a.e./ha < 598 g a.e./ha	Mortality, fecundity
		Leaf substrate	48-hr LR ₅₀ NOER	> 5976 g a.e./ha 5976 g a.e./ha	Mortality, fecundity
Hoverfly, <i>Episyrrhus balteatus</i>	Glyphosate 360 g/L, SL di-ammonium salt	Leaf substrate	48-hr LR ₅₀ NOER	> 5976 g a.e./ha 5976 g a.e./ha	Mortality, fecundity

Species Name or Taxon	Formulation Type	Exposure	Reported Endpoint	Toxicity Value	Measurement Endpoint
Lacewing, <i>Chrysoperla carnea</i>	Glyphosate 360 g/L, di-ammonium salt	Glass plates	48-hr LR ₅₀ NOER	> 5976 g a.e./ha 5976 g a.e./ha	Mortality, fecundity
Carabid beetle, <i>Poecilus cupreus</i>	Glyphosate 360 g/L, di-ammonium salt	Soil substrate	7-d LR ₅₀ NOER =	> 2988 g a.e./ha 2988 g a.e./ha	Mortality, prey consumption
Staphylinid beetle, <i>Aleochara bilineata</i> ,	Glyphosate 360 g/L, di-ammonium salt	Soil substrate	28-d NOER	5976 g a.e./ha (highest rate tested)	Reproduction

¹The duration of exposure is not clear and the nature of the exposure appears to be a combination of contact and oral. The results of this study are not particularly useful.

Table X.11 Toxicity Values of Glyphosate Technical and its Formulations to Birds

Species Name or Taxon	Formulation Type	Reported Endpoint	Toxicity Value	Degree of Toxicity ¹
Acute Oral				
Glyphosate Technical				
Bobwhite quail, <i>Colinus virginianus</i>	Glyphosate acid (95.6%)	LD ₅₀ NOEL	> 1912 mg a.e./kg bw 1912 mg a.e./kg bw (highest concentration tested)	Practically non-toxic
Bobwhite quail, <i>Colinus virginianus</i>	Glyphosate technical (97.5%)	LD ₅₀	> 2000 mg/kg bw	Practically non-toxic
Bobwhite quail, <i>Colinus virginianus</i>	Glyphosate technical	LD ₅₀	> 3196.3 mg a.e./kg bw	Practically non-toxic
Mallard duck, <i>Anas platyrhynchos</i>	Glyphosate technical (97.5%)	LD ₅₀ NOEL	> 2000 mg ae/kg bw 2000 mg a.e./kg bw (highest concentration tested)	Practically non-toxic
Canary, <i>Serinus canaria</i>	Glyphosate (acid, 96.3%)	LD ₅₀ NOAEL ED ₅₀	> 2000 mg a.e./kg bw 1200 mg a.e./kg bw 2819 mg ae/kg bw (regurgitation)	Practically non-toxic

Species Name or Taxon	Formulation Type	Reported Endpoint	Toxicity Value	Degree of Toxicity ¹
Glyphosate Formulation (POEA Unknown)				
Bobwhite quail, <i>Colinus virginianus</i>	MON 58121 – no information on the glyphosate content in the formulation	LD ₅₀ NOEL NOEL	598 mg MON 58121/kg bw ³ 292 mg MON 58121/kg bw (mortality) < 175 mg MON 58121/kg bw (body weight and food consumption)	Formulation is slightly toxic.
Bobwhite quail, <i>Colinus virginianus</i>	Glyphosate monoammonium salt, 68.5% a.i. (MON 14420 formulation)	LD ₅₀ NOAEL	1131 mg a.e./kg bw (1651mg formulation/kg bw) 333 mg a.e./kg bw (effect not reported)	Formulation is slightly toxic.
AMPA				
Bobwhite quail, <i>Colinus virginianus</i>	AMPA, 87.8%	LD ₅₀ NOAEL	> 1976 mg/kg bw NOAEL: 1185 mg/kg bw	AMPA is not toxic up to the highest concentration tested.
Acute Dietary				
Glyphosate Technical				
Bobwhite quail, <i>Colinus virginianus</i>	Glyphosate acid (95.6%)	5-d LC ₅₀ NOEC =	>1743 mg a.e./kg bw/day 4860 mg a.e./kg diet (highest concentration tested)	Practically non-toxic
Bobwhite quail, <i>Colinus virginianus</i>	Glyphosate acid (95.6%)	LC ₅₀ NOAEC	>5200 mg/kg diet (nominal) (>4971.2 mg a.e./kg diet corrected for purity); equivalent to 5-d LD ₅₀ >528 mg a.e./kg bw/day ² 4971.2 mg a.e./kg diet	Practically non-toxic
Bobwhite quail, <i>Colinus virginianus</i>	Glyphosate (98.5%)	LC ₅₀ NOAEC	>4640 mg a.e./kg diet (>4570 mg a.e./kg diet corrected for purity); equivalent to 5-d LD ₅₀ >485 mg a.e./kg bw/day ² 4570 mg a.e./kg diet (highest concentration tested)	Not toxic up to highest concentration tested

Species Name or Taxon	Formulation Type	Reported Endpoint	Toxicity Value	Degree of Toxicity
Mallard duck, <i>Anas platyrhynchos</i>	Glyphosate acid (95.6%)	5-d LC ₅₀ NOEC	>5160 mg ae/kg diet based on measured concentrations (>4971 mg ae/kg diet based on nominal concentrations corrected for purity); equivalent to a 5-d LD ₅₀ >2580 mg ae/kg bw/day 5160 mg a.e./kg diet based on mean measured concentrations (highest concentration tested)	Practically non-toxic
Glyphosate Formulation (POEA Unknown)				
Bobwhite quail, <i>Colinus virginianus</i>	MON 58121 – no information glyphosate content in the formulation	LC ₅₀ NOEC =	>5620 mg MON 58121/kg diet ³ ; equivalent to >597 mg MON 58121/kg bw/day 3160 mg MON 58121/kg diet (body-weight gain)	Formulation is practically non-toxic
Bobwhite quail, <i>Colinus virginianus</i>	Glyphosate isopropylamine salt, 31.32% a.i. (MON65005)	LC ₅₀ NOAEC	>1760 mg a.e./kg bw; equivalent to LD ₅₀ >187 mg a.e./kg bw/day ² 1760 mg a.e./kg bw (highest concentration tested)	Formulation is not toxic up to the highest concentration tested
Mallard duck, <i>Anas platyrhynchos</i>	Glyphosate isopropylamine salt, 31.32% a.i. (MON65005)	LC ₅₀ NOAEC	>1760 mg a.e./kg bw; equivalent to LD ₅₀ >100 mg a.e./kg bw/day ² 1760 mg a.e./kg bw (highest concentration tested)	Formulation is not toxic up to the highest concentration tested
Glyphosate Formulation (With POEA) 21-day Dietary				
Chicken	Roundup	21-d NOEC	45% reduced body weight at 4500 mg a.e./kg diet compared to controls after 21-days of exposure. = 450 mg a.e./kg diet (body weight), reported to be equivalent to a 21-day dietary NOEL of approximately 43 mg a.e./kg bw/day based on a 9.5% consumption rate of body weight.	NR

Species Name or Taxon	Formulation Type	Reported Endpoint	Toxicity Value	Degree of Toxicity ¹		
AMPA						
Bobwhite quail, <i>Colinus virginianus</i>	AMPA, 87.8%	LC ₅₀ NOAEC	>4934 mg/kg bw 4934 mg/kg bw	AMPA is not toxic up to the highest concentration tested		
Mallard duck, <i>Anas platyrhynchos</i>	AMPA, 87.8%					
Reproduction						
Glyphosate Technical						
Bobwhite quail, <i>Colinus virginianus</i>	Glyphosate technical (83%)	NOEC	1000 mg a.e./kg diet (highest concentration tested) (830 mg a.e./kg diet corrected for purity); equivalent to NOEL = 88 mg a.e./kg bw/day ²	—		
Bobwhite quail, <i>Colinus virginianus</i>	Glyphosate acid (95.6%)	NOEC	2160 mg ae/kg diet (highest concentration tested); equivalent to NOEL = 198 mg ae/kg bw/day	—		
Mallard duck, <i>Anas platyrhynchos</i>	Glyphosate (acid, 95.6%)	NOEC	2160 mg a.e./kg diet (highest concentration tested); equivalent to NOEL of 291 mg a.e./kg bw/day	—		
Mallard duck, <i>Anas platyrhynchos</i>	Glyphosate (acid, 90.4%)	NOEC	30 mg a.e./kg diet (27 mg ae/kg diet corrected for purity) (highest concentration tested) equivalent to NOEL of 1.5 mg a.e./kg bw/day ²	—		
Mallard duck, <i>Anas platyrhynchos</i>	Glyphosate technical (83%)	NOAEC	1000 mg a.e./kg diet (830 mg ae/kg diet corrected for purity) (highest concentration tested) equivalent to NOAEL = 47 mg a.e./kg bw/day ²	—		

¹ Oral and Dietary Toxicity classification of bird; Hazard Evaluation Division, Standard Evaluation Procedure, USEPA, 1985.

² The toxicity endpoint was converted by the reviewer from a concentration to a daily dose using the following general equation: Daily Dose = Concentration in food × (FIR/BW). In the absence of data from the study, default adult body weights (178 g for bobwhite quail and 1082 g for mallard duck) and food ingestion rates (18.9 g dry weight food/day for bobwhite quail and 61.2 g dry weight food/day for mallard duck) were used in the calculation.

³ Content of glyphosate in the formulation is not reported. This endpoint cannot be used for risk assessment purposes, as the daily doses used in calculations are on an active ingredient (or, in this case, acid equivalent) basis. It is also noted that the relevance of formulation MON 58121 to Canada is not known.

Table X.12 Toxicity Values of Glyphosate Technical and its Formulations to Mammals

Species Name or Taxon	Formulation Type	Reported Endpoint	Toxicity Value	Degree of Toxicity ¹
Acute Oral				
Glyphosate Technical				
Rat	Glyphosate technical (99%)	LD ₅₀	5600 mg/kg bw	Practically non-toxic
	Glyphosate technical (97.3%)	LD ₅₀	> 5000 mg/kg bw	Practically non-toxic
	Glyphosate technical (95.6%)	LD ₅₀	> 5000 mg/kg bw	Practically non-toxic
	Glyphosate technical (97.4%)	LD ₅₀	> 5000 mg/kg bw	Practically non-toxic
	Glyphosate acid (76 to 97.2%)	LD ₅₀	> 1920 to > 4860 mg a.e./kg bw (8 studies)	Practically non-toxic
	Glyphostate isopropylamine salt	72 hr LD ₅₀	approximately equal to 4400 mg a.e./kg bw (based on 5957 mg a.i./kg bw)	Practically non-toxic
	Glyphostate isopropylamine salt	LD ₅₀	> 5000 mg/kg bw (equivalent to >3700 mg a.e./kg bw)	Practically non-toxic
	Glyphosate technical	LD ₅₀	4873 mg/kg bw	Practically non-toxic
	Glyphosate technical	LD ₅₀	> 5000 mg/kg bw (same value for three different studies)	Practically non-toxic
Mouse	Glyphosate technical	LD ₅₀	1568 mg/kg bw	Slightly toxic
Deer mouse	Glyphostate isopropylamine salt	LD ₅₀	> 6000 mg/kg bw (equivalent to >4440 mg a.e./kg bw)	Practically non-toxic
Glyphosate Formulation (POEA Unknown)				
Rat	H-M2028, 11.4% a.i.	LD ₅₀	357 mg a.e./kg bw (estimated to be equivalent to 3132 mg formulation/kg bw)	Formulation is practically non-toxic.
	MON 20033 (EZ-Ject Capsuls), 63% a.i.	LD ₅₀	3150 mg a.e./kg bw (5000 mg formulation/kg bw)	Formulation is practically non-toxic.
	MON 77063 (Roundup Ultradry), 65.4% a.i.	LD ₅₀	2599 mg a.e./kg bw (5827 mg formulation/kg bw)	Formulation is practically non-toxic.
	Glyphomax, isopropylamine	LD ₅₀	724 mg a.e./kg bw (3803 mg formulation/kg bw)	Formulation is practically

Species Name or Taxon	Formulation Type	Reported Endpoint	Toxicity Value	Degree of Toxicity ¹
	salt, 22.9% a.i.			non-toxic.
	MON 20047, 18.4% a.i. (Roundup Rainfast, 25.1% isopropylamine salt, 18.6% a.e.)	LD ₅₀	460-690 mg a.e./kg bw (3750 mg formulation/kg bw)	Formulation is practically non-toxic.
	Various glyphosate formulations	LD ₅₀	>35.5 to >4000 mg a.e./kg bw (41 studies)	Formulation is not toxic up to the highest concentration tested.
Glyphosate Formulation (With POEA)				
Rat	Roundup (360 g/L, 18% surfactant)	LD ₅₀	2300 mg formulation/kg bw	Formulation is practically non-toxic.
Rat	Roundup (41% a.e., 15% surfactant)	72-hr LD ₅₀	1619 mg a.e./kg bw (5337 mg formulation/kg bw)	Formulation is practically non-toxic.
Rat	Roundup	LD ₅₀	>5000 mg/kg bw (unit for exposure not specified)	Formulation is practically non-toxic.
Mouse	Roundup	LD ₅₀	2300 mg formulation/kg bw (unit for exposure not specified)	Formulation is practically non-toxic.
Two-generation Reproduction (Dietary Exposure)				
Glyphosate Technical				
Rat	Glyphosate technical (97.7%)	Parental: NOAEL	685/779 mg/kg bw/day (males/females) (decreased body weight and body-weight gain)	
		Offspring: NOAEL	115/160 mg/kg bw/day (males/females) (decreased body weight)	—
		Repro: NOAEL	1768/2322 mg/kg bw/day (males/females) (highest concentration tested)	
	Glyphosate technical (99.2%)	Parental: NOAEL	143/179 mg/kg bw/day (males/females) (decreased body weight and body-weight gain)	—

Species Name or Taxon	Formulation Type	Reported Endpoint	Toxicity Value	Degree of Toxicity ¹
		NOAEL Repro: NOAEL	488/595 mg/kg bw/day (males/females) (highest concentration tested) 488/595 mg/kg bw/day (males/females) (highest concentration tested)	
	Glyphosate technical (98%)	Parental: NOAEL Offspring: NOAEL Repro: NOAEL	985/1054 mg/kg bw/day (males/females) (highest concentration tested) 99.4/104 mg/kg bw/day (males/females) (decreased body weight) 985/1054 mg/kg bw/day (males/females) (highest concentration tested)	—
	Glyphosate technical (97.67%)	NOAEL LOAEL	500 mg/kg bw/day (decreased body-weight gain in F1a, F2a and F2b male and female pups during lactation) 1500 mg/kg bw	—
Multi-generation (Dietary Exposure)				
Glyphosate Technical				
Rat	Glyphosate acid (98.7%)	NOAEL LOAEL	740 mg/kg bw/day (decreased body weight in parents and pups and equivocal decrease in average litter size) 2268 mg/kg bw/day	—
Three-generation (Dietary Exposure)				
Glyphosate Technical				
Rat	Glyphosate acid	NOAEL	30 mg/kg bw/day (highest concentration tested)	—

¹ According to USEPA Hazard Classification Scheme (1985).

Table X.13 Toxicity Values of Glyphosate Technical and its Formulations to Terrestrial Plant – Seedling Emergence

Species Name or Taxon	Formulation Type	Study Duration	Reported Endpoint	Toxicity Value (kg a.e./ha)	Measurement Endpoint
Glyphosate Technical					
Tomato, <i>Solanum lycopersicum</i>	Technical	21-d	EC ₂₅ - EC ₅₀	1.57-3.25	Dry weight
Corn, <i>Zea mays</i>	Technical	21-d	EC ₂₅ - EC ₅₀	> 4.48- > 4.48	Survival, plant height, dry weight
Oat, <i>Avena sativa</i>	Technical	21-d	EC ₂₅ - EC ₅₀	> 4.48- > 4.48	Survival, plant height, dry weight
Oat, <i>Avena sativa</i>	CP-70139 IPA 50%	14-d	EC ₂₅ - EC ₅₀	> 11.21- > 11.21	Emergence
Onion, <i>Allium cepa</i>	Technical	21-d	EC ₂₅ - EC ₅₀	2.02-4.26	Plant height
Wheat, <i>Triticum aestivum</i>	Technical	21-d	EC ₂₅ - EC ₅₀	> 4.48- > 4.48	Survival, plant height, dry weight
Radish, <i>Raphanus sativus</i>	Technical	21-d	EC ₂₅ - EC ₅₀	> 4.48- > 4.48	Survival
Cucumber, <i>Cucumis sativus</i>	Technical	21-d	EC ₂₅ - EC ₅₀	> 4.48- > 4.48	Survival, plant height, dry weight
Sunflower, <i>Helianthus annuus</i>	Technical	21-d	EC ₂₅ - EC ₅₀	> 4.48- > 4.48	Survival, plant height, dry weight
Carrot, <i>Daucus carota</i>	Technical	21-d	EC ₂₅ - EC ₅₀	2.35-4.48	Plant height
Rice, <i>Oryza sativa</i>	CP-70139 IPA 50%	14-d	EC ₂₅ - EC ₅₀	> 11.21- > 11.21	Emergence
Sorghum, <i>Sorghum bicolor</i>	CP-70139 IPA 50%	14-d	EC ₂₅ - EC ₅₀	> 11.21- > 11.21	Emergence
Sugar beet, <i>Beta vulgaris</i>	CP-70139 IPA 50%	14-d	EC ₂₅ - EC ₅₀	> 11.21- > 11.21	Emergence
Soybean, <i>Glycine max</i>	Technical	21-d	EC ₂₅ - EC ₅₀	> 4.48- > 4.48	Survival, plant height, dry weight
Soybean, <i>Glycine max</i>	CP-70139 IPA 50%	14-d	EC ₂₅ - EC ₅₀	> 11.21- > 11.21	Emergence
Coklebur, <i>Xanthium strumarium</i>	CP-70139 IPA 50%	14-d	EC ₂₅ - EC ₅₀	> 11.21- > 11.21	Emergence
Spiny coklebur,	CP-70139 IPA	14-d	EC ₂₅ -	> 11.21-	Emergence

Species Name or Taxon	Formulation Type	Study Duration	Reported Endpoint	Toxicity Value (kg a.c./ha)	Measurement Endpoint
<i>Xanthium spinosum</i>	50%		EC ₅₀	>11.21	
Downy brome, <i>Bromus tectorum</i>	CP-70139 IPA 50%	14-d	EC ₂₅ - EC ₅₀	> 11.21- >11.21	Emergence
Proso millet, <i>Panicum miliaceum</i>	CP-70139 IPA 50%	14-d	EC ₂₅ - EC ₅₀	>11.21- >11.21	Emergence
Barnyard grass, <i>Echinochloa crusgalli</i>	CP-70139 IPA 50%	14-d	EC ₂₅ - EC ₅₀	>11.21- >11.21	Emergence
Large crabgrass, <i>Digitaria sanguinalis</i>	CP-70139 IPA 50%	14-d	EC ₂₅ - EC ₅₀	>11.21- >11.21	Emergence
Wild buckwheat, <i>Polygonum convolvulus</i>	CP-70139 IPA 50%	14-d	EC ₂₅ - EC ₅₀	>11.21- >11.21	Emergence
Morning glory, <i>Ipomea spp.</i>	CP-70139 IPA 50%	14-d	EC ₂₅ - EC ₅₀	>11.21- >11.21	Emergence
Hemp sesbania, <i>Sesbania exalta</i>	CP-70139 IPA 50%	14-d	EC ₂₅ - EC ₅₀	>11.21- >11.21	Emergence
Common lambsquarters, <i>Chenopodium album</i>	CP-70139 IPA 50%	14-d	EC ₂₅ - EC ₅₀	>11.21- >11.21	Emergence
Pennsylvanian smartweed, <i>Polygonum pensylvanicum</i>	CP-70139 IPA 50%	14-d	EC ₂₅ - EC ₅₀	>11.21- >11.21	Emergence
Velvet leaf, <i>Abutilon theophrasti</i>	CP-70139 IPA 50%	14-d	EC ₂₅ - EC ₅₀	>11.21- >11.21	Emergence
Glyphosate Formulation (Non-POEA)					
Corn, <i>Zea mays</i>	Glyphosate acid, wettable powder, 48.3%	28-d	EC ₂₅ - EC ₅₀	> 4.48- > 4.48	Emergence, dry weight
Wheat, <i>Triticum aestivum</i>	Glyphosate acid, wettable powder, 48.3%	28-d	EC ₂₅ - EC ₅₀	> 4.48- > 4.48	Emergence, dry weight
Wild oat, <i>Avena fatua</i>	Glyphosate acid, wettable powder, 48.3%	28-d	EC ₂₅ - EC ₅₀	> 4.48- > 4.48	Emergence, dry weight
Armada Wheat, <i>Triticum aestivum</i> cv. Armada	Glyphosate acid, wettable powder, 48.3%	28-d	EC ₂₅ - EC ₅₀	> 4.48- > 4.48	Emergence, dry weight

Species Name or Taxon	Formulation Type	Study Duration	Reported Endpoint	Toxicity Value (kg a.e./ha)	Measurement Endpoint
Sugar beet, <i>Beta vulgaris</i>	Glyphosate acid, wettable powder, 48.3%	28-d	EC ₂₅ - EC ₅₀	> 4.48- > 4.48	Emergence, dry weight
Soybean, <i>Glycine max</i>	Glyphosate acid, wettable powder, 48.3%	28-d	EC ₂₅ - EC ₅₀	> 4.48- > 4.48	Emergence, dry weight
oilseed rape, <i>Brassica napus</i>	Glyphosate acid, wettable powder, 48.3%	28-d	EC ₂₅ - EC ₅₀	> 4.48- > 4.48	Emergence, dry weight
Goose grass, <i>Eleusine indica</i>	Glyphosate acid, wettable powder, 48.3%	28-d	EC ₂₅ - EC ₅₀	> 4.48- > 4.48	Emergence, dry weight
Purple nutsedge, <i>Cyperus rotundus</i>	Glyphosate acid, wettable powder, 48.3%	28-d	EC ₂₅ - EC ₅₀	> 4.48- > 4.48	Emergence, dry weight
Spiny cocklebur, <i>Xanthium spinosum</i>	Glyphosate acid, wettable powder, 48.3%	28-d	EC ₂₅ - EC ₅₀	> 4.48- > 4.48	Emergence, dry weight
Sicklepod, <i>Senna obtusifolia</i>	Glyphosate acid, wettable powder, 48.3%	28-d	EC ₂₅ - EC ₅₀	> 4.48- > 4.48	Emergence, dry weight

Table X.14 Toxicity Values of Glyphosate Technical and its Formulations to Terrestrial Plant – Vegetative Vigour

Species Name or Taxon (Latin)	Formulation Type	Study Duration (Day)	Endpoint Type	Toxicity Value (kg a.e./ha)	Measurement Endpoint
Glyphosate Technical					
Onion, <i>Allium cepa</i>	Glyphosate acid (96.6% purity)	21	EC ₂₅	0.95	Dry weight
Onion, <i>Allium cepa</i>	Glyphosate IPA	21	EC ₂₅	0.72	Dry weight
Oat, <i>Avena sativa</i>	Glyphosate acid (96.6% purity)	21	EC ₂₅	0.43	Dry weight
Oat, <i>Avena sativa</i>	Glyphosate IPA	21	EC ₂₅	0.74	Dry weight, survival
Cabbage, <i>Brassica oleraceae</i> var. <i>capitata</i>	Glyphosate acid (96.6% purity)	21	EC ₂₅	0.34	Dry weight

Species Name or Taxon (Latin)	Formulation Type	Study Duration (Day)	Endpoint Type	Toxicity Value (kg a.e./ha)	Measurement Endpoint
Cucumber, <i>Cucumis sativus</i>	Glyphosate acid (96.6% purity)	21	EC ₂₅	0.46	Dry weight
Cucumber, <i>Cucumis sativus</i>	Glyphosate IPA	21	EC ₂₅	0.51	Plant height
Carrot, <i>Daucus carota</i>	Glyphosate IPA	21	EC ₂₅	0.33	Dry weight
Soybean, <i>Glycine max</i>	Glyphosate acid (96.6% purity)	21	EC ₂₅	0.47	Dry weight
Soybean, <i>Glycine max</i>	Glyphosate IPA	21	EC ₂₅	0.33	Dry weight
Sunflower, <i>Helianthus annuus</i>	Glyphosate IPA	21	EC ₂₅	0.15	Dry weight
Lettuce, <i>Lactuca sativa</i>	Glyphosate acid (96.6% purity)	21	EC ₂₅	0.45	Dry weight
Perennial ryegrass, <i>Lolium perenne</i>	Glyphosate acid (96.6% purity)	21	EC ₂₅	0.90	Dry weight
Radish, <i>Raphanus sativus</i>	Glyphosate acid (96.6% purity)	21	EC ₂₅	0.16	Dry weight
Radish, <i>Raphanus sativus</i>	Glyphosate IPA	21	EC ₂₅	0.09	Dry weight
Tomato, <i>Solanum lycopersicum</i>	Glyphosate acid (96.6% purity)	21	EC ₂₅	0.10	Dry weight
Tomato, <i>Solanum lycopersicum</i>	Glyphosate IPA	21	EC ₂₅	0.24	Dry weight
Wheat, <i>Triticum aestivum</i> (winter)	Glyphosate IPA	21	EC ₂₅	0.20	Dry weight
Corn, <i>Zea mays</i>	Glyphosate acid (96.6% purity)	21	EC ₂₅	0.41	Dry weight
Corn, <i>Zea mays</i>	Glyphosate IPA	21	EC ₂₅	0.30	Dry weight
<hr/>					
Onion, <i>Allium cepa</i>	Glyphosate acid (96.6% purity)	21	EC ₅₀	1.79	Dry weight
Onion, <i>Allium cepa</i>	Glyphosate IPA	21	EC ₅₀	0.74	Dry weight

Species Name or Taxon (Latin)	Formulation Type	Study Duration (Day)	Endpoint Type	Toxicity Value (kg a.e./ha)	Measurement Endpoint
Oat, <i>Avena sativa</i>	Glyphosate acid (96.6% purity)	21	EC ₅₀	0.87	Dry weight
Oat, <i>Avena sativa</i>	Glyphosate IPA	21	EC ₅₀	0.74	Dry weight, survival
Cabbage, <i>Brassica oleracea</i> var. <i>capitata</i>	Glyphosate acid (96.6% purity)	21	EC ₅₀	0.74	Dry weight
Cucumber, <i>Cucumis sativus</i>	Glyphosate acid (96.6% purity)	21	EC ₅₀	0.90	Dry weight
Cucumber, <i>Cucumis sativus</i>	Glyphosate IPA	21	EC ₅₀	0.74	Dry weight, height
Carrot, <i>Daucus carota</i>	Glyphosate IPA	21	EC ₅₀	0.65	Dry weight
Soybean, <i>Glycine max</i>	Glyphosate acid (96.6% purity)	21	EC ₅₀	0.97	Dry weight
Soybean, <i>Glycine max</i>	Glyphosate IPA	21	EC ₅₀	0.66	Dry weight
Sunflower, <i>Helianthus annuus</i>	Glyphosate IPA	21	EC ₅₀	0.30	Dry weight
Lettuce, <i>Lactuca sativa</i>	Glyphosate acid (96.6% purity)	21	EC ₅₀	0.76	Dry weight
Perennial ryegrass, <i>Lolium perenne</i>	Glyphosate acid (96.6% purity)	21	EC ₅₀	1.34	Dry weight
Radish, <i>Raphanus sativus</i>	Glyphosate acid (96.6% purity)	21	EC ₅₀	0.25	Dry weight
Radish, <i>Raphanus sativus</i>	Glyphosate IPA	21	EC ₅₀	0.25	Survival
Tomato, <i>Solanum lycopersicum</i>	Glyphosate acid (96.6% purity)	21	EC ₅₀	0.15	Dry weight
Tomato, <i>Solanum lycopersicum</i>	Glyphosate IPA	21	EC ₅₀	0.53	Dry weight
Wheat, <i>Triticum aestivum</i> (winter)	Glyphosate IPA	21	EC ₅₀	0.65	Dry weight
Corn, <i>Zea mays</i>	Glyphosate acid (96.6% purity)	21	EC ₅₀	0.75	Dry weight

