APPENDIX A – Ecological Effects Data

This appendix contains toxicity data from ecotoxicology guideline studies used in oryzalin RED. Relevant studies from open literature were also reviewed. However, none of these studies were included in this assessment as they were found to be either of poor quality or did not address issues of concern to this risk assessment. Details and rationale behind the exclusion of the relevant open literature studies is presented in Table A-10.

Table A-1. Summary of Ecological Effects Data[1]

Guideline #		Study Type	Test Product	Data Valid for Risk Assessment?	Test Species	MRID #	Study Classification
71-1	850.2100	Avian Acute Oral	Technical	Yes	Bobwhite Quail	00098462	Acceptable
71-2	850.2200	Avian Subacute Dietary	Technical	Yes	Bobwhite Quail	00072593	Acceptable
				Yes	Mallard Duck	00072594	Acceptable
71-4	850.2300	Avian Reproduction	Technical	Yes	Bobwhite Quail	00129050	Supplemental
			Technical	Yes	Mallard Duck	00126843	Acceptable
			Technical	Yes	Bobwhite Quail	44162201	Acceptable
			Technical	Yes	Mallard Duck	44162202	Supplemental
81-1	870.1100	Mammalian Acute Oral	Technical	Yes	Rat	00026592	Acceptable
83-1	870.1300	Mammalian Chronic Dietary	Technical	Yes	Rat	00026779 00044332 00070569	Acceptable
72-1	850.1075	FW Fish Acute	Technical	Yes	Rainbow Trout	TN 1078	Acceptable
				Yes	Rainbow Trout	0072595	Acceptable
				Yes	Bluegill Sunfish	0072595	Acceptable
72-2	850.1010	FW Aquatic Invertebrate Acute	Technical	Yes	Water flea	00072596	Acceptable
72-3	850.1075	SW Fish Acute	Technical	Yes	Sheepshead Minnow	43887701	Acceptable
72-4	850.1035	SW Aquatic Invertebrate Acute	Technical	Yes	Grass Shrimp	43887703	Acceptable
	850.1025		Technical	Yes	Eastern Oyster	43887702	Acceptable
72-4	850.1400	FW Fish Early Life Stage	Technical	Yes	Rainbow Trout	00126842	Acceptable
				Yes	Fathead Minnow	00126841	Acceptable
72-4	850.1300	FW Aquatic Invertebrate	Technical	Yes	Water Flea	43986901	Acceptable

		Reproduction					
123-2	850.4400	Aquatic Vascular Plant	Technical	Yes	Duckweed	43136905	Supplemental
123-2	850.4400	Aquatic Non-Vascular plant	Technical Technical Technical Technical	Yes Yes Yes Yes	Green Algae Bluegreen Algae Freshwater Diatom Marine Diatom	43139601 43139602 43139603 43139604	Supplemental Supplemental Supplemental Supplemental
123-1(a)	850.4225	Seedling Emergence	Technical	Yes	Monocots and Dicots	42602401	Supplemental
123-1 (b)	850.4250	Vegetative Vigor	Technical	Yes	Monocots and Dicots	42602401	Supplemental
141-1	850.3020	Honey Bee Acute Contact	TEP[2]	Yes[3]	Honey Bee	00066220	Acceptable

[1]Mammalian studies are reviewed by HED

[2]TEP Typical End-use Product

[3]Because there is currently no standard method for using this data quantitatively, the data is used for qualitative purposes.

