

APPENDIX F: Ecotoxicity Endpoints for Cyfluthrin and *Beta*-Cyfluthrin: Empirical Versus Estimated Results (Based on % Active Isomers).

Cyfluthrin and *beta*-cyfluthrin are mixtures of eight isomers [four of the isomers are considered active: diastereoisomer II (1*R*,3*R*,1*S* + 1*S*,3*S*,1*R* = 1:1; *cis*) and diastereoisomer IV (1*R*,3*S*,1*S* + 1*S*,3*R*,1*R* = 1:1; *trans*)]. Cyfluthrin is ~19% (range of 17 – 21%) diastereoisomer II and ~22% (range from 21 – 25%) diastereoisomer IV, for a total of ~41% active isomers. *Beta*-cyfluthrin is ~35% (range of 30 – 40%) diastereoisomer II and ~62% (range from 57 – 67%) diastereoisomer IV, for a total of ~97% active isomers. Therefore, cyfluthrin is 42% active isomers when compared to *beta*-cyfluthrin ($41/97 = 42$). Therefore, the assumption is that the toxicity endpoints for *beta*-cyfluthrin should be 42% of the cyfluthrin endpoints (*e.g.*, if the cyfluthrin endpoint is 1 mg a.i./L, then the estimated *beta*-cyfluthrin endpoint would be 0.42 mg a.i./L).

Based on empirical versus predicted toxicity endpoints, it appears appropriate to do the risk assessment converting everything to a '*beta*-cyfluthrin' equivalent for aquatic organisms and terrestrial invertebrates (see **Table F-1**). For terrestrial vertebrates and terrestrial plants, cyfluthrin and *beta*-cyfluthrin should be assessed separately (see **Table F-2**).

Table F-1. Empirical Versus Predicted Toxicity Endpoints for Aquatic Species and *Beta*-Cyfluthrin.

Taxon	Species (common name)	Test Substance	% a.i.	End-point	Empirical Endpoint (µg a.i./L)	Predicted Endpoint (µg a.i./L)	Match (Y/N) (Within an Order of Magnitude)?
Freshwater Fish (acute)	<i>Oncorhynchus mykiss</i> (Rainbow trout)	Cyfluthrin	97.6%	LC ₅₀	0.209	N/A	N/A
		<i>Beta</i> -cyfluthrin	99.4%	LC ₅₀	0.068	0.086	Yes
Freshwater Fish (chronic)	<i>Oncorhynchus mykiss</i> (Rainbow trout)	Cyfluthrin	96%	NOAEC LOAEC	0.010 0.018	N/A	N/A
		<i>Beta</i> -cyfluthrin	No data	NOAEC LOAEC	No data	0.0042 0.0076	N/A
Estuarine/ Marine Fish (acute)	<i>Cyprinodon variegatus</i> (Sheepshead minnow)	Cyfluthrin	87%	LC ₅₀	4.05	N/A	N/A
		<i>Beta</i> -cyfluthrin	No data	LC ₅₀	No data	1.70	N/A
Estuarine/ Marine Fish (chronic)	<i>Cyprinodon variegatus</i> (Sheepshead minnow)	Cyfluthrin	90.5%	NOAEC LOAEC	0.025 0.084	N/A	N/A
		<i>Beta</i> -cyfluthrin	No data	NOAEC LOAEC	No data	0.011 0.035	N/A
Freshwater Invertebrate (acute)	<i>Daphnia magna</i> (Water Flea)	Cyfluthrin	2% TGAI	EC ₅₀	0.025 0.141	N/A	N/A
		<i>Beta</i> -cyfluthrin	2% Tech	EC ₅₀	No data 0.29	0.011 0.059	Yes (for TGAI)
Freshwater Invertebrate (chronic)	<i>Daphnia magna</i> (Water Flea)	Cyfluthrin	94.7%	NOAEC LOAEC	0.0074 0.0157	N/A	N/A
		<i>Beta</i> -cyfluthrin	No data	NOAEC LOAEC	No data	0.003 0.007	N/A
Estuarine/ Marine Invertebrate (acute)	<i>Mysidopsis bahia</i> (Mysid shrimp)	Cyfluthrin	92%	LC ₅₀	0.0024	N/A	N/A
		<i>Beta</i> -cyfluthrin	>98%	LC ₅₀	0.0022	0.001	Yes