Species Name or Taxon (Latin)	Formulation Type	Study Duration (Day)	Endpoint Type	Toxicity Value (kg a.e./ha)	Measurement Endpoint
Corn, <i>Zea mays</i>	Glyphosate IPA	21	EC ₅₀	0.64	Dry weight
Glyphosate Formulation (Non-POEA)					
Okra, <i>Abelmoschus esculentus</i>	Glyphosate acid wettable powder, 48.3%	28	EC ₂₅	0.17	Dry weight
Onion, <i>Allium cepa</i>	80 WDG, 75%	27	EC ₂₅	0.31	N/A
Oat, <i>Avena sativa</i>	Glyphosate acid wettable powder, 48.3%	28	EC ₂₅	0.20	Dry weight
Sugar beet, <i>Beta vulgaris</i>	Glyphosate acid wettable powder, 48.3%	28	EC ₂₅	0.18	Dry weight
Sugar beet, <i>Beta vulgaris</i>	80 WDG, 75%	27	EC ₂₅	0.24	N/A
Oilseed rape, <i>Brassica napus</i>	Glyphosate acid wettable powder, 48.3%	28	EC ₂₅	0.06	Dry weight
Cucumber, <i>Cucumis sativus</i>	Glyphosate acid wettable powder, 48.3%	28	EC ₂₅	0.17	Dry weight
Cucumber, <i>Cucumis sativus</i>	80 WDG, 75%	27	EC ₂₅	0.50	N/A
Purple nutsedge, <i>Cyperus rotundus</i>	Glyphosate acid wettable powder, 48.3%	28	EC ₂₅	0.86	Dry weight
Soybean, <i>Glycine max</i>	Glyphosate acid wettable powder, 48.3%	28	EC ₂₅	0.15	Dry weight
Soybean, <i>Glycine max</i>	80 WDG, 75%	27	EC ₂₅	0.36	N/A
Sunflower, <i>Helianthus annuus</i>	80 WDG, 75%	27	EC ₂₅	0.18	N/A
Lettuce, <i>Lactuca sativa</i>	Glyphosate acid wettable powder, 48.3%	28	EC ₂₅	0.24	Dry weight
Pea, <i>Pisum sativum</i>	80 WDG, 75%	27	EC ₂₅	1.00	N/A
Radish, <i>Raphanus sativus</i>	Glyphosate acid wettable powder, 48.3%	28	EC ₂₅	0.47	Dry weight
Radish, <i>Raphanus sativus</i>	80 WDG, 75%	27	EC ₂₅	0.10	N/A
Sorghum, <i>Sorghum bicolor</i>	80 WDG, 75%	27	EC ₂₅	0.07	N/A

Species Name or Taxon (Latin)	Formulation Type	Study Duration (Day)	Endpoint Type	Toxicity Value (kg a.e./ha)	Measurement Endpoint
Wheat, <i>Triticum aestivum</i>	Glyphosate acid wettable powder, 48.3%	28	EC ₂₅	0.13	Dry weight
Wheat, <i>Triticum aestivum</i>	80 WDG, 75%	27	EC ₂₅	0.25	N/A
Corn, <i>Zea mays</i>	Glyphosate acid wettable powder, 48.3%	28	EC ₂₅	0.16	Dry weight
Corn, <i>Zea mays</i>	80 WDG, 75%	27	EC ₂₅	0.39	N/A
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Okra, <i>Abelmoschus esculentus</i>	Glyphosate acid wettable powder, 48.3%	28	EC ₅₀	0.34	Dry weight
Oat, <i>Avena sativa</i>	Glyphosate acid wettable powder, 48.3%	28	EC ₅₀	0.34	Dry weight
Sugar beet, <i>Beta vulgaris</i>	Glyphosate acid wettable powder, 48.3%	28	EC ₅₀	0.40	Dry weight
Oilseed rape, <i>Brassica napus</i>	Glyphosate acid wettable powder, 48.3%	28	EC ₅₀	0.16	Dry weight
Cucumber, <i>Cucumis sativus</i>	Glyphosate acid wettable powder, 48.3%	28	EC ₅₀	0.40	Dry weight
Purple nutsedge, <i>Cyperus rotundus</i>	Glyphosate acid wettable powder, 48.3%	28	EC ₅₀	1.30	Dry weight
Soybean, <i>Glycine max</i>	Glyphosate acid wettable powder, 48.3%	28	EC ₅₀	0.35	Dry weight
Lettuce, <i>Lactuca sativa</i>	Glyphosate acid wettable powder, 48.3%	28	EC ₅₀	0.40	Dry weight
Radish, <i>Raphanus sativus</i>	Glyphosate acid wettable powder, 48.3%	28	EC ₅₀	1.10	Dry weight
Wheat, <i>Triticum aestivum</i>	Glyphosate acid wettable powder, 48.3%	28	EC ₅₀	0.23	Dry weight
Corn, <i>Zea mays</i>	Glyphosate acid wettable powder, 48.3%	28	EC ₅₀	0.28	Dry weight

Species Name or Taxon (Latin)	Formulation Type	Study Duration (Day)	Endpoint Type	Toxicity Value (kg a.e./ha)	Measurement Endpoint
English daisy, <i>Bellis perennis</i>	Roundup bio®	21	EC ₅₀	0.014	Dry weight
Cornflower, <i>Centaurea cyanus</i>	Roundup bio®	21	EC ₅₀	0.029	Dry weight
Elecampane, <i>Inula helenium</i>	Roundup bio®	21	EC ₅₀	0.043	Dry weight
Black-eyed Susan, <i>Rudbeckia hirta</i>	Roundup bio®	21	EC ₅₀	0.025	Dry weight
Canada Goldenrod, <i>Solidago canadensis</i>	Roundup bio®	21	EC ₅₀	0.024	Dry weight
Motherwort, <i>Leonorus cardiaca</i>	Roundup bio®	21	EC ₅₀	0.036	Dry weight
Spearmint, <i>Mentha spicata</i>	Roundup bio®	21	EC ₅₀	0.018	Dry weight
Catnip, <i>Nepeta cataria</i>	Roundup bio®	21	EC ₅₀	0.040	Dry weight
Heal-all, <i>Prunella vulgaris</i>	Roundup bio®	21	EC ₅₀	0.028	Dry weight
Wild buckwheat, <i>Polygonum convolvulus</i>	Roundup bio®	21	EC ₅₀	0.016	Dry weight
Curled dock, <i>Rumex crispus</i>	Roundup bio®	21	EC ₅₀	0.028	Dry weight
Scarlett pimpernel, <i>Anagallis arvensis</i>	Roundup bio®	21	EC ₅₀	0.018	Dry weight
Foxglove, <i>Digitalis purpurea</i>	Roundup bio®	21	EC ₅₀	0.065	Dry weight
Wild mustard, <i>Sinapis arvensis</i>	Roundup bio®	21	EC ₅₀	0.019	Dry weight
Common poppy, <i>Papaver rhoeas</i>	Roundup bio®	21	EC ₅₀	0.019	Dry weight
Glyphosate Formulation (With POEA)					
English daisy, <i>Bellis perennis</i> (NAW)	Roundup original® or Vision®	28	EC ₂₅	0.060	Biomass inhibition
English daisy, <i>Bellis perennis</i> (UK)	Roundup original® or Vision®	28	EC ₂₅	0.067	Biomass inhibition
English daisy, <i>Bellis perennis</i> (GER)	Roundup original® or Vision®	28	EC ₂₅	0.098	Biomass inhibition

Species Name or Taxon (Latin)	Formulation Type	Study Duration (Day)	Endpoint Type	Toxicity Value (kg a.e./ha)	Measurement Endpoint
Blue grama grass, <i>Bouteloua gracilis</i>	Roundup original® or Vision®	28	EC ₂₅	0.183	Biomass inhibition
Broccoli, <i>Brassica oleracea</i> var. <i>italica</i>	Roundup original® or Vision®	28	EC ₂₅	0.043	Biomass inhibition
Shepherd's purse, <i>Capsella bursa-pastoris</i>	Roundup original® or Vision®	28	EC ₂₅	0.135	Biomass inhibition
Cornflower, <i>Centaurea cyanus</i> (NAW)	Roundup original® or Vision®	28	EC ₂₅	0.235	Biomass inhibition
Cornflower, <i>Centaurea cyanus</i> (UK)	Roundup original® or Vision®	28	EC ₂₅	0.218	Biomass inhibition
Cornflower, <i>Centaurea cyanus</i> (GER)	Roundup original® or Vision®	28	EC ₂₅	0.195	Biomass inhibition
Mouse-eared chickweed, <i>Cerastium fontanum</i>	Roundup original® or Vision®	28	EC ₂₅	0.391	Biomass inhibition
Ox-eye-daisy, <i>Chrysanthemum leucanthemum</i> (spring)	Roundup original® or Vision®	28	EC ₂₅	0.965	Biomass inhibition
Ox-eye-daisy, <i>Chrysanthemum leucanthemum</i> (fall)	Roundup original® or Vision®	28	EC ₂₅	0.113	Biomass inhibition
Ox-eye-daisy, <i>Chrysanthemum leucanthemum</i> (winter)	Roundup original® or Vision®	28	EC ₂₅	0.821	Biomass inhibition
Ox-eye-daisy, <i>Chrysanthemum leucanthemum</i>	Roundup original® or Vision®	28	EC ₂₅	1.258	Biomass inhibition
Foxglove, <i>Digitalis purpurea</i> (NAW)	Roundup original® or Vision®	28	EC ₂₅	0.156	Biomass inhibition
Foxglove, <i>Digitalis purpurea</i> (NAE)	Roundup original® or Vision®	28	EC ₂₅	0.228	Biomass inhibition
Foxglove, <i>Digitalis purpurea</i> (GER)	Roundup original® or Vision®	28	EC ₂₅	0.104	Biomass inhibition

Species Name or Taxon (Latin)	Formulation Type	Study Duration (Day)	Endpoint Type	Toxicity Value (kg a.e./ha)	Measurement Endpoint
Buckwheat, <i>Fagopyrum esculentum</i>	Roundup original® or Vision®	28	EC ₂₅	0.196	Biomass inhibition
White avens, <i>Geum canadense</i> (spring)	Roundup original® or Vision®	28	EC ₂₅	0.450	Biomass inhibition
White avens, <i>Geum canadense</i> (summer)	Roundup original® or Vision®	28	EC ₂₅	0.042	Biomass inhibition
Sunflower, <i>Helianthus annuus</i> var. "Teddybear"	Roundup original® or Vision®	28	EC ₂₅	0.061	Biomass inhibition
Elecampane, <i>Inula helenium</i> (NAW)	Roundup original® or Vision®	28	EC ₂₅	0.761	Biomass inhibition
Elecampane, <i>Inula helenium</i> (NAE)	Roundup original® or Vision®	28	EC ₂₅	0.100	Biomass inhibition
Lettuce, <i>Lactuca sativa</i> var. "Tom Thumb" (spring)	Roundup original® or Vision®	28	EC ₂₅	0.007	Biomass inhibition
Lettuce, <i>Lactuca sativa</i> var. "Tom Thumb" (summer)	Roundup original® or Vision®	28	EC ₂₅	0.003	Biomass inhibition
Lettuce, <i>Lactuca sativa</i> var. "Tom Thumb" (winter)	Roundup original® or Vision®	28	EC ₂₅	0.404	Biomass inhibition
Lettuce, <i>Lactuca sativa</i> var. "Tom Thumb"	Roundup original® or Vision®	28	EC ₂₅	0.790	Biomass inhibition
Perennial ryegrass, <i>Lolium perenne</i>	Roundup original® or Vision®	28	EC ₂₅	0.206	Biomass inhibition
Water Horehound, <i>Lycopus americanus</i> (spring)	Roundup original® or Vision®	28	EC ₂₅	0.141	Biomass inhibition
Water Horehound, <i>Lycopus americanus</i> (fall)	Roundup original® or Vision®	28	EC ₂₅	0.087	Biomass inhibition
Water Horehound, <i>Lycopus americanus</i> (winter)	Roundup original® or Vision®	28	EC ₂₅	0.058	Biomass inhibition

Species Name or Taxon (Latin)	Formulation Type	Study Duration (Day)	Endpoint Type	Toxicity Value (kg a.e./ha)	Measurement Endpoint
Yellow sweet clover, <i>Melilotus officinalis</i>	Roundup original® or Vision®	28	EC ₂₅	0.118	Biomass inhibition
Tobacco, <i>Nicotiana rustica</i>	Roundup original® or Vision®	28	EC ₂₅	0.114	Biomass inhibition
Tioga-deer-tongue grass, <i>Panicum clandestinum</i>	Roundup original® or Vision®	28	EC ₂₅	0.178	Biomass inhibition
Common poppy, <i>Papaver rhoes</i>	Roundup original® or Vision®	28	EC ₂₅	0.129	Biomass inhibition
Pokeweed, <i>Phytolacca americana</i>	Roundup original® or Vision®	28	EC ₂₅	0.157	Biomass inhibition
Pennsylvania smartweed, <i>Polygonum pensylvanicum</i>	Roundup original® or Vision®	28	EC ₂₅	0.241	Biomass inhibition
Heal-all, <i>Prunella vulgaris</i> (NAW)	Roundup original® or Vision®	28	EC ₂₅	0.215	Biomass inhibition
Heal-all, <i>Prunella vulgaris</i> (UK)	Roundup original® or Vision®	28	EC ₂₅	0.066	Biomass inhibition
Heal-all, <i>Prunella vulgaris</i> (GER)	Roundup original® or Vision®	28	EC ₂₅	0.204	Biomass inhibition
Black-eyed Susan, <i>Rudbeckia hirta</i> (NAW)	Roundup original® or Vision®	28	EC ₂₅	1.299	Biomass inhibition
Black-eyed Susan, <i>Rudbeckia hirta</i> (MID)	Roundup original® or Vision®	28	EC ₂₅	1.415	Biomass inhibition
Black-eyed Susan, <i>Rudbeckia hirta</i> (NAE)	Roundup original® or Vision®	28	EC ₂₅	1.043	Biomass inhibition
Black-eyed Susan, <i>Rudbeckia hirta</i> (GER)	Roundup original® or Vision®	28	EC ₂₅	0.842	Biomass inhibition
Black-eyed Susan, <i>Rudbeckia hirta</i> (spring)	Roundup original® or Vision®	28	EC ₂₅	0.536	Biomass inhibition

Species Name or Taxon (Latin)	Formulation Type	Study Duration (Day)	Endpoint Type	Toxicity Value (kg a.e./ha)	Measurement Endpoint
Black-eyed Susan, <i>Rudbeckia hirta</i> (fall)	Roundup original® or Vision®	28	EC ₂₅	0.055	Biomass inhibition
Curled dock, <i>Rumex crispus</i> (NAE)	Roundup original® or Vision®	28	EC ₂₅	0.364	Biomass inhibition
Curled dock, <i>Rumex crispus</i> (PEN)	Roundup original® or Vision®	28	EC ₂₅	0.404	Biomass inhibition
Curled dock, <i>Rumex crispus</i> (UK)	Roundup original® or Vision®	28	EC ₂₅	0.629	Biomass inhibition
Climbing nightshade, <i>Solanum dulcamara</i>	Roundup original® or Vision®	28	EC ₂₅	0.090	Biomass inhibition
Tomato, <i>Solanum lycopersicum</i> var. "Beefsteak" (summer)	Roundup original® or Vision®	28	EC ₂₅	0.033	Biomass inhibition
Tomato, <i>Solanum lycopersicum</i> var. "Beefsteak" (winter)	Roundup original® or Vision®	28	EC ₂₅	0.004	Biomass inhibition
Canada Goldenrod, <i>Solidago canadensis</i> (ON)	Roundup original® or Vision®	28	EC ₂₅	0.246	Biomass inhibition
Canada Goldenrod, <i>Solidago canadensis</i> (GER)	Roundup original® or Vision®	28	EC ₂₅	0.178	Biomass inhibition
Wheat, <i>Triticum aestivum</i> (spring)	Roundup original® or Vision®	28	EC ₂₅	2.136	Biomass inhibition
Wheat, <i>Triticum aestivum</i> (winter)	Roundup original® or Vision®	28	EC ₂₅	2.136	Biomass inhibition
Blue vervain, <i>Verbena hastata</i>	Roundup original® or Vision®	28	EC ₂₅	0.450	Biomass inhibition
Tufted vetch, <i>Vicia americana</i>	Roundup original® or Vision®	28	EC ₂₅	0.304	Biomass inhibition

^a Ecotype: NAW = North America West; NAE = North America East; UK = United Kingdom; GER = Germany; ON = Ontario; MID = North America Middle; PEN = Pennsylvania

Table X.15 Effects of Single Exposure to a Glyphosate Formulation (Roundup Herbicide) on Two-Year-Old Green Ash, *Fraxinus subintegerrima*, Under Field Conditions (PMRA 1883054)

Measurement Endpoint	NOEC (kg a.e./ha)	LOEC (kg a.e./ha)	LC ₅₀ (kg a.e./ha)	EC ₅₀ (kg a.e./ha)
Budbreak	0.265	>0.265	0.461 (Day 15)	9.089 (Day 15)
Cm of new growth	0.088	0.265	0.070 (Day 257)	0.536 (Day 257)
Malformed leaves	0.088	0.265	0.252 (Day 296) 0.691 (Day 367)	0.624 (Day 296) 2.115 (Day 367)
Plants damaged	0.009	0.088	0.125 (Day 367)	0.293 (Day 367)
Plants with stunted terminals	< 0.009	0.009	0.019	0.029

Table X.16 Toxicity Effects of Glyphosate Technical, Glyphosate Formulations, the Transformation Products AMPA and the Formulant POEA to Aquatic Organisms

Species Name or Taxon	Formulation Type	Duration	Reported Endpoint	Toxicity Value (mg a.e./L)*	Measurement Endpoint
Freshwater Invertebrate Acute Data					
Glyphosate Technical					
<i>Daphnia magna</i>	Glyphosate acid	24 hr	LC ₅₀	129.4	Immobilization
<i>Daphnia magna</i>	Glyphosate technical 98.9%	24 hr	EC ₅₀	123.6	Immobilization
<i>Daphnia magna</i>	Glyphosate acid 97.3% a.e.	24 hr	EC ₅₀	840	Immobilization
<i>Daphnia magna</i>	Glyphosate	24 hr	EC ₅₀	234	Immobilization
<i>Daphnia magna</i> (juvenile)	40% glyphosate IPA	48 hr	EC ₅₀	1	Immobilization
<i>Daphnia magna</i> (juvenile)	40% glyphosate IPA	48 hr	EC ₅₀	5.3	Immobilization
<i>Daphnia magna</i> (adult)	40% glyphosate IPA	48 hr	EC ₅₀	16.3	Immobilization
<i>Daphnia magna</i>	Glyphosate technical	48 hr	EC ₅₀	84	Immobilization
<i>Daphnia magna</i>	Glyphosate acid 83% a.e.	48 hr	EC ₅₀	760	Immobilization
<i>Daphnia magna</i>	Glyphosate	48 hr	EC ₅₀	1900	Immobilization

Species Name or Taxon	Formulation Type	Duration	Reported Endpoint	Toxicity Value (mg a.e./L)*	Measurement Endpoint
<i>Chironomus plumosus</i>	Glyphosate acid, 96.7%	48 hr	EC ₅₀	53.2	Mortality
<i>Ceriodaphnia dubia</i>	Glyphosate acid	48 hr	EC ₅₀	147	Mortality
<i>Ceriodaphnia dubia</i>	Glyphosate IPA salt	48 hr	EC ₅₀	415	Mortality
<i>Lampsilis siliquoidea</i> (larvae)	Glyphosate (technical grade)	48 hr	EC ₅₀	> 200	Survival (shell closure response)
<i>Lampsilis siliquoidea</i> (Juvenile)	Glyphosate (technical grade)	96 hr	EC ₅₀	> 200	Mortality (based on foot movement)
<i>Lampsilis siliquoidea</i> (larvae)	Glyphosate IPA (technical grade)	48 hr	EC ₅₀	5	Survival (shell closure response)
<i>Lampsilis siliquoidea</i> (Juvenile)	Glyphosate IPA (technical grade)	96 hr	EC ₅₀	7.2	Mortality (based on foot movement)
<i>Daphnia magna</i>	Glyphos Bio CHA 4521 (30.9% ae)	48 hr	LC ₅₀	309	Immobilization
<i>Daphnia magna</i>	Glyphos Bio CHA 4525	48 hr	LC ₅₀	377	Immobilization
<i>Daphnia magna</i>	Glyphosate IPA, 10 % with surfactant Geronol CF/AR	48 hr	LC ₅₀	810	Immobilization
<i>Daphnia magna</i>	Glyphosate IPA, 35% with surfactant Geronol CF/AR	48 hr	LC ₅₀	610	Immobilization
<i>Daphnia magna</i>	Glyphosate IPA, 36%, with surfactant Geronol CF/AR	48 hr	LC ₅₀	220	Immobilization
<i>Daphnia magna</i>	Glyphosate IPA, 45% with surfactant Geronol CF/AR	48 hr	LC ₅₀	365	Immobilization
<i>Daphnia magna</i>	Glyphosate IPA, 46% (MON77945	48 hr	LC ₅₀	833	Immobilization

Species Name or Taxon	Formulation Type	Duration	Reported Endpoint	Toxicity Value (mg a.e./L)*	Measurement Endpoint
<i>Daphnia magna</i>	Glyphosate IPA, 62.4%, no surfactant	48 hr	LC ₅₀	401.3	Immobilization
<i>Daphnia magna</i>	Glyphosate IPA (X-77 surfactant)	48 hr	EC ₅₀	> 39	Immobilization
<i>Daphnia magna</i>	Glyphosate (80WDG formulation), 80%	48 hr	LC ₅₀	> 17.6	Immobilization
<i>Daphnia magna</i>	Glyphosate IPA, 35% (Roundup Biactive), Rhone-Poulenc surfactant	48 hr	LC ₅₀	150	Immobilization
<i>Daphnia magna</i>	Glyphosate, 41.2% (Roundup – MON 2139 NF-80-AA)	48 hr	LC ₅₀	94.5	Immobilization
<i>Daphnia magna</i>	RON-DO (48% IPA)	48 hr	LC ₅₀	46	Immobilization
<i>Daphnia spinulata</i>	RON-DO (48% IPA)	48 hr	LC ₅₀	49	Immobilization
<i>Hyalella azteca</i>	Rodeo	48 hr	LC ₅₀	225	Mortality
<i>Chironomus plumosus</i>	Rodeo (53.5% a.i.)	48 hr	LC ₅₀	650	Mortality
<i>Ceriodaphnia dubia</i>	Rodeo	48 hr	LC ₅₀	415	Mortality
<i>Ceriodaphnia dubia</i>	Roundup Biactive	48 hr	EC ₅₀	81.5	Mortality
<i>Ceriodaphnia dubia</i>	Roundup Biactive	48 hr	EC ₅₀	35.4	Mortality
<i>Ceriodaphnia dubia</i>	Accord	48 hr	LC ₅₀	> 7.33	Mortality
<i>Hyalella azteca</i>	Roundup Biactive	96 hr	LC ₅₀	120	Mortality
<i>Hyalella azteca</i>	Rodeo (53.5% a.i.)	96 hr	LC ₅₀	385	Mortality
<i>Nephelopsis obscura</i> (leech)	Rodeo (53.5% a.i.)	96hr	LC ₅₀	630	Mortality

Species Name or Taxon	Formulation Type	Duration	Reported Endpoint	Toxicity Value (mg a.c./L)*	Measurement Endpoint
<i>Lampsilis siliquoidea</i> (Larvae)	Aqua Star®	48 hr	LC ₅₀	> 148	Mortality
<i>Lampsilis siliquoidea</i> (Juvenile)	Aqua Star®	96 hr	LC ₅₀	> 148	Mortality
Glyphosate Formulation (With-POEA)					
<i>Gammarus pseudolimnaeus</i>	Glyphosate IPA, 30.3% (Roundup)	96 hr	LC ₅₀	31.8	Mortality
<i>Gammarus pseudolimnaeus</i>	Roundup (31.0%)	48 hr	LC ₅₀	13	Mortality
<i>Daphnia magna</i>	Roundup® MON 2139	24 hr	LC ₅₀	8.5	Immobilization
<i>Daphnia magna</i>	Glyphosate 360	24 hr	LC ₅₀	11.6	Immobilization
<i>Daphnia magna</i>	Roundup® MON 2139	48 hr	LC ₅₀	1.9	Immobilization
<i>Daphnia magna</i>	Glyphosate 360	48 hr	LC ₅₀	7.8	Immobilization
<i>Daphnia magna</i>	Roundup® (MON 2139)	48 hr	EC ₅₀	1.1	Immobilization
<i>Daphnia magna</i>	Glyphosate IPA (MON 77360), 30% a.i. (Roundup Ultra)	48 hr	EC ₅₀	3.2	Immobilization
<i>Daphnia magna</i>	Roundup 41.36%	48 hr	LC ₅₀	5.3	Immobilization
<i>Daphnia magna</i>	Glyphosate IPA (MON65005)	48 hr	EC ₅₀	2.7	Parent mortality
<i>Daphnia magna</i>	Roundup (18% glyphosate)	48 hr	LC ₅₀	2.7	Mortality
<i>Daphnia magna</i>	Roundup (18% glyphosate)	48 hr	LC ₅₀	7.8	Mortality
<i>Daphnia magna</i> (adult)	Roundup (18% glyphosate)	48 hr	LC ₅₀	22.9	Mortality
<i>Chironomus plumosus</i>	Roundup, 30.3%, with POEA	48 hr	LC ₅₀	13.3	Mortality
<i>Daphnia pulex</i>	Glyphosate IPA (Roundup), 30.3 %	48 hr	LC ₅₀	5.8	Immobilization
<i>Daphnia pulex</i> (unknown age)	Roundup® MON 2139	48hr	LC ₅₀	67.8	Immobilization

Species Name or Taxon	Formulation Type	Duration	Reported Endpoint	Toxicity Value (mg a.e./L)*	Measurement Endpoint
<i>Daphnia pulex</i>	Glyphosate IPA, 48% (MON 2139)	48 hr	LC ₅₀	68.3	Immobilization
<i>Ceriodaphnia dubia</i>	Accord SP + POEA	48 hr	LC ₅₀	> 5.5	Mortality
<i>Ceriodaphnia dubia</i>	Roundup (Monsanto)	48 hr	EC ₅₀	5.7	Mortality
<i>Ceriodaphnia dubia</i>	Roundup, 41% IPA salt	48 hr	LC ₅₀	5.39	Mortality
<i>Ceriodaphnia dubia</i>	Roundup	48 hr	LC ₅₀	7	Mortality in porewater, 0% TOC
Crayfish, <i>Orconectes nais</i>	Roundup 30.3%	48 hr	LC ₅₀	5.2	Mortality
<i>Hyalella azteca</i>	Roundup (Monsanto)	48 hr	LC ₅₀	1.5	Mortality
Crawfish, <i>Procambarus spp</i>	Roundup (35.6% acid equivalent)	48 hr	LC ₅₀	7701.3	Mortality
<i>Lampsilis siliquoidea</i> (Larvae)	Roundup®	48 hr	EC ₅₀	2.9	Mortality based on Shell closure
<i>Lampsilis siliquoidea</i> (Juvenile)	Roundup®	96 hr	EC ₅₀	5.9	Mortality based on Foot movement
Horsehair worms (nematode) <i>Chordodes nobilii</i>	Glyphosate acid and Roundup-like formulation (NOS)	96 hr	EC ₅₀	1.76	Mortality
POEA Alone					
<i>Daphnia pulex</i>	MON 0818	48 hr	EC ₅₀	2	Mortality
<i>Daphnia magna</i>	MON 0818	48 hr	EC ₅₀	2.9	Mortality based on immobilization
<i>Daphnia magna</i>	POEA with oxide: tallowamine ratio of 5:1	48 hr	EC ₅₀	0.176	Mortality based on immobilization
<i>Daphnia magna</i>	POEA with oxide: tallowamine ratio of 10:1	48 hr	EC ₅₀	0.097	Mortality based on immobilization

Species Name or Taxon	Formulation Type	Duration	Reported Endpoint	Toxicity Value (mg a.e./L)*	Measurement Endpoint
<i>Daphnia magna</i>	POEA with oxide: tallowamine ratio of 15:1	48 hr	EC ₅₀	0.849	Mortality based on immobilization
<i>C. plumosus</i>	MON 0818	48 hr	EC ₅₀	13	Immobilization
<i>Ceriodaphnia dubia</i>	Entry II ® (POEA alone)	48 hr	EC ₅₀	0.42	Mortality
<i>Ceriodaphnia dubia</i>	MON 0818	48 hr	EC ₅₀	1.15	Mortality based on animal count
Fairy shrimp (<i>T. platyurus</i>)	POEA with oxide: tallowamine ratio of 5:1	48 hr	EC ₅₀	0.00517	Mortality
Fairy shrimp (<i>T. platyurus</i>)	POEA with oxide: tallowamine ratio of 10:1	48 hr	EC ₅₀	0.0027	Mortality
Fairy shrimp (<i>T. platyurus</i>)	POEA with oxide: tallowamine ratio of 15:1	48 hr	EC ₅₀	0.00201	Mortality
<i>Lampsilis siliquoidea</i> (Larvae)	MON 0818	48 hr	EC ₅₀	0.5	Survival (shell closure response)
<i>Lampsilis siliquoidea</i> (Juvenile)	MON 0818	96 hr	EC ₅₀	3.8	Mortality (based on foot movement)
AMPA					
<i>Daphnia magna</i>	AMPA	48 hr	LC ₅₀	153	Immobilization
<i>Daphnia magna</i>	AMPA	48 hr	LC ₅₀	651.2	Immobilization
<i>Daphnia magna</i>	AMPA, 94.38%	96 hr	LC ₅₀	683	Immobilization
Freshwater Invertebrate Chronic Data					
Glyphosate Technical					
<i>Daphnia magna</i>	Glyphosate acid 97.6% a.e.	21-d	EC ₅₀	101	immobilization
<i>Daphnia magna</i>	Glyphosate acid 97.6% a.e.	21-d	NOEC	51	immobilization
<i>Daphnia magna</i>	Glyphosate acid 98.7% a.e.	21-d	NOEC	29.6	Reproduction
<i>Daphnia magna</i>	Glyphosate acid 99.7% a.e.	21-d	NOEC	50	Reproduction
<i>Daphnia magna</i>	40% glyphosate (IPA salt)	55-d	NOEC	1	survival

