

Appendix G

ECOTOX Literature

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APPENDIX G: Accepted ECOTOX Data Table

 The code list for ECOTOX can be found at: <http://cfpub.epa.gov/ecotox/blackbox/help/codelist.pdf>

Chemical Name	Genus	Species	Common Name	Effect Group	Effect	Meas	Endpt1	Endpt2	Dur Unit Orig	Dur Preferred	Dur Unit Preferred	Conc Value1 Preferred	Conc Value2 Preferred	Conc Units Preferred	% Purity	Ref #
2,4-D	Rattus	norvegicus	Norway rat	ACC	ACC	RSDE	NOAEL		d	30	d	100		ppm	100	93410
2,4-D	Rattus	norvegicus	Norway rat	ACC	ACC	RSDE	NOAEL		d	30	d	50		ppm	100	93410
2,4-D dimethylamine salt	Rattus	norvegicus	Norway rat	ACC	ACC	GACC	LOAEL		h	4.17E-02	d	200		ppm	100	93633
2,4-D	Tetrahymena	pyriformis	Ciliate	BEH	AVO	STIM	EC50		h	4.17E-02	d	158.3		mg/L	100	60864
2,4-D	Myriophyllum	sibiricum	Water milfoil	BCM	BCM	CHLA	LOAEL		d	14	d	1.47		mg/L	100	74985
2,4-D	Myriophyllum	sibiricum	Water milfoil	BCM	BCM	CHLA	LOAEL		d	14	d	1.47		mg/L	100	74985
2,4-D	Myriophyllum	sibiricum	Water milfoil	BCM	BCM	CHLA	NOEC	LOEC	d	14	d	0.0543	0.163	mg/L	100	74985
2,4-D	Myriophyllum	sibiricum	Water milfoil	BCM	BCM	CHLA	IC25		d	14	d	0.1662		mg/L	100	74985
2,4-D	Myriophyllum	sibiricum	Water milfoil	BCM	BCM	CHLA	IC50		d	14	d	0.3137		mg/L	100	74985
2,4-D	Myriophyllum	sibiricum	Water milfoil	BCM	BCM	CHLB	NOEC	LOEC	d	14	d	0.0543	0.163	mg/L	100	74985
2,4-D	Myriophyllum	sibiricum	Water milfoil	BCM	BCM	CHLB	IC25		d	14	d	0.1523		mg/L	100	74985
2,4-D	Myriophyllum	sibiricum	Water milfoil	BCM	BCM	CHLB	IC50		d	14	d	0.2537		mg/L	100	74985
2,4-D	Myriophyllum	sibiricum	Water milfoil	BCM	BCM	CARC	NOEC	LOEC	d	14	d	0.0543	0.163	mg/L	100	74985
2,4-D	Myriophyllum	sibiricum	Water milfoil	BCM	BCM	CARC	IC25		d	14	d	0.1461		mg/L	100	74985
2,4-D	Myriophyllum	sibiricum	Water milfoil	BCM	BCM	CARC	IC50		d	14	d	0.3085		mg/L	100	74985
2,4-D	Myriophyllum	sibiricum	Water milfoil	BCM	BCM	CHLA	NOEC	LOEC	d	14	d	0.0181	0.0543	mg/L	100	74985
2,4-D	Myriophyllum	sibiricum	Water milfoil	BCM	BCM	CHLA	IC25		d	14	d	0.0426		mg/L	100	74985
2,4-D	Myriophyllum	sibiricum	Water milfoil	BCM	BCM	CHLA	IC50		d	14	d	0.1238		mg/L	100	74985
2,4-D	Myriophyllum	sibiricum	Water milfoil	BCM	BCM	CHLB	NOEC	LOEC	d	14	d	0.0543	0.163	mg/L	100	74985
2,4-D	Myriophyllum	sibiricum	Water milfoil	BCM	BCM	CHLB	IC25		d	14	d	0.0672		mg/L	100	74985
2,4-D	Myriophyllum	sibiricum	Water milfoil	BCM	BCM	CHLB	IC50		d	14	d	0.1413		mg/L	100	74985
2,4-D	Myriophyllum	sibiricum	Water milfoil	BCM	BCM	CARC	NOEC	LOEC	d	14	d	0.0181	0.0543	mg/L	100	74985
2,4-D	Myriophyllum	sibiricum	Water milfoil	BCM	BCM	CARC	IC25		d	14	d	0.0345		mg/L	100	74985
2,4-D	Myriophyllum	sibiricum	Water milfoil	BCM	BCM	CARC	IC50		d	14	d	0.1096		mg/L	100	74985
2,4-D	Fundulus	heteroclitus	Mummichog	BCM	BCM	PRTL	LOAEL		d	14	d	0.01		mg/L	100	93400
2,4-D	Scenedesmus	quadricauda	Green algae	BCM	BCM	CHLA	NOAEL	LOAEL	stg	NA	stg	0.98	9.8	mg/L	49	55720
2,4-D	Mytilus	galloprovincialis	Mediterranean mussel	BCM	BCM	CAMP	LOAEL		d	15	d	0.03		mg/L	100	93394
2,4-D	Salvelinus	fontinalis	Brook trout	BCM	BCM	PLSC	LOAEL		d	7	d	5		mg/L	97 to	72745
2,4-D	Canis	familiaris	Domestic dog	BCM	BCM	NCON	NOAEL	LOEL	wk	91	d	1	3.75	mg/kg/d	96.7	48144
2,4-D	Canis	familiaris	Domestic dog	BCM	BCM	CRTN	NOAEL	LOEL	wk	91	d	0.5	1	mg/kg/d	96.7	48144
2,4-D	Canis	familiaris	Domestic dog	BCM	BCM	CREA	NOAEL	LOAEL	wk	28	d	1	5	ppm	96.7	48144
2,4-D	Canis	familiaris	Domestic dog	BCM	BCM	CREA	LOAEL		wk	28	d	1		ppm	96.7	48144
2,4-D	Rattus	norvegicus	Norway rat	BCM	BCM	PRCO	LOAEL		d	90	d	100		ppm	100	90486
2,4-D	Eisenia	fetida	Earthworm	BCM	BCM	SERP	NOAEL	LOAEL	h	2	d	3.5	18	ug/cm2	100	40121
2,4-D	Mus	musculus	House mouse	BCM	BCM	ANTO	NOAEL	LOAEL	d	9	d	0.1	100	ppm	100	93603
2,4-D	Mus	musculus	House mouse	BCM	BCM	ANTO	NOAEL	LOAEL	d	9	d	0.1	100	ppm	100	93603
2,4-D	Rattus	norvegicus	Norway rat	BCM	BCM	5HAA	LOAEL		h	0.1458333	d	47.5		mg/kg	>95	93598
2,4-D	Rattus	norvegicus	Norway rat	BCM	BCM	5HAA	LOAEL		h	0.1458333	d	47.5		mg/kg	>95	93598
2,4-D	Rattus	norvegicus	Norway rat	BCM	BCM	GNGL	LOAEL		d	18	d	100		mg/kg	100	93629
2,4-D	Rattus	norvegicus	Norway rat	BCM	BCM	GNGL	LOAEL		d	18	d	70		mg/kg	100	93629
2,4-D	Rattus	norvegicus	Norway rat	BCM	BCM	FECO	LOAEL		d	16	d	70		mg/kg bdwt	100	85545

Chemical Name	Genus	Species	Common Name	Effect Group	Effect	Meas	Endpt1	Endpt2	Dur Unit Orig	Dur Preferred	Dur Unit Preferred	Conc Value1 Preferred	Conc Value2 Preferred	Conc Units Preferred	% Purity	Ref #
2,4-D	Rattus	norvegicus	Norway rat	BCM	BCM	FECO	LOAEL		d	16	d	70		mg/kg bdwt	100	85545
2,4-D	Plankton	Plankton	NR	BCM	BCM	GBCM	EC50		h	0.125	d	33		mg/L	100	13724
2,4-D	Plankton	Plankton	NR	BCM	BCM	GBCM	EC50		h	0.125	d	33		mg/L	100	13724
2,4-D	Plankton	Plankton	NR	BCM	BCM	GBCM	EC50		h	0.125	d	33		mg/L	100	13724
2,4-D	Chlorella	pyrenoidosa	Green algae	BCM	BCM	CHLO	LOEC		h	3	d	50		mg/L	100	15189
2,4-D	Chlorella	pyrenoidosa	Green algae	BCM	BCM	CHLO	NOEC		h	3	d	5		mg/L	100	15189
2,4-D	Daphnia	magna	Water flea	BCM	BCM	GBCM	NOEC		d	21	d	32		mg/L	100	16782
2,4-D	Daphnia	magna	Water flea	BCM	BCM	GBCM	LOEC		d	21	d	56		mg/L	100	16782
2,4-D	Rattus	norvegicus	Norway rat	BCM	BCM	TRIG	NOAEL		mo	180	d	0.05		%	100	94239
2,4-D	Mus	musculus	House mouse	BCM	BCM	MCPR	LOAEL		d	4	d	100		ppm	100	93403
2,4-D	Rattus	norvegicus	Norway rat	BCM	BCM	CHOL	NOAEL		wk	14	d	150 TO 200		mg/kg bdwt	100	93402
2,4-D	Rattus	norvegicus	Norway rat	BCM	BCM	PHST	LOAEL		d	14	d	200		mg/kg bdwt	100	93542
2,4-D	Rattus	norvegicus	Norway rat	BCM	BCM	GD1A	LOAEL		d	18	d	70		mg/kg	100	93434
2,4-D	Rattus	norvegicus	Norway rat	BCM	BCM	GGT1	LOAEL		d	13	d	70		mg/kg	100	93434
2,4-D	Rattus	norvegicus	Norway rat	BCM	BCM	HVLA	NOAEL		d	96	d	70		ppm	100	93509
2,4-D	Rattus	norvegicus	Norway rat	BCM	BCM	HVLA	LOAEL		d	96	d	70		ppm	100	93509
2,4-D	Rattus	norvegicus	Norway rat	BCM	BCM	FFTA	LOAEL		d	15	d	14.7		ppm	98	93522
2,4-D dimethylamine salt	Cyprinus	carpio	common carp	BCM	BCM	MLDH	NOAEL		h	4	d	87		mg/L	100	73377
2,4-D dimethylamine salt	Tilapia	nilotica	Nile tilapia	BCM	BCM	MLDH	NOAEL		h	4	d	87		mg/L	100	73377
2,4-D dimethylamine salt	Cyprinus	carpio	common carp	BCM	BCM	MLDH	NOAEL		h	4	d	87		mg/L	100	93395
2,4-D dimethylamine salt	Tilapia	nilotica	Nile tilapia	BCM	BCM	MLDH	NOAEL		h	4	d	27		mg/L	100	60050
2,4-D dimethylamine salt	Eichhornia	crassipes	Water-hyacinth	BCM	BCM	PCON	LOAEL		d	<=17	d	0.25		kg/ha	50	71785
2,4-D dimethylamine salt	Bos	taurus	Domesticated cattle	BCM	BCM	HMCT	NOAEL		h	1	d	600		mg/kg bdwt	100	93405
2,4-D dimethylamine salt	Canis	familiaris	Domestic dog	BCM	BCM	NCON	LOEL		wk	91	d	1		mg/kg/d ae	66.7	48144
2,4-D dimethylamine salt	Canis	familiaris	Domestic dog	BCM	BCM	CREA	LOEL		wk	91	d	1		mg/kg/d ae	66.7	48144
2,4-D dimethylamine salt	Rattus	norvegicus	Norway rat	BCM	BCM	GLUC	LOAEL		h	0.2083333	d	600		mg/kg bdwt	100	40139
2,4-D dimethylamine salt	Salvinia	natans	Floating moss	BCM	BCM	CHLO	EC50		wk	28	d	0.3		mg/L	100	13738
2,4-D dimethylamine salt	Salvinia	natans	Floating moss	BCM	BCM	CHLO	EC50		wk	28	d	0.3		mg/L	100	13738
2,4-D dimethylamine salt	Rattus	norvegicus	Norway rat	BCM	BCM	GLUC	LOAEL		h	0.2083333	d	600		AI mg/kg bdwt/d	100	40128
2,4-D dimethylamine salt	Rattus	norvegicus	Norway rat	BCM	BCM	ALBM	LOAEL		d	30	d	200		AI mg/kg bdwt/d	100	40128
2,4-D dimethylamine salt	Rattus	norvegicus	Norway rat	BCM	BCM	GLUC	LOAEL		d	180	d	200		AI mg/kg bdwt/d	100	40128

Chemical Name	Genus	Species	Common Name	Effect Group	Effect	Meas	Endpt1	Endpt2	Dur Unit Orig	Dur Preferred	Dur Unit Preferred	Conc Value1 Preferred	Conc Value2 Preferred	Conc Units Preferred	% Purity	Ref #
2,4-D dimethylamine salt	Bos	taurus	Domesticated cattle	BCM	BCM	UREA	LOAEL		h	0.1666667	d	100		mg/kg bdwt	100	40111
2,4-D dimethylamine salt	Gallus	domesticus	Domestic Chicken	BCM	BCM	URIC	NOAEL	LOAEL	h	8.33E-02	d	100	300	mg/kg bdwt	100	87186
2,4-D dimethylamine salt	Oncorhynchus	mykiss	Rainbow trout,donaldson trout	BCM	BCM	VITE	LOAEL		d	7	d	1.64		mg/L	100	80643
2,4-D dimethylamine salt	Oncorhynchus	mykiss	Rainbow trout,donaldson trout	BCM	BCM	VITE	LOEC	NOEC	d	7	d	0.164	0.0164	mg/L	100	80643
2,4-D dimethylamine salt	Rattus	norvegicus	Norway rat	BCM	BCM	PHST	NOAEL		wk	14	d	200		mg/kg bdwt	100	72915
2,4-D dimethylamine salt	Gallus	domesticus	Domestic Chicken	BCM	BCM	PRCO	LOAEL		d	5	d	0.72		ul/kg	40	91304
2,4-D sodium salt	Rattus	norvegicus	Norway rat	BCM	BCM	5HAA	LOAEL		h	4.17E-02	d	200		mg/kg	100	93387
2,4-D sodium salt	Rattus	norvegicus	Norway rat	BCM	BCM	5HAA	NOAEL	LOAEL	h	8.33E-02	d	10	30	mg/kg	100	93387
2,4-D	Rattus	norvegicus	Norway rat	BEH	BEH	NMVM	NOAEL		d	~35	d	50 TO 70		ppm	100	93507
2,4-D	Rattus	norvegicus	Norway rat	BEH	BEH	NMVM	LOAEL		d	~35	d	50 TO 70		ppm	100	93507
2,4-D	Rattus	norvegicus	Norway rat	BEH	BEH	NMVM	LOAEL		d	~35	d	50 TO 70		ppm	100	93507
2,4-D	Rattus	norvegicus	Norway rat	BEH	BEH	NMVM	LOAEL		d	~35	d	50 TO 70		ppm	100	93507
2,4-D	Rattus	norvegicus	Norway rat	BEH	BEH	RRSP	LOAEL		d	4	d	100		mg/kg	100	93629
2,4-D	Rattus	norvegicus	Norway rat	BEH	BEH	GBHV	LOAEL		d	11	d	70		mg/kg	100	93629
2,4-D	Rattus	norvegicus	Norway rat	BEH	BEH	VMVT	LOAEL		d	18	d	100		mg/kg	100	93629
2,4-D	Rattus	norvegicus	Norway rat	BEH	BEH	VMVT	LOAEL		d	18	d	70		mg/kg	100	93629
2,4-D	Cancer	magister	Dungeness or edible crab	BEH	BEH	EQU	EC50		h	4	d	100		mg/L	98	6793
2,4-D	Rattus	norvegicus	Norway rat	BEH	BEH	NGRX	LOAEL		d	7	d	70		mg/kg	100	93507
2,4-D	Rattus	norvegicus	Norway rat	BEH	BEH	ACTV	LOAEL		h	0.25	d	100		ug	100	93508
2,4-D	Rattus	norvegicus	Norway rat	BEH	BEH	ACTV	LOAEL		h	0.25	d	100		ug	100	93508
2,4-D	Rattus	norvegicus	Norway rat	BEH	BEH	ACTV	NOAEL		d	7	d	50		ug	100	93508
2,4-D	Rattus	norvegicus	Norway rat	BEH	BEH	CRDN	NOAEL	LOAEL	d	1	d	72.3	241	mg/kg bdwt	96.4	93518
2,4-D	Rattus	norvegicus	Norway rat	BEH	BEH	CRDN	NOAEL	LOAEL	d	1	d	72.3	241	mg/kg bdwt	96.4	93518
2,4-D	Rattus	norvegicus	Norway rat	BEH	BEH	GPST	NOAEL	LOAEL	mo	360	d	72.3	144.6	ppm	96.4	93518
2,4-D	Rattus	norvegicus	Norway rat	BEH	BEH	GPST	NOAEL	LOAEL	mo	360	d	72.3	144.6	ppm	96.4	93518
2,4-D dimethylamine salt	Rattus	norvegicus	Norway rat	BEH	BEH	GPST	NOAEL		wk	14	d	150		ae mg/org	48	93658
2,4-D dimethylamine salt	Rattus	norvegicus	Norway rat	BEH	BEH	GPST	LOAEL		wk	21	d	111		ae mg/org	48	93658
2,4-D dimethylamine salt	Rattus	norvegicus	Norway rat	BEH	BEH	NRES	LOAEL		mi	0.125	d	60		ppm	100	93633
2,4-D dimethylamine salt	Rattus	norvegicus	Norway rat	BEH	BEH	VMVT	LOAEL		h	4.17E-02	d	200		ppm	100	93633
2,4-D dimethylamine salt	Rattus	norvegicus	Norway rat	BEH	BEH	VMVT	LOAEL		mi	0.125	d	60		ppm	100	93633
2,4-D dimethylamine salt	Rattus	norvegicus	Norway rat	BEH	BEH	VMVT	LOAEL		mi	0.125	d	200		ppm	100	93633

Chemical Name	Genus	Species	Common Name	Effect Group	Effect	Meas	Endpt1	Endpt2	Dur Unit Orig	Dur Preferred	Dur Unit Preferred	Conc Value1 Preferred	Conc Value2 Preferred	Conc Units Preferred	% Purity	Ref #
2,4-D isopropyl ester	Mus	musculus	House mouse	CEL	CEL	PCCM	NOAEL		h	3	d	400		mg/kg bdwt	97.1	93513
2,4-D	Danio	rerio	Zebra danio	CEL	CEL	SGDN	LOAEL		hpf	48	hpf	200		uM	100	93401
2,4-D	Danio	rerio	Zebra danio	CEL	CEL	CCHG	LOAEL		hpf	96	hpf	50		uM	100	93401
2,4-D	Mytilus	galloprovincialis	Mediterranean mussel	CEL	CEL	DNSY	NOAEL		d	15	d	0.03		mg/L	100	93394
2,4-D	Salvelinus	fontinalis	Brook trout	CEL	CEL	EOSN	LOAEL		d	7	d	5		mg/L	97 to	72745
2,4-D	Gallus	domesticus	Domestic Chicken	CEL	CEL	CDRT	NOAEL	LOAEL	d	4	d	0.99	1.98	mg/org	99	93618
2,4-D	Canis	familiaris	Domestic dog	CEL	CEL	LEUK	NOAEL		wk	364	d	7.5		ppm	96.7	48144
2,4-D	Canis	familiaris	Domestic dog	CEL	CEL	LEUK	NOAEL		wk	364	d	7.5		ppm	96.7	48144
2,4-D	Alligator	mississippiensis	American alligator	CEL	CEL	HGHT	NOAEL		d	10	d	13.664		ppm	97.6	70208
2,4-D	Eisenia	fetida	Earthworm	CEL	CEL	NCEL	NOAEL	LOAEL	h	2	d	1.5	3.5	ug/cm2	100	40121
2,4-D	Rattus	norvegicus	Norway rat	CEL	CEL	RSBC	LOAEL		d	>90	d	70		ppm	100	94215
2,4-D	Rattus	norvegicus	Norway rat	CEL	CEL	RSBC	NOAEL		d	>90	d	70		ppm	100	94215
2,4-D	Rattus	norvegicus	Norway rat	CEL	CEL	RSBC	LOAEL		d	12	d	70		mg/kg	100	93510
2,4-D	Rattus	norvegicus	Norway rat	CEL	CEL	RSBC	NOAEL		d	96	d	70		ppm	100	93510
2,4-D	Rattus	norvegicus	Norway rat	CEL	CEL	RSBC	LOAEL		d	12	d	70		mg/kg	100	93510
2,4-D	Rattus	norvegicus	Norway rat	CEL	CEL	RSBC	NOAEL		d	96	d	70		ppm	100	93510
2,4-D	Rattus	norvegicus	Norway rat	CEL	CEL	OGNL	LOAEL		wk	14	d	100		mg/kg bdwt	100	93402
2,4-D	Clarias	batrachus	Walking catfish	CEL	CEL	CCHG	LOAEL		h	2	d	24.5		mg/L	98	65759
2,4-D	Mus	musculus	House mouse	CEL	CEL	PCCM	NOAEL		h	3	d	400		mg/kg bdwt	96.1	93513
2,4-D butoxyethyl ester	Mus	musculus	House mouse	CEL	CEL	PCCM	NOAEL		h	3	d	375		mg/kg bdwt	95.6	93513
2,4-D dimethylamine salt	Mus	musculus	House mouse	CEL	CEL	NCEL	NOAEL	LOAEL	d	2	d	70.8	94.4	mg/kg bdwt	47.2	79428
2,4-D dimethylamine salt	Mus	musculus	House mouse	CEL	CEL	NCEL	NOAEL		d	7	d	150		AI mg/kg bdwt	47.2	80618
2,4-D dimethylamine salt	Mus	musculus	House mouse	CEL	CEL	BEUL	NOAEL	LOAEL	d	7	d	150	200	AI mg/kg bdwt	47.2	93382
2,4-D dimethylamine salt	Mus	musculus	House mouse	CEL	CEL	NCEL	NOAEL		d	64	d	370		ppm	100	93516
2,4-D dimethylamine salt	Mus	musculus	House mouse	CEL	CEL	PCCM	NOAEL		h	3	d	397		mg/kg bdwt	66.2	93513
2,4-D isopropylamine salt	Mus	musculus	House mouse	CEL	CEL	PCCM	NOAEL		h	3	d	376		mg/kg bdwt	50.1	93513
2,4-D diethanolamine salt	Mus	musculus	House mouse	CEL	CEL	PCCM	NOAEL		h	3	d	443		mg/kg bdwt	73.8	93513
2,4-D triisopropanolamine salt	Mus	musculus	House mouse	CEL	CEL	PCCM	NOAEL		h	3	d	542		mg/kg bdwt	70.9	93513
2,4-D isopropyl ester	Mus	musculus	House mouse	GRO	DVP	ABNM	NOAEL		d	8	d	94		mg/kg	100	91379
2,4-D isopropyl ester	Mus	musculus	House mouse	GRO	DVP	ABNM	LOAEL		d	8	d	94		mg/kg	100	91379
2,4-D isopropyl ester	Mus	musculus	House mouse	GRO	DVP	ABNM	NOAEL		d	8	d	46		mg/kg	100	91379
2,4-D isopropyl ester	Mus	musculus	House mouse	GRO	DVP	ABNM	NOAEL		d	8	d	150		mg/kg	100	91379
2,4-D isopropyl ester	Mus	musculus	House mouse	GRO	DVP	ABNM	NOAEL		d	8	d	94		mg/kg	100	91379
2,4-D isopropyl ester	Mus	musculus	House mouse	GRO	DVP	ABNM	NOAEL		d	7	d	94		mg/kg	100	89569
2,4-D isopropyl ester	Mus	musculus	House mouse	GRO	DVP	ABNM	LOAEL		d	7	d	94		mg/kg	100	89569

Chemical Name	Genus	Species	Common Name	Effect Group	Effect	Meas	Endpt1	Endpt2	Dur Unit Orig	Dur Preferred	Dur Unit Preferred	Conc Value1 Preferred	Conc Value2 Preferred	Conc Units Preferred	% Purity	Ref #
2,4-D isopropyl ester	Mus	musculus	House mouse	GRO	DVP	ABNM	NOAEL		d	7	d	46		mg/kg	100	89569
2,4-D isopropyl ester	Mus	musculus	House mouse	GRO	DVP	ABNM	NOAEL		d	8	d	94		mg/kg	100	89569
2,4-D isopropyl ester	Rattus	norvegicus	Norway rat	GRO	DVP	TERA	NOAEL	LOAEL	d	15	d	30	100	mg/kg/d	97.1	93515
2,4-D	Mus	musculus	House mouse	GRO	DVP	ABNM	NOAEL		d	8	d	215		mg/kg	100	91379
2,4-D	Mus	musculus	House mouse	GRO	DVP	ABNM	LOAEL		d	8	d	100		mg/kg	100	91379
2,4-D	Mus	musculus	House mouse	GRO	DVP	ABNM	LOAEL		d	8	d	100		mg/kg	100	91379
2,4-D	Mus	musculus	House mouse	GRO	DVP	ABNM	NOAEL		d	8	d	100		mg/kg	100	91379
2,4-D	Mus	musculus	House mouse	GRO	DVP	ABNM	NOAEL		d	8	d	98		mg/kg	100	91379
2,4-D	Mus	musculus	House mouse	GRO	DVP	ABNM	NOAEL		d	8	d	98		mg/kg	100	91379
2,4-D	Mus	musculus	House mouse	GRO	DVP	BSCY	NOAEL		h	4	d	0.01		ug/ml	100	82041
2,4-D	Mus	musculus	House mouse	GRO	DVP	BSCY	NOAEL		h	4	d	0.01		ug/ml	100	82041
2,4-D	Mus	musculus	House mouse	GRO	DVP	BSCY	NOAEL		h	4	d	0.01		ug/ml	100	82041
2,4-D	Danio	rerio	Zebra danio	GRO	DVP	ABNM	EC50		hpf	96	hpf	73		uM	100	93401
2,4-D	Scenedesmus	quadricauda	Green algae	GRO	DVP	GRRT	NOAEL	LOAEL	stg	NA	stg	0.98	9.8	mg/L	49	55720
2,4-D	Ceuthorrhynchidius	horridus	European Weevil	GRO	DVP	EMRG	LOAEL		wk	70	d	0.252		kg/ha	100	71021
2,4-D	Ceuthorrhynchidius	horridus	European Weevil	GRO	DVP	EMRG	LOAEL		wk	70	d	0.252		kg/ha	100	71021
2,4-D	Mus	musculus	House mouse	GRO	DVP	ABNM	LOAEL		d	7	d	100		mg/kg	100	89569
2,4-D	Mus	musculus	House mouse	GRO	DVP	ABNM	LOAEL		d	7	d	100		mg/kg	100	89569
2,4-D	Mus	musculus	House mouse	GRO	DVP	ABNM	LOAEL		d	7	d	100		mg/kg	100	89569
2,4-D	Mus	musculus	House mouse	GRO	DVP	ABNM	NOAEL		d	7	d	98		mg/kg	100	89569
2,4-D	Mus	musculus	House mouse	GRO	DVP	ABNM	NOAEL		d	8	d	98		mg/kg	100	89569
2,4-D	Mus	musculus	House mouse	GRO	DVP	ABNM	LOAEL		d	8	d	98		mg/kg	100	89569
2,4-D	Mus	musculus	House mouse	GRO	DVP	ABNM	LOAEL		d	7	d	100		mg/kg	100	89569
2,4-D	Cancer	magister	Dungeness or edible crab	GRO	DVP	MOLT	NOEC		h	1	d	33		mg/L	98	6793
2,4-D	Cancer	magister	Dungeness or edible crab	GRO	DVP	GDVP	EC50		h	4	d	10		mg/L	98	6793
2,4-D	Mytilus	edulis	Common bay mussel, blue mussel	GRO	DVP	GDVP	EC50		h	2	d	211.7		mg/L	100	8127
2,4-D	Myriophyllum	spicatum	Eurasian watermilfoil	GRO	DVP	GDVP	EC50		d	5	d	0.04		mg/L	100	13730
2,4-D	Xenopus	laevis	African clawed frog	GRO	DVP	ABNM	LOEC		h	4	d	223.74		mg/L	99	63246
2,4-D	Xenopus	laevis	African clawed frog	GRO	DVP	ABNM	EC50		h	4	d	267.3		mg/L	99	63246
2,4-D	Xenopus	laevis	African clawed frog	GRO	DVP	ABNM	EC50		h	4	d	242.55		mg/L	99	63246
2,4-D	Xenopus	laevis	African clawed frog	GRO	DVP	ABNM	LOEC		h	4	d	230.769		mg/L	99	63246
2,4-D	Mesocricetus	auratus	Golden hamster	GRO	DVP	TERA	NOAEL		d	9	d	100		mg/kg	100	36213
2,4-D	Mesocricetus	auratus	Golden hamster	GRO	DVP	TERA	NOAEL		d	9	d	100		mg/kg	100	36213
2,4-D	Mesocricetus	auratus	Golden hamster	GRO	DVP	TERA	NOAEL		d	9	d	100		mg/kg	100	36213
2,4-D	Rattus	norvegicus	Norway rat	GRO	DVP	TERA	NOAEL		d	15	d	75		mg/kg/d	97.5	93515
2,4-D	Oryctolagus	cuniculus	European rabbit	GRO	DVP	TERA	NOAEL		d	23	d	90		mg/kg/d	97.5	93515
2,4-D butoxyethyl ester	Rattus	norvegicus	Norway rat	GRO	DVP	TERA	NOAEL		d	15	d	125		mg/kg/d	95.6	93515

Chemical Name	Genus	Species	Common Name	Effect Group	Effect	Meas	Endpt1	Endpt2	Dur Unit Orig	Dur Preferred	Dur Unit Preferred	Conc Value1 Preferred	Conc Value2 Preferred	Conc Units Preferred	% Purity	Ref #
2,4-D butoxyethyl ester	Oryctolagus	cuniculus	European rabbit	GRO	DVP	TERA	NOAEL		d	23	d	75		ae mg/kg/d	95.6	93515
2,4-D dimethylamine salt	Gossypium	hirsutum	Cotton	GRO	DVP	MATR	LOAEL		d	74	d	0.033004		lb/acre	100	80741
2,4-D dimethylamine salt	Pectinophora	gossypiella	Pink bollworm	GRO	DVP	EMRG	NOAEL		d	>80	d	0.037		kg/ha	100	80741
2,4-D dimethylamine salt	Hyles	euphorbiae	Leafy Spurge Hawk Moth	GRO	DVP	EMRG	NOAEL		em	na	em	2.2		kg/ha	100	93347
2,4-D dimethylamine salt	Hyles	euphorbiae	Leafy Spurge Hawk Moth	GRO	DVP	EMRG	NOAEL		em	na	em	2.2		kg/ha	100	93347
2,4-D dimethylamine salt	Crassostrea	virginica	American or virginia oyster	GRO	DVP	GDVP	EC50		h	2	d	20.44		mg/L	100	2400
2,4-D dimethylamine salt	Rattus	norvegicus	Norway rat	GRO	DVP	TERA	NOAEL		d	15	d	100		ae mg/kg/d	66.2	93515
2,4-D dimethylamine salt	Oryctolagus	cuniculus	European rabbit	GRO	DVP	TERA	NOAEL		d	23	d	90		ae mg/kg/d	66.2	93515
2,4-D sodium salt	Chilo	suppressalis	Striped riceborer	GRO	DVP	WGHT	NOAEL		d	30	d	0.003		mg	0.1	50516
2,4-D sodium salt	Chilo	suppressalis	Striped riceborer	GRO	DVP	WGHT	NOAEL		d	20	d	0.003		mg	0.1	50516
2,4-D sodium salt	Chilo	suppressalis	Striped riceborer	GRO	DVP	WGHT	NOAEL		d	20	d	0.003 TO 0.005		mg	0.1	50516
2,4-D isopropylamine salt	Rattus	norvegicus	Norway rat	GRO	DVP	TERA	NOAEL		d	15	d	150		ae mg/kg/d	50.2	93515
2,4-D isopropylamine salt	Oryctolagus	cuniculus	European rabbit	GRO	DVP	TERA	NOAEL		d	23	d	75		ae mg/kg/d	50.2	93515
2,4-D diethanolamine salt	Rattus	norvegicus	Norway rat	GRO	DVP	TERA	LOAEL	NOAEL	d	15	d	101.6	50.8	ae mg/kg/d	73.1	93515
2,4-D diethanolamine salt	Oryctolagus	cuniculus	European rabbit	GRO	DVP	TERA	NOAEL	LOAEL	d	23	d	20.3	40.6	ae mg/kg/d	73.1	93515
2,4-D triisopropanolamine salt	Rattus	norvegicus	Norway rat	GRO	DVP	TERA	NOAEL	LOAEL	d	15	d	51	175	ae mg/kg/d	72.2	93515
2,4-D triisopropanolamine salt	Oryctolagus	cuniculus	European rabbit	GRO	DVP	TERA	NOAEL		d	23	d	75		ae mg/kg/d	72.2	93515
2,4-D	Allium	cepa	Common onion	BCM	ENZ	EROD	LOAEL		h	2	d	0.00108		ppm	90	88956
2,4-D	Mus	musculus	House mouse	BCM	ENZ	PNAD	LOAEL		d	3	d	50		mg/kg	100	92612
2,4-D	Mus	musculus	House mouse	BCM	ENZ	GSTR	NOAEL		d	4	d	50		mg/kg	100	92613
2,4-D	Mytilus	galloprovincialis	Mediterranean mussel	BCM	ENZ	ACHE	LOAEL		d	15	d	0.03		mg/L	100	93394
2,4-D	Triatoma	infestans	Kissing Bug	BCM	ENZ	GSTR	NOAEL		h	1	d	160		ug/org	100	93521
2,4-D	Spodoptera	eridania	Southern army worm	BCM	ENZ	ESTE	LOAEL		d	3	d	5000		ppm	100	93415
2,4-D	Canis	familiaris	Domestic dog	BCM	ENZ	AATT	NOAEL	LOEL	wk	91	d	0.5	1	ae mg/kg/d	96.7	48144
2,4-D	Alligator	mississippiensis	American alligator	BCM	ENZ	ARMT	NOAEL		d	10	d	14		ppm	100	63261
2,4-D	Alligator	mississippiensis	American alligator	BCM	ENZ	ARMT	NOAEL		d	10	d	14		ppm	100	63261
2,4-D	Eisenia	fetida	Earthworm	BCM	ENZ	PRTS	NOAEL	LOAEL	h	2	d	3.5	18	ug/cm2	100	40121
2,4-D	Mus	musculus	House mouse	BCM	ENZ	CTLS	NOAEL		d	9	d	100		ppm	100	93603
2,4-D	Mus	musculus	House mouse	BCM	ENZ	CTLS	NOAEL		d	9	d	100		ppm	100	93603

Chemical Name	Genus	Species	Common Name	Effect Group	Effect	Meas	Endpt1	Endpt2	Dur Unit Orig	Dur Preferred	Dur Unit Preferred	Conc Value1 Preferred	Conc Value2 Preferred	Conc Units Preferred	% Purity	Ref #
2,4-D	Rattus	norvegicus	Norway rat	BCM	ENZ	TSHX	LOAEL		d	16	d	70		mg/kg/d	100	93849
2,4-D	Rattus	norvegicus	Norway rat	BCM	ENZ	TPOX	NOAEL	LOAEL	d	16	d	70	100	mg/kg bdwt	100	85545
2,4-D	Rattus	norvegicus	Norway rat	BCM	ENZ	TPOX	LOAEL		d	16	d	70		mg/kg bdwt	100	85545
2,4-D	Rattus	norvegicus	Norway rat	BCM	ENZ	GENZ	LOAEL		mo	180	d	0.05		%	100	94239
2,4-D	Mus	musculus	House mouse	BCM	ENZ	EPHY	LOAEL		d	4	d	100		ppm	100	93403
2,4-D	Rattus	norvegicus	Norway rat	BCM	ENZ	LPLP	LOAEL		wk	14	d	100		mg/kg bdwt	100	93402
2,4-D	Rattus	norvegicus	Norway rat	BCM	ENZ	AHDX	LOAEL		d	14	d	200		mg/kg bdwt	100	93542
2,4-D	Mus	musculus	House mouse	BCM	ENZ	APND	LOAEL		d	8	d	48.5		mg/kg bdwt	97 to 99	93409
2,4-D	Rattus	norvegicus	Norway rat	BCM	ENZ	CTLS	LOAEL		mo	90	d	2500		ppm	100	93406
2,4-D	Mus	musculus	House mouse	BCM	ENZ	LADH	LOAEL		d	56	d	3.38		mg/kg bdwt	100	93525
2,4-D dimethylamine salt	Cyprinus	carpio	common carp	BCM	ENZ	SODA	LOAEL		h	4	d	87		mg/L	100	73377
2,4-D dimethylamine salt	Tilapia	nilotica	Nile tilapia	BCM	ENZ	SODA	LOAEL		h	4	d	87		mg/L	100	73377
2,4-D dimethylamine salt	Cyprinus	carpio	common carp	BCM	ENZ	GSTR	LOAEL		h	1	d	87		mg/L	100	93395
2,4-D dimethylamine salt	Tilapia	nilotica	Nile tilapia	BCM	ENZ	GLRE	LOAEL		h	3	d	27		mg/L	100	60050
2,4-D dimethylamine salt	Canis	familiaris	Domestic dog	BCM	ENZ	AATT	LOEL		wk	91	d	1		ae mg/kg/d	66.7	48144
2,4-D dimethylamine salt	Rattus	norvegicus	Norway rat	BCM	ENZ	EROD	LOAEL		h	4.8333333	d	1.9		ai mg/kg org	50	93655
2,4-D dimethylamine salt	Rattus	norvegicus	Norway rat	BCM	ENZ	ALPH	LOAEL		h	0.2083333	d	600		mg/kg bdwt	100	40139
2,4-D dimethylamine salt	Rattus	norvegicus	Norway rat	BCM	ENZ	ALPH	LOAEL		h	0.2083333	d	600		AI mg/kg bdwt/d	100	40128
2,4-D dimethylamine salt	Rattus	norvegicus	Norway rat	BCM	ENZ	ASAT	LOAEL		d	30	d	200		AI mg/kg bdwt/d	100	40128
2,4-D dimethylamine salt	Rattus	norvegicus	Norway rat	BCM	ENZ	ASAT	LOAEL		d	180	d	200		AI mg/kg bdwt/d	100	40128
2,4-D dimethylamine salt	Gallus	domesticus	Domestic Chicken	BCM	ENZ	ALPH	LOAEL		h	8.33E-02	d	500		mg/kg bdwt	100	87186
2,4-D dimethylamine salt	Rattus	norvegicus	Norway rat	BCM	ENZ	GSTR	NOAEL	LOAEL	wk	14	d	100	150	mg/kg bdwt	100	72915
2,4-D dimethylamine salt	Gallus	domesticus	Domestic Chicken	BCM	ENZ	ASAT	LOAEL		d	5	d	0.72		ul/kg	40	91304
2,4-D sodium salt	Rattus	norvegicus	Norway rat	BCM	ENZ	EROD	LOAEL		h	4.8333333	d	2.6		ai mg/kg org	82	93655
2,4-D	Labeo	rohita	Rohu	BEH	FDB	FCNS	NOAEL		h	4	d	1100		mg/L	100	19021
2,4-D	Labeo	rohita	Rohu	BEH	FDB	FCNS	NOAEL		h	4	d	1070		mg/L	100	19021
2,4-D	Labeo	rohita	Rohu	BEH	FDB	FCNS	NOAEL		h	4	d	1020		mg/L	100	19021
2,4-D	Labeo	rohita	Rohu	BEH	FDB	FCNS	LOAEL		h	4	d	850		mg/L	100	19021
2,4-D	Tilapia	mossambica	Mozambique tilapia	BEH	FDB	FCNS	NOAEL		h	4	d	1255		mg/L	100	19021

Chemical Name	Genus	Species	Common Name	Effect Group	Effect	Meas	Endpt1	Endpt2	Dur Unit Orig	Dur Preferred	Dur Unit Preferred	Conc Value1 Preferred	Conc Value2 Preferred	Conc Units Preferred	% Purity	Ref #
2,4-D	Tilapia	mossambica	Mozambique tilapia	BEH	FDB	FCNS	NOAEL		h	4	d	1275		mg/L	100	19021
2,4-D	Tilapia	mossambica	Mozambique tilapia	BEH	FDB	FCNS	NOAEL		h	4	d	1545		mg/L	100	19021
2,4-D	Tilapia	mossambica	Mozambique tilapia	BEH	FDB	FCNS	LOAEL		h	4	d	1200		mg/L	100	19021
2,4-D	Ceuthorrhynchidius	horridus	European Weevil	BEH	FDB	FDNG	LOAEL		wk	14	d	0.084		kg/ha	100	93656
2,4-D	Gallus	domesticus	Domestic Chicken	BEH	FDB	FEFF	NOAEL		wk	56	d	100		ppm	100	39366
2,4-D	Gallus	domesticus	Domestic Chicken	BEH	FDB	FEFF	NOAEL		wk	56	d	50		ppm	100	39366
2,4-D	Gallus	domesticus	Domestic Chicken	BEH	FDB	FEFF	NOAEL		wk	56	d	50		ppm	100	39366
2,4-D	Peromyscus	maniculatus	Deer mouse	BEH	FDB	FDNG	NOAEL		yr	365	d	2		ae lb/ac	100	50674
2,4-D	Peromyscus	maniculatus	Deer mouse	BEH	FDB	FDNG	LOAEL		mo	450	d	2		ae lb/ac	100	50674
2,4-D	Mus	musculus	House mouse	BEH	FDB	WCON	NOAEL		wk	105	d	50		ppm	100	93408
2,4-D	Rattus	norvegicus	Norway rat	BEH	FDB	FCNS	NOAEL		wk	91	d	150		ppm	97.3	93388
2,4-D	Rattus	norvegicus	Norway rat	BEH	FDB	FCNS	NOAEL		wk	91	d	150		ppm	97.3	93388
2,4-D	Rattus	norvegicus	Norway rat	BEH	FDB	FCNS	NOAEL		wk	91	d	150		ppm	100	93388
2,4-D	Rattus	norvegicus	Norway rat	BEH	FDB	FCNS	NOAEL		wk	91	d	150		ppm	100	93388
2,4-D	Rattus	norvegicus	Norway rat	BEH	FDB	FCNS	LOAEL		d	15	d	50		mg/kg	100	70980
2,4-D dimethylamine salt	Mus	musculus	House mouse	BEH	FDB	WCON	NOAEL		d	11	d	1		%	100	93404
2,4-D dimethylamine salt	Mus	musculus	House mouse	BEH	FDB	WCON	NOAEL		d	10	d	370		ppm	100	93516
2,4-D	Drosophila	melanogaster	Fruit fly	CEL	GEN	MUTA	LOAEL		d	>18	d	10000		ppm	100	40147
2,4-D	Mus	musculus	House mouse	CEL	GEN	APOP	LOAEL		h	4	d	0.01		ug/ml	100	82041
2,4-D	Mus	musculus	House mouse	CEL	GEN	APOP	LOAEL		h	4	d	0.01		ug/ml	100	82041
2,4-D	Mus	musculus	House mouse	CEL	GEN	APOP	LOAEL		h	4	d	0.01		ug/ml	100	82041
2,4-D	Nostoc	calicicola	Blue-green algae	CEL	GEN	MUTA	NOAEL		mi	8.33E-02	d	2000		mg/L	100	89877
2,4-D	Danio	rerio	Zebra danio	CEL	GEN	APOP	NOAEL	LOAEL	hpf	96	hpf	40	80	uM	100	93401
2,4-D	Channa	punctata	Snake-head catfish	CEL	GEN	MNUC	LOAEL		h	2	d	24.5		mg/L	98	68242
2,4-D	Mytilus	galloprovincialis	Mediterranean mussel	CEL	GEN	MNUC	NOAEL		d	15	d	0.03		mg/L	100	93394
2,4-D	Salvelinus	fontinalis	Brook trout	CEL	GEN	RNAC	LOAEL		d	7	d	5		mg/L	97 to	72745
2,4-D	Drosophila	melanogaster	Fruit fly	CEL	GEN	MUTA	NOAEL		d	3	d	2.5		mM	100	93384
2,4-D	Drosophila	melanogaster	Fruit fly	CEL	GEN	MUTA	NOAEL		d	3	d	2.5		mM	100	93384
2,4-D	Drosophila	melanogaster	Fruit fly	CEL	GEN	MUTA	NOAEL		d	3	d	2.5		mM	100	93384
2,4-D	Drosophila	melanogaster	Fruit fly	CEL	GEN	MUTA	NOAEL		d	3	d	2.5		mM	100	93384
2,4-D	Drosophila	melanogaster	Fruit fly	CEL	GEN	MUTA	LOAEL		h	2	d	2.5		mM	100	93384
2,4-D	Drosophila	melanogaster	Fruit fly	CEL	GEN	MUTA	NOAEL	LOAEL	h	2	d	2.45	4.9	mM	98	93411
2,4-D	Drosophila	melanogaster	Fruit fly	CEL	GEN	MUTA	NOAEL	LOAEL	h	2	d	2.45	4.9	mM	98	93411
2,4-D	Clarias	batrachus	Walking catfish	CEL	GEN	DAMG	LOEC		h	2	d	24.5		ppm	98	90041
2,4-D	Clarias	batrachus	Walking catfish	CEL	GEN	DAMG	LOEC		h	3	d	24.5		ppm	98	90041
2,4-D	Clarias	batrachus	Walking catfish	CEL	GEN	DAMG	LOEC		h	4	d	24.5		ppm	98	90041
2,4-D	Gallus	domesticus	Domestic Chicken	CEL	GEN	MITR	NOAEL	LOAEL	d	4	d	0.99	1.98	mg/org	99	93618
2,4-D	Rattus	norvegicus	Norway rat	CEL	GEN	DNAC	LOAEL		d	90	d	100		ppm	100	90486
2,4-D	Mus	musculus	House mouse	CEL	GEN	NABN	NOAEL	LOAEL	h	1	d	1000	1982	umol/kg bdwt	100	74877
2,4-D	Gallus	domesticus	Domestic Chicken	CEL	GEN	MITI	LOAEL		d	10	d	0.99		mg/org	99	40051
2,4-D	Mus	musculus	House mouse	CEL	GEN	CABR	NOAEL	LOAEL	h	1	d	3.234	32.34	mg/kg bdwt	98	93505
2,4-D	Mus	musculus	House mouse	CEL	GEN	CABR	NOAEL	LOAEL	d	4	d	1.666	3.234	mg/kg bdwt	98	93505

Chemical Name	Genus	Species	Common Name	Effect Group	Effect	Meas	Endpt1	Endpt2	Dur Unit Orig	Dur Preferred	Dur Unit Preferred	Conc Value1 Preferred	Conc Value2 Preferred	Conc Units Preferred	% Purity	Ref #
2,4-D	Mus	musculus	House mouse	CEL	GEN	CABR	NOAEL	LOAEL	d	6	d	1.666	3.234	mg/kg bdwt	98	93505
2,4-D	Mus	musculus	House mouse	CEL	GEN	GEXP	LOAEL		d	4	d	0.062		%	100	93348
2,4-D	Rattus	norvegicus	Norway rat	CEL	GEN	DNAC	NOAEL	LOAEL	d	18	d	70	100	mg/kg	100	93434
2,4-D	Rattus	norvegicus	Norway rat	CEL	GEN	DNAC	NOAEL	LOAEL	d	5	d	70	100	mg/kg	100	93434
2,4-D	Mus	musculus	House mouse	CEL	GEN	CABR	NOAEL	LOAEL	h	1.0833333	d	49.45	98.9	ppm	98.9	93517
2,4-D	Mus	musculus	House mouse	CEL	GEN	CABR	NOAEL	LOAEL	h	2.375	d	49.45	98.9	ppm	98.9	93517
2,4-D	Mus	musculus	House mouse	CEL	GEN	CABR	LOAEL		h	0.5	d	3.5		mg/kg	100	93524
2,4-D	Clarias	batrachus	Walking catfish	CEL	GEN	MNUC	LOAEL		h	2	d	24.5		mg/L	98	65759
2,4-D	Channa	punctata	Snake-head catfish	CEL	GEN	CABR	LOAEL		h	2	d	73.5		mg/L	98	93092
2,4-D	Mus	musculus	House mouse	CEL	GEN	CABR	NOAEL		d	4	d	100		mg/kg bdwt	100	93472
2,4-D	Mus	musculus	House mouse	CEL	GEN	CABR	NOAEL		d	5	d	100		mg/kg bdwt	100	93472
2,4-D dimethylamine salt	Rattus	norvegicus	Norway rat	CEL	GEN	CABR	NOAEL		d	15	d	100		mg/kg bdwt	100	93634
2,4-D dimethylamine salt	Mesocricetus	auratus	Golden hamster	CEL	GEN	CABR	NOAEL		d	9	d	100		mg/kg bdwt	100	93634
2,4-D isopropyl ester	Mus	musculus	House mouse	GRO	GRO	GAIN	NOAEL		d	8	d	94		mg/kg	100	91379
2,4-D isopropyl ester	Mus	musculus	House mouse	GRO	GRO	GAIN	LOAEL		d	8	d	94		mg/kg	100	91379
2,4-D isopropyl ester	Mus	musculus	House mouse	GRO	GRO	GAIN	NOAEL		d	8	d	46		mg/kg	100	91379
2,4-D isopropyl ester	Mus	musculus	House mouse	GRO	GRO	GAIN	NOAEL		d	8	d	150		mg/kg	100	91379
2,4-D isopropyl ester	Mus	musculus	House mouse	GRO	GRO	GAIN	NOAEL		d	8	d	94		mg/kg	100	91379
2,4-D isopropyl ester	Mus	musculus	House mouse	GRO	GRO	WGHT	LOAEL		d	7	d	94		mg/kg	100	89569
2,4-D isopropyl ester	Mus	musculus	House mouse	GRO	GRO	WGHT	LOAEL		d	7	d	94		mg/kg	100	89569
2,4-D isopropyl ester	Mus	musculus	House mouse	GRO	GRO	WGHT	NOAEL		d	7	d	46		mg/kg	100	89569
2,4-D isopropyl ester	Mus	musculus	House mouse	GRO	GRO	WGHT	LOAEL		d	8	d	94		mg/kg	100	89569
2,4-D isopropyl ester	Mus	musculus	House mouse	GRO	GRO	GAIN	LOAEL		d	9	d	0.5544		mM/kg bdwt	99	36267
2,4-D isopropyl ester	Rattus	norvegicus	Norway rat	GRO	GRO	GAIN	NOAEL	LOAEL	d	15	d	10	30	ae mg/kg/d	97.1	93515
2,4-D	Mus	musculus	House mouse	GRO	GRO	GAIN	NOAEL		d	8	d	215		mg/kg	100	91379
2,4-D	Mus	musculus	House mouse	GRO	GRO	GAIN	LOAEL		d	8	d	100		mg/kg	100	91379
2,4-D	Mus	musculus	House mouse	GRO	GRO	GAIN	LOAEL		d	8	d	100		mg/kg	100	91379
2,4-D	Mus	musculus	House mouse	GRO	GRO	GAIN	NOAEL		d	8	d	100		mg/kg	100	91379
2,4-D	Mus	musculus	House mouse	GRO	GRO	GAIN	NOAEL		d	8	d	98		mg/kg	100	91379
2,4-D	Mus	musculus	House mouse	GRO	GRO	GAIN	NOAEL		d	8	d	98		mg/kg	100	91379
2,4-D	Mus	musculus	House mouse	GRO	GRO	GAIN	NOAEL		d	8	d	98		mg/kg	100	91379
2,4-D	Myriophyllum	sibiricum	Water milfoil	GRO	GRO	LGTH	LOAEL		d	14	d	1.47		mg/L	100	74985
2,4-D	Myriophyllum	sibiricum	Water milfoil	GRO	GRO	LGTH	LOAEL		d	14	d	1.47		mg/L	100	74985
2,4-D	Myriophyllum	sibiricum	Water milfoil	GRO	GRO	RLGR	NOEC	LOEC	d	14	d	0.0181	0.0543	mg/L	100	74985
2,4-D	Myriophyllum	sibiricum	Water milfoil	GRO	GRO	RLGR	IC50		d	14	d	1.467		mg/L	100	74985
2,4-D	Myriophyllum	sibiricum	Water milfoil	GRO	GRO	LGTH	NOEC	LOEC	d	14	d	0.006	0.0181	mg/L	100	74985
2,4-D	Myriophyllum	sibiricum	Water milfoil	GRO	GRO	LGTH	NOEC	LOEC	d	14	d	0.006	0.0181	mg/L	100	74985
2,4-D	Myriophyllum	sibiricum	Water milfoil	GRO	GRO	LGTH	IC25		d	14	d	0.4099		mg/L	100	74985
2,4-D	Myriophyllum	sibiricum	Water milfoil	GRO	GRO	LGTH	IC50		d	14	d	1.467		mg/L	100	74985
2,4-D	Myriophyllum	sibiricum	Water milfoil	GRO	GRO	LGTH	NOEC	LOEC	d	14	d	0.002	0.006	mg/L	100	74985
2,4-D	Myriophyllum	sibiricum	Water milfoil	GRO	GRO	LGTH	IC25		d	14	d	0.0051		mg/L	100	74985
2,4-D	Myriophyllum	sibiricum	Water milfoil	GRO	GRO	LGTH	IC50		d	14	d	0.0131		mg/L	100	74985

Chemical Name	Genus	Species	Common Name	Effect Group	Effect	Meas	Endpt1	Endpt2	Dur Unit Orig	Dur Preferred	Dur Unit Preferred	Conc Value1 Preferred	Conc Value2 Preferred	Conc Units Preferred	% Purity	Ref #
2,4-D	Myriophyllum	sibiricum	Water milfoil	GRO	GRO	NROT	NOEC	LOEC	d	14	d	0.002	0.006	mg/L	100	74985
2,4-D	Myriophyllum	sibiricum	Water milfoil	GRO	GRO	NROT	IC25		d	14	d	0.0078		mg/L	100	74985
2,4-D	Myriophyllum	sibiricum	Water milfoil	GRO	GRO	NROT	IC50		d	14	d	0.0177		mg/L	100	74985
2,4-D	Myriophyllum	sibiricum	Water milfoil	GRO	GRO	WGHT	IC25		d	14	d	1.467		mg/L	100	74985
2,4-D	Myriophyllum	sibiricum	Water milfoil	GRO	GRO	WGHT	IC50		d	14	d	1.467		mg/L	100	74985
2,4-D	Cenococcum	geophilum	Ectomycorrhizal fungi	GRO	GRO	AREA	LOAEL	NOAEL	d	48	d	1000	100	ppm	100	93391
2,4-D	Hebeloma	longicaudum	Fungus	GRO	GRO	AREA	LOAEL	NOAEL	d	48	d	100	10	ppm	100	93391
2,4-D	Pisolithus	tinctorius	Ectomycorrhizal fungi	GRO	GRO	AREA	LOAEL		d	26	d	1		ppm	100	93391
2,4-D	Lemna	trisolca	Duckweed	GRO	GRO	BMAS	EC50		d	28	d	3		mg/L	100	93399
2,4-D	Lemna	trisolca	Duckweed	GRO	GRO	GAIN	EC50		d	28	d	3		mg/L	100	93399
2,4-D	Elodea	nuttalli	Waterweed, ditchmoss	GRO	GRO	BMAS	EC50		d	28	d	3		mg/L	100	93399
2,4-D	Elodea	nuttalli	Waterweed, ditchmoss	GRO	GRO	GAIN	EC50		d	28	d	3		mg/L	100	93399
2,4-D	Elodea	nuttalli	Waterweed, ditchmoss	GRO	GRO	NROT	EC50		d	28	d	0.982(0.6 TO 1.607)		mg/L	100	93399
2,4-D	Ranunculus	longirostris	Longbeak Buttercup	GRO	GRO	BMAS	EC50		d	28	d	2.731(1.556 TO 4.796)		mg/L	100	93399
2,4-D	Ranunculus	longirostris	Longbeak Buttercup	GRO	GRO	GAIN	EC50		d	28	d	0.719(0.329 TO 1.618)		mg/L	100	93399
2,4-D	Ranunculus	longirostris	Longbeak Buttercup	GRO	GRO	NROT	EC50		d	28	d	0.112(0.1 TO 0.125)		mg/L	100	93399
2,4-D	Ranunculus	aquatilis	Buttercup	GRO	GRO	BMAS	EC50		d	28	d	3		mg/L	100	93399
2,4-D	Ranunculus	aquatilis	Buttercup	GRO	GRO	GAIN	EC50		d	28	d	2.429(0.047 TO 1.237)		mg/L	100	93399
2,4-D	Potamogeton	crispus	Curled pondweed	GRO	GRO	BMAS	EC50		d	28	d	3		mg/L	100	93399
2,4-D	Potamogeton	crispus	Curled pondweed	GRO	GRO	GAIN	EC50		d	28	d	3		mg/L	100	93399
2,4-D	Potamogeton	crispus	Curled pondweed	GRO	GRO	NROT	EC50		d	28	d	0.326(0.271 TO 0.393)		mg/L	100	93399
2,4-D	Ranunculus	peltatus	Pond Water Crowfoot	GRO	GRO	NROT	EC50		d	28	d	0.271		mg/L	100	93399
2,4-D	Potamogeton	illinoensis	Pondweed	GRO	GRO	BMAS	EC50		d	28	d	3		mg/L	100	93399
2,4-D	Potamogeton	illinoensis	Pondweed	GRO	GRO	GAIN	EC50		d	28	d	1.3(0.484 TO 3.493)		mg/L	100	93399
2,4-D	Potamogeton	illinoensis	Pondweed	GRO	GRO	NROT	EC50		d	28	d	0.299(0.267 TO 0.334)		mg/L	100	93399
2,4-D	Elodea	nuttalli	Waterweed, ditchmoss	GRO	GRO	BMAS	EC50		d	28	d	2.243(0.768 TO 6.548)		mg/L	100	93399
2,4-D	Elodea	nuttalli	Waterweed, ditchmoss	GRO	GRO	GAIN	EC50		d	28	d	0.292(0.044 TO 1.904)		mg/L	100	93399
2,4-D	Elodea	nuttalli	Waterweed, ditchmoss	GRO	GRO	NROT	EC50		d	28	d	1.807		mg/L	100	93399
2,4-D	Daphnia	magna	Water flea	GRO	GRO	SIZE	NOAEL		d	6	d	0.1		mg/L	100	93397
2,4-D	Sclerotium	rolfsii	Filamentous fungi	GRO	GRO	LGTH	EC100		d	3	d	300		ppm	100	70487
2,4-D	Volvariella	esculenta	Ogiri Agbe	GRO	GRO	WGHT	NOAEL		d	7	d	10		ppm	100	93623
2,4-D	Lentinus	subnudus	Mushroom	GRO	GRO	WGHT	NOAEL		d	7	d	20		ppm	100	93622
2,4-D	Schizophyllum	commune	Mushroom	GRO	GRO	WGHT	NOAEL		d	7	d	20		ppm	100	93622