Table A-2. Aquatic Organisms' Acute Toxicity Data

Species	LC_{50}/EC_{50} (mg/L)	Slope	95% C.I. (mg/L)	MRID	Toxicity Category	Study Classification	Notes
Freshwater Fish							
Rainbow trout *(Onchorhynchus mykiss)*	3.45	-	3.0 – 3.9	TN 1078	Moderately toxic	Acceptable	-
	3.26	-	2.9 – 3.7	00072595	Moderately toxic	Acceptable	96 hr test with cold water fish; reported NOAEC = 3.2 ppm
Bluegill sunfish *(Lepomis macrochirus)*	2.88	9.33	2.23 – 3.7	00072595	Moderately toxic	Acceptable	96 hr study with warm water fish; reported NOAEC = 1 ppm
Marine/Estuarine Fish							
Sheepshead minnow *(Cyprinodon variegates)*	> 3.04	-	-	43887701	Moderately toxic	Acceptable	96 hr test; NOAEC = highest concentration tested (3.04 ppm)
Freshwater Invertebrates							
Water flea *(Daphnia magna)*	1.5	9.50	1.4 – 1.6	00072596	Moderately toxic	Acceptable	48-hour test; hypoactivity, prostration, and immobility were the effects noted at concentrations greater than 1.6 ppm; NOAEC = 0.62 ppm
Marine/Estuarine Invertebrates							
Grass shrimp (*Palaemonetes pugio*)	>3.11	-	-	43887701	Moderately toxic to practically non-toxic	Acceptable	96 hr test; only 20% mortality at the highest dose tested (3.1 ppm); NOAEC = 1.95 ppm
Eastern oyster (*Crassostrea virginica*)	0.285	-	0.2 – 0.5	43887702	Highly toxic	Acceptable	96 hour oyster shell deposition study; NOAEC = 0.0994 ppm

Table A-3. Aquatic Organisms' Chronic Toxicity Data

Species	LOAEC (mg/L)	NOAEC (mg/L)	MRID	Study Classification	Notes
Freshwater Fish					
Rainbow trout *(Onchorhynchus mykiss)*	>0.46	>0.46	00126842	Acceptable	66 day early life-stage study; no adverse effects at any concentration tested; based on MRID 00072595, NOAEC could range between 0.46 to 3.2 ppm
Fathead minnow (Pimephales promelas)	0.43	0.22	00126841	Acceptable	34 day early life-stage study; no adverse effects at all concentrations tested; however, mean larval weights were significantly lower than solvent control with the highest dose tested
Freshwater Invertebrates					
Water flea *(Daphnia magna)*	0.608	0.358	43986901	Acceptable	Life cycle test; dry weight of first generation daphnid is the most sensitive endpoint

Table A-4. Aquatic Plant Toxicity Data

Species	EC_{50}	Slope	95% C.I. (ppb)	MRID #	Notes
Aquatic non-vascular plants					
Green algae (Selenastrum capricornutum)	52 ppb	-	17.1 – 98.7	43136901	Endpoint affected = cell density; 5-day EC_{50} value; NOAEC = 13.8 ppb
Bluegreen algae (Anabaena flos-aquae)	>13.5 ppm	-	18.7 – 29.1	43136902	Endpoint affected = cell density; 5-day EC_{50} value; NOAEC = 8.1 ppm
Freshwater diatom (*Navicula pelliculosa*)	42 ppb	-	56.2 – 92.7	43136903	Endpoint affected = cell density; 5-day EC_{50} value; NOAEC = 15.4 ppb
Marine diatom (*Skeletonema costatum*)	51 ppb	-	27.9 – 88.9	43136904	Endpoint affected = cell density; 5-day EC_{50} value; NOAEC = 30.6 ppb
Aquatic vascular plants					
Duckweed (*Lemna gibba)*	13 ppb	-	11.6 – 20.5	43136905	Endpoint affected = frond count; 14-day EC_{50} value; 5-day NOAEC = 5.48 ppb