Species Name or Taxon	Formulation Type	Duration	Reported Endpoint	Toxicity Value (mg a.e./L)*	Measurement Endpoint
<i>Daphnia magna</i>	40% glyphosate (IPA salt)	55-d	NOEC	0.33	fecundity
<i>Lampsilis siliquoidea</i> (Juvenile)	Glyphosate (Technical grade)	21-d	EC ₅₀	> 200	Survival (shell length)
<i>Lampsilis siliquoidea</i> (Juvenile)	Glyphosate IPA (technical grade)	28-d	EC ₅₀	4.8	Survival (shell length)
Glyphosate Formulation (With POEA)					
<i>Daphnia magna</i>	Glyphosate 360	21-d	NOEC	0.54	Reproduction
<i>Daphnia magna</i>	Roundup (18% glyphosate)	55-d	NOEC	0.11	fecundity
<i>Daphnia magna</i>	Roundup (18% glyphosate)	55-d	NOEC	0.33	abortion rate
<i>Lampsilis siliquoidea</i> (Juvenile)	Roundup®	28-d	EC ₅₀	3.7	Survival (shell length)
Glyphosate Formulation (Non-POEA)					
<i>Lampsilis siliquoidea</i> (Juvenile)	Aqua Star®	28-d	EC ₅₀	43.8	Survival (shell length)
POEA Alone					
<i>Lampsilis siliquoidea</i> (Juvenile)	MON0818	28-d	EC ₅₀	1.7	Survival (shell length)
Freshwater Fish Acute Data					
Glyphosate Technical					
Fathead minnow (<i>Pimephales promelas</i>)	Glyphosate technical	24 hr	LC ₅₀	>84.4	Mortality
Fathead minnow (<i>Pimephales promelas</i>)	Technical grade	96 hr	LC ₅₀	97	Mortality
Fathead minnow (<i>Pimephales promelas</i>)	Glyphosate 87.3%	24 hr	LC ₅₀	84.9	Mortality
Rainbow trout (<i>Oncorhynchus mykiss</i>)	Glyphosate (95.6%) corrected	96 hr	LC ₅₀	124.8	Mortality
Rainbow trout (<i>Oncorhynchus mykiss</i>)	Glyphosate 83%	96 hr	LC ₅₀	71.4	Mortality

Species Name or Taxon	Formulation Type	Duration	Reported Endpoint	Toxicity Value (mg a.e./L)*	Measurement Endpoint
Rainbow trout (<i>Oncorhynchus mykiss</i>)	Glyphosate IPA	96 hr	LC ₅₀	> 461.8	Mortality
Rainbow trout (<i>Oncorhynchus mykiss</i>)	Glyphosate tech 96.7%	96 hr	LC ₅₀	130	Mortality
Rainbow trout (<i>Oncorhynchus mykiss</i>)	CP-67573	96 hr	LC ₅₀	38	Mortality
Rainbow trout (<i>Oncorhynchus mykiss</i>)	Glyphosate 360 technical (acid; 98.9%)	96 hr	LC ₅₀	95	Mortality
Rainbow trout (<i>Oncorhynchus mykiss</i>)	Glyphosate 360 technical, (acid; 98.9%)	96 hr	LC ₅₀	171	Mortality
Rainbow trout (<i>Oncorhynchus mykiss</i>)	Glyphosate technical	96 hr	LC ₅₀	140	Mortality
Rainbow trout (<i>Oncorhynchus mykiss</i>)	Glyphosate technical	96 hr	LC ₅₀	240	Mortality
Rainbow trout (<i>Oncorhynchus mykiss</i>)	Glyphosate technical	96 hr	LC ₅₀	22	Mortality
Rainbow trout (<i>Oncorhynchus mykiss</i>)	Glyphosate technical	96 hr	LC ₅₀	10	Mortality
Rainbow trout (<i>Oncorhynchus mykiss</i>)	Glyphosate technical	96 hr	LC ₅₀	99	Mortality
Rainbow trout (<i>Oncorhynchus mykiss</i>)	Glyphosate technical	96 hr	LC ₅₀	93	Mortality
Rainbow trout (<i>Oncorhynchus mykiss</i>)	Glyphosate technical	96 hr	LC ₅₀	197	Mortality
Carp (<i>Cyprinus carpio</i>)	Glyphosate Technical grade	96 hr	LC ₅₀	80	Mortality
Carp (<i>Cyprinus carpio</i>)	Glyphosate acid 97.6%	96 hr	LC ₅₀	115	Mortality
Carp (<i>Cyprinus carpio</i>)	Glyphosate	96 hr	LC ₅₀	620	Mortality

Species Name or Taxon	Formulation Type	Duration	Reported Endpoint	Toxicity Value (mg a.e./L)*	Measurement Endpoint
Harlequin Fish (<i>Rasbora heteromorpha</i>)	CP 67573	96 hr	LC ₅₀	168	Mortality
Bluegill sunfish (<i>Lepomis macrochirus</i>)	Glyphosate acid (95.6% a.e.) corr	96 hr	LC ₅₀	45	Mortality
Bluegill sunfish (<i>Lepomis macrochirus</i>)	Glyphosate 360 (95.6% a.e.)	96 hr	LC ₅₀	133.3	Mortality
Bluegill sunfish (<i>Lepomis macrochirus</i>)	Glyphosate 360 (95.6% a.e.)	96 hr	LC ₅₀	200	Mortality
Bluegill sunfish (<i>Lepomis macrochirus</i>)	Glyphosate acid (98.9% a.e.)	96 hr	LC ₅₀	78	Mortality
Bluegill sunfish (<i>Lepomis macrochirus</i>)	CP 67573 (96.7%)	96 hr	LC ₅₀	>24	Mortality
Bluegill sunfish (<i>Lepomis macrochirus</i>)	Glyphosate technical	96 hr	LC ₅₀	140	Mortality
Bluegill sunfish (<i>Lepomis macrochirus</i>)	Glyphosate technical	96 hr	LC ₅₀	220	Mortality
Bluegill sunfish (<i>Lepomis macrochirus</i>)	Glyphosate tech 96.7%	96 hr	LC ₅₀	135	Mortality
Bluegill sunfish (<i>Lepomis macrochirus</i>)	R-50224	96 hr	LC ₅₀	2048	Mortality
Bluegill sunfish (<i>Lepomis macrochirus</i>)	R-50224	96 hr	LC ₅₀	>1000	Mortality
Bluegill sunfish (<i>Lepomis macrochirus</i>)	Glyphosate technical (83%)	96 hr	LC ₅₀	99.6	Mortality
Bluegill sunfish (<i>Lepomis macrochirus</i>)	Glyphosate acid (95.6%)	96 hr	LC ₅₀	44	Mortality
Channel catfish (<i>Ictalurus punctatus</i>)	Technical grade	96 hr	LC ₅₀	130	Mortality

Species Name or Taxon	Formulation Type	Duration	Reported Endpoint	Toxicity Value (mg a.e./L)*	Measurement Endpoint
Japanese medaka (<i>Oryzias latipes</i>)	Glyphosate (>99.3%)	96 hr	LC ₅₀	> 160	Mortality
Glyphosate Formulation (Non-POEA)					
Rainbow trout (<i>Oncorhynchus mykiss</i>)	CHA4521 Glyfos BIO Herbicide (30.9% corr)	96 hr	LC ₅₀	> 309	Mortality
Rainbow trout (<i>Oncorhynchus mykiss</i>)	Rodeo® + X-77 corrected	96 hr	LC ₅₀	96.2	Mortality
Rainbow trout (<i>Oncorhynchus mykiss</i>)	CHA4521 Glyfos BIO 450 (IPA 37.7%)	96 hr	LC ₅₀	377	Mortality
Rainbow trout (<i>Oncorhynchus mykiss</i>)	Rodeo® IPA salt corrected	96 hr	LC ₅₀	429.2	Mortality
Rainbow trout (<i>Oncorhynchus mykiss</i>)	Rodeo/X-77 (surfactant) 40.5%	96 hr	LC ₅₀	134	Mortality
Rainbow trout (<i>Oncorhynchus mykiss</i>)	Glyphosate IPA salt (46%) MON77945	96 hr	LC ₅₀	> 449	Mortality
Rainbow trout (<i>Oncorhynchus mykiss</i>)	Glyphosate IPA salt (10%) + Geronol CF/AR	96 hr	LC ₅₀	> 450	Mortality
Rainbow trout (<i>Oncorhynchus mykiss</i>)	Glyphosate IPA salt (36%) + Geronol	96 hr	LC ₅₀	> 360	Mortality
Rainbow trout (<i>Oncorhynchus mykiss</i>)	Glyphosate IPA salt (45%) + Geronol	96 hr	LC ₅₀	> 450	Mortality
Bluegill sunfish (<i>Lepomis macrochirus</i>)	Glyphosate IPA (62.4% a.i)	96 hr	LC ₅₀	> 461.8	Mortality
Bluegill sunfish (<i>Lepomis macrochirus</i>)	Glyphosate IPA (62.4% a.i)	96 hr	LC ₅₀	32.4	Mortality
Guaru (<i>P. caudimaculatus</i>)	Rodeo	96 hr	LC ₅₀	> 975	Mortality
Guaru (<i>P. caudimaculatus</i>)	Rodeo + 0.5% Aterbane	96 hr	LC ₅₀	> 975	Mortality
Guaru (<i>P. caudimaculatus</i>)	Rodeo + 1% Aterbane	96 hr	LC ₅₀	> 975	Mortality

Species Name or Taxon	Formulation Type	Duration	Reported Endpoint	Toxicity Value (mg a.e./L)*	Measurement Endpoint
Glyphosate Formulation (With POEA)					
Rainbow trout (<i>Oncorhynchus mykiss</i>)	MON 77360	96 hr	LC ₅₀	1.6	Mortality
Rainbow trout (<i>Oncorhynchus mykiss</i>)	MON 58121	96 hr	LC ₅₀	0.16	Mortality
Rainbow trout (<i>Oncorhynchus mykiss</i>)	Glyphosate 360 (36% a.e.) corrected	96 hr	LC ₅₀	6.7	Mortality
Rainbow trout (<i>Oncorhynchus mykiss</i>)	Roundup® MON 2139	96 hr	LC ₅₀	17.3	Mortality
Rainbow trout (<i>Oncorhynchus mykiss</i>)	Roundup® MON 2139	96 hr	LC ₅₀	5.6	Mortality
Rainbow trout (<i>Oncorhynchus mykiss</i>)	Roundup® MON 2139	96 hr	LC ₅₀	1.2	Mortality
Rainbow trout (<i>Oncorhynchus mykiss</i>)	Roundup® MON 2139	96 hr	LC ₅₀	1	Mortality
Rainbow trout (<i>Oncorhynchus mykiss</i>)	Roundup® MON 2139	96 hr	LC ₅₀	1	Mortality
Rainbow trout (<i>Oncorhynchus mykiss</i>)	Roundup 31% a.i.	96 hr	LC ₅₀	2.5	Mortality
Rainbow trout (<i>Oncorhynchus mykiss</i>)	Roundup® MON 2139	96 hr	LC ₅₀	14.4	Mortality
Rainbow trout (<i>Oncorhynchus mykiss</i>)	Roundup® MON 2139	96 hr	LC ₅₀	13.7	Mortality
Rainbow trout (<i>Oncorhynchus mykiss</i>)	Glyphosate 41%	96 hr	LC ₅₀	7.6	Mortality
Rainbow trout (<i>Oncorhynchus mykiss</i>)	Glyphosate 41%	96 hr	LC ₅₀	1.3	Mortality
Rainbow trout (<i>Oncorhynchus mykiss</i>)	Glyphosate 41%	96 hr	LC ₅₀	8.3	Mortality

Species Name or Taxon	Formulation Type	Duration	Reported Endpoint	Toxicity Value (mg a.c./L)*	Measurement Endpoint
Rainbow trout (<i>Oncorhynchus mykiss</i>)	Glyphosate 41%	96 hr	LC ₅₀	14	Mortality
Rainbow trout (<i>Oncorhynchus mykiss</i>)	Glyphosate 41%	96 hr	LC ₅₀	7.5	Mortality
Rainbow trout (<i>Oncorhynchus mykiss</i>)	Glyphosate 41%	96 hr	LC ₅₀	7.4	Mortality
Rainbow trout (<i>Oncorhynchus mykiss</i>)	Glyphosate 41%	96 hr	LC ₅₀	7.6	Mortality
Rainbow trout (<i>Oncorhynchus mykiss</i>)	Glyphosate 41%	96 hr	LC ₅₀	1.6	Mortality
Rainbow trout (<i>Oncorhynchus mykiss</i>)	Glyphosate 41%	96 hr	LC ₅₀	1.4	Mortality
Rainbow trout (<i>Oncorhynchus mykiss</i>)	Glyphosate 41%	96 hr	LC ₅₀	1.4	Mortality
Rainbow trout (<i>Oncorhynchus mykiss</i>)	Glyphosate 41%	96 hr	LC ₅₀	9	Mortality
Rainbow trout (<i>Oncorhynchus mykiss</i>)	Glyphosate 41%	96 hr	LC ₅₀	7.6	Mortality
Rainbow trout (<i>Oncorhynchus mykiss</i>)	Glyphosate 41%	96 hr	LC ₅₀	7.6	Mortality
Rainbow trout (<i>Oncorhynchus mykiss</i>)	Glyphosate 41%	96 hr	LC ₅₀	7.6	Mortality
Rainbow trout (<i>Oncorhynchus mykiss</i>)	Glyphosate 41%	96 hr	LC ₅₀	3.4	Mortality
Rainbow trout (<i>Oncorhynchus mykiss</i>)	Roundup®	96 hr	LC ₅₀	5.5	Mortality
Rainbow trout (<i>Oncorhynchus mykiss</i>)	Roundup®	96 hr	LC ₅₀	8.1	Mortality

Species Name or Taxon	Formulation Type	Duration	Reported Endpoint	Toxicity Value (mg a.e./L)*	Measurement Endpoint
Rainbow trout (<i>Oncorhynchus mykiss</i>)	Roundup®	96 hr	LC ₅₀	8.9	Mortality
Rainbow trout (<i>Oncorhynchus mykiss</i>)	Roundup® (Vision®)	96 hr	LC ₅₀	5.5	Mortality
Rainbow trout (<i>Oncorhynchus mykiss</i>)	Roundup® (Vision®)	96 hr	LC ₅₀	4.3	Mortality
Rainbow trout (<i>Oncorhynchus mykiss</i>)	Roundup® (Vision®)	96 hr	LC ₅₀	10	Mortality
Rainbow trout (<i>Oncorhynchus mykiss</i>)	Roundup® (Vision®)	96 hr	LC ₅₀	4.6	Mortality
Rainbow trout (<i>Oncorhynchus mykiss</i>)	Vision® 10% MON 0818 surfactant	96 hr	LC ₅₀	22.9	Mortality
Rainbow trout (<i>Oncorhynchus mykiss</i>)	Vision®	96hr	LC ₅₀	10.42	Mortality
Rainbow trout (<i>Oncorhynchus mykiss</i>)	MON 2139 (Roundup) 41%	96 hr	LC ₅₀	2.5	Mortality
Rainbow trout (<i>Oncorhynchus mykiss</i>)	MON 65005	96 hr	LC ₅₀	2.5	Mortality
Rainbow trout (<i>Oncorhynchus mykiss</i>)	MON 78568	96 hr	LC ₅₀	1.9	Mortality
Rainbow trout Fry (<i>Oncorhynchus mykiss</i>)	Roundup® 36%	96 hr	LC ₅₀	5.5	Mortality
Rainbow trout Fry (<i>Oncorhynchus mykiss</i>)	Roundup®	96 hr	LC ₅₀	8	Mortality
Rainbow trout Fry (<i>Oncorhynchus mykiss</i>)	Roundup® 36%	96 hr	LC ₅₀	9.24	Mortality

Species Name or Taxon	Formulation Type	Duration	Reported Endpoint	Toxicity Value (mg a.c./L)*	Measurement Endpoint
Rainbow trout Fry (<i>Oncorhynchus mykiss</i>)	Roundup®	96 hr	LC ₅₀	7.8	Mortality
Rainbow trout Fry (<i>Oncorhynchus mykiss</i>)	Roundup®	96 hr	LC ₅₀	8.5	Mortality
Rainbow trout sac Fry (<i>Oncorhynchus mykiss</i>)	Roundup® MON 2139	96 hr	LC ₅₀	2.5	Mortality
Rainbow trout swim-up Fry (<i>Oncorhynchus mykiss</i>)	Roundup® MON 2139	96 hr	LC ₅₀	1.2	Mortality
Rainbow trout fingerling (<i>Oncorhynchus mykiss</i>)	Roundup® MON 2139	96 hr	LC ₅₀	0.96	Mortality
Rainbow trout fingerling (<i>Oncorhynchus mykiss</i>)	Roundup® MON 2139	96 hr	LC ₅₀	6.1	Mortality
Rainbow trout eggs (<i>Oncorhynchus mykiss</i>)	Roundup® MON 2139	96 hr	LC ₅₀	11.8	Mortality
Bluegill sunfish (<i>Lepomis macrochirus</i>)	Roundup®	96 hr	LC ₅₀	4.3	Mortality
Bluegill sunfish (<i>Lepomis macrochirus</i>)	Roundup®	96 hr	LC ₅₀	1.8	Mortality
Bluegill sunfish (<i>Lepomis macrochirus</i>)	Roundup® MON 2139 (36%)	96 hr	LC ₅₀	1.8	Mortality
Bluegill sunfish (<i>Lepomis macrochirus</i>)	Roundup® MON 2139 (36%) pH 6.5	96 hr	LC ₅₀	3.1	Mortality
Bluegill sunfish (<i>Lepomis macrochirus</i>)	Roundup® MON 2139 (36%) pH 7.5	96 hr	LC ₅₀	1.8	Mortality

Species Name or Taxon	Formulation Type	Duration	Reported Endpoint	Toxicity Value (mg a.e./L)*	Measurement Endpoint
Bluegill sunfish (<i>Lepomis macrochirus</i>)	Roundup® MON 2139 (36%) pH 8.5	96 hr	LC ₅₀	1.8	Mortality
Bluegill sunfish (<i>Lepomis macrochirus</i>)	Roundup® MON 2139 (36%) pH 9.5	96 hr	LC ₅₀	1.3	Mortality
Bluegill sunfish (<i>Lepomis macrochirus</i>)	Glyphosate 360 (36% corrected)	96 hr	LC ₅₀	4.3	Mortality
Bluegill sunfish (<i>Lepomis macrochirus</i>)	MON 2139	96 hr	LC ₅₀	1.8	Mortality
Bluegill sunfish (<i>Lepomis macrochirus</i>)	MON 2139	96 hr	LC ₅₀	1.8	Mortality
Bluegill sunfish (<i>Lepomis macrochirus</i>)	MON 2139	96 hr	LC ₅₀	1.3	Mortality
Bluegill sunfish (<i>Lepomis macrochirus</i>)	Glyphosate 41%	96 hr	LC ₅₀	5.6	Mortality
Bluegill sunfish (<i>Lepomis macrochirus</i>)	Glyphosate 41%	96 hr	LC ₅₀	7.5	Mortality
Bluegill sunfish (<i>Lepomis macrochirus</i>)	Glyphosate 41%	96 hr	LC ₅₀	4.5	Mortality
Bluegill sunfish (<i>Lepomis macrochirus</i>)	Glyphosate 41%	96 hr	LC ₅₀	4	Mortality
Bluegill sunfish (<i>Lepomis macrochirus</i>)	Glyphosate 41%	96 hr	LC ₅₀	4.2	Mortality
Bluegill sunfish (<i>Lepomis macrochirus</i>)	Glyphosate 41%	96 hr	LC ₅₀	2.4	Mortality
Bluegill sunfish (<i>Lepomis macrochirus</i>)	Glyphosate 41%	96 hr	LC ₅₀	2.4	Mortality
Bluegill sunfish (<i>Lepomis macrochirus</i>)	Glyphosate 41%	96 hr	LC ₅₀	1.8	Mortality

Species Name or Taxon	Formulation Type	Duration	Reported Endpoint	Toxicity Value (mg a.e./L)*	Measurement Endpoint
Bluegill sunfish (<i>Lepomis macrochirus</i>)	Roundup® MON 2139	96 hr	LC ₅₀	8.6	Mortality
<i>Bluegill sunfish (<i>Lepomis macrochirus</i>)</i>	MON 77360 (Roundup Ultra)	96 hr	LC ₅₀	2.24	Mortality
<i>Bluegill sunfish (<i>Lepomis macrochirus</i>)</i>	MON 65005 (Roundup Pro)	96 hr	LC ₅₀	2.4	Mortality
<i>Fathead minnow (<i>P. promelas</i>)</i>	Roundup® MON 2139	96 hr	LC ₅₀	1.7	Mortality
<i>Fathead minnow (<i>P. promelas</i>)</i>	Roundup® 41.36% glyphosate	96 hr	LC ₅₀	3.9	Mortality
<i>Channel catfish (<i>Ictalurus punctatus</i>)</i>	Roundup®	96 hr	LC ₅₀	9.6	Mortality
<i>Channel catfish (<i>Ictalurus punctatus</i>)</i>	Roundup® MON 2139	96 hr	LC ₅₀	5.2	Mortality
<i>Channel catfish (<i>Ictalurus punctatus</i>)</i>	Glyphosate 41%	96 hr	LC ₅₀	4.9	Mortality
<i>Channel catfish fingerlings (<i>Ictalurus punctatus</i>)</i>	Roundup® MON 2139	96 hr	LC ₅₀	9.6	Mortality
<i>Channel catfish sac fry (<i>Ictalurus punctatus</i>)</i>	Roundup® MON 2139	96 hr	LC ₅₀	3.2	Mortality
<i>Channel catfish swim-up fry (<i>Ictalurus punctatus</i>)</i>	Roundup® MON 2139	96 hr	LC ₅₀	2.4	Mortality
<i>Prochilodus lineatus (juvenile)</i>	Roundup (41% a.i.)	96 hr	LC ₅₀	5.61	Mortality
<i>Ten spotted live-bearer, <i>C. decemmaculatus</i></i>	Panzer (48%), IPA salt + POEA	96 hr	LC ₅₀	5.6	Mortality
<i>Ten spotted live-bearer, <i>C. decemmaculatus</i></i>	Credit (48%), IPA salt + POEA	96 hr	LC ₅₀	32.6	Mortality

Species Name or Taxon	Formulation Type	Duration	Reported Endpoint	Toxicity Value (mg a.e./L)*	Measurement Endpoint
<i>Channa punctatus</i>	Roundup flash formulation (41%)	96 hr	LC ₅₀	13.34	Mortality
<i>Jenynsia multidentata</i>	Roundup Max + POEA	96 hr	LC ₅₀	14.2	Mortality
Lee Koh (<i>Cyprinus carpio</i>)	Roundup 30.5%	96 hr	LC ₅₀	3.1	Mortality
Tilapia (<i>Oreochromis niloticus</i>)	Roundup 30.5%	96 hr	LC ₅₀	3.1	Mortality
Sturgeon, <i>Huso huso</i>	Roundup (41% a.e./L)	96 hr	LC ₅₀	19.3	Mortality
Sturgeon, <i>Acipenserstellatus</i>	Roundup (41% a.e./L)	96 hr	LC ₅₀	24.7	Mortality
Sturgeon, <i>A. persicus</i>	Roundup (41% a.e./L)	96 hr	LC ₅₀	26.1	Mortality
POEA Alone					
Rainbow trout (<i>Oncorhynchus mykiss</i>)	MON 0818	96 hr	LC ₅₀	2	Mortality
Rainbow trout (<i>Oncorhynchus mykiss</i>)	MON 0818	96 hr	LC ₅₀	2.5	Mortality
Rainbow trout (<i>Oncorhynchus mykiss</i>)	MON 0818	96 hr	LC ₅₀	1.6	Mortality
Rainbow trout (<i>Oncorhynchus mykiss</i>)	MON 0818	96 hr	LC ₅₀	2.6	Mortality
Rainbow trout (<i>Oncorhynchus mykiss</i>)	MON 0818	96 hr	LC ₅₀	1.7	Mortality
Rainbow trout (<i>Oncorhynchus mykiss</i>)	MON 0818 pH 6.5	96 hr	LC ₅₀	7.4	Mortality
Rainbow trout (<i>Oncorhynchus mykiss</i>)	MON 0818 pH 9.5	96 hr	LC ₅₀	0.65	Mortality
Rainbow trout fry (<i>Oncorhynchus mykiss</i>)	MON 0818	96 hr	LC ₅₀	3.2	Mortality

Species Name or Taxon	Formulation Type	Duration	Reported Endpoint	Toxicity Value (mg a.e./L)*	Measurement Endpoint
Fathead minnow (<i>P. promelas</i>)	MON 0818	96 hr	LC ₅₀	1	Mortality
Fathead minnow (<i>P. promelas</i>)	Entry® II	96 hr	LC ₅₀	> 0.44	Mortality
Channel catfish (<i>Ictalurus punctatus</i>)	MON 0818	96 hr	LC ₅₀	13	Mortality
Bluegill sunfish (<i>Lepomis macrochirus</i>)	MON 0818	96 hr	LC ₅₀	3	Mortality
Bluegill sunfish (<i>Lepomis macrochirus</i>)	MON 0818 pH 6.5	96 hr	LC ₅₀	1.3	Mortality
Bluegill sunfish (<i>Lepomis macrochirus</i>)	MON 0818 pH 9.5	96 hr	LC ₅₀	1	Mortality
Bluegill sunfish (<i>Lepomis macrochirus</i>)	Entry® II	96 hr	LC ₅₀	4.2	Mortality
AMPA					
Rainbow trout (<i>Oncorhynchus mykiss</i>)	AMPA	48 hr	LC ₅₀	> 180	Mortality
Rainbow trout (<i>Oncorhynchus mykiss</i>)	AMPA (purity 94.4%)	96 hr	LC ₅₀	491	Mortality
Freshwater Fish Chronic Data					
Glyphosate Technical					
Rainbow trout (<i>Oncorhynchus mykiss</i>)	Glyphosate technical acid 98.9 % a.e.	21-d	NOEC	150	Highest concentration tested
Fathead minnow (<i>P. promelas</i>)	Acid, technical grade	255-d	NOEC	25.7	Highest concentration tested
Glyphosate Formulation (With POEA)					
Rainbow trout (<i>Oncorhynchus mykiss</i>)	Glyphosate 360	21-d	NOEC	0.81	Sub-lethal effects
<i>Galaxias anomalous</i>	Glyphosate 360 (360 mg a.i./L, 10 – 20% POEA)	26-d	NOEC	0.36	Survival