Chemical Name	Genus	Species	Common Name	Effect Group	Effect	Meas	Endpt1	Endpt2	Dur Unit Orig	Dur Preferred	Dur Unit Preferred	Conc Value1 Preferred	Conc Value2 Preferred	Conc Units Preferred	% Purity	Ref #
2,4-D	Psathyrella	atroumbonata	Mushroom	GRO	GRO	WGHT	NOAEL		d	7	d	20		ppm	100	93624
2,4-D	Rattus	norvegicus	Norway rat	GRO	GRO	WGHT	NOAEL		yr	730	d	1250		ppm	99.12	36996
2,4-D	Gallus	domesticus	Domestic Chicken	GRO	GRO	WGHT	NOAEL	LOAEL	wk	28	d	10	100	ppm	100	39366
2,4-D	Gallus	domesticus	Domestic Chicken	GRO	GRO	WGHT	NOAEL	LOAEL	wk	56	d	5	10	ppm	100	39366
2,4-D	Gallus	domesticus	Domestic Chicken	GRO	GRO	WGHT	NOAEL	LOAEL	wk	28	d	5	10	ppm	100	39366
2,4-D	Canis	familiaris	Domestic dog	GRO	GRO	GAIN	NOAEL		wk	91	d	7.5		ae mg/kg/d	96.7	48144
2,4-D	Canis	familiaris	Domestic dog	GRO	GRO	GAIN	NOAEL		wk	91	d	7.5		ae mg/kg/d	96.7	48144
2,4-D	Canis	familiaris	Domestic dog	GRO	GRO	GAIN	NOAEL	LOEL	wk	91	d	1	3.75	ae mg/kg/d	96.7	48144
2,4-D	Canis	familiaris	Domestic dog	GRO	GRO	GAIN	NOAEL		yr	365	d	7.5		ppm	96.7	48144
2,4-D	Canis	familiaris	Domestic dog	GRO	GRO	GAIN	LOAEL		wk	273	d	1		ppm	96.7	48144
2,4-D	Rattus	norvegicus	Norway rat	GRO	GRO	WGHT	LOAEL		d	90	d	100		ppm	100	90486
2,4-D	Mus	musculus	House mouse	GRO	GRO	WGHT	LOAEL		d	7	d	100		mg/kg	100	89569
2,4-D	Mus	musculus	House mouse	GRO	GRO	WGHT	LOAEL		d	7	d	100		mg/kg	100	89569
2,4-D	Mus	musculus	House mouse	GRO	GRO	WGHT	LOAEL		d	7	d	100		mg/kg	100	89569
2,4-D	Mus	musculus	House mouse	GRO	GRO	WGHT	NOAEL		d	7	d	98		mg/kg	100	89569
2,4-D	Mus	musculus	House mouse	GRO	GRO	WGHT	LOAEL		d	8	d	98		mg/kg	100	89569
2,4-D	Mus	musculus	House mouse	GRO	GRO	WGHT	LOAEL		d	8	d	98		mg/kg	100	89569
2,4-D	Mus	musculus	House mouse	GRO	GRO	GAIN	NOAEL		d	9	d	100		ppm	100	93603
2,4-D	Mus	musculus	House mouse	GRO	GRO	GAIN	NOAEL		d	9	d	100		ppm	100	93603
2,4-D	Mus	musculus	House mouse	GRO	GRO	WGHT	LOAEL		d	7	d	100		mg/kg bdwt	100	89569
2,4-D	Rattus	norvegicus	Norway rat	GRO	GRO	WGHT	NOAEL	LOAEL	d	16	d	70	100	mg/kg/d	100	93849
2,4-D	Rattus	norvegicus	Norway rat	GRO	GRO	WGHT	LOAEL		d	14	d	100		mg/kg	100	93629
2,4-D	Rattus	norvegicus	Norway rat	GRO	GRO	WGHT	NOAEL		d	18	d	70		mg/kg	100	93629
2,4-D	Rattus	norvegicus	Norway rat	GRO	GRO	WGHT	NOAEL	LOAEL	d	7	d	70	100	mg/kg bdwt	100	85545
2,4-D	Rattus	norvegicus	Norway rat	GRO	GRO	WGHT	LOAEL		d	7	d	70		mg/kg bdwt	100	85545
2,4-D	Champia	parvula	Red algae	GRO	GRO	GGRO	MATC		d	11 TO 14	d	16.73		mg/L	100	11452
2,4-D	Champia	parvula	Red algae	GRO	GRO	GGRO	MATC		d	11 TO 14	d	34.26		mg/L	100	11452
2,4-D	Oryzias	latipes	Medaka, high-eyes	GRO	GRO	GGRO	MATC		d	28	d	329.2		mg/L	100	14908
2,4-D	Oryzias	latipes	Medaka, high-eyes	GRO	GRO	GGRO	NOEC		d	28	d	27.2		mg/L	100	14908
2,4-D	Oryzias	latipes	Medaka, high-eyes	GRO	GRO	GGRO	NOEC		d	28	d	30		mg/L	100	14908
2,4-D	Oryzias	latipes	Medaka, high-eyes	GRO	GRO	GGRO	MATC		d	28	d	42.5		mg/L	100	14908
2,4-D	Oryzias	latipes	Medaka, high-eyes	GRO	GRO	GGRO	LOEC		d	28	d	60.2		mg/L	100	14908
2,4-D	Oryzias	latipes	Medaka, high-eyes	GRO	GRO	GGRO	LOEC		d	28	d	56.5		mg/L	100	14908
2,4-D	Daphnia	magna	Water flea	GRO	GRO	GGRO	EC50		d	21	d	10		mg/L	100	16782
2,4-D	Sorghum	bicolor	Sudangrass	GRO	GRO	LGTH	EC50		d	6	d	6.33		1e-5 M	100	42840
2,4-D	Cucumis	sativus	Cucumber	GRO	GRO	LGTH	EC50		d	5	d	1.18		1e-5 M	100	42840
2,4-D	Rattus	norvegicus	Norway rat	GRO	GRO	GAIN	NOAEL		wk	28	d	109.89		mg/kg bdwt	99.9	94125
2,4-D	Rattus	norvegicus	Norway rat	GRO	GRO	GAIN	NOAEL		wk	28	d	109.89		mg/kg bdwt	99.9	94125
2,4-D	Rattus	norvegicus	Norway rat	GRO	GRO	GAIN	NOAEL		wk	28	d	149.85		mg/kg bdwt	99.9	94125

Chemical Name	Genus	Species	Common Name	Effect Group	Effect	Meas	Endpt1	Endpt2	Dur Unit Orig	Dur Preferred	Dur Unit Preferred	Conc Value1 Preferred	Conc Value2 Preferred	Conc Units Preferred	% Purity	Ref #
2,4-D	Mus	musculus	House mouse	GRO	GRO	GAIN	NOAEL		d	9	d	0.504		mM/kg bdwt	90	36267
2,4-D	Mus	musculus	House mouse	GRO	GRO	GAIN	LOAEL		d	4	d	0.72		mM/kg bdwt	90	36267
2,4-D	Mus	musculus	House mouse	GRO	GRO	GAIN	LOAEL		d	4	d	0.9		mM/kg bdwt	90	36267
2,4-D	Mus	musculus	House mouse	GRO	GRO	GAIN	LOAEL		d	4	d	0.9		mM/kg bdwt	90	36267
2,4-D	Mesocricetus	auratus	Golden hamster	GRO	GRO	WGHT	NOAEL		d	9	d	100		mg/kg	100	36213
2,4-D	Mesocricetus	auratus	Golden hamster	GRO	GRO	WGHT	NOAEL		d	9	d	100		mg/kg	100	36213
2,4-D	Mesocricetus	auratus	Golden hamster	GRO	GRO	WGHT	NOAEL		d	9	d	100		mg/kg	100	36213
2,4-D	Rattus	norvegicus	Norway rat	GRO	GRO	WGHT	NOAEL		wk	21	d	100		mg/kg	100	93540
2,4-D	Rattus	norvegicus	Norway rat	GRO	GRO	WGHT	NOAEL		wk	84	d	80		mg/kg	100	93540
2,4-D	Rattus	norvegicus	Norway rat	GRO	GRO	GAIN	LOAEL		d	14	d	200		mg/kg bdwt	100	93542
2,4-D	Rattus	norvegicus	Norway rat	GRO	GRO	WGHT	LOAEL		d	18	d	70		mg/kg	100	93434
2,4-D	Rattus	norvegicus	Norway rat	GRO	GRO	WGHT	NOAEL	LOAEL	d	13	d	70	100	mg/kg	100	93434
2,4-D	Mus	musculus	House mouse	GRO	GRO	GAIN	NOAEL		wk	105	d	50		ppm	100	93408
2,4-D	Rattus	norvegicus	Norway rat	GRO	GRO	GAIN	NOAEL	LOAEL	wk	91	d	100	150	ppm	97.3	93388
2,4-D	Rattus	norvegicus	Norway rat	GRO	GRO	GAIN	NOAEL	LOAEL	wk	91	d	100	150	ppm	97.3	93388
2,4-D	Rattus	norvegicus	Norway rat	GRO	GRO	GAIN	NOAEL	LOAEL	wk	91	d	60	100	ppm	100	93388
2,4-D	Rattus	norvegicus	Norway rat	GRO	GRO	GAIN	NOAEL	LOAEL	wk	91	d	15	60	ppm	100	93388
2,4-D	Rattus	norvegicus	Norway rat	GRO	GRO	WGHT	LOAEL		d	81	d	70		mg/kg	100	93507
2,4-D	Rattus	norvegicus	Norway rat	GRO	GRO	WGHT	NOAEL		d	96	d	70		mg/kg	100	93507
2,4-D	Rattus	norvegicus	Norway rat	GRO	GRO	WGHT	LOAEL		d	15	d	50		mg/kg	100	70980
2,4-D	Mus	musculus	House mouse	GRO	GRO	WGHT	NOAEL	LOAEL	mo	90	d	700	1680	ppm	100	93406
2,4-D	Rattus	norvegicus	Norway rat	GRO	GRO	WGHT	NOAEL	LOAEL	mo	360	d	4.82	72.3	ppm	96.4	93518
2,4-D	Rattus	norvegicus	Norway rat	GRO	GRO	GAIN	NOAEL		d	15	d	75		ae mg/kg/d	97.5	93515
2,4-D	Oryctolagus	cuniculus	European rabbit	GRO	GRO	GAIN	NOAEL		d	23	d	90		ae mg/kg/d	97.5	93515
2,4-D	Raphanus	sativus	Radish	GRO	GRO	BMAS	NOEC	LOEC	wk	28	d	0	0.01	ppm	99	62406
2,4-D	Hordeum	vulgare	Barley	GRO	GRO	BMAS	NOEC	LOEC	wk	28	d	0.01	0.1	ppm	99	62406
2,4-D	Glycine	max	Soybean	GRO	GRO	BMAS	NOEC	LOEC	wk	28	d	0.01	0.1	ppm	99	62406
2,4-D butoxyethyl ester	Oncorhynchus	gorbuscha	Pink salmon	GRO	GRO	LGTH	NOAEL	LOAEL	h	7	d	0.075	0.22	ae mg/L	100	18424
2,4-D butoxyethyl ester	Oncorhynchus	kisutch	Coho salmon,silver salmon	GRO	GRO	LGTH	NOAEL	LOAEL	h	7	d	0.075	0.22	ae mg/L	100	18424
2,4-D butoxyethyl ester	Oncorhynchus	kisutch	Coho salmon,silver salmon	GRO	GRO	LGTH	NOAEL	LOAEL	h	7	d	0.075	0.22	ae mg/L	100	18424
2,4-D butoxyethyl ester	Oncorhynchus	mykiss	Rainbow trout,donaldson trout	GRO	GRO	LGTH	NOAEL	LOAEL	h	7	d	0.075	0.22	ae mg/L	100	18424
2,4-D butoxyethyl ester	Oncorhynchus	mykiss	Rainbow trout,donaldson trout	GRO	GRO	LGTH	NOAEL	LOAEL	h	7	d	0.075	0.22	ae mg/L	100	18424
2,4-D butoxyethyl ester	Rattus	norvegicus	Norway rat	GRO	GRO	GAIN	NOAEL		d	15	d	125		ae mg/kg/d	95.6	93515

Chemical Name	Genus	Species	Common Name	Effect Group	Effect	Meas	Endpt1	Endpt2	Dur Unit Orig	Dur Preferred	Dur Unit Preferred	Conc Value1 Preferred	Conc Value2 Preferred	Conc Units Preferred	% Purity	Ref #
2,4-D butoxyethyl ester	Oryctolagus	cuniculus	European rabbit	GRO	GRO	GAIN	NOAEL		d	23	d	75		ae mg/kg/d	95.6	93515
2,4-D dimethylamine salt	Eichhornia	crassipes	Water-hyacinth	GRO	GRO	WGHT	LOAEL		d	<=17	d	0.25		kg/ha	50	71785
2,4-D dimethylamine salt	Canis	familiaris	Domestic dog	GRO	GRO	GAIN	NOAEL		wk	91	d	7.5		ae mg/kg/d	66.7	48144
2,4-D dimethylamine salt	Canis	familiaris	Domestic dog	GRO	GRO	GAIN	NOAEL	LOAEL	wk	91	d	3.75	7.5	ae mg/kg/d	66.7	48144
2,4-D dimethylamine salt	Canis	familiaris	Domestic dog	GRO	GRO	GAIN	NOAEL	LOEL	wk	91	d	3.75	7.5	ae mg/kg/d	66.7	48144
2,4-D dimethylamine salt	Rattus	norvegicus	Norway rat	GRO	GRO	WGHT	LOAEL		wk	14	d	150		ae mg/org	48	93658
2,4-D dimethylamine salt	Rattus	norvegicus	Norway rat	GRO	GRO	WGHT	LOAEL		wk	14	d	111		ae mg/org	48	93658
2,4-D dimethylamine salt	Rattus	norvegicus	Norway rat	GRO	GRO	WGHT	LOAEL		d	5	d	5.76		%	48	93626
2,4-D dimethylamine salt	Rattus	norvegicus	Norway rat	GRO	GRO	WGHT	LOAEL		d	12	d	5.76		%	48	93626
2,4-D dimethylamine salt	Salvinia	natans	Floating moss	GRO	GRO	GGRO	EC50		wk	28	d	6		mg/L	100	13738
2,4-D dimethylamine salt	Salvinia	natans	Floating moss	GRO	GRO	GGRO	EC50		wk	28	d	6.5		mg/L	100	13738
2,4-D dimethylamine salt	Gallus	domesticus	Domestic Chicken	GRO	GRO	GAIN	NOAEL	LOAEL	h	2	d	100	300	mg/kg bdwt	100	87186
2,4-D dimethylamine salt	Rattus	norvegicus	Norway rat	GRO	GRO	GAIN	NOAEL		d	28	d	10		mg/kg bdwt	100	93627
2,4-D dimethylamine salt	Mus	musculus	House mouse	GRO	GRO	GAIN	NOAEL		ges	na	ges	1		%	100	93404
2,4-D dimethylamine salt	Mus	musculus	House mouse	GRO	GRO	WGHT	NOAEL	LOAEL	d	16	d	8.5	37	ppm	100	93516
2,4-D dimethylamine salt	Rattus	norvegicus	Norway rat	GRO	GRO	GAIN	NOAEL	LOAEL	d	15	d	12.5	50	ae mg/kg/d	66.2	93515
2,4-D dimethylamine salt	Oryctolagus	cuniculus	European rabbit	GRO	GRO	GAIN	NOAEL		d	23	d	90		ae mg/kg/d	66.2	93515
2,4-D isopropylamine salt	Rattus	norvegicus	Norway rat	GRO	GRO	GAIN	NOAEL		d	15	d	150		ae mg/kg/d	50.2	93515
2,4-D isopropylamine salt	Oryctolagus	cuniculus	European rabbit	GRO	GRO	GAIN	NOAEL	LOAEL	d	23	d	30	75	ae mg/kg/d	50.2	93515
2,4-D diethanolamine salt	Rattus	norvegicus	Norway rat	GRO	GRO	WGHT	LOAEL	NOAEL	d	15	d	101.6	50.8	ae mg/kg/d	73.1	93515
2,4-D diethanolamine salt	Oryctolagus	cuniculus	European rabbit	GRO	GRO	GAIN	NOAEL	LOAEL	d	23	d	10.2	20.3	ae mg/kg/d	73.1	93515
2,4-D triisopropanolamine salt	Rattus	norvegicus	Norway rat	GRO	GRO	WGHT	NOAEL	LOAEL	d	15	d	51	175	ae mg/kg/d	72.2	93515
2,4-D triisopropanolamine salt	Oryctolagus	cuniculus	European rabbit	GRO	GRO	GAIN	NOAEL	LOAEL	d	23	d	30	75	ae mg/kg/d	72.2	93515

Chemical Name	Genus	Species	Common Name	Effect Group	Effect	Meas	Endpt1	Endpt2	Dur Unit Orig	Dur Preferred	Dur Unit Preferred	Conc Value1 Preferred	Conc Value2 Preferred	Conc Units Preferred	% Purity	Ref #
2,4-D	Ovis	aries	Domestic Sheep	CEL	HIS	CSTS	NOAEL		d	43	d	10		mg/kg bdwt	100	61494
2,4-D	Canis	familiaris	Domestic dog	CEL	HIS	GHIS	NOAEL	LOEL	wk	91	d	3.75	7.5	mg/kg/d	96.7	48144
2,4-D	Alligator	mississippiensis	American alligator	CEL	HIS	DEGN	NOAEL		d	10	d	13.664		ppm	97.6	70208
2,4-D	Mus	musculus	House mouse	CEL	HIS	HYPL	NOAEL	LOAEL	mo	90	d	700	1680	ppm	100	93406
2,4-D	Mesocricetus	auratus	Golden hamster	CEL	HIS	LESI	NOAEL	LOAEL	mo	90	d	1000	5000	ppm	100	93406
2,4-D	Rattus	norvegicus	Norway rat	CEL	HIS	DEGN	NOAEL	LOAEL	mo	360	d	72.3	144.6	ppm	96.4	93518
2,4-D	Rattus	norvegicus	Norway rat	CEL	HIS	DEGN	NOAEL		mo	360	d	144.6		ppm	96.4	93518
2,4-D dimethylamine salt	Canis	familiaris	Domestic dog	CEL	HIS	GHIS	NOAEL	LOEL	wk	91	d	3.75	7.5	mg/kg/d	66.7	48144
2,4-D	Ovis	aries	Domestic Sheep	BCM	HRM	THYR	LOAEL		d	36	d	10		mg/kg bdwt	100	61494
2,4-D	Alligator	mississippiensis	American alligator	BCM	HRM	ESDL	NOAEL		d	10	d	14		ppm	100	63261
2,4-D	Alligator	mississippiensis	American alligator	BCM	HRM	ESDL	NOAEL		d	10	d	14		ppm	100	63261
2,4-D	Rattus	norvegicus	Norway rat	BCM	HRM	DOPA	LOAEL		h	0.1458333	d	47.5		mg/kg	>95	93598
2,4-D	Rattus	norvegicus	Norway rat	BCM	HRM	DOPA	LOAEL		h	0.1458333	d	47.5		mg/kg	>95	93598
2,4-D	Rattus	norvegicus	Norway rat	BCM	HRM	SRTN	LOAEL		d	16	d	70		mg/kg/d	100	93849
2,4-D	Rattus	norvegicus	Norway rat	BCM	HRM	SRTN	LOAEL		d	96	d	70		ppm	100	93509
2,4-D	Rattus	norvegicus	Norway rat	BCM	HRM	SRTN	LOAEL		d	96	d	70		ppm	100	93509
2,4-D	Rattus	norvegicus	Norway rat	BCM	HRM	THYR	NOAEL		wk	91	d	150		ppm	97.3	93388
2,4-D	Rattus	norvegicus	Norway rat	BCM	HRM	THYR	LOAEL		wk	91	d	15		ppm	97.3	93388
2,4-D	Rattus	norvegicus	Norway rat	BCM	HRM	THYR	NOAEL		wk	91	d	150		ppm	100	93388
2,4-D	Rattus	norvegicus	Norway rat	BCM	HRM	THYR	LOAEL		wk	91	d	15		ppm	100	93388
2,4-D	Rattus	norvegicus	Norway rat	BCM	HRM	SRTN	LOAEL		h	0.25	d	100		ug	100	93508
2,4-D	Rattus	norvegicus	Norway rat	BCM	HRM	SRTN	LOAEL		h	0.25	d	100		ug	100	93508
2,4-D	Rattus	norvegicus	Norway rat	BCM	HRM	DOPA	LOAEL		d	3	d	50		ug	100	93508
2,4-D dimethylamine salt	Mus	musculus	House mouse	BCM	HRM	CORT	NOAEL	LOAEL	d	1	d	70.8	94.4	mg/kg bdwt	47.2	79428
2,4-D dimethylamine salt	Rattus	norvegicus	Norway rat	BCM	HRM	SRTN	LOAEL		h	4.17E-02	d	200		ppm	100	93633
2,4-D dimethylamine salt	Rattus	norvegicus	Norway rat	BCM	HRM	SRTN	NOAEL	LOAEL	h	0.125	d	10	60	ppm	100	93633
2,4-D dimethylamine salt	Rattus	norvegicus	Norway rat	BCM	HRM	SRTN	LOAEL		h	0.125	d	10		ppm	100	93633
2,4-D sodium salt	Rattus	norvegicus	Norway rat	BCM	HRM	DOPA	LOAEL		h	4.17E-02	d	200		mg/kg	100	93387
2,4-D sodium salt	Rattus	norvegicus	Norway rat	BCM	HRM	SRTN	NOAEL		h	8.33E-02	d	100		mg/kg	100	93387
2,4-D	Eisenia	fetida	Earthworm	PHY	IMM	PHAG	NOAEL	LOAEL	h	2	d	3.5	18	ug/cm2	100	40121
2,4-D dimethylamine salt	Mus	musculus	House mouse	PHY	IMM	ABDT	LOAEL		d	5	d	150		AI mg/kg bdwt	47.2	80618
2,4-D dimethylamine salt	Rattus	norvegicus	Norway rat	PHY	IMM	PHAG	NOAEL		d	28	d	10		mg/kg bdwt	100	93627
2,4-D dimethylamine salt	Mus	musculus	House mouse	PHY	IMM	LYMP	NOAEL	LOAEL	d	64	d	37	370	ppm	100	93516
2,4-D isopropyl ester	Mus	musculus	House mouse	PHY	INJ	TUMR	NOAEL		mo	540	d	46.4		ppm	100	71346
2,4-D	Mus	musculus	House mouse	PHY	INJ	TUMR	NOAEL		mo	540	d	100		ppm	100	71346
2,4-D	Rattus	norvegicus	Norway rat	PHY	INJ	MTMR	NOAEL		yr	730	d	1250		ppm	99.12	36996
2,4-D	Rattus	norvegicus	Norway rat	PHY	INJ	MTMR	NOAEL	LOAEL	yr	730	d	625	1250	ppm	99.12	36996
2,4-D	Mus	musculus	House mouse	PHY	INJ	GINJ	NOAEL		d	8	d	11.9		mg/ml	100	36304

Chemical Name	Genus	Species	Common Name	Effect Group	Effect	Meas	Endpt1	Endpt2	Dur Unit Orig	Dur Preferred	Dur Unit Preferred	Conc Value1 Preferred	Conc Value2 Preferred	Conc Units Preferred	% Purity	Ref #
2,4-D	Mus	musculus	House mouse	PHY	INJ	GINJ	NOAEL		d	8	d	11.9		mg/ml	100	36304
2,4-D	Mus	musculus	House mouse	PHY	INJ	GINJ	NOAEL		d	36	d	11.9		mg/ml	100	36304
2,4-D	Mus	musculus	House mouse	PHY	INJ	GINJ	NOAEL		d	36	d	11.9		mg/ml	100	36304
2,4-D butoxyethyl ester	Convolvulus	arvensis	Field bindweed	PHY	INJ	DAMG	NOEC		mo	360 TO 540	d	0.5		lb/acre	100	42096
2,4-D butoxyethyl ester	Convolvulus	arvensis	Field bindweed	PHY	INJ	DAMG	NOEC		mo	360 TO 540	d	0.5		lb/acre	100	42096
2,4-D butoxyethyl ester	Convolvulus	arvensis	Field bindweed	PHY	INJ	DAMG	NOEC		mo	360 TO 540	d	0.5		lb/acre	100	42096
2,4-D butoxyethyl ester	Convolvulus	arvensis	Field bindweed	PHY	INJ	DAMG	LOEC		mo	360 TO 540	d	0.5		lb/acre	100	42096
2,4-D butoxyethyl ester	Convolvulus	arvensis	Field bindweed	PHY	INJ	DAMG	LOEC		mo	360 TO 540	d	0.5		lb/acre	100	42096
2,4-D dimethylamine salt	Convolvulus	arvensis	Field bindweed	PHY	INJ	DAMG	NOEC		mo	360 TO 540	d	1		lb/acre	100	42096
2,4-D dimethylamine salt	Convolvulus	arvensis	Field bindweed	PHY	INJ	DAMG	LOEC		mo	360 TO 540	d	0.5		lb/acre	100	42096
2,4-D dimethylamine salt	Convolvulus	arvensis	Field bindweed	PHY	INJ	DAMG	NOEC		mo	360 TO 540	d	1		lb/acre	100	42096
2,4-D dimethylamine salt	Convolvulus	arvensis	Field bindweed	PHY	INJ	DAMG	NOEC		mo	360 TO 540	d	1		lb/acre	100	42096
2,4-D	Daphnia	magna	Water flea	PHY	ITX	IMBL	EC50		h	1.0833333	d	100		mg/L	100	2775
2,4-D	Cancer	magister	Dungeness or edible crab	PHY	ITX	IMBL	EC50		h	4	d	10		mg/L	98	6793
2,4-D	Daphnia	magna	Water flea	PHY	ITX	IMBL	EC50		h	0.1666667	d	100		mg/L	100	17456
2,4-D	Daphnia	magna	Water flea	PHY	ITX	IMBL	EC50		h	8.33E-02	d	100		mg/L	100	17456
2,4-D	Daphnia	magna	Water flea	PHY	ITX	IMBL	EC50		h	0.25	d	100		mg/L	100	17456
2,4-D	Daphnia	magna	Water flea	PHY	ITX	IMBL	EC50		h	1	d	100		mg/L	100	17456
2,4-D isopropyl ester	Mus	musculus	House mouse	MOR	MOR	MORT	NOAEL		d	8	d	94		mg/kg	100	91379
2,4-D isopropyl ester	Mus	musculus	House mouse	MOR	MOR	MORT	NOAEL		d	8	d	94		mg/kg	100	91379
2,4-D isopropyl ester	Mus	musculus	House mouse	MOR	MOR	MORT	NOAEL		d	8	d	150		mg/kg	100	91379
2,4-D isopropyl ester	Mus	musculus	House mouse	MOR	MOR	MORT	NOAEL		d	8	d	94		mg/kg	100	91379
2,4-D isopropyl ester	Mus	musculus	House mouse	MOR	MOR	MORT	NR-LETH		d	7	d	150		mg/kg	100	89569
2,4-D isopropyl ester	Mus	musculus	House mouse	MOR	MOR	MORT	NOAEL		d	7	d	94		mg/kg	100	89569
2,4-D isopropyl ester	Mus	musculus	House mouse	MOR	MOR	MORT	NOAEL		d	7	d	94		mg/kg	100	89569
2,4-D isopropyl ester	Mus	musculus	House mouse	MOR	MOR	MORT	NOAEL		d	7	d	46		mg/kg	100	89569
2,4-D isopropyl ester	Mus	musculus	House mouse	MOR	MOR	MORT	NOAEL		d	8	d	94		mg/kg	100	89569
2,4-D isopropyl ester	Lepomis	macrochirus	Bluegill	MOR	MOR	MORT	LC50*		h	1	d	0.9		mg/L	100	612
2,4-D isopropyl ester	Lepomis	macrochirus	Bluegill	MOR	MOR	MORT	LC50*		h	2	d	0.8		mg/L	100	612
2,4-D isopropyl ester	Mus	musculus	House mouse	MOR	MOR	MORT	NOAEL		d	9	d	0.5544		mM/kg bdwt	99	36267
2,4-D isopropyl ester	Rattus	norvegicus	Norway rat	MOR	MOR	MORT	NR-ZERO		d	15	d	30		ae mg/kg/d	97.1	93515
2,4-D isopropyl ester	Rattus	norvegicus	Norway rat	MOR	MOR	MORT	NOAEL		d	15	d	100		ae mg/kg/d	97.1	93515
2,4-D	Pomacea	canaliculata	Snail	MOR	MOR	MORT	LC50		h	2	d	5.08		mg/L	100	20421
2,4-D	Mus	musculus	House mouse	MOR	MOR	MORT	NOAEL		d	8	d	215		mg/kg	100	91379
2,4-D	Mus	musculus	House mouse	MOR	MOR	MORT	LOAEL		d	8	d	100		mg/kg	100	91379

Chemical Name	Genus	Species	Common Name	Effect Group	Effect	Meas	Endpt1	Endpt2	Dur Unit Orig	Dur Preferred	Dur Unit Preferred	Conc Value1 Preferred	Conc Value2 Preferred	Conc Units Preferred	% Purity	Ref #
2,4-D	Mus	musculus	House mouse	MOR	MOR	MORT	NOAEL		d	8	d	100		mg/kg	100	91379
2,4-D	Mus	musculus	House mouse	MOR	MOR	MORT	NOAEL		d	8	d	100		mg/kg	100	91379
2,4-D	Mus	musculus	House mouse	MOR	MOR	MORT	LOAEL		d	8	d	98		mg/kg	100	91379
2,4-D	Mus	musculus	House mouse	MOR	MOR	MORT	NOAEL		d	8	d	98		mg/kg	100	91379
2,4-D	Mus	musculus	House mouse	MOR	MOR	MORT	NOAEL		d	8	d	98		mg/kg	100	91379
2,4-D	Tilapia	nilotica	Nile tilapia	MOR	MOR	MORT	LC50		h	2	d	0.014		mg/L	100	20421
2,4-D	Microtus	canicaudus	Gray-tailed vole	MOR	MOR	MORT	NR-ZERO		d	14	d	400		mg/kg bdwt	100	70756
2,4-D	Microtus	canicaudus	Gray-tailed vole	MOR	MOR	MORT	NR-LETH		d	4	d	2500		mg/kg bdwt	100	70756
2,4-D	Microtus	canicaudus	Gray-tailed vole	MOR	MOR	MORT	LD50		d	14	d	1314		mg/kg bdwt	100	70756
2,4-D	Microtus	canicaudus	Gray-tailed vole	MOR	MOR	MORT	NR-ZERO		d	14	d	630		mg/kg bdwt	100	70756
2,4-D	Microtus	canicaudus	Gray-tailed vole	MOR	MOR	MORT	NR-LETH		d	4	d	2500		mg/kg bdwt	100	70756
2,4-D	Microtus	ochrogaster	Prairie vole	MOR	MOR	MORT	NR-LETH		d	3	d	4000		mg/kg bdwt	100	70756
2,4-D	Microtus	ochrogaster	Prairie vole	MOR	MOR	MORT	NR-ZERO		d	14	d	790		mg/kg bdwt	100	70756
2,4-D	Microtus	ochrogaster	Prairie vole	MOR	MOR	MORT	LD50		d	14	d	2106		mg/kg bdwt	100	70756
2,4-D	Microtus	ochrogaster	Prairie vole	MOR	MOR	MORT	LD50		d	14	d	2104		mg/kg bdwt	100	70756
2,4-D	Microtus	ochrogaster	Prairie vole	MOR	MOR	MORT	NR-ZERO		d	14	d	1000		mg/kg bdwt	100	70756
2,4-D	Microtus	ochrogaster	Prairie vole	MOR	MOR	MORT	NR-LETH		d	3	d	4000		mg/kg bdwt	100	70756
2,4-D	Deroceras	reticulatum	Grey field slug	MOR	MOR	MORT	NOAEL		d	10	d	1.2		kg/ha	100	79821
2,4-D	Deroceras	panormitanum	Longneck Fieldslug	MOR	MOR	MORT	NOAEL		d	10	d	1.2		kg/ha	100	79821
2,4-D	Deroceras	panormitanum	Longneck Fieldslug	MOR	MOR	MORT	NOAEL		d	10	d	0.8		AI %	100	79821
2,4-D	Deroceras	reticulatum	Grey field slug	MOR	MOR	MORT	NOAEL		d	10	d	0.8		AI %	100	79821
2,4-D	Tilapia	nilotica	Nile tilapia	MOR	MOR	MORT	LC01		h	2	d	13.11(5.76 TO 17.92)		mg/L	100	93393
2,4-D	Tilapia	nilotica	Nile tilapia	MOR	MOR	MORT	LC5		h	2	d	16.42(8.74 TO 21.06)		mg/L	100	93393
2,4-D	Astacus	leptodactylus	Crayfish	MOR	MOR	MORT	LC01		h	4	d	3.06		mg/L	100	93398
2,4-D	Astacus	leptodactylus	Crayfish	MOR	MOR	MORT	LC5		h	4	d	6.08		mg/L	100	93398
2,4-D	Astacus	leptodactylus	Crayfish	MOR	MOR	MORT	LC10		h	4	d	8.78		mg/L	100	93398
2,4-D	Astacus	leptodactylus	Crayfish	MOR	MOR	MORT	LC15		h	4	d	11.24		mg/L	100	93398
2,4-D	Astacus	leptodactylus	Crayfish	MOR	MOR	MORT	LC50		h	4	d	32.6(15.1 TO 32.16)		mg/L	100	93398
2,4-D	Astacus	leptodactylus	Crayfish	MOR	MOR	MORT	LC85		h	4	d	91.06		mg/L	100	93398
2,4-D	Astacus	leptodactylus	Crayfish	MOR	MOR	MORT	LC90		h	4	d	116.62		mg/L	100	93398
2,4-D	Astacus	leptodactylus	Crayfish	MOR	MOR	MORT	LC95		h	4	d	168.27		mg/L	100	93398
2,4-D	Astacus	leptodactylus	Crayfish	MOR	MOR	MORT	LC99		h	4	d	334.69		mg/L	100	93398
2,4-D	Tilapia	nilotica	Nile tilapia	MOR	MOR	MORT	LC10		h	2	d	18.51(10.89 TO 23)		mg/L	100	93393

Chemical Name	Genus	Species	Common Name	Effect Group	Effect	Meas	Endpt1	Endpt2	Dur Unit Orig	Dur Preferred	Dur Unit Preferred	Conc Value1 Preferred	Conc Value2 Preferred	Conc Units Preferred	% Purity	Ref #
2,4-D	Tilapia	nilotica	Nile tilapia	MOR	MOR	MORT	LC15		h	2	d	20.06(12.62 TO 24.47)		mg/L	100	93393
2,4-D	Tilapia	nilotica	Nile tilapia	MOR	MOR	MORT	LC50		h	2	d	28.23(22.55 TO 32.98)		mg/L	100	93393
2,4-D	Tilapia	nilotica	Nile tilapia	MOR	MOR	MORT	LC85		h	2	d	39.73(33.94 TO 52.81)		mg/L	100	93393
2,4-D	Tilapia	nilotica	Nile tilapia	MOR	MOR	MORT	LC90		h	2	d	43.07(36.44 TO 60.56)		mg/L	100	93393
2,4-D	Tilapia	nilotica	Nile tilapia	MOR	MOR	MORT	LC95		h	2	d	48.55(40.16 TO 74.78)		mg/L	100	93393
2,4-D	Tilapia	nilotica	Nile tilapia	MOR	MOR	MORT	LC99		h	2	d	60.78(47.58 TO 112.55)		mg/L	100	93393
2,4-D	Tilapia	nilotica	Nile tilapia	MOR	MOR	MORT	LC99		h	2	d	114.03(103.21 TO 149.68)		mg/L	100	93393
2,4-D	Tilapia	nilotica	Nile tilapia	MOR	MOR	MORT	LC95		h	2	d	105.31(97.36 TO 128.33)		mg/L	100	93393
2,4-D	Tilapia	nilotica	Nile tilapia	MOR	MOR	MORT	LC90		h	2	d	100.93(94.2 TO 118.45)		mg/L	100	93393
2,4-D	Tilapia	nilotica	Nile tilapia	MOR	MOR	MORT	LC85		h	2	d	98.08(92 TO 112.37)		mg/L	100	93393
2,4-D	Tilapia	nilotica	Nile tilapia	MOR	MOR	MORT	LC50		h	2	d	86.9(80.67 TO 92.8)		mg/L	100	93393
2,4-D	Tilapia	nilotica	Nile tilapia	MOR	MOR	MORT	LC15		h	2	d	76.99(65.75 TO 82.46)		mg/L	100	93393
2,4-D	Tilapia	nilotica	Nile tilapia	MOR	MOR	MORT	LC10		h	2	d	74.82(62.3 TO 80.62)		mg/L	100	93393
2,4-D	Tilapia	nilotica	Nile tilapia	MOR	MOR	MORT	LC5		h	2	d	71.71(57.45 TO 78.08)		mg/L	100	93393
2,4-D	Tilapia	nilotica	Nile tilapia	MOR	MOR	MORT	LC01		h	2	d	66.22(49.21 TO 73.72)		mg/L	100	93393
2,4-D	Danio	rerio	Zebra danio	MOR	MOR	MORT	LC50		hpf	96	hpf	132		uM	100	93401
2,4-D	Rana	pipiens	Leopard frog	MOR	MOR	MORT	LC50		h	4	d	181		mg/L	100	61180
2,4-D	Pimephales	promelas	Fathead minnow	MOR	MOR	MORT	LC50		h	4	d	165		mg/L	100	61180
2,4-D	Rana	pipiens	Leopard frog	MOR	MOR	MORT	NR-LETH		h	1	d	253		mg/L	100	61180
2,4-D	Pimephales	promelas	Fathead minnow	MOR	MOR	MORT	NR-LETH		h	1	d	253		mg/L	100	61180
2,4-D	Rana	pipiens	Leopard frog	MOR	MOR	MORT	LC50		h	4	d	1962		mg/L	100	61180
2,4-D	Pimephales	promelas	Fathead minnow	MOR	MOR	MORT	LC50		h	4	d	1966		mg/L	100	61180
2,4-D	Daphnia	magna	Water flea	MOR	MOR	MORT	LC50		h	4	d	417.8		mg/L	100	4740
2,4-D	Labeo	rohita	Rohu	MOR	MOR	MORT	LC50		h	4	d	913		mg/L	83	81822
2,4-D	Catla	catla	Catla	MOR	MOR	MORT	LC50		h	4	d	971.1		mg/L	83	81822
2,4-D	Cirrhinus	mrigala	Carp, hawk fish	MOR	MOR	MORT	LC50		h	4	d	950.35		mg/L	83	81822
2,4-D	Heteropneustes	fossilis	Indian catfish	MOR	MOR	MORT	LC50		h	4	d	1568.7		mg/L	83	81822
2,4-D	Anabas	testudineus	Climbing perch	MOR	MOR	MORT	LC50		h	4	d	1162		mg/L	83	81822
2,4-D	Clarias	batrachus	Walking catfish	MOR	MOR	MORT	LC50		h	4	d	1494		mg/L	83	81822
2,4-D	Mystus	vittatus	Striped catfish	MOR	MOR	MORT	LC50		h	4	d	1224.25		mg/L	83	81822
2,4-D	Wallago	attu	Wallago	MOR	MOR	MORT	LC50		h	4	d	1286.5		mg/L	83	81822
2,4-D	Tilapia	mossambica	Mozambique tilapia	MOR	MOR	MORT	LC50		h	4	d	1041.65		mg/L	83	81822

Chemical Name	Genus	Species	Common Name	Effect Group	Effect	Meas	Endpt1	Endpt2	Dur Unit Orig	Dur Preferred	Dur Unit Preferred	Conc Value1 Preferred	Conc Value2 Preferred	Conc Units Preferred	% Purity	Ref #
2,4-D	Esomus	danrica	Flying barb	MOR	MOR	MORT	LC50		h	4	d	1058.25		mg/L	83	81822
2,4-D	Labeo	rohita	Rohu	MOR	MOR	MORT	LC50		h	4	d	888.1		mg/L	83	81822
2,4-D	Anas	platyrhynchos	Mallard duck	MOR	MOR	MORT	LD50		d	14	d	2000		mg/kg bdwt	>99	50386
2,4-D	Anas	platyrhynchos	Mallard duck	MOR	MOR	MORT	LD50		d	14	d	1000		mg/kg bdwt	100	50386
2,4-D	Coturnix	japonica	Japanese quail	MOR	MOR	MORT	LD50		d	14	d	668(530 TO 842)		mg/kg bdwt	100	50386
2,4-D	Phasianus	colchicus	ring-necked pheasant	MOR	MOR	MORT	LD50		d	14	d	472(340 TO 654)		mg/kg bdwt	100	50386
2,4-D	Alectoris	chukar	Chukar	MOR	MOR	MORT	LD50		d	14	d	200 TO 400		mg/kg bdwt	100	50386
2,4-D	Columba	livia	rock dove	MOR	MOR	MORT	LD50		d	14	d	668(530 TO 842)		mg/kg bdwt	100	50386
2,4-D	Odocoileus	hemionus	Mule deer	MOR	MOR	MORT	LD50		d	14	d	400 TO 800		mg/kg bdwt	100	50386
2,4-D	Odocoileus	hemionus	Mule deer	MOR	MOR	MORT	NR-ZERO		d	30	d	240		mg/kg bdwt	100	50386
2,4-D	Spirostomum	ambiguum	Protozoa	MOR	MOR	MORT	EC50		h	1	d	38.4		mg/L	100	69821
2,4-D	Spirostomum	ambiguum	Protozoa	MOR	MOR	MORT	LC50		h	1	d	39.9		mg/L	100	69821
2,4-D	Heteropneustes	fossilis	Indian catfish	MOR	MOR	MORT	NR-ZERO		h	4	d	29.4		mg/L	98	73350
2,4-D	Heteropneustes	fossilis	Indian catfish	MOR	MOR	MORT	NR-LETH		h	4	d	117.6		mg/L	98	73350
2,4-D	Catla	catla	Catla	MOR	MOR	MORT	LC50		h	4	d	925.45		mg/L	83	81822
2,4-D	Cirrhinus	mrigala	Carp, hawk fish	MOR	MOR	MORT	LC50		h	4	d	958.65		mg/L	83	81822
2,4-D	Heteropneustes	fossilis	Indian catfish	MOR	MOR	MORT	LC50		h	4	d	1137.1		mg/L	83	81822
2,4-D	Anabas	testudineus	Climbing perch	MOR	MOR	MORT	LC50		h	4	d	1290.65		mg/L	83	81822
2,4-D	Clarias	batrachus	Walking catfish	MOR	MOR	MORT	LC50		h	4	d	1431.75		mg/L	83	81822
2,4-D	Mystus	vittatus	Striped catfish	MOR	MOR	MORT	LC50		h	4	d	1377.8		mg/L	83	81822
2,4-D	Wallago	attu	Wallago	MOR	MOR	MORT	LC50		h	4	d	1328		mg/L	83	81822
2,4-D	Tilapia	mossambica	Mozambique tilapia	MOR	MOR	MORT	LC50		h	4	d	1058.25		mg/L	83	81822
2,4-D	Esomus	danrica	Flying barb	MOR	MOR	MORT	LC50		h	4	d	1045.8		mg/L	83	81822
2,4-D	Labeo	rohita	Rohu	MOR	MOR	MORT	LC50		h	4	d	846.6		mg/L	83	81822
2,4-D	Catla	catla	Catla	MOR	MOR	MORT	LC50		h	4	d	879.8		mg/L	83	81822
2,4-D	Cirrhinus	mrigala	Carp, hawk fish	MOR	MOR	MORT	LC50		h	4	d	913		mg/L	83	81822
2,4-D	Heteropneustes	fossilis	Indian catfish	MOR	MOR	MORT	LC50		h	4	d	1344.6		mg/L	83	81822
2,4-D	Anabas	testudineus	Climbing perch	MOR	MOR	MORT	LC50		h	4	d	1245		mg/L	83	81822
2,4-D	Clarias	batrachus	Walking catfish	MOR	MOR	MORT	LC50		h	4	d	1033.35		mg/L	83	81822
2,4-D	Mystus	vittatus	Striped catfish	MOR	MOR	MORT	LC50		h	4	d	1132.95		mg/L	83	81822
2,4-D	Wallago	attu	Wallago	MOR	MOR	MORT	LC50		h	4	d	1220.1		mg/L	83	81822
2,4-D	Tilapia	mossambica	Mozambique tilapia	MOR	MOR	MORT	LC50		h	4	d	1282.35		mg/L	83	81822
2,4-D	Esomus	danrica	Flying barb	MOR	MOR	MORT	LC50		h	4	d	1311.4		mg/L	83	81822
2,4-D	Labeo	rohita	Rohu	MOR	MOR	MORT	LC50		h	4	d	705.5		mg/L	83	81822
2,4-D	Catla	catla	Catla	MOR	MOR	MORT	LC50		h	4	d	664		mg/L	83	81822
2,4-D	Cirrhinus	mrigala	Carp, hawk fish	MOR	MOR	MORT	LC50		h	4	d	614.2		mg/L	83	81822
2,4-D	Heteropneustes	fossilis	Indian catfish	MOR	MOR	MORT	LC50		h	4	d	1037.5		mg/L	83	81822
2,4-D	Clarias	batrachus	Walking catfish	MOR	MOR	MORT	NR-ZERO		h	4	d	68.6		mg/L	98	73350
2,4-D	Clarias	batrachus	Walking catfish	MOR	MOR	MORT	NR-LETH		h	4	d	156.8		mg/L	98	73350
2,4-D	Anabas	testudineus	Climbing perch	MOR	MOR	MORT	LC50		h	4	d	975.25		mg/L	83	81822
2,4-D	Clarias	batrachus	Walking catfish	MOR	MOR	MORT	LC50		h	4	d	119.56		mg/L	98	73350

Chemical Name	Genus	Species	Common Name	Effect Group	Effect	Meas	Endpt1	Endpt2	Dur Unit Orig	Dur Preferred	Dur Unit Preferred	Conc Value1 Preferred	Conc Value2 Preferred	Conc Units Preferred	% Purity	Ref #
2,4-D	Clarias	batrachus	Walking catfish	MOR	MOR	MORT	LC50		h	4	d	958.65		mg/L	83	81822
2,4-D	Heteropneustes	fossilis	Indian catfish	MOR	MOR	MORT	LC50		h	4	d	79.38		mg/L	98	73350
2,4-D	Mystus	vittatus	Striped catfish	MOR	MOR	MORT	LC50		h	4	d	1020.9		mg/L	83	81822
2,4-D	Wallago	attu	Wallago	MOR	MOR	MORT	LC50		h	4	d	1012.6		mg/L	83	81822
2,4-D	Tilapia	mossambica	Mozambique tilapia	MOR	MOR	MORT	LC50		h	4	d	996		mg/L	83	81822
2,4-D	Channa	punctata	Snake-head catfish	MOR	MOR	MORT	NR-LETH		h	4	d	147		mg/L	98	73350
2,4-D	Esomus	danrica	Flying barb	MOR	MOR	MORT	LC50		h	4	d	1033.35		mg/L	83	81822
2,4-D	Channa	punctata	Snake-head catfish	MOR	MOR	MORT	NR-ZERO		h	4	d	58.8		mg/L	98	73350
2,4-D	Culex	pipiens	House mosquito	MOR	MOR	MORT	NR-ZERO		h	4	d	49		mg/L	98	73350
2,4-D	Culex	pipiens	House mosquito	MOR	MOR	MORT	NR-LETH		h	4	d	490		mg/L	98	73350
2,4-D	Culex	pipiens	House mosquito	MOR	MOR	MORT	LC50		h	4	d	295.96		mg/L	98	73350
2,4-D	Channa	punctata	Snake-head catfish	MOR	MOR	MORT	LC50		h	4	d	104.86		mg/L	98	73350
2,4-D	Daphnia	magna	Water flea	MOR	MOR	MORT	LC50		h	4	d	1000		mg/L	100	4740
2,4-D	Brachionus	patulus	Rotifer	MOR	MOR	MORT	NR-LETH		d	5	d	500		mg/L	100	72983
2,4-D	Brachionus	patulus	Rotifer	MOR	MOR	MORT	NR-LETH		d	5	d	500		mg/L	100	72983
2,4-D	Daphnia	magna	Water flea	MOR	MOR	SVVS	NOAEL		d	6	d	0.1		mg/L	100	93397
2,4-D	Lycopersicon	esculentum	Tomato	MOR	MOR	MORT	NR-LETH		d	4	d	500		ppm	100	52847
2,4-D	Vigna	unguiculata	Black-eyed pea	MOR	MOR	MORT	NR-LETH		d	4	d	500		ppm	100	52847
2,4-D	Drosophila	melanogaster	Fruit fly	MOR	MOR	MORT	LD50		h	<=3	d	9.8		mM	98	93411
2,4-D	Rhopalosiphum	padi	Aphid	MOR	MOR	MORT	NOAEL		h	2	d	550		ai g/ha	100	63983
2,4-D	Coccinella	septempunctata	Sevenspotted lady beetle	MOR	MOR	MORT	NOAEL		h	2	d	550		ai g/ha	100	63983
2,4-D	Ceuthorhynchidius	horridus	European Weevil	MOR	MOR	HTCH	NOAEL		wk	~28	d	0.084		kg/ha	100	93656
2,4-D	Rattus	norvegicus	Norway rat	MOR	MOR	SURV	NOAEL		yr	730	d	1250		ppm	99.12	36996
2,4-D	Apis	mellifera	Carniolan Honey Bee	MOR	MOR	MORT	LD50		h	1	d	147.2 TO 151.9		ug/bee	100	39264
2,4-D	Apis	mellifera	Carniolan Honey Bee	MOR	MOR	MORT	LD50		h	1	d	113.3 TO 117		ug/bee	100	39264
2,4-D	Apis	mellifera	Carniolan Honey Bee	MOR	MOR	MORT	LD10		h	1	d	66.3 TO 80		ug/bee	100	39264
2,4-D	Apis	mellifera	Carniolan Honey Bee	MOR	MOR	MORT	LD10		h	1	d	98.9 TO 119.4		ug/bee	100	39264
2,4-D	Oncorhynchus	nerka	Sockeye salmon	MOR	MOR	MORT	NR-ZERO		h	7	d	196		mg/L	98	18424
2,4-D	Daphnia	magna	Water flea	MOR	MOR	MORT	NR-ZERO		h	2	d	2		mM	100	93992
2,4-D	Mus	musculus	House mouse	MOR	MOR	MORT	NOAEL		d	7	d	100		mg/kg	100	89569
2,4-D	Mus	musculus	House mouse	MOR	MOR	MORT	NOAEL		d	7	d	100		mg/kg	100	89569
2,4-D	Mus	musculus	House mouse	MOR	MOR	MORT	NOAEL		d	7	d	100		mg/kg	100	89569
2,4-D	Mus	musculus	House mouse	MOR	MOR	MORT	NOAEL		d	7	d	98		mg/kg	100	89569
2,4-D	Mus	musculus	House mouse	MOR	MOR	MORT	NOAEL		d	8	d	98		mg/kg	100	89569
2,4-D	Mus	musculus	House mouse	MOR	MOR	MORT	NOAEL		d	8	d	98		mg/kg	100	89569
2,4-D	Mus	musculus	House mouse	MOR	MOR	SURV	NOAEL		d	9	d	100		ppm	100	93603
2,4-D	Mus	musculus	House mouse	MOR	MOR	MORT	LOAEL		d	7	d	100		mg/kg bdwt	100	89569
2,4-D	Mus	musculus	House mouse	MOR	MOR	SURV	NOAEL		d	9	d	100		ppm	100	93603
2,4-D	Oncorhynchus	mykiss	Rainbow trout,donaldson trout	MOR	MOR	MORT	LC50		d	27	d	4.2		mg/L	100	563

Chemical Name	Genus	Species	Common Name	Effect Group	Effect	Meas	Endpt1	Endpt2	Dur Unit Orig	Dur Preferred	Dur Unit Preferred	Conc Value1 Preferred	Conc Value2 Preferred	Conc Units Preferred	% Purity	Ref #
2,4-D	Oncorhynchus	mykiss	Rainbow trout,donaldson trout	MOR	MOR	MORT	LC50		d	23	d	4.2		mg/L	100	563
2,4-D	Oncorhynchus	mykiss	Rainbow trout,donaldson trout	MOR	MOR	MORT	LC50		d	27	d	11		mg/L	100	563
2,4-D	Oncorhynchus	mykiss	Rainbow trout,donaldson trout	MOR	MOR	MORT	LC50		d	23	d	11		mg/L	100	563
2,4-D	Micropterus	salmoides	Largemouth bass	MOR	MOR	MORT	LC50		h	3.5	d	165.4		mg/L	100	563
2,4-D	Micropterus	salmoides	Largemouth bass	MOR	MOR	MORT	LC50		d	7.5	d	108.6		mg/L	100	563
2,4-D	Carassius	auratus	Goldfish	MOR	MOR	MORT	LC50		d	8	d	133.1		mg/L	100	563
2,4-D	Carassius	auratus	Goldfish	MOR	MOR	MORT	LC50		h	4	d	201		mg/L	100	563
2,4-D	Carassius	auratus	Goldfish	MOR	MOR	MORT	LC50		h	4	d	187		mg/L	100	563
2,4-D	Carassius	auratus	Goldfish	MOR	MOR	MORT	LC50		d	8	d	119.1		mg/L	100	563
2,4-D	Micropterus	salmoides	Largemouth bass	MOR	MOR	MORT	LC50		h	3.5	d	160.7		mg/L	100	563
2,4-D	Micropterus	salmoides	Largemouth bass	MOR	MOR	MORT	LC50		d	7.5	d	81.6		mg/L	100	563
2,4-D	Lepomis	macrochirus	Bluegill	MOR	MOR	MORT	LC50*		h	1	d	8		mg/L	100	612
2,4-D	Lepomis	macrochirus	Bluegill	MOR	MOR	MORT	LC50*		h	2	d	8		mg/L	100	612
2,4-D	Micropterus	salmoides	Largemouth bass	MOR	MOR	MORT	NR-ZERO		d	140	d	0.005 TO 1.631		mg/L	100	2757
2,4-D	Lepomis	macrochirus	Bluegill	MOR	MOR	MORT	NR-ZERO		d	140	d	0.005 TO 1.631		mg/L	100	2757
2,4-D	Ictalurus	punctatus	Channel catfish	MOR	MOR	MORT	NR-ZERO		d	140	d	0.005 TO 1.631		mg/L	100	2757
2,4-D	Lepomis	microlophus	Redear sunfish	MOR	MOR	MORT	NR-ZERO		d	140	d	0.005 TO 1.631		mg/L	100	2757
2,4-D	Ceriodaphnia	dubia	Water flea	MOR	MOR	MORT	LC50		h	2	d	236		mg/L	100	3590
2,4-D	Brachionus	calyciflorus	Rotifer	MOR	MOR	MORT	LC50		d	2	d	117		mg/L	100	3963
2,4-D	Cyprinus	carpio	common carp	MOR	MOR	MORT	LC50		h	1	d	310		mg/L	100	4321
2,4-D	Cyprinus	carpio	common carp	MOR	MOR	MORT	LC50		h	4	d	270		mg/L	100	4321
2,4-D	Cyprinus	carpio	common carp	MOR	MOR	MORT	LC50		h	2	d	295		mg/L	100	4321
2,4-D	Penaeus	monodon	Jumbo tiger prawn	MOR	MOR	MORT	NR-LETH		h	2	d	10		mg/L	100	4581
2,4-D	Penaeus	monodon	Jumbo tiger prawn	MOR	MOR	MORT	NR-LETH		h	1	d	10		mg/L	100	4581
2,4-D	Penaeus	monodon	Jumbo tiger prawn	MOR	MOR	MORT	NR-LETH		h	2	d	10		mg/L	100	4581
2,4-D	Penaeus	monodon	Jumbo tiger prawn	MOR	MOR	MORT	NR-LETH		h	1	d	10		mg/L	100	4581
2,4-D	Spicodiatomus	chilospinus	Calanoid copepod	MOR	MOR	MORT	LC50*		h	1	d	2.4		mg/L	100	5264
2,4-D	Spicodiatomus	chilospinus	Calanoid copepod	MOR	MOR	MORT	LC50*		h	2	d	1.85		mg/L	100	5264
2,4-D	Cyprinus	carpio	common carp	MOR	MOR	MORT	LC50*		h	1	d	38.72		mg/L	100	6387
2,4-D	Cyprinus	carpio	common carp	MOR	MOR	MORT	LC50*		h	4	d	24.15		mg/L	100	6387
2,4-D	Cyprinus	carpio	common carp	MOR	MOR	MORT	LC50*		h	1	d	35.72		mg/L	100	6387
2,4-D	Cyprinus	carpio	common carp	MOR	MOR	MORT	LC50*		h	2	d	21.3		mg/L	100	6387
2,4-D	Cyprinus	carpio	common carp	MOR	MOR	MORT	LC50*		h	4	d	15.3		mg/L	100	6387
2,4-D	Cyprinus	carpio	common carp	MOR	MOR	MORT	LC50*		h	2	d	18.4		mg/L	100	6387
2,4-D	Cyprinus	carpio	common carp	MOR	MOR	MORT	LC50*		h	4	d	5.1		mg/L	100	6387
2,4-D	Cyprinus	carpio	common carp	MOR	MOR	MORT	LC50*		h	1	d	5.93		mg/L	100	6387
2,4-D	Cyprinus	carpio	common carp	MOR	MOR	MORT	LC50*		h	4	d	31.25		mg/L	100	6387
2,4-D	Cyprinus	carpio	common carp	MOR	MOR	MORT	LC50*		h	2	d	42.5		mg/L	100	6387
2,4-D	Cyprinus	carpio	common carp	MOR	MOR	MORT	LC50*		h	2	d	35.38		mg/L	100	6387

Chemical Name	Genus	Species	Common Name	Effect Group	Effect	Meas	Endpt1	Endpt2	Dur Unit Orig	Dur Preferred	Dur Unit Preferred	Conc Value1 Preferred	Conc Value2 Preferred	Conc Units Preferred	% Purity	Ref #
2,4-D	Cyprinus	carpio	common carp	MOR	MOR	MORT	LC50*		h	1	d	45		mg/L	100	6387
2,4-D	Cyprinus	carpio	common carp	MOR	MOR	MORT	LC50*		h	1	d	35.72		mg/L	100	6387
2,4-D	Cyprinus	carpio	common carp	MOR	MOR	MORT	LC50*		h	4	d	20		mg/L	100	6387
2,4-D	Cyprinus	carpio	common carp	MOR	MOR	MORT	LC50*		h	2	d	35.72		mg/L	100	6387
2,4-D	Cyprinus	carpio	common carp	MOR	MOR	MORT	LC50*		h	1	d	20		mg/L	100	6387
2,4-D	Cyprinus	carpio	common carp	MOR	MOR	MORT	LC50*		h	2	d	5.8		mg/L	100	6387
2,4-D	Lumbriculus	variegatus	Oligochaete, worm	MOR	MOR	MORT	LC50		h	2	d	122.2		mg/L	100	6502
2,4-D	Lumbriculus	variegatus	Oligochaete, worm	MOR	MOR	MORT	LC50		h	4	d	122.2		mg/L	100	6502
2,4-D	Cancer	magister	Dungeness or edible crab	MOR	MOR	MORT	NOEC		d	>=69	d	10		mg/L	98	6793
2,4-D	Cancer	magister	Dungeness or edible crab	MOR	MOR	MORT	LC50		h	4	d	100		mg/L	98	6793
2,4-D	Cancer	magister	Dungeness or edible crab	MOR	MOR	MORT	NR-LETH		d	60 TO 65	d	10		mg/L	98	6793
2,4-D	Cancer	magister	Dungeness or edible crab	MOR	MOR	MORT	NOEC		d	>=69	d	10		mg/L	98	6793
2,4-D	Cancer	magister	Dungeness or edible crab	MOR	MOR	HTCH	NOEC		h	1	d	100		mg/L	98	6793
2,4-D	Cancer	magister	Dungeness or edible crab	MOR	MOR	MORT	LC50		h	4	d	10		mg/L	98	6793
2,4-D	Ameiurus	nebulosus	Brown bullhead	MOR	MOR	MORT	NR-LETH		d	7	d	3000		mg/L	100	8071
2,4-D	Lepomis	gibbosus	Pumpkinseed	MOR	MOR	MORT	NR-LETH		d	7	d	1500		mg/L	100	8071
2,4-D	NR	Cyprinodontidae	Killifish, topminnow family	MOR	MOR	MORT	NR-LETH		d	7	d	2500		mg/L	100	8071
2,4-D	Mytilus	edulis	Common bay mussel, blue mussel	MOR	MOR	MORT	LC50*		h	4	d	259		mg/L	100	8127
2,4-D	Wolffia	papulifera	Water-meal	MOR	MOR	MORT	NR-LETH		d	12 TO 30	d	1000		mg/L	100	9184
2,4-D	Brachionus	calyciflorus	Rotifer	MOR	MOR	MORT	LC50		h	1	d	117		mg/L	100	9385
2,4-D	Brachionus	calyciflorus	Rotifer	MOR	MOR	MORT	LT50		h	1	d	5		mg/L	100	10460
2,4-D	Brachionus	calyciflorus	Rotifer	MOR	MOR	MORT	NR-LETH		h	1.2916667	d	5		mg/L	100	10460
2,4-D	Daphnia	magna	Water flea	MOR	MOR	MORT	LC50		h	2	d	25		mg/L	100	11504
2,4-D	Daphnia	magna	Water flea	MOR	MOR	MORT	LC50		h	2	d	36.4		mg/L	100	11504
2,4-D	Lepomis	macrochirus	Bluegill	MOR	MOR	MORT	LC50		h	1	d	305		mg/L	100	11504
2,4-D	Lepomis	macrochirus	Bluegill	MOR	MOR	MORT	LC50		h	3	d	263		mg/L	100	11504
2,4-D	Lepomis	macrochirus	Bluegill	MOR	MOR	MORT	LC50		h	2	d	290		mg/L	100	11504
2,4-D	Lepomis	macrochirus	Bluegill	MOR	MOR	MORT	LC50		h	4	d	263		mg/L	100	11504
2,4-D	Pimephales	promelas	Fathead minnow	MOR	MOR	MORT	LC50		h	1	d	344		mg/L	100	11504
2,4-D	Pimephales	promelas	Fathead minnow	MOR	MOR	MORT	LC50		h	3	d	325		mg/L	100	11504
2,4-D	Pimephales	promelas	Fathead minnow	MOR	MOR	MORT	LC50		h	2	d	325		mg/L	100	11504
2,4-D	Pimephales	promelas	Fathead minnow	MOR	MOR	MORT	LC50		h	4	d	263		mg/L	100	11504
2,4-D	Oncorhynchus	mykiss	Rainbow trout, donaldson trout	MOR	MOR	MORT	LC50		h	4	d	358		mg/L	100	11504
2,4-D	Oncorhynchus	mykiss	Rainbow trout, donaldson trout	MOR	MOR	MORT	LC50		h	2	d	358		mg/L	100	11504
2,4-D	Oncorhynchus	mykiss	Rainbow trout, donaldson trout	MOR	MOR	MORT	LC50		h	3	d	358		mg/L	100	11504