Table A-5. Acute Avian Toxicity Data

Species	LD_{50}/LC_{50} (mg/kg ai)	Slope	95% C.I.	MRID	Toxicity Category	Study Classification	Notes
Avian Acute Oral							
Bobwhite quail (*Colinus virginianus*)	506.7 (combined male and female)	5.39	391 - 656	00098462	Slightly toxic	Acceptable	Effects noted include lethargy, ataxia, ruffled appearance, emaciation, and yellow colored loose feces within 5 hours following treatment; dose-related decline in food consumption (3 to 7 days after treatment) and body weight loss were also noted
Avian Subacute Dietary							
Bobwhite quail (*Colinus virginianus*)	>5000	-	-	00072593	Practically non-toxic	Acceptable	The 10% mortality noted in the highest dose is not treatment-related
Mallard duck (*Anas platyrhynchos*)	>5000	-	-	00072594		Acceptable	No mortality at highest doses; food consumption is greater in the treatments compared to controls

Table A-6. Chronic Avian (Reproduction) Toxicity Data

Species	LOAEC mg/kg ai	NOAEC mg/kg ai	MRID	Endpoints Affected	Study Classification	Notes
Bobwhite quail (*Colinus virginianus*)	> 1000	1000	00129050	No effects at highest dose on any endpoints tested	Supplemental	High bird mortality in controls due to head injuries led to supplemental classification of the study
Mallard duck (*Anas platyrhynchos*)	> 1000	1000	00126843	No effects at highest dose on any endpoints tested	Supplemental	The initial Core classification of the study was changed to Supplemental in oryzalin RED due to a 4-fold increase in oryzalin use rates since the study was first classified in 1982
Bobwhite quail (*Colinus virginianus*)	311	132	44162201	Female body weight	Acceptable	-
Mallard duck (*Anas platyrhynchos*)	>311	311	44162202	No effects at highest dose on any endpoints tested	Supplemental	Reduction in hatchling body weight at the lowest dose tested was not treatment-related

Table A-7. Mammalian Toxicity Data

Species	Endpoint	MRID	Toxicity Category	Study Classification	Notes
Rat (*Rattus norvegicus*)	LD_{50} = 10,0000 mg/kg ai	00026592	Practically non-toxic	Acceptable	No mortality at highest dose tested
Mammalian Chronic Dietary					
Rat (*Rattus norvegicus*)	NOAEL = 13.82 mg/kg/day; LOAEL = 42.9 mg/kg/day	00026779 00044332 00070569	-	Acceptable	Females were more sensitive than males; LOAEL values are based on decreased body weight gain, decreased hematology parameters, increased microscopic findings in the thyroid in females and decreased survival; increased thyroid weight, increased incidence of skin lesions; follicular cell thyroid tumors in both sexes, skin tumors in both sexes, and mammary gland tumors in females

Table A-8. Terrestrial Non-Target Insect Toxicity Data

Species	LC_{50} µg/bee	Toxicity Category	MRID #	Notes
Honey bee (*Apis mellifera*)	> 11	Practically non-toxic	00066220	Acute contact toxicity at 48 hours

Table A-9. Summary of Non-target Terrestrial Plant Seedling Emergence and Vegetative Vigor Toxicity Tier II Data (MRID 426024-01; Supplemental)

Crop	Type of Study Species	NOAEC (lb ai/A)	EC_{25} (lb ai/A)	Most sensitive parameter
Seedling Emergence				
Monocots	Corn	0.667	ND	Shoot length
	Oat	0.0740	0.16	Shoot length
	Onion	0.222	0.12	Shoot length
	Ryegrass	0.0080	**0.014**	Shoot length
Dicots	Cabbage	0.222	0.52	Shoot length
	Cucumber	0.0667	0.78	Shoot length
	Lettuce	0.222	0.088	Shoot length
	Radish	2.00	>6.00	Shoot length
	Soybean	6.00	>6.00	Shoot length
	Tomato	0.0056[1]	**0.050**	Shoot length
Vegetative Vigor				
Monocots	Corn	0.0740	**0.080**	Dry weight
	Oats	0.222	0.22	Shoot length
	Onion	2.00	>6.00	Shoot length
	Ryegrass	0.0253	0.097	Shoot length
Dicots	Cabbage	0.222	3.0	Shoot length
	Cucumber	0.222	1.5	Dry weight
	Lettuce	0.0253	0.040	Dry weight
	Radish	0.222	>6.00	Dry weight
	Soybean	2.00	3.1	Shoot length
	Tomato	0.0253	**0.030**	Dry weight

ND = Not determined

[1] EC_{05} reported because a NOAEC could not be determined. However, the EC_{05} was outside the tested concentration range; therefore, there is little statistical confidence in this value.