Species Name or Taxon	Formulation Type	Duration	Reported Endpoint	Toxicity Value (mg a.e./L)*	Measurement Endpoint
Fresh Water Algae Acute Data					
Glyphosate Technical					
<i>S. capricornutum</i>	Glyphosate acid 95.6% a.e.	120 hr	EC ₅₀	13	Cell density
<i>S. capricornutum</i>	Glyphosate acid 95.6% a.e.	120 hr	EC ₅₀	16	Biomass
<i>S. capricornutum</i>	Glyphosate acid, 95% (corrected)	48 hr	EC ₅₀	256.5	Growth
<i>S. capricornutum</i>	Glyphosate acid 96.6% a.e.	7-d	EC ₅₀	13.8	Growth
<i>S. capricornutum</i>	Glyphosate IPA acid	96 hr	EC ₅₀	24.7	Growth
<i>S. capricornutum</i>	Glyphosate IPA salt	96 hr	EC ₅₀	41	Growth
<i>S. capricornutum</i>	Glyphosate acid 95.6% a.e.	120 hr	EC ₅₀	21	Growth
<i>A. flos-aquae</i>	Glyphosate acid 95.6% a.e.	120 hr	EC ₅₀	18	Cell density
<i>A. flos-aquae</i>	Glyphosate acid 95.6% a.e.	120 hr	EC ₅₀	15	Biomass
<i>A. flos-aquae</i>	Glyphosate acid 95.6% a.e.	120 hr	EC ₅₀	38	Growth
<i>A. flos-aquae</i>	Glyphosate technical (96.6%) corrected	7-d	LC ₅₀	4.3	Growth
<i>N. pelliculosa</i>	Glyphosate acid 95.6% a.e.	120 hr	EC ₅₀	17	Biomass
<i>N. pelliculosa</i>	Glyphosate acid 96.6% a.e.	7-d	EC ₅₀	24.9	inhibition
<i>Freshwater periphyton in shade</i>	Glyphosate IPA (corrected)	6 hr	EC ₅₀	8.7	photosynthetic efficicency
<i>Freshwater periphyton in shade</i>	Glyphosate IPA (corrected)	6 hr	EC ₅₀	26.3	photosynthetic efficicency
<i>C. vulgaris</i>	Glyphosate acid, 95%	96 hr	EC ₅₀	4.7	Growth
<i>C. vulgaris</i>	Glyphosate acid, 97.5%	72 hr	EC ₅₀	41.7	Growth
<i>C. saccharophila</i>	Glyphosate acid, 97.5%	72 hr	EC ₅₀	40.6	Growth
<i>S. subspicatus</i>	Glyphosate acid	72 hr	EC ₅₀	26	Growth

Species Name or Taxon	Formulation Type	Duration	Reported Endpoint	Toxicity Value (mg a.e./L)*	Measurement Endpoint
	97.5%				
<i>S. subspicatus</i>	Glyphosate acid 98.8% a.i.	72 hr	EC ₅₀	326.9	Growth
<i>C. pyrenoidosa</i>	Glyphosate (technical 95%)	96 hr	EC ₅₀	3.53	Growth
<i>C. pyrenoidosa</i>	Glyphosate acid, 96.7%	96 hr	EC ₅₀	590	Growth
<i>C. hypnosporum</i>	Glyphosate acid, 96.7%	96 hr	EC ₅₀	68	Growth
<i>Z. clindricum</i>	Glyphosate acid, 96.7%	96 hr	EC ₅₀	88	Growth
<i>S. obliquus</i>	Glyphosate acid, 95%	96 hr	EC ₅₀	55.85	Growth
<i>S. acutus</i>	Glyphosate IPA, 99.5%	96 hr	EC ₅₀	10.2	Growth
<i>S. acutus</i>	Glyphosate acid, 97.5%	96 hr	EC ₅₀	24.5	Growth
<i>S. quadricauda</i>	Glyphosate IPA salt (99.5%)	96 hr	EC ₅₀	7.2	Growth
<i>C. fusa</i>	Glyphosate IPA	24 hr	EC ₅₀	280	Growth
Glyphosate Formulation (Non-POEA)					
<i>S. capricornutum</i>	CHA 4520 Glyphos Bio (31.3% corrected)	72 hr	EbC ₅₀	51	Biomass
<i>S. capricornutum</i>	CHA 4520 Glyphos Bio (31.3% corrected)	72 hr	ErC ₅₀	100.2	Growth rate
<i>S. capricornutum</i>	CHA 4521 Glyphos Bio (30.9% corrected)	72 hr	EbC ₅₀	58.4	Biomass
<i>S. capricornutum</i>	CHA 4521 Glyphos Bio (30.9% corrected)	72 hr	ErC ₅₀	77.9	Growth
<i>S. capricornutum</i>	CHA 45EXT (31.3% corrected)	72 hr	EbC ₅₀	24.1	Biomass
<i>S. capricornutum</i>	CHA 45EXT (31.3% corrected)	72 hr	ErC ₅₀	42.6	Growth

Species Name or Taxon	Formulation Type	Duration	Reported Endpoint	Toxicity Value (mg a.e./L)*	Measurement Endpoint
<i>S. capricornutum</i>	Glyphosate IPA salt, 36% + Geronol CF/AR	72 hr	EC ₅₀	97	NR
		72 hr	EC ₅₀	39	NR
<i>S. capricornutum</i>	CHA 4525 Glyphos Bio 450 (37.7%)	96 hr	EbC ₅₀	24.8	biomass
		96 hr	ErC ₅₀	130.1	growth
<i>Ankistrodesmus sp.</i>	Rodeo (no surfactant)	96 hr	EC ₅₀	29	NR
<i>N. pelliculosa</i>	Glyfos B 31%	96 hr	EC ₅₀	0.12	NR
Glyphosate Formulation (With POEA)					
<i>S. capricornutum</i>	Roundup, 360 g/L	48 hr	EC ₅₀	19	Growth
<i>S. capricornutum</i>	Glyphosate 360 g/L	72 hr	EC ₅₀	34	Cell density
<i>S. capricornutum</i>	Glyphosate 360 g/L	72 hr	EC ₅₀	38	Biomass
<i>S. capricornutum</i>	Glyphosate 360 g/L	72 hr	EC ₅₀	87	Growth
<i>S. capricornutum</i>	MON 78568,	72 hr	EC ₅₀	11.2	NR
<i>S. capricornutum</i>	Roundup, 41% IPA salt	96 hr	IC ₅₀	5.81	Growth inhibition
<i>S. capricornutum</i>	Glyphos IPA (31%)	96 hr	LC ₅₀	0.68	NR
<i>S. quadricauda</i>	Ron-do, 48% IPA	96 hr	LC ₅₀	9.09	NR
<i>Chlorella kessleri</i>	ATANOR (48% glyphosate IPA; surfactant: 50% IMPACTO	96 hr	EC ₅₀	19.7	Growth
POEA Alone					
<i>S. capricornutum</i>	POEA	96 hr	IC ₅₀	3.92	Growth inhibition
<i>S. capricornutum</i>	POEA	96 hr	EC ₅₀	4.1	NR
<i>N. pelliculosa</i>	POEA	96 hr	EC ₅₀	3.35	NR
AMPA					
<i>Scenedesmus subspicatus</i>	AMPA	120 hr	EC ₅₀	74	Cell density
<i>Scenedesmus subspicatus</i>	AMPA	120 hr	EC ₅₀	89.8	Biomass
<i>Scenedesmus subspicatus</i>	AMPA	120 hr	EC ₅₀	440	Growth

Species Name or Taxon	Formulation Type	Duration	Reported Endpoint	Toxicity Value (mg a.e./L)*	Measurement Endpoint
Freshwater Algae Chronic Data					
Glyphosate Technical					
<i>Chlorella vulgaris</i>	Glyphosate	21-d	EC ₅₀	292.3	Growth
<i>Spirulina platensis</i>	Glyphosate	21-d	EC ₅₀	>169	Growth
<i>Arthrospira fusiformis</i>	Glyphosate	21-d	EC ₅₀	>169	Growth
<i>Nostoc punctiforme</i>	Glyphosate	21-d	EC ₅₀	598.4	Growth
<i>Anabaena catenula</i>	Glyphosate	21-d	EC ₅₀	256.5	Growth
<i>Synechocystis aquatilis</i>	Glyphosate	21-d	EC ₅₀	164.9	Growth
<i>Microcystis eruginosa</i>	Glyphosate	21-d	EC ₅₀	251.4	Growth
<i>Leptolyngbya boryana</i>	Glyphosate	21-d	EC ₅₀	246.6	Growth
Glyphosate Formulation (With POEA)					
<i>Chlorella vulgaris</i>	Roundup 360 SL (23%)	21-d	EC ₅₀	27.1	Growth
<i>Spirulina platensis</i>	Roundup 360 SL (23%)	21-d	EC ₅₀	7.6	Growth
<i>Arthrospira fusiformis</i>	Roundup 360 SL (23%)	21-d	EC ₅₀	6.5	Growth
<i>Nostoc punctiforme</i>	Roundup 360 SL (23%)	21-d	EC ₅₀	9.7	Growth
<i>Anabaena catenula</i>	Roundup 360 SL (23%)	21-d	EC ₅₀	0.7	Growth
<i>Synechocystis aquatilis</i>	Roundup 360 SL (23%)	21-d	EC ₅₀	20.7	Growth
<i>Microcystis eruginosa</i>	Roundup 360 SL (23%)	21-d	EC ₅₀	1.5	Growth
<i>Leptolyngbya boryana</i>	Roundup 360 SL (23%)	21-d	EC ₅₀	0.9	Growth
Freshwater Plants Acute Data					
Glyphosate Technical					
<i>L. gibba</i>	Glyphosate acid, 95%	10-d	EC ₅₀	20.5	NR
<i>L. gibba</i>	Glyphosate acid 95.6% a.e.	14-d	EC ₅₀	12	Fronds

Species Name or Taxon	Formulation Type	Duration	Reported Endpoint	Toxicity Value (mg a.e./L)*	Measurement Endpoint
<i>L. gibba</i>	Glyphosate acid 95.6% a.e.	14-d	EC ₅₀	16	Dry wt
<i>L. gibba</i>	Glyphosate acid 95.6% a.e.	14-d	EC ₅₀	30.7	Growth
<i>L. gibba</i>	Glyphosate acid 95.6% a.e.	14-d	EC ₅₀	31.9	Biomass
<i>L. gibba</i>	Glyphosate acid, 96.8%	7-d	EC ₅₀	23.2	Biomass
<i>L. Minor</i>	Glyphosate acid, 95%	7-d	EC ₅₀	46.9	NR
<i>L. paucicostata</i>	Glyphosate, IPA	7-d	EC ₅₀	31	NR
Glyphosate Formulation (Non-POEA)					
<i>L. gibba</i>	Glyphos (Glyphosate IPA salt, 31%)	7-d	EC ₅₀	7.7	NR
Glyphosate Formulation (With POEA)					
<i>L. gibba</i>	Roundup Max, 70.7% a.e.	10-d	EC ₅₀	11.6	Growth
<i>L. Minor</i>	Roundup	48 hr	EC ₅₀	> 16.91	NR
<i>L. Minor</i>	Roundup 360 g/L	7-d	EC ₅₀	3.36	Growth
<i>L. Minor</i>	Roundup	14-d	EC ₅₀	2	Growth
<i>L. Minor</i>	MON 2139	7-d	ErC ₅₀	> 1.824	Growth inhibition
<i>Pontederia cordata</i>	MON 78087 (31.2%)	21-d	EC ₅₀	0.0488	Fresh shoot biomass
<i>Carex comosa</i>	MON 78087 (31.2%)	21-d	EC ₅₀	0.0625	Fresh shoot biomass
<i>Nymphaea odorata</i>	MON 78087 (31.2%)	21-d	EC ₅₀	0.0475	Fresh biomass
Amphibians Acute Data					
Glyphosate Technical					
<i>Crinia insignifera</i>	Glyphosate acid	48 hr	LC ₅₀	83.6	Mortality
<i>Crinia insignifera</i>	Glyphosate acid, 96%	96 hr	LC ₅₀	75	Mortality
<i>Crinia insignifera</i>	Glyphosate IPA salt	48 hr	LC ₅₀	> 466	Mortality
<i>Crinia insignifera</i>	Glyphosate acid, 96%	96 hr	LC ₅₀	103.2	Mortality
<i>Heleioporus eyrei</i>	Glyphosate IPA salt	48 hr	LC ₅₀	> 373	Mortality
<i>Limnodynastes dorsalis</i>	Glyphosate IPA salt	48 hr	LC ₅₀	> 400	Mortality

Species Name or Taxon	Formulation Type	Duration	Reported Endpoint	Toxicity Value (mg a.e./L)*	Measurement Endpoint
<i>Litoria moorei</i>	Glyphosate acid	48 hr	LC ₅₀	81.2	Mortality
<i>Litoria moorei</i>	Glyphosate acid	48 hr	LC ₅₀	121	Mortality
<i>Litoria moorei</i>	Glyphosate IPA	48 hr	LC ₅₀	> 343	Mortality
<i>Lithobates clamitans</i>	Glyphosate IPA salt	96 hr	LC ₅₀	> 17.9	Mortality
Glyphosate Formulation (Non-POEA)					
<i>Litoria moorei</i>	Roundup Biactive® MON 77920	48 hr	LC ₅₀	328	Mortality
<i>Limnodynastes dorsalis</i>	Roundup Biactive® MON 77920	48 hr	LC ₅₀	> 400	Mortality
<i>Heleioporos eyrei</i>	Roundup Biactive® MON 77920	48 hr	LC ₅₀	> 427	Mortality
<i>Crinia insignifera</i>	Roundup Biactive® MON 77920	48 hr	LC ₅₀	> 494	Mortality
<i>Ranidella signifera</i>	Glyphosate IPA 45% + Geronol	96 hr	LC ₅₀	> 450	Mortality
<i>Ranidella signifera</i>	Glyphosate IPA 10% + Geronol	96 hr	LC ₅₀	> 100	Mortality
<i>Ranidella signifera</i>	Glyphosate IPA 36% + Geronol	96 hr	LC ₅₀	> 360	Mortality
<i>Ranidella signifera</i>	Roundup Biactive® 36%	96 hr	LC ₅₀	> 360	Mortality
<i>Lithobates clamitans</i>	Roundup Biactive® MON 77920	96 hr	LC ₅₀	> 17.9	Mortality
<i>Xenopus laevis</i>	Rodeo®	96 hr	LC ₅₀	7297	Mortality
Glyphosate Formulation (With POEA)					
<i>Ambystoma gracile</i>	Roundup Original® Max	96 hr	LC ₅₀	2.8	Mortality
<i>Ambystoma laterale</i>	Roundup Original® Max	96 hr	LC ₅₀	3.2	Mortality
<i>Ambystoma maculatum</i>	Roundup Original® Max	96 hr	LC ₅₀	2.8	Mortality
<i>Anaxyrus americanus</i>	Roundup Original®/MON 78087 (15% POEA)	96 hr	LC ₅₀	< 4	Mortality
<i>Anaxyrus americanus</i>	Vision® (15% POEA) pH 6	96 hr	LC ₅₀	4.8	Mortality

Species Name or Taxon	Formulation Type	Duration	Reported Endpoint	Toxicity Value (mg a.e./L)*	Measurement Endpoint
<i>Anaxyrus americanus</i>	Vision® (15% POEA) pH 7.5	96 hr	LC ₅₀	6.4	Mortality
<i>Anaxyrus americanus</i>	Roundup Original®/MON 78087 (15% POEA)	96 hr	LC ₅₀	8	Mortality
<i>Anaxyrus americanus</i>	Roundup Original® Max	96 hr	LC ₅₀	1.6	Mortality
<i>Anaxyrus americanus</i>	Vision® (15% POEA) pH 7.5	96 hr	LC ₅₀	1.7	Mortality
<i>Anaxyrus americanus</i>	Vision® (15% POEA) pH 6	96 hr	LC ₅₀	2.9	Mortality
<i>Anaxyrus boreas</i>	Roundup Original® Max	96 hr	LC ₅₀	2	Mortality
<i>Anaxyrus fowleri</i>	Roundup Weathermax	96 hr	LC ₅₀	1.96	Mortality
<i>Centrolene prosoblepon</i>	Glyphos + Cosmo-Flux (10-15% POEA)	96 hr	LC ₅₀	2.4	Mortality
<i>Crinia insignifera</i>	Roundup® 360	48 hr	LC ₅₀	30.4	Mortality
<i>Crinia insignifera</i>	Roundup® (MON 2139)	48 hr	LC ₅₀	49.4	Mortality
<i>Crinia insignifera</i>	Roundup® (MON 2139)	48 hr	LC ₅₀	51.8	Mortality
<i>Crinia insignifera</i>	Roundup® 360	96 hr	LC ₅₀	5.6	Mortality
<i>Crinia insignifera</i>	Roundup® 360	48 hr	LC ₅₀	38.2	Mortality
<i>Crinia insignifera</i>	Roundup® (MON 2139)	48 hr	LC ₅₀	3.6	Mortality
<i>Dendropsophus microcephalus</i>	Glyphos + Cosmo-Flux (10-15% POEA)	96 hr	LC ₅₀	1.2	Mortality
<i>Engystomops pustulosus</i>	Glyphos + Cosmo-Flux (10-15% POEA)	96 hr	LC ₅₀	2.8	Mortality
<i>Heleioporus eyrei</i>	Roundup® (MON 2139)	48 hr	LC ₅₀	6.3	Mortality
<i>Heleioporus eyrei</i>	Roundup® (MON 2139)	48 hr	LC ₅₀	8.6	Mortality
<i>Hyla chrysocelis</i>	Roundup Weathermax	96 hr	LC ₅₀	3.26	Mortality
<i>Hyla chrysocelis</i>	Roundup®	96 hr		2.5	Mortality

Species Name or Taxon	Formulation Type	Duration	Reported Endpoint	Toxicity Value (mg a.e./L) ^a	Measurement Endpoint
	original formulation		LC ₅₀		
<i>Hyla versicolor</i>	Roundup Original® Max	96 hr	LC ₅₀	1.7	Mortality
<i>Hypsiboas crepitans</i>	Glyphos + Cosmo-Flux (10-15% POEA)	96 hr	LC ₅₀	2.1	Mortality
<i>Limnodynastes dorsalis</i>	Roundup® (MON 2139)	48 hr	LC ₅₀	3	Mortality
<i>Litoria moorei</i>	Roundup® (MON 2139)	48 hr	LC ₅₀	2.9	Mortality
<i>Litoria moorei</i>	Roundup® (MON 2139)	48 hr	LC ₅₀	11.6	Mortality
<i>Notophthalmus viridescens</i>	Roundup Original® Max	96 hr	LC ₅₀	2.7	Mortality
<i>Pseudacris crucifer</i>	Roundup Original® Max	96 hr	LC ₅₀	0.8	Mortality
<i>Lithobates clamitans</i>	Vision® (15% POEA)	96 hr	LC ₅₀	2.7	Mortality
<i>Lithobates clamitans</i>	Vision® (15% POEA)	96 hr	LC ₅₀	4.34	Mortality
<i>Rana cascadae</i>	Roundup Original® Max	96 hr	LC ₅₀	1.7	Mortality
<i>Lithobates catesbeianus</i>	Roundup Original® Max	96 hr	LC ₅₀	0.8	Mortality
<i>Lithobates catesbeianus</i>	Roundup Weathermax	96 hr	LC ₅₀	1.97	Mortality
<i>Lithobates catesbeianus</i>	Roundup® original formulation	96 hr	LC ₅₀	2.77	Mortality
<i>Lithobates clamitans</i>	Glyfos BIO® with 3-7% POEA	96 hr	LC ₅₀	> 17.9	Mortality
<i>Lithobates clamitans</i>	Glyfos AU® with 3-7% POEA	96 hr	LC ₅₀	8.9	Mortality
<i>Lithobates clamitans</i>	Roundup® original formulation	96 hr	LC ₅₀	4.22	Mortality
<i>Lithobates clamitans</i>	Vision® (15% POEA) pH 7.5	96 hr	LC ₅₀	1.4	Mortality
<i>Lithobates clamitans</i>	Roundup Transorb®	96 hr	LC ₅₀	2.2	Mortality

Species Name or Taxon	Formulation Type	Duration	Reported Endpoint	Toxicity Value (mg a.e./L)*	Measurement Endpoint
	(15% POEA)				
<i>Lithobates clamitans</i>	Roundup Weathermax	96 hr	LC ₅₀	2.77	Mortality
<i>Lithobates clamitans</i>	Vision® (15% POEA) pH 6	96 hr	LC ₅₀	3.5	Mortality
<i>Lithobates clamitans</i>	Vision® (15% POEA) pH 7.5	96 hr	LC ₅₀	4.1	Mortality
<i>Lithobates clamitans</i>	Vision® (15% POEA) pH 6	96 hr	LC ₅₀	5.3	Mortality
<i>Lithobates clamitans</i>	Roundup Original® Max	96 hr	LC ₅₀	1.4	Mortality
<i>Lithobates clamitans</i>	Roundup Original®/MON 78087 (15% POEA)	96 hr	LC ₅₀	7.1	Mortality
<i>Lithobates clamitans</i>	Roundup Original®/MON 78087 (15% POEA)	96 hr	LC ₅₀	2	Mortality
<i>Lithobates pipiens</i>	Roundup Weathermax	96 hr	LC ₅₀	2.27	Mortality
<i>Lithobates pipiens</i>	Roundup Original® Max	96 hr	LC ₅₀	1.5	Mortality
<i>Lithobates pipiens</i>	Roundup Original®/MON 78087 (15% POEA)	96 hr	LC ₅₀	2.9	Mortality
<i>Lithobates pipiens</i>	Vision® (15% POEA)	96 hr	LC ₅₀	4.25	Mortality
<i>Lithobates pipiens</i>	Vision® (15% POEA)	96 hr	LC ₅₀	11.47	Mortality
<i>Lithobates pipiens</i>	Roundup Original®/MON 78087 (15% POEA)	96 hr	LC ₅₀	6.5	Mortality
<i>Lithobates pipiens</i>	Vision® (15% POEA) pH 6	96 hr	LC ₅₀	1.8	Mortality
<i>Lithobates pipiens</i>	Vision® (15% POEA) pH 7.5	96 hr	LC ₅₀	1.1	Mortality
<i>Lithobates pipiens</i>	Vision® (15% POEA) pH 7.5	96 hr	LC ₅₀	7.5	Mortality
<i>Lithobates pipiens</i>	Vision® (15% POEA) pH 6	96 hr	LC ₅₀	15.1	Mortality

Species Name or Taxon	Formulation Type	Duration	Reported Endpoint	Toxicity Value (mg a.e./L)*	Measurement Endpoint
<i>Lithobates pipiens</i>	Roundup® original formulation	96 hr	LC ₅₀	1.8	Mortality
<i>Rana sphenocephalia</i>	Roundup Weathermax	96 hr	LC ₅₀	1.33	Mortality
<i>Rana sphenocephalia</i>	Roundup® original formulation	96 hr	LC ₅₀	2.05	Mortality
<i>Lithobates sylvaticus</i>	Roundup Original® Max	96 hr	LC ₅₀	1.9	Mortality
<i>Lithobates sylvaticus</i>	Roundup Original®/MON 78087 (15% POEA)	96 hr	LC ₅₀	> 8	Mortality
<i>Lithobates sylvaticus</i>	Roundup Original®/MON 78087 (15% POEA)	96 hr	LC ₅₀	5.1	Mortality
<i>Rhinella margaritifera</i>	Glyphos + Cosmo-Flux (10-15% POEA)	96 hr	LC ₅₀	1.5	Mortality
<i>Rhinella granulosa</i>	Glyphos + Cosmo-Flux (10-15% POEA)	96 hr	LC ₅₀	2.3	Mortality
<i>Rhinella marina</i>	Glyphos + Cosmo-Flux (10-15% POEA)	96 hr	LC ₅₀	2.7	Mortality
<i>Scinax ruber</i>	Glyphos + Cosmo-Flux (10-15% POEA)	96 hr	LC ₅₀	1.6	Mortality
<i>Scinax nasicus</i>	Glyfos (48% IPA and 15% POEA)	96 hr	LC ₅₀	0.94	Mortality
<i>Scinax nasicus</i>	Glyfos (48% IPA and 15% POEA)	96 hr	LC ₅₀	0.94	Mortality
<i>Spea bombifrons</i>	Roundup WeatherMAX® (crop playa)	96 hr	LC ₅₀	1.85	Mortality
<i>Spea bombifrons</i>	Roundup WeatherMAX® (grass playa)	96 hr	LC ₅₀	2.03	Mortality

Species Name or Taxon	Formulation Type	Duration	Reported Endpoint	Toxicity Value (mg a.e./L)*	Measurement Endpoint
<i>Spea multiplicata</i>	Roundup WeatherMAX® (crop playa)	96 hr	LC ₅₀	2.11	Mortality
<i>Spea multiplicata</i>	Roundup WeatherMAX® (grass playa)	96 hr	LC ₅₀	2.3	Mortality
<i>Xenopus laevis</i>	Roundup with POEA	96 hr	LC ₅₀	9.3	Mortality
<i>Xenopus laevis</i>	Glyphos + Cosmo-Flux	96 hr	LC ₅₀	1.3	Mortality
<i>Xenopus laevis</i>	Vision® (15% POEA) pH 7.5	96 hr	LC ₅₀	0.88	Mortality
<i>Xenopus laevis</i>	Vision® (15% POEA) pH 6	96 hr	LC ₅₀	2.1	Mortality
<i>Xenopus laevis</i>	Vision® (15% POEA) pH 7.5	96 hr	LC ₅₀	14.6	Mortality
<i>Xenopus laevis</i>	Vision® (15% POEA) pH 6	96 hr	LC ₅₀	15.6	Mortality
POTA Alone					
<i>Lithobates clamitans</i>	MON 0818	96 hr	LC ₅₀	1.32	Mortality
<i>Xenopus laevis</i>	POEA	96 hr	LC ₅₀	6.8	Mortality
<i>Lithobates pipiens</i>	MON 0818	96 hr	LC ₅₀	0.68	Mortality
<i>Lithobates catesbeianus</i>	MON 0818	96 hr	LC ₅₀	0.83	Mortality
<i>Anaxyrus fowleri</i>	MON 0818	96 hr	LC ₅₀	0.8	Mortality
<i>Hyla chrysocelis</i>	MON 0818	96 hr	LC ₅₀	> 1.25	Mortality
<i>Lithobates clamitans</i>	MON 0818 (69-73%)	96 hr	LC ₅₀	2.2	Mortality
Amphibians Subchronic and Chronic Data					
Glyphosate Technical					
<i>Lithobates pipiens</i>	Technical grade glyphosate IPA	42-d	NOEC	1.8	Highest limit concentration
Glyphosate Formulation (With POEA)					
<i>Lithobates catesbeianus</i>	Roundup (IPA with surfactant, corrected)	16-d	LC ₅₀	1.55	Mortality
<i>Lithobates clamitans</i>	Roundup (IPA with surfactant, corrected)	16-d	LC ₅₀	1.63	Mortality

Species Name or Taxon	Formulation Type	Duration	Reported Endpoint	Toxicity Value (mg a.e./L)*	Measurement Endpoint
<i>Hyla versicolor</i>	Roundup (IPA with surfactant, corrected)	16-d	LC ₅₀	1	Mortality
<i>Lithobates pipiens</i>	Roundup (IPA with surfactant, corrected)	16-d	LC ₅₀	1.85	Mortality
<i>Anaxyrus americanus</i>	Roundup (IPA with surfactant, corrected)	16-d	LC ₅₀	1.89	Mortality
<i>Lithobates sylvaticus</i>	Roundup (IPA with surfactant, corrected)	16-d	LC ₅₀	1	Mortality
Amphibian Terrestrial Microcosm					
Glyphosate Formulation (With POEA)					
<i>Rhinella margaritifera</i>	Glyphos and Cosmo-Flux	96 hr	LC ₅₀	14.8	Mortality
<i>Scinax ruber</i>	Glyphos and Cosmo-Flux	96 hr	LC ₅₀	7.3	Mortality
<i>Rhinella granulosa</i>	Glyphos and Cosmo-Flux	96 hr	LC ₅₀	6.5	Mortality
<i>Centrolene prosoblepon</i>	Glyphos and Cosmo-Flux	96 hr	LC ₅₀	4.5	Mortality
<i>Rhinella marina</i>	Glyphos and Cosmo-Flux	96 hr	LC ₅₀	22.8	Mortality
<i>Engystomops pustulosus</i>	Glyphos and Cosmo-Flux	96 hr	LC ₅₀	19.6	Mortality
<i>Pristimantis taeniatus</i>	Glyphos and Cosmo-Flux	96 hr	LC ₅₀	5.6	Mortality
<i>Dendrobates truncatus</i>	Glyphos and Cosmo-Flux	96 hr	LC ₅₀	> 7.38	Mortality
Amphibian Aquatic Field Microcosm					
Glyphosate Formulation (With POEA)					
<i>Rhinella marina</i>	Glyphos and Cosmo-Flux	96 hr	LC ₅₀	5.96	Mortality
<i>Scinax ruber</i>	Glyphos and Cosmo-Flux	96 hr	LC ₅₀	6.9	Mortality
<i>Hypsiboas crepitans</i>	Glyphos and Cosmo-Flux	96 hr	LC ₅₀	7.3	Mortality
<i>Rhinella granulosa</i>	Glyphos and Cosmo-Flux	96 hr	LC ₅₀	7.17	Mortality