Chemical Name	Genus	Species	Common Name	Effect Group	Effect	Meas	Endpt1	Endpt2	Dur Unit Orig	Dur Preferred	Dur Unit Preferred	Conc Value1 Preferred	Conc Value2 Preferred	Conc Units Preferred	% Purity	Ref #
2,4-D	Oncorhynchus	mykiss	Rainbow trout,donaldson trout	MOR	MOR	MORT	LC50		h	1	d	358		mg/L	100	11504
2,4-D	Daphnia	magna	Water flea	MOR	MOR	MORT	LC50		h	1	d	100		mg/L	100	11504
2,4-D	Daphnia	magna	Water flea	MOR	MOR	MORT	LC50		h	1	d	100		mg/L	100	11504
2,4-D	Oncorhynchus	kisutch	Coho salmon,silver salmon	MOR	MOR	MORT	NR-ZERO		mi	4.17E-02	d	30		mg/L	100	14329
2,4-D	Myriophyllum	spicatum	Eurasian watermilfoil	MOR	MOR	MORT	NR-LETH		h	0.5 TO 3	d	1.02		mg/L	100	14896
2,4-D	Oryzias	latipes	Medaka, high-eyes	MOR	MOR	MORT	NR-LETH		h	4	d	4560		mg/L	100	14908
2,4-D	Oryzias	latipes	Medaka, high-eyes	MOR	MOR	MORT	NOEC		d	28	d	27.2		mg/L	100	14908
2,4-D	Oryzias	latipes	Medaka, high-eyes	MOR	MOR	MORT	NOEC		d	28	d	30		mg/L	100	14908
2,4-D	Oryzias	latipes	Medaka, high-eyes	MOR	MOR	MORT	MATC		d	28	d	39.2		mg/L	100	14908
2,4-D	Oryzias	latipes	Medaka, high-eyes	MOR	MOR	MORT	LOEC		d	28	d	56.5		mg/L	100	14908
2,4-D	Oryzias	latipes	Medaka, high-eyes	MOR	MOR	MORT	NR-LETH		d	28	d	221		mg/L	100	14908
2,4-D	Oryzias	latipes	Medaka, high-eyes	MOR	MOR	MORT	NR-ZERO		h	4	d	1100		mg/L	100	14908
2,4-D	Oryzias	latipes	Medaka, high-eyes	MOR	MOR	MORT	MATC		d	28	d	42.5		mg/L	100	14908
2,4-D	Oryzias	latipes	Medaka, high-eyes	MOR	MOR	MORT	LC50		h	4	d	2780		mg/L	100	14908
2,4-D	Oryzias	latipes	Medaka, high-eyes	MOR	MOR	MORT	LOEC		d	28	d	60.2		mg/L	100	14908
2,4-D	Phyllospora	comosa	Brown algae	MOR	MOR	MORT	NOEC		h	4	d	100		mg/L	100	14985
2,4-D	Phyllospora	comosa	Brown algae	MOR	MOR	MORT	NR-LETH		h	1	d	1000		mg/L	100	14985
2,4-D	Phyllospora	comosa	Brown algae	MOR	MOR	MORT	LOEC		h	4	d	1000		mg/L	100	14985
2,4-D	Phyllospora	comosa	Brown algae	MOR	MOR	MORT	LOEC		h	4	d	100		mg/L	100	14985
2,4-D	Phyllospora	comosa	Brown algae	MOR	MOR	MORT	NOEC		h	4	d	10		mg/L	100	14985
2,4-D	Brachionus	plicatilis	Rotifer	MOR	MOR	MORT	LC50		h	1	d	598		mg/L	100	16539
2,4-D	Oryzias	latipes	Medaka, high-eyes	MOR	MOR	MORT	NR-LETH		d	28	d	217		mg/L	100	17120
2,4-D	Danio	rerio	Zebra danio	MOR	MOR	MORT	LC50		h	0.1666667	d	100		mg/L	100	17456
2,4-D	Danio	rerio	Zebra danio	MOR	MOR	MORT	LC50		h	1	d	100		mg/L	100	17456
2,4-D	Danio	rerio	Zebra danio	MOR	MOR	MORT	LC50		h	0.25	d	100		mg/L	100	17456
2,4-D	Danio	rerio	Zebra danio	MOR	MOR	MORT	LC50		h	8.33E-02	d	100		mg/L	100	17456
2,4-D	Brachionus	calyciflorus	Rotifer	MOR	MOR	MORT	LC50		h	1	d	117		mg/L	100	17689
2,4-D	Potamogeton	pectinatus	Sago pondweed	MOR	MOR	MORT	NR-ZERO		d	0 TO 60	d	0.1		mg/L	100	17961
2,4-D	Myriophyllum	sibiricum	Water milfoil	MOR	MOR	MORT	NR-ZERO		d	0 TO 60	d	0.01		mg/L	100	17961
2,4-D	Ceriodaphnia	dubia	Water flea	MOR	MOR	MORT	EC50		h	5.21E-02	d	422		mg/L	100	18961
2,4-D	Brachionus	calyciflorus	Rotifer	MOR	MOR	MORT	LC50		h	1	d	422		mg/L	100	18961
2,4-D	Tinca	tinca	Tench	MOR	MOR	MORT	LC50		h	4	d	800		mg/L	100	20178
2,4-D	Nothobranchius	guentheri	Killifish	MOR	MOR	MORT	LC50		h	1	d	90		mg/L	100	20487
2,4-D	Nothobranchius	guentheri	Killifish	MOR	MOR	MORT	EC50		h	1	d	80		mg/L	100	20487
2,4-D	Ampelisca	araucana	Gammarid amphipod	MOR	MOR	MORT	LC50		h	2	d	0.0912		mg/L	100	54390
2,4-D	Xenopus	laevis	African clawed frog	MOR	MOR	MORT	LC50		h	4	d	251.46		mg/L	99	63246
2,4-D	Xenopus	laevis	African clawed frog	MOR	MOR	MORT	LC50		h	4	d	267.3		mg/L	99	63246
2,4-D	Ligumia	subrostrata	Pondmussel	MOR	MOR	MORT	NOEC		h	1	d	181.15		mg/L	100	81810
2,4-D	Daphnia	magna	Water flea	MOR	MOR	MORT	NOEC		h	1	d	263.88		mg/L	100	81810
2,4-D	Lampsilis	siliquoidea	Lamp-mussel	MOR	MOR	MORT	NOEC		h	1	d	191.7		mg/L	100	81810
2,4-D	Lampsilis	siliquoidea	Lamp-mussel	MOR	MOR	MORT	LC50		h	1	d	362.2		mg/L	100	81810
2,4-D	Megaloniaias	nervosa	Washboard mussel	MOR	MOR	MORT	LC50		h	1	d	247.9		mg/L	100	81810
2,4-D	Megaloniaias	nervosa	Washboard mussel	MOR	MOR	MORT	NOEC		h	1	d	191.7		mg/L	100	81810
2,4-D	Utterbackia	imbecillis	Paper pondshell	MOR	MOR	MORT	LC50		h	1	d	436.5		mg/L	100	81810

Chemical Name	Genus	Species	Common Name	Effect Group	Effect	Meas	Endpt1	Endpt2	Dur Unit Orig	Dur Preferred	Dur Unit Preferred	Conc Value1 Preferred	Conc Value2 Preferred	Conc Units Preferred	% Purity	Ref #
2,4-D	Utterbackia	imbecillis	Paper pondshell	MOR	MOR	MORT	NOEC		h	1	d	226.45		mg/L	100	81810
2,4-D	Daphnia	magna	Water flea	MOR	MOR	MORT	LC50		h	1	d	415.7		mg/L	100	81810
2,4-D	Ligumia	subrostrata	Pondmussel	MOR	MOR	MORT	LC50		h	1	d	352.9		mg/L	100	81810
2,4-D	Leptodea	fragilis	Fragile Papershell	MOR	MOR	MORT	NOEC		h	1	d	153.4		mg/L	100	81810
2,4-D	Leptodea	fragilis	Fragile Papershell	MOR	MOR	MORT	LC50		h	1	d	8.18		mg/L	100	81810
2,4-D	Lampsilis	cardium	Plain Pocketbook	MOR	MOR	MORT	LC50		h	1	d	402.3		mg/L	100	81810
2,4-D	Lampsilis	cardium	Plain Pocketbook	MOR	MOR	MORT	NOEC		h	1	d	191.7		mg/L	100	81810
2,4-D	Ceriodaphnia	dubia	Water flea	MOR	MOR	MORT	NOEC		h	1	d	166.2		mg/L	100	81810
2,4-D	Ceriodaphnia	dubia	Water flea	MOR	MOR	MORT	LC50		h	1	d	272.5		mg/L	100	81810
2,4-D	Anas	platyrhynchos	Mallard duck	MOR	MOR	MORT	LD50		d	18	d	192		lb/acre	100	35249
2,4-D	Anas	platyrhynchos	Mallard duck	MOR	MOR	MORT	LD50		d	18	d	41.8		lb/acre	100	35249
2,4-D	Eisenia	fetida	earthworm	MOR	MOR	MORT	LC50		h	2	d	61.6		AI ug/cm2	100	40531
2,4-D	Rattus	norvegicus	Norway rat	MOR	MOR	MORT	LOAEL		wk	28	d	69.93		mg/kg bdwt	99.9	94125
2,4-D	Rattus	norvegicus	Norway rat	MOR	MOR	MORT	LOAEL		wk	28	d	69.93		mg/kg bdwt	99.9	94125
2,4-D	Rattus	norvegicus	Norway rat	MOR	MOR	MORT	LOAEL		wk	28	d	149.85		mg/kg bdwt	99.9	94125
2,4-D	Mus	musculus	House mouse	MOR	MOR	MORT	NOAEL		d	9	d	0.504		mM/kg bdwt	90	36267
2,4-D	Mus	musculus	House mouse	MOR	MOR	MORT	LOAEL		d	4	d	0.72		mM/kg bdwt	90	36267
2,4-D	Mus	musculus	House mouse	MOR	MOR	MORT	NOAEL		d	4	d	0.9		mM/kg bdwt	90	36267
2,4-D	Mus	musculus	House mouse	MOR	MOR	MORT	LOAEL		d	4	d	0.9		mM/kg bdwt	90	36267
2,4-D	Rattus	norvegicus	Norway rat	MOR	MOR	MORT	NR-ZERO		wk	91	d	150		ppm	97.3	93388
2,4-D	Rattus	norvegicus	Norway rat	MOR	MOR	MORT	NR-ZERO		wk	91	d	150		ppm	97.3	93388
2,4-D	Mus	musculus	House mouse	MOR	MOR	MORT	NOAEL		wk	105	d	50		ppm	100	93408
2,4-D	Rattus	norvegicus	Norway rat	MOR	MOR	MORT	NR-ZERO		wk	91	d	150		ppm	100	93388
2,4-D	Rattus	norvegicus	Norway rat	MOR	MOR	MORT	NR-ZERO		wk	91	d	150		ppm	100	93388
2,4-D	Rattus	norvegicus	Norway rat	MOR	MOR	MORT	NR-ZERO		d	15	d	75		ae mg/kg/d	97.5	93515
2,4-D	Rattus	norvegicus	Norway rat	MOR	MOR	MORT	NOAEL		d	15	d	75		ae mg/kg/d	97.5	93515
2,4-D	Oryctolagus	cuniculus	European rabbit	MOR	MOR	MORT	NR-ZERO		d	23	d	90		ae mg/kg/d	97.5	93515
2,4-D	Oryctolagus	cuniculus	European rabbit	MOR	MOR	MORT	NOAEL		d	23	d	90		ae mg/kg/d	97.5	93515
2,4-D	Tetrahymena	pyriformis	Ciliate	MOR	MOR	MORT	LC50		h	1	d	500		mg/L	100	60864
2,4-D butoxyethyl ester	Crassostrea	virginica	American or virginia oyster	MOR	MOR	MORT	NR-ZERO		d	7	d	0.1		mg/L	100	14134
2,4-D butoxyethyl ester	Pleurobema	cordatum	Ohio Pigtoe	MOR	MOR	MORT	NR-ZERO		d	7	d	5		mg/L	100	14134
2,4-D butoxyethyl ester	Crassostrea	virginica	American or virginia oyster	MOR	MOR	MORT	EC50		h	4	d	3.75		mg/L	100	14134
2,4-D butoxyethyl ester	Fundulus	similis	Longnose killifish	MOR	MOR	MORT	LC50		h	2	d	5		mg/L	100	14134

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2,4-D butoxyethyl ester	Oncorhynchus	nerka	Sockeye salmon	MOR	MOR	MORT	LC50		h	4	d	0.45		ae mg/L	100	18424
2,4-D butoxyethyl ester	Oncorhynchus	kisutch	Coho salmon,silver salmon	MOR	MOR	MORT	LC50		h	4	d	0.45		ae mg/L	100	18424
2,4-D butoxyethyl ester	Oncorhynchus	gorbuscha	Pink salmon	MOR	MOR	MORT	LC50		h	4	d	0.45		ae mg/L	100	18424
2,4-D butoxyethyl ester	Oncorhynchus	nerka	Sockeye salmon	MOR	MOR	MORT	LC50		h	4	d	0.45 TO 0.54		ae mg/L	100	18424
2,4-D butoxyethyl ester	Oncorhynchus	mykiss	Rainbow trout,donaldson trout	MOR	MOR	MORT	LC50		h	4	d	0.2 TO 0.4		ae mg/L	100	18424
2,4-D butoxyethyl ester	Oncorhynchus	nerka	Sockeye salmon	MOR	MOR	MORT	NR-ZERO	NR-LETH	h	4	d	0.22	0.54	ae mg/L	100	18424
2,4-D butoxyethyl ester	Oncorhynchus	nerka	Sockeye salmon	MOR	MOR	MORT	NR-ZERO	NR-LETH	h	4	d	0.416	0.54	ae mg/L	100	18424
2,4-D butoxyethyl ester	Oncorhynchus	kisutch	Coho salmon,silver salmon	MOR	MOR	MORT	NR-ZERO	NR-LETH	h	4	d	0.22	0.54	ae mg/L	100	18424
2,4-D butoxyethyl ester	Oncorhynchus	gorbuscha	Pink salmon	MOR	MOR	MORT	NR-ZERO	NR-LETH	h	4	d	0.22	0.54	ae mg/L	100	18424
2,4-D butoxyethyl ester	Oncorhynchus	mykiss	Rainbow trout,donaldson trout	MOR	MOR	MORT	NR-ZERO		h	4	d	0.22		ae mg/L	100	18424
2,4-D butoxyethyl ester	Oncorhynchus	mykiss	Rainbow trout,donaldson trout	MOR	MOR	MORT	NR-LETH		h	7	d	0.416		ae mg/L	100	18424
2,4-D butoxyethyl ester	Oncorhynchus	gorbuscha	Pink salmon	MOR	MOR	MORT	NR-ZERO	NR-LETH	h	7	d	0.075	0.416	ae mg/L	100	18424
2,4-D butoxyethyl ester	Oncorhynchus	kisutch	Coho salmon,silver salmon	MOR	MOR	MORT	NR-LETH		h	7	d	0.416		ae mg/L	100	18424
2,4-D butoxyethyl ester	Oncorhynchus	mykiss	Rainbow trout,donaldson trout	MOR	MOR	MORT	NR-ZERO	NR-LETH	h	7	d	0.075	0.416	ae mg/L	100	18424
2,4-D butoxyethyl ester	Oncorhynchus	mykiss	Rainbow trout,donaldson trout	MOR	MOR	MORT	NR-ZERO	NR-LETH	h	7	d	0.075	0.416	ae mg/L	100	18424
2,4-D butoxyethyl ester	Lepomis	macrochirus	Bluegill	MOR	MOR	MORT	LC50*		h	2	d	2.1		mg/L	100	612
2,4-D butoxyethyl ester	Lepomis	macrochirus	Bluegill	MOR	MOR	MORT	LC50*		h	2	d	1.1		mg/L	100	612
2,4-D butoxyethyl ester	Lepomis	macrochirus	Bluegill	MOR	MOR	MORT	LC50*		h	1	d	2.1		mg/L	100	612
2,4-D butoxyethyl ester	Lepomis	macrochirus	Bluegill	MOR	MOR	MORT	LC50*		h	1	d	1.1		mg/L	100	612
2,4-D butoxyethyl ester	Lepomis	macrochirus	Bluegill	MOR	MOR	MORT	LC50		h	1	d	36.5		mg/L	100	879
2,4-D butoxyethyl ester	Lepomis	macrochirus	Bluegill	MOR	MOR	MORT	LC50		h	1	d	43.4		mg/L	100	879
2,4-D butoxyethyl ester	Lepomis	macrochirus	Bluegill	MOR	MOR	MORT	LC50		h	1	d	2.1		mg/L	100	879

Chemical Name	Genus	Species	Common Name	Effect Group	Effect	Meas	Endpt1	Endpt2	Dur Unit Orig	Dur Preferred	Dur Unit Preferred	Conc Value1 Preferred	Conc Value2 Preferred	Conc Units Preferred	% Purity	Ref #
2,4-D butoxyethyl ester	Lepomis	macrochirus	Bluegill	MOR	MOR	MORT	LC50		h	2	d	2.1		mg/L	100	879
2,4-D butoxyethyl ester	Lepomis	macrochirus	Bluegill	MOR	MOR	MORT	LC50		h	2	d	34.5		mg/L	100	879
2,4-D butoxyethyl ester	Lepomis	macrochirus	Bluegill	MOR	MOR	MORT	LC50		h	2	d	41.4		mg/L	100	879
2,4-D butoxyethyl ester	Ameiurus	melas	Black bullhead	MOR	MOR	MORT	LC50		h	0.25	d	8.9		mg/L	100	2135
2,4-D butoxyethyl ester	Lepomis	macrochirus	Bluegill	MOR	MOR	MORT	LC50		h	0.5	d	2.12		mg/L	100	2135
2,4-D butoxyethyl ester	Lepomis	macrochirus	Bluegill	MOR	MOR	MORT	LC50		h	0.25	d	2.03		mg/L	100	2135
2,4-D butoxyethyl ester	Lepomis	macrochirus	Bluegill	MOR	MOR	MORT	LC50		h	0.25	d	2.09		mg/L	100	2135
2,4-D butoxyethyl ester	Lepomis	macrochirus	Bluegill	MOR	MOR	MORT	LC50		h	1	d	1.54		mg/L	100	2135
2,4-D butoxyethyl ester	Lepomis	macrochirus	Bluegill	MOR	MOR	MORT	LC50		h	1	d	1.46		mg/L	100	2135
2,4-D butoxyethyl ester	Lepomis	macrochirus	Bluegill	MOR	MOR	MORT	LC50		h	0.25	d	2.65		mg/L	100	2135
2,4-D butoxyethyl ester	Lepomis	macrochirus	Bluegill	MOR	MOR	MORT	LC50		h	0.25	d	2.5		mg/L	100	2135
2,4-D butoxyethyl ester	Lepomis	macrochirus	Bluegill	MOR	MOR	MORT	LC50		h	2	d	1.51		mg/L	100	2135
2,4-D butoxyethyl ester	Lepomis	macrochirus	Bluegill	MOR	MOR	MORT	LC50		h	1	d	1.74		mg/L	100	2135
2,4-D butoxyethyl ester	Lepomis	macrochirus	Bluegill	MOR	MOR	MORT	LC50		h	0.5	d	2		mg/L	100	2135
2,4-D butoxyethyl ester	Lepomis	macrochirus	Bluegill	MOR	MOR	MORT	LC50		h	0.25	d	2.16		mg/L	100	2135
2,4-D butoxyethyl ester	Lepomis	macrochirus	Bluegill	MOR	MOR	MORT	LC50		h	2	d	1.38		mg/L	100	2135
2,4-D butoxyethyl ester	Lepomis	macrochirus	Bluegill	MOR	MOR	MORT	LC50		h	1	d	1.71		mg/L	100	2135
2,4-D butoxyethyl ester	Lepomis	macrochirus	Bluegill	MOR	MOR	MORT	LC50		h	0.5	d	2.02		mg/L	100	2135
2,4-D butoxyethyl ester	Lepomis	macrochirus	Bluegill	MOR	MOR	MORT	LC50		h	0.25	d	2.5		mg/L	100	2135
2,4-D butoxyethyl ester	Lepomis	macrochirus	Bluegill	MOR	MOR	MORT	LC50		h	2	d	1.47		mg/L	100	2135
2,4-D butoxyethyl ester	Lepomis	macrochirus	Bluegill	MOR	MOR	MORT	LC50		h	1	d	1.98		mg/L	100	2135
2,4-D butoxyethyl ester	Lepomis	macrochirus	Bluegill	MOR	MOR	MORT	LC50		h	1	d	1.68		mg/L	100	2135
2,4-D butoxyethyl ester	Oncorhynchus	mykiss	Rainbow trout, donaldson trout	MOR	MOR	MORT	LC50		h	1	d	1.56		mg/L	100	2135

Chemical Name	Genus	Species	Common Name	Effect Group	Effect	Meas	Endpt1	Endpt2	Dur Unit Orig	Dur Preferred	Dur Unit Preferred	Conc Value1 Preferred	Conc Value2 Preferred	Conc Units Preferred	% Purity	Ref #
2,4-D butoxyethyl ester	Oncorhynchus	mykiss	Rainbow trout,donaldson trout	MOR	MOR	MORT	LC50		h	0.5	d	1.98		mg/L	100	2135
2,4-D butoxyethyl ester	Oncorhynchus	mykiss	Rainbow trout,donaldson trout	MOR	MOR	MORT	LC50		h	2	d	1.5		mg/L	100	2135
2,4-D butoxyethyl ester	Oncorhynchus	mykiss	Rainbow trout,donaldson trout	MOR	MOR	MORT	LC50		h	2	d	1.46		mg/L	100	2135
2,4-D butoxyethyl ester	Oncorhynchus	mykiss	Rainbow trout,donaldson trout	MOR	MOR	MORT	LC50		h	0.25	d	3.44		mg/L	100	2135
2,4-D butoxyethyl ester	Oncorhynchus	mykiss	Rainbow trout,donaldson trout	MOR	MOR	MORT	LC50		h	0.25	d	3.2		mg/L	100	2135
2,4-D butoxyethyl ester	Oncorhynchus	mykiss	Rainbow trout,donaldson trout	MOR	MOR	MORT	LC50		h	0.25	d	2.81		mg/L	100	2135
2,4-D butoxyethyl ester	Oncorhynchus	mykiss	Rainbow trout,donaldson trout	MOR	MOR	MORT	LC50		h	1	d	1.56		mg/L	100	2135
2,4-D butoxyethyl ester	Oncorhynchus	mykiss	Rainbow trout,donaldson trout	MOR	MOR	MORT	LC50		h	0.5	d	1.96		mg/L	100	2135
2,4-D butoxyethyl ester	Oncorhynchus	mykiss	Rainbow trout,donaldson trout	MOR	MOR	MORT	LC50		h	0.5	d	1.94		mg/L	100	2135
2,4-D butoxyethyl ester	Oncorhynchus	mykiss	Rainbow trout,donaldson trout	MOR	MOR	MORT	LC50		h	2	d	1.55		mg/L	100	2135
2,4-D butoxyethyl ester	Oncorhynchus	mykiss	Rainbow trout,donaldson trout	MOR	MOR	MORT	LC50		h	1	d	1.52		mg/L	100	2135
2,4-D butoxyethyl ester	Carassius	auratus	Goldfish	MOR	MOR	MORT	LC50		h	0.25	d	5		mg/L	100	2135
2,4-D butoxyethyl ester	Carassius	auratus	Goldfish	MOR	MOR	MORT	LC50		h	2	d	2.65		mg/L	100	2135
2,4-D butoxyethyl ester	Carassius	auratus	Goldfish	MOR	MOR	MORT	LC50		h	1	d	3.63		mg/L	100	2135
2,4-D butoxyethyl ester	Carassius	auratus	Goldfish	MOR	MOR	MORT	LC50		h	0.5	d	4.5		mg/L	100	2135
2,4-D butoxyethyl ester	Carassius	auratus	Goldfish	MOR	MOR	MORT	LC50		h	2	d	3.62		mg/L	100	2135
2,4-D butoxyethyl ester	Carassius	auratus	Goldfish	MOR	MOR	MORT	LC50		h	0.25	d	5.17		mg/L	100	2135
2,4-D butoxyethyl ester	Carassius	auratus	Goldfish	MOR	MOR	MORT	LC50		h	0.25	d	5.78		mg/L	100	2135
2,4-D butoxyethyl ester	Carassius	auratus	Goldfish	MOR	MOR	MORT	LC50		h	1	d	3.98		mg/L	100	2135

Chemical Name	Genus	Species	Common Name	Effect Group	Effect	Meas	Endpt1	Endpt2	Dur Unit Orig	Dur Preferred	Dur Unit Preferred	Conc Value1 Preferred	Conc Value2 Preferred	Conc Units Preferred	% Purity	Ref #
2,4-D butoxyethyl ester	Carassius	auratus	Goldfish	MOR	MOR	MORT	LC50		h	1	d	4.1		mg/L	100	2135
2,4-D butoxyethyl ester	Carassius	auratus	Goldfish	MOR	MOR	MORT	LC50		h	2	d	2.72		mg/L	100	2135
2,4-D butoxyethyl ester	Carassius	auratus	Goldfish	MOR	MOR	MORT	LC50		h	0.5	d	3.95		mg/L	100	2135
2,4-D butoxyethyl ester	Carassius	auratus	Goldfish	MOR	MOR	MORT	LC50		h	0.5	d	4.55		mg/L	100	2135
2,4-D butoxyethyl ester	Ameiurus	melas	Black bullhead	MOR	MOR	MORT	LC50		h	2	d	7.1		mg/L	100	2135
2,4-D butoxyethyl ester	Ameiurus	melas	Black bullhead	MOR	MOR	MORT	LC50		h	1	d	8.8		mg/L	100	2135
2,4-D butoxyethyl ester	Ameiurus	melas	Black bullhead	MOR	MOR	MORT	LC50		h	0.25	d	10.6		mg/L	100	2135
2,4-D butoxyethyl ester	Ameiurus	melas	Black bullhead	MOR	MOR	MORT	LC50		h	0.25	d	11.2		mg/L	100	2135
2,4-D butoxyethyl ester	Ameiurus	melas	Black bullhead	MOR	MOR	MORT	LC50		h	2	d	7.7		mg/L	100	2135
2,4-D butoxyethyl ester	Ameiurus	melas	Black bullhead	MOR	MOR	MORT	LC50		h	1	d	8.7		mg/L	100	2135
2,4-D butoxyethyl ester	Oncorhynchus	mykiss	Rainbow trout,donaldson trout	MOR	MOR	MORT	LC50		h	4	d	0.452		mg/L	100	10642
2,4-D butoxyethyl ester	Oncorhynchus	tshawytscha	Chinook salmon	MOR	MOR	MORT	LC50		h	4	d	0.327		mg/L	100	10642
2,4-D butoxyethyl ester	Oncorhynchus	mykiss	Rainbow trout,donaldson trout	MOR	MOR	MORT	LC50		h	4	d	3.689		mg/L	100	10642
2,4-D butoxyethyl ester	Oncorhynchus	mykiss	Rainbow trout,donaldson trout	MOR	MOR	MORT	LC50		h	4	d	1.206		mg/L	100	10642
2,4-D butoxyethyl ester	Oncorhynchus	mykiss	Rainbow trout,donaldson trout	MOR	MOR	MORT	LC50		h	4	d	0.484		mg/L	100	10642
2,4-D butoxyethyl ester	Oncorhynchus	mykiss	Rainbow trout,donaldson trout	MOR	MOR	MORT	LC50		h	4	d	0.525		mg/L	100	10642
2,4-D butoxyethyl ester	Oncorhynchus	tshawytscha	Chinook salmon	MOR	MOR	MORT	LC50		h	4	d	0.332		mg/L	100	10642
2,4-D butoxyethyl ester	Oncorhynchus	tshawytscha	Chinook salmon	MOR	MOR	MORT	LC50		h	4	d	0.303		mg/L	100	10642
2,4-D butoxyethyl ester	Oncorhynchus	tshawytscha	Chinook salmon	MOR	MOR	MORT	LC50		h	4	d	0.418		mg/L	100	10642
2,4-D butoxyethyl ester	Oncorhynchus	mykiss	Rainbow trout,donaldson trout	MOR	MOR	MORT	LC50		h	4	d	0.512		mg/L	100	10642
2,4-D butoxyethyl ester	Coturnix	japonica	Japanese quail	MOR	MOR	MORT	LC50		d	8	d	3465		mg/kg bdwt	69.3	35243

Chemical Name	Genus	Species	Common Name	Effect Group	Effect	Meas	Endpt1	Endpt2	Dur Unit Orig	Dur Preferred	Dur Unit Preferred	Conc Value1 Preferred	Conc Value2 Preferred	Conc Units Preferred	% Purity	Ref #
2,4-D butoxyethyl ester	Anas	platyrhynchos	Mallard duck	MOR	MOR	MORT	LC50		d	8	d	3465		mg/kg bdwt	69.3	35243
2,4-D butoxyethyl ester	Colinus	virginianus	northern bobwhite	MOR	MOR	MORT	LC50		d	8	d	3465		mg/kg bdwt	69.3	35243
2,4-D butoxyethyl ester	Phasianus	colchicus	ring-necked pheasant	MOR	MOR	MORT	LC50		d	8	d	3465		mg/kg bdwt	69.3	35243
2,4-D butoxyethyl ester	Rattus	norvegicus	Norway rat	MOR	MOR	MORT	NR-ZERO		d	15	d	125		ae mg/kg/d	95.6	93515
2,4-D butoxyethyl ester	Rattus	norvegicus	Norway rat	MOR	MOR	MORT	NOAEL		d	15	d	125		ae mg/kg/d	95.6	93515
2,4-D butoxyethyl ester	Oryctolagus	cuniculus	European rabbit	MOR	MOR	MORT	NOAEL		d	23	d	75		ae mg/kg/d	95.6	93515
2,4-D dimethylamine salt	Cyprinus	carpio	common carp	MOR	MOR	MORT	LC50		h	1	d	320		ppm	40	3241
2,4-D dimethylamine salt	Macrobrachium	sp.	Shrimp	MOR	MOR	MORT	LC50		h	1	d	368		ppm	40	3241
2,4-D dimethylamine salt	Corbicula	sp.	Clam	MOR	MOR	MORT	LC50		h	1	d	368		ppm	40	3241
2,4-D dimethylamine salt	Cyprinus	carpio	common carp	MOR	MOR	MORT	NR-ZERO		h	4	d	87		mg/L	100	93395
2,4-D dimethylamine salt	Procambarus	clarkii	Red swamp crayfish	MOR	MOR	MORT	LC50		h	4	d	185(75 TO 343)		mg/L	38.8	93412
2,4-D dimethylamine salt	Anas	platyrhynchos	Mallard duck	MOR	MOR	MORT	LD50		d	14	d	2000		mg/kg bdwt	100	50386
2,4-D dimethylamine salt	Hyles	euphorbiae	Leafy Spurge Hawk Moth	MOR	MOR	SURV	NOAEL		em	na	em	2.2		kg/ha	100	93347
2,4-D dimethylamine salt	Hyles	euphorbiae	Leafy Spurge Hawk Moth	MOR	MOR	SURV	NOAEL		em	na	em	2.2		kg/ha	100	93347
2,4-D dimethylamine salt	Corbicula	manilensis	Asiatic clam	MOR	MOR	MORT	LC50		h	4	d	0.76		mg/L	100	418
2,4-D dimethylamine salt	Lepomis	macrochirus	Bluegill	MOR	MOR	MORT	LC50*		h	2	d	165		mg/L	100	612
2,4-D dimethylamine salt	Lepomis	macrochirus	Bluegill	MOR	MOR	MORT	LC50*		h	2	d	416		mg/L	100	612
2,4-D dimethylamine salt	Lepomis	macrochirus	Bluegill	MOR	MOR	MORT	LC50*		h	2	d	458		mg/L	100	612
2,4-D dimethylamine salt	Lepomis	macrochirus	Bluegill	MOR	MOR	MORT	LC50*		h	2	d	166		mg/L	100	612
2,4-D dimethylamine salt	Lepomis	macrochirus	Bluegill	MOR	MOR	MORT	LC50*		h	2	d	273		mg/L	100	612
2,4-D dimethylamine salt	Lepomis	macrochirus	Bluegill	MOR	MOR	MORT	LC50*		h	2	d	353		mg/L	100	612
2,4-D dimethylamine salt	Lepomis	macrochirus	Bluegill	MOR	MOR	MORT	LC50*		h	1	d	165		mg/L	100	612
2,4-D dimethylamine salt	Lepomis	macrochirus	Bluegill	MOR	MOR	MORT	LC50*		h	1	d	166		mg/L	100	612
2,4-D dimethylamine salt	Lepomis	macrochirus	Bluegill	MOR	MOR	MORT	LC50*		h	2	d	220		mg/L	100	612

Chemical Name	Genus	Species	Common Name	Effect Group	Effect	Meas	Endpt1	Endpt2	Dur Unit Orig	Dur Preferred	Dur Unit Preferred	Conc Value1 Preferred	Conc Value2 Preferred	Conc Units Preferred	% Purity	Ref #
2,4-D dimethylamine salt	Lepomis	macrochirus	Bluegill	MOR	MOR	MORT	LC50*		h	1	d	220		mg/L	100	612
2,4-D dimethylamine salt	Lepomis	macrochirus	Bluegill	MOR	MOR	MORT	LC50*		h	1	d	273		mg/L	100	612
2,4-D dimethylamine salt	Lepomis	macrochirus	Bluegill	MOR	MOR	MORT	LC50*		h	1	d	390		mg/L	100	612
2,4-D dimethylamine salt	Lepomis	macrochirus	Bluegill	MOR	MOR	MORT	LC50*		h	1	d	500		mg/L	100	612
2,4-D dimethylamine salt	Lepomis	macrochirus	Bluegill	MOR	MOR	MORT	LC50*		h	1	d	542		mg/L	100	612
2,4-D dimethylamine salt	Lepomis	macrochirus	Bluegill	MOR	MOR	MORT	LC50		h	0.25	d	282		mg/L	100	2135
2,4-D dimethylamine salt	Lepomis	macrochirus	Bluegill	MOR	MOR	MORT	LC50		h	2	d	140		mg/L	100	2135
2,4-D dimethylamine salt	Lepomis	macrochirus	Bluegill	MOR	MOR	MORT	LC50		h	1	d	176		mg/L	100	2135
2,4-D dimethylamine salt	Lepomis	macrochirus	Bluegill	MOR	MOR	MORT	LC50		h	1	d	193		mg/L	100	2135
2,4-D dimethylamine salt	Lepomis	macrochirus	Bluegill	MOR	MOR	MORT	LC50		h	0.25	d	290		mg/L	100	2135
2,4-D dimethylamine salt	Lepomis	macrochirus	Bluegill	MOR	MOR	MORT	LC50		h	2	d	144		mg/L	100	2135
2,4-D dimethylamine salt	Crassostrea	virginica	American or virginia oyster	MOR	MOR	MORT	LC50		d	14	d	64.2		mg/L	100	2400
2,4-D dimethylamine salt	Pseudacris	triseriata	Western chorus frog	MOR	MOR	MORT	LC50*		h	1	d	100		mg/L	100	2891
2,4-D dimethylamine salt	Pseudacris	triseriata	Western chorus frog	MOR	MOR	MORT	LC50*		h	4	d	100		mg/L	100	2891
2,4-D dimethylamine salt	Procambarus	clarkii	Red swamp crayfish	MOR	MOR	MORT	LC50		h	4	d	1389		mg/L	100	5245
2,4-D dimethylamine salt	Bufo	bufo	Toad	MOR	MOR	MORT	LC50*		h	1	d	40		mg/L	100	6594
2,4-D dimethylamine salt	Bufo	bufo	Toad	MOR	MOR	MORT	LC50*		h	1	d	40		mg/L	100	6594
2,4-D dimethylamine salt	Bufo	bufo	Toad	MOR	MOR	MORT	LC50*		h	1	d	40		mg/L	100	6594
2,4-D dimethylamine salt	Bufo	bufo	Toad	MOR	MOR	MORT	LC50*		h	1	d	40		mg/L	100	6594
2,4-D dimethylamine salt	Bufo	bufo	Toad	MOR	MOR	MORT	LC50*		h	1	d	40		mg/L	100	6594
2,4-D dimethylamine salt	Bufo	bufo	Toad	MOR	MOR	MORT	LC50*		h	1	d	40		mg/L	100	6594
2,4-D dimethylamine salt	Eichhornia	crassipes	Water-hyacinth	MOR	MOR	MORT	NR-LETH		wk	7 TO 21	d	1000		g/ha	100	10924
2,4-D dimethylamine salt	Pimephales	promelas	Fathead minnow	MOR	MOR	MORT	LC50		h	2	d	382		mg/L	100	11504
2,4-D dimethylamine salt	Daphnia	magna	Water flea	MOR	MOR	MORT	LC50		h	1	d	406		mg/L	100	11504

Chemical Name	Genus	Species	Common Name	Effect Group	Effect	Meas	Endpt1	Endpt2	Dur Unit Orig	Dur Preferred	Dur Unit Preferred	Conc Value1 Preferred	Conc Value2 Preferred	Conc Units Preferred	% Purity	Ref #
2,4-D dimethylamine salt	Daphnia	magna	Water flea	MOR	MOR	MORT	LC50		h	2	d	184		mg/L	100	11504
2,4-D dimethylamine salt	Lepomis	macrochirus	Bluegill	MOR	MOR	MORT	LC50		h	2	d	570		mg/L	100	11504
2,4-D dimethylamine salt	Lepomis	macrochirus	Bluegill	MOR	MOR	MORT	LC50		h	4	d	524		mg/L	100	11504
2,4-D dimethylamine salt	Lepomis	macrochirus	Bluegill	MOR	MOR	MORT	LC50		h	1	d	600		mg/L	100	11504
2,4-D dimethylamine salt	Lepomis	macrochirus	Bluegill	MOR	MOR	MORT	LC50		h	3	d	547		mg/L	100	11504
2,4-D dimethylamine salt	Oncorhynchus	mykiss	Rainbow trout,donaldson trout	MOR	MOR	MORT	LC50		h	4	d	250		mg/L	100	11504
2,4-D dimethylamine salt	Oncorhynchus	mykiss	Rainbow trout,donaldson trout	MOR	MOR	MORT	LC50		h	2	d	258		mg/L	100	11504
2,4-D dimethylamine salt	Oncorhynchus	mykiss	Rainbow trout,donaldson trout	MOR	MOR	MORT	LC50		h	3	d	250		mg/L	100	11504
2,4-D dimethylamine salt	Oncorhynchus	mykiss	Rainbow trout,donaldson trout	MOR	MOR	MORT	LC50		h	1	d	303		mg/L	100	11504
2,4-D dimethylamine salt	Pimephales	promelas	Fathead minnow	MOR	MOR	MORT	LC50		h	3	d	365		mg/L	100	11504
2,4-D dimethylamine salt	Pimephales	promelas	Fathead minnow	MOR	MOR	MORT	LC50		h	1	d	600		mg/L	100	11504
2,4-D dimethylamine salt	Pimephales	promelas	Fathead minnow	MOR	MOR	MORT	LC50		h	4	d	344		mg/L	100	11504
2,4-D dimethylamine salt	Labeo	rohita	Rohu	MOR	MOR	MORT	NR-ZERO		h	4	d	100		mg/L	100	16007
2,4-D dimethylamine salt	Labeo	rohita	Rohu	MOR	MOR	MORT	NR-ZERO		h	1	d	2		mg/L	100	16007
2,4-D dimethylamine salt	Labeo	rohita	Rohu	MOR	MOR	MORT	NR-ZERO		d	24	d	2		mg/L	100	16007
2,4-D dimethylamine salt	Cyprinus	carpio	common carp	MOR	MOR	MORT	NR-ZERO		d	30	d	80		mg/L	100	19598
2,4-D dimethylamine salt	Gallus	domesticus	Domestic Chicken	MOR	MOR	MORT	LD50		h	7	d	420(365 TO 483)		mg/kg bdwt	100	87186
2,4-D dimethylamine salt	Gallus	domesticus	Domestic Chicken	MOR	MOR	MORT	ET50		h	1.10416666 666667(0.6 916666666 66667 TO 1.76666666 666667)	d	500		mg/kg bdwt	100	87186
2,4-D dimethylamine salt	Oryctolagus	cuniculus	European rabbit	MOR	MOR	MORT	LC50		wk	14	d	2244		mg/kg ae	100	93388
2,4-D dimethylamine salt	Rattus	norvegicus	Norway rat	MOR	MOR	MORT	NR-ZERO		d	15	d	100		mg/kg/d	66.2	93515

Chemical Name	Genus	Species	Common Name	Effect Group	Effect	Meas	Endpt1	Endpt2	Dur Unit Orig	Dur Preferred	Dur Unit Preferred	Conc Value1 Preferred	Conc Value2 Preferred	Conc Units Preferred	% Purity	Ref #
2,4-D dimethylamine salt	Rattus	norvegicus	Norway rat	MOR	MOR	MORT	NOAEL		d	15	d	100		ae mg/kg/d	66.2	93515
2,4-D dimethylamine salt	Oryctolagus	cuniculus	European rabbit	MOR	MOR	MORT	NOAEL		d	23	d	90		ae mg/kg/d	66.2	93515
2,4-D dimethylamine salt	Cyprinus	carpio	common carp	MOR	MOR	MORT	NR-ZERO		h	4	d	87		mg/L	100	73377
2,4-D dimethylamine salt	Tilapia	nilotica	Nile tilapia	MOR	MOR	MORT	NR-ZERO		h	4	d	87		mg/L	100	73377
2,4-D sodium salt	Daphnia	magna	Water flea	MOR	MOR	MORT	LC50		h	4	d	1042.3		mg/L	100	4740
2,4-D sodium salt	Anas	platyrhynchos	Mallard duck	MOR	MOR	MORT	LD50		d	14	d	2025		mg/kg bdwt	>99	50386
2,4-D sodium salt	Daphnia	magna	Water flea	MOR	MOR	MORT	LC50		h	4	d	268.5		mg/L	100	4740
2,4-D sodium salt	Daphnia	magna	Water flea	MOR	MOR	MORT	LC50		h	4	d	300		mg/L	100	4740
2,4-D sodium salt	Daphnia	magna	Water flea	MOR	MOR	MORT	LC50		h	4	d	400		mg/L	100	4740
2,4-D sodium salt	Chilo	suppressalis	Striped riceborer	MOR	MOR	HTCH	NOAEL		d	30	d	0.003		mg	0.1	50516
2,4-D sodium salt	Chilo	suppressalis	Striped riceborer	MOR	MOR	SURV	NOAEL		d	20	d	0.003		mg	0.1	50516
2,4-D sodium salt	Chilo	suppressalis	Striped riceborer	MOR	MOR	SURV	NOAEL		d	20	d	0.003 TO 0.005		mg	0.1	50516
2,4-D sodium salt	Anacystis	nidulans	Blue-green algae	MOR	MOR	MORT	NR-ZERO		d	10	d	1600		mg/L	80	65980
2,4-D sodium salt	Anacystis	nidulans	Blue-green algae	MOR	MOR	MORT	NR-ZERO		d	10	d	1600		mg/L	80	65980
2,4-D sodium salt	Anacystis	nidulans	Blue-green algae	MOR	MOR	MORT	NR-ZERO		d	10	d	1600		mg/L	80	65980
2,4-D sodium salt	Apis	mellifera	Carniolan Honey Bee	MOR	MOR	MORT	LD50		h	1	d	62.1		ug/bee	100	39264
2,4-D sodium salt	Apis	mellifera	Carniolan Honey Bee	MOR	MOR	MORT	LD50		h	1	d	42.7		ug/bee	100	39264
2,4-D sodium salt	Apis	mellifera	Carniolan Honey Bee	MOR	MOR	MORT	LD50		h	1	d	37.7		ug/bee	100	39264
2,4-D sodium salt	Apis	mellifera	Carniolan Honey Bee	MOR	MOR	MORT	LD50		h	1	d	71.5		ug/bee	100	39264
2,4-D sodium salt	Apis	mellifera	Carniolan Honey Bee	MOR	MOR	MORT	LD50		h	1	d	87		ug/bee	100	39264
2,4-D sodium salt	Apis	mellifera	Carniolan Honey Bee	MOR	MOR	MORT	LD50		h	1	d	79.9		ug/bee	100	39264
2,4-D sodium salt	Apis	mellifera	Carniolan Honey Bee	MOR	MOR	MORT	LD50		h	1	d	69.7		ug/bee	100	39264
2,4-D sodium salt	Apis	mellifera	Carniolan Honey Bee	MOR	MOR	MORT	LD50		h	1	d	92		ug/bee	100	39264
2,4-D sodium salt	Apis	mellifera	Carniolan Honey Bee	MOR	MOR	MORT	LD50		h	1	d	72.5		ug/bee	100	39264
2,4-D sodium salt	Apis	mellifera	Carniolan Honey Bee	MOR	MOR	MORT	LD50		h	1	d	43.4		ug/bee	100	39264
2,4-D sodium salt	Apis	mellifera	Carniolan Honey Bee	MOR	MOR	MORT	LD50		h	1	d	81.8		ug/bee	100	39264
2,4-D sodium salt	Apis	mellifera	Carniolan Honey Bee	MOR	MOR	MORT	LD50		h	1	d	64.4		ug/bee	100	39264
2,4-D sodium salt	Apis	mellifera	Carniolan Honey Bee	MOR	MOR	MORT	LD50		h	1	d	56.5		ug/bee	100	39264
2,4-D sodium salt	Apis	mellifera	Carniolan Honey Bee	MOR	MOR	MORT	LD50		h	1	d	72.8		ug/bee	100	39264

Chemical Name	Genus	Species	Common Name	Effect Group	Effect	Meas	Endpt1	Endpt2	Dur Unit Orig	Dur Preferred	Dur Unit Preferred	Conc Value1 Preferred	Conc Value2 Preferred	Conc Units Preferred	% Purity	Ref #
2,4-D sodium salt	Apis	mellifera	Carniolan Honey Bee	MOR	MOR	MORT	LD50		h	1	d	780.2		ppm	100	39264
2,4-D sodium salt	Apis	mellifera	Carniolan Honey Bee	MOR	MOR	MORT	LD50		h	1	d	1218.5		ppm	100	39264
2,4-D sodium salt	Apis	mellifera	Carniolan Honey Bee	MOR	MOR	MORT	LD50		h	1	d	1139.9		ppm	100	39264
2,4-D sodium salt	Apis	mellifera	Carniolan Honey Bee	MOR	MOR	MORT	LD50		h	1	d	1054.1		ppm	100	39264
2,4-D sodium salt	Apis	mellifera	Carniolan Honey Bee	MOR	MOR	MORT	LD50		h	1	d	1006.2		ppm	100	39264
2,4-D sodium salt	Apis	mellifera	Carniolan Honey Bee	MOR	MOR	MORT	LD50		h	1	d	928.3		ppm	100	39264
2,4-D sodium salt	Apis	mellifera	Carniolan Honey Bee	MOR	MOR	MORT	LD50		h	1	d	660.6		ppm	100	39264
2,4-D sodium salt	Apis	mellifera	Carniolan Honey Bee	MOR	MOR	MORT	LD50		h	1	d	615		ppm	100	39264
2,4-D sodium salt	Apis	mellifera	Carniolan Honey Bee	MOR	MOR	MORT	LD50		h	1	d	660		ppm	100	39264
2,4-D sodium salt	Apis	mellifera	Carniolan Honey Bee	MOR	MOR	MORT	LD50		h	1	d	1059.3		ppm	100	39264
2,4-D sodium salt	Apis	mellifera	Carniolan Honey Bee	MOR	MOR	MORT	LD50		h	1	d	60.7(56.1 TO 64.2)		ug/bee	100	39264
2,4-D sodium salt	Apis	mellifera	Carniolan Honey Bee	MOR	MOR	MORT	LD50		h	1	d	65.4(62.7 TO 68.2)		ug/bee	100	39264
2,4-D sodium salt	Apis	mellifera	Carniolan Honey Bee	MOR	MOR	MORT	LD50		h	1	d	69.1(67.4 TO 70)		ug/bee	100	39264
2,4-D sodium salt	Apis	mellifera	Carniolan Honey Bee	MOR	MOR	MORT	LD50		h	1	d	70(66.1 TO 76.2)		ug/bee	100	39264
2,4-D sodium salt	Apis	mellifera	Carniolan Honey Bee	MOR	MOR	MORT	LD50		h	1	d	72.4(69 TO 76.4)		ug/bee	100	39264
2,4-D sodium salt	Apis	mellifera	Carniolan Honey Bee	MOR	MOR	MORT	LD50		h	1	d	74.4(71.6 TO 79.4)		ug/bee	100	39264
2,4-D sodium salt	Apis	mellifera	Carniolan Honey Bee	MOR	MOR	MORT	LD50		h	1	d	82.5(79.6 TO 84.7)		ug/bee	100	39264
2,4-D sodium salt	Apis	mellifera	Carniolan Honey Bee	MOR	MOR	MORT	LD50		h	1	d	85.2(83.6 TO 105.9)		ug/bee	100	39264
2,4-D sodium salt	Apis	mellifera	Carniolan Honey Bee	MOR	MOR	MORT	LD50		h	1	d	92.4(90 TO 99.5)		ug/bee	100	39264
2,4-D sodium salt	Apis	mellifera	Carniolan Honey Bee	MOR	MOR	MORT	LD50		h	1	d	96.1(93.8 TO 111.3)		ug/bee	100	39264
2,4-D sodium salt	Apis	mellifera	Carniolan Honey Bee	MOR	MOR	MORT	LD50		h	1	d	75		ug/bee	100	39264
2,4-D sodium salt	Apis	mellifera	Carniolan Honey Bee	MOR	MOR	MORT	LD50		h	1	d	56.9		ug/bee	100	39264
2,4-D sodium salt	Apis	mellifera	Carniolan Honey Bee	MOR	MOR	MORT	LD50		h	1	d	58.9		ug/bee	100	39264
2,4-D sodium salt	Apis	mellifera	Carniolan Honey Bee	MOR	MOR	MORT	LD50		h	1	d	83.2		ug/bee	100	39264

Chemical Name	Genus	Species	Common Name	Effect Group	Effect	Meas	Endpt1	Endpt2	Dur Unit Orig	Dur Preferred	Dur Unit Preferred	Conc Value1 Preferred	Conc Value2 Preferred	Conc Units Preferred	% Purity	Ref #
2,4-D sodium salt	Apis	mellifera	Carniolan Honey Bee	MOR	MOR	MORT	LD50		h	1	d	68.2		ug/bee	100	39264
2,4-D sodium salt	Apis	mellifera	Carniolan Honey Bee	MOR	MOR	MORT	LD50		h	1	d	61.9		ug/bee	100	39264
2,4-D sodium salt	Apis	mellifera	Carniolan Honey Bee	MOR	MOR	MORT	LD50		h	1	d	59.3		ug/bee	100	39264
2,4-D sodium salt	Apis	mellifera	Carniolan Honey Bee	MOR	MOR	MORT	LD50		h	1	d	75.1		ug/bee	100	39264
2,4-D sodium salt	Apis	mellifera	Carniolan Honey Bee	MOR	MOR	MORT	LD50		h	1	d	79.8		ug/bee	100	39264
2,4-D sodium salt	Apis	mellifera	Carniolan Honey Bee	MOR	MOR	MORT	LD50		h	1	d	68.7		ug/bee	100	39264
2,4-D sodium salt	Bufo	bufo	Toad	MOR	MOR	MORT	LC50*		h	1	d	40		mg/L	100	6594
2,4-D sodium salt	Bufo	bufo	Toad	MOR	MOR	MORT	LC50*		h	1	d	40		mg/L	100	6594
2,4-D sodium salt	Bufo	bufo	Toad	MOR	MOR	MORT	LC50*		h	1	d	40		mg/L	100	6594
2,4-D sodium salt	Bufo	bufo	Toad	MOR	MOR	MORT	LC50*		h	1	d	40		mg/L	100	6594
2,4-D sodium salt	Bufo	bufo	Toad	MOR	MOR	MORT	LC50*		h	1	d	40		mg/L	100	6594
2,4-D sodium salt	Bufo	bufo	Toad	MOR	MOR	MORT	LC50*		h	1	d	40		mg/L	100	6594
2,4-D sodium salt	Cyclops	vicinus	Cyclopoid copepod	MOR	MOR	MORT	NR-ZERO		d		d	15		mM	100	17466
2,4-D sodium salt	Cyclops	vicinus	Cyclopoid copepod	MOR	MOR	MORT	NR-ZERO		d		d	15		mM	100	17466
2,4-D sodium salt	Cyprinus	carpio	common carp	MOR	MOR	MORT	NR-ZERO		h	3	d	400		mg/L	100	70658
2,4-D sodium salt	Labeo	rohita	Rohu	MOR	MOR	MORT	NR-ZERO		h	3	d	400		mg/L	100	70658
2,4-D isopropylamine salt	Rattus	norvegicus	Norway rat	MOR	MOR	MORT	NR-ZERO		d	15	d	51		ae mg/kg/d	50.2	93515
2,4-D isopropylamine salt	Rattus	norvegicus	Norway rat	MOR	MOR	MORT	NOAEL		d	15	d	150		ae mg/kg/d	50.2	93515
2,4-D isopropylamine salt	Oryctolagus	cuniculus	European rabbit	MOR	MOR	MORT	NR-ZERO		d	23	d	10		ae mg/kg/d	50.2	93515
2,4-D isopropylamine salt	Oryctolagus	cuniculus	European rabbit	MOR	MOR	MORT	NOAEL		d	23	d	75		ae mg/kg/d	50.2	93515
2,4-D diethanolamine salt	Rattus	norvegicus	Norway rat	MOR	MOR	MORT	NOAEL		d	15	d	101.6		ae mg/kg/d	73.1	93515
2,4-D diethanolamine salt	Rattus	norvegicus	Norway rat	MOR	MOR	MORT	NR-ZERO		d	15	d	101.6		ae mg/kg/d	73.1	93515
2,4-D diethanolamine salt	Oryctolagus	cuniculus	European rabbit	MOR	MOR	MORT	NOAEL		d	23	d	40.6		ae mg/kg/d	73.1	93515
2,4-D triisopropanolamine salt	Rattus	norvegicus	Norway rat	MOR	MOR	MORT	NR-ZERO		d	15	d	51		ae mg/kg/d	72.2	93515
2,4-D triisopropanolamine salt	Rattus	norvegicus	Norway rat	MOR	MOR	MORT	NOAEL		d	15	d	175		ae mg/kg/d	72.2	93515
2,4-D triisopropanolamine salt	Oryctolagus	cuniculus	European rabbit	MOR	MOR	MORT	NOAEL		d	23	d	75		ae mg/kg/d	72.2	93515
2,4-D isopropyl ester	Mus	musculus	House mouse	GRO	MPH	VOLU	LOAEL		d	8	d	94		mg/kg	100	91379
2,4-D isopropyl ester	Mus	musculus	House mouse	GRO	MPH	VOLU	LOAEL		d	8	d	94		mg/kg	100	91379
2,4-D isopropyl ester	Mus	musculus	House mouse	GRO	MPH	WGHT	LOAEL		d	8	d	46		mg/kg	100	91379
2,4-D isopropyl ester	Mus	musculus	House mouse	GRO	MPH	WGHT	NOAEL		d	8	d	150		mg/kg	100	91379

Chemical Name	Genus	Species	Common Name	Effect Group	Effect	Meas	Endpt1	Endpt2	Dur Unit Orig	Dur Preferred	Dur Unit Preferred	Conc Value1 Preferred	Conc Value2 Preferred	Conc Units Preferred	% Purity	Ref #
2,4-D isopropyl ester	Mus	musculus	House mouse	GRO	MPH	WGHT	LOAEL		d	8	d	94		mg/kg	100	91379
2,4-D isopropyl ester	Mus	musculus	House mouse	GRO	MPH	SMIX	NOAEL		d	7	d	94		mg/kg	100	89569
2,4-D isopropyl ester	Mus	musculus	House mouse	GRO	MPH	SMIX	NOAEL		d	7	d	94		mg/kg	100	89569
2,4-D isopropyl ester	Mus	musculus	House mouse	GRO	MPH	SMIX	LOAEL		d	7	d	46		mg/kg	100	89569
2,4-D isopropyl ester	Mus	musculus	House mouse	GRO	MPH	SMIX	LOAEL		d	8	d	94		mg/kg	100	89569
2,4-D isopropyl ester	Mus	musculus	House mouse	GRO	MPH	SMIX	LOAEL		d	9	d	0.5544		mM/kg bdwt	99	36267
2,4-D	Mus	musculus	House mouse	GRO	MPH	WGHT	NOAEL		d	8	d	215		mg/kg	100	91379
2,4-D	Mus	musculus	House mouse	GRO	MPH	VOLU	LOAEL		d	8	d	100		mg/kg	100	91379
2,4-D	Mus	musculus	House mouse	GRO	MPH	WGHT	LOAEL		d	8	d	100		mg/kg	100	91379
2,4-D	Mus	musculus	House mouse	GRO	MPH	WGHT	NOAEL		d	8	d	100		mg/kg	100	91379
2,4-D	Mus	musculus	House mouse	GRO	MPH	WGHT	NOAEL		d	8	d	98		mg/kg	100	91379
2,4-D	Mus	musculus	House mouse	GRO	MPH	WGHT	LOAEL		d	8	d	98		mg/kg	100	91379
2,4-D	Mus	musculus	House mouse	GRO	MPH	WGHT	LOAEL		d	8	d	98		mg/kg	100	91379
2,4-D	Mus	musculus	House mouse	GRO	MPH	SMIX	NOAEL		d	3	d	50		mg/kg	100	92612
2,4-D	Tinca	tinca	Tench	GRO	MPH	BVSL	LOAEL		d	5	d	181		mg/L	100	72787
2,4-D	Myriophyllum	sibiricum	Water milfoil	GRO	MPH	AREA	LOAEL		d	14	d	1.47		mg/L	100	74985
2,4-D	Myriophyllum	sibiricum	Water milfoil	GRO	MPH	AREA	LOAEL		d	14	d	1.47		mg/L	100	74985
2,4-D	Myriophyllum	sibiricum	Water milfoil	GRO	MPH	AREA	NOEC	LOEC	d	14	d	0.0181	0.0543	mg/L	100	74985
2,4-D	Myriophyllum	sibiricum	Water milfoil	GRO	MPH	AREA	IC25		d	14	d	0.0737		mg/L	100	74985
2,4-D	Myriophyllum	sibiricum	Water milfoil	GRO	MPH	AREA	IC50		d	14	d	0.9574		mg/L	100	74985
2,4-D	Elodea	nuttalli	Waterweed, ditchmoss	GRO	MPH	WGHT	EC50		d	28	d	0.898(0.213 TO 3.781)		mg/L	100	93399
2,4-D	Elodea	nuttalli	Waterweed, ditchmoss	GRO	MPH	LGTH	EC50		d	28	d	3		mg/L	100	93399
2,4-D	Elodea	nuttalli	Waterweed, ditchmoss	GRO	MPH	LGTH	EC50		d	28	d	0.574(0.368 TO 0.894)		mg/L	100	93399
2,4-D	Ranunculus	longirostris	Longbeak Buttercup	GRO	MPH	WGHT	EC50		d	28	d	0.111(0.091 TO 0.135)		mg/L	100	93399
2,4-D	Ranunculus	longirostris	Longbeak Buttercup	GRO	MPH	LGTH	EC50		d	28	d	1.12(0.186 TO 6.744)		mg/L	100	93399
2,4-D	Ranunculus	longirostris	Longbeak Buttercup	GRO	MPH	LGTH	EC50		d	28	d	0.1		mg/L	100	93399
2,4-D	Ranunculus	aquatis	Buttercup	GRO	MPH	LGTH	EC50		d	28	d	0.683(0.14 TO 3.339)		mg/L	100	93399
2,4-D	Ranunculus	aquatis	Buttercup	GRO	MPH	LGTH	EC50		d	28	d	0.092(0.055 TO 0.155)		mg/L	100	93399
2,4-D	Potamogeton	crispus	Curled pondweed	GRO	MPH	WGHT	EC50		d	28	d	0.347(0.155 TO 0.78)		mg/L	100	93399
2,4-D	Potamogeton	crispus	Curled pondweed	GRO	MPH	LGTH	EC50		d	28	d	1.988(1.431 TO 2.762)		mg/L	100	93399
2,4-D	Potamogeton	crispus	Curled pondweed	GRO	MPH	LGTH	EC50		d	28	d	0.29(0.282 TO 0.398)		mg/L	100	93399
2,4-D	Ranunculus	peltatus	Pond Water Crowfoot	GRO	MPH	WGHT	EC50		d	28	d	0.245		mg/L	100	93399
2,4-D	Ranunculus	peltatus	Pond Water Crowfoot	GRO	MPH	LGTH	EC50		d	28	d	0.14(0.018 TO 1.058)		mg/L	100	93399
2,4-D	Ranunculus	peltatus	Pond Water Crowfoot	GRO	MPH	LGTH	EC50		d	28	d	0.263(0.059 TO 1.167)		mg/L	100	93399

Chemical Name	Genus	Species	Common Name	Effect Group	Effect	Meas	Endpt1	Endpt2	Dur Unit Orig	Dur Preferred	Dur Unit Preferred	Conc Value1 Preferred	Conc Value2 Preferred	Conc Units Preferred	% Purity	Ref #
2,4-D	Potamogeton	illinoensis	Pondweed	GRO	MPH	LGTH	EC50		d	28	d	1.063(0.344 TO 3.283)		mg/L	100	93399
2,4-D	Potamogeton	illinoensis	Pondweed	GRO	MPH	LGTH	EC50		d	28	d	0.181(0.06 TO 0.547)		mg/L	100	93399
2,4-D	Elodea	nuttalli	Waterweed, ditchmoss	GRO	MPH	WGHT	EC50		d	28	d	1.096(0.852 TO 1.411)		mg/L	100	93399
2,4-D	Elodea	nuttalli	Waterweed, ditchmoss	GRO	MPH	LGTH	EC50		d	28	d	0.785(0.391 TO 1.58)		mg/L	100	93399
2,4-D	Elodea	nuttalli	Waterweed, ditchmoss	GRO	MPH	LGTH	EC50		d	28	d	0.997		mg/L	100	93399
2,4-D	Rattus	norvegicus	Norway rat	GRO	MPH	SMIX	NOAEL		yr	730	d	1250		ppm	99.12	36996
2,4-D	Canis	familiaris	Domestic dog	GRO	MPH	SMIX	NOAEL	LOEL	wk	91	d	1	3.75	mg/kg/d	96.7	48144
2,4-D	Alligator	mississippiensis	American alligator	GRO	MPH	DMTR	NOAEL		d	10	d	13.664		ppm	97.6	70208
2,4-D	Mus	musculus	House mouse	GRO	MPH	SMIX	LOAEL		d	7	d	100		mg/kg	100	89569
2,4-D	Mus	musculus	House mouse	GRO	MPH	SMIX	NOAEL		d	7	d	100		mg/kg	100	89569
2,4-D	Mus	musculus	House mouse	GRO	MPH	SMIX	LOAEL		d	7	d	100		mg/kg	100	89569
2,4-D	Mus	musculus	House mouse	GRO	MPH	SMIX	NOAEL		d	7	d	98		mg/kg	100	89569
2,4-D	Mus	musculus	House mouse	GRO	MPH	SMIX	LOAEL		d	8	d	98		mg/kg	100	89569
2,4-D	Mus	musculus	House mouse	GRO	MPH	SMIX	NOAEL		d	8	d	98		mg/kg	100	89569
2,4-D	Mus	musculus	House mouse	GRO	MPH	SMIX	LOAEL		d	7	d	100		mg/kg bdwt	100	89569
2,4-D	Rattus	norvegicus	Norway rat	GRO	MPH	WGHT	NOAEL	LOAEL	d	16	d	70	100	mg/kg/d	100	93849
2,4-D	Rattus	norvegicus	Norway rat	GRO	MPH	WGHT	NOAEL	LOAEL	d	16	d	70	100	mg/kg bdwt	100	85545
2,4-D	Rattus	norvegicus	Norway rat	GRO	MPH	WGHT	LOAEL		d	16	d	70		mg/kg bdwt	100	85545
2,4-D	Mus	musculus	House mouse	GRO	MPH	SMIX	LOAEL		d	9	d	0.504		mM/kg bdwt	90	36267
2,4-D	Mus	musculus	House mouse	GRO	MPH	SMIX	NOAEL		d	4	d	0.72		mM/kg bdwt	90	36267
2,4-D	Mus	musculus	House mouse	GRO	MPH	ABNM	NOAEL	LOAEL	d	35	d	3.234	32.34	mg/kg bdwt	98	93505
2,4-D	Mus	musculus	House mouse	GRO	MPH	SMIX	LOAEL		d	4	d	0.9		mM/kg bdwt	90	36267
2,4-D	Mus	musculus	House mouse	GRO	MPH	SMIX	LOAEL		d	4	d	100		ppm	100	93403
2,4-D	Mus	musculus	House mouse	GRO	MPH	SMIX	LOAEL		d	4	d	0.9		mM/kg bdwt	90	36267
2,4-D	Rattus	norvegicus	Norway rat	GRO	MPH	AREA	LOAEL		d	96	d	70		ppm	100	93514
2,4-D	Rattus	norvegicus	Norway rat	GRO	MPH	AREA	LOAEL		d	96	d	70		ppm	100	93514
2,4-D	Rattus	norvegicus	Norway rat	GRO	MPH	SMIX	NOAEL		wk	14	d	150 TO 200		mg/kg bdwt	100	93402
2,4-D	Rattus	norvegicus	Norway rat	GRO	MPH	THIK	NOAEL		d	14	d	200		mg/kg bdwt	100	93542
2,4-D	Rattus	norvegicus	Norway rat	GRO	MPH	WGHT	LOAEL		d	10	d	70		mg/kg	100	93434
2,4-D	Rattus	norvegicus	Norway rat	GRO	MPH	WEAR	NOAEL	LOAEL	d	5	d	70	100	mg/kg	100	93434
2,4-D	Rattus	norvegicus	Norway rat	GRO	MPH	SMIX	LOAEL		wk	91	d	15		ppm	97.3	93388
2,4-D	Rattus	norvegicus	Norway rat	GRO	MPH	SMIX	NOAEL	LOAEL	wk	91	d	100	150	ppm	97.3	93388
2,4-D	Rattus	norvegicus	Norway rat	GRO	MPH	SMIX	LOAEL		wk	91	d	15		ppm	100	93388