Table A-10. Open Literature Studies Deemed Relevant but Classified Invalid for Use in the Current Assessment for Oryzalin

Reference # and Citation	Organism	Study Type	Endpoint(s) Reported	Rationale for Exclusion from the Assessment
13100 Felix et al., 1988, Ann. Appl. Biol., 113:55 - 60	*Dunaliella bioculata* (an unicellular alga with two flagella)	Herbicide screening study	Cell lysis at 100 uM (= 34.63 ppm)	The study compared 24 commercial herbicides. A single oryzalin dose at 34.63 ppm was tested. The study concluded that the algal cells became round, lost flagella, and lysed at 34.63 ppm. Bleaching of cells was also noted in the solvent control. The study was classified as INVALID as it did not test a series of oryzalin doses to determine the median dose required to produce a lethal effect. Furthermore, based on the single tested dose, oryzalin concentration at which death of algal cells occurred is not clear.
94265 Hall et al., 2007, Marine Env. Res., 63:115 - 131	*Oryzias latipes* (freshwater fish)	Reproduction and reproductive fitness study	Time to egg hatch was affected at all tested concentrations (0.25, 0.5, and 1.0 ppm ai for technical grade oryzalin and 0.4, 0.8, and 1.5 ppm ai for Surflan) --- Greater number of non-fertilized eggs at 0.25 and 0.5 ppm ai of oryzalin and 0.5 ppm ai of Surflan --- Intersex lesions at all concentrations of Surflan	Both technical and formulated (Surflan) products of oryzalin were evaluated in two tests (reproductive effects study and histologic effects study) at 0.25, 0.5, and 1.0 and 0.4, 0.8, and 1.5 ppm ai, respectively, on teleost medaka, a freshwater fish, to determine the 21-day exposure effects of oryzalin on the indices of reproductive fitness such as fertility and fecundity. The studies concluded that both oryzalin and Surflan caused intersex lesions and impaired fertilization success and time to egg hatch but not overall egg production and egg viability. The study was classified as INVALID in view of the high variability noted with all the treatment groups that masked the statistical differences for parameters key to the study such as egg production. No raw data is available to calculate the NOAEC and LOAEC values. Even if raw data is available, it is unlikely that the study could have generated a definitive endpoint since reproductive effects were noted at the lowest concentrations tested for both products. Other issues of suspect were higher mean number of non-fertilized eggs at lower concentrations than at higher concentrations and the use of treatment means (instead of median values) for non-parametric data analysis used in the study.
[1]Mayer and Ellersieck 1986	*Gammarus fasciatus* (Scud)	Acute toxicity test	48 hr EC_{50} = 0.2 ppm	The study tested the formulated product of oryzalin (75%WP) and found that the product is highly toxic to scud. The study is classified as INVALID as it is unclear whether treatments are replicated, a solvent control was used, and raw data is available.
[1]Mayer and	*Asellus brevicaudus*	Acute toxicity	48 hr EC_{50} =	The study tested the formulated product of

Ellersieck 1986	(Aquatic sowbug)	test	0.4 ppm	oryzalin (75%WP) and found that the product is highly toxic to aquatic sowbug. The study is classified as INVALID as it is unclear whether treatments are replicated, a solvent control was used, and raw data is available. Furthermore, approximately 20% mortality is noted in control treatments.

[1]Mayer and Ellersieck 1986 is compilation of data regarding pesticide effects on aquatic organisms. Many, although not all, of the data reported are based on tests conducted in government laboratories.