Species Name or Taxon	Formulation Type	Duration	Reported Endpoint	Toxicity Value (mg a.e./L)*	Measurement Endpoint
Amphibian Aquatic Field Mesocosm					
Glyphosate Formulation (With POEA)					
<i>Lithobates sylvaticus</i>	Roundup Original Max® (Early applic.)	21-d	LC ₅₀	2.1	Mortality
<i>Lithobates sylvaticus</i>	Roundup Original Max® ((Midday applic.)	21-d	LC ₅₀	2.44	Mortality
<i>Lithobates sylvaticus</i>	Roundup Original Max® (Late applic.)	21-d	LC ₅₀	4.27	Mortality
<i>Anaxyrus americanus</i>	Roundup Original Max® (Early applic.)	21-d	LC ₅₀	2.31	Mortality
<i>Anaxyrus americanus</i>	Roundup Original Max® (Midday applic.)	21-d	LC ₅₀	2.3	Mortality
<i>Anaxyrus americanus</i>	Roundup Original Max® (Late applic.)	21-d	LC ₅₀	3.93	Mortality
<i>Hyla versicolor</i>	Roundup Original Max® (high density)	16-d	LC ₅₀	1.71	Mortality
<i>Lithobates catesbeianus</i>	Roundup Original Max® (high density)	16-d	LC ₅₀	1.61	Mortality
<i>Lithobates clamitans</i>	Roundup Original Max® (high density)	16-d	LC ₅₀	2.18	Mortality
<i>Lithobates clamitans</i>	Vision Max (540 g a.e/L)	14-d	LC ₅₀	> 0.55	Mortality
Glyphosate Technical					
<i>Oyster embryo</i>	Glyphosate technical	24 hr	EC ₅₀	> 0.005	Embryo abnormality (32% effect at 0.005 mg a.e./L)
Pacific Oyster	Glyphosate (97% purity) corrected	48 hr	EC ₅₀	> 97	Metamorphic success
Mysid S hrimp	Glyphosate acid (95.6% purity)	96 hr	LC ₅₀	80	Mortality

Species Name or Taxon	Formulation Type	Duration	Reported Endpoint	Toxicity Value (mg a.e./L)*	Measurement Endpoint
Fiddler Crab	Roundup Technical (96.7% purity)	96 hr	EC ₅₀	934	Mean carapace width
Grass Shrimp	Roundup Technical (96.7% purity)	96 hr	EC ₅₀	281	Mean length
Pacific Oyster	Glyphosate acid (95.6% purity)	48 hr	EC ₅₀	40	Larval development
Pacific Oyster	glyphosate (97% purity)	48 hr	EC ₅₀	27.5	Larval development
Atlantic Oyster (embryo)	Roundup Technical (96.7% purity)	48 hr	EC ₅₀	> 10	Larval development
<i>Acartia tonsa</i>	Glyphosate acid	48 hr	LC ₅₀	35.3	Mortality
<i>Acartia tonsa</i>	Glyphosate IPA	48 hr	LC ₅₀	49.3	Mortality
Glyphosate Formulation (Non-POEA)					
Pacific Oyster	Glyphosate SL (YF11357) 28.3%	48 hr	EC ₅₀	23.2	Laraval development
Mysid Shrimp	Glyphosate SL (YF11357) 28.3%	96 hr	EC ₅₀	> 54	Mortality
Glyphosate Formulation (With POEA)					
Blue crab	Roundup Pro (50.2% IPA) POEA)	24 hr	LC ₅₀	158.6	Juvenile mortality
Pacific Oyster	Roundup Express (7.3 g a.i./L)	48 hr	EC ₅₀	6.9	Metamorphic success
Pacific Oyster	Roundup Allées et Terrasses (4.4 g a.i./L)	48 hr	EC ₅₀	7.6	Metamorphic success
<i>Acartia tonsa</i>	Roundup	48 hr	LC ₅₀	1.8	Mortality
<i>Oyster embryo</i>	Roundup	24 hr	EC ₅₀	> 0.005	Highest tested concentration
Atlantic Oyster (embryo)	MON 2139 Roundup® (30.75 % a.e.)	48 hr	EC ₅₀	1	shell development
POEA Alone					
<i>Acartia tonsa</i>	POEA	48 hr	LC ₅₀	0.6	Mortality
AMPA					
Pacific Oyster	AMPA	48 hr	EC ₅₀	> 97	Metamorphic success

Species Name or Taxon	Formulation Type	Duration	Reported Endpoint	Toxicity Value (mg a.e./L)*	Measurement Endpoint
Estuarine/Marine Fish Acute Data					
Glyphosate Technical					
Sheepshead minnow	Glyphosate technical (95.6% purity)	96 hr	LC ₅₀	247	Mortality
Chinook salmon	Glyphosate technical (city)	96 hr	LC ₅₀	19	Mortality
Chinook salmon	Glyphosate technical (creek)	96 hr	LC ₅₀	30	Mortality
Chinook salmon	Glyphosate technical (reconstituted)	96 hr	LC ₅₀	102	Mortality
Chinook salmon	Glyphosate technical (well)	96 hr	LC ₅₀	108	Mortality
Chinook salmon	Glyphosate technical (lake)	96 hr	LC ₅₀	211	Mortality
Coho salmon	Glyphosate technical (city)	96 hr	LC ₅₀	27	Mortality
Coho salmon	Glyphosate technical (creek)	96 hr	LC ₅₀	36	Mortality
Coho salmon	Glyphosate technical (reconstituted)	96 hr	LC ₅₀	112	Mortality
Coho salmon	Glyphosate technical (well)	96 hr	LC ₅₀	111	Mortality
Coho salmon	Glyphosate technical (lake)	96 hr	LC ₅₀	174	Mortality
Chum salmon	Glyphosate technical (city)	96 hr	LC ₅₀	10	Mortality
Chum salmon	Glyphosate technical (creek)	96 hr	LC ₅₀	22	Mortality
Chum salmon	Glyphosate technical (reconstituted)	96 hr	LC ₅₀	99	Mortality
Chum salmon	Glyphosate technical (lake)	96 hr	LC ₅₀	148	Mortality
Pink salmon	Glyphosate technical (city)	96 hr	LC ₅₀	14	Mortality
Pink salmon	Glyphosate technical (creek)	96 hr	LC ₅₀	23	Mortality
Pink salmon	Glyphosate technical (reconstituted)	96 hr	LC ₅₀	94	Mortality

Species Name or Taxon	Formulation Type	Duration	Reported Endpoint	Toxicity Value (mg a.e./L)*	Measurement Endpoint
Pink salmon	Glyphosate technical (well)	96 hr	LC ₅₀	102	Mortality
Pink salmon	Glyphosate technical (lake)	96 hr	LC ₅₀	190	Mortality
Glyphosate Formulation (Non-POEA)					
Chinook salmon	Rodeo® + X-77	96 hr	LC ₅₀	103.8	Mortality
Chinook salmon	Rodeo® + X-77	96 hr	LC ₅₀	180.2	Mortality
Coho salmon	Rodeo® + X-77	96 hr	LC ₅₀	148.3	Mortality
Glyphosate Formulation (With POEA)					
Chinook salmon	Roundup®	96 hr	LC ₅₀	7.1	Mortality
Chinook salmon	Roundup® (Vision®) 30.5%	96 hr	LC ₅₀	5.8	Mortality
Chinook salmon	Roundup® (Vision®) 30.5%	96 hr	LC ₅₀	8.2	Mortality
Chinook salmon	Roundup® (Vision®) 30.5%	96 hr	LC ₅₀	10	Mortality
Chinook salmon	Roundup® (Vision®) 30.5%	96 hr	LC ₅₀	5.2	Mortality
Chinook salmon	Roundup® (Vision®) 30.5%	96 hr	LC ₅₀	6.7	Mortality
Chinook salmon	MON 8709 30.5%	96 hr	LC ₅₀	8.54	Mortality
Chinook salmon	MON 8709 30.5%	96 hr	LC ₅₀	13.7	Mortality
Chinook salmon	MON 8709 30.5%	96 hr	LC ₅₀	18.9	Mortality
Chinook salmon	MON 8709 30.5%	96 hr	LC ₅₀	20.4	Mortality
Chinook salmon	MON 8709 30.5%	96 hr	LC ₅₀	10.1	Mortality
Chinook salmon	Roundup®	96 hr	LC ₅₀	7.1	Mortality
Coho salmon	Roundup®	96 hr	LC ₅₀	8.1	Mortality
Coho salmon	Roundup® (Vision®)	96 hr	LC ₅₀	8.2	Mortality
Coho salmon	Roundup® (Vision®)	96 hr	LC ₅₀	9.2	Mortality
Coho salmon	Roundup® (Vision®)	96 hr	LC ₅₀	10	Mortality

Species Name or Taxon	Formulation Type	Duration	Reported Endpoint	Toxicity Value (mg a.e./L)*	Measurement Endpoint
Coho salmon	Roundup® (Vision®)	96 hr	LC ₅₀	4	Mortality
Coho salmon	Roundup® (Vision®)	96 hr	LC ₅₀	9	Mortality
Coho salmon	MON 8709	96 hr	LC ₅₀	13.4	Mortality
Coho salmon	MON 8709	96 hr	LC ₅₀	15.6	Mortality
Coho salmon	MON 8709	96 hr	LC ₅₀	16.8	Mortality
Coho salmon	MON 8709	96 hr	LC ₅₀	7.6	Mortality
Coho salmon	MON 8709	96 hr	LC ₅₀	10.4	Mortality
Coho salmon (fry)	Roundup®	96 hr	LC ₅₀	12.8	Mortality
Chum salmon	Roundup® (Vision®)	96 hr	LC ₅₀	5.8	Mortality
Chum salmon	Roundup® (Vision®)	96 hr	LC ₅₀	3.4	Mortality
Chum salmon	Roundup® (Vision®)	96 hr	LC ₅₀	6.1	Mortality
Chum salmon	Roundup® (Vision®)	96 hr	LC ₅₀	4.6	Mortality
Chum salmon	MON 8709	96 hr	LC ₅₀	11	Mortality
Chum salmon	MON 8709	96 hr	LC ₅₀	7	Mortality
Chum salmon	MON 8709	96 hr	LC ₅₀	10.4	Mortality
Chum salmon	MON 8709	96 hr	LC ₅₀	17.7	Mortality
Pink salmon	Roundup® (Vision®)	96 hr	LC ₅₀	5.8	Mortality
Pink salmon	Roundup® (Vision®)	96 hr	LC ₅₀	4.3	Mortality
Pink salmon	Roundup® (Vision®)	96 hr	LC ₅₀	10.1	Mortality
Pink salmon	Roundup® (Vision®)	96 hr	LC ₅₀	9.5	Mortality
Pink salmon	Roundup® (Vision®)	96 hr	LC ₅₀	5.2	Mortality
Pink salmon	MON 8709	96 hr	LC ₅₀	14	Mortality
Pink salmon	MON 8709	96 hr	LC ₅₀	14.6	Mortality
Pink salmon	MON 8709	96 hr	LC ₅₀	10.4	Mortality
Pink salmon	MON 8709	96 hr	LC ₅₀	7.9	Mortality
Pink salmon	MON 8709	96 hr	LC ₅₀	7.3	Mortality
Sockeye salmon	Roundup®	96 hr	LC ₅₀	8.1	Mortality
Sockeye salmon	Roundup®	96 hr	LC ₅₀	8.4	Mortality
Sockeye salmon (fry)	Roundup®	96 hr	LC ₅₀	8.7	Mortality

Species Name or Taxon	Formulation Type	Duration	Reported Endpoint	Toxicity Value (mg a.e./L)*	Measurement Endpoint
Sheepshead minnow	MON 2139 Roundup® 30.75%	96 hr	LC ₅₀	2.7	Mortality
POEA Alone					
Chinook salmon	MON 0818 (city)	96 hr	LC ₅₀	2.8	Mortality
Chinook salmon	MON 0818 (creek)	96 hr	LC ₅₀	2.8	Mortality
Chinook salmon	MON 0818 (reconstituted)	96 hr	LC ₅₀	2.7	Mortality
Chinook salmon	MON 0818 (well)	96 hr	LC ₅₀	2.6	Mortality
Chinook salmon	MON 0818 (lake)	96 hr	LC ₅₀	1.7	Mortality
Coho salmon	MON 0818 (city)	96 hr	LC ₅₀	4.6	Mortality
Coho salmon	MON 0818 (creek)	96 hr	LC ₅₀	3.2	Mortality
Coho salmon	MON 0818 (reconstituted)	96 hr	LC ₅₀	2.8	Mortality
Coho salmon	MON 0818 (well)	96 hr	LC ₅₀	2.9	Mortality
Coho salmon	MON 0818 (lake)	96 hr	LC ₅₀	1.8	Mortality
Coho salmon (fry)	MON 0818	96 hr	LC ₅₀	3.5	Mortality
Chum salmon	MON 0818 (city)	96 hr	LC ₅₀	2.7	Mortality
Chum salmon	MON 0818 (creek)	96 hr	LC ₅₀	2.6	Mortality
Chum salmon	MON 0818 (reconstituted)	96 hr	LC ₅₀	1.4	Mortality
Chum salmon	MON 0818 (lake)	96 hr	LC ₅₀	2.6	Mortality
Pink salmon	MON 0818 (city)	96 hr	LC ₅₀	4.5	Mortality
Pink salmon	MON 0818 (creek)	96 hr	LC ₅₀	2.8	Mortality
Pink salmon	MON 0818 (reconstituted)	96 hr	LC ₅₀	1.5	Mortality
Pink salmon	MON 0818 (well)	96 hr	LC ₅₀	2.6	Mortality

Species Name or Taxon	Formulation Type	Duration	Reported Endpoint	Toxicity Value (mg a.e./L)*	Measurement Endpoint
Pink salmon	MON 0818 (lake)	96 hr	LC ₅₀	1.4	Mortality
Sockeye salmon (fry)	MON 0818	96 hr	LC ₅₀	2.6	Mortality
Estuarine/Marine Fish Chronic Data					
Glyphosate Technical					
Threespine stickleback	Glyphosate (> 96%)	42-d	NOEC	0.1	Mortality and Length
Marine Algae Acute Data					
Glyphosate Technical					
<i>S. costatum</i>	Glyphosate technical	96 hr	EC ₅₀	11	Biomass
<i>S. costatum</i>	Glyphosate technical	96 hr	IC ₅₀	2.27	Growth inhibition
<i>S. costatum</i>	Glyphosate technical	96 hr	IC ₅₀	5.89	Growth inhibition
<i>S. costatum</i>	Glyphosate technical	7-d	EC ₅₀	0.64	Growth inhibition
Glyphosate Formulation (With POEA)					
<i>S. costatum</i>	Roundup	96 hr	EC ₅₀	1.85	Growth inhibition
POEA Alone					
<i>S. costatum</i>	POEA	96 hr	EC ₅₀	3.35	Growth inhibition
Marine Algae Chronic Data					
Glyphosate Technical					
<i>Chlorella vulgaris</i>	Glyphosate technical	21-d	EC ₅₀	62.33	Growth inhibition
<i>Chlorella vulgaris</i>	Glyphosate technical	21-d	EC ₅₀	292.3	Growth inhibition
<i>Spirulina platensis</i>	Glyphosate technical	21-d	EC ₅₀	101.18	Growth inhibition
<i>Spirulina platensis</i>	Glyphosate technical	21-d	EC ₅₀	> 169	Growth inhibition
<i>Arthrospira fusiformis</i>	Glyphosate technical	21-d	EC ₅₀	61.8	Growth inhibition
<i>Arthrospira fusiformis</i>	Glyphosate technical	21-d	EC ₅₀	> 169	Growth inhibition
<i>Nostoc punctiforme</i>	Glyphosate technical	21-d	EC ₅₀	44.48	Growth inhibition

Species Name or Taxon	Formulation Type	Duration	Reported Endpoint	Toxicity Value (mg a.e./L)*	Measurement Endpoint
<i>Nostoc punctiforme</i>	Glyphosate technical	21-d	EC ₅₀	598.4	Growth inhibition
<i>Anabaena catenula</i>	Glyphosate technical	21-d	EC ₅₀	5.33	Growth inhibition
<i>Anabaena catenula</i>	Glyphosate technical	21-d	EC ₅₀	256.5	Growth inhibition
<i>Synechocystis aquatilis</i>	Glyphosate technical	21-d	EC ₅₀	174.75	Growth inhibition
<i>Synechocystis aquatilis</i>	Glyphosate technical	21-d	EC ₅₀	164.9	Growth inhibition
<i>Microcystis eruginosa</i>	Glyphosate technical	21-d	EC ₅₀	8.03	Growth inhibition
<i>Microcystis eruginosa</i>	Glyphosate technical	21-d	EC ₅₀	251.4	Growth inhibition
<i>Leptolybya boryana</i>	Glyphosate technical	21-d	EC ₅₀	6.68	Growth inhibition
<i>Leptolybya boryana</i>	Glyphosate technical	21-d	EC ₅₀	246.6	Growth inhibition
Glyphosate Formulation (With POEA)					
<i>Chlorella vulgaris</i>		21-d	EC ₅₀	21.26	Growth inhibition
<i>Spirulina plastensis</i>		21-d	EC ₅₀	5.96	Growth inhibition
<i>Arthrospira fusiformis</i>		21-d	EC ₅₀	5.08	Growth inhibition
<i>Nostoc punctiforme</i>		21-d	EC ₅₀	7.61	Growth inhibition
<i>Anabaena catenula</i>		21-d	EC ₅₀	0.52	Growth inhibition
<i>Synechocystis aquatilis</i>		21-d	EC ₅₀	16.16	Growth inhibition
<i>Microcystis eruginosa</i>		21-d	EC ₅₀	1.21	Growth inhibition
<i>Leptolybya boryana</i>		21-d	EC ₅₀	0.74	Growth inhibition

Table X.17 Summary of Species Sensitivity Distributions (SSDs) for Glyphosate, Its Major Transformation Product AMPA and the Formulant POEA: HC₅ OR Most Sensitive Species by Taxonomic Group: Fish, Aquatic Invertebrates, Amphibians, Aquatic Plants, Algae and Terrestrial Plants

Terrestrial and Aquatic Organisms	Glyphosate Technical		Glyphosate Formulation (Non-POEA)		Glyphosate Formulation (With POEA)		AMPA	POEA ¹	
	Exposure								
	Acute	Chronic	Acute	Chronic	Acute	Chronic	Acute	Acute	Chronic
Terrestrial Organisms									
Earthworms (mg a.e./kg soil)	690 ^x	—	—	—	0.253 ^x	—	—	—	—
Snails (mg a.e./L)	—	NOEC: 1000	—	NOEC: 29.7 (NOEC: 219 mg a.e./kg soil)	LC50: 2.3 ^x	NOEC: 8.55	—	—	—
Terrestrial Plants (SE) EC ₅₀ (kg a.e./ha)	EC ₅₀ : 3.25 ^x	—	EC ₅₀ : 4.48 ^x	—	—	—	—	—	—
Terrestrial Plants (VV) EC ₂₅ (kg a.e./ha)	HC ₅ : 0.12	—	HC ₅ : 0.0664	—	—	—	—	—	—
Terrestrial Plants (VV) EC ₅₀ (kg a.e./ha)	HC ₅ : 0.27	—	—	—	—	—	—	—	—
Terrestrial Plants (VV) EC ₅₀ Non-crop (kg a.e./ha)	—	—	HC ₅ : 0.0 126	—	—	—	—	—	—
Terrestrial Plants EC ₅₀ Mixed (kg a.e./ha)	—	—	EC ₅₀ : 0.014 ^x	—	—	—	—	—	—
Terrestrial Plants EC ₂₅ Mixed (kg a.e./ha)	—	—	—	—	HC ₅ : 0.035	—	—	—	—
Aquatic Organisms									
Freshwater Invertebrates (mg a.e./L)	HC ₅ : 16.9	NOEC: 7.1	HC ₅ : 30.5	EC ₅₀ : 43.8 ^x	HC ₅ : 0.19	NOEC: 0.269	LC ₅₀ : 408.2 ^x	HC ₅ : 0.0041	EC ₅₀ : 1.7 ^x
Freshwater Fish (mg a.e./L)	HC ₅ : 80.4	NOEC: 25.7	LC ₅₀ : 122.3 ^x	—	—	—	—	—	—
Freshwater	HC ₅ : 6.55	HC ₅ : 118.2	EC ₅₀ : 0.12 ^x	—	EC ₅₀ : 9.1 ^x	HC ₅ : 0.42	EC ₅₀ : 143 ^x	EC ₅₀ : 3.35 ^x	EC ₅₀ : 3.35 ^x

Terrestrial and Aquatic Organisms	Glyphosate Technical		Glyphosate Formulation (Non-POEA)		Glyphosate Formulation (With POEA)		AMPA	POEA ¹	
			Exposure					Acute	Chronic
	Acute	Chronic	Acute	Chronic	Acute	Chronic	Acute	Acute	Chronic
Algae (mg a.e./L)									
Freshwater Plants (mg a.e./L)	EC ₅₀ : 21.1 ^x	—	EC ₅₀ : 7.7 ^x	—	HC ₅ : 0.003	—	—	—	—
Amphibians (mg a.e./L)	HC ₅ : 14.9	NOEC: 1.8	HC ₅ : 18.1	—	HC ₅ : 0.93	HC ₅ (LC ₅₀): 0.86	—	HC ₅ : 0.35	—
Amphibians – Mesocosm (mg a.e./L)	—	—	—	—	HC ₅ : 2.29 (HC ₅ : 3.28 kg a.e./ha)	HC ₅ (LC ₅₀): 1.36, NOEC: 0.55	—	—	—
Marine Invertebrates (mg a.e./L)	HC ₅ : 0.3	—	EC ₅₀ : 23.2 ^x	—	HC ₅ : 0.1	—	EC ₅₀ : 97 ^x	EC ₅₀ : 0.6 ^x	—
Marine Fish (mg a.e./L)	HC ₅ : 23.4	NOEC: 0.1	LC ₅₀ : 136.8 ^x	—	HC ₅ : 3.04	—	—	HC ₅ : 2.06	—
Marine algae (mg a.e./L)	EC ₅₀ : 3.11 ^x	HC ₅ : 28.4	—	—	EC ₅₀ : 3.35 ^x	HC ₅ : 0.33	—	EC ₅₀ : 1.85	EC ₅₀ : 1.85

^x Not an HC₅ value, SSDs could not be determined, the most sensitive species endpoint value is reported and uncertainty factor to be applied as required; ¹POEA: formulant, POEA concentrations cannot be directly compared to other data; SE = Seedling emergence, VV = Vegetative vigour.

Table X.18 Risk Quotients for Earthworms and the Soil Beneficials Exposed to the Glyphosate Technical, Glyphosate Formulations and the Transformation Product AMPA

Test Material	Expo-sure	Endpoint (mg a.e./kg soil)	Crop	EEC (mg a.e./kg soil)	RQ ¹	Level of Concern Exceeded
Earthworms						
Glyphosate Technical	Acute	1/2LC ₅₀ : 163.9	Apple	4.24	0.03	No
Glyphosate Formulation (With POEA)	Acute	1/2LC ₅₀ : > 2129	Apple	4.24	< 0.002	No
	Potato	1.92	< 0.001	No		
	Chronic	NOEC: 21.3	Apple	4.24	0.2	No
Glyphosate Formulation (POEA Unknown)	Acute	1/2LC ₅₀ : > 500	Apple	4.24	< 0.009	No
	Acute	1/2LC ₅₀ : > 500	Apple	3.5	< 0.007	No
AMPA	Acute	1/2LC ₅₀ : > 500	Apple	3.5	0.12	No
Springtail (<i>Collembolan</i>), <i>Poecilia candida</i>						
Glyphosate Formulation (POEA Unknown)	Acute 48-h	EC ₅₀ /2 = 0.57 mg a.e./kg soil	Apple	In-field: 4.24 mg a.e./kg soil	7.4	Yes
	Off-field (ground application,	0.2		No		

Test Material	Exposure	Endpoints (mg a.e./kg soil)	Crop	EFC (mg a.e./kg soil)	RQ	Level of Concern Exceeded	
Chronic – Reproduction - 28 d	Canola	$EC_{50}/2 = 0.27 \text{ mg a.e./kg soil}$ (In the absence of a NOEC)	Canola	3% drift): 0.13 mg a.e./kg soil			
				Refinement In-field (0.6 soil deposition factor): 2.544 mg a.e./kg soil	4.45	Yes	
				In-field: 3.47 mg a.e./kg soil	6.1	Yes	
				Off-field (ground application, 3% drift): 0.10 mg a.e./kg soil	0.2	No	
				Off-field (aerial application, 17% drift): 0.59 mg a.e./kg soil	1	Marginal	
	Potato		Potato	Refinement In-field (0.6 soil deposition factor): 2.082 mg a.e./kg soil	3.78	Yes	
				In-field: 1.92 mg a.e./kg soil	3.43	Yes	
				Off-field (ground application, 3% drift): 0.06 mg a.e./kg soil	0.01	No	
				Refinement In-field (0.6 soil deposition factor): 1.152 mg a.e./kg soil	2	Yes	
				In-field: 4.24 mg a.e./kg soil	15.7	Yes	
Chronic – Reproduction - 28 d	Apple	$EC_{50}/2 = 0.27 \text{ mg a.e./kg soil}$ (In the absence of a NOEC)	Apple	Off-field (ground application, 3% drift): 0.13 mg a.e./kg soil	0.5	No	
				Refinement In-field (0.6 soil deposition factor): 2.544 mg a.e./kg soil	9.4	Yes	
				In-field: 3.47 mg a.e./kg soil	13	Yes	
				Off-field (ground application, 3% drift): 0.10 mg a.e./kg soil	0.4	No	
				Off-field (aerial application, 17% drift): 0.59 mg a.e./kg soil	2.2	Yes	
	Canola		Canola	Refinement In-field (0.6 soil deposition factor): 2.082 mg a.e./kg soil	7.7	Yes	
				In-field: 1.92 mg a.e./kg soil	7.1	Yes	
				Off-field (ground application, 3% drift): 0.06 mg a.e./kg soil	0.2	No	
				In-field: 3.47 mg a.e./kg soil	13	Yes	
				Refinement In-field (0.6 soil deposition factor): 2.544 mg a.e./kg soil	9.4	Yes	

Test Material	Exposure	Endpoints (mg a.e./kg soil)	Crop	EEC (mg a.e./kg soil)	RQ ¹	Level of Concern Exceeded
				Refinement In-field (0.6 soil deposition factor): 1.152 mg a.e./kg soil	4.3	Yes

¹ Shaded cells and bold values indicate that the level of concern is exceeded (RQ > 1).