Chemical Name	Genus	Species	Common Name	Effect Group	Effect	Meas	Endpt1	Endpt2	Dur Unit Orig	Dur Preferred	Dur Unit Preferred	Conc Value1 Preferred	Conc Value2 Preferred	Conc Units Preferred	% Purity	Ref #
2,4-D	Rattus	norvegicus	Norway rat	GRO	MPH	SMIX	NOAEL	LOAEL	wk	91	d	15	60	ppm	100	93388
2,4-D	Rattus	norvegicus	Norway rat	GRO	MPH	WGHT	LOAEL		d	7	d	50		mg/kg	100	70980
2,4-D	Mus	musculus	House mouse	GRO	MPH	WGHT	NOAEL	LOAEL	mo	90	d	700	1680	ppm	100	93406
2,4-D dimethylamine salt	Canis	familiaris	Domestic dog	GRO	MPH	SMIX	NOAEL	LOEL	wk	91	d	3.75	7.5	ae mg/kg/d	66.7	48144
2,4-D dimethylamine salt	Mus	musculus	House mouse	GRO	MPH	SMIX	NOAEL	LOAEL	d	2	d	70.8	94.4	mg/kg bdwt	47.2	79428
2,4-D dimethylamine salt	Rattus	norvegicus	Norway rat	GRO	MPH	WGHT	NOAEL		wk	14	d	150		ae mg/org	48	93658
2,4-D dimethylamine salt	Rattus	norvegicus	Norway rat	GRO	MPH	WGHT	LOAEL		wk	21	d	111		ae mg/org	48	93658
2,4-D dimethylamine salt	Mus	musculus	House mouse	GRO	MPH	SMIX	NOAEL		d	10	d	150		AI mg/kg bdwt	47.2	80618
2,4-D dimethylamine salt	Rattus	norvegicus	Norway rat	GRO	MPH	SMIX	NOAEL		d	28	d	10		mg/kg bdwt	100	93627
2,4-D dimethylamine salt	Mus	musculus	House mouse	GRO	MPH	WGHT	NOAEL	LOAEL	d	64	d	8.5	37	ppm	100	93516
2,4-D isopropyl ester	Mus	musculus	House mouse	PHY	PHY	FVOL	LOAEL		d	7	d	94		mg/kg	100	89569
2,4-D isopropyl ester	Mus	musculus	House mouse	PHY	PHY	FVOL	LOAEL		d	7	d	94		mg/kg	100	89569
2,4-D isopropyl ester	Mus	musculus	House mouse	PHY	PHY	FVOL	LOAEL		d	7	d	46		mg/kg	100	89569
2,4-D isopropyl ester	Mus	musculus	House mouse	PHY	PHY	FVOL	LOAEL		d	8	d	94		mg/kg	100	89569
2,4-D	Myriophyllum	sibiricum	Water milfoil	PHY	PHY	PERM	LOAEL		d	14	d	1.47		mg/L	100	74985
2,4-D	Myriophyllum	sibiricum	Water milfoil	PHY	PHY	PERM	LOAEL		d	14	d	1.47		mg/L	100	74985
2,4-D	Myriophyllum	sibiricum	Water milfoil	PHY	PHY	PERM	NOEC	LOEC	d	14	d	0.0181	0.0543	mg/L	100	74985
2,4-D	Myriophyllum	sibiricum	Water milfoil	PHY	PHY	PERM	IC25		d	14	d	0.2283		mg/L	100	74985
2,4-D	Myriophyllum	sibiricum	Water milfoil	PHY	PHY	PERM	IC50		d	14	d	0.9574		mg/L	100	74985
2,4-D	Scenedesmus	quadricauda	Green algae	PHY	PHY	PSYN	NOAEL	LOAEL	mi	4.17E-02	d	0.098	0.98	mg/L	49	55720
2,4-D	Mytilus	galloprovincialis	Mediterranean mussel	PHY	PHY	GPHY	LOAEL		d	15	d	0.03		mg/L	100	93394
2,4-D	Canis	familiaris	Domestic dog	PHY	PHY	NVCV	NOAEL		d	28	d	125		ppm	100	93541
2,4-D	Potamogeton	pectinatus	Sago pondweed	PHY	PHY	PSYN	NOAEL		h	0.125	d	10000		mg/L	100	70739
2,4-D	Potamogeton	pectinatus	Sago pondweed	PHY	PHY	PSYN	IC50		h	0.125	d	0.01		mg/L	100	70739
2,4-D	Mus	musculus	House mouse	PHY	PHY	FVOL	NOAEL		d	7	d	100		mg/kg	100	89569
2,4-D	Mus	musculus	House mouse	PHY	PHY	FVOL	LOAEL		d	7	d	100		mg/kg	100	89569
2,4-D	Mus	musculus	House mouse	PHY	PHY	FVOL	NOAEL		d	7	d	98		mg/kg	100	89569
2,4-D	Mus	musculus	House mouse	PHY	PHY	FVOL	NOAEL		d	8	d	98		mg/kg	100	89569
2,4-D	Mus	musculus	House mouse	PHY	PHY	FVOL	NOAEL		d	8	d	98		mg/kg	100	89569
2,4-D	Mus	musculus	House mouse	PHY	PHY	FVOL	NOAEL		d	7	d	100		mg/kg bdwt	100	89569
2,4-D	Rattus	norvegicus	Norway rat	PHY	PHY	NVCV	NOAEL		wk	21	d	100		mg/kg	100	93540
2,4-D	Rattus	norvegicus	Norway rat	PHY	PHY	NVCV	NOAEL		wk	84	d	80		mg/kg	100	93540
2,4-D	Rattus	norvegicus	Norway rat	PHY	PHY	EXCR	NOAEL	LOAEL	mo	270	d	72.3	144.6	ppm	96.4	93518
2,4-D	Rattus	norvegicus	Norway rat	PHY	PHY	EXCR	NOAEL		mo	360	d	144.6		ppm	96.4	93518
2,4-D dimethylamine salt	Eichhornia	crassipes	Water-hyacinth	PHY	PHY	GPHY	LOAEL		d	<=17	d	0.25		kg/ha	50	71785
2,4-D dimethylamine salt	Rattus	norvegicus	Norway rat	PHY	PHY	VOLU	NOAEL		h	2.875	d	1.9		ai mg/kg org	50	93655
2,4-D dimethylamine salt	Rattus	norvegicus	Norway rat	PHY	PHY	VOLU	LOAEL		h	2.875	d	1.9		mg/kg bdwt	50	93655

Chemical Name	Genus	Species	Common Name	Effect Group	Effect	Meas	Endpt1	Endpt2	Dur Unit Orig	Dur Preferred	Dur Unit Preferred	Conc Value1 Preferred	Conc Value2 Preferred	Conc Units Preferred	% Purity	Ref #
2,4-D dimethylamine salt	Rattus	norvegicus	Norway rat	PHY	PHY	NRXN	LOAEL		d	22	d	5.76		%	48	93626
2,4-D dimethylamine salt	Rattus	norvegicus	Norway rat	PHY	PHY	NRXN	LOAEL		d	36	d	5.76		%	48	93626
2,4-D dimethylamine salt	Pseudokirchneriella	subcapitata	Green algae	PHY	PHY	PSYN	EC50		h	1	d	78.8		mg/L	100	11780
2,4-D sodium salt	Asellus	aquaticus	Aquatic sowbug	PHY	PHY	OXYG	LOAEL		h	<=1	d	1.25		mM	100	9033
2,4-D sodium salt	Rattus	norvegicus	Norway rat	PHY	PHY	VOLU	NOAEL		h	2.875	d	2.6		ai mg/kg org	82	93655
2,4-D sodium salt	Rattus	norvegicus	Norway rat	PHY	PHY	VOLU	LOAEL		h	2.875	d	2.6		mg/kg bdwt	82	93655
2,4-D	Paramecium	trichium	Paramecium	POP	POP	ABND	IC50		d	2	d	180.1		uM	100	82825
2,4-D	Paramecium	caudatum	Ciliate	POP	POP	ABND	IC50		d	2	d	0.36		mM	100	82825
2,4-D	NR	Fungi	Fungi Kingdom	POP	POP	ABND	NOAEL		d	6	d	10		ppm	>=94	54977
2,4-D	Penicillium	expansum	Blue mold	POP	POP	ABND	LOAEL		d	11	d	32		ppm	100	91689
2,4-D	Mucor	piriformis	Fungus	POP	POP	ABND	LOAEL		d	11	d	32		ppm	100	91689
2,4-D	Botrytis	cinerea	Fungi	POP	POP	ABND	NOAEL		d	74	d	32		ppm	100	91689
2,4-D	Botrytis	cinerea	Fungi	POP	POP	ABND	LOAEL		h	1	d	34		ppm	100	91689
2,4-D	Mucor	piriformis	Fungus	POP	POP	ABND	LOAEL		d	22	d	34		ppm	100	91689
2,4-D	Penicillium	expansum	Blue mold	POP	POP	ABND	LOAEL		d	36	d	34		ppm	100	91689
2,4-D	NR	Fungi	Fungi Kingdom	POP	POP	ABND	NOAEL		d	7	d	9.4		ppm	>=94	93645
2,4-D	NR	Fungi	Fungi Kingdom	POP	POP	ABND	NOAEL		d	7	d	9.4		ppm	>=94	93646
2,4-D	Pseudokirchneriella	subcapitata	Green algae	POP	POP	PGRT	NOEC		h	1	d	99		mg/L	99	62406
2,4-D	Chlorella	vulgaris	Green algae	POP	POP	PGRT	NOEC		h	1	d	99		mg/L	99	62406
2,4-D	Carduus	thoermeri	Plumeless Thistle	POP	POP	ABND	LOAEL		wk	70	d	0.224784		lb/acre	100	71021
2,4-D	Cochliobolus	sativus	Fungus	POP	POP	SRFA	NOAEL		d	10	d	20		ml	100	83238
2,4-D	Rotylenchulus	reniformis	Kidney-shaped nematode	POP	POP	ABND	NOAEL		d	40	d	3.6		mg/eu	100	72021
2,4-D	Urophora	affinis	Fruit Fly	POP	POP	CNTL	NOAEL		wk	28	d	2.2		ai kg/ha	100	71033
2,4-D	Urophora	affinis	Fruit Fly	POP	POP	CNTL	NOAEL		wk	28	d	2.2		ai kg/ha	100	71033
2,4-D	Urophora	quadrifasciata	Fruit Fly	POP	POP	CNTL	NOAEL		wk	28	d	2.2		ai kg/ha	100	71033
2,4-D	Urophora	quadrifasciata	Fruit Fly	POP	POP	CNTL	NOAEL		wk	28	d	2.2		ai kg/ha	100	71033
2,4-D	Carduus	acanthoides	Plumeless Thistle	POP	POP	ABND	LOAEL		wk	70	d	0.224784		lb/acre	100	71021
2,4-D	Ceuthorrhynchidius	horridus	European Weevil	POP	POP	ABND	LOAEL		wk	14	d	0.084		kg/ha	100	93656
2,4-D	Lygus	lineolaris	Tarnished plant bug	POP	POP	ABND	NOAEL		d	64	d	1.12		AI kg/ha	5.7	93657
2,4-D	Lygus	lineolaris	Tarnished plant bug	POP	POP	ABND	NOAEL		d	58	d	1.12		AI kg/ha	5.7	93657
2,4-D	Lygus	lineolaris	Tarnished plant bug	POP	POP	ABND	NOAEL		d	64	d	1.12		AI kg/ha	5.7	93657
2,4-D	Lygus	lineolaris	Tarnished plant bug	POP	POP	ABND	NOAEL		d	64	d	1.12		AI kg/ha	5.7	93657
2,4-D	Lygus	lineolaris	Tarnished plant bug	POP	POP	ABND	NOAEL		d	64	d	1.12		AI kg/ha	5.7	93657
2,4-D	Lygus	lineolaris	Tarnished plant bug	POP	POP	ABND	NOAEL		d	64	d	1.12		AI kg/ha	5.7	93657
2,4-D	Peromyscus	maniculatus	Deer mouse	POP	POP	ABND	LOAEL		yr	~1095	d	3		lb/acre	100	35284

Chemical Name	Genus	Species	Common Name	Effect Group	Effect	Meas	Endpt1	Endpt2	Dur Unit Orig	Dur Preferred	Dur Unit Preferred	Conc Value1 Preferred	Conc Value2 Preferred	Conc Units Preferred	% Purity	Ref #
2,4-D	Peromyscus	maniculatus	Deer mouse	POP	POP	ABND	LOAEL		yr	~730	d	3		lb/acre	100	35284
2,4-D	Peromyscus	maniculatus	Deer mouse	POP	POP	ABND	LOAEL		mo	~60	d	3		lb/acre	100	35284
2,4-D	Peromyscus	maniculatus	Deer mouse	POP	POP	ABND	LOAEL		yr	~730	d	3		lb/acre	100	35284
2,4-D	Peromyscus	maniculatus	Deer mouse	POP	POP	ABND	LOAEL		mo	~60	d	3		lb/acre	100	35284
2,4-D	Peromyscus	maniculatus	Deer mouse	POP	POP	ABND	LOAEL		mo	~60	d	3		lb/acre	100	35284
2,4-D	Peromyscus	maniculatus	Deer mouse	POP	POP	ABND	LOAEL		yr	~1095	d	3		lb/acre	100	35284
2,4-D	Peromyscus	maniculatus	Deer mouse	POP	POP	ABND	NOAEL		yr	~2190	d	3		lb/acre	100	35284
2,4-D	Peromyscus	maniculatus	Deer mouse	POP	POP	ABND	NOAEL		yr	~2190	d	3		lb/acre	100	35284
2,4-D	Peromyscus	maniculatus	Deer mouse	POP	POP	ABND	NOAEL		yr	~1825	d	3		lb/acre	100	35284
2,4-D	Peromyscus	maniculatus	Deer mouse	POP	POP	ABND	NOAEL		yr	~2555	d	3		lb/acre	100	35284
2,4-D	Peromyscus	maniculatus	Deer mouse	POP	POP	ABND	NOAEL		yr	~1460	d	3		lb/acre	100	35284
2,4-D	Peromyscus	maniculatus	Deer mouse	POP	POP	ABND	LOAEL		mo	~60	d	3		lb/acre	100	35284
2,4-D	Peromyscus	maniculatus	Deer mouse	POP	POP	ABND	LOAEL		mo	~60	d	3		lb/acre	100	35284
2,4-D	Tamias	minimus	Least chipmunk	POP	POP	ABND	LOAEL		yr	~1460	d	3		lb/acre	100	35284
2,4-D	Tamias	minimus	Least chipmunk	POP	POP	ABND	NOAEL		yr	~2555	d	3		lb/acre	100	35284
2,4-D	Microtus	montanus	Montane vole	POP	POP	ABND	LOAEL		yr	~2555	d	3		lb/acre	100	35284
2,4-D	Microtus	montanus	Montane vole	POP	POP	ABND	NOAEL		yr	~1825	d	3		lb/acre	100	35284
2,4-D	Microtus	montanus	Montane vole	POP	POP	ABND	NOAEL		yr	~1460	d	3		lb/acre	100	35284
2,4-D	Microtus	montanus	Montane vole	POP	POP	ABND	LOAEL		yr	~2555	d	3		lb/acre	100	35284
2,4-D	Microtus	montanus	Montane vole	POP	POP	ABND	LOAEL		yr	~1095	d	3		lb/acre	100	35284
2,4-D	Chlorella	pyrenoidosa	Green algae	POP	POP	DBLT	EC50		h	1	d	10		uM	100	7485
2,4-D	Chlorococcum	sp.	Green algae	POP	POP	DBLT	EC50		h	1	d	10		uM	100	7485
2,4-D	Lyngbya	sp.	Blue-green algae	POP	POP	DBLT	EC50		h	1	d	10		uM	100	7485
2,4-D	Anabaena	variabilis	Blue-green algae	POP	POP	CHLA	EC50		h	2	d	10		uM	100	7485
2,4-D	Scenedesmus	quadricauda	Green algae	POP	POP	GP	EC50		d	20	d	98		mg/L	100	13758
2,4-D	Scenedesmus	quadricauda	Green algae	POP	POP	GP	LOEC		d	20	d	70		mg/L	100	13758
2,4-D	Daphnia	magna	Water flea	POP	POP	GP	NOEC		d	21	d	56		mg/L	100	16782
2,4-D	Daphnia	magna	Water flea	POP	POP	GP	LOEC		d	21	d	100		mg/L	100	16782
2,4-D	Lemna	minor	Duckweed	POP	POP	GP	EC50		h	4	d	100		mg/L	100	18093
2,4-D	Pseudokirchneriella	subcapitata	Green algae	POP	POP	BMAS	NOEC		h	1 TO 4	d	25		mg/L	100	18093
2,4-D	Pseudokirchneriella	subcapitata	Green algae	POP	POP	GP	EC50		h	4	d	41.772		mg/L	100	18093
2,4-D	Pseudokirchneriella	subcapitata	Green algae	POP	POP	BMAS	LOEC		h	1 TO 4	d	50		mg/L	100	18093
2,4-D	Pseudokirchneriella	subcapitata	Green algae	POP	POP	PGRT	NOEC		h	4	d	100		mg/L	99	19243
2,4-D	Chlorella	vulgaris	Green algae	POP	POP	PGRT	NOEC		h	4	d	100		mg/L	99	19243
2,4-D	Chaetoceros	calcitrans	Diatom	POP	POP	PGRT	EC50		d	21	d	9.2		mg/L	100	19372
2,4-D	Pseudokirchneriella	subcapitata	Green algae	POP	POP	ABND	EC50		h	4	d	24.2		mg/L	100	45196
2,4-D	Pseudokirchneriella	subcapitata	Green algae	POP	POP	ABND	EC50		h	4	d	25.9		mg/L	100	45196
2,4-D	Dunaliella	tertiolecta	Green algae	POP	POP	PSYN	EC50		h	4.17E-02	d	160.22		mg/L	100	66270
2,4-D	Dunaliella	tertiolecta	Green algae	POP	POP	PSYN	EC50		h	1	d	246.5		mg/L	100	66270
2,4-D butoxyethyl ester	Convolvulus	arvensis	Field bindweed	POP	POP	CNTL	NOEC		mo	360 TO 540	d	0.5		lb/acre	100	42096
2,4-D butoxyethyl ester	Convolvulus	arvensis	Field bindweed	POP	POP	CNTL	NOEC		mo	360 TO 540	d	0.5		lb/acre	100	42096

Chemical Name	Genus	Species	Common Name	Effect Group	Effect	Meas	Endpt1	Endpt2	Dur Unit Orig	Dur Preferred	Dur Unit Preferred	Conc Value1 Preferred	Conc Value2 Preferred	Conc Units Preferred	% Purity	Ref #
2,4-D butoxyethyl ester	Convolvulus	arvensis	Field bindweed	POP	POP	CNTL	LOEC		mo	360 TO 540	d	0.5		lb/acre	100	42096
2,4-D butoxyethyl ester	Convolvulus	arvensis	Field bindweed	POP	POP	CNTL	LOEC		mo	360 TO 540	d	0.5		lb/acre	100	42096
2,4-D butoxyethyl ester	Convolvulus	arvensis	Field bindweed	POP	POP	CNTL	LOEC		mo	360 TO 540	d	0.5		lb/acre	100	42096
2,4-D dimethylamine salt	Pectinophora	gossypiella	Pink bollworm	POP	POP	ABND	LOAEL		d	80	d	0.037		kg/ha	100	80741
2,4-D dimethylamine salt	Eichhornia	crassipes	Water-hyacinth	POP	POP	BMAS	LOAEL		d	25	d	0.56		AI kg/ha	100	10690
2,4-D dimethylamine salt	Eichhornia	crassipes	Water-hyacinth	POP	POP	ABND	LOAEL		d	25	d	0.56		AI kg/ha	100	10690
2,4-D dimethylamine salt	Algae	Algae	Algae	POP	POP	ABND	NOAEL		d	1	d	2		mg/L	100	20051
2,4-D dimethylamine salt	Algae	Algae	Algae	POP	POP	CHLA	NOAEL		d	7	d	2		mg/L	100	20051
2,4-D dimethylamine salt	Algae	Algae	Algae	POP	POP	CHLA	NOAEL	LOAEL	d	1	d	40	100	mg/L	100	20051
2,4-D dimethylamine salt	Pseudokirchneriella	subcapitata	Green algae	POP	POP	BMAS	EC50		wk	14 TO 21	d	103		mg/L	100	11780
2,4-D dimethylamine salt	Salvinia	natans	Floating moss	POP	POP	BMAS	EC50		wk	28	d	6.5		mg/L	100	13738
2,4-D dimethylamine salt	Convolvulus	arvensis	Field bindweed	POP	POP	CNTL	NOEC		mo	360 TO 540	d	1		lb/acre	100	42096
2,4-D dimethylamine salt	Convolvulus	arvensis	Field bindweed	POP	POP	CNTL	LOEC		mo	360 TO 540	d	0.5		lb/acre	100	42096
2,4-D dimethylamine salt	Convolvulus	arvensis	Field bindweed	POP	POP	CNTL	LOEC		mo	360 TO 540	d	0.5		lb/acre	100	42096
2,4-D dimethylamine salt	Convolvulus	arvensis	Field bindweed	POP	POP	CNTL	LOEC		mo	360 TO 540	d	1		lb/acre	100	42096
2,4-D dimethylamine salt	Convolvulus	arvensis	Field bindweed	POP	POP	CNTL	NOEC		mo	360 TO 540	d	0.5		lb/acre	100	42096
2,4-D sodium salt	Collembola	Collembola	Springtail	POP	POP	ABND	NOAEL		mo	330	d	3		kg/ha	100	53301
2,4-D sodium salt	Collembola	Collembola	Springtail	POP	POP	ABND	NOAEL		mo	330	d	3		kg/ha	100	53301
2,4-D sodium salt	Acarina	Acarina	Chigger, Tick, Mite subclass	POP	POP	ABND	NOAEL		mo	330	d	3		kg/ha	100	53301
2,4-D sodium salt	Acarina	Acarina	Chigger, Tick, Mite subclass	POP	POP	ABND	NOAEL		mo	330	d	3		kg/ha	100	53301
2,4-D sodium salt	Onychiurus	jubilarius	Springtail	POP	POP	ABND	NOAEL		mo	330	d	3		kg/ha	100	53301
2,4-D sodium salt	Onychiurus	jubilarius	Springtail	POP	POP	ABND	NOAEL		mo	330	d	3		kg/ha	100	53301
2,4-D sodium salt	Tullbergia	krausbaueri	Springtail	POP	POP	ABND	NOAEL		mo	330	d	3		kg/ha	100	53301
2,4-D sodium salt	Tullbergia	krausbaueri	Springtail	POP	POP	ABND	NOAEL		mo	330	d	3		kg/ha	100	53301
2,4-D sodium salt	Folsomia	sp.	NR	POP	POP	ABND	NOAEL		mo	330	d	3		kg/ha	100	53301
2,4-D sodium salt	Folsomia	sp.	NR	POP	POP	ABND	NOAEL		mo	330	d	3		kg/ha	100	53301
2,4-D sodium salt	Isotoma	notabilis	Springtail	POP	POP	ABND	NOAEL		mo	330	d	3		kg/ha	100	53301
2,4-D sodium salt	Isotoma	notabilis	Springtail	POP	POP	ABND	NOAEL		mo	330	d	3		kg/ha	100	53301
2,4-D sodium salt	Ceratophysella	denticulata	Springtail	POP	POP	ABND	LOAEL		mo	330	d	1.5		kg/ha	100	53301
2,4-D sodium salt	Ceratophysella	denticulata	Springtail	POP	POP	ABND	LOAEL		mo	330	d	1.5		kg/ha	100	53301
2,4-D sodium salt	Rhodacarellus	silesiacus	Mite	POP	POP	ABND	NOAEL		mo	330	d	3		kg/ha	100	53301

Chemical Name	Genus	Species	Common Name	Effect Group	Effect	Meas	Endpt1	Endpt2	Dur Unit Orig	Dur Preferred	Dur Unit Preferred	Conc Value1 Preferred	Conc Value2 Preferred	Conc Units Preferred	% Purity	Ref #
2,4-D sodium salt	Rhodacarellus	silesiacus	Mite	POP	POP	ABND	NOAEL		mo	330	d	3		kg/ha	100	53301
2,4-D sodium salt	Tyrophagus	longior	Mite	POP	POP	ABND	NOAEL		mo	330	d	3		kg/ha	100	53301
2,4-D sodium salt	Tyrophagus	longior	Mite	POP	POP	ABND	NOAEL		mo	330	d	3		kg/ha	100	53301
2,4-D sodium salt	Tectocephus	velatus	Mite	POP	POP	ABND	NOAEL		mo	330	d	3		kg/ha	100	53301
2,4-D sodium salt	Tectocephus	velatus	Mite	POP	POP	ABND	NOAEL		mo	330	d	3		kg/ha	100	53301
2,4-D sodium salt	Scenedesmus	quadricauda	Green algae	POP	POP	PGRT	LC50		d	14	d	0.5		mg/L	100	17259
2,4-D sodium salt	Chlorella	pyrenoidosa	Green algae	POP	POP	PGRT	LC50		d	14	d	0.00015		mg/L	100	17259
2,4-D sodium salt	Stichococcus	sp.	Green algae	POP	POP	PGRT	LC50		d	14	d	7		mg/L	100	17259
2,4-D sodium salt	Scenedesmus	acutus	Green algae	POP	POP	PGRT	LC50		d	14	d	0.6		mg/L	100	17259
2,4-D sodium salt	Anabaena	variabilis	Blue-green algae	POP	POP	PGRT	LC50		d	14	d	100		mg/L	100	17259
2,4-D sodium salt	Oscillatoria	sp.	Blue-green algae	POP	POP	PGRT	LC50		d	14	d	80		mg/L	100	17259
2,4-D sodium salt	Spirulina	platensis	Blue-green algae	POP	POP	PGRT	LC50		d	14	d	60		mg/L	100	17259
2,4-D sodium salt	Chlorococcum	sp.	Green algae	POP	POP	PGRT	LC50		d	14	d	0.028		mg/L	100	17259
2,4-D dimethylamine salt	Algae	Algae	Algae	SYS	PRS	GPPR	NOAEL		d	7	d	2		mg/L	100	20051
2,4-D dimethylamine salt	Algae	Algae	Algae	SYS	PRS	GPPR	LOAEL		d	1	d	2		mg/L	100	20051
2,4-D isopropyl ester	Mus	musculus	House mouse	REP	REP	NOIM	NOAEL		d	8	d	94		mg/kg	100	91379
2,4-D isopropyl ester	Mus	musculus	House mouse	REP	REP	NOIM	NOAEL		d	8	d	94		mg/kg	100	91379
2,4-D isopropyl ester	Mus	musculus	House mouse	REP	REP	NOIM	LOAEL		d	8	d	46		mg/kg	100	91379
2,4-D isopropyl ester	Mus	musculus	House mouse	REP	REP	NOIM	NOAEL		d	8	d	150		mg/kg	100	91379
2,4-D isopropyl ester	Mus	musculus	House mouse	REP	REP	NOIM	NOAEL		d	8	d	94		mg/kg	100	91379
2,4-D isopropyl ester	Mus	musculus	House mouse	REP	REP	NOIM	NOAEL		d	7	d	94		mg/kg	100	89569
2,4-D isopropyl ester	Mus	musculus	House mouse	REP	REP	NOIM	NOAEL		d	7	d	94		mg/kg	100	89569
2,4-D isopropyl ester	Mus	musculus	House mouse	REP	REP	NOIM	LOAEL		d	7	d	46		mg/kg	100	89569
2,4-D isopropyl ester	Mus	musculus	House mouse	REP	REP	NOIM	NOAEL		d	8	d	94		mg/kg	100	89569
2,4-D isopropyl ester	Rattus	norvegicus	Norway rat	REP	REP	PROG	NOAEL		d	15	d	100		mg/kg/d	97.1	93515
2,4-D	Mus	musculus	House mouse	REP	REP	NOIM	NOAEL		d	8	d	215		mg/kg	100	91379
2,4-D	Mus	musculus	House mouse	REP	REP	NOIM	LOAEL		d	8	d	100		mg/kg	100	91379
2,4-D	Mus	musculus	House mouse	REP	REP	NOIM	NOAEL		d	8	d	100		mg/kg	100	91379
2,4-D	Mus	musculus	House mouse	REP	REP	NOIM	NOAEL		d	8	d	100		mg/kg	100	91379
2,4-D	Mus	musculus	House mouse	REP	REP	NOIM	NOAEL		d	8	d	98		mg/kg	100	91379
2,4-D	Mus	musculus	House mouse	REP	REP	NOIM	NOAEL		d	8	d	98		mg/kg	100	91379
2,4-D	Mus	musculus	House mouse	REP	REP	NOIM	NOAEL		d	8	d	98		mg/kg	100	91379
2,4-D	Penicillium	expansum	Blue mold	REP	REP	GERM	LOAEL		h	1.2916667	d	32		ppm	100	91689
2,4-D	Botrytis	cinerea	Fungi	REP	REP	GERM	LOAEL		h	0.9166667	d	32		ppm	100	91689
2,4-D	Mucor	piriformis	Fungus	REP	REP	GERM	LOAEL		h	0.9166667	d	32		ppm	100	91689
2,4-D	Mucor	piriformis	Fungus	REP	REP	GERM	NOAEL		h	0.3333333	d	128		ppm	100	91689
2,4-D	Botrytis	cinerea	Fungi	REP	REP	GERM	NOAEL		h	0.3333333	d	128		ppm	100	91689
2,4-D	Penicillium	expansum	Blue mold	REP	REP	GERM	NOAEL		h	0.75	d	128		ppm	100	91689
2,4-D	Daphnia	magna	Water flea	REP	REP	FCND	NOAEL		d	6	d	0.1		mg/L	100	93397
2,4-D	Rotylenchulus	reniformis	Kidney-shaped nematode	REP	REP	PROG	NOAEL		d	40	d	3.6		mg/eu	100	72021
2,4-D	Mus	musculus	House mouse	REP	REP	NOIM	LOAEL		d	7	d	100		mg/kg	100	89569
2,4-D	Mus	musculus	House mouse	REP	REP	NOIM	LOAEL		d	7	d	100		mg/kg	100	89569
2,4-D	Mus	musculus	House mouse	REP	REP	NOIM	NOAEL		d	7	d	100		mg/kg	100	89569
2,4-D	Mus	musculus	House mouse	REP	REP	NOIM	NOAEL		d	7	d	98		mg/kg	100	89569
2,4-D	Mus	musculus	House mouse	REP	REP	NOIM	NOAEL		d	8	d	98		mg/kg	100	89569

Chemical Name	Genus	Species	Common Name	Effect Group	Effect	Meas	Endpt1	Endpt2	Dur Unit Orig	Dur Preferred	Dur Unit Preferred	Conc Value1 Preferred	Conc Value2 Preferred	Conc Units Preferred	% Purity	Ref #
2,4-D	Mus	musculus	House mouse	REP	REP	NOIM	NOAEL		d	8	d	98		mg/kg	100	89569
2,4-D	Mus	musculus	House mouse	REP	REP	NCLU	NOAEL		d	9	d	100		ppm	100	93603
2,4-D	Mus	musculus	House mouse	REP	REP	PROG	LOAEL		d	7	d	100		mg/kg bdwt	100	89569
2,4-D	Mus	musculus	House mouse	REP	REP	NCLU	NOAEL		d	9	d	100		ppm	100	93603
2,4-D	Ceriodaphnia	dubia	Water flea	REP	REP	GREP	IC50		d	7	d	69.8		mg/L	100	3590
2,4-D	Ceriodaphnia	dubia	Water flea	REP	REP	GREP	MATC		d	7	d	23.3		mg/L	100	3590
2,4-D	Ceriodaphnia	dubia	Water flea	REP	REP	GREP	IC50		d	7	d	72.5		mg/L	100	3590
2,4-D	Ceriodaphnia	dubia	Water flea	REP	REP	GREP	MATC		d	7	d	48.8		mg/L	100	3590
2,4-D	Ceriodaphnia	dubia	Water flea	REP	REP	GREP	MATC		d	4	d	49		mg/L	100	3590
2,4-D	Ceriodaphnia	dubia	Water flea	REP	REP	GREP	IC50		d	4	d	86.8		mg/L	100	3590
2,4-D	Ceriodaphnia	dubia	Water flea	REP	REP	GREP	MATC		d	4	d	50.4		mg/L	100	3590
2,4-D	Ceriodaphnia	dubia	Water flea	REP	REP	GREP	IC50		d	4	d	81.8		mg/L	100	3590
2,4-D	Brachionus	calyciflorus	Rotifer	REP	REP	GREP	EC50		d	2	d	128		mg/L	100	3963
2,4-D	Brachionus	calyciflorus	Rotifer	REP	REP	GREP	LOEC		d	2	d	83		mg/L	100	3963
2,4-D	Brachionus	calyciflorus	Rotifer	REP	REP	GREP	NOEC		d	2	d	58		mg/L	100	3963
2,4-D	Pseudoaegerita	sp.	Hyphomycete fungi	REP	REP	GERM	IC50		h	0.6666667	d	7940		mg/L	100	9651
2,4-D	Champia	parvula	Red algae	REP	REP	GREP	MATC		d	11 TO 14	d	34.26		mg/L	100	11452
2,4-D	Arbacia	sp.	Sea urchin	REP	REP	FERZ	EC50		mi	4.8611111111111E-02 TO 0.0625	d	232.1		mg/L	100	20469
2,4-D	Arbacia	sp.	Sea urchin	REP	REP	FERZ	EC50		mi	4.8611111111111E-02 TO 0.0625	d	227.6		mg/L	100	20469
2,4-D	Arbacia	sp.	Sea urchin	REP	REP	FERZ	EC50		mi	4.8611111111111E-02 TO 0.0625	d	156.5		mg/L	100	20469
2,4-D	Mesocricetus	auratus	Golden hamster	REP	REP	PROG	NOAEL		d	9	d	100		mg/kg	100	36213
2,4-D	Mesocricetus	auratus	Golden hamster	REP	REP	PROG	NOAEL		d	9	d	100		mg/kg	100	36213
2,4-D	Mesocricetus	auratus	Golden hamster	REP	REP	PROG	NOAEL	LOAEL	d	9	d	40	60	mg/kg	100	36213
2,4-D	Rattus	norvegicus	Norway rat	REP	REP	PROG	NOAEL		d	15	d	75		ae mg/kg/d	97.5	93515
2,4-D	Oryctolagus	cuniculus	European rabbit	REP	REP	PROG	NOAEL		d	23	d	90		ae mg/kg/d	97.5	93515
2,4-D butoxyethyl ester	Rattus	norvegicus	Norway rat	REP	REP	PROG	NOAEL		d	15	d	125		ae mg/kg/d	95.6	93515
2,4-D butoxyethyl ester	Oryctolagus	cuniculus	European rabbit	REP	REP	PROG	NOAEL		d	23	d	75		ae mg/kg/d	95.6	93515
2,4-D dimethylamine salt	Rattus	norvegicus	Norway rat	REP	REP	PROG	NOAEL		d	15	d	100		ae mg/kg/d	66.2	93515
2,4-D dimethylamine salt	Oryctolagus	cuniculus	European rabbit	REP	REP	PROG	NOAEL		d	23	d	90		ae mg/kg/d	66.2	93515
2,4-D sodium salt	Daphnia	magna	Water flea	REP	REP	PROG	NOAEL	LOAEL	d	2	d	25	50	mg/L	100	4740
2,4-D isopropylamine salt	Rattus	norvegicus	Norway rat	REP	REP	PROG	NOAEL		d	15	d	150		ae mg/kg/d	50.2	93515

Chemical Name	Genus	Species	Common Name	Effect Group	Effect	Meas	Endpt1	Endpt2	Dur Unit Orig	Dur Preferred	Dur Unit Preferred	Conc Value1 Preferred	Conc Value2 Preferred	Conc Units Preferred	% Purity	Ref #
2,4-D isopropylamine salt	Oryctolagus	cuniculus	European rabbit	REP	REP	PROG	NOAEL		d	23	d	75		ae mg/kg/d	50.2	93515
2,4-D diethanolamine salt	Rattus	norvegicus	Norway rat	REP	REP	PROG	NOAEL		d	15	d	101.6		ae mg/kg/d	73.1	93515
2,4-D diethanolamine salt	Oryctolagus	cuniculus	European rabbit	REP	REP	PROG	NOAEL		d	23	d	40.6		ae mg/kg/d	73.1	93515
2,4-D triisopropanolamine salt	Rattus	norvegicus	Norway rat	REP	REP	PROG	NOAEL		d	15	d	175		ae mg/kg/d	72.2	93515
2,4-D triisopropanolamine salt	Oryctolagus	cuniculus	European rabbit	REP	REP	PROG	NOAEL		d	23	d	75		ae mg/kg/d	72.2	93515

Explanation of OPP Acceptability Criteria and Rejection Codes for ECOTOX Data

Studies located and coded into ECOTOX must meet acceptability criteria, as established in the *Interim Guidance of the Evaluation Criteria for Ecological Toxicity Data in the Open Literature, Phase I and II*, Office of Pesticide Programs, U.S. Environmental Protection Agency, July 16, 2004. Studies that do not meet these criteria are designated in the bibliography as “Accepted for ECOTOX but not OPP.” The intent of the acceptability criteria is to ensure data quality and verifiability. The criteria parallel criteria used in evaluating registrant-submitted studies. Specific criteria are listed below, along with the corresponding rejection code.

- The paper does not report toxicology information for a chemical of concern to OPP; (Rejection Code: NO COC)
- The article is not published in English language; (Rejection Code: NO FOREIGN)
- The study is not presented as a full article. Abstracts will not be considered; (Rejection Code: NO ABSTRACT)
- The paper is not publicly available document; (Rejection Code: NO NOT PUBLIC (typically not used, as any paper acquired from the ECOTOX holding or through the literature search is considered public))
- The paper is not the primary source of the data; (Rejection Code: NO REVIEW)
- The paper does not report that treatment(s) were compared to an acceptable control; (Rejection Code: NO CONTROL)
- The paper does not report an explicit duration of exposure; (Rejection Code: NO DURATION)
- The paper does not report a concurrent environmental chemical concentration/dose or application rate; (Rejection Code: NO CONC)
- The paper does not report the location of the study (e.g., laboratory vs. field); (Rejection Code: NO LOCATION)
- The paper does not report a biological effect on live, whole organisms; (Rejection Code: NO IN-VITRO)
- The paper does not report the species that was tested; and this species can be verified in a reliable source; (Rejection Code: NO SPECIES)
- The paper does not report effects associated with exposure to a single chemical. (Rejection Code: NO MIXTURE). It should be noted that all papers including data on pesticide mixtures are considered.

Additionally, efficacy studies on target species are excluded and coded as NO TARGET.

Data that originated from the OPP Pesticide Ecotoxicity Database is coded as NO EFED. These data are already available to the chemical team.

APPENDIX G

2,4-D

Papers that Were Accepted for ECOTOX

Acceptable for ECOTOX and OPP

1. Ackers, J. T., Johnston, M. F., and Haasch, M. L. (2000). Immunodetection of Hepatic Peroxisomal PMP70 as an Indicator of Peroxisomal Proliferation in the Mummichog, *Fundulus heteroclitus*. *Mar.Environ.Res.* 50: 361-365.

EcoReference No.: 93400

Chemical of Concern: 24D; Habitat: A; Effect Codes: BCM; Rejection Code: LITE EVAL CODED(24D).

2. Adbellatif, A. G., Preat, V., Vamecq, J., Nilsson, R., and Roberfroid, M. (1990). Peroxisome Proliferation and Modulation of Rat Liver Carcinogenesis by 2,4-Dichlorophenoxyacetic Acid, 2,4,5-Trichlorophenoxyacetic Acid, Perfluorooctanoic Acid and Nafenopin. *Carcinogenesis* 11: 1899-1902.

EcoReference No.: 94239

Chemical of Concern: 24D; Habitat: T; Effect Codes: CEL,BCM,PHY; Rejection Code: LITE EVAL CODED(24D).

3. Alexander, H. C., Gersich, F. M., and Mayes, M. A. (1985). Acute Toxicity of Four Phenoxy Herbicides to Aquatic Organisms. *Bull.Environ.Contam.Toxicol.* 35: 314-321 (OECDG Data File).

EcoReference No.: 11504

Chemical of Concern: 24DXY; Habitat: A; Effect Codes: MOR; Rejection Code: LITE EVAL CODED(24DXY).

4. Amer, S. M. and Aly, F. A. E. (2001). Genotoxic Effect of 2,4-Dichlorophenoxy Acetic Acid and Its Metabolite 2,4-Dichlorophenol in Mouse. *Mutat.Res.* 494: 1-12.

EcoReference No.: 93505

Chemical of Concern: 24D,24DC; Habitat: T; Effect Codes: CEL; Rejection Code: LITE EVAL CODED(24D).

5. Arias, E. (1995). Cytogenetic and Cytokinetic Effects of 2,4-D on B Lymphocytes During Development of the Chick Embryo. *In Vitro Toxicol.* 8: 65-70.

EcoReference No.: 40051

Chemical of Concern: 24D; Habitat: T; Effect Codes: CEL; Rejection Code: LITE EVAL CODED(24D).

6. Arias, E. (2003). Sister Chromatid Exchange Induction by the Herbicide 2,4-Dichlorophenoxyacetic Acid in Chick Embryos. *Ecotoxicol.Environ.Saf.* 55: 338-343.

EcoReference No.: 93618

Chemical of Concern: 24DIO,24D; Habitat: T; Effect Codes: CEL; Rejection Code: LITE EVAL CODED(24D).

7. Ateeq, B., Farah, M. A., and Ahmad, W. (2005). Detection of DNA Damage by Alkaline Single Cell Gel

Electrophoresis in 2,4-Dichlorophenoxyacetic-Acid- and Butachlor-Exposed Erythrocytes of *Clarias batrachus*. *Ecotoxicol.Environ.Saf.* 62: 348-354.

EcoReference No.: 90041

Chemical of Concern: 24D,BTC; Habitat: A; Effect Codes: CEL; Rejection Code: LITE EVAL CODED(24D).

8. Ateeq, B., Farah, M. A., Ali, M. N., and Ahmad, W. (2002). Induction of Micronuclei and Erythrocyte Alterations in the Catfish *Clarias batrachus* by 2,4-Dichlorophenoxyacetic Acid and Butachlor. *Mutat.Res.* 518: 135-144.

EcoReference No.: 65759

Chemical of Concern: 24D,BTC; Habitat: A; Effect Codes: CEL; Rejection Code: LITE EVAL CODED(24D).

9. Aydin, H., Ozdemir, N., and Uzunoren, N. (2005). Investigation of the Accumulation of 2,4-Dichlorophenoxyacetic Acid (2,4-D) in Rat Kidneys. *Forensic Sci.Int.* 153: 53-57.

EcoReference No.: 93410

Chemical of Concern: 24D; Habitat: T; Effect Codes: ACC; Rejection Code: LITE EVAL CODED(24D).

10. Bailey, H. C. and Liu, D. H. W. (1980). *Lumbriculus variegatus*, a Benthic Oligochaete, as a Bioassay Organism. In: J.C.Eaton, P.R.Parrish, and A.C.Hendricks (Eds.), *Aquatic Toxicology and Hazard Assessment, 3rd Symposium, ASTM STP 707, Philadelphia, PA* 205-215.

EcoReference No.: 6502

Chemical of Concern: DDT,24DXY,TNT,MLN,Hg,Zn,CuS,Cr,Pb,Cd,CHD,CBL,MXC; Habitat: A; Effect Codes: MOR; Rejection Code: LITE EVAL CODED(24DXY,CBL,CuS,OW-TRV-Cu,MLN),OK(ALL CHEMS).

11. Bariola, L. A., Kittock, D. L., Arle, H. F., Vail, P. V., and Henneberry, T. J. (1976). Controlling Pink Bollworms: Effects of Chemical Termination of Cotton Fruiting on Populations of Diapausing Larvae. *J.Econ.Entomol.* 69: 633-636.

EcoReference No.: 80741

Chemical of Concern: DMDP,CQTC,CFRM; Habitat: T; Effect Codes: POP,REP; Rejection Code: LITE EVAL CODED(CFRM,CQTC,DMDP).

12. Bednarz, T. (1981). The Effect of Pesticides on the Growth of Green and Blue-Green Algae Cultures. *Acta Hydrobiol.* 23: 155-172.

EcoReference No.: 17259

Chemical of Concern: 24DXY,ATZ,DU,SZ,MXC,DDT; Habitat: A; Effect Codes: POP,CEL; Rejection Code: LITE EVAL CODED(24DXY,ATZ,SZ),OK(ALL CHEMS).

13. Belgers, J. D. M., Van Lieverloo, R. J., Van der Pas, L. J. T., and Van den Brink, P. J. (2007). Effects of the Herbicide 2,4-D on the Growth of Nine Aquatic Macrophytes. *Aquat.Bot.* 86: 260-268 .

EcoReference No.: 93399

Chemical of Concern: 24D; Habitat: A; Effect Codes: POP,GRO; Rejection Code: LITE EVAL CODED(24D).

14. Benli, A. C. K., Sarikaya, R., Sepici-Dincel, A., Selvi, M., Sahin, D., and Erkoc, F. (2007). Investigation of Acute Toxicity of (2,4-Dichlorophenoxy)Acetic Acid (2,4-D) Herbicide on Crayfish (*Astacus leptodactylus* Esch. 1823). *Pestic.Biochem.Physiol.* 88: 296-299.

EcoReference No.: 93398

Chemical of Concern: 24D; Habitat: A; Effect Codes: MOR,BEH; Rejection Code: LITE EVAL CODED(24D).

15. Bionetics Research Laboratories Incorporated (1968). Evaluation of Carcinogenic, Teratogenic, and Mutagenic Activities of Selected Pesticides and Industrial Chemicals. Volume II. Teratogenic Study in Mice and Rats. *Natl.Cancer Inst., NTIS PB-223 160*: 150 p.

EcoReference No.: 89569

Chemical of Concern:

PPB,PPZ,Captan,CBL,DU,THM,24DXY,DDT,ATZ,AMTL,Nabam,IPPA,24DB,24DIO,24D,24DC;

Habitat : T; Effect Codes: MOR,REP,GRO; Rejection Code: LITE EVAL CODED(Captan,ATZ,24D,IPPA),OK(ALL CHEMS).

16. Bionetics Research Laboratories Incorporated (1968). Evaluation of Carcinogenic, Teratogenic, and Mutagenic Selected Pesticides and Industrial Chemicals. Vol II. Teratogenic Study in Mice and Rats. *Natl.Cancer Inst., NTIS PB-223 160* 150 p.

EcoReference No.: 91379

Chemical of Concern:

PPZ,Captan,PPB,24DXY,CBL,DU,THM,PNB,DDT,ATZ,Nabam,Folpet,ETU,PNB,MTAS,IPPA;

Habitat: T; Effect Codes: GRO,MOR,REP; Rejection Code: LITE EVAL CODED(ATZ,Folpet,ETU,Captan,24DXY,IPPA),OK(ALL CHEMS).

17. Bird, K. T. (1993). Comparisons of Herbicide Toxicity Using In Vitro Cultures of *Myriophyllum spicatum*. *J.Aquat.Plant Manag.* 31: 43-45.

EcoReference No.: 13730

Chemical of Concern: 24DXY,ATZ,GYP; Habitat: A; Effect Codes: GRO; Rejection Code: LITE EVAL CODED(24DXY,ATZ),OK(ALL CHEMS).

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EcoReference No.: 563

Chemical of Concern: 24DXY,ATZ,MLN,PL,CBZ,AN,MLN,CPH,CF,PCB; Habitat: A; Effect Codes: MOR; Rejection Code: LITE EVAL CODED(24DXY,ATZ,MLN),OK(ALL CHEMS).

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EcoReference No.: 93408

Chemical of Concern: DMDP; Habitat: T; Effect Codes: PHY,GRO,BEH,MOR; Rejection Code: LITE EVAL CODED(DMDP).

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EcoReference No.: 93627

Chemical of Concern: TRL,TFN,DMDP; Habitat: T; Effect Codes: GRO,PHY; Rejection Code: LITE EVAL CODED(DMDP),OK(TRL,TFN).

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Amphetamine-Challenged Rats. *Ann.N.Y.Acad.Sci.* 965: 314-323.

EcoReference No.: 94215

Chemical of Concern: 24D; Habitat: T; Effect Codes: BCM; Rejection Code: LITE EVAL CODED(24D).

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EcoReference No.: 93509

Chemical of Concern: 24D; Habitat: T; Effect Codes: BCM; Rejection Code: LITE EVAL CODED(24D).

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EcoReference No.: 93598

Chemical of Concern: 24D; Habitat: T; Effect Codes: BCM,ACC; Rejection Code: LITE EVAL CODED(24D).

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EcoReference No.: 93508

Chemical of Concern: 24D; Habitat: T; Effect Codes: BEH,BCM; Rejection Code: LITE EVAL CODED(24D).

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EcoReference No.: 93507

Chemical of Concern: 24D; Habitat: T; Effect Codes: GRO,BEH; Rejection Code: LITE EVAL CODED(24D).

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EcoReference No.: 93510

Chemical of Concern: 24D; Habitat: T; Effect Codes: BCM; Rejection Code: LITE EVAL CODED(24D).

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EcoReference No.: 14329

Chemical of Concern: 24DXY,SZ,OXT,CuS,DBAC; Habitat: A; Effect Codes: MOR; Rejection Code: LITE EVAL CODED(24DXY),NO ENDPOINT(SZ,OXT,CuS,DBAC).

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Superior, WI 6 p.

EcoReference No.: 61180

Chemical of Concern: 24D,DZ; Habitat: A; Effect Codes: MOR; Rejection Code: LITE EVAL CODED(DZ,24D).

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EcoReference No.: 13724

Chemical of Concern: 24DXY,ATZ,DBN,DU,PMT,SZ,TFN,PPZ,Captan; Habitat: A; Effect Codes: BCM; Rejection Code: LITE EVAL CODED(24DXY,Captan,ATZ,SZ,PPZ),OK(ALL CHEMS).

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EcoReference No.: 14985

Chemical of Concern: 24DXY; Habitat: A; Effect Codes: MOR; Rejection Code: LITE EVAL CODED(24DXY).

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EcoReference No.: 14134

Chemical of Concern:

DU,ATZ,AMTR,PMT,PRO,ACL,DCPA,PAQT,MLT,NTP,TBF,VNT,EPTC,PCL,PEB,DDT,24DXY BEE,24D,DMDP; Habitat: A; Effect Codes: MOR,GRO,POP; Rejection Code: LITE EVAL CODED(24DXYBEE,PRO,ATZ,MLT,ACL,TBF),OK(ALL CHEMS),NO ENDPOINT(24D,DMDP).

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EcoReference No.: 6793

Chemical of Concern: CBF,CHD,MLN,MXC,24DXY,Captan,PPN,TFN,TBF; Habitat: A; Effect Codes: GRO,MOR,CEL,ACC,BEH; Rejection Code: LITE EVAL CODED(24DXY,TBF,CBF,MLN,Captan),OK(ALL CHEMS).

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EcoReference No.: 418

Chemical of Concern: 24DXY,CuS,RTN,ATM,FML; Habitat: A; Effect Codes: MOR; Rejection Code: LITE EVAL CODED(24DXY,RTN,CuS,ATM),OK(ALL CHEMS).

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EcoReference No.: 93513

Chemical of Concern: IPPA,24DXYBEE,24D,DMDP,24DXYEE,DEAC,IPAD,TPD; Habitat: T; Effect Codes: MOR,GRO,CEL; Rejection Code: LITE EVAL CODED(IPPA,24DXYBEE,24D,DMDP,DEAC,24DXYEE,IPAD,TPD).

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Dog. *Fundam Appl Toxicol* 29: 78-85.

EcoReference No.: 48144

Chemical of Concern: 24D,24DXYEE,DMDP; Habitat: T; Effect Codes: BCM,MOR,GRO,BEH; Rejection Code: LITE EVAL CODED(24D,24DXYEE,DMDP).

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EcoReference No.: 93515

Chemical of Concern: IPPA,24DXYBEE,TPD,IPAD,DEAC,DMDP,24D,24DXYEE; Habitat: T; Effect Codes: GRO,MOR,REP,PHY; Rejection Code: LITE EVAL CODED(IPPA,24DXYBEE,TPD,IPAD,DEAC,DMDP,24D,24DXYEE).

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EcoReference No.: 93409

Chemical of Concern: PRN,TXP,24D; Habitat: T; Effect Codes: BCM; Rejection Code: LITE EVAL CODED(24D).

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EcoReference No.: 5245

Chemical of Concern: CuOH,BMY,THM,24DXY,MLT,MP,CBL,CBF,MLN,PPN,Captan; Habitat: A; Effect Codes: MOR; Rejection Code: LITE EVAL CODED(24DXY,MLT,CuOH).

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EcoReference No.: 70756

Chemical of Concern: PNB,TFV,24D,MP,PRN,PPN,PNB,SZ,DLD; Habitat: T; Effect Codes: MOR,PHY; Rejection Code: LITE EVAL CODED(SZ,MP,24D) .

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EcoReference No.: 36213

Chemical of Concern: 24D; Habitat: T; Effect Codes: MOR,REP,GRO,PHY; Rejection Code: LITE EVAL CODED(24D).

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EcoReference No.: 36267

Chemical of Concern: 24D,IPPA,24DXY,24DIO,NBZ; Habitat: T; Effect Codes: GRO,REP,MOR; Rejection Code: LITE EVAL CODED(24D,IPPA).

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EcoReference No.: 63261

Chemical of Concern: ATZ,24D,VCZ; Habitat: T; Effect Codes: BCM,CEL; Rejection Code: LITE EVAL CODED(ATZ,24D),OK(VCZ).

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EcoReference No.: 70208

Chemical of Concern: ATZ,24D; Habitat: T; Effect Codes: BCM,CEL,GRO; Rejection Code: LITE EVAL CODED(ATZ,24D).

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EcoReference No.: 2775

Chemical of Concern: EDT,24DXY,DBN,DU,MLT,PAQT,PPN,AMTL,MCPA,As; Habitat: A; Effect Codes: PHY,MOR; Rejection Code: LITE EVAL CODED(24DXY,MLT).

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EcoReference No.: 36304

Chemical of Concern: 24D; Habitat: T; Effect Codes: GRO,PHY; Rejection Code: LITE EVAL CODED(24D).

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EcoReference No.: 2400

Chemical of Concern:

EDT,24DXY,AZ,CBL,CMPPH,DS,DU,HCCH,MLN,PCP,PRN,DDT,NaPCP,DZ,DBAC,DCB,TCC;
Habitat: A; Effect Codes: MOR; Rejection Code: LITE EVAL CODED(24DXY,TCC,CBL,AZ,DCB,DZ,PCP,NaPCP,DBAC,MLN),OK(ALL CHEMS).

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EcoReference No.: 16782

Chemical of Concern: 24DXY,Cd; Habitat: A; Effect Codes: POP,GRO,BCM; Rejection Code: LITE EVAL CODED(24DXY).

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EcoReference No.: 79428

Chemical of Concern: DMDP,PPN; Habitat: T; Effect Codes: GRO,CEL,BCM; Rejection Code: LITE EVAL CODED(DMDP),OK(PPN).

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EcoReference No.: 93382

Chemical of Concern: PPN,DMDP; Habitat: T; Effect Codes: CEL; Rejection Code: LITE EVAL

CODED(DMDP).

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EcoReference No.: 3241

Chemical of Concern: CBL,MP,PMR,CYP,AZ,BTC,MCPA,24DXY; Habitat: A; Effect Codes: PHY; Rejection Code: LITE EVAL CODED(CBL,CYP,MP,24DXY),OK(PMR,AZ,BTN,MCPA),NO COC(MTAS).

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EcoReference No.: 17456

Chemical of Concern: 24DXY,DMT,DS,DZ,HCCH,MLN,CuS,PCP,Zn,PL; Habitat: A; Effect Codes: MOR; Rejection Code: LITE EVAL CODED(24DXY,MLN).

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EcoReference No.: 93603

Chemical of Concern: 24D; Habitat: T; Effect Codes: REP,BCM,GRO; Rejection Code: LITE EVAL CODED(24D).

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EcoReference No.: 94214

Chemical of Concern: 24D; Habitat: T; Effect Codes: PHY,BEH; Rejection Code: LITE EVAL CODED(24D).

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EcoReference No.: 93387

Chemical of Concern: NaDPA; Habitat: T; Effect Codes: BCM; Rejection Code: LITE EVAL CODED(NaDPA).

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EcoReference No.: 93391

Chemical of Concern: GYP,24D,HXZ,TPR; Habitat: T; Effect Codes: POP; Rejection Code: LITE EVAL CODED(24D,GYP,HXZ).

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EcoReference No.: 92612

Chemical of Concern: CHD,CPY,ES,MLN,PMR,24D,PPB,TFN,FNV,TBF; Habitat: T; Effect Codes: GRO,BCM; Rejection Code: LITE EVAL CODED(CPY,24D,TBF,FNV),OK(MLN,PMR,PPB).

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EcoReference No.: 18093

Chemical of Concern: 24DXY,ACR,ATZ,BMN,MBZ,MTL,PAQT,SZ,DMM,TFN; Habitat: A; Effect Codes: POP; Rejection Code: LITE EVAL CODED(24DXY,ATZ,MTL,SZ),OK(ALL CHEMS).

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EcoReference No.: 93092

Chemical of Concern: PCP,24D; Habitat: A; Effect Codes: CEL; Rejection Code: LITE EVAL CODED(24D),OK(PCP).

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EcoReference No.: 68242

Chemical of Concern: PCP,24D; Habitat: A; Effect Codes: CEL; Rejection Code: LITE EVAL CODED(PCP,24D).

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EcoReference No.: 73350

Chemical of Concern: BTC,24D,PCP; Habitat: A; Effect Codes: MOR; Rejection Code: LITE EVAL CODED(PCP,24D).

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EcoReference No.: 13758

Chemical of Concern: 24DXY,NAA,IAA; Habitat: A; Effect Codes: POP; Rejection Code: LITE EVAL CODED(24DXY,IAA),OK(NAA).

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EcoReference No.: 88956

Chemical of Concern:

MP,HCB,Zn,Pb,Cr,Cu,Cd,DMT,EN,DLD,AND,BAP,PAH,24DXY,MLN,HCB,DDT,ES,CBL; Habitat: T; Effect Codes: BCM; Rejection Code: LITE EVAL CODED(CBL,MLN,24DXY),NO MIXTURE(MP,DMT).

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EcoReference No.: 85545

Chemical of Concern: 24D; Habitat: T; Effect Codes: GRO,BCM,ACC; Rejection Code: LITE EVAL CODED(24D).

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EcoReference No.: 10642

Chemical of Concern: 24DXY; Habitat: A; Effect Codes: MOR,GRO; Rejection Code: LITE EVAL CODED(24DXY).

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EcoReference No.: 70739

Chemical of Concern: ATZ,SZ,ACR,CZE,GYP,LNR,MTL,MBZ,24D,PAQT,ACF; Habitat: A; Effect Codes: PHY; Rejection Code: LITE EVAL CODED(MTL,ATZ,SZ,LNR,24D),OK(ACR,CZE,GYP,MBZ,PAQT,ACF)).

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EcoReference No.: 94125

Chemical of Concern: 24D; Habitat: T; Effect Codes: REP,MOR,GRO; Rejection Code: LITE EVAL CODED(24D).

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EcoReference No.: 17961

Chemical of Concern: 24DXY; Habitat: A; Effect Codes: MOR,GRO,BEH,PHY; Rejection Code: LITE EVAL CODED(24DXY).