Taxon	Species (common name)	Test Substance	% a.i.	End-point	Empirical Endpoint (µg a.i./L)	Predicted Endpoint (µg a.i./L)	Match (Y/N) (Within an Order of Magnitude)?
Estuarine/ Marine Invertebrate (chronic)	<i>Mysidopsis bahia</i> (Mysid shrimp)	Cyfluthrin	97%	NOAEC LOAEC	0.00017 0.00040	N/A	N/A
		<i>Beta</i> -cyfluthrin	No data	NOAEC LOAEC	No data	0.00007 0.00017	N/A
Vascular Aquatic Plant	Duckweed (<i>Lemna</i> sp.)	Cyfluthrin	No data available				
		<i>Beta</i> -cyfluthrin	No data available				
Non-Vascular Aquatic Plant	Green algae (<i>Pseudokirchneriella subcapita</i>)	Cyfluthrin	98.7%	EC ₅₀	>181	N/A	N/A
	Algae (<i>Scenedesmus subspicatus</i> CHODAT)		95.8%	EC ₅₀	>2	N/A	N/A
		<i>Beta</i> -cyfluthrin	No data	EC ₅₀	No data	N/A	N/A

Table F-2. Empirical Versus Predicted Toxicity Endpoints for Terrestrial Species and *Beta*-Cyfluthrin.

Taxon	Species (common name)	Test Substance	% a.i.	End-point	Empirical Endpoint (µg a.i./L)	Predicted Endpoint (µg a.i./L)	Match (Y/N) (Within an Order of Magnitude)?
Bird (acute)	<i>Colinus virginianus</i> (Bobwhite quail)	Cyfluthrin	87%	LD ₅₀	>2,000 mg a.i./kg-bw	N/A	N/A
		<i>Beta</i> -cyfluthrin	No data	LD ₅₀	No data	N/A	N/A
Bird (sub-acute)	<i>Colinus virginianus</i> (Bobwhite quail)	Cyfluthrin	87%	LC ₅₀	>5,000 mg a.i./kg-diet	N/A	N/A
		<i>Beta</i> -cyfluthrin	No data	LC ₅₀	No data	N/A	N/A
Bird (chronic)	<i>Anas platyrhynchos</i> (Mallard duck)	Cyfluthrin	94%	NOAEC	250 mg a.i./kg-diet	N/A	LOAEC = 1,000 mg a.i./kg-diet based on a reduction in the number of eggs laid, eggs set, fertilized eggs, 3-week viable embryos, hatchlings and 14-day survivors
		<i>Beta</i> -cyfluthrin	94%	NOAEC	269 mg a.i./kg-bw	N/A	N/A
Mammal (acute)	<i>Rattus norvegicus</i> (Laboratory Rat)	Cyfluthrin	Technical	LD ₅₀	16.2 mg a.i./kg-bw (male)	N/A	N/A
		<i>Beta</i> -cyfluthrin	Technical	LD ₅₀	960 mg a.i./kg-bw (male)	6.8 mg a.i./kg-bw	No
Mammal (chronic)	<i>Rattus norvegicus</i> (Laboratory Rat)	Cyfluthrin	Technical	NOAEL	50 mg a.i./kg-diet (5.4 mg a.i./kg/day)	N/A	N/A
		<i>Beta</i> -cyfluthrin	No data	NOAEL	No data	21 mg a.i./kg-diet	N/A

Taxon	Species (common name)	Test Substance	% a.i.	End- point	Empirical Endpoint (µg a.i./L)	Predicted Endpoint (µg a.i./L)	Match (Y/N) (Within an Order of Magnitude)?
Terrestrial Invertebrate (acute)	<i>Apis mellifera</i> (Honey bee)	Cyfluthrin	93%	LD ₅₀	0.037 µg a.i./bee (contact)	N/A	N/A
		<i>Beta</i> - cyfluthrin	98.4%	LD ₅₀	0.05 µg a.i./bee (contact) 0.012 µg a.i./bee (oral)	0.016 µg a.i./bee (contact)	Yes
Terrestrial Plants (vegetative vigor/seedling emergence)	Variety of species	Cyfluthrin	No data available				
		<i>Beta</i> - cyfluthrin	No data available				