Table X.19 Screening and Refinement Level Risk Assessment and Risk Quotients for Bees and Predators and Parasitic Arthropods Exposed to the Glyphosate Technical, Glyphosate Formulations and the Transformation Product AMPA

Organism	Exposure	Endpoint Value	Crop	EEC	RQ ¹	Level of Concern Exceeded
Bee						
Glyphosate Technical						
Honeybee, <i>Apis mellifera</i>	Contact	LD ₅₀ > 182 µg a.e./bee	—	4.32 kg a.e./ha × 2.4 µg a.e./bee per kg a.e./ha = 10.37 µg a.e./bee	< 0.06	No
	Oral	LD ₅₀ > 182 µg a.e./bee	—	4.32 kg a.e./ha × 29 µg a.e./bee per kg a.e./ha = 125.28 µg a.e./bee	< 0.7	No
	Brood / hive	Risk is not expected from exposure to glyphosate based on the mode of action, a lack of effects observed for adult bees, and a lack of significant effects to other immature insects (chironomid and beneficial arthropods).				
Glyphosate Formulation (With POEA)						
EUP + POEA	Contact	LD ₅₀ > 182 µg a.e./bee	—	4.32 kg a.e./ha × 2.4 µg a.e./bee per kg a.e./ha = 10.37 µg a.e./bee	< 0.09	No
	Oral	LD ₅₀ > 116 µg a.e./bee	—	4.32 kg a.e./ha × 29 µg a.e./bee per kg a.e./ha = 125.28 µg a.e./bee	< 1.25	No
	Brood / hive	Risk is not expected from exposure to glyphosate based on the mode of action, a lack of effects observed for adult bees, and a lack of significant effects to other immature insects (chironomid and beneficial arthropods).				
Arthropods						
Predatory arthropod, <i>Typhlodromus</i> <i>pyri</i>	Contact, glass plate	LR ₅₀ = 161.9 g a.e./ha	Apple	In-field: 7285 g a.e./ha	45.0	Yes
				Off-field (ground application, 3% drift): 29 g a.e./ha	1.3	No
			Canola	In-field: 6990 g a.e./ha	43.0	Yes
				Off-field (ground application, 3% drift): 210Vg a.e./ha	1.3	No
				Off-field (aerial)	7.3	Yes

Organism	Exposure	Endpoint Value	Crop	EEC	RQ ¹	Level of Concern Exceeded	
Contact, leaf substrate	Potato	LR ₅₀ = 1567 g a.e./ha		application, 17% drift): 1188 g a.e./ha			
				In-field: 4320 g a.e./ha	27.0	Yes	
			Potato	Off-field (ground application, 3% drift): 130 g a.e./ha	0.8	No	
			Apple	In-field: 7285 g a.e./ha	4.7	Yes	
				Off-field (ground application, 3% drift): 219 g a.e./ha	0.1	No	
				Refined In-field (0.4 foliar deposition factor): 2914 g a.e./ha	1.9	Yes	
				In-field: 6990 g a.e./ha	4.5	Yes	
	Canola			Off-field (ground application, 3% drift): 210 g a.e./ha	0.1	No	
				Off-field (aerial application, 17% drift): 1188 g a.e./ha	0.8	No	
				Refined In-field (0.4 foliar deposition factor): 2796 g a.e./ha	1.8	Yes	
			Potato	In-field: 4320 g a.e./ha	2.8	Yes	
				Off-field (ground application, 3% drift): 130 g a.e./ha	0.08	No	
				Refined In-field (0.4 foliar deposition factor): 1728 g a.e./ha	1.1	No	

Organism	Exposure	Endpoint Value	Crop	EFC	RQ ^a	Level of Concern Exceeded
Parasitoid arthropod, <i>Aphidius rhopalosiphi</i>	Contact, glass plate	LR ₅₀ = 2267 g a.e./ha	Apple	In-field: 7285 g a.e./ha	3.2	Yes
				Off-field (ground application, 3% drift): 219 g a.e./ha	0.1	No
			Canola	In-field: 6990 g a.e./ha	3.1	Yes
				Off-field (ground application, 3% drift): 210 g a.e./ha	0.09	No
				Off-field (aerial application, 17% drift): 1188 g a.e./ha	0.5	No
			Potato	In-field: 4320 g a.e./ha	1.9	No
				Off-field (ground application, 3% drift): 130 g a.e./ha	0.06	No
	Contact, leaf substrate	LR ₅₀ > 5976 g a.e./ha; ER ₅₀ > 5976 g a.e./ha	Apple	In-field: 7285 g a.e./ha	< 1.2	No
				Off-field (ground application, 3% drift): 219 g a.e./ha	< 0.04	No
				Refined In-field (0.4 foliar dissipation factor): 2914 g a.e./ha	< 0.5	No
			Canola	In-field: 6990 g a.e./ha	< 1.2	No
				Off-field (ground application, 3% drift): 210 g a.e./ha	< 0.04	No
				Off-field (aerial application, 17% drift): 1188 g a.e./ha	< 0.2	No
			Potato	Refined In-field (0.4 foliar deposition factor): 2796 g a.e./ha	< 0.5	No
				In-field: 4320 g a.e./ha	< 0.7	No
				Off-field (ground application, 3% drift): 130 g a.e./ha	< 0.02	No
Lacewing, <i>Chrysoperla carnea</i>	Contact, glass plate	LR ₅₀ > 5976 g a.e./ha; ER ₅₀ > 5976 g a.e./ha	Apple	In-field: 7285 g a.e./ha	< 1.2	Yes
				Off-field (ground application, 3% drift): 219 g a.e./ha	< 0.04	No
				Refined In-field (0.4 foliar deposition factor): 2914 g a.e./ha	< 0.5	No
			Canola	In-field: 6990 g a.e./ha	< 1.2	Yes

Organism	Exposure	Endpoint Value	Crop	EEC	RQ ¹	Level of Concern Exceeded
Hoverfly, <i>Episyphus balteatus</i>	Contact, leaf substrate	LR ₅₀ > 5976 g a.e./ha; ER ₅₀ > 5976 g a.e./ha		Off-field (ground application, 3% drift): 210 g a.e./ha	< 0.04	No
				Off-field (aerial application, 17% drift): 1188 g a.e./ha	< 0.2	No
				Refined In-field (0.4 foliar deposition factor): 2796 g a.e./ha	< 0.5	No
			Potato	In-field: 4320 g a.e./ha	< 0.7	No
				Off-field (ground application, 3% drift): 130 g a.e./ha	< 0.02	No
			Apple	In-field: 7285 g a.e./ha	< 1.2	Yes
				Off-field (ground application, 3% drift): 219 g a.e./ha	< 0.04	No
				Refined In-field (0.4 foliar deposition factor): 2914 g a.e./ha	< 0.5	No
				In-field: 6990 g a.e./ha	< 1.2	Yes
			Canola	Off-field (ground application, 3% drift): 210 g a.e./ha	< 0.04	No
				Off-field (aerial application, 17% drift): 1188 g a.e./ha	< 0.2	No
				Refined In-field (0.4 foliar deposition factor): 2796 g a.e./ha	< 0.5	No
Carabid beetle, <i>Poecilus cupreus</i>	Contact, sand substrate	LR ₅₀ > 2988 g a.e./ha; ER ₅₀ > 2988 g a.e./ha	Apple	In-field: 4320 g a.e./ha	< 0.7	No
				Off-field (ground application, 3% drift): 130 g a.e./ha	< 0.02	No
				In-field: 7285 g a.e./ha	< 2.4	Yes
				Off-field (ground application, 3% drift): 219 g a.e./ha	< 0.07	No
		Canola	Apple	Refined In-field (0.6 soil deposition factor): 4371 g a.e./ha	< 1.5	Yes
				In-field: 6990 g a.e./ha	< 2.3	Yes
				Off-field (ground application, 3% drift):	< 0.07	No

Organism	Exposure	Endpoint Value	Crop	EEC	RQ ¹	Level of Concern Exceeded
Staphyniid beetle, <i>Aleochara bilineata</i>	Chronic, soil substrate	NOER = 5976 g a.e./ha, highest rate tested	Potato	210 g a.e./ha		
				Off-field (aerial application, 17% drift): 1188 g a.e./ha	< 0.4	No
				Refined In-field (0.6 soil deposition factor): 4194 g a.e./ha	< 1.4	Yes
				In-field: 4320 g a.e./ha	< 1.4	Yes
			Apple	Off-field (ground application, 3% drift): 130 g a.e./ha	< 0.04	No
				Refined In-field (0.6 soil dissipation factor): 2592 g a.e./ha	< 0.9	No
			Canola	In-field: 7285 g a.e./ha	1.2	Yes
				Off-field (ground application, 3% drift): 219 g a.e./ha	0.04	No
				In-field: 6990 g a.e./ha	1.1	Yes
				Off-field (aerial application, 17% drift): 210 g a.e./ha	0.04	No
			Potato	Off-field (aerial application, 17% drift): 1188 g a.e./ha	0.2	No
				In-field: 4320 g a.e./ha	0.7	No
				Off-field (ground application, 3% drift): 130 g a.e./ha	0.02	No

Risk Quotient (RQ) = EEC/endpoint; shaded cells and bold values indicate that the screening level RQ exceeds the LOC of 2.0 for *A. rhopalosiphi* and *T. pyri* and 1.0 for others.

Table X.20 Screening Level Risk Assessment for Birds and Mammals Exposed to Glyphosate Technical

Species	Threshold (mg a.e./kg bw/d)	Endpoint (mg a.e./kg bw)	EEC (mg a.e./kg bw)	Level of Concern
Step 1: Risk of Birds				
Step 2: Risk of Mammals				
Acute	> 319.63	Insectivore	592.97	No
Reproduction	291	Insectivore	592.97	No
Step 3: Risk of Mammal Herd (100 kg)				
Acute	> 319.63	Insectivore	462.75	No

Animal Size	Toxicity (mg a.c/kg bw/d)	Feeding Guild (Food Item)	EDE (mg a.c/kg bw)	RQ	Level of Concern Exceeded
Reproduction	291	Insectivore	462.75	1.6	Yes
Large-Sized Bird (1 kg)					
Acute	> 319.63	Herbivore (short grass)	298.91	< 0.9	No
Reproduction	291	Herbivore (short grass)	298.91	1	Marginal
Screening Level - Mammals					
Small Mammal (0.015 kg)					
Acute	156.8	Insectivore	341.06	2.2	Yes
Reproduction	740	Insectivore	341.06	0.5	No
Medium-Sized Mammal (0.035 kg)					
Acute	156.8	Herbivore (short grass)	661.47	4.2	Yes
Reproduction	740	Herbivore (short grass)	661.47	0.9	No
Large-Sized Mammal (1 kg)					
Acute	156.8	Herbivore (short grass)	353.45	2.3	Yes
Reproduction	740	Herbivore (short grass)	353.45	0.5	No

Shaded cells and **bold values** indicate that the level of concern is exceeded (RQ > 1).

Table X.21 Risk Assessment Refinement for Birds Exposed to Glyphosate Technical

Exposure	Toxicity (mg a.e./kg bw/d)	Food Guild (Food Item)	Maximum Nomogram Residues				Mean Nomogram Residues			
			On-field EDE (mg a.e./kg bw)	RQ	Off-field (3% drift) EDE (mg a.e./kg bw)	RQ	On-field EDE (mg a.e./kg bw)	RQ	Off-field (3% drift) EDE (mg a.e./kg bw)	RQ
Small Bird (0.02 kg)										
Acute	> 319.63	Insectivore	592.97	< 1.9	17.79	< 0.06	409.43	< 1.3	12.28	< 0.04
	> 319.63	Granivore (grain and seeds)	91.77	< 0.3	2.75	< 0.01	43.77	< 0.1	1.31	< 0.004
	> 319.63	Frugivore (fruit)	183.54	< 0.6	5.51	< 0.02	87.53	< 0.3	2.63	< 0.01
Dietary	> 258.00	Insectivore	592.97	< 2.3	17.79	< 0.07	409.43	< 2.0	12.28	< 0.05
	> 258.00	Granivore (grain and seeds)	91.77	< 0.4	2.75	< 0.01	43.77	< 0.2	1.31	< 0.01
	> 258.00	Frugivore (fruit)	183.54	< 0.7	5.51	< 0.02	87.53	< 0.3	2.63	< 0.01
Reproduction	291	Insectivore	592.97	2.0	17.79	0.06	409.43	1.4	12.28	< 0.04
	291	Granivore (grain and seeds)	91.77	0.3	2.75	0.01	43.77	0.2	1.31	< 0.005
	291	Frugivore (fruit)	183.54	0.6	5.51	0.02	87.53	0.3	2.63	0.01
Medium-Sized Bird (0.1 kg)										
Acute	> 319.63	Insectivore	462.75	< 1.5	13.88	< 0.04	319.52	< 1.0	9.59	< 0.03
	> 319.63	Granivore (grain and seeds)	71.62	< 0.2	2.15	< 0.01	34.16	< 0.1	1.02	< 0.003
	> 319.63	Frugivore (fruit)	143.23	< 0.5	4.3	< 0.01	68.31	< 0.2	2.05	< 0.01
Dietary	> 258.00	Insectivore	462.75	< 1.8	13.88	< 0.05	319.52	< 1.2	9.59	< 0.04
	> 258.00	Granivore (grain and seeds)	71.62	< 0.3	2.15	< 0.01	34.16	< 0.1	1.02	< 0.004
	> 258.00	Frugivore (fruit)	143.23	< 0.6	4.3	< 0.02	68.31	< 0.3	2.05	< 0.01
Reproduction	291	Insectivore	462.75	1.6	13.88	0.05	319.52	1.1	9.59	0.03
	291	Granivore (grain and seeds)	71.62	0.3	2.15	0.01	34.16	0.1	1.02	0.004
	291	Frugivore (fruit)	143.23	0.5	4.3	0.01	68.31	0.2	2.05	0.01
Large-Sized Bird (1 kg)										
Acute	>319.63	Insectivore	135.1	< 0.4	4.05	< 0.01	93.29	< 0.3	2.8	< 0.01
	>319.63	Granivore (grain and seeds)	20.91	< 0.1	0.63	< 0.002	93.29	< 0.3	0.3	< 0.001

Exposure	Toxicity (mg a.e./kg bw/d)	Food Guild (Food Item)	Maximum Nomogram Residues				Mean Nomogram Residues			
			On-field EDE (mg a.e./kg bw)	RQ	Off-field (3% drift) EDE (mg a.e./kg bw)	RQ	On-field EDE (mg a.e./kg bw)	RQ	Off-field (3% drift) EDE (mg a.e./kg bw)	RQ
	>319.63	Frugivore (fruit)	41.82	< 0.1	1.25	< 0.004	19.94	< 0.1	0.6	< 0.002
	> 319.63	Herbivore (short grass)	298.91	< 0.9	8.97	< 0.03	106.16	< 0.3	3.18	< 0.01
	> 319.63	Herbivore (long grass)	182.51	< 0.6	5.48	< 0.02	59.6	< 0.2	1.79	< 0.01
	> 319.63	Herbivore (Broadleaf plants)	276.56	< 0.9	8.3	< 0.03	91.42	< 0.3	2.74	< 0.01
Dietary	>258.00	Insectivore	135.1	< 0.5	4.05	< 0.02	93.29	< 0.4	2.8	< 0.01
	> 258.00	Granivore (grain and seeds)	20.91	< 0.1	0.63	< 0.002	93.29	< 0.4	0.3	< 0.001
	> 258.00	Frugivore (fruit)	41.82	< 0.2	1.25	< 0.005	19.94	< 0.1	0.6	< 0.002
	> 258.00	Herbivore (short grass)	298.91	< 1.2	8.97	< 0.03	106.16	< 0.4	3.18	< 0.01
	> 258.00	Herbivore (long grass)	182.51	< 0.7	5.48	< 0.02	59.6	< 0.2	1.79	< 0.01
	> 258.00	Herbivore (Broadleaf plants)	276.56	< 1.1	8.3	< 0.03	91.42	< 0.4	2.74	< 0.01
Reproduction	291	Insectivore	135.1	0.5	4.05	0.01	93.29	0.3	2.8	0.01
	291	Granivore (grain and seeds)	20.91	0.1	0.63	0.002	93.29	0.3	0.3	0.001
	291	Frugivore (fruit)	41.82	0.1	1.25	0.004	19.94	0.1	0.6	0.002
	291	Herbivore (short grass)	298.91	1.0	8.97	0.03	106.16	0.4	3.18	0.01
	291	Herbivore (long grass)	182.51	0.6	5.48	0.02	59.6	0.2	1.79	0.01
	291	Herbivore (Broadleaf plants)	276.56	1.0	8.3	0.03	91.42	0.3	2.74	0.01

Shaded cells and **bold values** indicate that the level of concern is exceeded (RQ > 1).

Table X.22 Screening Level Risk Assessment for Glyphosate Formulations Exposed to Wild Birds and Mammals – Single Application Rate

Exposure	Toxicity (mg a.e/kg bw/d)	Feeding Guild (Food Item)	EDE (mg a.e/kg bw)	RQ
Small Bird (0.02 kg)				
Acute	113.1	Insectivore	351.63	3.1
Reproduction	n/a	Insectivore	351.63	n/a
Medium-Sized Bird (0.1 kg)				
Acute	113.1	Insectivore	274.41	2.4
Reproduction	n/a	Insectivore	274.41	n/a
Large-Sized Bird (1 kg)				
Acute	113.1	Herbivore (short grass)	177.25	1.6
Reproduction	n/a	Herbivore (short grass)	177.25	n/a
Small Mammal (0.015 kg)				
Acute	35.7	Insectivore	202.25	5.7
Reproduction	n/a	Insectivore	202.25	n/a
Medium-Sized Mammal (0.035 kg)				
Acute	35.7	Herbivore (short grass)	392.25	11
Reproduction	n/a	Herbivore (short grass)	392.25	n/a
Large-Sized Mammal (1 kg)				
Acute	35.7	Herbivore (short grass)	209.59	5.9
Reproduction	n/a	Herbivore (short grass)	209.59	n/a

Shaded cells and **bold values** indicate that the level of concern is exceeded (RQ > 1).

Table X.23 Further Characterization of Risks of Glyphosate Formulations to Wild Birds – Single Application Rate

	Toxicity (mg a.e./kg bw/d)	Food Guild (food item)	Maximum Nomogram Residues				Mean Nomogram Residues			
			On-field EDE (mg a.e./kg bw)	RQ	Off-field (3% drift) EDE (mg a.e./kg bw)	RQ	On-field EDE (mg a.e./kg bw)	RQ	Off-field (3% drift) EDE (mg a.e./kg bw)	RQ
Small Bird (0.02 kg)										
Acute	113.1	Insectivore	351.63	3.1	10.55	0.09	242.79	2.2	7.28	0.06
	113.1	Granivore (grain and seeds)	54.42	0.5	1.63	0.01	25.95	0.23	0.78	0.01
	113.1	Frugivore (fruit)	108.84	0.96	3.27	0.03	51.91	0.46	1.56	0.01
Dietary	> 18.70	Insectivore	351.63	< 18.8	10.55	< 0.6	242.79	< 13.0	7.28	< 0.4
	> 18.70	Granivore (grain and seeds)	54.42	< 2.9	1.63	< 0.09	25.95	< 1.4	0.78	< 0.04
	> 18.70	Frugivore (fruit)	108.84	< 5.8	3.27	< 0.2	51.91	< 2.8	1.56	< 0.08
Medium-Sized Bird (0.1 kg)										
Acute	113.1	Insectivore	274.41	2.4	8.23	0.07	189.47	1.7	5.68	0.05
	113.1	Granivore (grain and seeds)	42.47	0.4	1.27	0.01	20.25	0.18	0.61	0.01
	113.1	Frugivore (fruit)	84.94	0.8	2.55	0.02	40.51	0.36	1.22	0.01
Dietary	> 18.70	Insectivore	274.41	< 14.7	8.23	< 0.4	189.47	< 10.1	5.68	< 0.30
	> 18.70	Granivore (grain and seeds)	42.47	< 2.3	1.27	< 0.07	20.25	< 1.1	0.61	< 0.03
	> 18.70	Frugivore (fruit)	84.94	< 4.5	2.55	< 0.1	40.51	< 2.2	1.22	< 0.06
Large-Sized Bird (1 kg)										
Acute	113.1	Insectivore	80.12	0.7	2.4	0.02	55.32	0.5	1.66	0.01
	113.1	Granivore (grain and seeds)	12.4	0.1	0.37	0.003	55.32	0.5	0.18	0.002
	113.1	Frugivore (fruit)	24.8	0.2	0.74	0.01	11.83	0.1	0.35	0.003
	113.1	Herbivore (short grass)	177.25	1.6	5.32	0.05	62.95	0.6	1.89	0.02
	113.1	Herbivore (long grass)	108.23	0.96	3.25	0.03	35.34	0.3	1.06	0.01
	113.1	Herbivore (Broadleaf plants)	164	1.5	4.92	0.04	54.21	0.5	1.63	0.01
Dietary	> 18.70	Insectivore	80.12	< 4.3	2.4	< 0.1	55.32	< 3.0	1.66	< 0.09
	> 18.70	Granivore (grain and seeds)	12.4	< 0.7	0.37	< 0.02	55.32	< 3.0	0.18	< 0.01

	Toxicity (mg a.e./kg bw/d)	Food Guild (food item)	Maximum Nomogram Residues				Mean Nomogram Residues			
			On-field EDE (mg a.e./kg bw)	RQ	Off-field (3% drift) EDE (mg a.e./kg bw)	RQ	On-field EDE (mg a.e./kg bw)	RQ	Off-field (3% drift) EDE (mg a.e./kg bw)	RQ
	> 18.70	Frugivore (fruit)	24.8	< 1.3	0.74	< 0.04	11.83	< 0.6	0.35	< 0.02
	> 18.70	Herbivore (short grass)	177.25	< 9.5	5.32	< 0.3	62.95	< 3.4	1.89	< 0.1
	> 18.70	Herbivore (long grass)	108.23	< 5.8	3.25	< 0.2	35.34	< 1.9	1.06	< 0.06
	> 18.70	Herbivore (Broadleaf plants)	164	< 8.8	4.92	< 0.3	54.21	< 2.9	1.63	< 0.09

Shaded cells and bold values indicate that the level of concern is exceeded (RQ > 1).

Table X.24 Further Characterization of the Risk of Glyphosate Technical to Wild Mammals

	Toxicity (mg a.e./kg bw/d)	Food Guild (Food Item)	Maximum Nomogram Residues				Mean Nomogram Residues			
			On-field EDE (mg a.e./kg bw)	RQ	Off-field (3% drift) EDE (mg a.e./kg bw)	RQ	On-field EDE (mg a.e./kg bw)	RQ	Off-field (3% drift) EDE (mg a.e./kg bw)	RQ
Small Mammal (0.015 kg)										
Acute – most sensitive endpoint	156.8	Insectivore	341.06	2.2	10.23	0.07	235.49	1.5	7.06	0.05
	156.8	Granivore (grain and seeds)	52.78	0.3	1.58	0.01	25.17	0.2	0.76	0.007
	156.8	Frugivore (fruit)	105.57	0.7	3.17	0.02	50.35	0.3	1.51	0.01
Acute – least sensitive endpoint	560	Insectivore	341.06	0.6	10.23	0.02	235.49	0.4	7.06	0.01
	560	Granivore (grain and seeds)	52.78	0.09	1.58	0.003	25.17	0.04	0.76	0.001
	560	Frugivore (fruit)	105.57	0.2	3.17	0.01	50.35	0.09	1.51	0.003
Medium-Sized Mammal (0.035 kg)										
Acute – most sensitive endpoint	156.8	Insectivore	298.98	1.9	8.97	0.06	206.44	1.3	6.19	0.04
	156.8	Granivore (grain and seeds)	46.27	0.3	1.39	0.009	22.07	0.1	0.66	0.004
	156.8	Frugivore (fruit)	92.54	0.6	2.78	0.02	44.13	0.3	1.32	0.008
	156.8	Herbivore (short grass)	661.47	4.2	19.84	0.1	234.92	1.5	7.05	0.04

	Toxicity (mg a.e./kg bw/d)	Food Guild (Food Item)	Maximum Nomogram Residues				Mean Nomogram Residues			
			On-field EDF (mg a.e./kg bw)	RQ	Off-field (3% drift) EDF (mg a.e./kg bw)	RQ	On-field EDF (mg a.e./kg bw)	RQ	Off-field (3% drift) EDF (mg a.e./kg bw)	RQ
	156.8	Herbivore (long grass)	403.88	2.6	12.12	0.08	131.88	0.8	3.96	0.03
	156.8	Herbivore (broadleaf plants)	612.01	3.9	18.36	0.1	202.32	1.3	6.07	0.04
Acute – least sensitive endpoint	560	Insectivore	298.98	0.5	8.97	0.02	206.44	0.4	6.19	0.01
	560	Granivore (grain and seeds)	46.27	0.08	1.39	0.002	22.07	0.04	0.66	0.001
	560	Frugivore (fruit)	92.54	0.2	2.78	0.005	44.13	0.08	1.32	0.002
	560	Herbivore (short grass)	661.47	1.2	19.84	0.04	234.92	0.4	7.05	0.01
	560	Herbivore (long grass)	403.88	0.7	12.12	0.02	131.88	0.2	3.96	0.01
	560	Herbivore (broadleaf plants)	612.01	1.1	18.36	0.03	202.32	0.4	6.07	0.01
Large-Sized Mammal (1 kg)										
Acute – most sensitive endpoint	156.8	Insectivore	159.75	1	4.79	0.03	110.31	0.7	3.31	0.02
	156.8	Granivore (grain and seeds)	24.72	0.2	0.74	0.005	11.79	0.08	0.35	0.002
	156.8	Frugivore (fruit)	49.45	0.3	1.48	0.01	23.58	0.2	0.71	0.005
	156.8	Herbivore (short grass)	353.45	2.3	10.6	0.07	125.52	0.8	3.77	0.02
	156.8	Herbivore (long grass)	215.81	1.4	6.47	0.04	70.47	0.4	2.11	0.01
	156.8	Herbivore (broadleaf plants)	327.01	2.1	9.81	0.06	108.1	0.7	3.24	0.02
Acute – least sensitive endpoint	560	Insectivore	159.75	0.3	4.79	0.01	110.31	0.2	3.31	0.01
	560	Granivore (grain and seeds)	24.72	0.04	0.74	0.001	11.79	0.02	0.35	0.001
	560	Frugivore (fruit)	49.45	0.09	1.48	0.003	23.58	0.04	0.71	0.001
	560	Herbivore (short grass)	353.45	0.6	10.6	0.02	125.52	0.2	3.77	0.01
	560	Herbivore (long grass)	215.81	0.4	6.47	0.01	70.47	0.1	2.11	0.004
	560	Herbivore (broadleaf plants)	327.01	0.6	9.81	0.02	108.1	0.2	3.24	0.01

Shaded cells and bold values indicate that the level of concern is exceeded (RQ > 1).

Table X.25 Further Characterization of Risks of Glyphosate Formulations to Wild Mammals – Single Application Rate

	Toxicity (mg a.e./kg bw/d)	Food Guild (Food Item)	Maximum Nomogram Residues				Mean Nomogram Residues			
			On-field EDE (mg a.e./kg bw)	RQ	Off-field (3% drift) EDE (mg a.e./kg bw)	RQ	On-field EDE (mg a.e./kg bw)	RQ	Off-field (3% drift) EDE (mg a.e./kg bw)	RQ
Small Mammal (0.015 kg)										
Acute – most sensitive endpoint	35.7	Insectivore	202.25	5.7	6.07	0.2	139.65	3.9	4.19	0.1
	35.7	Granivore (grain and seeds)	31.3	0.9	0.94	0.03	14.93	0.4	0.45	0.01
	35.7	Frugivore (fruit)	62.6	1.7	1.88	0.05	29.86	0.8	0.9	0.03
Acute – least sensitive endpoint	> 400.00	Insectivore	202.25	< 0.5	6.07	< 0.02	139.65	< 0.35	4.19	< 0.01
	> 400.00	Granivore (grain and seeds)	31.3	< 0.08	0.94	< 0.002	14.93	< 0.04	0.45	< 0.001
	> 400.00	Frugivore (fruit)	62.6	< 0.2	1.88	< 0.005	29.86	< 0.07	0.9	< 0.002
Medium Sized Mammal (0.035 kg)										
Acute – most sensitive endpoint	35.7	Insectivore	177.29	5	5.32	0.1	122.42	3.4	3.67	0.1
	35.7	Granivore (grain and seeds)	27.44	0.8	0.82	0.02	13.09	0.4	0.39	0.01
	35.7	Frugivore (fruit)	54.88	1.5	1.65	0.05	26.17	0.7	0.79	0.02
	35.7	Herbivore (short grass)	392.25	11	11.77	0.3	139.3	3.9	4.18	0.1
	35.7	Herbivore (long grass)	239.5	6.7	7.19	0.2	78.2	2.2	2.35	0.07
	35.7	Herbivore (broadleaf plants)	362.92	10.2	10.89	0.3	119.97	3.4	3.6	0.1
Acute – least sensitive endpoint	> 400.00	Insectivore	177.29	< 0.4	5.32	< 0.01	122.42	< 0.3	3.67	< 0.01
	> 400.00	Granivore (grain and seeds)	27.44	< 0.07	0.82	< 0.002	13.09	< 0.03	0.39	< 0.001
	> 400.00	Frugivore (fruit)	54.88	< 0.1	1.65	< 0.004	26.17	< 0.07	0.79	< 0.002
	> 400.00	Herbivore (short grass)	392.25	< 0.98	11.77	< 0.03	139.3	< 0.4	4.18	< 0.01
	> 400.00	Herbivore (long grass)	239.5	< 0.6	7.19	< 0.02	78.2	< 0.2	2.35	< 0.01
	> 400.00	Herbivore (broadleaf plants)	362.92	< 0.9	10.89	< 0.03	119.97	< 0.3	3.6	< 0.01

Toxicity (mg a.e./kg bw/d)	Food Guild (Food Item)	Maximum Nomogram Residues				Mean Nomogram Residues				
		On-field EDR (mg a.e./kg bw)	RQ	Off-field (3% drift) EDE (mg a.e./kg bw)	RQ	On-field EDE (mg a.e./kg bw)	RQ	Off-field (3% drift) EDE (mg a.e./kg bw)	RQ	
Large-Sized Mammal (1 kg)										
Acute – most sensitive endpoint	35.7	Insectivore	94.73	2.6	2.84	0.08	65.41	1.8	1.96	0.06
	35.7	Granivore (grain and seeds)	14.66	0.4	0.44	0.01	6.99	0.2	0.21	0.006
	35.7	Frugivore (fruit)	29.32	0.8	0.88	0.02	13.98	0.4	0.42	0.01
	35.7	Herbivore (short grass)	209.59	5.9	6.29	0.2	74.44	2.1	2.23	0.06
	35.7	Herbivore (long grass)	127.97	3.6	3.84	0.1	41.79	1.2	1.25	0.04
	35.7	Herbivore (broadleaf plants)	193.92	5.4	5.82	0.2	64.11	1.8	1.92	0.05
Acute – least sensitive endpoint	> 400.00	Insectivore	94.73	< 0.2	2.84	< 0.01	65.41	< 0.2	1.96	< 0.005
	> 400.00	Granivore (grain and seeds)	14.66	< 0.04	0.44	< 0.001	6.99	< 0.02	0.21	< 0.001
	> 400.00	Frugivore (fruit)	29.32	< 0.07	0.88	< 0.002	13.98	< 0.03	0.42	< 0.001
	> 400.00	Herbivore (short grass)	209.59	< 0.5	6.29	< 0.02	74.44	< 0.2	2.23	< 0.01
	> 400.00	Herbivore (long grass)	127.97	< 0.3	3.84	< 0.01	41.79	< 0.1	1.25	< 0.003
	> 400.00	Herbivore (broadleaf plants)	193.92	< 0.5	5.82	< 0.01	64.11	< 0.2	1.92	< 0.005

¹EDE = Estimated dietary exposure; is calculated using the following formula: (FIR/BW) × EEC, where: FIR: Food Ingestion Rate (Nagy, 1987). For mammals, the “all mammals” equation was used: FIR (g dry weight/day) = 0.235(BW in g)^{0.822}.