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EcoReference No.: 93514

Chemical of Concern: 24D; Habitat: T; Effect Codes: CEL; Rejection Code: LITE EVAL CODED(24D).

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EcoReference No.: 93849

Chemical of Concern: 24D; Habitat: T; Effect Codes: GRO,BCM; Rejection Code: LITE EVAL CODED(24D).

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EcoReference No.: 19243

Chemical of Concern: CuS,SZ,24DXY,ACR,BMC,BMN,LNR; Habitat: AT; Effect Codes: GRO, PHY, BCM,POP; Rejection Code: LITE EVAL CODED(24DXY,BMC,SZ,CuS),OK(ALL CHEMS).

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- EcoReference No.: 62406
 Chemical of Concern: DSMA,NPM,CuS,AMTL,SZ,TRL,BMN,BFL,DMB,CCA,ACR,24D,PCL,NP,LNR,BMC; Habitat: AT; Effect Codes: GRO,POP; Rejection Code: LITE EVAL CODED(24D,LNR),OK(CuS,SZ,DMB,BMC).
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- EcoReference No.: 10460
 Chemical of Concern: SZ,24DXY; Habitat: A; Effect Codes: MOR,BEH; Rejection Code: LITE EVAL CODED(24DXY),NO CONTROL(SZ).
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- EcoReference No.: 72787
 Chemical of Concern: 24D,CPY; Habitat: A; Effect Codes: CEL; Rejection Code: LITE EVAL CODED(CPY,24D).
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- EcoReference No.: 20178
 Chemical of Concern: 24DXY; Habitat: A; Effect Codes: BEH,BCM,CEL,GRO,MOR; Rejection Code: LITE EVAL CODED(24DXY).
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- EcoReference No.: 13738
 Chemical of Concern: 24DXY,MTL; Habitat: A; Effect Codes: POP,GRO,BCM; Rejection Code: LITE EVAL CODED(24DXY,MTL),OK(ALL CHEMS).
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- EcoReference No.: 93388
 Chemical of Concern: 24DXY,24D,NaDPA,DMDP,24DXYBEE; Habitat: T; Effect Codes: MOR,ACC,GRO,BEH; Rejection Code: LITE EVAL CODED(24D,NaDPA,DMDP,24DXYBEE).
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- EcoReference No.: 93384
 Chemical of Concern: Cr03,K2Cr04,24D; Habitat: T; Effect Codes: CEL; Rejection Code: LITE EVAL CODED(24D),OK(Cr03).

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EcoReference No.: 93412

Chemical of Concern: DMDP; Habitat: A; Effect Codes: MOR; Rejection Code: LITE EVAL CODED(DMDP).

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EcoReference No.: 14896

Chemical of Concern: 24DXY; Habitat: A; Effect Codes: POP,MOR; Rejection Code: LITE EVAL CODED(24DXY).

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EcoReference No.: 82041

Chemical of Concern: CPY,DMB,MCP1,PMR,MZB,24D,DDT,ATZ,MTL,PDM,TBO,CTN,NHN;
Habitat: T; Effect Codes: GRO,CEL; Rejection Code: LITE EVAL CODED(CTN,MZB,MTL,MCP1,ATZ,CPY,24D),OK(DMB,PMR,DDT,PDM,TBO,NHN),NO COC(DEAC).

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EcoReference No.: 36996

Chemical of Concern: 24D; Habitat: T; Effect Codes: MOR,GRO,PHY,REP,CEL; Rejection Code: LITE EVAL CODED(24D).

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EcoReference No.: 8071

Chemical of Concern: 24DXY; Habitat: A; Effect Codes: MOR; Rejection Code: LITE EVAL CODED(24DXY).

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EcoReference No.: 2878

Chemical of Concern: 24DXY; Habitat: A; Effect Codes: POP,MOR; Rejection Code: LITE EVAL CODED(24DXY).

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EcoReference No.: 7485

Chemical of Concern: 24DXY,ACR,PMT; Habitat: A; Effect Codes: GRO; Rejection Code: LITE EVAL CODED(24DXY).

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EcoReference No.: 72915

Chemical of Concern: DMDP,GYP; Habitat: T; Effect Codes: BCM,MOR; Rejection Code: LITE EVAL CODED(DMDP),OK(GYP).

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EcoReference No.: 35243

Chemical of Concern:

24DXY,ABT,ADC,AMTL,AND,ATZ,Captan,CBF,CBL,Cd,Cr,DDT,DLD,DMT,DS,DU,DZ,ES,ETN,FNT,HCCH,Hg,HPT,MCPB,MLN,MP,MRX,MTAS,MXC,Naled,Pb,PCB,PCL,PCP,PQT,PRN,PRT,PYN,RSM,RTN,SZ,TFM,THM,TVP,TXP,Zn,ZnP,As,AZ,OXD; Habitat: T; Effect Codes: MOR; Rejection Code: LITE EVAL CODED(24DXY,CPY,MP,Naled,Captan,MLN,OXD,MTAS,CBL,DZ,ATZ,CBF,ADC,MOM,DMT,SZ,ZnP,RTN,RSM,MCPB,PCP,PRT),OK(ALL CHEMS).

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EcoReference No.: 19372

Chemical of Concern: 24DXY,BMN,HCCH,MP,MAL,MCPPI,FNT,CBF; Habitat: A; Effect Codes: POP,MOR,GRO; Rejection Code: LITE EVAL CODED(24DXY,MCPPI,MAL,MP),OK(BMN,HCCH,FNT,CBF).

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EcoReference No.: 83238

Chemical of Concern: 24D,MCPPI,DMB; Habitat: T; Effect Codes: GRO,REP; Rejection Code: LITE EVAL CODED(MCPPI,24D),OK(DMB).

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EcoReference No.: 35249

Chemical of Concern:

ACP,CBL,DZ,DMT,EN,HCCH,MLN,MOM,Naled,PRN,PMR,PSM,SPS,TMP,TXP,AMTL,ATZ,BMN,MCPA,24DXY,DMB,GYP,PAQT,PCL,PRO,PPN,TFN,ALSV; Habitat: T; Effect Codes: MOR,GRO; Rejection Code: LITE EVAL CODED(24DXY,Naled,MLN,CBL,ACP,PRO,DZ,ATZ,MOM,DMT,DMB,ALSV),OK(ALL CHEMS),NO MIXTURE(BMN,MCPA).

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EcoReference No.: 14908

Chemical of Concern: ASCN,AN,PL,24DXY; Habitat: A; Effect Codes: MOR,GRO; Rejection Code: LITE EVAL CODED(24DXY,ASCN),OK(AN,PL).

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EcoReference No.: 15189

Chemical of Concern: 24DXY,HCCH,PCP,CPH,NP,PL; Habitat: A; Effect Codes: BCM,PHY; Rejection Code: LITE EVAL CODED(24DXY),NO ENDPOINT,CONTROL(PCP).

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EcoReference No.: 50386

Chemical of Concern:

ACP,ACL,ACR,ADC,AND,ATN,AMTL,ANZ,ATZ,4AP,AZ,PPX,BTY,Captan,CBL,CBF,CHD,CQT C,CPY,CMPH,CZE,24D,DDT,DDVP,DEF,DEM,DZ,DBN,DLN,DCF,DCTP,DLD,DMT,DQTB,DS, DU,ES,EDT,EN,EP,ETN,FNT,FNTH,FMV,Folpet,FNF,HPT,PSM,HCCH,MLN,MDT,MCB,MOM,M TPN,MXC,MP,MVP,MRX,NABAM,Naled,FMP,PQT,PRN,PCP,PRT,PCL,RSM,RTN,STAR,STCH, TCDD,TMP,TZL,TVP,TZL,THM,TXP,TCF,TFN,ZnP,ZINEB; Habitat: T; Effect Codes: MOR; Rejection Code: LITE EVAL CODED(CPY,24D),OK(ALL CHEMS).

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EcoReference No.: 879

Chemical of Concern: EDT,24DXY,DBN; Habitat: A; Effect Codes: MOR; Rejection Code: LITE EVAL CODED(24DXY).

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EcoReference No.: 612

Chemical of Concern: 24DXY,DPP1; Habitat: A; Effect Codes: MOR; Rejection Code: LITE EVAL CODED(24DXY),NO CONTROL(DPP1).

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EcoReference No.: 2135

Chemical of Concern: EDT,24DXY,DBN,CuS,As,PCP; Habitat: A; Effect Codes: MOR; Rejection Code: LITE EVAL CODED(24DXY,CuS,OW-TRV-Cu,PCP),OK(ALL CHEMS).

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EcoReference No.: 71346

Chemical of Concern:

DU,PNB,DDT,SZ,ATZ,RTN,FBM,MRX,PPZ,THM,CBL,24DXY,24D,IPPA,24DIO,Maneb,Zineb,Captan,Nabam,Folpet,ETU,ES,IAA,BPH; Habitat: T; Effect Codes: CEL; Rejection Code: LITE EVAL CODED(24D,Maneb,CBL,SZ,ATZ,RTN,PPZ,Captan,Folpet,IPPA),NO ENDPOINT(ETU),OK(BPH).

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EcoReference No.: 93542

- Chemical of Concern: MCPA,MCPB,24D; Habitat: T; Effect Codes: GRO,BCM; Rejection Code: LITE EVAL CODED(24D),OK(MCPB).
98. Ishii, S. and Hirano, C. (1963). Growth Responses of Larvae of the Rice Stem Borer to Rice Plants Treated with 2,4-D. *Entomol.Exp.Appl.* 6: 257-262.
- EcoReference No.: 50516
Chemical of Concern: NaDPA; Habitat: T; Effect Codes: PHY,MOR,GRO,POP,BCM; Rejection Code: LITE EVAL CODED(NaDPA).
99. Johnson, D. R. (1964). Effects of Range Treatment with 2,4-D on Food Habits of Rodents. *Ecology* 45: 241-249.
- EcoReference No.: 50674
Chemical of Concern: 24D; Habitat: T; Effect Codes: BEH,POP; Rejection Code: LITE EVAL CODED(24D).
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- EcoReference No.: 35284
Chemical of Concern: 24D; Habitat: T; Effect Codes: POP; Rejection Code: LITE EVAL CODED(24D).
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- EcoReference No.: 17120
Chemical of Concern: 24DXY,DPDP; Habitat: A; Effect Codes: MOR; Rejection Code: LITE EVAL CODED(24DXY,DPDP).
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- EcoReference No.: 93622
Chemical of Concern: 24D,GIB,NAA; Habitat: T; Effect Codes: GRO; Rejection Code: LITE EVAL CODED(24D).
103. Jonathan, S. G. and Fasidi, I. O. (2003). Studies on *Psathyrella atroumbonata* (Pegler), a Nigerian Edible Fungus. *Food Chem.* 81: 481-484.
- EcoReference No.: 93624
Chemical of Concern: GIB,NAA,24D; Habitat: T; Effect Codes: GRO; Rejection Code: LITE EVAL CODED(24D).
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- EcoReference No.: 93623
Chemical of Concern: GIB,24D,IAA; Habitat: T; Effect Codes: GRO; Rejection Code: LITE EVAL CODED(24D),OK(IAA).
105. Joyce, J. C. and Haller, W. T. (1984). Effect of 2,4-D and Gibberellic Acid on Waterhyacinths Under

Operational Conditions. *J.Aquat.Plant Manag.* 22: 75-78.

EcoReference No.: 10690

Chemical of Concern: DMDP; Habitat: A; Effect Codes: POP,GRO,MOR; Rejection Code: LITE EVAL CODED(DMDP).

106. Kader, H. A., Thayumanavan, B., and Krishnaswamy, S. (1976). The Relative Toxicities of Ten Biocides on *Spicodiatomus chelospinus* Rajendran (1973) [Copepoda: Calanoida]. *Comp.Physiol.Ecol.* 1: 78-82.

EcoReference No.: 5264

Chemical of Concern: DDT,ES,HCCH,DLD,CBL,24DXY; Habitat: A; Effect Codes: MOR; Rejection Code: LITE EVAL CODED(24DXY,CBL),OK(ALL CHEMS).

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EcoReference No.: 40147

Chemical of Concern: PRO,GYP,TFN,PMR,24DXY; Habitat: T; Effect Codes: CEL; Rejection Code: LITE EVAL CODED(PRO,24DXY),OK(PMR,TFN,GYP).

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EcoReference No.: 93415

Chemical of Concern: 24D,ATZ; Habitat: T; Effect Codes: MOR,BCM; Rejection Code: LITE EVAL CODED(24D),OK(ATZ).

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EcoReference No.: 93397

Chemical of Concern: TXP,PHTH,MBZ,MTL,24D,ACO,ACR,AMZ,CSF,CZE,DDT,DFZ,LNR; Habitat: A; Effect Codes: MOR,GRO,REP; Rejection Code: LITE EVAL CODED(24D,LNR),OK(TARGET-MTL).

110. Kim, C. S., Keizer, R. F., and Pritchard, J. B. (1988). 2,4-Dichlorophenoxyacetic Acid Intoxication Increases Its Accumulation Within the Brain. *Brain Res.* 440: 216-226.

EcoReference No.: 93600

Chemical of Concern: 24D; Habitat: T; Effect Codes: ACC,BCM; Rejection Code: LITE EVAL CODED(24D).

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EcoReference No.: 93472

Chemical of Concern: 24D; Habitat: T; Effect Codes: CEL; Rejection Code: LITE EVAL CODED(24D).

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- EcoReference No.: 93655
Chemical of Concern: NaDPA,DMDP; Habitat: T; Effect Codes: ACC,BCM,PHY; Rejection Code: LITE EVAL CODED(NaDPA,DMDP).
113. Kobraei, M. E. and White, D. S. (1996). Effects of 2,4-Dichlorophenoxyacetic Acid on Kentucky Algae: Simultaneous Laboratory and Field Toxicity Testings. *Arch.Environ.Contam.Toxicol.* 31: 571-580 .
- EcoReference No.: 20051
Chemical of Concern: DMDP; Habitat: A; Effect Codes: SYS,BCM,POP; Rejection Code: LITE EVAL CODED(DMDP).
114. Kulkarni, A. P., Fabacher, D. L., and Hodgson, E. (1980). Pesticides as Inducers of Hepatic Drug-Metabolizing Enzymes - II. Glutathione S-Transferases. *Gen.Pharmacol.* 11: 437-441.
- EcoReference No.: 92613
Chemical of Concern: TBF,TFN,ES,CHD,MLN,CPY,PPB,24D,PMR; Habitat: T; Effect Codes: BCM; Rejection Code: LITE EVAL CODED(CPY,24D),OK(MLN,PPB,PMR,TBF).
115. Larrain, A., Riveros, A., Silva, J., and Bay-Schmith, E. (1999). Toxicity of Metals and Pesticides Using the Sperm Cell Bioassay with the Sea Urchin *Arbacia spatuligera*. *Bull.Environ.Contam.Toxicol.* 62: 749-757.
- EcoReference No.: 20469
Chemical of Concern: CuS,24DXY,Cr,Cd,PCP,Zn; Habitat: A; Effect Codes: REP; Rejection Code: LITE EVAL CODED(24DXY,CuS,PCP),OK(ALL CHEMS).
116. Lee, K., Johnson, V. J., and Blakley, B. R. (2001). The Effect of Exposure to a Commercial 2,4-D Formulation During Gestation on the Immune Response in CD-1 Mice. *Toxicology* 165: 39-49.
- EcoReference No.: 93516
Chemical of Concern: DMDP; Habitat: T; Effect Codes: GRO,BEH,PHY,CEL; Rejection Code: LITE EVAL CODED(DMDP).
117. Lee, K., Johnson, V. J., and Blakley, B. R. (2000). The Effect of Exposure to a Commercial 2,4-D Herbicide Formulation During Gestation on Urethan-Induced Lung Adenoma Formation in CD-1 Mice. *Vet.Hum.Toxicol.* 42: 129-132.
- EcoReference No.: 93404
Chemical of Concern: DMDP; Habitat: T; Effect Codes: GRO,BEH,PHY; Rejection Code: LITE EVAL CODED(DMDP).
118. Linnainmaa, K. (1984). Induction of Sister Chromatid Exchanges by the Peroxisome Proliferators 2,4-D, MCPA, and Clofibrate In Vivo and In Vitro. *Carcinogenesis* 5: 703-707.
- EcoReference No.: 93634
Chemical of Concern: DMDP,MCPA; Habitat: T; Effect Codes: CEL; Rejection Code: LITE EVAL CODED(DMDP).
119. Lio-Po, G. D. and Sanvictores, E. G. (1986). Tolerance of *Penaeus monodon* Eggs and Larvae to Fungicides Against *Lagenidium* sp. and *Haliphthoros philippinensis*. *Aquaculture* 51: 161-168.
- EcoReference No.: 4581
Chemical of Concern: 24DXY,CTN,TFN,DBAC,24DB; Habitat: A; Effect Codes: MOR,GRO; Rejection Code: LITE EVAL CODED(24DXY,DBAC,CTN),OK(TFN,24DB).

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- EcoReference No.: 8127
Chemical of Concern: MXC,CBL,MLN,TFN,24DXY; Habitat: A; Effect Codes: GRO,MOR; Rejection Code: LITE EVAL CODED(24DXY,CBL,MLN),OK(MXC,TFN).
121. Lundgren, B., Meijer, J., and DePierre, J. W. (1987). Induction of Cytosolic and Microsomal Epoxide Hydrolases and Proliferation of Peroxisomes and Mitochondria in Mouse Liver After Dietary Exposure to p-Chlorophenoxyacetic Acid, 2,4-Dichlorophenoxyacetic Acid and 2,4,5-Trichlorophenoxyacetic Acid. *Biochem.Pharmacol.* 36: 815-821.
- EcoReference No.: 93403
Chemical of Concern: 24D; Habitat: T; Effect Codes: GRO,CEL,BCM; Rejection Code: LITE EVAL CODED(24D).
122. Madrigal-Bujaidar, E., Hernandez-Ceruelos, A., and Chamorro, G. (2001). Induction of Sister Chromatid Exchanges by 2,4-Dichlorophenoxyacetic Acid in Somatic and Germ Cells of Mice Exposed In Vivo. *Food Chem.Toxicol.* 39: 941-946.
- EcoReference No.: 93517
Chemical of Concern: 24D; Habitat: T; Effect Codes: CEL; Rejection Code: LITE EVAL CODED(24D).
123. Martens, D. W., Gordon, R. W., and Servizi, J. A. (1980). Toxicity of Butoxyethyl Ester of 2,4-D to Selected Salmon and Trout. *Prog.Rep.No.40, International Pacific Salmon Fish.Comm., New Westminster, B.C.* 18 p.
- EcoReference No.: 18424
Chemical of Concern: 24D,24DXYBEE; Habitat: A; Effect Codes: GRO,MOR; Rejection Code: LITE EVAL CODED(24D,24DXYBEE).
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- EcoReference No.: 93626
Chemical of Concern: DMDP; Habitat: T; Effect Codes: GRO,PHY,CEL,ACC; Rejection Code: LITE EVAL CODED(DMDP).
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Chemical of Concern: 24D; Habitat: T; Effect Codes: BEH,GRO,PHY; Rejection Code: LITE EVAL CODED(24D).
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Chemical of Concern: DMDP; Habitat: T; Effect Codes: GRO,ACC,CEL,BEH; Rejection Code: LITE EVAL CODED(DMDP).
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EcoReference No.: 71033

Chemical of Concern: 24D,PCL; Habitat: T; Effect Codes: POP,MOR; Rejection Code: LITE EVAL CODED(24D).

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EcoReference No.: 66270

Chemical of Concern: DU,SZ,Hg,Zn,Cu,Cd,MLN,24DXY,Be,Cr,Ag,PL,TOL,BNZ,Ni,GYP,BMC; Habitat: A; Effect Codes: POP; Rejection Code: LITE EVAL CODED(24DXY,SZ,MLN),OK(ALL CHEMS).

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EcoReference No.: 91689

Chemical of Concern: PZM,NFZ,FZF,DBN,PAQT,24DXY,SZ,DU; Habitat: T; Effect Codes: REP,POP,MOR; Rejection Code: LITE EVAL CODED(PZM,24DXY),OK(SZ).

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EcoReference No.: 81810

Chemical of Concern: CBL,Cu,NYP,PCP,PMR,24DXY; Habitat: A; Effect Codes: MOR; Rejection Code: LITE EVAL CODED(24DXY).

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EcoReference No.: 93348

Chemical of Concern: 24D; Habitat: T; Effect Codes: BEH,CEL; Rejection Code: LITE EVAL CODED(24D).

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EcoReference No.: 82825

Chemical of Concern: IGS,K2Cr2O7,MANEB,NiCl,CdCl,24D,TBC,PAQT,HCCH,MLN,NYP; Habitat: A; Effect Codes: POP; Rejection Code: LITE EVAL CODED(IGS,K2Cr2O7,MANEB,NiCl,CdCl,24D,TBC,PAQT,HCCH,MLN).

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EcoReference No.: 63246

Chemical of Concern: ATZ,24DXY,EDT; Habitat: A; Effect Codes: GRO,MOR; Rejection Code: LITE EVAL CODED(24DXY,ATZ),OK(ALL CHEMS).

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- EcoReference No.: 87186
Chemical of Concern: DMDP; Habitat: T; Effect Codes: ACC,BCM,BEH,GRO,MOR,PHY,CEL; Rejection Code: LITE EVAL CODED(DMDP).
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- EcoReference No.: 69821
Chemical of Concern: ACYP,DM,PRM,HCCH,CBL,MOM,MLN,Captan,LNR,GYP,PDM,BT,DMB,DDVP,THM,DOD,IPD,TPE,PDM,PCH,24D,MCPA; Habitat: A; Effect Codes: MOR; Rejection Code: LITE EVAL CODED(CBL,MLN,MOM,DMB,Captan,24D,LNR).
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- EcoReference No.: 63983
Chemical of Concern: MCPP1,DMB,24D,MCPA,DMT,CBL,MZB,TDF,PCZ,CQTC,EPH,BMN,PIM; Habitat: T; Effect Codes: REP,MOR,POP; Rejection Code: LITE EVAL CODED(24D,DMT,PCZ,DMB,TDF,MZB),NO MIXTURE(MCPP1),OK(CBL,MCPA,EPH,BMN,PIM),TARGET(CQTC).
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- EcoReference No.: 18961
Chemical of Concern: EDT,24DXY,MLN,Zn,Cd,CuS; Habitat: A; Effect Codes: MOR; Rejection Code: LITE EVAL CODED(24DXY,CuS,MLN),OK(ALL CHEMS).
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Chemical of Concern: 24DXY; Habitat: A; Effect Codes: MOR,GRO,BCM,CEL; Rejection Code: LITE EVAL CODED(24DXY).
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- EcoReference No.: 90486
Chemical of Concern: AMTL,TCF,DDVP,ATZ,ACR,24D,MZB; Habitat: T; Effect Codes: GRO,BCM; Rejection Code: LITE EVAL CODED(MZB,ATZ,24D),OK(AMTL,TCF,DDVP,ACR).
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Chemical of Concern: 24DXY,ACR,DBN,PQT,Captan; Habitat: A; Effect Codes: MOR; Rejection Code: LITE EVAL CODED(24DXY,Captan).
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Trout Exposed to Carbaryl, Atrazine, 2,4-Dichlorophenoxyacetic Acid, and Parathion: A Cytochemical Study. *Ph.D.Thesis, Pennsylvania State Univ., University Park, PA* 213 p.

EcoReference No.: 72745

Chemical of Concern: ATZ,CBL,24D,PRN; Habitat: A; Effect Codes: PHY,CEL,BCM,BEH; Rejection Code: LITE EVAL CODED(CBL,ATZ,24D),OK(PRN).

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EcoReference No.: 93633

Chemical of Concern: 24D; Habitat: T; Effect Codes: PHY,ACC,BCM; Rejection Code: LITE EVAL CODED(24D).

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EcoReference No.: 52847

Chemical of Concern: 24D,NAA; Habitat: T; Effect Codes: GRO,MOR; Rejection Code: LITE EVAL CODED(24D).

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EcoReference No.: 3590

Chemical of Concern: ACR,ATZ,MXC,BTC,CuS,CBL,24DXY,PL,PAH; Habitat: A; Effect Codes: REP,MOR; Rejection Code: LITE EVAL CODED(24DXY,CBL,ATZ,CuS,OW-TRV-Cu),OK(ALL CHEMS).

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EcoReference No.: 73377

Chemical of Concern: DMDP,AZ; Habitat: A; Effect Codes: BCM; Rejection Code: LITE EVAL CODED(DMDP,AZ).

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EcoReference No.: 60050

Chemical of Concern: DMDP,AZ; Habitat: A; Effect Codes: PHY,BCM; Rejection Code: LITE EVAL CODED(AZ,DMDP).

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EcoReference No.: 19598

Chemical of Concern: 24DXY; Habitat: A; Effect Codes: MOR,BCM; Rejection Code: LITE EVAL CODED(24DXY).

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Chemical of Concern: 24D; Habitat: T; Effect Codes: GRO,CEL; Rejection Code: LITE EVAL CODED(24D).
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- EcoReference No.: 89877
Chemical of Concern: MLN,DU,24D,PCH,ATZ; Habitat: A; Effect Codes: CEL; Rejection Code: LITE EVAL CODED(ATZ,MLN,24D),OK(DU,PCH).
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Chemical of Concern: SZ,PAQT,24DXY; Habitat: A; Effect Codes: MOR; Rejection Code: LITE EVAL CODED(24DXY,SZ),OK(ALL CHEMS).
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Chemical of Concern: CBD,24D; Habitat: A; Effect Codes: MOR; Rejection Code: LITE EVAL CODED(24D).
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Chemical of Concern: DMDP; Habitat: T; Effect Codes: PHY,BCM,CEL; Rejection Code: LITE EVAL CODED(DMDP).
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Chemical of Concern: DMDP; Habitat: T; Effect Codes: PHY,BEH,ACC; Rejection Code: LITE EVAL CODED(DMDP).
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Chemical of Concern: DMDP; Habitat: T; Effect Codes: BCM; Rejection Code: LITE EVAL CODED(DMDP).
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Cattle Serum Components and Enzyme Activities. *Vet.Hum.Toxicol.* 37: 329-332.

EcoReference No.: 40111

Chemical of Concern: DMDP; Habitat: T; Effect Codes: BCM,PHY; Rejection Code: LITE EVAL CODED(DMDP).

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EcoReference No.: 10924

Chemical of Concern: 24DXY,CFRM; Habitat: A; Effect Codes: POP; Rejection Code: LITE EVAL CODED(24DXY),NO ENDPOINT(CFRM).

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EcoReference No.: 53301

Chemical of Concern: NaDPA,SZ; Habitat: T; Effect Codes: POP; Rejection Code: LITE EVAL CODED(NaDPA),OK(SZ).

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EcoReference No.: 9651

Chemical of Concern: 24DXY,PCP; Habitat: A; Effect Codes: REP; Rejection Code: LITE EVAL CODED(24DXY,PCP).

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EcoReference No.: 4740

Chemical of Concern: 24D,NaDPA; Habitat: A; Effect Codes: MOR,REP; Rejection Code: LITE EVAL CODED(24D,NaDPA).

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EcoReference No.: 93394

Chemical of Concern: ANT,PHE,NAPH,24D,HCCH; Habitat: A; Effect Codes: BCM,CEL; Rejection Code: LITE EVAL CODED(24D),NO MIXTURE(ANT,PHE,NAPH).

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EcoReference No.: 72021

Chemical of Concern: 24D,MCPB; Habitat: T; Effect Codes: REP,POP; Rejection Code: LITE EVAL CODED(MCPB,24D).

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EcoReference No.: 61494

- Chemical of Concern: TFN,CBF,DMT,24DXY,CPY,PCP,HCCH; Habitat: T; Effect Codes: BCM; Rejection Code: LITE EVAL CODED(24DXY,CPY,CBF,DMT),OK(HCCH,TFN).
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- EcoReference No.: 93347
Chemical of Concern: PCL,DMDP; Habitat: T; Effect Codes: MOR,REP; Rejection Code: LITE EVAL CODED(DMDP).
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Chemical of Concern:
DU,FNV,ES,FNF,FML,NCTN,CBD,MLN,PRN,Captan,TPM,PPB,DCTP,ACP,BMY,MBZ,PAQT,BN Z,CH3I,TFN,NaN03,AZ,24DXY,NP,Cd,Pb,CuS,DDT,PAH,IDM,DMM,CYP,PMR,CBF,ADC,MOM,CBL,PPX,CPY,NHN,CTC; Habitat: T; Effect Codes: MOR; Rejection Code: LITE EVAL CODED(24DXY,FNV,CPY,Captan,MLN,ADC,CBL,NCTN,CBF,MOM,PPB,CuS,CYP),OK(ALL CHEMS).
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- EcoReference No.: 60864
Chemical of Concern: 24D,CuS,GYPI; Habitat: A; Effect Codes: MOR,GRO,POP; Rejection Code: LITE EVAL CODED(24D),OK(CuS,GYPI).
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- EcoReference No.: 74985
Chemical of Concern:
PI,ZnCl2,TPR,24D,ATZ,DQTBBr,FDE,GYP,HXZ,MTL,GYPA,GYPI,BNZ,ETHN,MOL; Habitat: A; Effect Codes: GRO,BCM,CEL; Rejection Code: LITE EVAL CODED(MTL,ATZ,HXZ,24D,GYP,GYPI).
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- EcoReference No.: 93434
Chemical of Concern: 24D; Habitat: T; Effect Codes: GRO,BCM,CEL; Rejection Code: LITE EVAL CODED(24D).
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- EcoReference No.: 93629
Chemical of Concern: 24D; Habitat: T; Effect Codes: GRO,PHY,CEL,BCM; Rejection Code: LITE EVAL CODED(24D).
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- EcoReference No.: 80618
Chemical of Concern: PPN,DMDP; Habitat: T; Effect Codes: PHY; Rejection Code: LITE EVAL CODED(DMDP),NO COC(DPP1).
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- EcoReference No.: 2891
Chemical of Concern: EDT,24DXY,AZ,HCCH,MLN,MLT,Naled,PAQT,PPB,TFN,TXP,AND,HPT,DLD,PRN,EN,DDT,M XC,TBF; Habitat: A; Effect Codes: MOR,BEH,MOR; Rejection Code: LITE EVAL CODED(24DXY,TBF,MLT,PPB,MLN),OK(ALL CHEMS).
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- EcoReference No.: 93393
Chemical of Concern: 24D; Habitat: A; Effect Codes: MOR; Rejection Code: LITE EVAL CODED(24D).
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- EcoReference No.: 81822
Chemical of Concern: 24D; Habitat: A; Effect Codes: MOR,BEH; Rejection Code: LITE EVAL CODED(24D).
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- EcoReference No.: 19021
Chemical of Concern: SZ,24DXY,Urea; Habitat: A; Effect Codes: MOR; Rejection Code: LITE EVAL CODED(SZ,24DXY),OK(Urea).
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Chemical of Concern: 24D; Habitat: A; Effect Codes: POP; Rejection Code: LITE EVAL CODED(24D).
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- EcoReference No.: 74877
Chemical of Concern: FNT,DDVP,HCCH,DDT,24D; Habitat: T; Effect Codes: CEL,BCM; Rejection Code: LITE EVAL CODED(24D).
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- EcoReference No.: 2757
Chemical of Concern: 24DXY; Habitat: A; Effect Codes: POP,MOR,ACC; Rejection Code: LITE EVAL CODED(24DXY).
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- EcoReference No.: 20487
Chemical of Concern: NH,Cu,TNT,MLN,PCP,Zn,PL,Cd,24DXY,C8OH; Habitat: A; Effect Codes: MOR; Rejection Code: LITE EVAL CODED(24DXY,C8OH,Cu,PCP,MLN),OK(ALL CHEMS).
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- EcoReference No.: 70487
Chemical of Concern: 24D,CLNB,ADC,Captan,THM,PAQT,PPN,Cu,ATZ,HCCH,PNB ; Habitat: T; Effect Codes: GRO; Rejection Code: LITE EVAL CODED(ADC,ATZ,CLNB,Captan,24D).
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- EcoReference No.: 93521
Chemical of Concern: 24D,MLN,TMT,DDT,FNT; Habitat: T; Effect Codes: BCM; Rejection Code: LITE EVAL CODED(24D),OK(TARGET-MLN,TMT).
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- EcoReference No.: 17689
Chemical of Concern: 24DXY,CPY,DZ,Cu,AMSV,Se,Ag,Cd,Zn,NH,Pb,Ni,CF,NaPCP; Habitat: A; Effect Codes: REP,POP,MOR; Rejection Code: LITE EVAL CODED(24DXY,CPY,DZ,OW-TRV-Cu),OK(ALL CHEMS).
182. Snell, T. W. and Moffat, B. D. (1992). A 2-d Life Cycle Test with the Rotifer *Brachionus calyciflorus*. *Environ.Toxicol.Chem.* 11: 1249-1257.
- EcoReference No.: 3963
Chemical of Concern: 24DXY,CPY,DZ,Cu,AMSV,NaPCP,PL,Cr,Cd; Habitat: A; Effect Codes: MOR,REP; Rejection Code: LITE EVAL CODED(24DXY,CPY,DZ,Cu,OW-TRV-Cu,NaPCP,AMSV,Cr),OK(ALL CHEMS).
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- EcoReference No.: 16539
Chemical of Concern: 24DXY,Cu,Pb,Ni,Se,Ag,Hg,Cd,Zn,TBT,NaPCP,PL,24D,Cu,NHCl,AMSV; Habitat: A; Effect Codes: MOR; Rejection Code: LITE EVAL CODED(24DXY,Cu,NaPCP,AMSV),OK(ALL CHEMS).
184. Snell, T. W., Moffat, B. D., Janssen, C., and Persoone, G. (1991). Acute Toxicity Tests Using Rotifers IV. Effects of Cyst Age, Temperature, and Salinity on the Sensitivity of *Brachionus calyciflorus*. *Ecotoxicol.Environ.Saf.* 21: 308-317 (OECDG Data File).
- EcoReference No.: 9385

Chemical of Concern:
24DXY,CPY,NaPCP,NHCl,Se,FNT,TOL,CF,BZ,Cu,TCF,PL,TBT,HgCl₂,Ni,Al,Pb,Ag,Cd,Zn,AMSV;
Habitat: A; Effect Codes: MOR; Rejection Code: LITE EVAL CODED(24DXY,CPY,Cu,OW-
TRV-Cu,NaPCP,AMSV),OK(ALL CHEMS).

185. Snodgrass, G. L. and Stadelbacher, E. A. (1994). Population Levels of Tarnished Plant Bugs (Heteroptera: Miridae) and Beneficial Arthropods Following Early-Season Treatments of Geranium dissectum for Control of Bollworms and Tobacco Budworms (Lepidoptera: Noctuidae). *Environ.Entomol.* 23: 1091-1096.

EcoReference No.: 93657
Chemical of Concern: 24D; Habitat: T; Effect Codes: POP; Rejection Code: LITE EVAL CODED(24D).

186. Somlyay, I. M. and Varnagy, L. E. (1988). Effects of Various Pesticides on Plasma Biochemistry of Chicken Embryos. *Microbios Lett.* 39: 7-11.

EcoReference No.: 91304
Chemical of Concern: MP,CBD,DMDP; Habitat: T; Effect Codes: BCM,GRO; Rejection Code: LITE EVAL CODED(DMDP),OK(MP).

187. Soto, E., Larrain, A., and Bay-Schmith, E. (2000). Sensitivity of *Ampelisca araucana* Juveniles (Crustacea: Amphipoda) to Organic and Inorganic Toxicants in Tests of Acute Toxicity. *Bull.Environ.Contam.Toxicol.* 64: 574-578.

EcoReference No.: 54390
Chemical of Concern: 24DXY,CuS,Cr,PCP; Habitat: A; Effect Codes: MOR; Rejection Code: LITE EVAL CODED(24DXY,CuS,PCP),OK(ALL CHEMS).

188. St.Laurent, D., Blaise, C., MacQuarrie, P., Scroggins, R., and Trottier, B. (1992). Comparative Assessment of Herbicide Phytotoxicity to *Selenastrum capricornutum* Using Microplate and Flask Bioassay Procedures. *Environ.Toxicol.Water Qual.* 7: 35-48.

EcoReference No.: 45196
Chemical of Concern: Cu,HXZ,MTL,GYP,24DXY,BMN,Zn,CZE,DQTBr,PL; Habitat: A; Effect Codes: GRO; Rejection Code: LITE EVAL CODED(24DXY,MTL,OW-TRV-Cu,HXZ),OK(ALL CHEMS).

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EcoReference No.: 93541
Chemical of Concern: 24D; Habitat: T; Effect Codes: PHY,CEL; Rejection Code: LITE EVAL CODED(24D).

190. Stoyer, T. L. and Kok, L. T. (1987). Insect/Plant Interactions in Integrating *Trichosirocalus horridus* (Coleoptera: Curculionidae) and 2,4-Dichlorophenoxyacetic Acid for *Carduus* Thistle Control. *Environ.Entomol.* 16: 864-868.

EcoReference No.: 71021
Chemical of Concern: 24D; Habitat: T; Effect Codes: POP,GRO; Rejection Code: LITE EVAL CODED(24D).

191. Stoyer, T. L. and Kok, L. T. (1989). Oviposition by *Trichosirocalus horridus* (Coleoptera: Curculionidae), a Biological Control Agent for *Carduus* Thistles, on Plants Treated with Low Dosages of 2,4-Dichlorophenoxyacetic Acid. *Environ.Entomol.* 18: 715-718.

- EcoReference No.: 93656
Chemical of Concern: 24D; Habitat: T; Effect Codes: POP,REP; Rejection Code: LITE EVAL CODED(24D).
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- EcoReference No.: 93522
Chemical of Concern: 24D; Habitat: T; Effect Codes: BEH,GRO,BCM,ACC; Rejection Code: LITE EVAL CODED(24D).
193. Sturtz, N., Evangelista De Duffard, A. M., and Duffard, R. (2000). Detection of 2,4-Dichlorophenoxyacetic Acid (2,4-D) Residues in Neonates Breast-fed by 2,4-D Exposed Dams. *Neurotoxicology* 21: 147-154.
- EcoReference No.: 70980
Chemical of Concern: 24D; Habitat: T; Effect Codes: GRO,ACC; Rejection Code: LITE EVAL CODED(24D).
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- EcoReference No.: 42840
Chemical of Concern:
PNB,SZ,ATZ,DU,24DXY,DBN,DMB,LNR,PMT,AMTL,CPP,MLH,PL,NaCLO,PCP,EPTC,2CP,4NP,AMTR,PCP,DLPCP,DL,NH; Habitat: T; Effect Codes: GRO,REP,MOR; Rejection Code: LITE EVAL CODED(24DXY,ATZ,DMB,PCP),TARGET(SZ,DMB).
195. Tejada, A. W., Bajet, C. M., Magbauna, M. G., Gambalan, N. B., Araez, L. C., and Magallona, E. D. (1994). Toxicity of Pesticides to Target and Non-Target Fauna of the Lowland Rice Ecosystem. In: B.Widianarko, K.Vink, and N.M.Van Straalen (Eds.), *Environmental Toxicology in South East Asia*, VU Univ.Press, Amsterdam, Netherlands 89-103.
- EcoReference No.: 20421
Chemical of Concern:
MP,ES,CBF,CPY,CYP,EFX,TDC,MTM,MLN,FNV,CYF,FNT,CBL,24D,MCPA,BTC,FZFB,TBC,ODZ,MZB,DZ; Habitat: AT; Effect Codes: MOR; Rejection Code: LITE EVAL CODED(24D,FNV,MP,CPY,MZB,CBL,CYP,MTM,DZ,TDC,CYF,MLN),OK(ES,CBF,EFX,MCPA,BTC,FZFB,TBC,ODZ,FNT).
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- EcoReference No.: 11452
Chemical of Concern: PCP,24DXY,ISO,ES,BNZ,CPH,PL,TXP,NAPH; Habitat: A; Effect Codes: GRO,REP,POP; Rejection Code: LITE EVAL CODED(24DXY,NAPH,PCP),OK(ALL CHEMS).
197. Tiwari, D. N. and Pandey, A. K. (1981). 2,4-D Resistant Mutant Strains of *Anacystis nidulans* & Filament Formation. *Indian J.Exp.Biol.* 19: 988-990.
- EcoReference No.: 65980
Chemical of Concern: NaDPA; Habitat: A; Effect Codes: GRO,MOR,POP; Rejection Code: NO COC(CBL),LITE EVAL CODED(NaDPA).

198. Ton, C., Lin, Y., and Willett, C. (2006). Zebrafish as a Model for Developmental Neurotoxicity Testing. *Birth Defects Res.A* 76: 553-567.

EcoReference No.: 93401
Chemical of Concern: DDT,24D,ATZ,DLD,MLN,NYP,TCDD; Habitat: A; Effect Codes: CEL,MOR,GRO,PHY; Rejection Code: LITE EVAL CODED(24D),OK(ATZ,MLN).
199. Toyoshima, E., Mayer, R. F., Max, S. R., and Eccles, C. (1985). 2,4-Dichlorophenoxyacetic Acid (2,4-D) does not Cause Polyneuropathy in the Rat. *J.Neurol.Sci.* 70: 225-229.

EcoReference No.: 93540
Chemical of Concern: 24D; Habitat: T; Effect Codes: PHY,GRO; Rejection Code: LITE EVAL CODED(24D).
200. Tripathy, N. K., Routray, P. K., Sahu, G. P., and Kumar, A. A. (1993). Genotoxicity of 2,4-Dichlorophenoxyacetic Acid Tested in Somatic and Germ-Line Cells of Drosophila. *Mutat.Res.* 319: 237-242.

EcoReference No.: 93411
Chemical of Concern: 24D; Habitat: T; Effect Codes: MOR,PHY,CEL; Rejection Code: LITE EVAL CODED(24D).
201. Tu, C. M. (1978). Effect of Pesticides on Acetylene Reduction and Microorganisms in a Sandy Loam. *Soil Biol Biochem* 10: 451-456.

EcoReference No.: 54977
Chemical of Concern: OML,EP,HCCH,NTP,24D,THM,Maneb,Captan,DPDP,PMR,CBF,CPY,DZ,ETN,FNF,MLN,PRN,PR T,CHD,DLD; Habitat: T; Effect Codes: POP,SYS; Rejection Code: LITE EVAL CODED(24D,Captan,CPY,MLN),OK(ALL CHEMS).
202. Tu, C. M. (1981). Effects of Pesticides on Activities of Enzymes and Microorganisms in a Clay Soil. *J.Environ.Sci.Health Part B* 16: 179-191.

EcoReference No.: 93646
Chemical of Concern: 13DPE,PMR,OML,CBF,HCCH,DLD,CHD,TBO,PRT,PRN,MLN,CPY,DZ,ETN,EP,FNF,Captan,Maneb,THM,24D,NTP; Habitat: T; Effect Codes: SYS,POP; Rejection Code: LITE EVAL CODED(CPY,PMR,24D,DD,13DPE,TC17),OK TARGET(Maneb,Captan),OK(CBF,PRT,MLN,DZ,THM).
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EcoReference No.: 93645
Chemical of Concern: NTP,24D,13DPE,PMR,OML,CBF,HCCH,DLD,CHD,TBO,PRT,PRN,MLN,CPY,DZ,ETN,EP,FNF,Captan,Maneb,THM; Habitat: T; Effect Codes: POP,SYS; Rejection Code: LITE EVAL CODED(CPY,24D,PMR,DD,TC17,13DPE),OK TARGET(Maneb,Captan),OK(CBF,PRT,MLN,DZ,THM).
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EcoReference No.: 11780
Chemical of Concern: SZ,24DXY,ATZ,GYP,CuCl,Cr,Ag,Zn,Cd; Habitat: A; Effect Codes:

- POP,PHY; Rejection Code: LITE EVAL CODED(24DXY,ATZ,SZ,CuCl,OW-TRV-Cu),OK(ALL CHEMS).
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- EcoReference No.: 93402
Chemical of Concern: GYPI,24D,MCPA; Habitat: T; Effect Codes: BCM,CEL,GRO; Rejection Code: LITE EVAL CODED(24D),OK(GYPI).
206. Van der Gulik, J. and Springett, J. A. (1980). The Effect of Commonly Used Biocides on Slugs. *Proc.N.Z.Weed Pest Control Conf.* 33: 225-229.
- EcoReference No.: 79821
Chemical of Concern: PCH,PCL,MCPA,PAQT,MBZ,LNR,24DXY,ACR,PRT,MP,MOM,MTM,HCCH,DZM,TPM,TPE,DIN O,Maneb,CBD,CBL,Captan,CAP,BMY,THM,DDT,PZM; Habitat: T; Effect Codes: MOR; Rejection Code: LITE EVAL CODED(MOM,PZM,24DXY),OK(ALL CHEMS),NO ENDPOINT(MP).
207. Vardia, H. K. and Durve, V. S. (1981). The Toxicity of 2,4-D to *Cyprinus carpio* var. communis in Relation to the Seasonal Variation in the Temperature. *Hydrobiologia* 77: 155-159.
- EcoReference No.: 6387
Chemical of Concern: 24DXY; Habitat: A; Effect Codes: MOR; Rejection Code: LITE EVAL CODED(24DXY).
208. Venkov, P., Topashka Ancheva, M., Georgieva, M., Alexieva, V., and Karanov, E. (2000). Genotoxic Effect of Substituted Phenoxyacetic Acids. *Arch.Toxicol.* 74: 560-566.
- EcoReference No.: 93524
Chemical of Concern: 24D,ATZ; Habitat: T; Effect Codes: CEL; Rejection Code: LITE EVAL CODED(24D),OK(ATZ).
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- EcoReference No.: 40121
Chemical of Concern: CBL,24D; Habitat: T; Effect Codes: BCM,CEL,MOR,PHY; Rejection Code: LITE EVAL CODED(CBL,24D).
210. Wahl, O. and Ulm, K. (1983). Influence of Pollen Feeding and Physiological Condition on Pesticide Sensitivity of the Honey Bee *Apis mellifera carnica*. *Oecologia* 59: 106-128.
- EcoReference No.: 39264
Chemical of Concern: 24D,NaDPA,MZB,MnS04,ZnS,FBM,Captan,PHSL,ES,Ziram,Zineb,Maneb; Habitat: T; Effect Codes: MOR; Rejection Code: LITE EVAL CODED(MZB,Maneb,Captan,24D,NaDPA),OK(MnS04,ZnS,FBM,PHSL,ES,Ziram,Zineb).
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- EcoReference No.: 39366
Chemical of Concern: 24D; Habitat: T; Effect Codes: GRO,BCM; Rejection Code: LITE EVAL CODED(24D).

212. Wierzbicka, M. (1974). Haemolymph Concentration in Cyclopoida Copepodids During Active and Resting Stage and the Effect of 2,4-D Sodium Salt. *Pol.Arch.Hydrobiol.* 21: 269-273.
- EcoReference No.: 17466
Chemical of Concern: 24DXY; Habitat: A; Effect Codes: PHY,MOR; Rejection Code: LITE EVAL CODED(24DXY).
213. Wiese, A. F. and Rea, H. E. (1962). Factors Affecting the Toxicity of Phenoxy Herbicides to Field Bindweeds. *Weeds* 10: 58-61.
- EcoReference No.: 42096
Chemical of Concern: 24DXY; Habitat: T; Rejection Code: LITE EVAL CODED(24DXY).
214. Wong, P. K. (2000). Effects of 2,4-D, Glyphosate and Paraquat on Growth, Photosynthesis and Chlorophyll-a Synthesis of *Scenedesmus quadricauda* Berb 614. *Chemosphere* 41: 177-182.
- EcoReference No.: 55720
Chemical of Concern: PAQT,GYP,24D; Habitat: A; Effect Codes: POP,BCM,PHY; Rejection Code: LITE EVAL CODED(24D),OK(GYP).
215. Worthley, E. G. and Schott, C. D. (1972). The Comparative Effects of CS and Various Pollutants on Fresh Water Phytoplankton Colonies of *Wolffia papulifera* Thompson. *Edgewater Arsenal Tech.Rep.EATR 4595* 29 p. (NTIS/AD-736336).
- EcoReference No.: 9184
Chemical of Concern: 24DXY,CBL,DZ,MLN,IAA,AND,DLD,DDT; Habitat: A; Effect Codes: MOR; Rejection Code: LITE EVAL CODED(24DXY,CBL,IAA,DZ,MLN),OK(ALL CHEMS).
216. Wright, A. D. and Bourne, A. S. (1990). Effect of 2,4-D on the Quality of Water Hyacinth as Food for Insects. *Plant Prot.Q.* 5: 139-141.
- EcoReference No.: 71785
Chemical of Concern: 24D; Habitat: A; Effect Codes: GRO,BCM; Rejection Code: LITE EVAL CODED(24D).
217. Xie, L., Thrippleton, K., Irwin, M. A., Siemering, G. S., Mekebri, A., Crane, D., Berry, K., and Schlenk, D. (2005). Evaluation of Estrogenic Activities of Aquatic Herbicides and Surfactants Using an Rainbow Trout Vitellogenin Assay. *Toxicol.Sci.* 87: 391-398.
- EcoReference No.: 80643
Chemical of Concern: DQTBr,GYP,DMDP,EED,NYP; Habitat: A; Effect Codes: PHY,BCM; Rejection Code: LITE EVAL CODED(DMDP),OK(DQTBr,GYP),NO MIXTURE(EED,NYP).
218. Yadava, N. K., Pahuja, S. S., and Bhatnagar, A. (1993). Toxicity of Herbicides on Fingerlings (*Labeo rohita* Hamilton) and Weeds in Pond. In: *Proc.Int.Symp.Indian Soc.of Weed Science, Nov.18-20, Hisar, India* 3: 250-253.
- EcoReference No.: 16007
Chemical of Concern: SZ,24DXY,MSMA; Habitat: A; Effect Codes: MOR,BEH,SYS; Rejection Code: LITE EVAL CODED(24DXY,SZ),OK(ALL CHEMS).
219. Yilmaz, H. R. and Yuksel, E. (2005). Effect of 2,4-Dichlorophenoxyacetic Acid on the Activities of Some Metabolic Enzymes for Generating Pyridine Nucleotide Pool of Cells from Mouse Liver. *Toxicol.Ind.Health* 21: 231-237.
- EcoReference No.: 93525

Chemical of Concern: 24D; Habitat: T; Effect Codes: BCM,CEL; Rejection Code: LITE EVAL CODED(24D).

220. Zimakowska, D. (1973). Effects of 2,4-D-Na of Various Concentrations on Respiration of an Aquatic Crustacean *Asellus aquaticus* L. *Pol.Arch.Hydrobiol.* 20: 469-473.

EcoReference No.: 9033

Chemical of Concern: NaDPA; Habitat: A; Effect Codes: PHY; Rejection Code: LITE EVAL CODED(NaDPA).

Acceptable for ECOTOX but not OPP

1. Aberg, B. (1950). On Auxin Antagonists and Synergists in Root Growth. *Physiol.Plant.* 3: 447-461.

EcoReference No.: 43195

Chemical of Concern: 24DXY,NAA,IAA; Habitat: T; Effect Codes: GRO; Rejection Code: OK(NAA),OK TARGET(IAA),NO COC(CBL),NO ENDPOINT,NO CONTROL(24DXY).

2. Aberg, B. (1954). Studies on Plant Growth Regulators. IX. Para-Alkyl-Phenoxy-Acetic and -Propionic Acids, and Some Related Derivatives of Naturally Occurring Phenols. *Physiol.Plant.* 7: 241-252.

EcoReference No.: 41174

Chemical of Concern: 24DXY; Habitat: T; Effect Codes: GRO; Rejection Code: NO ENDPOINT,NO CONTROL(24DXY).

3. Abou Akkada, A. R., Hassan, M. A., and Naga, M. (1975). A Note on the Effect of Herbicides on the Metabolism and Performance of Lambs. *Anim.Prod.* 20: 311-313.

EcoReference No.: 35546

Chemical of Concern: 24D; Habitat: T; Effect Codes: GRO,BCM; Rejection Code: NO ENDPOINT(24D).

4. Abou-El-Hassan, A. A., Zidan, Z. H., Zidan, A. A., El-Zemaity, M. S., and Ragab, F. M. (1990). Molluscicidal Activities of Certain Herbicides Against Schistosomiasis Snail Vectors. *Egypt.J.Bilharz.* 12: 133-144.

EcoReference No.: 61873

Chemical of Concern: 24D,DU,CuS,NSM; Habitat: A; Effect Codes: MOR; Rejection Code: NO CONTROL(24D,CuS).

5. Adams, J. B. (1960). Effects of Spraying 2,4-D Amine on Coccinellid Larvae. *Can.J.Zool.* 38: 285-288.

EcoReference No.: 74818

Chemical of Concern: 24DXY; Habitat: T; Effect Codes: MOR; Rejection Code: NO ENDPOINT.

6. Adams, S. L., Horvat, S. T., Irwin, A. E., Junkin, R. W., Koreman, N. M., and Blakley, B. R. (1991). The Effects of Tordon 202C Exposure on Urethan-Induced Lung Adenoma Formation in Female CD-1 Mice. *Vet.Hum.Toxicol.* 33: 209-211.

EcoReference No.: 93566

Chemical of Concern: 24D,PCL; Habitat: T; Effect Codes: GRO,BEH,PHY; Rejection Code: NO MIXTURE(24D).

7. Agrawal, S. C. and Misra, U. (2002). Vegetative Survival, Akinete and Zoosporangium Formation and Germination in Some Selected Algae as Affected by Nutrients, pH, Metals, and Pesticides. *Folia Microbiol.* 47: 527-534.

EcoReference No.: 74661

Chemical of Concern: Co,CuS,Zn,Hg,Pb,PRT,CBF,24DXY,MZB,CBD; Habitat: A; Effect Codes: CEL; Rejection Code: NO ENDPOINT(ALL CHEMS).

8. Ahmad, W. and Ali, M. N. (1994). Cytotoxic Assay of 2,4-Dichlorophenoxyacetic Acid (2,4-D) by Mitotic Index Profiles in *Culex pipiens fatigans*. *Mitt.Schweiz Entomol.Ges.* 67: 169-175.

EcoReference No.: 17598

Chemical of Concern: 24DXY; Habitat: A; Effect Codes: CEL,GRO; Rejection Code: NO ENDPOINT(24DXY).

9. Al-Arabi, S. A. M., Adolfsson-Erici, M., Waagbo, R., Ali, M. S., and Goksoyr, A. (2005). Contaminant Accumulation and Biomarker Responses in Caged Fish Exposed to Effluents from Anthropogenic Sources in the Karnaphuly River, Bangladesh. *Environ.Toxicol.Chem.* 24: 1968-1978.

EcoReference No.: 88169

Chemical of Concern: CPH,24DC,CBZ,HCCH,DDT,PCB; Habitat: A; Effect Codes: ACC; Rejection Code: NO MIXTURE,EFFECT.

10. Al-Rajeh, S., Iyer, V., and Olson, W. H. (1989). Effect of Diltiazem on 2,4-D-Induced Myotonia in Rats. *Muscle Nerve* 12: 470-472.

EcoReference No.: 93569

Chemical of Concern: 24D; Habitat: T; Effect Codes: PHY; Rejection Code: NO CONTROL(24D).

11. Al-Sulaiman, A., Al-Rajeh, S., and Iyer, V. (1986). The Influence of Skeletal Muscle Reinnervation on Experimentally Induced Myotonia. *Muscle Nerve* 9: 364-366.

EcoReference No.: 93366

Chemical of Concern: 24D; Habitat: T; Effect Codes: PHY; Rejection Code: NO CONTROL,NO ENDPOINT(24D).

12. Alabaster, J. S. (1967). Estimating the Effect of Herbicides on Fish. *In: Proc.Eur.Weed Res.Counc.Symp.* 3 p.

EcoReference No.: 68543

Chemical of Concern: PQT,SZ,24DXY,MLH; Habitat: A; Effect Codes: MOR; Rejection Code: NO ENDPOINT,CONTROL(ALL CHEMS).

13. Alabaster, J. S. (1969). Survival of Fish in 164 Herbicides, Insecticides, Fungicides, Wetting Agents and Miscellaneous Substances. *Int.Pest Control* 11: 29-35 (Author Communication Used).

EcoReference No.: 542

Chemical of Concern:

24DXY,ATZ,CMPH,DBN,DZ,PQT,SZ,ACL,DZM,TFN,TBTO,PYZ,FUR,NaPCP,MCP1; Habitat: A; Effect Codes: MOR; Rejection Code: NO CONTROL(ALL CHEMS).

14. Alban, E. K. and Keirns, V. E. (1948). Pre-Emergence and Post-Emergence Weed Control in Vegetable Crops with 2,4-D and Oil. *P Am S Hort* 51: 526-532.

EcoReference No.: 43206

Chemical of Concern: 24DXY; Habitat: T; Effect Codes: MOR; Rejection Code: NO ENDPOINT,NO CONTROL(24DXY).

15. Ali, M. N. and Ahmad, W. (1996). Genotoxicity of 2, 4-Dichlorophenoxyacetic Acid (2, 4-D) on Filial Vector, *Culex pipiens fatigans*. *J.Environ.Biol.* 17: 331-337.

EcoReference No.: 94121

Chemical of Concern: 24D; Habitat: A; Effect Codes: CEL; Rejection Code: NO
ENDPOINT(24D).

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EcoReference No.: 43771

Chemical of Concern: 24DXY; Habitat: T; Effect Codes: GRO; Rejection Code: NO
ENDPOINT,NO CONTROL(24DXY).

17. Alpoz, A. R., Tosun, N., Eronat, C., Delen, N., and Sen, B. H. (2001). Effects of 2,4-Dichlorophenoxy Acetic Acid Dimethyl Amine Salt on Dental Hard Tissue Formation in Rats. *Environ.Int.* 26: 137-142.

EcoReference No.: 93430

Chemical of Concern: DMDP; Habitat: T; Effect Codes: CEL; Rejection Code: NO
ENDPOINT(DMDP).

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EcoReference No.: 43291

Chemical of Concern: 24DXY; Habitat: T; Effect Codes: BCM,CEL,GRO; Rejection Code: NO
ENDPOINT,NO CONTROL(24DXY).

19. Apelbaum, A. and Burg, S. P. (1972). Effects of Ethylene and 2,4-Dichlorophenoxyacetic Acid on Cellular Expansion in *Pisum sativum*. *Plant Physl* 50: 125-131.

EcoReference No.: 43292

Chemical of Concern: 24DXY; Habitat: T; Effect Codes: BCM,GRO,PHY; Rejection Code: NO
ENDPOINT,NO CONTROL(24DXY).

20. Applegate, V. C., Howell, J. H., Hall, A. E. Jr., and Smith, M. A. (1957). Toxicity of 4,346 Chemicals to Larval Lampreys and Fishes. *Spec.Sci.Rep.Fish.No.207, Fish Wildl.Serv., U.S.D.I., Washington, D.C.* 157 p.

EcoReference No.: 638

Chemical of Concern:

24DXY,DZ,HCCH,MLN,MP,ACL,NAA,NYP,CST,Cu,RTN,NaN₃,Ni,CuS,PCP,NaPCP,NaCr,DBAC,
Zn,ATZ,Cd,NaID,Pb,As,DCB,CBL,DMPA,PEPPG,ANT,PAH,PHE; Habitat: A; Effect Codes:
BEH,MOR; Rejection Code: NO ENDPOINT(ALL CHEMS).

21. Arias, E. (1994). Acute Toxicity to Chick Embryos of a Formulated Product Containing the Phenoxy Herbicide 2,4-Dichlorophenoxyacetic Acid (2,4-D). *Med.Sci.Res.* 22: 11-12.

EcoReference No.: 93413; Habitat: T; Effect Codes: MOR,PHY,CEL; Rejection Code: NO
COC(24DIO).

22. Arnold, E. K., Beasley, V. R., Parker, A. J., and Stedelin, J. R. (1991). 2,4-D Toxicosis II: A Pilot Study of Clinical Pathologic and Electroencephalographic Effects and Residues of 2,4-D in Orally Dosed Dogs. *Vet.Hum.Toxicol.* 33: 446-449.

EcoReference No.: 93564

Chemical of Concern: 24D; Habitat: T; Effect Codes: PHY,BCM,ACC; Rejection Code: NO
ENDPOINT(24D).

23. Arnold, E. K., Lovell, R. A., Beasley, V. R., Parker, A. J., and Stedelin, J. R. (1991). 2,4-D Toxicosis III: An

- Attempt to Produce 2,4-D-Toxicosis in Dogs on Treated Grass Plots. *Vet.Hum.Toxicol.* 33: 457-461.
- EcoReference No.: 93563
Chemical of Concern: 24D; Habitat: T; Effect Codes: CEL,ACC,PHY; Rejection Code: NO ENDPOINT(24D).
24. Arnold, R. N., Gregory, E. J., and Smeal, D. (1988). Effects of Herbicides on Weeds in Field Corn Grown on Coarse-Textured Soils. *Appl.Agric.Res.* 3: 21-23.
- EcoReference No.: 73778
Chemical of Concern: MTL,ACR,EPTC,CZE,24DXY,DMB,VRN; Habitat: T; Effect Codes: POP,PHY; Rejection Code: NO ENDPOINT(ALL CHEMS,TARGET-MTL).
25. Artamonov, V. I. (1974). Effect of 2,4-D on Riboflavin Metabolism. *Fiziol.Rast.* 21: 842-847 (ENG TRANSL).
- EcoReference No.: 44276
Chemical of Concern: 24DXY; Habitat: T; Effect Codes: BCM; Rejection Code: NO ENDPOINT,NO CONTROL(24DXY).
26. Arvy, L. and Lhoste, J. (1946). Action of Sodium 2,4-Dichlorophenoxyacetate on Plants. *Experientia* 2: 495-497.
- EcoReference No.: 43766
Chemical of Concern: 24DXY; Habitat: T; Effect Codes: GRO,PHY; Rejection Code: NO ENDPOINT,NO CONTROL(24DXY).
27. Ashton, F. M., Devilliers, O. T., Glenn, R. K., and Duke, W. B. (1977). Localization of Metabolic Sites of Action on Herbicides. *Pestic.Biochem.Physiol.* 7: 122-141.
- EcoReference No.: 42644
Chemical of Concern: 24DXY,ATZ,BMC,DBN,TFN,PAQT,EPTC; Habitat: T; Effect Codes: PHY,CEL,BCM; Rejection Code: NO ENDPOINT,NO CONTROL(ALL CHEMS).
28. Ashton, F. M., Penner, D., and Hoffman, S. (1968). Effect of Several Herbicides on Proteolytic Activity of Squash Seedlings. *Weed Sci.* 16: 169-171.
- EcoReference No.: 43990
Chemical of Concern: TFN,EDT,24DXY,ATZ,BMC,BMN,BS,DBN,DMB; Habitat: T; Effect Codes: BCM,GRO; Rejection Code: NO ENDPOINT,NO CONTROL(ALL CHEMS).
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- EcoReference No.: 94058
Chemical of Concern: 24D,24DXY,BTC; Habitat: A; Effect Codes: CEL; Rejection Code: NO ENDPOINT(24D).
30. Azmi, M. and Supaad, M. A. (1990). Herbicide Combinations for Early Post-Emergence Applications in Direct-Seeded Rice. *Mardi (Malays.Agric.Res.Dev.Inst.) Res.J.* 18: 213-220.
- EcoReference No.: 74943
Chemical of Concern: MLT,TBC,PPN,QNC,BSF,ODZ,24DXY,FNPE; Habitat: T; Effect Codes: POP; Rejection Code: NO MIXTURE(ALL CHEMS EXCEPT FNPE),OK(FNPE).
31. Badji, C. A., Guedes, R. N. C., Silva, A. A., Correa, A. S., Queiroz, M. E. L. R., and Michereff-Filho, M.

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- EcoReference No.: 93963
Chemical of Concern: DM; Habitat: T; Effect Codes: POP; Rejection Code: NO COC(24D,GYP).
32. Bage, G., Cekanova, E., and Larsson, K. S. (1973). Teratogenic and Embryotoxic Effects of the Herbicides Di- and Trichlorophenoxyacetic Acids (2,4-D and 2,4,5-T). *Acta Pharmacol.Toxicol.* 32: 408-416 .
- EcoReference No.: 47230
Chemical of Concern: 24D; Habitat: T; Effect Codes: REP,MOR,GRO; Rejection Code: NO MIXTURE(24D).
33. Bailey, D. R. (1972). Control of *Acacia flavescens* with Herbicides. *Aust J Ex A* 12: 441-446.
- EcoReference No.: 40692
Chemical of Concern: 24DXY; Habitat: T; Effect Codes: POP,GRO; Rejection Code: NO ENDPOINT,NO CONTROL(24DXY).
34. Bain, M. B. and Boltz, S. E. (1992). Effect of Aquatic Plant Control on the Microdistribution and Population Characteristics of Largemouth Bass. *Trans.Am.Fish.Soc.* 121: 94-103.
- EcoReference No.: 16234
Chemical of Concern: 24DXY; Habitat: A; Effect Codes: POP,GRO,BEH; Rejection Code: NO ENDPOINT(24DXY).
35. Baird, D. D., Upchurch, R. P., and Selleck, G. W. (1972). Phosphonomethyl Glycine, a New Broad-Spectrum, Postemergence Herbicide. *Proc.Calif.Weed Conf.* 24: 94-102.
- EcoReference No.: 41900
Chemical of Concern: SZ,TRB,24DXY,PAQT,MSMA; Habitat: T; Effect Codes: MOR,PHY,GRO,POP; Rejection Code: NO ENDPOINT,CONTROL(ALL CHEMS).
36. Bakale, V. L. and Kolhe, R. L. (1982). Effect of Herbicides on Meiosis in *Solanum surattense* Burm. F. *Bio Vigyanam* 8: 7-9 .
- EcoReference No.: 25761
Chemical of Concern: 24DXY,PQT,BMC; Habitat: T; Effect Codes: CEL; Rejection Code: NO ENDPOINT(24DXY,PQT,TARGET-BMC).
37. Banks, P. A., Kirby, M. A., and Santelmann, P. W. (1977). Influence of Postemergence and Subsurface Layered Herbicides on Horsenettle and Peanuts. *Weed Sci.* 25: 5-8.
- EcoReference No.: 41434
Chemical of Concern: TFN,NPM,GYP,PCL,DMB,PAQT,AMTL,24DXY; Habitat: T; Effect Codes: PHY; Rejection Code: OK TARGET(DMB),OK(TFN,NPM,GYP,PCL,PAQT,AMTL),NO ENDPOINT,NO CONTROL(24DXY).
38. Barnekow, D. E., Hamburg, A. W., Puvanesarajah, V., and Guo, M. (2001). Metabolism of 2,4-Dichlorophenoxyacetic Acid in Laying Hens and Lactating Goats. *J.Agric.Food Chem.* 49: 156-163.
- EcoReference No.: 93431
Chemical of Concern: 24D; Habitat: T; Effect Codes: ACC; Rejection Code: NO ENDPOINT(24D).
39. Barnekow, D. E., Premkumar, N. D., Stewart, S., and Hamburg, A. W. (2001). Uniformly 14C-Ring-Labeled

2,4-Dichlorophenoxyacetic Acid: A Metabolism Study in Bluegill Sunfish, *Lepomis macrochirus*. *J.Agric.Food Chem.* 49: 2853-2859.

EcoReference No.: 68280

Chemical of Concern: 24D; Habitat: A; Effect Codes: ACC; Rejection Code: NO
ENDPOINT(24D).

40. Barnett, N. M. (1970). Dipyridyl-Induced Cell Elongation and Inhibition of Cell Wall Hydroxyproline Biosynthesis. *Plant Physl* 45: 188-191.

EcoReference No.: 42807

Chemical of Concern: 24DXY; Habitat: T; Effect Codes: PHY,GRO; Rejection Code: NO
ENDPOINT,NO CONTROL(24DXY).

41. Baron, F. J., Stark, N., and Schubert, G. H. (1964). Effects of Season and Rate of Application of 2,4-D and 2,4,5-T on Pine Seedlings and on Mountain Whitethorn in California. *J.For.* 62: 472-474 .

EcoReference No.: 42157

Chemical of Concern: 24DXY; Habitat: T; Effect Codes: PHY,MOR,GRO; Rejection Code: NO
ENDPOINT,NO CONTROL(24DXY).

42. Bartley, T. R. (1967). Progress Report on Evaluation of Copper for Aquatic Weed Control and Herbicide Residues on Irrigation Systems. *U.S.Bureau of Reclamation Rep.No.WC-32, U.S.Dept.of the Interior, Denver, CO* 58 p.

EcoReference No.: 47349

Chemical of Concern: DMDP,CuS; Habitat: A; Effect Codes: ACC; Rejection Code: NO
ENDPOINT(DMDP,CuS).

43. Basler, E. and Nakazawa, K. (1961). Some Effects of 2,4-Dichlorophenoxyacetic Acid on Nucleic Acids of Cotton Cotyledon Tissue. *Bot.Gaz.* 122: 228-232.

EcoReference No.: 42515

Chemical of Concern: 24DXY; Habitat: T; Effect Codes: PHY,BCM,CEL; Rejection Code: NO
ENDPOINT,NO CONTROL(24DXY).

44. Basu, R. N. (1972). Effect of Non-Auxin Chemicals on Translocation of Auxins in Cuttings of *Phaseolus Vulgaris* (L.). *J.Exp.Bot.* 23: 357-365.

EcoReference No.: 43282

Chemical of Concern: 24DXY,SCA,IAA; Habitat: T; Effect Codes: GRO; Rejection Code:
OK(SCA),OK TARGET(IAA),NO ENDPOINT,NO CONTROL(24DXY).

45. Batjer, L. P. and Marth, P. C. (1945). New Materials for Delaying Fruit Abscission of Apples. *Science* 101: 363-364.

EcoReference No.: 43066

Chemical of Concern: 24DXY; Habitat: T; Effect Codes: PHY; Rejection Code: NO
ENDPOINT,NO CONTROL(24DXY).

46. Batjer, L. P., Siegelman, H. W., Rogers, B. L., and Gerhardt, F. (1954). Results of Four Years' Test of the Effect of 2,4,5-Trichlorophenoxypropionic Acid on Maturity and Fruit Drop of Apples in the Northwest. *P Am S Hort* 64: 215-221.

EcoReference No.: 42493

Chemical of Concern: 24DXY,NAA; Habitat: T; Effect Codes: GRO,PHY; Rejection Code: NO

ENDPOINT,NO CONTROL(24DXY).

47. Batjer, L. P., Thompson, A. H., and Gerhardt, F. (1948). A Comparison of Naphthaleneacetic Acid and 2,4-Dichlorophenoxyacetic Acid Sprays for Controlling Pre-Harvest Drop of Bartlett Pears. *Proc.Am.Soc.Hortic.* 51: 71-74.

EcoReference No.: 43237

Chemical of Concern: 24DXY,NAA; Habitat: T; Effect Codes: PHY,GRO; Rejection Code: NO ENDPOINT,NO CONTROL(24DXY).

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EcoReference No.: 14530

Chemical of Concern: 24DXY,PCP,NaPCP,DZ; Habitat: A; Effect Codes: MOR,REP; Rejection Code: LITE EVAL CODED(DZ,PCP),NO ENDPOINT(24DXY,NaPCP).

49. Beal, J. M. (1944). Further Observations on the Telemorphic Effects of Certain Growth-Regulating Substances. *Bot.Gaz.* 106: 165-178.

EcoReference No.: 43057

Chemical of Concern: NAA,IAA,BNOA,24DXY; Habitat: T; Effect Codes: PHY; Rejection Code: NO ENDPOINT(NAA,IAA,BNOA),NO ENDPOINT,NO CONTROL(24DXY).

50. Beal, J. M. (1945). Histological Reactions of Bean Plants to Certain of the Substituted Phenoxy Compounds. *Bot.Gaz.* 107: 200-217.

EcoReference No.: 43079

Chemical of Concern: 24DXY; Habitat: T; Effect Codes: CEL,POP,PHY,GRO; Rejection Code: NO ENDPOINT,NO CONTROL(24DXY).

51. Beasley, V. R., Arnold, E. K., Lovell, R. A., and Parker, A. J. (1991). 2,4-D Toxicosis I: A Pilot Study of 2,4-Dichlorophenoxyacetic Acid- and Dicamba-Induced Myotonia in Experimental Dogs. *Vet.Hum.Toxicol.* 33: 435-440.

EcoReference No.: 76625

Chemical of Concern: DMB,24DXY; Habitat: T; Effect Codes: PHY; Rejection Code: NO ENDPOINT(DMB,24DXY).

52. Beaven, G. F., Rawls, C. K., and Beckett, G. E. (1962). Field Observations upon Estuarine Animals Exposed to 2,4-D. *Proc.Northeast.Weed Control Conf.* 16: 449-458.

EcoReference No.: 13624

Chemical of Concern: 24DXYBEE; Habitat: A; Effect Codes: MOR,POP,ACC; Rejection Code: NO ENDPOINT(24DXYBEE).

53. Bebawi, F. F. and Mohamed, B. F. (1984). Effects of 2,4-D on Mature and Juvenile Plants of Water Hyacinth (*Eichornia crassipes* (Mart.) Solms). *Hydrobiologia* 110: 91-93.

EcoReference No.: 11238

Chemical of Concern: 24DXY; Habitat: A; Effect Codes: BEH; Rejection Code: NO ENDPOINT,NO CONTROL(24DXY).

54. Bednarz, T. (1981). The Effect of 2,4-D Acid on Green and Blue-Green Algae in Unialgal and Mixed Cultures. *Acta Hydrobiol.* 23: 173-182.

EcoReference No.: 14515

Chemical of Concern: 24D; Habitat: A; Effect Codes: POP,GRO; Rejection Code: NO ENDPOINT(24D).

55. Bednarz, T. (1981). The Evaluation of the Adaptation Ability of Some Green Algae to 2,4-D Acid, Monuron, and Diuron Admixtures, Under Laboratory Conditions . *Acta Hydrobiol.* 23: 251-257.

EcoReference No.: 60995

Chemical of Concern: SZ,ATZ,DU,24DXY; Habitat: A; Effect Codes: POP; Rejection Code: NO ENDPOINT(SZ,ATZ,DU),NO ENDPOINT,NO CONTROL(24DXY).

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EcoReference No.: 42108

Chemical of Concern: 24DXY; Habitat: T; Effect Codes: BCM,PHY; Rejection Code: NO ENDPOINT,NO CONTROL(24DXY).

57. Bell, A. R., Nalewaja, J. D., Alam, S., Schooler, A. B., and Hsieh, T. S. (1973). Herbicide Response and Morphology of Interspecific Sowthistle Crosses. *Weed Sci.* 21: 189-193.

EcoReference No.: 40679

Chemical of Concern: 24DXY,DMB,PCL; Habitat: T; Effect Codes: MOR,PHY,GRO; Rejection Code: NO CONTROL(DMB,PCL),NO ENDPOINT,NO CONTROL(24DXY).

58. Bell, A. R., Nalewaja, J. D., and Schooler, A. B. (1972). Response of Kochia Selections to 2,4-D, Dicamba, and Picloram. *Weed Sci.* 20: 458-461.

EcoReference No.: 40693

Chemical of Concern: 24DXY,DMB,PCL; Habitat: T; Effect Codes: PHY,REP,GRO; Rejection Code: OK TARGET(DMB),OK(PCL),NO ENDPOINT,NO CONTROL(24DXY).

59. Benijts-Claus, C. and Persoone, G. (1975). Toxicity of Three Herbicides in the Aquatic Ecosystem (La Toxicite de Trois Herbicides sur L'Ecosysteme Aquatique) . *La Tribune Du Cereveau* 28(383):340-346 (FRE); *Pestic.Abstr.*9(7):526 (1976) (ABS).

EcoReference No.: 2877

Chemical of Concern: 24DXY,PQT; Habitat: A; Effect Codes: GRO,POP,MOR; Rejection Code: NO ENDPOINT,NO CONTROL(24DXY).

60. Bertagnolli, B. L. and Nadakavukaren, M. J. (1970). Effect of 2,4-Dichlorophenoxyacetic Acid on the Fine Structure of *Chlorella pyrenoidosa* Chick. *J.Phycol.* 6: 98-100.

EcoReference No.: 2785

Chemical of Concern: 24DXY; Habitat: A; Effect Codes: CEL; Rejection Code: NO ENDPOINT,NO CONTROL(24DXY).

61. Bertagnolli, B. L. and Nadakavukaren, M. J. (1974). Some Physiological Responses of *Chlorella pyrenoidosa* to 2,4-Dichlorophenoxyacetic Acid. *J.Exp.Bot.* 25: 180-188.

EcoReference No.: 8487

Chemical of Concern: 24DXY; Habitat: A; Effect Codes: PHY,BCM,POP; Rejection Code: NO ENDPOINT,NO CONTROL(24DXY).

62. Bettoli, P. W. and Clark, P. W. (1992). Behavior of Sunfish Exposed to Herbicides: A Field Study. *Environ.Toxicol.Chem.* 11: 1461-1467.

EcoReference No.: 5846

Chemical of Concern: EDT,24DXY; Habitat: A; Effect Codes: BEH; Rejection Code: NO
ENDPOINT,NO CONTROL(24DXY).

63. Bhan, V. M., Stoller, E. W., and Slife, F. W. (1970). Toxicity, Absorption, Translocation, and Metabolism of 2,4-D in Yellow Nutsedge. *Weed Sci.* 18: 733-737.

EcoReference No.: 43679

Chemical of Concern: 24DXY; Habitat: T; Effect Codes: GRO,POP; Rejection Code: NO
ENDPOINT,NO CONTROL(24DXY).

64. Bhowmik, P., Mohasin, M., and Somchoudhury, A. K. (2004). Effect of Some Herbicides on an Agriculturally Important Non-Target Fauna-Crabs, *Paratelphusa bouvieri* (Rathbun). *Environ.Ecol.* 22: 494-496 .

EcoReference No.: 87936

Chemical of Concern: NaDPA,GYP,PAQT; Habitat: A; Effect Codes: MOR; Rejection Code: NO
ENDPOINT,CONTROL(NaDPA,GYP).

65. Bidwell, R. G. S. and Turner, W. B. (1966). Effects of Growth Regulators on CO₂ Assimilation in Leaves, and Its Correlation with the Bud Break Response in Photosynthesis. *Plant Physiol.* 41: 267-270 .

EcoReference No.: 42352

Chemical of Concern: IAA,GIB,NAA,DPP1,24DXY; Habitat: T; Effect Codes: PHY; Rejection Code: NO
ENDPOINT(IAA,GIB,NAA,DPP1),NO ENDPOINT,NO CONTROL(24DXY).

66. Bills, T. D., Marking, L. L., and Mauck, W. L. (1981). Polychlorinated Biphenyl (Aroclor 1254) Residues in Rainbow Trout: Effects on Sensitivity to Nine Fishery Chemicals. *N.Am.J.Fish.Manag.* 1: 200-203.

EcoReference No.: 10390

Chemical of Concern: 24DXY,PCB,TFM,Cu,CuS,RTN; Habitat: A; Effect Codes: MOR,ACC;
Rejection Code: NO CONTROL(TFM,Cu,24DXY,CuS,RTN),OK(PCB-EFED),LITE EVAL
CODED(OW-TRV-Cu).

67. Binns, W., James, L. F., and Johnson, A. E. (1971). Control of Larkspur with Herbicides Plus Nitrogen Fertilizer. *J.Range Manag.* 24: 110-113.

EcoReference No.: 40678

Chemical of Concern: 24DXY; Habitat: T; Effect Codes: MOR; Rejection Code: NO
ENDPOINT,NO CONTROL(24DXY).

68. Birmingham, B. C. and Colman, B. (1985). Persistence and Fate of 2,4-D Butoxyethanol Ester in Artificial Ponds. *J.Environ.Qual.* 14: 100-104.

EcoReference No.: 10741

Chemical of Concern: 24DXY; Habitat: A; Effect Codes: ACC; Rejection Code: NO
CONTROL(24DXY).

69. Birmingham, B. C., Thorndyke, M., and Colman, B. (1983). The Dynamics and Persistence of the Herbicide Aquakleen in Small Artificial Ponds and Its Impact on Non-target Aquatic Microflora and Microfauna. In: *N.K.Kaushik and K.R.Solomon (Eds.), Proc.8th Annual Aquatic Toxicity Workshop, Nov.2-4, 1981, Guelph, Ontario, Can.Tech.Rep.Fish.Aquat.Sci.No.1151* 12-23.

EcoReference No.: 4105

Chemical of Concern: 24DXY,Zn; Habitat: A; Effect Codes: ACC,POP; Rejection Code: NO
ENDPOINT(24DXY).

70. Biro, P. (1979). Acute Effects of the Sodium Salt of 2,4-D on the Early Developmental Stages of Bleak, *Alburnus alburnus*. *J.Fish Biol.* 14: 101-109.
- EcoReference No.: 5588
Chemical of Concern: 24DXY; Habitat: A; Effect Codes: MOR; Rejection Code: NO CONTROL(24DXY).
71. Biswas, P. K. and Haynes, R. L. (1970). Herbicidal Effects on Water Uptake of Seeds of Selected Weed Species. *Physiol.Plant.* 23: 583-590.
- EcoReference No.: 43961
Chemical of Concern: 24DXY,DU; Habitat: T; Effect Codes: BCM; Rejection Code: NO ENDPOINT,NO CONTROL(24DXY).
72. Bjorklund, N.-E. and Erne, K. (1966). Toxicological Studies of Phenoxyacetic Herbicides in Animals. *Acta Vet.Scand.* 7: 364-390.
- EcoReference No.: 61050
Chemical of Concern: 24DXY; Habitat: T; Effect Codes: REP,CEL,PHY,ACC,GRO,BCM,MOR,BEH; Rejection Code: NO COC(24D).
73. Black, W. N. (1976). Effects of Herbicide Rates and Time of Application on the Control of Tansy Ragwort in Pastures. *Can.J.Plant Sci.* 56: 605-610.
- EcoReference No.: 41550
Chemical of Concern: 24DXY,MCPB,MCPA,24DB,CBZ; Habitat: T; Effect Codes: POP; Rejection Code: OK(MCPA,24DB,CBZ),OK TARGET(MCPB),NO ENDPOINT,NO CONTROL(24DXY).
74. Blackman, G. E. and Robertson-Cuninghame, R. C. (1955). Interrelationships Between Light Intensity and the Physiological Effects of 2,4 Dichlorophenoxyacetic Acid on the Growth of *Helianthus Annus*. *J.Exp.Bot.* 6: 177-211.
- EcoReference No.: 41851
Chemical of Concern: 24DXY; Habitat: T; Effect Codes: GRO; Rejection Code: NO ENDPOINT,NO CONTROL(24DXY).
75. Blair, B. O. (1951). Mesquite Seed and Seedling Response to 2,4-D and 2,4,5-T. *Bot.Gaz.* 112: 518521.
- EcoReference No.: 43788
Chemical of Concern: 24DXY; Habitat: T; Effect Codes: GRO; Rejection Code: NO ENDPOINT,NO CONTROL(24DXY).
76. Blaisdell, J. P. and Mueggler, W. F. (1956). Effect of 2,4-D on Forbs and Shrubs Associated with Big Sagebrush. *J.Range Manag.* 9: 30-40.
- EcoReference No.: 42480
Chemical of Concern: 24DXY; Habitat: T; Effect Codes: MOR; Rejection Code: NO ENDPOINT,NO CONTROL(24DXY).
77. Blakley, B. R. (1997). Effect of Roundup and Tordon 202C Herbicides on Antibody Production in Mice. *Vet.Hum.Toxicol.* 39: 204-206.
- EcoReference No.: 93565
Chemical of Concern: 24D,PCL; Habitat: T; Effect Codes: GRO,BEH,PHY,CEL; Rejection Code: NO MIXTURE(24D).

78. Blakley, B. R. and Blakley, P. M. (1986). The Effect of Prenatal Exposure to the n-Butylester of 2,4-Dichlorophenoxyacetic Acid (2,4-D) on the Immune Response in Mice. *Teratology* 33: 15-20.
- EcoReference No.: 93414
Chemical of Concern: 24DXY; Habitat: T; Effect Codes: PHY,CEL,GRO; Rejection Code: NO COC(24D).
79. Blakley, P. M., Kim, J. S., and Firneisz, G. D. (1989). Effects of Gestational Exposure to Tordon 202c on Fetal Growth and Development in CD-1 Mice. *J.Toxicol.Environ.Health* 28: 309-316.
- EcoReference No.: 93365
Chemical of Concern: PCL,24D; Habitat: T; Effect Codes: GRO,MOR,REP,BEH; Rejection Code: NO MIXTURE(24D).
80. Blakley, P. M., Kim, J. S., and Firneisz, G. D. (1989). Effects of Preconceptional and Gestational Exposure to Tordon 202c on Fetal Growth and Development in CD-1 Mice. *Teratology* 39: 547-553.
- EcoReference No.: 93561
Chemical of Concern: PCL,24D; Habitat: T; Effect Codes: REP,MOR,GRO,BEH; Rejection Code: NO MIXTURE(24D).
81. Bohm, H. H. and Muller, H. (1976). Model Studies on the Accumulation of Herbicides by Microalgae. *Naturwissenschaften* 63: 296.
- EcoReference No.: 7729
Chemical of Concern: 24DXY,ATZ; Habitat: A; Effect Codes: ACC; Rejection Code: NO CONTROL,ENDPOINT(24DXY,ATZ).
82. Borthwick, S. M. (1988). Impact of Agricultural Pesticides on Aquatic Invertebrates Inhabiting Prairie Wetlands. *M.S.Thesis, Colorado State Univ., Ft.Collins, CO* 76.
- EcoReference No.: 13461
Chemical of Concern: 24DXY,MP; Habitat: A; Effect Codes: MOR; Rejection Code: NO ENDPOINT(24DXY,MP).
83. Bottrill, D. E. and Hanson, J. B. (1968). Short-Term Growth Response to Growth Regulators in Roots of Zea mays. *Aust.J.Biol.* 21: 201-208.
- EcoReference No.: 43449
Chemical of Concern: 24DXY; Habitat: T; Effect Codes: GRO; Rejection Code: NO ENDPOINT,NO CONTROL(24DXY).
84. Boumaiza, M., Ktari, M. H., and Vitiello, P. (1979). Toxicity of Several Pesticides Used in Tunisia, for *Aphanius fasciatus* Nardo, 1827 (Pisces, Cyprinodontidae). *Arch.Inst.Pasteur Tunis* 56: 307-342 (FRE).
- EcoReference No.: 5365
Chemical of Concern: 24DXY,BT,CPY,DMT,DZ,MLN,PSM,PHMD,OMT; Habitat: A; Effect Codes: MOR; Rejection Code: NO FOREIGN,NO CONTROL(ALL CHEMS).
85. Bovey, R. W. (1964). Aerial Application of Herbicides for Control of Sand Sagebrush. *J.Range Manag.* 17: 253-256 .
- EcoReference No.: 42251
Chemical of Concern: 24DXY; Habitat: T; Effect Codes: MOR; Rejection Code: NO ENDPOINT,NO CONTROL(24DXY).

86. Bovey, R. W., Baur, J. R., and Bashaw, E. C. (1979). Tolerance of Kleingrass to Herbicides. *J.Range Manag.* 32: 337-339.

EcoReference No.: 41537

Chemical of Concern: DMB,HXZ,TET,PCL,24DXY,PPZ; Habitat: T; Effect Codes: PHY; Rejection Code: LITE EVAL CODED(PPZ),OK TARGET(DMB),OK(TET,PCL),NO ENDPOINT,NO CONTROL(24DXY,HXZ).

87. Bovey, R. W., Baur, J. R., and Morton, H. L. (1970). Control of Huisache and Associated Woody Species in South Texas. *J.Range Manag.* 23: 47-50.

EcoReference No.: 43356

Chemical of Concern: 24DXY,BMC,DMB,PAQT,PCL; Habitat: T; Effect Codes: POP; Rejection Code: OK TARGET(DMB),OK(PAQT,PCL),NO CONTROL,NO ENDPOINT(24DXY,BMC).

88. Bowes, G. and Molberg, E. S. (1975). Picloram for the Control of Leafy Spurge. *Can.J.Plant Sci.* 55: 1023-1027.

EcoReference No.: 43436

Chemical of Concern: 24DXY; Habitat: T; Effect Codes: POP; Rejection Code: NO ENDPOINT,NO CONTROL(24DXY).

89. Boyle, T. P. (1980). Effects of the Aquatic Herbicide 2,4-D DMA on the Ecology of Experimental Ponds. *Environ.Pollut.Ser.A* 21: 35-49.

EcoReference No.: 2605

Chemical of Concern: 24DXY; Habitat: A; Effect Codes: MOR,BCM,PRS,POP,GRO,PHY; Rejection Code: NO ENDPOINT(24DXY).

90. Bridie, A. L., Wolff, C. J. M., and Winter, M. (1979). The Acute Toxicity of Some Petrochemicals to Goldfish. *Water Res.* 13: 623-626 (OECDG Data File).

EcoReference No.: 623

Chemical of Concern: ETO,ACL,DEAC,PPO,BNZ,TOL,PL,AMSV,ISO,TEG; Habitat: A; Effect Codes: MOR; Rejection Code: NO CONTROL(ALL CHEMS).

91. Bringmann, G. (1978). Investigation of Biological Harmful Effects of Chemical Substances Which are Classified as Dangerous for Water on Protozoa. *Z.Wasser-Abwasser-Forsch.* 11(6):210-215, TR-80-0307, Literature Research Company 13 p. (ENG TRANSL) (OECDG Data File).

EcoReference No.: 6601

Chemical of Concern:

Urea,ATC,24DXYEE,ACL,TOL,PL,Pb,DNT,HgCl₂,SFL,Be,Ni,NaCr,CF,HCB,ETHB,4NP,CN,PHTH,DCB,DEAC,NP,FUR,BNZ,3CE,NBZ,NaCN,CuS,Ag,BZO,As,Ni,Ag,Se,AMSV,NaBr,Cd,NaID,C₈O₈H; Habitat: A; Effect Codes: POP; Rejection Code: NO CONTROL,FOREIGN(ALL CHEMS).

92. Bringmann, G. and Kuhn, R. (1981). Comparison of the Effect of Toxic Substances on the Flagellate Organisms Such as Ciliates and the Holozoic Bacteria-Devouring Organisms Such as Saprozoic Protozoans (Vergleich der Wirkung von Schadstoffen auf Flagellate Sowie Ciliate bzw. auf Holozoische Bakterienfressende Sowie Saprozoische Protozoen). *Gwf-Wasser Abwasser* 122: 308-313 (GER) (ENG ABS) (OECDG Data File).

EcoReference No.: 720

Chemical of Concern:

ACL,CN,FUR,Cu,CuS,BZO,AMSV,NaID,C₈OH,DCB,PGR,CHG,ICRE,DNT,C₆OH,NP,HgCl₂,4NP,24DC,NBZ,3CE,BNZ; Habitat: A; Effect Codes: POP; Rejection Code: NO FOREIGN,LITE

EVAL CODED(OW-TRV-Cu).

93. Bringmann, G. and Kuhn, R. (1980). Comparison of the Toxicity Thresholds of Water Pollutants to Bacteria, Algae, and Protozoa in the Cell Multiplication Inhibition Test. *Water Res.* 14: 231-241 (Author Communication Used).

EcoReference No.: 5303

Chemical of Concern:

Be,Cd,Ag,CuS,Ni,SFL,HgCl₂,Pb,24DC,PL,MCRE,ETHB,NBZ,DCB,NP,PHTH,3CE,BNZ,CF,AN,Urea,CTC,ATC,NP,CN,NaCr,FUR,Cu,BZO,As,Ni,Ag,Cd,Se,Pb,AMSV,NaBr,NaID,C8OH; Habitat: A; Effect Codes: POP; Rejection Code: NO ENDPOINT(ALL CHEMS).

94. Bringmann, G. and Kuhn, R. (1978). Testing of Substances for Their Toxicity Threshold: Model Organisms *Microcystis (Diplocystis) aeruginosa* and *Scenedesmus quadricauda*. *Mitt.Int.Ver.Theor.Angew.Limnol.* 21: 275-284 (Author Communication Used).

EcoReference No.: 15134

Chemical of Concern:

Be,Cd,Ag,CuS,Ni,SFL,HgCl₂,ATZ,LNR,Pb,CN,DNT,24DC,FRN,PL,CBZ,MCRE,ETHB,FUR,NBZ,PHTH,3CE,NP,AN,CBL,CF,HCCH,ATC,Urea,CTC,NaCr,Cu,BZO,As,Se,AMSV,NaBr,NaID,C8OH,DCB; Habitat: A; Effect Codes: POP; Rejection Code: NO ENDPOINT(ALL CHEMS).

95. Bringmann, G. and Kuhn, R. (1959). Water Toxicological Studies with Protozoa as Test Organisms. *TR-80-0058, Literature Research Company:13 p./ Gesund.-Ing.80:239-242 (GER) / Chem.Abstr.* 53: 22630D-(GER)(ENG TRANSL).

EcoReference No.: 2394

Chemical of Concern: Ag,Cr,CN,CuS,NaN₃,As,Ni,24DP,Cd,Se,Pb,Zn,NH; Habitat: A; Effect Codes: BEH; Rejection Code: NO ENDPOINT,FOREIGN(ALL CHEMS),LITE EVAL CODED(OW-TRV-Cu).

96. Bringmann, G., Kuhn, R., and Winter, A. (1980). Determination of the Biological Effect From Water Pollutants to Protozoa. III. Saprozoic Flagellates (Bestimmung der Biologischen Schädigung Wassergefährdender Stoffe Gegen Protozoen III. Saprozoische Flagellaten). *Z.Wasser-Abwasser-Forsch.* 13: 170-173 (GER) (ENG ABS) (OECDG Data File).

EcoReference No.: 5719

Chemical of Concern:

CTC,Urea,ATC,AN,NP,BZO,PPN,CF,BNZ,3CE,HCN,DCB,FUR,NBZ,ETHB,ACL,DXN,24DC,DNT,CN,MCRE,TOL,PL,DEAC,Pb,FRN,HgCl₂,SFL,Ni,CuS,Ag,Cd,Be,NaCr,As,Ni,Ag,Cd,Se,Pb,AMSV,NaBr,NaID,C8OH; Habitat: A; Effect Codes: POP; Rejection Code: NO FOREIGN.

97. Brooker, M. P. (1976). The Ecological Effects of the Use of Dalapon and 2,4-D for Drainage Channel Management I. Flora and Chemistry. *Arch.Hydrobiol.* 78: 396-412.

EcoReference No.: 14686

Chemical of Concern: DMDP; Habitat: A; Effect Codes: POP; Rejection Code: NO CONTROL(DMDP).

98. Brooker, M. P. (1976). The Ecological Effects of the Use of Dalapon and 2,4-D for Drainage Channel Management II. Fauna. *Arch.Hydrobiol.* 78: 507-525.

EcoReference No.: 93368

Chemical of Concern: 24D; Habitat: A; Effect Codes: POP; Rejection Code: NO MIXTURE(24D).

99. Brown, J. W. (1946). Effect of 2,4-Dichlorophenoxyacetic Acid on the Water Relations, the Accumulation and

Distribution of Solid Matter, and the Respiration of Bean Plants. *Bot.Gaz.* 107: 332-343.

EcoReference No.: 43089

Chemical of Concern: 24DXY; Habitat: T; Effect Codes: GRO,PHY,BCM,MOR,CEL; Rejection Code: NO ENDPOINT,NO CONTROL(24DXY).

100. Burrill, L. C., Cannon, L. E., Duddles, R. E., and Poole, A. P. (1992). Effect of Adjuvants on Herbicide Activity on Gorse. *Proc.West.Soc.Weed Sci.* 45: 60-65.

EcoReference No.: 87080

Chemical of Concern: 24DXY,IZP,DMB,GYP; Habitat: T; Effect Codes: POP; Rejection Code: NO COC(PYPG),NO ENDPOINT,NO CONTROL(24DXY,IZP,DMB).

101. Burstrom, H., Sjoberg, B., and Hansen, B. A. M. (1976). The Plant Growth Activity of Phenoxy-Thioacetic Acids. *Act Ag Sc* 6: 155-177.

EcoReference No.: 40676

Chemical of Concern: 24DXY; Habitat: T; Effect Codes: GRO; Rejection Code: NO ENDPOINT,NO CONTROL(24DXY).

102. Burton, D. F. (1950). Anatomy of the Cotton Leaf and Effects Induced by 2,4-Dichlorophenoxyacetic Acid. *Bot.Gaz.* 111: 325-332.

EcoReference No.: 43185

Chemical of Concern: 24DXY; Habitat: T; Effect Codes: PHY; Rejection Code: NO ENDPOINT,NO CONTROL(24DXY).

103. Burton, D. F. (1947). Formative Effects of Certain Chlorophenoxy Compounds on Bean Leaves. *Bot.Gaz.* 109: 183-194.

EcoReference No.: 43172

Chemical of Concern: 24DXY; Habitat: T; Effect Codes: GRO; Rejection Code: NO ENDPOINT,NO CONTROL(24DXY).

104. Buslovich, S. Y. and Borushko, N. V. (1976). Chloroderivatives of Phenoxyacetic Acid as Antagonists of Thyroid Hormones. *Farmakol.Toksikol.(Mosc.)* 4: 481-483 (RUS) (ENG ABS).

EcoReference No.: 7742

Chemical of Concern: 24DXY; Habitat: A; Effect Codes: GRO; Rejection Code: NO ENDPOINT,NO CONTROL(24DXY).

105. Butler, G. L., Deason, T. R., and O'Kelley, J. C. (1975). The Effect of Atrazine, 2,4-D, Methoxychlor, Carbaryl and Diazinon on the Growth of Planktonic Algae. *Br.Phycol.J.* 10: 371-376.

EcoReference No.: 7429

Chemical of Concern: 24DXY,ATZ,CBL,DZ; Habitat: A; Effect Codes: POP; Rejection Code: NO ENDPOINT(ATZ,CBL,DZ),NO ENDPOINT,NO CONTROL(24DXY).

106. Butler, G. L., Deason, T. R., and O'Kelley, J. C. (1975). Loss of Five Pesticides from Cultures of Twenty-One Planktonic Algae. *Bull.Environ.Contam.Toxicol.* 13: 149-152.

EcoReference No.: 60703

Chemical of Concern: DZ,ATZ,MXL,24DXY,CBL; Habitat: A; Effect Codes: ACC; Rejection Code: NO ENDPOINT(ALL CHEMS).

107. Butler, P. A. (1963). Commercial Fisheries Investigations. *Circ.No.167, Fish Wildl.Serv., Washington,*

D.C. 11-25.

EcoReference No.: 2188

Chemical of Concern:

AZ,CBL,DZ,HCCH,MLN,Naled,PSM,24DXY,DS,DU,PEB,Folpet,RTN,FBM,CHD,DEM,TXP,MRX,ETN,DZ,AND,MCPA,HPT,DDT,DDVP,EN,CBL,MXC,OXD; Habitat: A; Effect Codes: NOC,GRO,MOR,BEH,PHY; Rejection Code: NO CONTROL(ALL CHEMS),NO ENDPOINT,NO CONTROL(24DXY,OXD,MLN).

108. Butler, P. A. (1964). Commercial Fishery Investigations. In: *Pesticide-Wildlife Studies, 1963, U.S.D.I., Fish and Wildl.Serv.,Circ.199* 28 p.(Author Communication Used).

EcoReference No.: 646

Chemical of Concern:

AZ,DS,HCCH,MLN,MP,Naled,PRT,24DXY,CMPH,DMT,DU,PEB,PSM,NTP,TXP,CBL,TBF; Habitat: A; Effect Codes: BEH,POP,MOR,GRO,ACC,SYS; Rejection Code: NO CONTROL(MP,Naled),LITE EVAL CODED(MLN,PRT),OK(ALL CHEMS),NO ENDPOINT(DMT),NO ENDPOINT,NO CONTROL(24DXY,TBF).

109. Cain, J. R. and Cain, R. K. (1983). The Effects of Selected Herbicides on Zygospor Germination and Growth of *Chlamydomonas moewusii* (Chlorophyceae, Volvocales). *J.Phycol.* 19: 301-305.

EcoReference No.: 61203

Chemical of Concern:

EDT,ATZ,DU,PCL,24DXY,PAQT,PRO,PPN,DMB,LNR,ACR,AMTR,BMN,AMTL; Habitat: A; Effect Codes: POP,REP; Rejection Code: LITE EVAL CODED(PRO,ATZ),OK(ALL CHEMS),NO ENDPOINT(24DXY).

110. Caldwell, R. S., Buchanan, D. V., Armstrong, D. A., Mallon, M. H., and Millemann, R. E. (1979). Toxicity of the Herbicides 2,4-D, DEF, Propanil and Trifluralin to the Dungeness Crab, Cancer magister. *Arch.Environ.Contam.Toxicol.* 8: 383-396.

EcoReference No.: 5724

Chemical of Concern: 24DXY,TFN,TBF; Habitat: A; Effect Codes: MOR,GRO; Rejection Code: NO ENDPOINT,NO CONTROL(24DXY,TBF).

111. Calleja, M. C., Persoone, G., and Geladi, P. (1994). Comparative Acute Toxicity of the First 50 Multicentre Evaluation of In Vitro Cytotoxicity Chemicals to Aquatic Non-Vertebrates. *Arch.Environ.Contam.Toxicol.* 26: 69-78.

EcoReference No.: 13669

Chemical of Concern:

24DXY,HCCH,MLN,WFN,PCP,Ba,CTC,PL,SFL,NCTN,LPS,PAQT,As,CuS,Hg,TI,CF,AMSV; Habitat: A; Effect Codes: MOR,PHY; Rejection Code: NO CONTROL(ALL CHEMS).

112. Campbell, R. W. (1959). Some Effects of Various Esters of 2,4-Dichlorophenoxyacetic Acid on the Morphological Development of the Strawberry. *Weeds* 7: 77-81.

EcoReference No.: 42726

Chemical of Concern: 24DXY; Habitat: T; Effect Codes: PHY,GRO; Rejection Code: NO ENDPOINT,NO CONTROL(24DXY).

113. Canode, C. L. (1974). Tolerance of Five Cool-Season Perennial Grasses to Selected Herbicides. *Agron.J.* 66: 683-686 .

EcoReference No.: 40690

- Chemical of Concern: 24DXY,DMB,BMN,CPP,PCL; Habitat: T; Effect Codes: REP,POP; Rejection Code: NO MIXTURE(DMB,BMN,CPP,PCL),NO ENDPOINT(24DXY).
114. Carlson, R. F. (1947). Control of Weeds in Strawberry Plantings by the Use of 2,4-Dichlorophenoxyacetic Acid. *P Am S Hort* 49: 221-223.
- EcoReference No.: 43108
Chemical of Concern: 24DXY; Habitat: T; Effect Codes: MOR,PHY,GRO,BCM; Rejection Code: NO ENDPOINT,NO CONTROL(24DXY).
115. Carlson, R. W. (1990). Ventilatory Patterns of Bluegill (*Lepomis macrochirus*) Exposed to Organic Chemicals with Different Mechanisms of Toxic Action. *Comp.Biochem.Physiol.C* 95: 181-196.
- EcoReference No.: 3461
Chemical of Concern: CF,24DXY,C8OH,NP,CBL,ACC,PCP,RTN,MLN; Habitat: A; Effect Codes: PHY,MOR; Rejection Code: LITE EVAL CODED(CBL,C8OH,ACL),NO ENDPOINT(ALL CHEMS).
116. Carpenter, K. and Wilson, C. (1956). The Relative Toxicity of MCPB, 2,4-DB and MCPA to Cereals. *Proc.Br.Weed Control Conf.* 1: 417-422.
- EcoReference No.: 28109
Chemical of Concern: 24DXY,MCPB,MCPA; Habitat: T; Effect Codes: GRO,POP; Rejection Code: NO ENDPOINT,CONTROL(ALL CHEMS,MCPB-TARGET).
117. Carpenter, L. A. and Eaton, D. L. (1983). The Disposition of 2,4-Dichlorophenoxyacetic Acid in Rainbow Trout. *Arch.Environ.Contam.Toxicol.* 12: 169-173.
- EcoReference No.: 15556
Chemical of Concern: 24DXY; Habitat: A; Effect Codes: ACC; Rejection Code: NO ENDPOINT(24DXY).
118. Carpentier, A. G., MacKenzie, D. L., and Frank, R. (1988). Residues and Efficacy of Two Formulations of 2,4-D on Aquatic Macrophytes in Buckhorn Lake, Ontario. *J.Aquat.Plant Manage.* 26: 29-37.
- EcoReference No.: 2735
Chemical of Concern: 24DXY; Habitat: A; Effect Codes: ACC,POP; Rejection Code: NO ENDPOINT,NO CONTROL(24DXY).
119. Carson, A. G. and Bandeen, J. D. (1975). Chemical Control of Canada Thistle. *Weed Sci.* 23: 116-118.
- EcoReference No.: 43665
Chemical of Concern: 24DXY,DMB,ATZ; Habitat: T; Effect Codes: POP; Rejection Code: OK TARGET(ATZ,DMB),OK(ALL CHEMS),NO ENDPOINT,NO CONTROL(24DXY).
120. Castro de Cantarini, S., Duffard, R., and Evangelista de Duffard, A. (1992). Esterase Activities During Chick Embryonic Development and Its Relationship with the Metabolism of 2,4-Dichlorophenoxyacetic Acid Butyl Ester. *Bull.Environ.Contam.Toxicol.* 49: 520-526.
- EcoReference No.: 93386
Chemical of Concern: 24DXY,24D; Habitat: T; Effect Codes: ACC,BCM,GRO; Rejection Code: NO ENDPOINT(24D).
121. Castro de Cantarini, S. M., Evangelista De Duffard, A. M., and Duffard, R. O. (1989). Penetration

Studies and Residue Determinations of 2,4-Dichlorophenoxyacetic Acid Butyl Ester in Fertile Hen Eggs and Chicks Hatched from Treated Eggs. *Drug Chem.Toxicol.* 12: 137-146.

EcoReference No.: 94120; Habitat: T; Effect Codes: ACC,MOR,GRO,PHY; Rejection Code: NO COC(24DXYBEE).

122. Chamberlain, K. and Wain, R. L. (1978). Studies on Plant-Growth Regulating Substances. LV. the Plant Growth-Promoting Properties of Some B-Aryl-Propionic Acids. *Ann.Appl.Biol.* 90: 115-119.

EcoReference No.: 40940

Chemical of Concern: 24DXY; Habitat: T; Effect Codes: PHY,GRO; Rejection Code: NO ENDPOINT,NO CONTROL(24DXY).

123. Chandrashekar, K. R. and Kaveriappa, K. M. (1994). Effect of Pesticides on Sporulation and Germination of Conidia of Aquatic Hyphomycetes. *J.Environ.Biol.* 15: 315-324.

EcoReference No.: 13517

Chemical of Concern: 24DXY,MLN,PQT,Zn,MZB,Captan; Habitat: A; Effect Codes: REP,GRO; Rejection Code: NO ENDPOINT(Captan,24DXY,MLN,PQT,Zn,MZB).

124. Chandrashekar, K. R. and Kaveriappa, K. M. (1989). Effect of Pesticides on the Growth of Aquatic Hyphomycetes. *Toxicol.Lett.* 48: 311-315.

EcoReference No.: 3076

Chemical of Concern: 24DXY,PQT,Zn,MANEB,Captan,MZB; Habitat: A; Effect Codes: POP; Rejection Code: NO ENDPOINT(PQT,Zn,MANEB,Captan,MZB),NO ENDPOINT,NO CONTROL(24DXY).

125. Charles, J. M., Henwood, S. M., and Leeming, N. M. (1999). Developmental Toxicity Studies in Rats and Rabbits and Two-Generation Reproduction Study in Rats on 4-(2,4-Dichlorophenoxy)butyric Acid. *Int.J.Toxicol.* 18: 177-189.

EcoReference No.: 93568

Chemical of Concern: 24DB; Habitat: T; Effect Codes: MOR,REP,GRO; Rejection Code: NO COC(24D).

126. Chaturvedi, A. K. (1993). Toxicological Evaluation of Mixtures of Ten Widely Used Pesticides. *J.Appl.Toxicol.* 13: 183-188.

EcoReference No.: 93558

Chemical of Concern: TXP,PRN,ACR,AND,ATZ,24D,DDT,DLD,ES,HCCH; Habitat: T; Effect Codes: BCM,GRO,PHY,BEH; Rejection Code: NO MIXTURE(ATZ,24D).

127. Chen, H. and Galston, A. W. (1965). Inhibitory Effects of 6-Methylpurine on Plant Cell Growth. *Plant Cell Physiol.* 6: 365-370.

EcoReference No.: 42324

Chemical of Concern: 24DXY; Habitat: T; Effect Codes: CEL; Rejection Code: NO MIXTURE(24DXY).

128. Chen, L. G., Ali, A., Fletcher, R. A., Switzer, C. M., and Stephenson, G. R. (1973). Effects of Auxin-Like Herbicides on Nucleohistones in Cucumber and Wheat Roots. *Weed Sci.* 21: 181-184.

EcoReference No.: 41468

Chemical of Concern: 24DXY,DMB; Habitat: T; Effect Codes: GRO,CEL; Rejection Code: NO ENDPOINT(DMB),NO ENDPOINT,NO CONTROL(24DXY).

129. Chen, L. G., Switzer, C. M., and Fletcher, R. A. (1972). Nucleic Acid and Protein Changes Induced by Auxin-Like Herbicides. *Weed Sci.* 20: 53-55.

EcoReference No.: 41896
Chemical of Concern: 24DXY,PCL,DMB; Habitat: T; Effect Codes: GRO,CEL,PHY; Rejection Code: NO ENDPOINT(PCL,DMB),NO ENDPOINT,NO CONTROL(24DXY).
130. Chen, Y., Lin, C., Chang, H., Guilfoyle, T. J., and Key, J. L. (1975). Isolation and Properties of Nuclei from Control and Auxin-Treated Soybean Hypocotyl. *Plant Physl* 56: 78-82.

EcoReference No.: 43920
Chemical of Concern: 24DXY; Habitat: T; Effect Codes: CEL,BCM,GRO; Rejection Code: NO ENDPOINT,NO CONTROL(24DXY).
131. Chen, Y. M. and Lin, C. Y. (1977). Effect of Dowco 290 on Rna Synthesis in Soybean Hypocotyl. *Taiwania* 22: 73-79.

EcoReference No.: 42789
Chemical of Concern: 24DXY; Habitat: T; Effect Codes: CEL,BCM; Rejection Code: NO ENDPOINT,NO CONTROL(24DXY).
132. Chinnaswamy, R. and Patel, R. J. (1986). Detoxication of Herbicides by Blue-Green Algae. *Indian J.Ecol.* 13: 5-9.

EcoReference No.: 14056
Chemical of Concern: NaDPA; Habitat: T; Effect Codes: GRO; Rejection Code: NO ENDPOINT(NaDPA).
133. Cholakakis, J. M., McKee, M. J., Wong, L. C. K., and Gile, J. D. (1981). Acute and Subacute Toxicity of Pesticides in Microtine Rodents. In: *D.W.Lamb and E.E.Kenaga (Eds), Avian and Mammalian Wildlife Toxicology, 2nd Conference, ASTM STP 757, Phaildelphia, PA* 143-154.

EcoReference No.: 36150
Chemical of Concern: SZ,PNB,DLD,PRN,PPN,24DXY,MP,TFN; Habitat: T; Effect Codes: MOR,BEH,PHY; Rejection Code: NO CONTROL(ALL CHEMS).
134. Chouhan, M. S., Verma, D., and Pandey, A. K. (1983). Herbicide Induced Haematological Changes and Their Recovery in a Freshwater Fish, *Puntius ticto* (Ham.) . *Comp.Physiol.Ecol.* 8: 249-251.

EcoReference No.: 11077
Chemical of Concern: 24DXY; Habitat: A; Effect Codes: CEL; Rejection Code: NO ENDPOINT(24DXY),NO COC(DPP1).
135. Chrispeels, M. J. and Hanson, J. B. (1962). The Increase in Ribonucleic Acid Content of Cytoplasmic Particulates of Soybean Hypocotyl Induced by 2,4-Dichlorophenoxyacetic Acid. *Weeds* 10: 123-125.

EcoReference No.: 42078
Chemical of Concern: 24DXY; Habitat: T; Effect Codes: CEL,PHY; Rejection Code: NO ENDPOINT,NO CONTROL(24DXY).
136. Christoffers, D. and Ernst, D. E. W. (1983). The In-Vivo Fluorescence of *Chlorella fusca* as a Biological Test for the Inhibition of Photosynthesis. *Toxicol.EnvIRON.Chem.* 7: 61-71.

EcoReference No.: 45160
Chemical of Concern: CBL,PbAC,PCP,DLD,DDT,HCCH,Cd,HgCl2,24DXY; Habitat: A; Effect Codes: PHY; Rejection Code: NO CONTROL,NO ENDPOINT(ALL CHEMS).

137. Clay, D. V. and West, T. M. (1987). The Response of Traizine Resistant and Susceptible Biotypes of *Erigeron canadensis* to 23 Herbicides. *Meded.Fac.Landbouwk.Rijksuniv.Gent* 52: 1195-1206.
- EcoReference No.: 70179
Chemical of Concern:
SZ,PHMD,GYP,AMTL,24DXY,TPR,OYZ,CPR,PCH,DU,NPP,OXF,NFZ,ODZ,PDM,PAQT,PYD,IZP,FXP; Habitat: T; Effect Codes: PHY,GRO; Rejection Code: NO ENDPOINT(ALL CHEMS,TARGET-IZP),TARGET(OYZ).
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- EcoReference No.: 42538
Chemical of Concern: 24DXY; Habitat: T; Effect Codes: MOR,PHY,GRO; Rejection Code: NO ENDPOINT,NO CONTROL(24DXY).
139. Cluff, G. J., Roundy, B. A., Evans, R. A., and Young, J. A. (1983). Herbicidal Control of Greasewood and Salt Rabbitbrush (*Chrysothamnus nauseosus* ssp. *consimilis*). *Weed Sci.* 31: 275-279.
- EcoReference No.: 41101
Chemical of Concern: TPR,PCL,24DXY,DMB; Habitat: T; Effect Codes: MOR,GRO; Rejection Code: NO CONTROL(TPR,PCL,DMB),NO ENDPOINT,NO CONTROL(24DXY).
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- EcoReference No.: 2784
Chemical of Concern: 24DXY,24D,DLD,DDT; Habitat: A; Effect Codes: BEH,GRO,MOR,ACC; Rejection Code: NO ENDPOINT(24D),NO ENDPOINT,NO CONTROL(24DXY).
141. Cope, O. B. (1966). Contamination of the Freshwater Ecosystem by Pesticides . *J.Appl.Ecol.* 3: 33-44 (Publ in Part As 6797).
- EcoReference No.: 10337
Chemical of Concern:
DDT,HCCH,DLD,DU,MLN,24DXY,CBL,DBN,DZ,MLT,PAQT,PYN,TFN,CuS; Habitat: A; Effect Codes: MOR,ACC,REP; Rejection Code: NO CONTROL(ALL CHEMS).
142. Cope, O. B. (1946). Preliminary Tests of Herbicides vs. Fishes. *U.S.Fish Wildl.Serv.Memorandum* 9 p.
- EcoReference No.: 4934
Chemical of Concern: NaDPA,24D; Habitat: A; Effect Codes: MOR; Rejection Code: NO ENDPOINT(NaDPA,24D).
143. Cope, O. B. (1965). Sport Fishery Investigations. In: *Fish and Wildl.Serv.Cicr.226, Effects of Pesticides on Fish and Wildlife - 1964 Research Findings of the Fish and Wildlife Service, Washington, D.C.*: 51-63 (Publ in Part As 6797) .
- EcoReference No.: 2871
Chemical of Concern:
CHD,CuS,PAQT,MCB,TFN,DBN,DZ,AND,PYN,HPT,EN,DLD,HCCH,EPRN,DDT,TXP,MRT,VNT,CU,ATN,DU,SZ,MLN,RTN,MXC,DDVP,DMT,FNTH,TCF,ADC,CBL,BS,DBM,FNF,24DXY,AMSV,DBAC,NSM,BYT,MVP; Habitat: A; Effect Codes: MOR,BCM; Rejection Code: NO CONTROL(24DXY,Naled,BS,MLN),OK(ALL CHEMS).

144. Cope, O. B., Wood, E. M., and Wallen, G. H. (1970). Some Chronic Effects of 2,4-D on the Bluegill (*Lepomis macrochirus*). *Trans.Am.Fish.Soc.* 99: 1-12.
- EcoReference No.: 9535
Chemical of Concern: 24DXY; Habitat: A; Effect Codes: ACC,GRO,BCM,CEL,MOR; Rejection Code: NO ENDPOINT,NO CONTROL(24DXY).
145. Corkern, C. B., Jordan, D. L., Griffin, J. L., Vidrine, P. R., Williams, B. J., and Reynolds, D. B. (1999). Influence of Adjuvants on Interactions of Sethoxydim with Selected Broadleaf Herbicides Used in Corn (*Zea mays*). *Weed Technol.* 13: 821-824.
- EcoReference No.: 63264
Chemical of Concern: ATZ,24DXY,BMN,BT,SXD; Habitat: T; Effect Codes: POP; Rejection Code: NO CONTROL(TARGET-SXD),MIXTURE(ATZ,24DXY,BMN,BT,TARGET-ATZ).
146. Costa, J. and Appleby, A. P. (1976). Response of Two Yellow Nutsedge Varieties to Three Herbicides. *Weed Sci.* 24: 54-58.
- EcoReference No.: 41686
Chemical of Concern: 24DXY,ATZ; Habitat: T; Effect Codes: POP,GRO,BCM; Rejection Code: OK TARGET(ATZ),NO ENDPOINT,NO CONTROL(24DXY).
147. Couch, R., Nelson, E., and Mohrman, M. (1978). Monitoring the Effects of 2,4-D Applied to Eurasian Watermilfoil on Selected Non-target Organisms in Kerr Reservoir, 1978. *U.S.EPA-OPP Registration Standard*.
- EcoReference No.: 13028
Chemical of Concern: 24DXY; Habitat: A; Effect Codes: POP; Rejection Code: NO ENDPOINT(24DXY).
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- EcoReference No.: 61756
Chemical of Concern: 24DXYBEE; Habitat: A; Effect Codes: POP; Rejection Code: NO ENDPOINT(24DXYBEE).
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- EcoReference No.: 74055
Chemical of Concern: MTL,BTC,ACR,MBZ,DMM,24DXY,CPP,CSF,OXF,EPTC,ATC; Habitat: A; Effect Codes: GRO,BCM; Rejection Code: NO ENDPOINT(ALL CHEMS).
150. Crafts, A. S. and Yamaguchi, S. (1964). The Autoradiography of Plant Materials. *Manual 35, The Autoradiography of Plant Materials, Calif.Agric.Exp.Stn., Davis, CA* 143 p.
- EcoReference No.: 72130
Chemical of Concern: 24DXY,ATZ,PCP,SZ,Zn; Habitat: T; Effect Codes: GRO,ACC,BCM; Rejection Code: NO CONC(SZ),ENDPOINT(ALL CHEMS,TARGET-ATZ).
151. Crane, J. C. and Blondeau, R. (1949). The Use of Growth-Regulating Chemicals to Induce Parthenocarpic Fruit in the Calimyrna Fig. *Plant Physl* 24: 44-54.
- EcoReference No.: 43214
Chemical of Concern: 24DXY; Habitat: T; Effect Codes: REP,PHY; Rejection Code: NO

ENDPOINT,NO CONTROL(24DXY).

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EcoReference No.: 14348

Chemical of Concern: TXP,AND,MLN,24DXY,PCP,CBL,HCCH,PRN,DDT,PAQT; Habitat: A; Effect Codes: GRO,MOR; Rejection Code: NO CONTROL,NO ENDPOINT(ALL CHEMS).

153. Croker, B. H. (1953). Effects of 2,4-Dichlorophenoxyacetic Acid and 2,4,5-Trichlorophenoxyacetic Acid on Mitosis in *Allium cepa*. *Bot.Gaz.* 114: 274-283.

EcoReference No.: 41609

Chemical of Concern: 24DXY; Habitat: T; Effect Codes: GEN; Rejection Code: NO GENETIC.

154. Cronin, M. T. D., Zhao, Y. H., and Yu, R. L. (2000). pH-Dependence and QSAR Analysis of the Toxicity of Phenols and Anilines to *Daphnia magna*. *Environ.Toxicol.* 15: 140-148.

EcoReference No.: 77674

Chemical of Concern: PCP,24DC,AN,PL; Habitat: A; Effect Codes: PHY; Rejection Code: NO CONTROL(ALL CHEMS).

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EcoReference No.: 4871

Chemical of Concern: DU,LNR,PAQT,24DXY,BMC,BMN,DBN,DMB,PCL; Habitat: A; Effect Codes: POP; Rejection Code: NO CONTROL,ENDPOINT(ALL CHEMS).

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EcoReference No.: 44271

Chemical of Concern: 24DXY; Habitat: T; Effect Codes: BCM; Rejection Code: NO ENDPOINT,NO CONTROL(24DXY).

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EcoReference No.: 39975

Chemical of Concern: DMT,24DXY,GYP; Habitat: T; Effect Codes: POP,GRO; Rejection Code: NO ENDPOINT(ALL CHEMS).

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EcoReference No.: 41454

Chemical of Concern: 24DXY; Habitat: T; Effect Codes: GRO; Rejection Code: NO ENDPOINT,NO CONTROL(24DXY).

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EcoReference No.: 61780

- Chemical of Concern: NaDPA; Habitat: A; Effect Codes: GRO,POP; Rejection Code: NO
ENDPOINT(NaDPA).
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- EcoReference No.: 7640
Chemical of Concern: 24DXY,HCCH; Habitat: A; Effect Codes: POP; Rejection Code: NO
ENDPOINT(24DXY).
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- EcoReference No.: 43100
Chemical of Concern: 24DXY,NAA; Habitat: T; Effect Codes: GRO; Rejection Code: NO
ENDPOINT,NO CONTROL(24DXY).
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- EcoReference No.: 2786
Chemical of Concern: 24DXY,MCPB; Habitat: A; Effect Codes: MOR; Rejection Code: NO
CONTROL(24DXY,MCPB).
163. Davison, J. G. and Bailey, J. A. (1974). The Response of Convolvulus Arvensis (Bindweed) to 2,4-D, MCPA, MCPB, Dichlorprop, Mecoprop, 2,4,5-T, Dicamba and Glyphosate at Various Doses and Application Dates. *Proc.Br.Weed Control Conf.* 12: 641-648.
- EcoReference No.: 41744
Chemical of Concern: 24DXY,MCPA,MCPB,DPP1,MCPPI,DMB,GYP; Habitat: T; Effect Codes: POP,GRO; Rejection Code: NO ENDPOINT(MCPA,MCPPI,DMB,GYP,DPP1,MCPB-TARGET),NO ENDPOINT,NO CONTROL(24DXY).
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- EcoReference No.: 4642
Chemical of Concern: 24D; Habitat: A; Effect Codes: MOR,GRO,PHY; Rejection Code: NO
ENDPOINT(24D).
165. De Coen, W. M. and Janssen, C. R. (1998). The Use of Biomarkers in Daphnia magna Toxicity Testing. I. The Digestive Physiology of Daphnids Exposed to Toxic Stress. *Hydrobiologia* 367: 199-209.
- EcoReference No.: 59807
Chemical of Concern: CdCl₂,24D; Habitat: A; Effect Codes: BCM,PHY; Rejection Code: NO
ENDPOINT(24D).
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- EcoReference No.: 93915; Habitat: T; Effect Codes: BCM; Rejection Code: NO
COC(24DXYBEE).
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Herbicide Florasulam in Wheat and Broadleaf Weeds. *Pest Manag.Sci.* 62: 316-324.

EcoReference No.: 89510

Chemical of Concern: 24DXYEE,FSM; Habitat: T; Effect Codes: ACC; Rejection Code: NO CONTROL,NO ENDPOINT(FSM,24DXYEE).