BW: Generic Body Weight ; EEC: Concentration of pesticide on food item based on Hoerger and Kenaga (1972) and Kenaga (1973) and modified according to Fletcher et al. (1994). At the screening level, relevant food items representing the most conservative EEC are used.

Shaded cells and **bold values** indicate that the level of concern is exceeded (RQ > 1).

Table X.26 Risk Assessment (In-field and Off-field) and Risk Quotients for Terrestrial Vascular Plants (Seedling Emergence and Vegetative Vigour) at the Maximum Rate of Application for Glyphosate in Different Crop Productions

Organism	Exposure	Endpoint Value	Crop	EEC	RQ ¹
Vascular Plants	Seedling emergence	EC ₅₀ : 3.25 kg a.e./ha	Apple	In-field: 9.55 kg a.e./ha	2.9
				Off-field (ground application, 3% drift): 0.287 kg a.e./ha	0.09
			Canola	In-field: 7.812 kg a.e./ha	2.4
				Off-field (ground application, 3% drift): 0.234 kg a.e./ha	0.07
			Corn	Off-field (aerial application, 17% drift): 1.328 kg a.e./ha	0.4
				In-field: 7.528 kg a.e./ha	2.3
			Potato	Off-field (ground application, 3% drift): 0.226 kg a.e./ha	0.07
				In-field: 4.32 kg a.e./ha	1.3
				Off-field (ground application, 3% drift): 0.13 kg a.e./ha	0.04
	Vegetative vigour – formulations without POEA	EC ₅₀ value: 0.014 kg a.e./ha	Apple	In-field: 7.285 kg a.e./ha	520.4
				Off-field (ground application, 3% drift): 0.219 kg a.e./ha	15.6
			Canola	In-field: 6.99 kg a.e./ha	499.3
				Off-field (ground application, 3% drift): 0.21 kg a.e./ha	15.0
			Corn	Off-field (aerial application, 17% drift): 1.19 kg a.e./ha	85.0
				In-field: 6.522 kg a.e./ha	465.9
			Potato	Off-field (ground application, 3% drift): 0.196 kg a.e./ha	14.0
				In-field: 4.32 kg a.e./ha	308.6
				Off-field (ground application, 3% drift): 0.13 kg a.e./ha	9.3
	Vegetative vigour – formulations	HC ₅ of SSD for 2 × EC ₂₅ values: 0.069 kg a.e./ha	Apple	In-field: 7.285 kg a.e./ha	105.6
				Off-field (ground application, 3% drift): 0.219 kg a.e./ha	3.2

Organism	Exposure	Endpoint Value	Crop	EEC	RQ ¹
Daphnia magna	with POEA	LC ₅₀ : 0.001 mg a.e./L	Canola	In-field: 6.99 kg a.e./ha	101.3
				Off-field (ground application, 3% drift): 0.21 kg a.e./ha	3.0
				Off-field (aerial application, 17% drift): 1.19 kg a.e./ha	17.2
		LC ₅₀ : 0.002 mg a.e./L	Corn	In-field: 6.522 kg a.e./ha	94.5
				Off-field (ground application, 3% drift): 0.196 kg a.e./ha	2.8
		LC ₅₀ : 0.003 mg a.e./L	Potato	In-field: 4.32 kg a.e./ha	62.6
				Off-field (ground application, 3% drift): 0.13 kg a.e./ha	1.9

¹ Shaded cells and bold values indicate that the level of concern is exceeded (RQ > 1).

Table X.27 Screening Level Risk Assessment of Glyphosate Technical, Glyphosate Formulations, the Transformation Product AMPA and the Formulant POEA to Aquatic Organisms Following Ground Boom Application in Different Crop Productions

Test Material	Exposure	Endpoint Value (mg a.e./L)	Crop	Application Rate/Interval	Depth (cm)	EEC (mg a.e./L)	RQ ¹
Freshwater Invertebrates							
Technical grade active ingredient	Acute	HC ₅ : 16.9	Apple	4320 g a.e./ha × 2 + 3960 g a.e./ha at 14 d	80	1.5	0.09
	Chronic	NOEC: 7.14					0.2
EUP Non-POEA	Acute	HC ₅ : 30.5	Apple	4320 g a.e./ha × 2 + 3960 g a.e./ha at 14 d	80	1.5	0.05
	Chronic	½ EC ₅₀ : 21.9					0.07
EUP With POEA	Acute	HC ₅ : 0.19	Apple	4320 g a.e./ha × 2 + 3960 g a.e./ha at 14 d	80	1.5	7.9
			Potato	4320 g a.e./ha			0.5
	Chronic	NOEC: 0.27	Apple	4320 g a.e./ha × 2 + 3960 g a.e./ha at 14 d			1.5
			Potato	4320 g a.e./ha			0.5
POEA	Acute	HC ₅ : 0.0041	Apple	1967 g a.e./ha × 2 + 1803 g a.e./ha		0.51	124

Test Material	Exposure	Endpoint Value (mg a.e./L)	Crop	Application Rate/Interval	Depth (cm)	EEC (mg a.e./L)	RQ ¹
AMPA	Chronic	mg/L	Potato	at 14 d	15	8.2	0.28
				1967 g a.e./ha			
		½ EC ₅₀ : 0.85 mg/L	Apple	1967 g a.e./ha × 2 + 1803 g a.e./ha at 14 d			
			Potato	1967 g a.e./ha			
	Acute	½ EC ₅₀ : 204 mg/L	Apple	2837 g a.e./ha × 2 + 2600 g a.e./ha at 14 d			
Snails							
Technical grade active ingredient	Chronic	NOEC: 1000	Apple	4320 g a.e./ha × 2 + 3960 g a.e./ha at 14 d	15	8.2	0.01
EUP Non-POEA	Chronic	NOEC: 29.6					0.28
EUP With POEA	Acute	½ LC ₅₀ : 1.15	Apple	4320 g a.e./ha × 2 + 3960 g a.e./ha at 14 d		2.88	7.1
			Potato	4320 g a.e./ha			2.5
	Chronic	NOEC: 8.6	Apple	4320 g a.e./ha × 2 + 3960 g a.e./ha at 14 d		8.2	0.95
Freshwater Fish							
Technical grade active ingredient	Acute	HC ₅ : 80.4	Apple	4320 g a.e./ha × 2 + 3960 g a.e./ha at 14 d	80	1.5	0.02
	Chronic	NOEC: 25.7	Apple				0.06
EUP Non-POEA	Acute	1/10 LC ₅₀ : 12.2	Apple			1.5	0.12
EUP With POEA	Acute	HC ₅ : 1.74	Apple				0.86
	Chronic	NOEC: 0.36	Apple				4.2
POEA	Acute	HC ₅ : 0.26	Apple	1967 g a.e./ha × 2 + 1803 g a.e./ha at 14 d		0.5	1.4
AMPA	Acute	1/10 LC ₅₀ : 29.7	Apple	2837 g a.e./ha × 2 + 2600 g a.e./ha at 14 d		0.51	2.1
						0.9	0.03

Test Material	Exposure	Endpoint Value (mg a.e./L)	Crop	Application Rate/Interval	Depth (cm)	EEC (mg a.e./L)	RQ ¹
Freshwater Algae							
Technical grade active ingredient	Acute	HC ₅ : 6.6	Apple	4320 g a.e./ha × 2 + 3960 g a.e./ha at 14 d	80	1.5	0.23
	Chronic	HC ₅ : 118					0.01
EUP Non-POEA	Acute	½ EC ₅₀ : 0.06	Apple	4320 g a.e./ha × 2 + 3960 g a.e./ha at 14 d		1.5	25
			Potato	4320 g a.e./ha		0.5	8.3
EUP With POEA	Acute	½ EC ₅₀ : 4.6	Apple	4320 g a.e./ha × 2 + 3960 g a.e./ha at 14 d		1.5	0.32
	Chronic	HC ₅ : 0.42	Apple	4320 g a.e./ha × 2 + 3960 g a.e./ha at 14 d		1.5	3.6
POEA ALONE	Acute	½ EC ₅₀ : 1.7	Apple	1967 g a.e./ha × 2 + 1803 g a.e./ha at 14 d		0.51	0.3
AMPA	Acute	½ EC ₅₀ : 71.5	Apple	2837 g a.e./ha × 2 + 2600 g a.e./ha at 14 d		0.9	0.01
Freshwater Plants							
Technical grade active ingredient	Acute	½ EC ₅₀ : 10.6	Apple	4320 g a.e./ha × 2 + 3960 g a.e./ha at 14 d	80	1.5	0.14
EUP Non-POEA	Acute	½ EC ₅₀ : 3.85	Apple	4320 g a.e./ha × 2 + 3960 g a.e./ha at 14 d		1.5	0.39
EUP With POEA	Acute	HC ₅ : 0.003	Apple	4320 g a.e./ha × 2 + 3960 g a.e./ha at 14 d		1.5	500
			Potato	4320 g a.e./ha		0.5	167
Amphibians Lab Data							
Technical grade active ingredient	Acute	HC ₅ : 15	Apple	4320 g a.e./ha × 2 + 3960 g a.e./ha at 14 d	15	8.2	0.55
	Chronic	42-d NOEC: 1.8	Apple	4320 g a.e./ha × 2 + 3960 g a.e./ha at 14 d		8.2	4.6
			Potato	4320 g a.e./ha		2.9	1.6

Test Material	Exposure	Endpoint Value (mg a.e./L)	Crop	Application Rate/Interval	Depth (cm)	EEC (mg a.e./L)	RQ ¹
EUP Non-POEA	Acute	HC ₅ : 18	Apple	4320 g a.e./ha × 2 + 3960 g a.e./ha at 14 d		8.2	0.46
EUP With POEA	Acute	HC ₅ : 0.93	Apple	4320 g a.e./ha × 2 + 3960 g a.e./ha at 14 d	15	8.2	8.8
			Potato	4320 g a.e./ha		2.9	3.1
	Chronic	HC ₅ : 0.86	Apple	4320 g a.e./ha × 2 + 3960 g a.e./ha at 14 d		8.2	9.5
			Potato	4320 g a.e./ha		2.9	3.4
Amphibian Field Mesocosm Data							
EUP With POEA	Acute	HC ₅ : 2.29	Apple	4320 g a.e./ha × 2 + 3960 g a.e./ha at 14 d	15	8.2	3.6
			Potato	4320 g a.e./ha		2.9	1.3
	Chronic	HC ₅ : 1.36	Apple	4320 g a.e./ha × 2 + 3960 g a.e./ha at 14 d		8.2	6.0
			Potato	4320 g a.e./ha		2.9	2.1
Marine/Estuarine Invertebrates							
Technical grade active ingredient	Acute	HC ₅ : 0.3	Apple	4320 g a.e./ha × 2 + 3960 g a.e./ha at 14 d	80	1.5	5
			Potato	4320 g a.e./ha		0.5	1.7
EUP Non-POEA	Acute	½ EC50: 11.6	Apple	4320 g a.e./ha × 2 + 3960 g a.e./ha at 14 d		1.5	0.13
EUP With POEA	Acute	HC ₅ : 0.01	Apple	4320 g a.e./ha × 2 + 3960 g a.e./ha at 14 d		1.5	150
			Potato	4320 g a.e./ha		0.5	50
POEA	Acute	½ EC50: 0.3	Apple	1967 g a.e./ha × 2 + 1803 g a.e./ha at 14 d		0.51	1.7
			Potato	1967 g a.e./ha		0.25	0.83
AMPA	Acute	½ EC50: > 48.5	Apple	2837 g a.e./ha × 2 + 2600 g a.e./ha at 14 d		0.9	< 0.02

Test Material	Exposure	Endpoint Value (mg a.e./L)	Crop	Application Rate/Interval	Depth (cm)	EEC (mg a.e./L)	RQ ¹
Marine/Estuarine Fish							
Technical grade active ingredient	Acute	HC ₅ : 23	Apple	4320 g a.e./ha × 2 + 3960 g a.e./ha at 14 d	80	1.5	0.06
	Chronic	NOEC: 0.1	Apple	4320 g a.e./ha × 2 + 3960 g a.e./ha at 14 d		1.5	15
			Potato	4320 g a.e./ha		0.5	5
EUP Non-POEA	Acute	1/10 LC ₅₀ : 14	Apple	4320 g a.e./ha × 2 + 3960 g a.e./ha at 14 d	80	1.5	0.11
EUP With POEA	Acute	HC ₅ : 3.0	Apple	4320 g a.e./ha × 2 + 3960 g a.e./ha at 14 d		1.5	0.5
			Potato	4320 g a.e./ha		0.5	0.17
POEA	Acute	HC ₅ : 2.1	Apple	1967 g a.e./ha × 2 + 1803 g a.e./ha at 14 d		0.51	0.24
			Potato	1967 g a.e./ha		0.25	0.12
Marine/Estuarine Algae							
Technical grade active ingredient	Acute	½ EC ₅₀ : 1.6	Apple	4320 g a.e./ha × 2 + 3960 g a.e./ha at 14 d	80	1.5	0.94
	Chronic	HC ₅ : 28.4	Apple	4320 g a.e./ha × 2 + 3960 g a.e./ha at 14 d		1.5	0.05
EUP With POEA	Acute	½ EC ₅₀ : 1.7	Apple	4320 g a.e./ha × 2 + 3960 g a.e./ha at 14 d		1.5	0.88
	Chronic	HC ₅ : 0.33	Apple	4320 g a.e./ha × 2 + 3960 g a.e./ha at 14 d		1.5	4.4
			Potato	4320 g a.e./ha		0.5	2.9
POEA	Acute	½ EC ₅₀ : 0.93	Apple	1967 g a.e./ha × 2 + 1803 g a.e./ha at 14 d		0.51	0.55

¹ Shaded cells and bold values indicate that the level of concern is exceeded (RQ > 1).

Refined Risk Assessment on Non-Target Aquatic Species

Table X.28 Further Risk Characterization of Glyphosate Technical, Glyphosate Formulations, Transformation Product AMPA and the Formulant POEA Exposed to Aquatic Organisms Following Drift from Ground Boom or Aerial Applications in Different Crop Productions

Test Material	Exposure	Endpoint Value (mg a.e./L)	Use Scenario	Application Rate (g ae/ha)	EEC (mg a.e./L)	RQ	LOC Exceeded
Freshwater Invertebrates							
EUP With POEA	Acute	HC ₅ : 0.19	Aerial (canola)	4320 + 4320 + 902 at 10 d	0.2	1.1	Yes
			Ground (potato)	4320	0.02	0.11	No
	Chronic	NOEC :0.27	Aerial (canola)	4320 + 4320 + 902 at 10 d	0.2	0.74	No
			Ground (potato)	4320	0.02	0.07	No
POEA	Acute	HC ₅ : 0.0041	Aerial (canola)	1967 + 1967 + 411 at 10 d	0.066	16.1	Yes
			Ground (potato)	1967	0.0075	1.8	Yes
Freshwater Snails							
EUP With POEA	Acute	½ LC ₅₀ : 1.15	Aerial (canola)	4320 + 4320 + 902 at 10 d	1.06	0.92	No
			Ground (potato)	4320	0.09	0.08	No
Freshwater Fish							
EUP With POEA	Chronic	NOEC :0.36	Aerial (canola)	4320 + 4320 + 902 at 10 d	0.2	0.56	No
			Ground (potato)	4320	0.02	0.06	No
POEA	Acute	HC ₅ : 0.26	Aerial (canola)	1967 + 1967 + 411 at 10 d	0.066	0.25	No
Amphibian Laboratory Data							
Technical grade active ingredient	Chronic	NOEC: 1.8	Aerial (canola)	4320 + 4320 + 902 at 10 d	1.06	0.59	No
			Ground (potato)	4320	0.09	0.05	No
	Acute	HC ₅ : 0.93	Aerial (canola)	4320 + 4320 + 902 at 10 d	1.06	1.1	Yes
			Ground (potato)	4320	0.09	0.1	No
EUP With POEA	Chronic	HC ₅ : 0.86	Aerial (canola)	4320 + 4320 + 902 at 10 d	1.06	1.2	Yes
			Ground (potato)	4320	0.09	0.1	No
Amphibian Field/Mesocosm Data							
EUP With POEA	Acute	HC ₅ : 2.29	Aerial (canola)	4320 + 4320 + 902 at 10 d	1.06	0.5	No
			Ground (potato)	4320	0.09	0.04	No
	Chronic	HC ₅ : 1.36	Aerial (canola)	4320 + 4320 + 902 at 10 d	1.06	0.8	No
			Ground (potato)	4320	0.09	0.07	No

Test Material	Exposure	Endpoint Value (mg ae/L)	Use Scenario	Application Rate (g ae/ha)	EEC (mg a.c/L)	RQ	LOC Exceeded
Freshwater Algae							
EUP Non-POEA	Acute	½ EC50: 0.06	Aerial (canola)	4320 + 4320 + 902 at 10 d	0.2	3.3	Yes
			Ground (potato)	4320	0.02	0.33	No
EUP With POEA	Chronic	HC ₅ : 0.42	Aerial (canola)	4320 + 4320 + 902 at 10 d	0.2	0.48	No
			Ground (potato)	4320	0.02	0.05	No
Freshwater Plants							
EUP With POEA	Acute	HC ₅ :0.003	Aerial (canola)	4320 + 4320 + 902 at 10 d	0.2	67	Yes
			Ground (potato)	4320	0.02	6.7	Yes
Marine/Estuarine Invertebrates							
Technical grade active ingredient	Acute	HC ₅ : 0.3	Aerial (canola)	4320 + 4320 + 902 at 10 d	0.2	0.67	No
			Ground (potato)	4320	0.02	0.07	No
EUP With POEA	Acute	HC ₅ : 0.01	Aerial (canola)	4320 + 4320 + 902 at 10 d	0.2	20	Yes
			Ground (potato)	4320	0.02	2	Yes
POEA	Acute	½ EC50: 0.3	Aerial (canola)	1967 + 1967 + 411 at 10 d	0.066	0.22	No
			Ground (potato)	1967	0.008	0.03	No
Marine/Estuarine Fish							
Technical grade active ingredient	Chronic	NOEC: 0.1	Aerial (canola)	4320 + 4320 + 902 at 10 d	0.2	2	Yes
			Ground (potato)	4320	0.02	0.2	No
Marine/Estuarine Algae							
EUP With POEA	Chronic	HC ₅ : 0.33	Aerial (canola)	4320 + 4320 + 902 at 10 d	0.2	0.6	No
			Ground (potato)	4320	0.02	0.12	No

Shaded cells and **bold values** indicate that the level of concern is exceeded (RQ > 1).

Table X.29 Further Risk Characterization of Glyphosate Technical and Glyphosate Formulations Exposed to Aquatic Organisms Following Runoff in Different Crop Productions

Test Material	Exposure	Endpoint Value (mg a.g./L)	Crop-Region (Use Rate g a.e./ha, Application Interval)	EEC (mg a.e./L)	RQ	LOC Exceeded		
Freshwater Organisms								
Freshwater Invertebrates								
EUP With POEA	Acute	HC ₅ : 0.19	Potato – PEI (4320)	0.096	0.51	No		
	Chronic	NOEC: 0.27		0.078	0.29	No		
Freshwater Snails								
EUP With POEA	Acute	½ EC ₅₀ : 1.15	Potato – PEI (4320)	0.096	0.08	No		
Freshwater Fish								
EUP With POEA	Chronic	NOEC: 0.36	Potato – PEI (4320)	0.091	0.25	No		
			Apple – BC (2 × 4320 +3960, 14 d)	0.003	0.01	No		
Freshwater Amphibians								
EUP With POEA	Laboratory Data		Potato – PEI (4320)	0.159	0.17	No		
	Acute	HC ₅ : 0.93		0.006	0.01	No		
	Chronic	HC ₅ : 0.86	Potato – PEI (4320)	0.102	0.12	No		
			Apple – BC (2 × 4320 +3960, 14 d)	0.002	<0.01	No		
	Chronic	HC ₅ : 1.36	Potato – PEI (4320)	0.102	0.08	No		
Freshwater Algae								
EUP Non-POEA	Acute	HC ₅ : 0.06	Potato – PEI (4320)	0.096	1.6	Yes		
			Apple – BC (2 × 4320 +3960, 14 d)	0.003	0.05	No		
EUP With POEA	Chronic	HC ₅ : 0.42	Potato – PEI (4320)	0.078	0.19	No		
Freshwater Plants								
EUP With POEA	Acute	HC ₅ : 0.003	Potato – PEI (4320)	0.078	26	Yes		
			Apple – BC (2 × 4320 +3960, 14 d)	0.002	0.67	No		
Marine/Estuarine Organisms								
Marine/Estuarine Invertebrates								
EUP With POEA	Acute	HC ₅ : 0.01	Potato – PEI (4320)	0.096	9.6	Yes		
			Apple – BC (2 × 4320 +3960, 14 d)	0.003	0.3	No		
Marine/Estuarine Fish								
Technical grade active ingredient	Chronic	NOEC: 0.1	Potato – PEI (4320)	0.078	0.78	No		

Test Material	Exposure	Endpoint Value (mg a.e./L)	Half-Life (a.e.) in Water (d)	Transformation Product Exposure (a.e.) in Water (d)	EEC (mg a.e./L)	RQ	LOC Exceeded
EUP With POEA	Chronic	TC ₅₀ : 0.33	Depot - TC ₅₀ : 4.120	0.071	0.33	1.00	No

Shaded cells and bold values indicate that the level of concern is exceeded (RQ > 1).

Table X.30 Further Risk Characterization of Glyphosate Technical, Glyphosate Formulations, Transformation Product AMPA and the Formulant POEA Exposed to Aquatic Organisms Using Freshwater Monitoring Data in Different Crop Productions

Test Material	Exposure	Endpoint Value (mg a.e./L)	EEC (mg a.e./L)	RQ	LOC Exceeded
Freshwater Invertebrate					
EUP With POEA	Acute	HC ₅ : 0.19	0.041	0.22	No
	Chronic	NOEC: 0.27	0.041	0.15	No
Freshwater Snails					
EUP With POEA	Acute	½ EC ₅₀ : 1.15	0.041	0.04	No
Freshwater Fish					
EUP With POEA	Chronic	NOEC: 0.36	0.041	0.11	No
Freshwater Amphibians					
EUP With POEA	Acute	HC ₅ : 0.93	0.041	0.04	No
	Chronic	HC ₅ : 0.86	0.041	0.05	No
Freshwater Algae					
EUP Non-POEA	Acute	HC ₅ : 0.06	0.041	0.68	No
EUP With POEA	Chronic	HC ₅ : 0.42	0.041	0.1	No
Freshwater Plants					
EUP With POEA	Chronic	HC ₅ : 0.003	0.041	14	Yes

Shaded cells and bold values indicate that the level of concern is exceeded (RQ > 1). No monitoring data were available for marine/estuarine environment.

Appendix XI Glyphosate Aquatic Ecoscenario and Drinking Water Assessment

Modelling Results

Aquatic Ecoscenario Assessment: Level 1 Modelling

For Level 1 aquatic ecoscenario assessment, estimated environmental concentrations (EECs) of glyphosate from runoff into a receiving water body were simulated using the PRZM/EXAMS models. The PRZM/EXAMS models simulate pesticide runoff from a treated field into an adjacent water body and the fate of a pesticide within that water body. For the Level 1 assessment, the water body consists of a 1 ha wetland with an average depth of 0.8 m and a drainage area of 10 ha. A seasonal water body was also used to assess the risk to amphibians, as a risk was identified at the screening level. This water body is essentially a scaled-down version of the permanent water body noted above, but having a water depth of 0.15 m. EECs for glyphosate in pore water were also generated in a water body with an average depth of 0.8 m.

A number of initial application dates between April and November were modelled. Table 2 lists the application information and the main environmental fate characteristics used in the simulations. The EECs are for the portion of the pesticide that enters the water body via runoff only; deposition from spray drift is not included. The models were run for 50 years for all scenarios. The major groundwater and surface water model inputs for level 1 assessment used the combined residues of glyphosate and its transformation product AMPA as the most conservative values in potential sources of drinking water. The major input parameters for the model are summarized in Table XI.1.

The EECs are calculated from the model output from each run as follows. For each year of the simulation, PRZM/EXAMS calculates peak (or daily maximum) and time-averaged concentrations. The time-averaged concentrations are calculated by averaging the daily concentrations over five time periods (96-hour, 21-day, 60-day, 90-day, and 1 year). The 90th percentiles over each averaging period are reported as the EECs for that period.

The largest EECs of all selected runs of a given use pattern/regional scenario are reported in Tables XI.3-5, Appendix XI.

Table XI.1 Major Groundwater and Surface Water Model Inputs for Level 1 Assessment of Glyphosate and AMPA (Combined Residues)

Type of input	Parameter	Value
Application Information	Crop(s) to be treated	Apple, potato, wheat, canola, corn, soybean, turf and sod, and other crops
	Maximum allowable application rate per year (g a.i./ha)	12600 for apple 10445 for corn 9542 for canola, wheat and soybean 4320 for potato and other crops
	Maximum rate each application (g a.i./ha)	4320 for all crops
	Maximum number of applications per year	3 for apple, canola, wheat and soybean 4 for corn 1 for potato and other crops
	Minimum interval between applications (days)	14 for apple and corn 10 for canola, wheat and soybean
	Method of application	Aerial and ground for drinking water modelling ground for ecological modelling
Environmental Fate Characteristics	Hydrolysis half-life at pH 7 (days)	Stable for the combined residue 1627 for parent glyphosate
	Photolysis half-life in water (days)	216
	Adsorption K_{OC} (mL/g)	30 (20 th percentile of 11 K_d values for "AMPA") for drinking water modelling 48.8 (20 th percentile of 10 K_d values for "glyphosate") for ecological modelling
	Aerobic soil biotransformation half-life (days)	135.3 (90 th percentile confidence bound on mean of 4 half-life values adjusted to 25°C for the combined residue for drinking water modelling) 32.6 (90 th percentile confidence bound on mean of 7 half-life values adjusted to 25°C for glyphosate for ecological modelling)
	Aerobic aquatic biotransformation half-life (days)	637 (80 th percentile of 3 half-life values for the combined residue for drinking water modelling) 413.6 (80 th percentile of 3 half-life values for glyphosate for ecological modelling)
	Anaerobic aquatic biotransformation half-life (days)	617 (the only half-life value available for the combined residue for drinking water modelling) 273 (the only half-life value available for glyphosate for ecological modelling)

Table XI.2 Crops, Rates Modelled at Level 1 Ecoscenario Modelling

Region	Crop	Rate in kg a.e./ha; Application Interval in Days	Scenario
British Columbia	Apple	12.6 ($2 \times 4.32 + 3.96$; 14)	Apple - BC
	Canola	9.542 ($2 \times 4.32 + 0.902$; 10)	Barley - AB
Prairie	Canola, wheat, soybean	9.542 ($2 \times 4.32 + 0.902$; 10)	Wheat - MB
	Canola, wheat, soybean	9.542 ($2 \times 4.32 + 0.902$; 10)	Wheat - SK
Ontario	Apple	12.6 ($2 \times 4.32 + 3.96$; 14)	Apple - ON
	Corn	10.445 ($2 \times 4.32 + 2 \times 0.903$; 14)	Corn - ON
Québec	Apple	12.6 ($2 \times 4.32 + 3.96$; 14)	Apple - QC

Table XI.3 Level 1 Aquatic Ecoscenario Modelling EECs (µg a.e./L) in Water Column for Glyphosate in a Water Body 0.8 m Deep, Excluding Spray Drift

Crop Region	Peak	EEC (µg a.i./L)				
		96-Hour	21-Day	60-Day	90-Day	Yearly
Apple - British Columbia	3.4	2.8	1.9	1.4	1.4	1.0
Canola - British Columbia	38	33	24	23	23	19
Canola, wheat, soybean - Manitoba	66	58	41	34	34	27
Canola, wheat, soybean - Saskatchewan	57	47	30	26	24	19
Apple - Ontario	51	42	27	23	22	18
Corn - Ontario	67	56	37	34	34	29
Apple - Québec	38	32	21	20	19	13
Corn - Québec	50	44	37	34	34	30
Potato, soybean and others - Prince Edward Island	96	91	78	73	70	58
Maximum	96	91	78	73	70	58

Table XI.4 Level 1 Aquatic Ecoscenario Modelling EECs (µg a.e./L) in Water Column for Glyphosate in a Water Body 0.15 m Deep, Excluding Spray Drift

Crop – Region	Peak	EEC (µg a.i./L)				
		96-Hour	21-Day	60-Day	90-Day	Yearly
Apple – British Columbia	15	5.9	2.4	1.7	1.7	1.3
Canola – British Columbia	160	68	31	28	28	23
Canola, wheat, soybean – Manitoba	234	105	54	42	41	33
Canola, wheat, soybean – Saskatchewan	192	87	39	32	30	23
Apple – Ontario	216	86	35	28	26	22
Corn – Ontario	234	101	50	42	41	34
Apple – Québec	170	65	27	24	23	16
Corn – Québec	160	78	49	42	41	36
Potato, soybean and others – Prince Edward Island	255	159	102	89	85	70
Maximum	255	159	102	89	85	70

Table XI.5 Level 1 Aquatic Ecoscenario Modelling EECs (µg a.e./L) in Pore Water for Glyphosate in a Water Body 0.8 m Deep, Excluding Spray Drift

Crop – Region	Peak	EEC (µg a.i./L)				
		96-Hour	21-Day	60-Day	90-Day	Yearly
Apple – British Columbia	1.3	1.3	1.3	1.2	1.2	1.0
Canola – British Columbia	21	21	21	20	20	19
Canola, wheat, soybean – Manitoba	34	34	34	34	34	25
Canola, wheat, soybean – Saskatchewan	22	22	22	22	22	19
Apple – Ontario	21	21	21	21	21	18
Corn – Ontario	32	32	32	32	32	28
Apple – Québec	17	17	17	17	16	13
Corn – Québec	33	33	33	33	32	29
Potato, soybean and others – Prince Edward Island	67	67	67	66	65	57
Maximum	67	67	67	66	65	57

Estimated Concentrations in Drinking Water Sources: Level 1 and Level 2 Modelling

A Level 1 drinking water assessment was conducted using conservative assumptions with respect to environmental fate, application rate and timing, and geographic scenario. The Level 1 EEC estimate is expected to allow for future use expansion into other crops at this application rate. Table 1 lists the application information and main environmental fate characteristics used in the simulations.