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EcoReference No.: 93436

Chemical of Concern: 24D,24DC,PL; Habitat: T; Effect Codes: MOR,GRO,ACC; Rejection Code: NO MIXTURE(24D).

169. Derscheid, L. A., Stahler, L. M., and Kratochvil, D. E. (1953). Differential Responses of Oat Varieties to 2,4-Dichlorophenoxyacetic Acid (2,4-D). *Agron.J.* 45: 11-17.

EcoReference No.: 42531

Chemical of Concern: 24DXY; Habitat: T; Effect Codes: POP; Rejection Code: NO ENDPOINT(24DXY).

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EcoReference No.: 40697

Chemical of Concern: 24DXY; Habitat: T; Effect Codes: MOR; Rejection Code: NO ENDPOINT,NO CONTROL(24DXY).

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EcoReference No.: 40803

Chemical of Concern: ATZ,ACR,PDM,24DXY,EPTC,BTY,CZE; Habitat: T; Effect Codes: POP; Rejection Code: OK(CZE,PDM),OK TARGET(ATZ),NO MIXTURE(BTY,EPTC,24DXY,ACR).

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EcoReference No.: 42222

Chemical of Concern: 24DXY; Habitat: T; Effect Codes: GRO,BCM,PHY; Rejection Code: NO ENDPOINT,NO CONTROL(24DXY).

173. Dive, D., Leclerc, H., and Persoone, G. (1980). Pesticide Toxicity on the Ciliate Protozoan Colpidium campylum: Possible Consequences of the Effect of Pesticides in the Aquatic Environment. *Ecotoxicol.Environ.Saf.* 4: 129-133 (Author Communication Used).

EcoReference No.: 5941

Chemical of Concern:

PNB,THM,PCP,PCB,MP,EPRN,MLN,MCPB,MCPA,CBL,AZ,AND,DDT,24DXY,HCCH,FNT,EN,E S,DMT,DLD; Habitat: A; Effect Codes: POP; Rejection Code: NO ENDPOINT(ALL CHEMS)/NO SPECIES(PCB).

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EcoReference No.: 42957

- Chemical of Concern: 24DXY,DZ; Habitat: T; Effect Codes: GRO,BCM; Rejection Code: NO
ENDPOINT,NO CONTROL(24DXY).
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- EcoReference No.: 42773
Chemical of Concern: 24DXY; Habitat: T; Effect Codes: GRO; Rejection Code: NO
CONTROL,ENDPOINT(24DXY).
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- EcoReference No.: 6447
Chemical of Concern: 24DXY; Habitat: A; Effect Codes: MOR; Rejection Code: NO
ENDPOINT,NO CONTROL(24DXY).
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- EcoReference No.: 12873
Chemical of Concern: 24DXY; Habitat: A; Effect Codes: BEH; Rejection Code: NO
ENDPOINT(24DXY).
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- EcoReference No.: 43860
Chemical of Concern: 24DXY,NAA; Habitat: T; Effect Codes: GRO; Rejection Code: NO
ENDPOINT,NO CONTROL(24DXY).
179. Dragicevic, V., Sredojevic, S., Vrvic, M., Djukanovic, L., and Todorovic, M. (2004). The Mass and Water Partitioning as Growth Factors of Maize Seedlings Influenced by Ageing and 2,4-D. *Fresenius Environ.Bull.* 12: 336-340.
- EcoReference No.: 82790
Chemical of Concern: DEAC; Habitat: T; Effect Codes: REP,GRO; Rejection Code: NO
ENDPOINT(DEAC).
180. Drill, V. A. and Hiratzka, T. (1953). Toxicity of 2,4-Dichlorophenoxyacetic Acid and 2,4,5-Trichlorophenoxyacetic Acid. A Report on Their Acute and Chronic Toxicity in Dogs. *Arch.Ind.Hyg.Occup.Med.* 7: 61-67.
- EcoReference No.: 74854
Chemical of Concern: 24D; Habitat: T; Effect Codes: MOR,BCM,GRO; Rejection Code: NO
ENDPOINT(24D).
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- EcoReference No.: 36479
Chemical of Concern: EN,24DXY; Habitat: T; Effect Codes: MOR,GRO; Rejection Code: NO
ENDPOINT(24D).

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EcoReference No.: 93628
Chemical of Concern: 24DXY; Habitat: T; Effect Codes: MOR,BCM,PHY; Rejection Code: NO COC(24D).
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EcoReference No.: 61479
Chemical of Concern: ATZ,CPP,MCP1,DMB,24D,LNR,MCPA,MCPB,DPP1,SZ,BMN,PAQT,PCP; Habitat: T; Effect Codes: MOR; Rejection Code: No Dose//NO ENDPOINT(ALL CHEMS).
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EcoReference No.: 81159
Chemical of Concern: ATZ,BMN,DMB,DPP1,DQTB, LNR,MCPA,MCPB,MCP1,PAQT,PCP,SZ,24DXY; Habitat: T; Effect Codes: MOR; Rejection Code: NO ENDPOINT(ALL CHEMS).
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EcoReference No.: 19621
Chemical of Concern: DU,EDT,24DXYBEE,BNZ,EDTK; Habitat: A; Effect Codes: POP; Rejection Code: NO ENDPOINT,NO CONTROL(24DXYBEE).
186. Eames, A. J. (1950). Destruction of Phloem in Young Bean Seedlings After Treatment with 2,4-D. *Am.J.Bot.* 37: 840-847 .

EcoReference No.: 43201
Chemical of Concern: 24DXY; Habitat: T; Effect Codes: PHY; Rejection Code: NO ENDPOINT,NO CONTROL(24DXY).
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EcoReference No.: 42862
Chemical of Concern: 24DXY; Habitat: T; Effect Codes: MOR; Rejection Code: NO ENDPOINT,NO CONTROL(24DXY).
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EcoReference No.: 16390
Chemical of Concern: 24DXY,AMTL; Habitat: A; Rejection Code: NO ABSTRACT.
189. Edgerton, L. J. (1947). A Method for Evaluating the Effectiveness of Growth Substances in Delaying Apple Abscission. *P Am S Hort* 49: 42-44.

EcoReference No.: 43756
Chemical of Concern: 24DXY,NAA; Habitat: T; Effect Codes: PHY; Rejection Code: NO ENDPOINT,NO CONTROL(24DXY).

190. Edgerton, L. J. and Hoffman, M. B. (1953). The Effect of Some Growth Substances on Leaf Petiole Abscission and Preharvest Fruit Drop of Several Apple Varieties. *P Am S Hort* 62: 159-166.

EcoReference No.: 42399
Chemical of Concern: 24DXY,NAA; Habitat: T; Effect Codes: PHY; Rejection Code: NO
ENDPOINT,NO CONTROL(24DXY).
191. Edgerton, L. J. and Hoffman, M. B. (1951). The Effectiveness of Several Growth Regulating Chemicals in Delaying the Harvest Drop of the McIntosh Apple. *Proc.Am.Soc.Hortic.* 57: 121-124.

EcoReference No.: 43786
Chemical of Concern: 24DXY,DPP1; Habitat: T; Effect Codes: POP; Rejection Code: NO
ENDPOINT(ALL CHEMS).
192. Edgerton, L. J. and Hoffman, M. B. (1948). Tests with 2,4-Dichlorophenoxyacetic Acid for Delaying Fruit Drop of McIntosh. *P Am S Hort* 51: 67-70.

EcoReference No.: 43762
Chemical of Concern: 24DXY,NAA; Habitat: T; Effect Codes: PHY; Rejection Code: NO
ENDPOINT,NO CONTROL(24DXY).
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EcoReference No.: 93380
Chemical of Concern: 24D,24DXYBEE; Habitat: A; Effect Codes: ACC; Rejection Code: NO
ENDPOINT(24D,24DXYBEE).
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EcoReference No.: 43418
Chemical of Concern: 24DXY; Habitat: T; Effect Codes: BCM; Rejection Code: NO
ENDPOINT,NO CONTROL(24DXY).
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EcoReference No.: 6457
Chemical of Concern: 24DXY,Fe; Habitat: A; Effect Codes: CEL,POP; Rejection Code: NO
ENDPOINT,NO CONTROL(24DXY).
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EcoReference No.: 14736
Chemical of Concern: 24DXY; Habitat: A; Effect Codes: POP,BEH; Rejection Code: NO
ENDPOINT,NO CONTROL(24DXY).
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EcoReference No.: 18518

- Chemical of Concern: 24DXY,ATZ,DBN,GYP; Habitat: A; Effect Codes: BCM,MOR; Rejection Code: LITE EVAL CODED(ATZ),OK(DBN,GYP),NO ENDPOINT(24DXY).
198. Eliasson, L. (1959). Growth Response of Pea Roots to 2,4-D Applied to the Hypocotyl. *Physiol.Plant.* 12: 834-840 .
- EcoReference No.: 42055
Chemical of Concern: 24DXY; Habitat: T; Effect Codes: GRO; Rejection Code: NO ENDPOINT,NO CONTROL(24DXY).
199. Ellgehausen, H., Guth, J. A., and Esser, H. O. (1980). Factors Determining the Bioaccumulation Potential of Pesticides in the Individual Compartments of Aquatic Food Chains. *Ecotoxicol.Environ.Saf.* 4: 134-157.
- EcoReference No.: 6458
Chemical of Concern: 24DXY,ATZ,MTL; Habitat: A; Effect Codes: ACC; Rejection Code: NO CONTROL(ATZ,MTL),NO ENDPOINT,NO CONTROL(24DXY).
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Chemical of Concern: 24DXY; Habitat: T; Effect Codes: GRO; Rejection Code: NO ENDPOINT,NO CONTROL(24DXY).
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Chemical of Concern: MCPANa,MCPBNa,24DB,24DXY,NAA; Habitat: T; Effect Codes: GRO,PHY,POP; Rejection Code: NO ENDPOINT(MCPANa,24DB),NO COC(IAA,MCPB),OK(MCPBNa),NO ENDPOINT,NO CONTROL(24DXY).
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Chemical of Concern: 24DXY; Habitat: T; Effect Codes: GRO,POP,PHY; Rejection Code: NO ENDPOINT,NO CONTROL(24DXY).
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Chemical of Concern: 24DXY,BMN,LNR,MCP1; Habitat: T; Effect Codes: PHY; Rejection Code: NO ENDPOINT(ALL CHEMS).
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Chemical of Concern: 24DXY; Habitat: A; Effect Codes: PHY; Rejection Code: NO ENDPOINT,NO CONTROL(24DXY).
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EcoReference No.: 93612

Chemical of Concern: 24D; Habitat: T; Effect Codes: BEH,MOR; Rejection Code: NO ENDPOINT(24D).

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Chemical of Concern: 24DXY,24D; Habitat: T; Effect Codes: BCM,ACC; Rejection Code: NO IN VITRO(24D).

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Chemical of Concern: 24DXY,DU,LNR,MLT,PMT,TFN,VNT,PPN,NPM,FMU; Habitat: A; Effect Codes: MOR; Rejection Code: NO ENDPOINT(MLT),NO ENDPOINT,NO CONTROL(24DXY).

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Chemical of Concern: DMDP,24DXY; Habitat: T; Effect Codes: POP,GRO; Rejection Code: NO MIXTURE(DMDP).

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Chemical of Concern: 24DXY; Habitat: T; Effect Codes: PHY; Rejection Code: NO ENDPOINT,NO CONTROL(24DXY).

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Chemical of Concern: 24DXY; Habitat: T; Effect Codes: PHY; Rejection Code: NO ENDPOINT,NO CONTROL(24DXY).

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Chemical of Concern: 24DXY,ATZ,BT,GYP,SZ,TRL; Habitat: A; Effect Codes: POP; Rejection Code: NO CONTROL(24DXY,ATZ,BT,GYP,SZ,TRL).

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EcoReference No.: 40902

Chemical of Concern: 24DXY,DPP1,MCP1,MCPA,MCPB; Habitat: T; Effect Codes: BCM;

Rejection Code: OK(MCPA,MCPB),OK TARGET(MCPP1,DPP1),NO ENDPOINT,NO CONTROL(24DXY).

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Chemical of Concern: DPP1,24DXY; Habitat: T; Effect Codes: GRO; Rejection Code: OK TARGET(DPP1),NO ENDPOINT,NO CONTROL(24DXY).

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Chemical of Concern: 24DXY; Habitat: T; Effect Codes: CEL; Rejection Code: NO ENDPOINT(24DXY).

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EcoReference No.: 59846

Chemical of Concern: 24DXY,CBL,MLN; Habitat: A; Effect Codes: BCM,BEH; Rejection Code: NO CONTROL(MLN,CBL,24DXY).

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Chemical of Concern:

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Chemical of Concern: 24DXY,MCPA,MCPB; Habitat: T; Effect Codes: GRO; Rejection Code: NO ENDPOINT(MCPA,MCPB-TARGET),NO ENDPOINT,NO CONTROL(24DXY).

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EcoReference No.: 90482

Chemical of Concern: SFL,PCB,ATZ,CF,DEAC,ETHN,EDB,HgCl₂,PYR,Captan,CBL,Maneb; Habitat: A; Effect Codes: BCM,CEL; Rejection Code: NO ENDPOINT(ALL CHEMS).

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Chemical of Concern:

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TARGET(ATZ,SZ,DMB),OK(DU,BMN,TRB,TFN,LNR,CZE,MTZ,AMTL,CPP,IPN,MCPA,HgCl₂,PCL),NO ENDPOINT,NO CONTROL(24DXY,AMTR,PPZ,BMC).
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Chemical of Concern: 24DXY; Habitat: T; Effect Codes: GRO; Rejection Code: NO
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Chemical of Concern: 24D; Habitat: AT; Effect Codes: POP,PHY,GRO; Rejection Code: NO
ENDPOINT(24D).
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Chemical of Concern: 24DXY; Habitat: T; Effect Codes: GRO; Rejection Code: NO
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Chemical of Concern: NAA,IAA,CN,CuS,24DXY,AN,BZD,CBL; Habitat: A; Effect Codes: MOR; Rejection Code: NO CONTROL(NAA,IAA,CN,CuS,AN,BZD,CBL),NO ENDPOINT,NO CONTROL(24DXY).
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Chemical of Concern: 24DXY; Habitat: T; Effect Codes: GRO,BCM; Rejection Code: NO
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Chemical of Concern: EDT,24DXY,GYP,CuS,AMSV,ACL; Habitat: A; Effect Codes: BEH; Rejection Code: NO CONTROL,ENDPOINT(EDT,24DXY,GYP,CuS,AMSV,ACL).
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Chemical of Concern: ACL,24DXY; Habitat: A; Effect Codes: ACC; Rejection Code: NO
ENDPOINT(24DXY),TOX DATA(ACL).

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Chemical of Concern: EDT,24DXY,GYP,CuS,AMSV,ACL; Habitat: A; Effect Codes: BEH; Rejection Code: NO ENDPOINT(EDT,GYP,CuS,AMSV,ACL),LITE EVAL CODED(OW-TRV-Cu),NO ENDPOINT,NO CONTROL(24DXY).
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Chemical of Concern: 24DXY; Habitat: T; Effect Codes: POP; Rejection Code: NO ENDPOINT,NO CONTROL(24DXY).
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Chemical of Concern: 24DXY; Habitat: T; Effect Codes: MOR,POP; Rejection Code: NO ENDPOINT,NO CONTROL(24DXY).
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Chemical of Concern: ACR,SXD,24D,GYP; Habitat: T; Effect Codes: MOR,PHY; Rejection Code: NO ENDPOINT(SXD,GYP,24D).
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Chemical of Concern: ATZ,24DXY; Habitat: T; Effect Codes: POP; Rejection Code: LITE EVAL CODED(ATZ),NO ENDPOINT(24DXY).
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Chemical of Concern: 24DXY; Habitat: A; Effect Codes: ACC; Rejection Code: NO ENDPOINT,NO CONTROL(24DXY).
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Chemical of Concern: 24DXY,IAA,BNOA; Habitat: T; Effect Codes: PHY; Rejection Code: NO ENDPOINT(IAA,BNOA),NO ENDPOINT,NO CONTROL(24DXY).

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Chemical of Concern: MDL,ACAC,24DXE,AND,Urea,PCB,DDT,PAH,PHA,CYP,DLD,PCP,HCCP,DBZ,BZD,Captan;
Habitat: AT; Effect Codes: ACC; Rejection Code: NO CONTROL(ALL CHEMS) NO EFFECT(PCB).
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Chemical of Concern: AN,PAH,PCP,PCB,AND,NP,CBL,ANT,24DX; Habitat: AT; Effect Codes: ACC; Rejection Code: NO CONTROL(24DX),NO ENDPOINT,CONTROL(ALL CHEMS)//NO ACC(TRV).
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Chemical of Concern: 24DX,SZ,PAQT; Habitat: A; Effect Codes: ACC; Rejection Code: NO ENDPOINT(SZ,PAQT),NO ENDPOINT,NO CONTROL(24DX).
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Chemical of Concern: 24DX; Habitat: T; Effect Codes: POP,MOR; Rejection Code: NO ENDPOINT(24DX).
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Chemical of Concern: 24DX; Habitat: A; Effect Codes: BCM; Rejection Code: NO ENDPOINT(24DX).
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Chemical of Concern: 24D; Habitat: A; Effect Codes: ACC; Rejection Code: NO ENDPOINT,NO CONTROL(24D).
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Chemical of Concern: 24DX; Habitat: T; Effect Codes: POP,GRO; Rejection Code: NO MIXTURE(24DX).

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Chemical of Concern: MCPB,Na,24DXY,MCPA; Habitat: T; Effect Codes: ACC; Rejection Code: NO MIXTURE(MCPB-TARGET,24DXY,MCPA).
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Chemical of Concern: 24D; Habitat: T; Effect Codes: BCM,CEL; Rejection Code: NO ENDPOINT(24D).
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Chemical of Concern: 24DXY,Zn; Habitat: A; Effect Codes: PHY; Rejection Code: NO ENDPOINT(24DXY).
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Chemical of Concern: 24DXYBEE; Habitat: A; Effect Codes: BCM,POP; Rejection Code: NO ENDPOINT(24DXYBEE).
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Chemical of Concern: 24DXYBEE,TPR; Habitat: A; Effect Codes: POP; Rejection Code: NO ENDPOINT,NO CONTROL(24DXYBEE).
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Chemical of Concern: PCP,24DXY,BZO,CYP,PNB,ATZ,CBL,DBN,HCCH,NAPH,PHE,PAH; Habitat: A; Effect Codes: ACC; Rejection Code: NO CONTROL(ALL CHEMS).
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Chemical of Concern: SZ,ATZ,24DXY; Habitat: T; Effect Codes: MOR; Rejection Code: NO ENDPOINT,CONTROL(ALL CHEMS).
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Chemical of Concern: BTC,24DXY; Habitat: A; Effect Codes: POP; Rejection Code: NO COC(24D).
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Chemical of Concern: 24DXY; Habitat: T; Effect Codes: PHY; Rejection Code: NO ENDPOINT,NO CONTROL(24DXY).
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Chemical of Concern: 24D; Habitat: T; Effect Codes: ACC; Rejection Code: NO ENDPOINT,NO CONTROL(24D).
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Chemical of Concern: PMS,PQT,ATZ,NSF,24DXY,DMB; Habitat: T; Effect Codes: POP; Rejection Code: NO COC(MTL),MIXTURE(24DXY),TARGET(DMB,ATZ).
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Chemical of Concern: 24DXY,MCP1; Habitat: A; Effect Codes: MOR; Rejection Code: NO ENDPOINT(ALL CHEMS).
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Chemical of Concern: 24DXY,MCP1,TGT; Habitat: A; Effect Codes: MOR; Rejection Code: NO ENDPOINT(ALL CHEMS).
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Chemical of Concern: 24DXY; Habitat: A; Effect Codes: CEL; Rejection Code: NO ENDPOINT(24DXY).
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Chemical of Concern: 24DXY; Habitat: T; Effect Codes: BCM; Rejection Code: NO ENDPOINT,NO CONTROL(24DXY).

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Chemical of Concern: 24DXY; Habitat: T; Effect Codes: MOR,CEL,PHY; Rejection Code: NO ENDPOINT,NO CONTROL(24DXY).
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Chemical of Concern: IAA,CBL,24DXY; Habitat: T; Effect Codes: POP; Rejection Code: NO ENDPOINT(IAA,CBL),NO ENDPOINT,NO CONTROL(24DXY).
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Chemical of Concern: ATZ,24DXY,NAA; Habitat: A; Effect Codes: POP; Rejection Code: NO ENDPOINT(ALL CHEMS).
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Chemical of Concern: MLN,CPY,24DXY; Habitat: A; Effect Codes: REP,BCM; Rejection Code: NO ENDPOINT(MLN),NO ENDPOINT,NO CONTROL(24DXY,CPY).
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Chemical of Concern: 24DXY; Habitat: T; Effect Codes: MOR,PHY; Rejection Code: NO ENDPOINT,NO CONTROL(24DXY).
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Chemical of Concern: 24D; Habitat: A; Effect Codes: MOR,ACC; Rejection Code: NO MIXTURE(24D).
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Chemical of Concern: 24D; Habitat: T; Effect Codes: ACC; Rejection Code: NO CONTROL,NO ENDPOINT(24D).
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- EcoReference No.: 49757

- Chemical of Concern: Captan,CHX,FNV,24DXY,PAQT,MLH; Habitat: T; Effect Codes: ACC; Rejection Code: NO CONTROL(Captan,FNV,24DXY).
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- EcoReference No.: 93124
Chemical of Concern: FNV,24DXY,24D,PMR; Habitat: T; Effect Codes: ACC; Rejection Code: NO CONTROL(FNV,24D,PMR).
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- EcoReference No.: 93559
Chemical of Concern: 24D; Habitat: A; Effect Codes: ACC,PHY; Rejection Code: NO ENDPOINT(24D).
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- EcoReference No.: 7791
Chemical of Concern: 24DXY,HCCH,MLN; Habitat: A; Effect Codes: MOR; Rejection Code: NO ENDPOINT(MLN),NO ENDPOINT,NO CONTROL(24DXY).
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- EcoReference No.: 76313
Chemical of Concern: Zn,Ni,Co,24DXY,Captan,DDT; Habitat: AT; Effect Codes: POP,REP,MOR; Rejection Code: OK(Co),NO ENDPOINT(Captan,Ni,Zn,24DXY,DDT).
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- EcoReference No.: 14155
Chemical of Concern: NaPCP,PL,NP,24DXY; Habitat: A; Effect Codes: CEL; Rejection Code: NO ENDPOINT(NaPCP,PL,NP,24DXY).
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- EcoReference No.: 13492
Chemical of Concern: 24DB; Habitat: A; Effect Codes: ACC; Rejection Code: NO COC(24D).
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- EcoReference No.: 43548
Chemical of Concern: IAA,24DXY; Habitat: T; Rejection Code: NO TOX DATA(TARGET(IAA),NO ENDPOINT,NO CONTROL(24DXY).
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- EcoReference No.: 42394
Chemical of Concern: 24DXY; Habitat: T; Effect Codes: REP; Rejection Code: NO
ENDPOINT,NO CONTROL(24DXY).
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- EcoReference No.: 40763
Chemical of Concern: DPP1,24DXY,DMB,MTZ,MCP1; Habitat: T; Effect Codes: POP; Rejection Code: OK TARGET(DMB),OK(MTZ),NO MIXTURE(24DXY,DPP1,MCP1).
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- EcoReference No.: 14810
Chemical of Concern: 24D,MCPA,TPR,NHN; Habitat: T; Effect Codes: POP,PHY,BCM; Rejection Code: NO ENDPOINT(24D).
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- EcoReference No.: 43919
Chemical of Concern: 24DXY,PCL; Habitat: T; Effect Codes: PHY; Rejection Code: NO
CONTROL,ENDPOINT(ALL CHEMS).
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Chemical of Concern: 24DXY; Habitat: T; Effect Codes: MOR; Rejection Code: NO
ENDPOINT,NO CONTROL(24DXY).
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- EcoReference No.: 40930
Chemical of Concern: 24DXY; Habitat: T; Rejection Code: NO ENDPOINT(24DXY).
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Chemical of Concern: 24DXY,PQT; Habitat: T; Effect Codes: GRO,CEL,PHY,POP; Rejection Code: NO ENDPOINT,NO CONTROL(24DXY).
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- EcoReference No.: 43090
Chemical of Concern: 24DXY; Habitat: T; Effect Codes: REP; Rejection Code: NO
ENDPOINT,NO CONTROL(24DXY).
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- EcoReference No.: 43084; Habitat: T; Effect Codes: REP; Rejection Code: NO

ENDPOINT(24DXY) .

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EcoReference No.: 43777

Chemical of Concern: 24DXY; Habitat: T; Effect Codes: REP,PHY,MOR; Rejection Code: NO ENDPOINT,NO CONTROL(24DXY).

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EcoReference No.: 43091

Chemical of Concern: 24DXY; Habitat: T; Effect Codes: MOR,CEL,PHY; Rejection Code: NO ENDPOINT,NO CONTROL(24DXY).

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EcoReference No.: 43055

Chemical of Concern: 24DXY; Habitat: T; Effect Codes: MOR,PHY,BCM,REP,POP,GRO; Rejection Code: NO ENDPOINT,NO CONTROL(24DXY).

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EcoReference No.: 5145

Chemical of Concern: 24DXY,CBL,CPY,MLN,DDT,EN; Habitat: A; Effect Codes: BEH; Rejection Code: NO CONTROL(CBL),NO ENDPOINT(24DXY,CPY,MLN).

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EcoReference No.: 5147

Chemical of Concern: DDT,CBL,EN,MLN,CPY,24DXY; Habitat: A; Effect Codes: BEH; Rejection Code: NO CONTROL(MLN),OK(DDT,CBL,EN),NO CONTROL,NO ENDPOINT(24DXY,CPY).

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EcoReference No.: 5146

Chemical of Concern: 24DXY,CBL,CPY,MLN,DDT,EN; Habitat: A; Effect Codes: BEH; Rejection Code: LITE EVAL CODED(CBL),OK(DDT,EN),NO ENDPOINT(24DXY,CPY,MLN).

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EcoReference No.: 43148

Chemical of Concern: 24DXY; Habitat: T; Effect Codes: BCM,GRO,PHY; Rejection Code: NO ENDPOINT,NO CONTROL(24DXY).

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EcoReference No.: 43744

Chemical of Concern: 24DXY; Habitat: T; Effect Codes: MOR,GRO,REP; Rejection Code: NO

ENDPOINT(24DXY).

289. Hanson, W. R. (1952). Effects of Some Herbicides and Insecticides on Biota of North Dakota Marshes. *J.Wildl.Manag.* 16: 299-308.

EcoReference No.: 8933

Chemical of Concern: 24D,DDT,CHD,TXP,24DXY; Habitat: AT; Effect Codes: POP,REP; Rejection Code: NO ENDPOINT(24DXY).

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EcoReference No.: 49959

Chemical of Concern: 24DXY; Habitat: T; Rejection Code: NO ENDPOINT,NO CONTROL(24DXY).

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EcoReference No.: 43116

Chemical of Concern: 24DXY; Habitat: T; Effect Codes: POP; Rejection Code: NO ENDPOINT,NO CONTROL(24DXY).

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EcoReference No.: 5761

Chemical of Concern:

DDT,TPN,FNTH,24DXY,PRN,PAQT,CBL,PYN,Zineb,CZE,FBM,PPX,PPX,MOM,ES,TBC,MLN,F E,SZ,NaPCP,Captan,AND,DZ,ETN,FLAC,PPN,FNT,RTN,EN; Habitat: A; Effect Codes: MOR; Rejection Code: NO FOREIGN,NO CONTROL,(ALL CHEMS).

293. Hassan, S. A., Bigler, F., Bogenschutz, H., Boller, E., Brun, J., Calis, J. N. M., Chiverton, P., Coremans-Pelseneer, J., Duso, C., Lewis, G. B., Mansour, F., Moreth, L., Oomen, P. A., Overmeer, W. P. J., Polgar, L., Rieckmann, W., Samsoe-Petersen, L., Staubli, A., Sterk, G., Tavares, K., Tuset, J. J., and Viggiani, G. (1991). Results of the Fifth Joint Pesticide Testing Programme Carried Out by the IOBC/WPRS-Working Group "Pesticides and Beneficial Organisms". *Entomophaga* 36: 55-67.

EcoReference No.: 73087

Chemical of Concern: OML,CTZ,HYT,FYC,BTN,Maneb,24DXY,GFS,DFZ,Captan,CTN,IPD; Habitat: T; Effect Codes: MOR; Rejection Code: NO ENDPOINT(ALL CHEMS).

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EcoReference No.: 5270

Chemical of Concern: PCP,CPH,24DC; Habitat: A; Effect Codes: MOR; Rejection Code: NO CONTROL(ALL CHEMS).

295. Hawf, L. R. and Behrens, R. (1974). Selectivity Factors in the Response of Plants to 2,4-DB. *Weed Sci.* 22: 245-249 .

EcoReference No.: 44059

Chemical of Concern: 24DXY; Habitat: T; Effect Codes: GRO; Rejection Code: NO ENDPOINT,NO CONTROL(24DXY).

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- EcoReference No.: 73776
Chemical of Concern:
ACR,ATZ,BT,DMB,DU,MTL,MBZ,DMM,PDM,ACF,BFL,24DXY,EPTC,FZFB,PCL,SXD,TFN,VN
T; Habitat: T; Effect Codes: POP; Rejection Code: NO ENDPOINT(ALL CHEMS,TARGET-
ATZ,MTL).
297. Heikes, E. E. (1964). Tordon and Other Herbicides. Field Testing for the Control of Deep-Rooted Perennial Weeds in Colorado. *Down Earth* 20: 9-12.
- EcoReference No.: 42302
Chemical of Concern: 24DXY,DMB; Habitat: T; Effect Codes: MOR,PHY; Rejection Code: NO
ENDPOINT,NO CONTROL(24DXY,DMB).
298. Heiny, D. K. (1994). Field Survival of Phoma proboscis and Synergism with Herbicides for Control of Field Bindweed. *Plant Dis.* 78: 1156-1164.
- EcoReference No.: 83302
Chemical of Concern: MCPP1,24DXY; Habitat: T; Effect Codes: MOR,PHY; Rejection Code: NO
MIXTURE(24DXY,MCPP1).
299. Hendrich, W., Kubiak, Z., Jurajda, K., and Pawlaczyk-Szpilowa, M. (1976). Effect of Herbicides on Photosynthetic Electron Transport and on the Growth of the Alga *Scenedesmus quadricauda*. *Acta Soc.Bot.Pol.* 155: 101-110.
- EcoReference No.: 62762
Chemical of Concern: 24DXY,PQT,LNR,SZ,CP; Habitat: A; Effect Codes: POP; Rejection Code:
NO ENDPOINT(ALL CHEMS).
300. Herron, J. W. (1962). Nimblewill in Kentucky Bluegrass Lawns Controlled by Herbicides. *K Farm Home Sci* 8: 4-5, 8.
- EcoReference No.: 40889
Chemical of Concern: 24DXY; Habitat: T; Effect Codes: GRO; Rejection Code: NO
ENDPOINT,NO CONTROL(24DXY).
301. Hiatt, R. W., Naughton, J. J., and Matthews, D. C. (1953). Effects of Chemicals on a Schooling Fish, *Kuhlia sandvicensis*. *Biol.Bull.* 104: 28-44.
- EcoReference No.: 10010
Chemical of Concern:
Cu,Ba,AND,PL,CHN,HCB,PHTH,RTN,ETO,BNZ,HCCH,CHD,PRN,Urea,STCH,ASCN,CuCl,Tl,BR
A,CN,24DC,CuS,NaBS,HOX,NaPCP, IAA; Habitat: A; Effect Codes: BEH; Rejection Code: NO
CONTROL,ENDPOINT(ALL CHEMS).
302. Hidaka, H., Hattanda, M., and Tatsukawa, R. (1984). Avoidance of Pesticides with Medakas (*Oryzias latipes*). *J.Agric.Chem.Soc.Jpn.(Nippon Nogeikagaku Kaishi)* 58: 145-151 (JPN) (ENG ABS).
- EcoReference No.: 11710
Chemical of Concern: PCP,24DXY,DZ,TBC,CBL; Habitat: A; Effect Codes: BEH; Rejection Code:
NO FOREIGN(PCP,DZ,TBC,CBL),NO ENDPOINT,NO CONTROL(24DXY).
303. Hiltibran, R. C. (1967). Effects of Some Herbicides on Fertilized Fish Eggs and Fry.

Trans.Am.Fish.Soc. 96: 414-416.

EcoReference No.: 2751

Chemical of Concern: EDT,SZ,24DXY,ATZ,DBN,AMTL,IODP,DPP1,As; Habitat: A; Effect Codes: MOR; Rejection Code: LITE EVAL CODED(DPP1,ATZ,SZ),OK(EDT,DBN,AMTL,IODP,As),NO ENDPOINT,NO CONTROL(24DXY).

304. Hoagland, R. E. and Duke, S. O. (1983). Relationships Between Phenylalanine Ammonia-Lyase Activity and Physiological Responses of Soybean (*Glycine max*) Seedlings to Herbicides. *Weed Sci.* 31: 845-852.

EcoReference No.: 41002

Chemical of Concern: 24DXY,ATZ,DMM,MBZ,NFZ,PAQT,AMTR; Habitat: T; Effect Codes: BCM; Rejection Code: NO ENDPOINT(DMM,MBZ,NFZ,PAQT,AMTR,TARGET-ATZ),NO ENDPOINT,NO CONTROL(24DXY).

305. Hodges, C. F. (1994). Vegetative Growth and Sporulation of *Bipolaris sorokiniana* on Sequentially Older Infected Leaves of *Poa pratensis* Exposed to Postemergence Herbicides. *Mycopathologia* 128: 105-109.

EcoReference No.: 83264

Chemical of Concern: DMB,24D,MCPPI; Habitat: T; Effect Codes: POP,REP; Rejection Code: NO CONC(24D,DMB,MCPPI).

306. Hoeppe, R. E. and Westerdahl, H. E. (1983). Dissipation of 2,4-D DMA and Bee from Water, Mud, and Fish at Lake Seminole, Georgia. *Water Resour.Bull.* 19: 197-204.

EcoReference No.: 15597

Chemical of Concern: 24DXYBEE; Habitat: A; Effect Codes: ACC; Rejection Code: NO ENDPOINT,NO CONTROL(24DXYBEE).

307. Hollingsworth, E. B., Quimby, P. C. Jr., and Jaramillo, D. C. (1979). Control of Saltcedar by Subsurface Placement of Herbicides. *J.Range Manag.* 32: 288-291.

EcoReference No.: 41536

Chemical of Concern: TRB,BMC,PCL,DU,DMB,24DXY,As; Habitat: T; Effect Codes: MOR; Rejection Code: OK TARGET(DMB),OK(TRB,PCL,DU,As),NO CONTROL,NO ENDPOINT(24DXY,BMC).

308. Holm, R. E., O'Brien, T. J., Key, J. L., and Cherry, J. H. (1970). The Influence of Auxin and Ethylene on Chromatin-Directed Ribonucleic Acid Synthesis in Soybean Hypocotyl. *Plant Physl* 45: 41-45.

EcoReference No.: 42805

Chemical of Concern: 24DXY; Habitat: T; Effect Codes: CEL,GRO; Rejection Code: NO ENDPOINT,NO CONTROL(24DXY).

309. Holst, R. W., Yopp, J. H., and Kapusta, G. (1982). Effect of Several Pesticides on the Growth and Nitrogen Assimilation of the *Azolla-anabaena* Symbiosis. *Weed Sci.* 30: 54-58.

EcoReference No.: 70299

Chemical of Concern: SZ,ATZ,LNR,MBZ,24DXY,DMB; Habitat: A; Effect Codes: POP,PHY,BCM; Rejection Code: LITE EVAL CODED(ATZ,SZ,DMB),NO ENDPOINT(24DXY).

310. Holt, J. S., Radosovich, S. R., and Graves, W. L. (1985). Long-Term Effects on Vegetation of Herbicide Treatments in Chaparral. *Weed Sci.* 33: 353-357.

- EcoReference No.: 44103
Chemical of Concern: 24DXY,GYP,TPR; Habitat: T; Effect Codes: POP; Rejection Code: NO ENDPOINT,NO CONTROL(24DXY).
311. Hooper, F. N. (1953). The Effect of Applications of Pelleted 2,4-D upon the Bottom Fauna of Kent Lake, Oakland County, Michigan. *Proc.N.C.Weed Control Conf.* 15: 41.
- EcoReference No.: 2748
Chemical of Concern: 24DXY; Habitat: A; Effect Codes: POP; Rejection Code: NO ENDPOINT(24DXY).
312. Hopkins, R. and Kain, J. M. (1971). The Effect of Marine Pollutants on Laminarea hyperboria. *Mar.Pollut.Bull.* 2: 75-77.
- EcoReference No.: 9356
Chemical of Concern: 24DXY,ATZ,CuS,Zn,PEPPG; Habitat: A; Effect Codes: POP,CEL; Rejection Code: NO ENDPOINT(ATZ,Zn,PEPPG),LITE EVAL CODED(OW-TRV-Cu),NO ENDPOINT,NO CONTROL(24DXY).
313. Hruschka, H. W. and Kaufman, J. (1949). Storage Tests with Long Island Cauliflower to Inhibit Leaf Abscission by Using Plant Growth Regulators. *P Am S Hort* 54: 438-446.
- EcoReference No.: 43745
Chemical of Concern: 24DXY; Habitat: T; Effect Codes: GRO; Rejection Code: NO ENDPOINT,NO CONTROL(24DXY).
314. Huang, J. C. and Gloyna, E. F. (1967). Effects of Toxic Organics on Photosynthetic Reoxygenation. *Contract No.WP-00688-03, Tech.Rep.to Fed.Water Pollut.Control Admin., U.S.D.I., Ctr.for Res.Water Resour., Univ.of Texas, Austin, TX* 163 p. (NTIS/PB-216749) (Author Communication Used).
- EcoReference No.: 2232
Chemical of Concern: 24DXY,HCCH,PCP,PL,NP,DDT,24DC; Habitat: A; Effect Codes: BCM,PHY; Rejection Code: NO ENDPOINT(ALL CHEMS),NO ENDPOINT,NO CONTROL(24DXY).
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- EcoReference No.: 42300
Chemical of Concern: 24DXY; Habitat: T; Effect Codes: GRO,MOR; Rejection Code: NO ENDPOINT,NO CONTROL(24DXY).
316. Huffaker, R. C., Miller, M. D., and Mikkelsen, D. S. (1962). The Effects of 2,4-D, Iron and Chelate Supplements on Dark C02 Fixation in Cell-Free Homogenates of Field Beans. *Crop Sci.* 2: 127-129.
- EcoReference No.: 42089
Chemical of Concern: 24DXY,Fe; Habitat: T; Effect Codes: PHY; Rejection Code: NO ENDPOINT,NO CONTROL(24DXY).
317. Huffaker, R. C., Sarquis, A. V., and Miller, M. D. (1969). Modification of the Effects of 2,4-D Inhibition of Growth and Lethality in Field Beans by Copper Sulfate and Copper Ethylenediaminetetraacetic Acid. *Crop Sci.* 9: 737-738.
- EcoReference No.: 43359

- Chemical of Concern: 24DXY,CuS; Habitat: T; Effect Codes: GRO; Rejection Code: OK(CuS),NO MIXTURE(24DXY).
318. Hughes, E. E. (1968). Hygroscopic Additives to Phenoxy Herbicides for Control of Saltcedar. *Weed Sci.* 16: 486-488.
- EcoReference No.: 87111
Chemical of Concern: PYPG,24DXY; Habitat: T; Effect Codes: PHY; Rejection Code: NO MIXTURE(PYPG),NO CONTROL(24DXY).
319. Hughes, J. S. (1962). The Toxicity to Fish of Different Formulations of 2,4,5-T, 2-(2,4-DP) and Silvex. *Proc.So.Weed Conf.* 15: 5p.
- EcoReference No.: 91242
Chemical of Concern: 24DXY,DPP1; Habitat: A; Effect Codes: MOR; Rejection Code: NO CONTROL(24DXY,DPP1).
320. Hughes, J. S. and Davis, J. T. (1964). Effects of Selected Herbicides on Bluegill Sunfish. *In: Proc.8th Annu.Conf., Southeast.Assoc.Game Fish Comm., Oct.18-21 &22, 1964, Clearwater, FL* 18: 480-482.
- EcoReference No.: 880
Chemical of Concern: As,24DXY,MCPA,EDT,PCL,DCPA,FMU; Habitat: A; Effect Codes: MOR; Rejection Code: NO CONTROL(24DXY).
321. Hull, A. C. Jr. (1971). Effect of Spraying with 2,4-D upon Abundance of Pocket Gophers in Franklin Basin, Idaho. *J.Range Manag.* 24: 230-232.
- EcoReference No.: 50402
Chemical of Concern: 24D; Habitat: T; Effect Codes: POP; Rejection Code: NO ENDPOINT(24D).
322. Humphreys, T. E. and Dugger, W. M. Jr. (1957). The Effect of 2,4-Dichlorophenoxyacetic Acid on the Respiration of Etiolated Pea Seedlings. *Plant Physl* 32: 530-536.
- EcoReference No.: 42457
Chemical of Concern: 24DXY; Habitat: T; Effect Codes: PHY; Rejection Code: NO ENDPOINT,NO CONTROL(24DXY).
323. Hunt, L. M., Gilbert, B. N., and Palmer, J. S. (1970). Effects of a Herbicide, 2-Ethyl Hexyl Ester of 2,4-D on Magnesium: Calcium Ratios and Blood Urea Nitrogen Levels in Sheep and Cattle. *Bull.EnvIRON.Contam.Toxicol.* 5: 54-60.
- EcoReference No.: 37210
Chemical of Concern: 24DXYEE; Habitat: T; Effect Codes: BCM,MOR,GRO; Rejection Code: NO ENDPOINT(24DXYEE).
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- EcoReference No.: 41864
Chemical of Concern: PCL,24DXY,DMB; Habitat: T; Effect Codes: GRO; Rejection Code: OK TARGET(DMB),OK(PCL),NO ENDPOINT,NO CONTROL(24DXY).
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- EcoReference No.: 62799

- Chemical of Concern: ATZ,DDT,DU,GYP,MCPA,24DXY,THM; Habitat: A; Effect Codes: POP,GRO; Rejection Code: NO ENDPOINT(ALL CHEMS).
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Chemical of Concern: 24DXY; Habitat: T; Effect Codes: MOR; Rejection Code: NO ENDPOINT,NO CONTROL(24DXY).
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Chemical of Concern: MgCl₂,CaCl₂,IAA,24DXY; Habitat: T; Effect Codes: BCM,GRO; Rejection Code: NO ENDPOINT(MgCl₂,CaCl₂,IAA),NO ENDPOINT,NO CONTROL(24DXY).
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Chemical of Concern: 24DXY; Habitat: A; Effect Codes: POP,BCM; Rejection Code: NO ENDPOINT,NO CONTROL(24DXY).
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Chemical of Concern: 24D; Habitat: T; Effect Codes: POP; Rejection Code: NO ENDPOINT(24D).
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Chemical of Concern: 24DC,DXN,TCDD; Habitat: T; Effect Codes: ACC; Rejection Code: NO SPECIES.
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Chemical of Concern: 24DXY,DMB; Habitat: T; Effect Codes: PHY,GRO; Rejection Code: NO ENDPOINT,CONTROL(ALL CHEMS).
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Chemical of Concern: 24DXY; Habitat: T; Effect Codes: PHY,GRO; Rejection Code: NO ENDPOINT,NO CONTROL(24DXY).
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Chemical of Concern: 24DXY; Habitat: T; Effect Codes: REP,MOR,GRO; Rejection Code: NO ENDPOINT(24DXY).
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Chemical of Concern: 24DXY; Habitat: T; Effect Codes: GRO,PHY,MOR; Rejection Code: NO ENDPOINT,NO CONTROL(24DXY).
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- EcoReference No.: 44037
Chemical of Concern: DPP1,24DXY,TPR,DMB,DKGNa,MCPPI; Habitat: T; Effect Codes: POP; Rejection Code: NO ENDPOINT(DPP1,TPR,DMB,DKGNa,MCPPI),NO ENDPOINT,NO CONTROL(24DXY).
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Chemical of Concern: 24DXY,BT; Habitat: T; Effect Codes: MOR; Rejection Code: NO ENDPOINT,NO CONTROL(24DXY).
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Chemical of Concern: 24DXY,BT,CFRM,DMB,MCPPI; Habitat: T; Effect Codes: POP,PHY; Rejection Code: NO ENDPOINT(24DXY,BT,CFRM,DMB,MCPPI).
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Chemical of Concern: 24DXY,DMB,MCPPI,DKGNa; Habitat: T; Effect Codes: POP; Rejection Code: NO CONTROL,NO ENDPOINT(24DXY,DMB,MCPPI,DKGNa) .
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Chemical of Concern: 24DXY; Habitat: A; Effect Codes: MOR; Rejection Code: NO ENDPOINT,NO CONTROL(24DXY).
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Chemical of Concern: NaDPA; Habitat: A; Effect Codes: ACC; Rejection Code: NO ENDPOINT,CONTROL(NaDPA).
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Phenylacetic Acid in Two Marine Species. *Xenobiotica* 6: 393-398.

EcoReference No.: 433

Chemical of Concern: 24D; Habitat: A; Effect Codes: ACC; Rejection Code: NO
ENDPOINT,CONTROL(24D).

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EcoReference No.: 42887

Chemical of Concern: 24DXY,DMB,MCPB,MCPPI,PCL,MCPA,24DB,DPP1; Habitat: T; Effect Codes: PHY; Rejection Code: OK(PCL,MCPA),OK
TARGET(SZ,MCPB,MCPPI,DPP1),TARGET(DMB),NO ENDPOINT,NO CONTROL(24DXY).

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EcoReference No.: 43244

Chemical of Concern: 24DXY; Habitat: T; Effect Codes: PHY; Rejection Code: NO
ENDPOINT(24DXY).

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EcoReference No.: 35277

Chemical of Concern: 24DXY; Habitat: T; Effect Codes: CEL; Rejection Code: NO
ENDPOINT(24DXY).

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EcoReference No.: 40771

Chemical of Concern: BMC,24DXY,ATZ,DU; Habitat: T; Effect Codes: PHY,POP; Rejection Code: OK(BMC),OK TARGET(ATZ),NO MIXTURE(24DXY,DU),NO
CONTROL,ENDPOINT(BMC).

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EcoReference No.: 7813

Chemical of Concern: AMTL,PAQT,24DXY,DMB,PCL,As; Habitat: A; Effect Codes: MOR; Rejection Code: LITE EVAL CODED(DMB),OK(AMTL,PAQT,PCL,As),NO ENDPOINT,NO
CONTROL(24DXY).

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EcoReference No.: 43153

Chemical of Concern: 24DXY; Habitat: T; Effect Codes: PHY; Rejection Code: NO
ENDPOINT(24DXY).

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EcoReference No.: 17126

Chemical of Concern:

- ADC,DXN,ASCN,FML,BNZ,ISO,AN,24DXY,PL,DDT,NAPH,ISO,DPDP,Se,TOL,MXC,DZ,DCB;
Habitat: A; Effect Codes: MOR,CEL,GRO; Rejection Code: LITE EVAL
 CODED(DPDP,ASCN),NO ENDPOINT(24DXY,DCB,NAPH,DZ,ADC).
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- EcoReference No.: 74959
 Chemical of Concern: MLT,PPN,TBC,QNC,24DXY,TPR; Habitat: T; Effect Codes: GRO;
Rejection Code: NO ENDPOINT (ALL CHEMS).
350. Johnston, A. M. (1962). The Relationship of Structure to Activity in Plant-Growth-Regulating Compounds. 2. Growth-Regulating Activity of Substituted Amides of 2,4-Dichlorophenoxyacetic Acid. *Biochem.J.* 82: 425-428.
- EcoReference No.: 42026
 Chemical of Concern: 24DXY; Habitat: T; Effect Codes: BCM; Rejection Code: NO
 ENDPOINT(24DXY).
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- EcoReference No.: 70074
 Chemical of Concern:
 24DXY,ABT,ACL,ADC,AMTL,AMTR,AND,ASM,ATN,ATZ,AZ,BFL,BMC,BMN,BS,BTY,Captan,
 CBL,CCA,CHD,CMPH,CPY,CQTC,CTHM,Cu,CuFRA,DBN,DCB,DCNA,DDD,DDT,DDVP,D
 EM,DINO,DLD,DMB,DMT,DOD,DPP1,DQTBBr,DS,DU,DZ,DZM,EDT,EN,EP,EPTC,ES,ETN,FLA
 C,FMU,FNF,FNT,FNTH,Folpet,HCCH,HPT,LNR,Maneb,MCB,MCPA,MCPB,MCPP1MDT,MLH,M
 LN,MLT,MRX,MTM,MVP,MXC,Naled,NPM,PB,PCH,PCL,PCP,PEB,PHMD,PHSL,PMT,PPHD,PP
 N,PPX,PPZ,PQT,PRN,PRO,PRT,PYN,PYZ,RTN,SFT,SID,SZ,TCF,TFN,THM,TRB,TRL,TXP,VNT,
 Zineb; Habitat: T; Effect Codes: MOR; Rejection Code: NO PUBL
 AS(24DXY,ABT,ACL,AMTL,AMTR,ASM,ATN,AZ,BFL,BMC,BMN,BS,BTY,CCA,CMPH,CPY,C
 PY,CQTC,CTHM,DBN,DCB,DCNA,DDT,DINO,DOD,DPP1,DQTBBr,DU,DZM,EP,EPTC,ES,FMU,F
 NF,FNT,Folpet,HCCH,HPT,LNR,MCB,MCPP1,MLT,MP,MRX,MTM,MXC,Naled,NPM,Pb,PCH,PC
 L,PEB,PHSL,PPN,PPZ,PQT,PRO,PYN,PYZ,RTN,RYA,SFT,SID,TFN,THM,TRL,VNT),NO
 CONTROL,DURATION(ALL CHEMS).
352. Jones, W. E. (1975). Detection of Pollutants by Fish Tests. *Water Treat.Exam.* 24: 132-139.
- EcoReference No.: 20141
 Chemical of Concern:
 24DXY,PQT,RTN,3CE,MCPA,CN,Hg,Cd,EN,DLD,DDT,HCCH,DEM,PRN,ES,Zn; Habitat: A;
Effect Codes: PHY; Rejection Code: NO CONTROL(ALL CHEMS),NO ENDPOINT,NO
 CONTROL(24DXY).
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- EcoReference No.: 40965
 Chemical of Concern: 24DB; Habitat: T; Effect Codes: GRO,MOR; Rejection Code: NO
 CONTROL,ENDPOINT(ALL CHEMS).
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- EcoReference No.: 14395

- Chemical of Concern: CuS,EDT,ACL,24D,SZ,ATZ,DU,PRO,24DXY; Habitat: A; Effect Codes: POP; Rejection Code: LITE EVAL CODED(PRO,ATZ,SZ,CuS,ACL),OK(24D),NO ENDPOINT(24DXY).
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- EcoReference No.: 62325
Chemical of Concern: GIB,24D; Habitat: A; Effect Codes: GRO,POP; Rejection Code: NO ENDPOINT(24D).
356. Joshi, P. C. and Misra, R. B. (1986). Evaluation of Chemically-Induced Phototoxicity to Aquatic Organism Using Paramecium as a Model. *Biochem.Biophys.Res.Comm.* 139: 79-84.
- EcoReference No.: 12021
Chemical of Concern: 24DXY,DMT,HCCH,MLN,DOD,Cu,Zn,MZB,ANT,PHE,PAH; Habitat: A; Effect Codes: MOR; Rejection Code: NO ENDPOINT(DMT,HCCH,MLN,DOD,Cu,Zn,MZB),NO ENDPOINT,NO CONTROL(24DXY,ANT).
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- EcoReference No.: 11685
Chemical of Concern: 24D; Habitat: A; Effect Codes: GRO,MOR; Rejection Code: NO ENDPOINT(24D).
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- EcoReference No.: 93367
Chemical of Concern: CdS,PbAC,CuS,24D; Habitat: T; Effect Codes: MOR,GRO; Rejection Code: NO ENDPOINT(24D),NO MIXTURE(CuS).
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- EcoReference No.: 93433
Chemical of Concern: DMDP; Habitat: T; Effect Codes: CEL; Rejection Code: NO ENDPOINT(DMDP).
360. Kamler, E. (1972). Bioenergetical Aspects of the Influence of 2,4-D-Na on the Early Development Stages in Carp (Cyprinus carpio L.). *Pol.Arch.Hydrobiol.* 19 : 451-474.
- EcoReference No.: 2935
Chemical of Concern: 24DXY; Habitat: A; Effect Codes: PHY; Rejection Code: NO ENDPOINT,NO CONTROL(24DXY).
361. Kamler, E. (1973). Effect of 2,4D-Na on the Respiration and Calorific Value in Embryonic and Larval Development of Carp (Cyprinus carpio L.). *Exp.Water Toxicol.(Eksp.Vodn.Toksikol.)* 5: 45-60 (RUS) (ENG ABS).
- EcoReference No.: 8874
Chemical of Concern: 24DXY; Habitat: A; Effect Codes: MOR; Rejection Code: NO ENDPOINT,NO CONTROL(24DXY).

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- EcoReference No.: 2945
Chemical of Concern: 24DXY; Habitat: A; Effect Codes: MOR,BEH,GRO,PHY; Rejection Code: NO ENDPOINT,NO CONTROL(24DXY).
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- Chemical of Concern: 24DXYBEE; Habitat: A; Rejection Code: NO ENDPOINT,SPECIES(24DXYBEE).
364. Kaniewska-Prus, M. (1975). The Effect of 2,4D-Na Herbicide on Oxygen Consumption and Survival of *Simocephalus vetulus* o.f. Muller (Cladocera). *Pol.Arch.Hydrobiol.* 22: 593-599.
- EcoReference No.: 2938
Chemical of Concern: 24DXY; Habitat: A; Effect Codes: PHY,MOR; Rejection Code: NO ENDPOINT,NO CONTROL(24DXY).
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- EcoReference No.: 42334
Chemical of Concern: IAA,GIB,NAA,24DXY; Habitat: T; Effect Codes: GRO; Rejection Code: NO ENDPOINT(IAA,GIB,NAA),NO ENDPOINT,NO CONTROL(24DXY).
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- EcoReference No.: 41612
Chemical of Concern: 24DXY; Habitat: T; Effect Codes: CEL; Rejection Code: NO ENDPOINT(24DXY).
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- EcoReference No.: 76033
Chemical of Concern: 24DXY; Habitat: T; Rejection Code: NO COC(RTN),CONTROL,ENDPOINT(24DXY).
368. Kaya, B., Yanikoglu, A., and Marcos, R. (1999). Genotoxicity Studies on the Phenoxyacetates 2,4-D and 4-CPA in the *Drosophila* Wing Spot Test. *Teratog.Carcinog.Mutagen.* 19: 305-312.
- EcoReference No.: 93594
Chemical of Concern: 24DXY; Habitat: T; Effect Codes: CEL,GRO; Rejection Code: NO COC(24D).
369. Kelling, F. J., Biancaniello, G., and den Otter, C. J. (2002). Electrophysiological Characterization of Olfactory Cell Types in the Antennae and Palps of the Housefly. *J.Insect Physiol.* 48: 997-1008.
- EcoReference No.: 86656
Chemical of Concern: MSCL,LIM; Habitat: T; Effect Codes: CEL; Rejection Code: NO COC(OCT3,24DXYEE).

370. Kelly, S. and Avery, G. S. Jr. (1949). The Effect of 2,4-Dichlorophenoxyacetic Acid and Other Physiologically Active Substances on Respiration. *Am.J.Bot.* 36: 421-426.
- EcoReference No.: 43753
Chemical of Concern: 24DXY; Habitat: T; Effect Codes: PHY; Rejection Code: NO ENDPOINT,NO CONTROL(24DXY).
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- EcoReference No.: 40935
Chemical of Concern: 24DXY; Habitat: T; Effect Codes: PHY; Rejection Code: NO ENDPOINT,NO CONTROL(24DXY).
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- EcoReference No.: 359
Chemical of Concern: PCP,CPH,24DC; Habitat: A; Effect Codes: PHY; Rejection Code: NO ABSTRACT(ALL CHEMS).
373. Kessler, E. (1980). Documentation of a 2,4-D Accident. *Environ.Conservation* 7: 139-144.
- EcoReference No.: 94114
Chemical of Concern: 24D; Habitat: T; Effect Codes: PHY; Rejection Code: NO ENDPOINT,NO CONTROL(24D).
374. Key, J. L. (1962). Changes in Ascorbic Acid Metabolism Associated with Auxin-Induced Growth. *Plant Physl* 37: 349-356 .
- EcoReference No.: 42094
Chemical of Concern: 24DXY; Habitat: T; Effect Codes: GRO,PHY; Rejection Code: NO ENDPOINT,NO CONTROL(24DXY).
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- EcoReference No.: 93375
Chemical of Concern: 24D; Habitat: T; Effect Codes: BCM,REP,GRO,CEL; Rejection Code: NO ENDPOINT(24D).
376. Khaleda, L., Ahmed, A. M. A., Marzan, L. W., and Al-Forkan, M. (2007). Identification of Callus Induction and Plant Regeneration Responsiveness in Presence of NaCl in In Vitro Culture of Some Deepwater Rice (*Oryza sativa* L.) Cultivars. *Asian J.Plant Sci.* 6: 36-41.
- EcoReference No.: 93551
Chemical of Concern: 24D,NaCl; Habitat: A; Effect Codes: PHY,GRO; Rejection Code: NO ENDPOINT,CONTROL(24D).
377. Khan, M. A. Q. (1977). Elimination of Pesticides by Aquatic Animals. In: M.A.Q.Khan (Ed.), *Pesticides in Aquatic Environments*, Plenum Press, NY 107-125.
- EcoReference No.: 4929
Chemical of Concern:

- 24DXY,DZ,CPY,AZ,PRN,MXC,EDT,HPT,DDT,DLD,HCCH,CHD,SZ,MLN,As; Habitat: A; Effect Codes: ACC; Rejection Code: NO CONTROL(ALL CHEMS).
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- EcoReference No.: 35302
Chemical of Concern: 24DXY,TCDD; Habitat: T; Rejection Code: NO ENDPOINT(24DXY).
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- EcoReference No.: 14589
Chemical of Concern: 24DXYBEE,DMDP; Habitat: A; Effect Codes: ACC,GRO; Rejection Code: NO ENDPOINT(DMDP,24DXYBEE).
380. Killgore, K. J. (1984). Use of Herbicide/Adjuvant Formulations for the Control of Myriophyllum spicatum L. *Misc.Pap.A-84-8, Army Engineer Waterways Exp.Station, Vicksburg, MS* 64.
- EcoReference No.: 15565
Chemical of Concern: DQTBBr,DMDP,24DXYBEE,EDT; Habitat: A; Effect Codes: POP,GRO; Rejection Code: NO ENDPOINT(DMDP,24DXYBEE).
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- EcoReference No.: 93467
Chemical of Concern: 24D; Habitat: T; Effect Codes: ACC; Rejection Code: NO CONTROL,NO ENDPOINT(24D).
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- EcoReference No.: 93609
Chemical of Concern: 24D; Habitat: T; Effect Codes: ACC; Rejection Code: NO CONTROL,NO ENDPOINT(24D).
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- EcoReference No.: 93464
Chemical of Concern: 24D; Habitat: T; Effect Codes: PHY; Rejection Code: NO CONTROL(24D).
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Chemical of Concern: 24D; Habitat: T; Effect Codes: ACC; Rejection Code: NO CONTROL,NO ENDPOINT(24D).

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Chemical of Concern: 24D,NaDPA; Habitat: T; Effect Codes: ACC; Rejection Code: NO ENDPOINT,NO CONTROL(24D,NaDPA).
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Chemical of Concern: PCP,Maneb,24DXY,Zineb; Habitat: T; Effect Codes: CEL,PHY; Rejection Code: NO ENDPOINT(ALL CHEMS).
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Chemical of Concern: CdCl₂,24D,BMY; Habitat: T; Effect Codes: POP; Rejection Code: NO MIXTURE(24D).
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Chemical of Concern: 24DXY; Habitat: A; Effect Codes: MOR; Rejection Code: NO ENDPOINT(24DXY).
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Chemical of Concern: MCPB,MCPA,24DXY,24DB; Habitat: T; Effect Codes: ACC,PHY,GRO; Rejection Code: NO ENDPOINT(ALL CHEMS,MCPB-TARGET).
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Chemical of Concern: 24DXY; Habitat: A; Effect Codes: PHY,MOR; Rejection Code: NO ENDPOINT,NO CONTROL(24DXY).
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Chemical of Concern: 24DXY; Habitat: A; Effect Codes: PHY,MOR; Rejection Code: NO ENDPOINT,NO CONTROL(24DXY).
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Chemical of Concern: 24DXY; Habitat: T; Effect Codes: GRO,BCM,PHY,MOR; Rejection Code: NO ENDPOINT,NO CONTROL(24DXY).
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Chemical of Concern: 24DXY,MCPP2,DPP1,24D; Habitat: T; Effect Codes: BCM,ACC; Rejection Code: NO CONTROL(MCPP2,DPP1,24D).
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Chemical of Concern: 24DXY; Habitat: A; Effect Codes: POP,BCM; Rejection Code: NO ENDPOINT(24DXY).
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Chemical of Concern: 24D; Habitat: T; Effect Codes: POP; Rejection Code: NO ENDPOINT(24D).
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Chemical of Concern: 24DXY; Habitat: A; Effect Codes: BCM; Rejection Code: NO ENDPOINT(24DXY).
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Chemical of Concern: MTL,AMTL,24DXY,AMTR; Habitat: T; Effect Codes: BCM; Rejection Code: NO ENDPOINT,TARGET(MTL).
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Chemical of Concern: 24DXY; Habitat: A; Effect Codes: MOR,GRO,REP; Rejection Code: NO ENDPOINT(24DXY).
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Chemical of Concern: 24D; Habitat: A; Effect Codes: ACC,PHY; Rejection Code: NO CONTROL(24D).
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EcoReference No.: 93468

Chemical of Concern: FZF; Habitat: T; Effect Codes: CEL,BCM; Rejection Code: NO COC(24DXY).