A number of initial application dates between March and November were modelled. The model was run for 50 years for all scenarios. The largest EECs of all selected runs are reported in Table XI.6 below.

Table XI.6 Level 1 Estimated Environmental Concentrations of the Combined Residue (Glyphosate and AMPA) in Potential Drinking Water

Compound	Groundwater EEC ($\mu\text{g a.i./L}$)			Surface Water EEC ($\mu\text{g a.i./L}$)		
			Reservoir	Dugout		
	Daily ¹	Yearly ²	Daily ³	Yearly ⁴	Daily ³	Yearly ⁴
Glyphosate and AMPA	0	0	299	136	1647	1538

1 90th percentile of daily average concentrations.

2 90th percentile of yearly average concentrations.

3 90th percentile of yearly peak concentrations.

4 90th percentile of yearly average concentrations.

A Level 2 drinking water assessment was conducted using conservative assumptions with respect to environmental fate, but using crop specific application rate and timing, and geographic scenario. The Level 2 EEC estimates are therefore not expected to allow for future use expansion into other crops.

A number of initial application dates between March and November were modelled. The model was run for 50 years for all scenarios. The largest EECs of all selected runs are reported in Table 7 that follows.

Table XI.7 Level 2 Estimated Environmental Concentrations of the Combined Residue (Glyphosate and AMPA) in Potential Drinking Water

Crop	Groundwater EEC ($\mu\text{g a.i./L}$)		Surface Water EEC ($\mu\text{g a.i./L}$)			
			Reservoir		Dugout	
	Daily ¹	Yearly ²	Daily ³	Yearly ⁴	Daily ³	Yearly ⁴
Apple	NM ⁵	NM ⁵	150	105	NM ⁵	NM ⁵
Corn	NM ⁵	NM ⁵	131	71	NM ⁵	NM ⁵
Wheat, canola and soybean	NM ⁵	NM ⁵	267	197	843	780
Potato and other crops	NM ⁵	NM ⁵	68	44	NM ⁵	NM ⁵

1 90th percentile of daily average concentrations.

2 90th percentile of yearly average concentrations.

3 90th percentile of yearly peak concentrations.

4 90th percentile of yearly average concentrations.

5 NM -- not modelled.

Water Monitoring Data

Glyphosate is registered for use in agriculture, forestry and some domestic uses across Canada. The major environmental transformation product of glyphosate is AMPA (aminomethyl phosphonic acid). Polyoxyethyleneamine (POEA) is used as a surfactant in some end-use products containing glyphosate. POEA has been found to be toxic to aquatic organisms.

A search for water monitoring data on glyphosate, AMPA and POEA was conducted. Canadian water monitoring data on glyphosate and AMPA were available from various relevant regions in several provinces across the country. No Canadian monitoring data were available for the surfactant POEA.

United States databases were also searched for monitoring of glyphosate, AMPA and POEA in water. Data on residues present in water samples taken in the United States are important to consider in the Canadian water assessment given the extensive monitoring programs that exist in the United States. Local weather patterns, runoff events, circumstantial hydrogeology as well as testing and reporting methods are probably more important influences on residue data than Northern versus Southern climate. Regarding climate, if temperatures are cooler, residues may break down more slowly. Alternatively, if temperatures are warmer, growing seasons may be longer and pesticide inputs may be more numerous and frequent.

In the United States, monitoring data were available from the US Geological Survey National Water Quality Assessment program (NAWQA) database, the US Environmental Protection Agency's Storage and Retrieval (STORET) data warehouse, the California Department of Pesticide Regulation database, and some published literature. Neither glyphosate nor AMPA were part of the analyte lists in the US Department of Agriculture Pesticide Data Program (USDA, PDP) and the US Geological Survey National Stream Quality Accounting Network (NASQAN) program. No monitoring data were available for the surfactant POEA in any of the US sources searched.

For the purposes of the drinking water assessment, information was extracted from the available sources, tabulated and sorted into categories as follows:

1. Residues in known drinking water sources (both surface and groundwater).
2. Residues in ambient water that may serve as a drinking water source (both surface and groundwater).
3. Residues in ambient water that are unlikely to serve as a drinking water source.

Discussions and Conclusions

Overall, available data indicate that glyphosate and AMPA are monitored routinely in groundwater and surface waters in many use areas of Canada and the United States.

Glyphosate and AMPA are seldom detected in groundwater. This is expected as both compounds have high K_d and K_{oc} values, and low groundwater ubiquity score (GUS) scores indicating that they bind tightly to soils and do not have a strong propensity to leach into groundwater.

Glyphosate and AMPA are often detected in surface water. This is expected near areas where glyphosate is used as it can easily reach water bodies through drift, runoff (likely sorbed to soil particles), and irrigation canal discharges. Glyphosate is readily soluble in water and is stable to hydrolysis at environmentally relevant pHs. Glyphosate is also not subject to photochemical degradation. The duration of glyphosate and AMPA exposure in water can vary based on several factors, including the amount of organic carbon present in the water body.

The predicted daily and yearly exposure values from the models represent high-end exposure estimates for drinking water that should be considered in the human health dietary risk assessment for acute and chronic exposures, respectively. The highest concentrations detected in surface water samples from sources that may be used as drinking water sources (29 µg/L of glyphosate, 3.8 µg/L of AMPA, or 32.8 µg/L combined) can also be considered in the acute assessment. For the chronic assessment for human health, the yearly concentrations estimated via modelling represent reasonable high-end exposure estimates for drinking water and should be considered in the human health dietary risk assessment. Monitoring data indicate that glyphosate and AMPA are often detected in surface water but at relatively low levels.

For the aquatic risk assessment, the highest detection of glyphosate in surface water (40.8 µg/L) is higher than the peak concentrations predicted by modelling in some scenarios run in water bodies 80 cm and 15 cm deep. As such, this monitoring value (40.8 µg/L) should be considered along with the modelling numbers in the acute assessment for aquatic organisms (both 15 cm and 80 cm depths). The value of 3100 µg/L from the prospective monitoring study could also be considered in the amphibian risk assessment, as a conservative short-term exposure estimate. For

longer term exposures, the concentrations estimated via modelling represent reasonable high-end exposure estimates for aquatic habitats. Monitoring data indicate that glyphosate and AMPA are frequently detected in surface water but not at levels that meet or exceed the most sensitive HC₅ from species sensitivity distributions (Amphibians, HC₅ of NOEC from chronic studies: 1800 µg/L).

Appendix XII Proposed Label Amendments for Products Containing Glyphosate

The label amendments presented below do not include all label requirements for individual products, such as first aid statements, disposal statements, precautionary statements and supplementary protective equipment. Information on labels of currently registered products should not be removed unless it contradicts the following label statements.

A) Label Amendments for Glyphosate Technical Products

The following label amendments are required on the Glyphosate Technical labels:

- 1) Add to the primary panel of the Technical product labels:

The signal words “DANGER – EYE IRRITANT”, and accompanying glyphs.

- 2) Before **STORAGE** section, Add the title “**ENVIRONMENTAL HAZARDS**” and the following statement:

- **TOXIC** to non-target terrestrial plants
- **TOXIC** to aquatic organisms

- 3) Remove the following statement under the “**DISPOSAL AND DECONTAMINATION**”

“Canadian formulators of this technical should dispose of unwanted active and containers in accordance with municipal or provincial regulations. For information on disposal of unused, unwanted product, contact the manufacturer or the provincial regulatory agency. Contact the manufacturer and the provincial regulatory agency in the case of a spill, and for clean-up of spills.”

and replace it with the following statement:

“Canadian manufacturers should dispose of unwanted active ingredients and containers in accordance with municipal or provincial regulations. For additional details and clean up of spills, contact the manufacturer or the provincial regulatory agency.”

B) For Commercial and Agricultural Class Products Containing Glyphosate

- 1) Add to DIRECTIONS FOR USE:

Restricted Entry Intervals

“The restricted entry interval is 12 hours after application for all agricultural uses.”

2) Add to Use Precautions

"Apply only when the potential for drift to areas of human habitation or areas of human activity such as houses, cottages, schools and recreational areas is minimal. Take into consideration wind speed, wind direction, temperature inversions, application equipment and sprayer settings."

3) Add the following to ENVIRONMENTAL HAZARDS:

- **TOXIC** to non-target terrestrial plants. Observe buffer zones specified under DIRECTIONS FOR USE.
- **TOXIC** to aquatic organisms. Observe buffer zones specified under DIRECTIONS FOR USE.
- To reduce runoff from treated areas into aquatic habitats, avoid application to areas with a moderate to steep slope, compacted soil or clay.
- Avoid application when heavy rain is forecast.
- Contamination of aquatic areas as a result of runoff may be reduced by including a vegetative strip between the treated area and the edge of the water body.

4) Add to DIRECTIONS FOR USE

The following statement is required for all agricultural and commercial pesticide products:

- As this product is not registered for the control of pests in aquatic systems, **DO NOT** use to control aquatic pests
- **DO NOT** contaminate irrigation or drinking water supplies or aquatic habitats by cleaning of equipment or disposal of wastes.

5) Add to DIRECTIONS FOR USE

For **field applications using conventional boom sprayers** (agricultural or commercial products), the following statements are required:

Field sprayer application: **DO NOT** apply during periods of dead calm. Avoid application of this product when winds are gusty. **DO NOT** apply with spray droplets smaller than the American Society of Agricultural Engineers (ASAE) medium classification. Boom height must be 60 cm or less above the crop or ground.

For **airblast applications** (agricultural or commercial products), the following statements are required:

Airblast application: DO NOT apply during periods of dead calm. Avoid application of this product when winds are gusty. DO NOT direct spray above plants to be treated. Turn off outward pointing nozzles at row ends and outer rows. DO NOT apply when wind speed is greater than 16 km/h at the application site as measured outside of the treatment area on the upwind side.

For **aerial applications** (agricultural or commercial products) the following statements are required:

Aerial application: DO NOT apply during periods of dead calm. Avoid application of this product when winds are gusty. DO NOT apply when wind speed is greater than 16 km/h at flying height at the site of application. DO NOT apply with spray droplets smaller than the American Society of Agricultural Engineers (ASAE S572.1) coarse classification. To reduce drift caused by turbulent wingtip vortices, the nozzle distribution along the spray boom length MUST NOT exceed 65% of the wing | or rotorspan.

Buffer Zones

Use of the following spray methods or equipment DO NOT require a buffer zone:
hand-held or backpack sprayer and spot treatment.

The buffer zones specified in Tables 1 and 2 that follow are required between the point of direct application and the closest downwind edge of sensitive estuarine/marine habitats.

Table 1 Buffer Zones for the Protection of Aquatic Organisms and Terrestrial Plants from Spray Drift of Glyphosate Products Formulated with POEA

Method of Application	Crop	Buffer Zones (Metres) Required for the Protection of				
		Freshwater Habitats of Depths	Estuarine/Marine Habitats of Depths	Terrestrial Habitat		
		Less than 1 m	Greater than 1 m	Less than 1 m	Greater than 1 m	
Field Sprayer	<p>Forest and Woodlands (for sites greater than 500 ha) and Woodland Management (for sites less than 500 ha): Conifer release for Douglas fir, fir, hemlock, pine, spruce.</p> <p>Woodland management: Deciduous release (ground only) for (partial list) ash, walnut, linden or basswood, cherry, oak, elm, poplar .</p> <p>Site preparation (ground only, including sites greater than 500 ha).</p> <p>Forest roadside (ground only).</p> <p>Ground Forest tree planting nurseries (ground only).</p> <p>Established deciduous plantings of ash, caragana, cherry, elm, lilac, maple, mountain ash, poplar, Russian olive, and willow.</p> <p>Prior to or in established conifer plantings of fir, juniper, pine, spruce, and yew.</p> <p>Shelterbelts.</p> <p>Nursery stock.</p> <p>Woody ornamentals including forest tree nursery and Christmas tree plantations.</p> <p>Deciduous (ash, caragana, cherry, elm, lilac, maple, mountain ash, poplar, Russian olive, willow) and coniferous (fir, juniper, pine, spruce and yew).</p> <p>Forest (Short rotation intensive culture (SRIC) poplar).</p>	1	0	0	0	NR

Rye, Ginseng – New gardens	1	1	1	0	1
Ginseng – Established gardens	2	1	1	0	1
Filberts or Hazelnut, Cranberry Pasture	3	1	1	1	2
Summer fallow					
Sugar beets (Roundup Ready only)					
Highbush blueberry	4	2	1	1	3
Canola (glyphosate tolerant)					
Corn (glyphosate tolerant)					
Forage grasses and legume including seed production					
Corn					
Sugar beet					
Strawberry,					
Lowbush blueberry, Walnut,					
Soybean (Glyphosate tolerant, Or Roundup Ready soybean varieties, or Roundup Ready 2 Yield soybean varieties), Turf grass (Prior to establishment or renovation)					
Wheat					
Barley					
Oats	5	3	1	1	4
Soybean					
Corn – Sweet (Roundup Ready 2 Technology),					
Canola					
Peas					
Dry beans					
Flax (including low linoleic acid varieties)					
Lentils,					
Chickpea,					
Lupin (dried)					
Fava bean (dried),					
Mustard (yellow/white, brown, oriental)					
Pearl millet					
Sorghum (grain) (not for use as a forage crop)					
Asparagus					

	<p>Apple Apricot Cherry (sweet/sour) Peaches Pears Plums Grapes, Filberts or Hazelnut (pre-seeding)</p> <p>Non-cropland and industrial uses: Industrial and rights of way areas*: railroad, pipelines, highway, telephone and power rights-of-way; petroleum tank farms, pumping installations, roadsides, storage areas; lumberyards; fence rows, and industrial plant sites.</p> <p>Recreational and public areas such as parking areas, school yards, parks, golf courses, other public areas, airports and similar industrial or non-crop areas.</p>	10	4	1	1	5
Airblast or Mistblowers	<p>Forest, Woodlands and woodland management, Conifer release for Douglas fir, fir, hemlock, pine, spruce</p> <p>Deciduous release (ground only) for (partial list) ash, walnut, linden or basswood, cherry, oak, elm, poplar</p> <p>Ground for sites > 500 ha (forest use)</p> <p>Woodland management</p> <p>Site preparation (Ground only)</p> <p>Forest roadside (Ground only)</p> <p>Forest tree planting, nurseries (ground only)</p> <p>Established deciduous plantings of ash, caragana, cherry, elm, lilac, maple, mountain ash, poplar, Russian olive and willow.</p> <p>Prior to or in established conifer plantings of fir, juniper, pine, spruce and yew.</p>	2	0	0	0	NR
	Forest and Woodlands, Site preparation for sites > 500 ha	4	0	0	0	NR
	Pasture	40	30	5	2	35

	Non-crop land and industrial uses: Industrial and rights of way areas*: railroad, pipelines, highway, telephone and power rights-of-way; petroleum tank farms, pumping installations, roadsides, storage areas; lumberyards; fence rows, industrial plant sites Recreational and public areas such as parking areas, school yards, parks, golf courses, other public areas, airports and similar industrial or non-crop areas.		45	35	10	3	40
	Turf grass (prior to establishment or renovation)		45	35	10	4	40
Aerial	Rye	Fixed wing	15	10	0	0	40
	Corn						
	Corn – Sweet (Roundup Ready 2 Technology)	Rotary wing	15	10	0	0	40
	Chickpea						
	Lupin (dried)	Fixed wing	30	0	0	0	NR
	Fava bean (dried)		20	0	0	0	NR
	Mustard (yellow/white, brown, oriental)						
	Pearl millet						
	Sorghum (grain) (not for use as a forage crop)						
	Sugar beet						
	Forest and Woodlands (for sites > 500 ha): Conifer release – Aerial strip thinning of conifers	Rotary wing	25	0	0	0	NR
	Woodland management						

	(for sites < 500 ha): Conifer release for Douglas fir, fir, hemlock, pine, spruce	Rotary wing	15	0	0	0	NR
Forest and Woodlands (for sites > 500 ha): Site preparation	Fixed wing	60	0	0	0	0	NR
	Rotary wing	40	0	0	0	0	NR
Woodland management (for sites < 500 ha): Site preparation	Fixed wing	50	0	0	0	0	NR
	Rotary wing	35	0	0	0	0	NR
Sugar beets (Roundup Ready only) Wheat Barley Oats Soybean Canola Peas Dry beans Flax (including low linoleic acid varieties) Lentils	Fixed wing	40	15	0	0	0	60
	Rotary wing	30	15	0	0	0	50
	Fixed wing	45	15	0	0	0	65
	Rotary wing	30	15	0	0	0	55
	Fixed wing	55	15	0	0	0	75
	Rotary wing	35	15	0	0	0	60
	Fixed wing	60	20	0	0	0	65
	Rotary wing	45	15	0	0	0	55
	Fixed wing	70	20	0	0	0	70

	tolerant, or Roundup Ready soybean varieties, or Roundup Ready 2 Yield soybean varieties)	Rotary wing	45	15	0	0	60
Corn (glyphosate tolerant)	Fixed wing	70	20	0	0	85	
	Rotary wing	45	15	0	0	65	
Pasture	Fixed wing	90	40	0	0	125	
	Rotary wing	60	25	0	0	85	
Non-cropland and industrial uses: Industrial and rights-of-way areas*: railroad, pipelines, highway, telephone and power rights-of-way; petroleum tank farms, pumping installations, roadsides, storage areas; lumberyards; fence rows, industrial plant sites. Recreational and public areas- such as parking areas, school yards, parks, golf courses, other public areas, airports and similar industrial or non-crop areas	Fixed wing	350	200	30	15	300	
	Rotary wing	150	80	20	4	150	

* Buffer zones for the protection of terrestrial habitats are not required for use on rights-of-way including railroad ballast, rail and hydro rights-of-way, utility easements, roads, and training grounds and firing ranges on military bases.

NR = Buffer zones for the protection of terrestrial habitats are not required for forestry uses.

Table 2. Buffer Zones for the Protection of Aquatic Organisms and Terrestrial Plants from Spray Drift of Glyphosate Products without POEA

Method of Application	Crop	Buffer Zones (Metres) Required for the Protection of		
		Freshwater Habitat of Depths		Terrestrial Habitat
		Less than 1 m	Greater than 1 m	
Field Sprayer	Ginseng – New garden	1	0	1
	Rye			
	Sugar beets (Roundup ready only)	1	1	1
	Ginseng – Established garden			
	Filberts or Hazelnut – Established			
	Wheat, barley, oats	1	1	4
	Soybean			
	Corn-Sweet (Roundup-Ready 2 Technology)			
	Canola,			
	Canola (glyphosate tolerant)			
	Peas			
	Dry beans			
	Flax (including low linoleic acid varieties)			
	Lentils			
	Chickpea			
	Lupin (dried)			
	Fava bean (dried)			
	Mustard (yellow/white, brown, oriental)			
	Pearl millet			
	Sorghum (grain) (not for use as a forage crop)			
	Asparagus			

Method of Application	Crop	Buffer Zones (Metres) Required for the Protection of		
		Freshwater Habitat or Depths		Terrestrial Habitat
		Less than 1 m	Greater than 1 m	
	Highbush blueberry Cranberry Pasture, Summer fallow			
	Apple Apricot, Cherry (Sweet/Sour) Peaches Pears Plums Grapes Filberts or Hazelnut – pre-seeding Soybean (Glyphosate tolerant, or Roundup-Ready soybean varieties, or Roundup-Ready 2 Yield soybean varieties) Turf grass (Prior to establishment or renovation) Corn (glyphosate tolerant) Forage grasses and legumes including seed production Corn Sugar beet Strawberry Lowbush blueberry Walnut Non-cropland and industrial uses; Industrial and rights of way areas*: railroad, pipelines, highway, telephone and power rights-of-way; petroleum tank farms, pumping installations, roadsides, storage areas; lumberyards; fence rows, industrial plant sites. Recreational and public areas- such as parking areas, school yards, parks, golf courses, other public areas, airports and similar industrial or non-crop areas	1	1	5

Method of Application	Crop	Buffer Zones (Metres) Required for the Protection of			Terrestrial Habitat	
		Freshwater Habitat or Depths		Less than 1 m		
		Less than 1 m	Greater than 1 m			
Airblast or Mistblower	Pasture		10	3	35	
	Turf grass (Prior to establishment or renovation)		15	5	40	
	Non-crop land and industrial uses: Industrial and rights of way areas*: railroad, pipelines, highway, telephone and power rights-of-way; petroleum tank farms, pumping installations, roadsides, storage areas; lumberyards; fence rows, industrial plant sites		15	5	40	
	Recreational and public areas such as parking areas, school yards, parks, golf courses, other public areas, airports and similar industrial or non-crop areas.					
Aerial	Rye, Corn, Corn-Sweet (Roundup Ready 2 Technology), Chickpea, Lupin (dried), Fava bean (dried)	Fixed wing	0	0	40	
	Mustard (yellow/white, brown, oriental)	Rotary wing	0	0	40	
	Pearl millet, Sorghum (grain) (not for use as a forage crop)					
	Sugar beet					
	Sugar beets (Roundup Ready only)	Fixed wing	0	0	60	
	Wheat, Barley, Oats, Soybean	Rotary wing	0	0	50	
	Canola					
	Peas, Dry beans					
	Flax (including low linoleic acid varieties)					
	Lentils					
	Canola (glyphosate-tolerant)	Fixed wing	0	0	65	
	Forage grasses and legume including seed production	Rotary wing	0	0	55	

Method of Application	Crop	Buffer Zones (Metres) Required for the Protection of Freshwater Habitat or Depth			Terrestrial Habitat
		Less than 1 m		Greater than 1 m	
		Fixed wing	Rotary wing		
Corn (glyphosate tolerant) Soybean (Glyphosate tolerant, Or Roundup Ready soybean varieties, or Roundup Ready 2 Yield soybean varieties) Summer fallow	Fixed wing	0	0		85
		0	0		65
	Pasture	0	0		125
		0	0		185
	Non-crop land and industrial uses: Industrial and rights of way areas*, railroad, pipelines, highway, telephone and power rights-of-way; petroleum tank farms, pumping installations, roadsides, storage areas; lumberyards; fence rows, industrial plant sites Recreational and public areas such as parking areas, school yards, parks, golf courses, other public areas, airports and similar industrial or non-crop areas.	Fixed wing	40	25	300
		Rotary wing	25	15	150

* Buffer zones for the protection of terrestrial habitats are not required for use on rights-of-way including railroad ballast, rail and hydro rights-of-way, utility easements, roads, and training grounds and firing ranges on military bases.

For tank mixes, consult the labels of the tank-mix partners and observe the largest (most restrictive) buffer zone of the products involved in the tank mixture and apply using the coarsest spray (ASAE) category indicated on the labels for those tank mix partners.

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- 1524674 2007, Glyphosate, DACO: 2.11.2,2.11.3,2.11.4 CBI
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- 1545002 Manufacturing Method for the TGAI, DACO: 2.11.1

- 1545004 Detailed Production Process Description, DACO: 2.11.3
- 1545048 Manufacturing Summary, DACO: 2.11.1
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2.2.14.11,2.2.14.12,2.2.14.13,2.2.14.14,2.2.14.2,2.2.14.3,2.2.14.4,2.2.14.5,2.2.14.6,2.2.14.7,2.2.14.8,2.2.14.9,2.
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B. Studies Considered for the Toxicological Hazard Assessment

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1126892	1991, 90 Day oral toxicity study of AMPA in dogs, DACO: 4.7
1126903	1993, A developmental toxicity study of AMPA in rats, DACO: 4.5.2
1126905	1991, An evaluation of the potential of AMPA to induce unscheduled DNA synthesis in the in vitro hepatocyte DNA repair assay using the male F-344 rat, DACO: 4.5.4
1149395	1993, Correspondence: re- 90 day dog study with AMPA, DACO: 4.7
1149396	1991, 90-day oral (capsule) toxicity study in dogs with AMPA. Missing pages requested as per letter dated October 4,1993, DACO: 4.7
1149397	1991, Results of the stability analyses of AMPA (aminomethyl phosphonic acid) test material used in a 90 day dog study at Wil laboratories, DACO: 4.7
1156204	1994, A mouse micronucleus study of AMPA, DACO: 4.5.4
1161752	1991, Assessment of acute oral toxicity of (n-methyl-n-phosphonomethyl)glycine to rats (glyphosate), DACO: 4.2.1
1161753	1993, AMPA: acute oral toxicity (limit) test in rats, DACO: 4.2.1
1161755	1993, AMPA: acute dermal toxicity (limit) test in rats, DACO: 4.2.2
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1161760	1989, Glyphosate technical: primary eye irritation test in rabbits, DACO: 4.2.4
1161761	1989, Compound No.3607: primary eye irritation test in rabbits (glyphosate), DACO: 4.2.4
1161763	1989, Glyphosate technical: primary skin irritation test in rabbits, DACO: 4.2.5
1161765	1989, Glyphosate technical: Magnusson-Kligman maximisation test in guinea pigs, DACO: 4.2.6
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1161769	1993, AMPA 13 week toxicity study in rats with administration by gavage, DACO: 4.3.1
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- 1161780 1993, Mutagenicity test: in vitro mammalian cell gene mutation test performed with mouse lymphoma cells (L5178Y) test compound: AMPA, DACO: 4.5.4
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- 1161782 1993, Mutagenicity test: Ames salmonella test with AMPA, DACO: 4.5.4
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- 1161784 1991, Mutagenicity test: micronucleus test with glyphosate, DACO: 4.5.4
- 1161785 1991, Mutagenicity test: Ames salmonella assay with glyphosate, DACO: 4.5.4
- 1161786 1993, Glyphosate 104 week dietary carcinogenicity study in mice, DACO: 4.4.1,4.4.2
- 1161787 1989, Glyphosate 13 week dietary toxicity study in mice, DACO: 4.3.1
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- 1184695 1972, Acute oral toxicity study with CP67573 in albino rabbits, DACO: 4.2.1
- 1184722 1979, Ninety-day subacute toxicity test with aminomethylphosphonic acid CP50435 in rats, DACO: 4.3.1
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- 1212019 1988, Glyphosate acid: mutagenicity evaluation in *Salmonella typhimurium*, DACO: 4.5.4
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- 1212022 1996, Glyphosate acid: an evaluation of mutagenic potential using *S. typhimurium* and *E. coli*, DACO: 4.5.6
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- 1212027 1996, Glyphosate acid: excretion and tissue retention of a single oral dose (10mg/kg) in the rat, DACO: 4.5.9
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- 1212037 1996, Glyphosate acid: subchronic neurotoxicity study in rats, DACO: 4.5.13
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	Dawley rats, DACO: 4.5.1
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1411000	2007, Glyphosate acid technical response to clarifax, DACO: 4.5.3
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1874178	2009, Acute eye irritation study of glyphosate technical in rabbits, DACO: 4.2.4
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Note: Only published studies that are cited in the PRVD are listed below; a full list of published information considered in the re-evaluation is available upon request.

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C. Studies Considered for the Occupational Risk Assessment

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E. Studies Considered for the Environmental Risk Assessment

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- 1142767 Photodegradation and anaerobic aquatic metabolism of glyphosate, N-phosphono-methylglycine final report (RD924;MSL-0598;7863), DACO: 8.2.1,8.2.3.1
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