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EcoReference No.: 40616

Chemical of Concern:

EDT,SZ,24DC,ATZ,24DXY,ACR,BMC,BMN,BS,DBN,DMB,LNR,PQT,TRB,TFN,PYZ,NaN3,PRO;

Habitat: AT; Effect Codes: POP,GRO; Rejection Code: LITE EVAL

CODED(BMC,PRO,ATZ,SZ,PYZ,NaN3-aquatic),NO ENDPOINT(BMC,BS,SZ-terrestrial,DMB),NO ENDPOINT,NO CONTROL(24DXY).

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EcoReference No.: 41831

Chemical of Concern: SZ,ATZ,DU,24DXY,PPN; Habitat: T; Effect Codes: REP; Rejection Code: NO ENDPOINT(ALL CHEMS).

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EcoReference No.: 11523

Chemical of Concern: 24DXY,SCA,Pb,CTC,FML; Habitat: A; Effect Codes: GRO,MOR; Rejection Code: LITE EVAL CODED(SCA),OK(Pb,CTC,FML),NO CONTROL,NO ENDPOINT(24DXY).

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EcoReference No.: 74168

Chemical of Concern: MLT,IZP,IMQ,BSFM,BTC,DTP,TBC,24DXY,BT; Habitat: T; Effect Codes: GRO,POP,BCM,PHY; Rejection Code: NO CONTROL(ALL CHEMS,TARGET-IZP).

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EcoReference No.: 42305

Chemical of Concern: 24DXY; Habitat: T; Effect Codes: GRO; Rejection Code: NO ENDPOINT,NO CONTROL(24DXY).

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EcoReference No.: 93553

Chemical of Concern: ES; Habitat: T; Effect Codes: GRO,PHY,CEL; Rejection Code: NO COC(24D).

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- EcoReference No.: 93379
Chemical of Concern: NaDPA; Habitat: A; Effect Codes: CEL,BCM; Rejection Code: NO
ENDPOINT(NaDPA).
408. Lacsina, R. Q. and Seaman, D. E. (1971). Phenoxy Acid Herbicides for Barnyardgrass Control in Transplanted Rice. *Weed Sci.* 19: 203-206.
- EcoReference No.: 41859
Chemical of Concern: 24DXY; Habitat: T; Effect Codes: MOR; Rejection Code: NO
ENDPOINT,NO CONTROL(24DXY).
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.
- EcoReference No.: 43917
Chemical of Concern: 24DXY; Habitat: T; Effect Codes: GRO,POP; Rejection Code: NO
ENDPOINT,NO CONTROL(24DXY).
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- EcoReference No.: 40694
Chemical of Concern: 24DXY; Habitat: T; Effect Codes: MOR; Rejection Code: NO
ENDPOINT,NO CONTROL(24DXY).
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- EcoReference No.: 40685
Chemical of Concern: 24DXY,GYP,DMB; Habitat: T; Effect Codes: POP; Rejection Code: NO
CONTROL,NO ENDPOINT(24DXY,GYP,DMB).
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- EcoReference No.: 90590
Chemical of Concern:
SZ,PCL,PAQT,MCPA,EDT,DBN,AMTR,MTPN,SMM,TPR,HXZ,BMC,AMTL,DU,IZP,DMB,FDE,
GYP,24D; Habitat: AT; Effect Codes: POP; Rejection Code: NO ENDPOINT,NO
CONTROL(SZ,MTPN,SMM,HXZ,BMC,DU,IZP,DMB,GYP,24D).
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- EcoReference No.: 41657
Chemical of Concern: 24DXY; Habitat: T; Effect Codes: REP,GRO; Rejection Code: NO
ENDPOINT,NO CONTROL(24DXY).
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- EcoReference No.: 44002
Chemical of Concern: 24DXY; Habitat: T; Effect Codes: MOR; Rejection Code: NO
ENDPOINT,NO CONTROL(24DXY).

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- EcoReference No.: 41367
Chemical of Concern: 24DXY; Habitat: T; Effect Codes: PHY; Rejection Code: NO ENDPOINT,NO CONTROL(24DXY).
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Chemical of Concern: 24DXY; Habitat: T; Effect Codes: GRO; Rejection Code: NO ENDPOINT,NO CONTROL(24DXY).
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- EcoReference No.: 40963
Chemical of Concern: 24DB; Habitat: T; Effect Codes: REP; Rejection Code: NO ENDPOINT(24DB).
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Chemical of Concern: 24DXY; Habitat: A; Effect Codes: POP; Rejection Code: NO ENDPOINT(24DXY).
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- EcoReference No.: 37684
Chemical of Concern: 24D,MCPA; Habitat: T; Effect Codes: ACC,BEH,GRO; Rejection Code: NO ENDPOINT(24D).
420. Li, D., Ic, M., Brown, J. A., and Gold, M. H. (1995). Regulation of Manganese Peroxidase Gene Transcription by Hydrogen Peroxide, Chemical Stress, and Molecular Oxygen. *Appl.Environ.Microbiol.* 61: 341-345.
- EcoReference No.: 89719
Chemical of Concern: HOX,24DC,MnSO4,As,ETHN; Habitat: T; Effect Codes: POP,CEL,BCM; Rejection Code: NO ENDPOINT(24DC,AS).
421. Lichtenstein, E. P., Liang, T. T., and Anderegg, B. N. (1973). Synergism of Insecticides by Herbicides. *Science* 181: 847-849.
- EcoReference No.: 2939
Chemical of Concern: SZ,24DXY,ATZ,DZ,PRT,PRN,CBF,DDT,DLD,MP; Habitat: AT; Effect Codes: MOR; Rejection Code: LITE EVAL CODED(ATZ,SZ),NO ENDPOINT(24DXY,MP,DZ,PRT,PRN,CBF,DDT,DLD).
422. Lilius, H., Hastbacka, T., and Isomaa, B. (1995). A Comparison of the Toxicity of 30 Reference Chemicals to Daphnia magna and Daphnia pulex. *Environ.Toxicol.Chem.* 14: 2085-2088.
- EcoReference No.: 16385
Chemical of Concern: 24DXY,MLN,CuS,NCTN,PNB,As; Habitat: A; Effect Codes: PHY,MOR; Rejection Code: NO CONTROL(24DXY,MLN,CuS,NCTN,PNB,As),LITE EVAL CODED(OW-

TRV-Cu).

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EcoReference No.: 16756

Chemical of Concern:

24DXY,HCCH,MLN,WFN,CF,CuS,PAQT,PL,SFL,LPS,PCP,CTC,BA,Hg,Ti,NCTN; Habitat: A; Effect Codes: PHY,MOR,CEL; Rejection Code: NO CONTROL(ALL CHEMS).

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EcoReference No.: 94122

Chemical of Concern: 24D,CHTS; Habitat: A; Effect Codes: BCM,PHY; Rejection Code: NO TOX DATA(24D).

425. Linden, E., Bengtsson, B. E., Svanberg, O., and Sundstrom, G. (1979). The Acute Toxicity of 78 Chemicals and Pesticide Formulations Against Two Brackish Water Organisms, the Bleak (*Alburnus alburnus*) and the Harpacticoid *Nitocra spinipes*. *Chemosphere* 8: 843-851 (Author Communication Used) (OECDG Data File).

EcoReference No.: 5185

Chemical of Concern:

DZM,DBN,DDT,24DXYBEE,FNV,GYP,MANEB,MCPA,PCP,MCPPI,CQTC,MCPA,PMR,TBTF,OTN,C10OH,Zn,NH,C8OH,24DXY; Habitat: A; Effect Codes: MOR; Rejection Code: LITE EVAL CODED(C8OH,MCPPI,PCP,C10OH,DZM,CQTC,DBAC,OTN),OK(ALL CHEMS),NO CONTROL(24DXY,FNV,Maneb).

426. Lindquist, N. G. and Ullberg, S. (1971). Distribution of the Herbicides 2,4,5-T and 2,4-D in Pregnant Mice. Accumulation in the Yolk Sac Epithelium. *Experientia (Basel)* 27: 1439-1441.

EcoReference No.: 93994

Chemical of Concern: 24D; Habitat: T; Effect Codes: ACC; Rejection Code: NO CONTROL,NO ENDPOINT(24D).

427. Lio-Po, G. D., Sanvictores, M. E. G., Baticados, M. C. L., and Lavilla, C. R. (1982). In Vitro Effect of Fungicides on Hyphal Growth and Sporogenesis of *Lagenidium* spp. Isolated from *Penaeus monodon* Larvae and *Scylla serrata* Eggs. *J.Fish Dis.* 5: 97-112.

EcoReference No.: 65464

Chemical of Concern:

ACAC,BMY,DBAC,BRA,CaOCl,CuS,24DXY,CTN,ETHN,FML,HOX,IODN,PL,KPM,TFN; Habitat: A; Effect Codes: POP,GRO; Rejection Code: NO ENDPOINT(ALL CHEMS).

428. Little, E. E., Archeski, R. D., Flerov, B. A., and Kozlovskaya, V. I. (1990). Behavioral Indicators of Sublethal Toxicity in Rainbow Trout. *Arch.Environ.Contam.Toxicol.* 19: 380-385.

EcoReference No.: 3175

Chemical of Concern: PCP,MP,CHD,CBL,24DXY,TBF; Habitat: A; Effect Codes: BEH; Rejection Code: LITE EVAL CODED(CBL,PCP),OK(CHD),NO ENDPOINT(24DXY,MP,TBF).

429. Lockhart, J. A. and Weintraub, R. L. (1957). Influence of 2,4-Dichlorophenoxyacetic Acid on Auxin Content of Bean Seedlings. *Am.J.Bot.* 44: 424-428.

EcoReference No.: 42464

Chemical of Concern: 24DXY; Habitat: T; Effect Codes: BCM,GRO,POP; Rejection Code: NO ENDPOINT,NO CONTROL(24DXY).

430. Lorz, H. W., Glenn, S. W., Williams, R. H., Kunkel, C. M., Norris, L. A., and Loper, B. R. (1979). Effects of Selected Herbicides on Smolting of Coho Salmon. *EPA-600/3-79-071, U.S.EPA, Corvallis, OR* 102 p.

EcoReference No.: 561

Chemical of Concern: PCLK,DMB,ATZ,PAQT,24DXY,ACL,AMTL; Habitat: A; Effect Codes: MOR; Rejection Code: LITE EVAL CODED(ATZ,DMB,ACL),OK(PCLK,PAQT,AMTL),NO ENDPOINT,NO CONTROL(24DXY).

431. Loustalot, A. J. and Muzik, T. J. (1953). Effect of 2,4-D on Apparent Photosynthesis and Developmental Morphology of Velvet Beans. *Bot.Gaz.* 115: 56-66.

EcoReference No.: 42536

Chemical of Concern: 24DXY; Habitat: T; Effect Codes: PHY,CEL,MOR,BCM; Rejection Code: NO ENDPOINT,NO CONTROL(24DXY).

432. Lu, P. Y. and Metcalf, R. L. (1975). Environmental Fate and Biodegradability of Benzene Derivatives as Studied in a Model Aquatic Ecosystem. *Environ.Health Perspect.* 10: 269-284.

EcoReference No.: 2480

Chemical of Concern: BZO,PCP,24DXY; Habitat: A; Effect Codes: ACC; Rejection Code: NO CONTROL(ALL CHEMS).

433. Lutts, S., Almansouri, M., and Kinet, J.-M. (2004). Salinity and Water Stress have Contrasting Effects on the Relationship Between Growth and Cell Viability During and After Stress Exposure in Durum Wheat Callus. *Plant Sci.* 167: 9-18.

EcoReference No.: 94123

Chemical of Concern: 24D; Habitat: T; Effect Codes: GRO,PHY,BCM; Rejection Code: NO TOX DATA(24D).

434. Lutz, H. and Lutz-Ostertag, Y. (1972). The Action of Different Pesticides on the Development of Bird Embryos. *Adv.Exp.Med.Biol.* 27: 127-150.

EcoReference No.: 37772

Chemical of Concern: PRN,ES,DDT,AND,24D; Habitat: T; Effect Codes: GRO,REP,MOR,CEL,PHY; Rejection Code: NO ENDPOINT(24D).

435. MacKenzie, C. L. Jr. and Shearer, L. W. (1959). Chemical Control of *Polydora websteri* and Other Annelids Inhabiting Oyster Shells. *Proc.Natl.Shellfish Assoc.* 50: 105-111.

EcoReference No.: 19935

Chemical of Concern: CBL,RTN,24DC,DCB,DDT,3CE,4CE,PL; Habitat: A; Effect Codes: BEH; Rejection Code: NO CONTROL(ALL CHEMS).

436. MacPhee, C. and Ruelle, R. (1969). Lethal Effects of 1888 Chemicals upon Four Species of Fish from Western North America. *Bull.No.3, Forest, Wildl.and Range Exp.Stn., Univ.of Idaho, Moscow, ID* 112 p.

EcoReference No.: 15148

Chemical of Concern:

- PNB,24DXY,Captan,CBL,DOD,HCCH,MLN,NYP,CST,WFN,FUR,Cu,CuS,NaN₃,CuCl,PCP,ACL,ATM,Se,DBAC,Zn,DZ,Pb,DCB,IAA,ANT,PAH; Habitat: A; Effect Codes: MOR,BEH; Rejection Code: NO CONTROL,NO ENDPOINT(ALL CHEMS).
437. Mahmood, S. K. and Rao, A. M. M. (1995). Impact of Pesticides on Root Exudates of *Ageratum conyzoides* L. *Bangladesh J.Bot.* 24: 225-227.
- EcoReference No.: 74720
Chemical of Concern: CBF,MLH,24DXY,ATZ; Habitat: T; Effect Codes: BCM; Rejection Code: NO ENDPOINT(ALL CHEMS,TARGET-ATZ).
438. Mann, J. D. and Pu, M. (1968). Inhibition of Lipid Synthesis by Certain Herbicides. *Weed Sci.* 1: 197-198.
- EcoReference No.: 43988
Chemical of Concern: EDT,SZ,24DXY,ATZ,DBN,TFN,PCP,PCL; Habitat: T; Effect Codes: BCM; Rejection Code: NO ENDPOINT,NO CONTROL,DURATION(EDT,SZ,24DXY,ATZ,DBN,TFN,PCP,PCL).
439. Mansfield, T. A. (1967). Stomatal Behavior Following Treatment with Auxin-Like Substances and Phenylmercuric Acetate. *New Phytol.* 66: 325-330.
- EcoReference No.: 42893
Chemical of Concern: 24DXY,NAA; Habitat: T; Effect Codes: PHY; Rejection Code: NO ENDPOINT,NO CONTROL(24DXY).
440. Mansour, M., Feicht, E. A., Behechti, A., Schramm, K. W., and Kettrup, A. (1999). Determination Photostability of Selected Agrochemicals in Water and Soil. *Chemosphere* 39: 575-585.
- EcoReference No.: 85031
Chemical of Concern: DZ,HCCH,DDT,CPY,PRN,IZP,24DXY,K₂Cr₂O₇; Habitat: A; Effect Codes: PHY; Rejection Code: NO CONTROL(K₂Cr₂O₇),NO SPECIES(DZ,DDT,CPY,PRN,IZP,24DXY,HCCH).
441. Marshall, C. D. and Rutschky III, C. W. (1974). Single Herbicide Treatment: Effect on the Diversity of Aquatic Insects in Stone Valley Lake, Huntingdon County, PA. *Proc.Pap.Acad.Sci.* 48: 127-131.
- EcoReference No.: 2759
Chemical of Concern: 24DXY; Habitat: A; Effect Codes: POP; Rejection Code: NO ENDPOINT,NO CONTROL(24DXY).
442. Marth, P. C. and Davis, F. F. (1945). Relation of Temperature to the Selective Herbicidal Effects of 2,4-Dichlorophenoxyacetic Acid. *Bot.Gaz.* 106: 463-472.
- EcoReference No.: 43072
Chemical of Concern: 24DXY; Habitat: T; Effect Codes: POP,MOR,PHY; Rejection Code: NO ENDPOINT,NO CONTROL(24DXY).
443. Marth, P. C. and Mitchell, J. W. (1944). 2,4-Dichlorophenoxyacetic Acid as a Differential Herbicide. *Bot.Gaz.* 106: 223-232.
- EcoReference No.: 43056
Chemical of Concern: 24DXY; Habitat: T; Effect Codes: MOR; Rejection Code: NO ENDPOINT,NO CONTROL(24DXY).
444. Marth, P. C. and Mitchell, J. W. (1946). Period of Effective Weed Control by the Use of 2,4-

Dichlorophenoxyacetic Acid. *Science* 104: 77-79.

EcoReference No.: 43093

Chemical of Concern: 24DXY; Habitat: T; Effect Codes: POP; Rejection Code: NO
ENDPOINT,NO CONTROL(24DXY).

445. Martin, L. W. and Wiggans, S. C. (1959). The Tolerance of Earthworms to Certain Insecticides, Herbicides and Fertilizers. *Oklahoma State University Experiment Station, Processed Series No.334* 4 p.

EcoReference No.: 51944

Chemical of Concern: 24DXY,Captan,DDT,MLN; Habitat: T; Effect Codes: MOR; Rejection Code: NO CONTROL(24DXY,Captan,DDT,MLN)//No Media:AQU. OM, pH, Control//.

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EcoReference No.: 94119

Chemical of Concern: CBD,FRM,OML,24D,GYP; Habitat: T; Effect Codes: ACC; Rejection Code: NO ENDPOINT(FRM,24D,GYP).

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EcoReference No.: 93873; Habitat: T; Effect Codes: POP; Rejection Code: NO COC(24DXY).

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EcoReference No.: 43490

Chemical of Concern: IAA,24DXY; Habitat: T; Effect Codes: GRO; Rejection Code: NO
ENDPOINT(ALL CHEMS).

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Chemical of Concern: 24DXY; Habitat: A; Effect Codes: GRO,MOR; Rejection Code: NO
ENDPOINT,NO CONTROL(24DXY).

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EcoReference No.: 52018

Chemical of Concern: DMDP; Habitat: T; Effect Codes: REP,BCM,GRO,MOR,POP; Rejection Code: NO ENDPOINT(DMDP).

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EcoReference No.: 5109

Chemical of Concern: 24DXY; Habitat: A; Effect Codes: GRO; Rejection Code: NO
ENDPOINT,NO CONTROL(24DXY).

452. Mayer, F. L. Jr. (1974). Pesticides as Pollutants. In: B.G.Liptak (Ed.), *Environmental Engineer's Handbook*, Chilton Book Co., Radnor, PA 405-418 (Publ in Part As 6797).
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 Chemical of Concern:
 AND,CHD,DDT,DLD,ES,EN,HPT,TXP,DZ,CPY,PRN,CBL,ACL,ATZ,Cu,EDT,SZ,As,MLN,Captan,Naled,24DXY; Habitat: A; Effect Codes: MOR; Rejection Code: NO
 CONTROL(AND,CHD,DDT,DLD,ES,EN,HPT,TXP,DZ,CPY,PRN,CBL,ACL,ATZ,Cu,EDT,SZ,As,MLN,Captan,Naled),NO ENDPOINT,NO CONTROL(24DXY).
453. Mayeux, H. S. Jr., Drawe, D. L., and Scifres, C. J. (1979). Control of Common Goldenweed with Herbicides and Associated Forage Release. *J.Range Manag.* 32: 271-274.
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 Chemical of Concern: 24DXY; Habitat: T; Effect Codes: MOR; Rejection Code: NO
 ENDPOINT,NO CONTROL(24DXY).
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- EcoReference No.: 44033
 Chemical of Concern: 24DXY,ATZ,BYP,PAQT,PCL,GYP,DMB; Habitat: T; Effect Codes: POP; Rejection Code: OK TARGET(ATZ,DMB),OK(BYP,PAQT,PCL,GYP),NO ENDPOINT,NO CONTROL(24DXY).
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- EcoReference No.: 41465
 Chemical of Concern: 24DXY,DMB,PCL,ATZ,TPR; Habitat: T; Effect Codes: POP,BCM; Rejection Code: OK TARGET(ATZ,DMB),OK(TPR,PCL),NO ENDPOINT,NO CONTROL(24DXY).
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 Chemical of Concern: 24DXY,DMB,PCL; Habitat: T; Effect Codes: POP,MOR; Rejection Code: OK TARGET(DMB),OK(PCL),NO ENDPOINT,NO CONTROL(24DXY).
457. McCollister, D. D. and Leng, M. L. (1969). Toxicology of Picloram and Safety Evaluation of Tordon Herbicides. *Down Earth* 25: 5-10.
- EcoReference No.: 37865
 Chemical of Concern: BOR,MCPA,24D,PCL; Habitat: AT; Effect Codes: BCM,GRO,BEH,MOR,REP,BCM,ACC; Rejection Code: NO COC(24D).
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- EcoReference No.: 858
 Chemical of Concern: 24DXY,BS,DU,MBZ,DMM,TFN; Habitat: A; Effect Codes: MOR; Rejection Code: NO CONTROL(BS),NO ENDPOINT,NO CONTROL(24DXY).
459. McRae, D. H. and Bonner, J. (1953). Chemical Structure and Antiauxin Activity. *Physiol.Plant.* 6:

485-510.

EcoReference No.: 40793

Chemical of Concern: 24DXY,IAA; Habitat: T; Effect Codes: GRO; Rejection Code: NO
ENDPOINT(24DXY,TARGET-IAA).

460. Meehan, W. R., Norris, L. A., and Sears, H. S. (1974). Toxicity of Various Formulations of 2,4-D to Salmonids in Southeast Alaska. *J.Fish.Res.Board Can.* 31: 480-484.

EcoReference No.: 2776

Chemical of Concern: 24DXY; Habitat: A; Effect Codes: MOR; Rejection Code: NO
ENDPOINT,NO CONTROL(24DXY).

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EcoReference No.: 37948

Chemical of Concern:

ACP,PRN,CBL,PPX,EN,HCCH,MRX,PCP,MLN,FNF,FNT,TMP,DFZ,MTPN,FTT,ADC,CPYM,CP
Y,PCH,24DXY,PHMD,MXC,DMB,ACR,ATZ,TBO,GYP,OYZ,BT,MBZ,TFN,CBF,Maneb,Zineb,AN
D,DLDDDT,HPT,TXP,CHD,PPN,Captan; Habitat: AT; Effect Codes: ACC; Rejection Code: NO
CONTROL,NO ENDPOINT(ALL CHEMS).

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EcoReference No.: 44158

Chemical of Concern: 24DXY,GYP,HXZ,TPR,TET; Habitat: T; Effect Codes: MOR,POP;
Rejection Code: NO ENDPOINT,NO CONTROL(24DXY,HXZ).

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EcoReference No.: 42799

Chemical of Concern: 24DXY,BMC,DMB,PCL,PAQT; Habitat: T; Effect Codes: MOR,PHY;
Rejection Code: OK(PCL,PAQT),OK TARGET(DMB),NO CONTROL,NO
ENDPOINT(24DXY,BMC).

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EcoReference No.: 93378

Chemical of Concern: 24D; Habitat: A; Effect Codes: CEL; Rejection Code: NO
ENDPOINT(24D).

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EcoReference No.: 41735

Chemical of Concern: 24DXY,IAA; Habitat: T; Effect Codes: CEL; Rejection Code: NO
ENDPOINT(TARGET-IAA),NO COC(SZ),NO ENDPOINT,NO CONTROL(24DXY).

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- EcoReference No.: 93268
Chemical of Concern: HXZ,IZP,PCL,TPR,24DXY; Habitat: T; Effect Codes: POP; Rejection Code: NO CONTROL(HXZ,IZP,24DXY).
467. Miller, R. W., Honarvar, S., and Hunsaker, B. (1980). Effects of Drilling Fluids on Soils and Plants: I. Individual Fluid Components. *J.Environ.Qual.* 9: 547-552.
- EcoReference No.: 44338
Chemical of Concern: Ba,NaCr,24DXY,PL; Habitat: T; Effect Codes: BMS,GRO; Rejection Code: LITE EVAL CODED(NaCr),OK(Ba,PL),NO ENDPOINT(24DXY)//Ok(TRV).
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- EcoReference No.: 444
Chemical of Concern: 24DXY,TBC; Habitat: A; Effect Codes: PHY,MOR; Rejection Code: NO ENDPOINT,NO CONTROL(24DXY).
469. Mishra, B. K., Sahu, A. K., and Pani, K. C. (1987). On the Breeding Response of Indian Major Carp, *Labeo rohita* (Ham.), Reared in Weed-Infested Ponds and Exposed to Herbicide Formulations During Normal. *Vet.Ar.* 57: 311-318.
- EcoReference No.: 3359
Chemical of Concern: 24DXY; Habitat: A; Effect Codes: POP,GRO,REP,CEL; Rejection Code: NO ENDPOINT(24DXY).
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- EcoReference No.: 41745
Chemical of Concern: 24DXY; Habitat: T; Effect Codes: GRO,BCM; Rejection Code: NO ENDPOINT,NO CONTROL(24DXY).
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Chemical of Concern: 24DXY; Habitat: T; Effect Codes: GRO; Rejection Code: NO ENDPOINT(24DXY).
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- EcoReference No.: 43081
Chemical of Concern: 24DXY; Habitat: T; Effect Codes: GRO; Rejection Code: NO ENDPOINT,NO CONTROL(24DXY).
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Chemical of Concern: 24DXY; Habitat: T; Effect Codes: GRO; Rejection Code: NO ENDPOINT(24DXY).
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- EcoReference No.: 42438
Chemical of Concern: 24DXY,DMB; Habitat: T; Effect Codes: POP; Rejection Code: NO ENDPOINT(DMB),NO ENDPOINT,NO CONTROL(24DXY).
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- EcoReference No.: 43495
Chemical of Concern: PCL,AMTL,24DXY,DMB,24DB,NH; Habitat: T; Effect Codes: POP,MOR; Rejection Code: NO ENDPOINT(ALL CHEMS).
476. Miyake, I. and Yukio, I. (1960). Killing the Arrowroot by Chemicals. *B Gov F e S* 123: 21-44.
- EcoReference No.: 42050
Chemical of Concern: 24DXY; Habitat: T; Effect Codes: PHY,BCM; Rejection Code: NO ENDPOINT,NO CONTROL(24DXY).
477. Mohammad, F. K. and St.Omer, V. E. V. (1986). Behavioral and Developmental Effects in Rats Following In Utero Exposure to 2,4-D/2,4,5-T Mixture. *Neurobehav.Toxicol.Teratol.* 8: 551-560.
- EcoReference No.: 93562
Chemical of Concern: 24D; Habitat: T; Effect Codes: PHY,GRO,BEH,MOR; Rejection Code: NO MIXTURE(24D).
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Chemical of Concern: 24DXY; Habitat: T; Effect Codes: CEL; Rejection Code: NO ENDPOINT,NO CONTROL(24DXY).
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- EcoReference No.: 43761
Chemical of Concern: 24DXY; Habitat: T; Effect Codes: PHY; Rejection Code: NO ENDPOINT,NO CONTROL(24DXY).
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Chemical of Concern: 24DXY; Habitat: T; Effect Codes: GRO; Rejection Code: NO ENDPOINT,NO CONTROL(24DXY).
481. Morey, P. R. and Cronshaw, J. (1968). Induction of Tension Wood by 2,4-Dinitrophenol and Auxins. *Protoplasma* 65: 393-405 .
- EcoReference No.: 43875
Chemical of Concern: 24DXY,NAA,IAA,GIB; Habitat: T; Effect Codes: GRO; Rejection Code: NO ENDPOINT(NAA,IAA,GIB),NO ENDPOINT,NO CONTROL(24DXY).
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Chemical of Concern: 24DXY; Habitat: T; Effect Codes: BCM; Rejection Code: NO
ENDPOINT,NO CONTROL(24DXY).
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- EcoReference No.: 93599
Chemical of Concern: 24DXY; Habitat: T; Effect Codes: BCM; Rejection Code: NO COC(24D).
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Chemical of Concern: 24DXY; Habitat: T; Effect Codes: MOR; Rejection Code: NO
ENDPOINT,NO CONTROL(24DXY).
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Chemical of Concern: 24DXY; Habitat: T; Effect Codes: BCM; Rejection Code: NO
ENDPOINT,NO CONTROL(24DXY).
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- EcoReference No.: 883
Chemical of Concern: 24DXY,MLN; Habitat: A; Effect Codes: MOR,BEH,POP,GRO,REP;
Rejection Code: NO ENDPOINT(24DXY,MLN).
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- EcoReference No.: 5816
Chemical of Concern: 24DXY; Habitat: A; Effect Codes: BEH,MOR; Rejection Code: NO
ENDPOINT,NO CONTROL(24DXY).
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- EcoReference No.: 44153
Chemical of Concern: 24DXY; Habitat: T; Effect Codes: GRO,BCM; Rejection Code: NO
ENDPOINT,NO CONTROL(24DXY).
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- EcoReference No.: 42535
Chemical of Concern: 24DXY,BZO,SCA,IAA; Habitat: T; Effect Codes: GRO; Rejection Code:
NO CONTROL,NO ENDPOINT(24DXY,BZO,SCA,IAA).
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Chemical of Concern: IAA,24DXY; Habitat: T; Effect Codes: GRO; Rejection Code: NO
ENDPOINT(IAA),NO ENDPOINT,NO CONTROL(24DXY).
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Chemical of Concern: 24DXY; Habitat: T; Effect Codes: BCM; Rejection Code: NO
ENDPOINT,NO CONTROL(24DXY).
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- EcoReference No.: 13263
Chemical of Concern: 24DXY,DM; Habitat: A; Effect Codes: CEL; Rejection Code: NO
ENDPOINT,NO CONTROL(24DXY).
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- EcoReference No.: 77365
Chemical of Concern: DXN,TCDD,24DXY,MCPA; Habitat: T; Effect Codes: GRO,BCM,CEL;
Rejection Code: NO ENDPOINT.
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- EcoReference No.: 42504
Chemical of Concern: 24DXY; Habitat: T; Effect Codes: MOR,GRO; Rejection Code: NO
ENDPOINT(24DXY).
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- EcoReference No.: 42796
Chemical of Concern: 24DXY; Habitat: T; Effect Codes: BCM,PHY; Rejection Code: NO
ENDPOINT,NO CONTROL(24DXY).
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- EcoReference No.: 43440
Chemical of Concern: 24DXY; Habitat: T; Effect Codes: PHY; Rejection Code: NO
ENDPOINT,NO CONTROL(24DXY).
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- EcoReference No.: 93486
Chemical of Concern: HCCH,FNT,CPY,24D,DMB,HXZ,PCL,TPR; Habitat: T; Effect Codes: ACC;
Rejection Code: NO CONTROL,ENDPOINT(CPY,24D,DMP,HXZ).

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Chemical of Concern: 24DXY; Habitat: T; Effect Codes: BCM; Rejection Code: NO
ENDPOINT,NO CONTROL(24DXY).
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Chemical of Concern: 24DXY; Habitat: T; Effect Codes: BCM; Rejection Code: NO
ENDPOINT,NO CONTROL(24DXY).
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Chemical of Concern: 24DXY; Habitat: T; Effect Codes: GRO; Rejection Code: NO
ENDPOINT,NO CONTROL(24DXY).
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- EcoReference No.: 42111
Chemical of Concern: 24DXY; Habitat: T; Effect Codes: PHY; Rejection Code: NO
ENDPOINT,NO CONTROL(24DXY).
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- EcoReference No.: 94117
Chemical of Concern: 24D; Habitat: T; Effect Codes: ACC; Rejection Code: NO
ENDPOINT(24D).
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- EcoReference No.: 86279
Chemical of Concern: PRO,SZ,24DXY,NaPCP,Ziram; Habitat: A; Effect Codes: POP; Rejection Code: NO
ENDPOINT(ALL CHEMS).
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- EcoReference No.: 15281
Chemical of Concern:
24DXY,ACR,BMC,BS,DBN,DU,LNR,MLT,PEB,PMT,PQT,SZ,TBC,PHMD,PYZ,CuS,PCP,PPZ,QO
C; Habitat : A; Effect Codes: MOR; Rejection Code: NO
FOREIGN,CONTROL,ENDPOINT(QOC,BS),NO ENDPOINT,NO CONTROL(24DXY).
505. Nishiuchi, Y. and Hashimoto, Y. (1969). Toxicity of Pesticides to Some Fresh Water Organisms. *Rev.Plant Prot.Res.* 2: 137-139.

- EcoReference No.: 2682
Chemical of Concern: DDT,HCCH,PRN,MCPA,MLN,SZ,Captan,Ziram,24DXY,PPN,ATZ,NaPCP;
Habitat: A; Effect Codes: MOR; Rejection Code: NO CONTROL(ALL CHEMS).
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Chemical of Concern: 24DXY,ATZ,DU,LNR,SZ,PAQT; Habitat: A; Effect Codes: CEL; Rejection Code: NO ENDPOINT(ATZ,DU,LNR,SZ,PAQT),NO ENDPOINT,NO CONTROL(24DXY).
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- EcoReference No.: 42426
Chemical of Concern: 24DXY; Habitat: T; Effect Codes: PHY; Rejection Code: NO ENDPOINT,NO CONTROL(24DXY).
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- EcoReference No.: 43759
Chemical of Concern: 24DXY; Habitat: T; Effect Codes: GRO,REP; Rejection Code: NO ENDPOINT(24DXY).
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- EcoReference No.: 6963
Chemical of Concern: SZ,24DXY,GYP,LNR,OXF,PMT,AMTL,NaN3; Habitat: A; Effect Codes: PHY; Rejection Code: LITE EVAL CODED(SZ,NaN3),NO ENDPOINT(24DXY).
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Chemical of Concern: 24DXY,DFQ,BMN,DMB,MCPA; Habitat: T; Effect Codes: GRO,POP; Rejection Code: OK(DFQ),NO MIXTURE(DMB,MCPA,BMN),NO ENDPOINT(24DXY).
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Chemical of Concern: 24DXY; Habitat: T; Effect Codes: MOR; Rejection Code: NO ENDPOINT,NO CONTROL(24DXY).
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Chemical of Concern: 24D,PCL; Habitat: T; Effect Codes: GRO,REP,ACC; Rejection Code: NO MIXTURE(24D,PCL).
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Chemical of Concern: 24D,PCL; Habitat: T; Effect Codes: GRO,CEL,BCM; Rejection Code: NO MIXTURE(24D,PCL).
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Chemical of Concern: 24DXY; Habitat: T; Effect Codes: REP; Rejection Code: NO ENDPOINT,NO CONTROL(24DXY).
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Chemical of Concern: BTC,EPTC,PAQT,DCPA,GYP,LNR,NPM,24DXY,AMTL,PCP,MCPPI;
Habitat: A; Effect Codes: GRO; Rejection Code: NO FOREIGN,NO COC(CBL),NO ENDPOINT,NO CONTROL(24DXY).
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Chemical of Concern: 24DXY; Habitat: A; Effect Codes: BCM,POP,PRS; Rejection Code: NO ENDPOINT,NO CONTROL(24DXY).
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Chemical of Concern: 24DXY; Habitat: A; Effect Codes: MOR; Rejection Code: NO CONTROL(24DXY).
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Chemical of Concern: 24DXY,TBC; Habitat: A; Effect Codes: MOR; Rejection Code: NO CONTROL(24DXY).
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Chemical of Concern: BSF,BTC,24DXY,FNP,MLT,ODZ,PPN,TBC,QVC; Habitat: A; Effect Codes: POP,MOR; Rejection Code: NO ENDPOINT,NO CONTROL(24DXY).
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Chemical of Concern: 24D; Habitat: T; Effect Codes: ACC; Rejection Code: NO CONTROL(24D).

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Chemical of Concern: 24DXY; Habitat: T; Effect Codes: CEL,PHY; Rejection Code: NO ENDPOINT,NO CONTROL(24DXY).
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Chemical of Concern: 24DXY,DPP1; Habitat: T; Effect Codes: CEL,GRO,PHY; Rejection Code: NO ENDPOINT,NO CONTROL(24DXY,TARGET-DPP1).
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Chemical of Concern: 24DXY; Habitat: T; Effect Codes: PHY; Rejection Code: NO ENDPOINT,NO CONTROL(24DXY).
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Chemical of Concern: 24DXY; Habitat: A; Effect Codes: ACC,POP; Rejection Code: NO ENDPOINT,NO CONTROL(24DXY).
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Chemical of Concern: 24DXY,HCCH,CuS,Ag,NaPCP,Zn; Habitat: A; Effect Codes: POP; Rejection Code: NO CONTROL,NO ENDPOINT(24DXY,HCCH,CuS,Ag,NaPCP,Zn).
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Chemical of Concern: 24DXYEE,MCPB,MCPA,PEB,VNT,EPTC,MSMA,CCA,TFN,PAQT,DQTBr,NPM,PYZ,DCPA,AM TL,DMDP,24D; Habitat: T; Effect Codes: GRO,MOR,BEH; Rejection Code: NO ENDPOINT(DMDP,24D,24DXYEE).
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Chemical of Concern: 24DXY,PPA,MCPA,LNR,DU,TRL,ATZ,SZ,PRO,PPZ,DMB,BMC,DBN,PCLK; Habitat: T; Effect Codes: GRO,PHY,MOR; Rejection Code: LITE EVAL CODED(PRO),NO ENDPOINT,NO CONTROL(ATZ,SZ),OK(PPA,MCPA,LNR,DU,TRL,PPZ,DMB,BMC,DBN,PCLK),NO COC(24DXYEE).

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Chemical of Concern: NaDPA; Habitat: T; Effect Codes: POP,MOR; Rejection Code: NO ENDPOINT(NaDPA).
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Chemical of Concern: 24DXY,PCL,DMB; Habitat: T; Effect Codes: PHY,MOR; Rejection Code: NO ENDPOINT(PCL,DMB),NO ENDPOINT,NO CONTROL(24DXY).
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Chemical of Concern: DFPM; Habitat: T; Effect Codes: BCM,CEL,PHY; Rejection Code: NO COC(24DXY).
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- EcoReference No.: 16056
Chemical of Concern:
FNT,ANZ,DDVP,DLD,24DXY,CBF,CPY,CTN,DMT,DZ,HCCH,MLN,MLT,MP,MTM,PMT,TBC,D
M,EFV,BPZ,PPN,OMT,PCH,FPP,NaPCP,CaPS,OMT,Zn,DDT,Zineb,PPHD,FNV,CYH,BTC,TDF,Ni
; Habitat: A; Effect Codes: MOR; Rejection Code: NO FOREIGN,NO CONTROL(ALL
CHEMS),NO ENDPOINT,NO CONTROL(CPY),NO CONTROL(24DXY).
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Chemical of Concern: 24D; Habitat: A; Effect Codes: POP,CEL; Rejection Code: NO ENDPOINT(24D).
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Chemical of Concern: 24DXY,DLD,MLN,MP,ES; Habitat: A; Effect Codes: PHY; Rejection Code: NO ENDPOINT(ALL CHEMS).
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Chemical of Concern: 24DXY; Habitat: T; Effect Codes: POP; Rejection Code: NO CONTROL,ENDPOINT(24DXY).
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Chemical of Concern: 24DXY,CFRM,PAQT,TRB,EPTC,As; Habitat: T; Effect Codes: PHY,GRO,POP; Rejection Code: NO ENDPOINT(ALL CHEMS).
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Chemical of Concern: 24D; Habitat: A; Effect Codes: POP; Rejection Code: NO CONTROL,NO ENDPOINT(24D).
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Chemical of Concern: 24DXY,LNR; Habitat: T; Effect Codes: REP,POP; Rejection Code: OK(LNR),NO ENDPOINT,NO CONTROL(24DXY).
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Chemical of Concern: 24DXYBEE; Habitat: A; Effect Codes: MOR; Rejection Code: NO ENDPOINT,CONTROL(24DXYBEE).
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Chemical of Concern: 24DXY; Habitat: T; Effect Codes: PHY,BCM; Rejection Code: NO ENDPOINT,NO CONTROL(24DXY).
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Chemical of Concern: 24DXY; Habitat: T; Effect Codes: REP; Rejection Code: NO ENDPOINT,NO CONTROL(24DXY).
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Chemical of Concern: 24DXY; Habitat: T; Effect Codes: MOR; Rejection Code: NO ENDPOINT,NO CONTROL(24DXY).
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Chemical of Concern: 24DXY,ATZ; Habitat: A; Effect Codes: POP; Rejection Code: NO FOREIGN(ATZ),NO ENDPOINT,NO CONTROL(24DXY).

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Chemical of Concern: 24D,24DXY; Habitat: A; Effect Codes: POP,GRO,BCM; Rejection Code: NO ENDPOINT(24D,24DXY).

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Chemical of Concern: DMDP; Habitat: T; Effect Codes: ACC; Rejection Code: NO CONTROL,NO ENDPOINT(DMDP).

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EcoReference No.: 93668

Chemical of Concern: DMDP; Habitat: T; Effect Codes: ACC; Rejection Code: NO CONTROL,NO ENDPOINT(DMDP).

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Chemical of Concern: 24DXY; Habitat: T; Effect Codes: PHY,BCM; Rejection Code: NO ENDPOINT,NO CONTROL(24DXY).

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EcoReference No.: 67585

Chemical of Concern: HCCH,DDT,PCB,DLD,CBL,AND,24D; Habitat: AT; Effect Codes: ACC; Rejection Code: NO MIXTURE,EFFECT,ENDPOINT(ALL CHEMS).

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EcoReference No.: 71507

Chemical of Concern: MLT; Habitat: A; Effect Codes: SYS,POP; Rejection Code: NO TOX DATA(MLT,24DXY).

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Chemical of Concern: 24DXY,ATZ,GYP; Habitat: T; Effect Codes: GRO; Rejection Code: OK(GYP),OK TARGET(ATZ),NO ENDPOINT,NO CONTROL(24DXY).

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Chemical of Concern: ACL,CBL,24DXY,SZ,CBF,ATZ,BMN,TPR,MBZ,GYP,TET,MTC,IZT,DMM,PCL,CSF,HXZ;
Habitat: A; Effect Codes: PHY,POP; Rejection Code: LITE EVAL
CODED(CBL,ATZ,CBF,MTL,SZ,PCZ,ACL),OK(ALL CHEMS),NO ENDPOINT(24DXY,HXZ).
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Chemical of Concern: EDT,DBN,24DXY,DMB; Habitat: A; Effect Codes: MOR,PHY; Rejection Code: NO ENDPOINT(ALL CHEMS).
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Chemical of Concern: 24D; Habitat: A; Effect Codes: ACC,BCM; Rejection Code: NO CONTROL,NO ENDPOINT(24D).
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Chemical of Concern: 24DXY,IAA,BNOA; Habitat: T; Effect Codes: PHY; Rejection Code: NO ENDPOINT(IAA,BNOA),NO ENDPOINT,NO CONTROL(24DXY).
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Chemical of Concern: ATZ,DBN,24DXY,GYP; Habitat: A; Effect Codes: CEL; Rejection Code: NO ENDPOINT(ALL CHEMS).
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- EcoReference No.: 2756
Chemical of Concern: 24DXY,MLN,AND,DDT,PRN,MXC; Habitat: A; Effect Codes: POP,GRO; Rejection Code: NO ENDPOINT(24DXY,MLN,AND,DDT,PRN,MXC).
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Chemical of Concern: SZ,24DXY,ATZ,AZ,DBN,DMT,MLN,CuS,CrAC,SFL,HgCl2,NYP,Cd,Pb,Maneb,DDT,FML,PRN,EP RN,DLN,DPDP,PAQT,PL,ACY,ES,HCCH,MCRE,TI; Habitat: A; Effect Codes: MOR; Rejection Code: LITE EVAL CODED(AZ,ATZ,SZ,DMT,CuS,CrAC),OK(ALL CHEMS),NO CONTROL(24DXY,DPDP,MLN,MZB,Maneb).

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 Chemical of Concern:
 24DXY,AZD,BFT,BMY,CPZ,CYF,DTP,EP,FNF,FPD,FSTAl,FVL,MFD,MYC,PRM,TEZ,TPM;
Habitat: T; Effect Codes: POP; Rejection Code: LITE EVAL
 CODED(MFD,AZD,FVL,BFT,CYF),OK(ALL CHEMS),NO ENDPOINT(24DXY).
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 Chemical of Concern: 24DXY; Habitat: T; Effect Codes: CEL; Rejection Code: NO
 ENDPOINT,NO CONTROL(24DXY).
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 Chemical of Concern: 24DXY,TRB; Habitat: T; Effect Codes: GRO; Rejection Code: NO
 ENDPOINT,NO CONTROL(24DXY).
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 Chemical of Concern: 24DXY; Habitat: A; Effect Codes: REP,MOR; Rejection Code: NO
 ENDPOINT,NO CONTROL(24DXY).
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 Chemical of Concern: 24DXY; Habitat: T; Effect Codes: GRO; Rejection Code: NO
 ENDPOINT,NO CONTROL(24DXY).
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 Chemical of Concern: 24DXY; Habitat: A; Effect Codes: MOR; Rejection Code: NO
 ENDPOINT,NO CONTROL(24DXY).
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- EcoReference No.: 41472
 Chemical of Concern: 24DXY,GYP,TPR; Habitat: T; Effect Codes: PHY; Rejection Code: NO
 ENDPOINT,NO CONTROL(24DXY).
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- EcoReference No.: 43251
Chemical of Concern: 24DXY,GYP,TPR,DPP1,ASM; Habitat: T; Effect Codes: PHY,MOR,GRO; Rejection Code: OK(GYP,TPR,ASM),OK TARGET(DPP1),NO ENDPOINT,NO CONTROL(24DXY).
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- EcoReference No.: 72248
Chemical of Concern: 24D; Habitat: A; Effect Codes: MOR; Rejection Code: NO CONTROL(24D).
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Chemical of Concern: 24DXY; Habitat: A; Effect Codes: POP,REP; Rejection Code: NO ENDPOINT(24DXY).
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Chemical of Concern: 24D; Habitat: A; Effect Codes: POP,GRO; Rejection Code: NO CONTROL,NO ENDPOINT(24D).
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Chemical of Concern: 24DXY,GYP; Habitat: A; Effect Codes: POP,MOR; Rejection Code: NO ENDPOINT(24DXY).
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Chemical of Concern: 24DXY; Habitat: A; Effect Codes: MOR,BEH; Rejection Code: NO ENDPOINT,NO CONTROL(24DXY).
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Chemical of Concern: ACL,PCP,ACY,DNT,MLN,HgCl₂, 24DP,4NP,2CP,PL,ACE,Se ; Habitat: A; Effect Codes: PHY,MOR; Rejection Code: NO CONTROL(ALL CHEMS).
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- Chemical of Concern: 24DXY; Habitat: A; Effect Codes: POP,PHY; Rejection Code: NO ENDPOINT(24DXY).
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Chemical of Concern: 24D; Habitat: T; Effect Codes: ACC; Rejection Code: NO CONTROL(24D).
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Chemical of Concern: 24DXY; Habitat: T; Effect Codes: PHY,BCM; Rejection Code: NO ENDPOINT,NO CONTROL(24DXY).
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Chemical of Concern: 24DXYBEE; Habitat: A; Effect Codes: ACC; Rejection Code: NO ENDPOINT(24DXYBEE).
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Chemical of Concern: 24DXY; Habitat: A; Effect Codes: BEH,POP,GRO,MOR; Rejection Code: NO ENDPOINT(24DXY).
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Chemical of Concern: 24D; Habitat: A; Effect Codes: MOR; Rejection Code: NO ENDPOINT(24D).
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Chemical of Concern: 24DXY; Habitat: T; Effect Codes: PHY; Rejection Code: NO ENDPOINT,NO CONTROL(24DXY).
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Chemical of Concern: 24DXY,MLN,MP,AND; Habitat: A; Effect Codes: MOR,BCM; Rejection Code: NO CONTROL(MLN,24DXY,MP,AND).
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EcoReference No.: 93520

Chemical of Concern: FPN,TMX; Habitat: T; Effect Codes: MOR; Rejection Code: OK
TARGET(FPN),NO COC(24DXY).

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EcoReference No.: 69278

Chemical of Concern: 24D,CPR,PCL; Habitat: T; Effect Codes: POP; Rejection Code: NO
MIXTURE(24D).

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EcoReference No.: 43363

Chemical of Concern: 24DXY,IAA,NAA,GIB; Habitat: T; Effect Codes: CEL; Rejection Code: NO
ENDPOINT(IAA,NAA,GIB),NO ENDPOINT,NO CONTROL(24DXY).

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EcoReference No.: 43138

Chemical of Concern: 24DXY,IAA,ETL; Habitat: T; Effect Codes: PHY; Rejection Code: NO
ENDPOINT,NO CONTROL(24DXY),NO ENDPOINT(TARGET-IAA).

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Chemical of Concern: 24DXY; Habitat: A; Effect Codes: MOR,PHY; Rejection Code: NO
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EcoReference No.: 42025

Chemical of Concern: 24DXY; Habitat: T; Effect Codes: PHY; Rejection Code: NO
ENDPOINT,NO CONTROL(24DXY).

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EcoReference No.: 42122

Chemical of Concern: 24DXY; Habitat: T; Effect Codes: POP; Rejection Code: NO
ENDPOINT,NO CONTROL(24DXY).

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Chemical of Concern: 24DXY; Habitat: A; Effect Codes: ACC; Rejection Code: NO

ENDPOINT,NO CONTROL(24DXY).

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Chemical of Concern: 24DXY; Habitat: T; Effect Codes: PHY; Rejection Code: NO
ENDPOINT,NO CONTROL(24DXY).

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Chemical of Concern: 24DXY,CPY; Habitat: A; Effect Codes: MOR; Rejection Code: NO
ENDPOINT,NO CONTROL(24DXY,CPY).

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Chemical of Concern: EPRN; Habitat: A; Effect Codes: MOR,CEL; Rejection Code: NO
COC(24DXY).

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EcoReference No.: 14688

Chemical of Concern: 24DXY; Habitat: A; Effect Codes: MOR,PHY; Rejection Code: NO
ENDPOINT(24DXY).

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EcoReference No.: 42112

Chemical of Concern: 24DXY; Habitat: T; Effect Codes: MOR; Rejection Code: NO
ENDPOINT,NO CONTROL(24DXY).

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EcoReference No.: 41513

Chemical of Concern: 24DXY; Habitat: T; Effect Codes: GRO,PHY; Rejection Code: NO
ENDPOINT,NO CONTROL(24DXY).

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EcoReference No.: 42330

Chemical of Concern: NaClO,24DXY,MCPB,ATZ,DV; Habitat: T; Effect Codes: GRO; Rejection Code: NO
ENDPOINT(ALL CHEMS,MCPB-TARGET).

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Chemical of Concern: PQT,DQTBBr,MCPB,AMTL,24DXY; Habitat: T; Effect Codes: PHY,GRO; Rejection Code: NO ENDPOINT(ALL CHEMS,MCPB-TARGET),MIXTURE(PQT,DQTBBr).
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- EcoReference No.: 43384
Chemical of Concern: 24DXY; Habitat: T; Rejection Code: NO GENETIC.
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Chemical of Concern: AND,DLD,MLN,24DXYEE; Habitat: T; Effect Codes: BCM,BEH; Rejection Code: NO ENDPOINT(ALL CHEMS).
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- EcoReference No.: 60978
Chemical of Concern: 24DXY,GYP,HXZ,IZP,MSFM,SMM,TPR; Habitat: A; Effect Codes: GRO,MOR; Rejection Code: NO CONTROL(ALL CHEMS),TARGET(SMM).
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Chemical of Concern: 24DXY,NAA,IAA; Habitat: T; Effect Codes: GRO; Rejection Code: OK(NAA),OK TARGET(IAA),NO ENDPOINT,NO CONTROL(24DXY).
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Chemical of Concern: 24DXY; Habitat: T; Effect Codes: GRO; Rejection Code: NO ENDPOINT,NO CONTROL(24DXY).
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- EcoReference No.: 93631
Chemical of Concern: MCPA,24DXY; Habitat: T; Effect Codes: GRO,BCM; Rejection Code: NO COC(24D).
602. Sand, P. F. and McCarty, M. K. (1963). Control of Woollyleaf Franseria with 2,4-D. *Weeds* 11: 25-27.
- EcoReference No.: 42782
Chemical of Concern: 24DXY; Habitat: T; Effect Codes: MOR; Rejection Code: NO ENDPOINT,NO CONTROL(24DXY).
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Distribution of 2,4-Dichlorophenoxyacetic Acid (2,4-D) in Maternal and Fetal Rabbits.
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EcoReference No.: 93854

Chemical of Concern: 24D,NaDPA; Habitat: T; Effect Codes: ACC,BCM; Rejection Code: NO CONTROL,NO ENDPOINT(24D,NaDPA).

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J.Water Pollut.Control Fed. 24: 1544-1550 (Publ in Part As 6797).

EcoReference No.: 886

Chemical of Concern: SZ,EDT,24DXY,BS,DBN,DMB,DU,MLT,PEB,TFN; Habitat: A; Effect Codes: MOR,PHY; Rejection Code: LITE EVAL CODED(MLT,SZ,DMB),OK(ALL CHEMS),NO CONTROL(24DXY,BS).

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EcoReference No.: 885

Chemical of Concern:

SZ,EDT,24DXY,AZ,CBL,CMPh,CPY,DBN,DMB,DMT,DS,DU,DZ,HCCH,MLN,MLT,Naled,PAQT ,PRT,TFN,RTN,NaN₃,ATN,OXD,Captan,TBF; Habitat: A; Effect Codes: MOR; Rejection Code: LITE EVAL CODED(CBL,AZ,DZ,MLT,SZ,DMT,RTN,NaN₃,DMB,PRT,ATN),NO CONTROL(24DXY,CPY,MLN,Naled,OXD,Captan,TBF).

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EcoReference No.: 889

Chemical of Concern:

24DXY,AZ,CBL,CPY,DBN,DMT,DS,DU,DZ,HCCH,MLN,MLT,Naled,PYN,TFN,RTN,As,NaN₃,ATN,OXD,Captan,TBF; Habitat: A; Effect Codes: MOR; Rejection Code: NO CONTROL(24DXY,CPY,TBF,Naled,OXD,Captan,MLN),LITE EVAL CODED(CBL,DZ,MLT,DMT,RTN,NaN₃,ATN),OK(ALL CHEMS).

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EcoReference No.: 888

Chemical of Concern: 24DXY,CBL,DBN,DU,DZ,HCCH,MLN,Naled,CYT,PYN,TFN,RTN,As;

Habitat: A; Effect Codes: PHY; Rejection Code: NO

CONTROL(24DXY,CBL,DBN,DU,DZ,HCCH,MLN,Naled,CYT,PYN,TFN,RTN,As).

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EcoReference No.: 89882

Chemical of Concern:

PPN,DMB,24DXY,MZB,Zineb,Maneb,Captan,BMY,TCF,ACP,AZ,CBF,CPY,DZ,EN,MLN,MOM,M P,DS,FNTH,PMR,PRT,TFN,ETN; Habitat: T; Effect Codes: REP,CEL,PHY; Rejection Code: NO ENDPOINT(ALL CHEMS),NO BACTERIA(DZ,EN,PMR,MZB,Maneb,Zineb,24DXY,PPN,TFN,ETN).

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Chemical of Concern: LNR,DU,24DB,ATZ,DMB,PAQT,FMU,PMT; Habitat: T; Effect Codes: GRO,MOR; Rejection Code: OK(PMT),NO ENDPOINT(24DB,ATZ,DMB,PAQT,FMV).
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- EcoReference No.: 69850
Chemical of Concern: 24D; Habitat: A; Effect Codes: MOR,BEH,PHY,CEL; Rejection Code: NO ENDPOINT(24D).
611. Sarkar, S. K. (1990). Acute Toxicity of Herbicide 2,4-D on Common Carp Fry *Cyprinus carpio*. *Environ.Ecol.* 8: 1316-1318.
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Chemical of Concern: 24DXY; Habitat: A; Effect Codes: MOR; Rejection Code: NO CONTROL(24DXY).
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Chemical of Concern: 24DXY; Habitat: A; Effect Codes: MOR,POP; Rejection Code: NO ENDPOINT(24DXY).
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Chemical of Concern: 24DXY,ACE; Habitat: A; Effect Codes: CEL; Rejection Code: NO ENDPOINT(24DXY).
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- EcoReference No.: 10
Chemical of Concern: ACE,24D; Habitat: A; Effect Codes: CEL,POP; Rejection Code: NO ENDPOINT(24D).
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- EcoReference No.: 43872
Chemical of Concern: ATZ,24DXY,EPTC; Habitat: T; Effect Codes: REP,MOR; Rejection Code: OK(EPTC),OK TARGET(ATZ),NO ENDPOINT,NO CONTROL(24DXY).
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- EcoReference No.: 93607
Chemical of Concern: LCYT,TFN,LCF,GYP,IZT,24D,QZF,ATZ,CRM,TBO,MTL,CZE,PDM,TFN;

- Habitat: T; Effect Codes: MOR,REP,POP; Rejection Code: OK(ATZ),NO MIXTURE(GYP,24D,LCF,MTL).
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- EcoReference No.: 93917
Chemical of Concern: 24D,MCPA; Habitat: A; Effect Codes: PHY; Rejection Code: NO ENDPOINT(24D).
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Chemical of Concern: 24DXY; Habitat: T; Effect Codes: GRO; Rejection Code: NO ENDPOINT,NO CONTROL(24DXY).
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Chemical of Concern: 24DXY; Habitat: T; Effect Codes: MOR; Rejection Code: NO ENDPOINT,NO CONTROL(24DXY).
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- EcoReference No.: 6615
Chemical of Concern: RSM,SZ,CBL,CPY,HCCH,MLN,MP,Naled,24DXY,MCPB,ATM; Habitat: A; Effect Codes: SYS,ACC,MOR,BCM,POP; Rejection Code: NO CONTROL(RSM,SZ,CBL,CPY,HCCH,MLN,MP,Naled,MCPB,ATM),NO ENDPOINT,NO CONTROL(24DXY).
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Chemical of Concern: 24DXY; Habitat: A; Effect Codes: GRO; Rejection Code: NO ENDPOINT,NO CONTROL(24DXY).
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Chemical of Concern: 24DXY; Habitat: A; Effect Codes: ACC,MOR; Rejection Code: NO ENDPOINT(24DXY).
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Chemical of Concern: DMDP; Habitat: A; Effect Codes: ACC,MOR,PHY,REP; Rejection Code: NO ENDPOINT(DMDP).
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Chemical of Concern: DMDP; Habitat: A; Effect Codes: ACC,MOR; Rejection Code: NO CONTROL(DMDP).
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Chemical of Concern: 24DXY; Habitat: AT; Effect Codes: ACC; Rejection Code: NO ENDPOINT.
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- EcoReference No.: 93632
Chemical of Concern: 24DXY; Habitat: T; Effect Codes: PHY,ACC; Rejection Code: NO COC(24D).
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- EcoReference No.: 93619; Habitat: T; Effect Codes: BEH,PHY,ACC; Rejection Code: NO COC(24DXY).
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- EcoReference No.: 4300
Chemical of Concern: 24DXY; Habitat: A; Effect Codes: MOR,POP; Rejection Code: NO ENDPOINT,NO CONTROL(24DXY).
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- EcoReference No.: 71943; Habitat: A; Effect Codes: POP,PHY; Rejection Code: NO COC(24DXY).
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- EcoReference No.: 42227
Chemical of Concern: ATZ,DU,SZ,AMTL,NaPCP,EPTC,24DXY,PPZ; Habitat: T; Effect Codes: PHY,POP; Rejection Code: OK(NaPCP,EPTC),NO ENDPOINT(SZ,AMTL,ATZ,DU,PPZ,TARGET-SZ),NO ENDPOINT,NO CONTROL(24DXY).
631. Seaburg, J. H. (1963). Toxicity of 2,4-Dichlorophenoxyacetic Acid for Man and Dog. *Arch.Environ.Health* 7: 202-209.
- EcoReference No.: 74911
Chemical of Concern: 24DXY; Habitat: T; Effect Codes: PHY,BEH; Rejection Code: NO ENDPOINT.
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Chemical of Concern: 24DXY; Habitat: A; Effect Codes: ACC,MOR; Rejection Code: NO ENDPOINT(24DXY).
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Chemical of Concern: 24DXY,HXZ,MTL,CuS,BMN,GYP,PCL,IMB,PL,Zn,CuS,Cr,CZE,DQTB; Habitat: A; Effect Codes: CEL; Rejection Code: LITE EVAL CODED(MTL,CuS),NO CONTROL(24DXY,HXZ).
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Chemical of Concern: DLD,CBL,RTN,PCP; Habitat: A; Effect Codes: MOR,ACC,BCM; Rejection Code: NO ABSTRACT(ALL CHEMS).
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Chemical of Concern: 24DXY; Habitat: T; Effect Codes: PHY,POP,GRO,REP; Rejection Code:
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Chemical of Concern: 24DXY; Habitat: T; Effect Codes: GRO; Rejection Code: NO
ENDPOINT(24DXY).

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EcoReference No.: 42370

Chemical of Concern: 24DXY,NAA; Habitat: T; Effect Codes: PHY,GRO,POP; Rejection Code:
NO ENDPOINT,NO CONTROL(24DXY).

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Chemical of Concern: 24DXY; Habitat: T; Effect Codes: GRO; Rejection Code: NO
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Chemical of Concern: 24DXY; Habitat: T; Effect Codes: PHY; Rejection Code: NO
ENDPOINT,NO CONTROL(24DXY).

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- EcoReference No.: 40698
Chemical of Concern: 24DXY,DMB,PCL,AMTL; Habitat: T; Effect Codes: POP; Rejection Code: NO CONTROL(DMB,PCL,AMTL),NO ENDPOINT,NO CONTROL(24DXY).
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Chemical of Concern: 24DXY; Habitat: T; Effect Codes: PHY,REP,GRO,POP; Rejection Code: NO ENDPOINT,NO CONTROL(24DXY).
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Chemical of Concern: 24DXY; Habitat: T; Effect Codes: MOR; Rejection Code: NO ENDPOINT,NO CONTROL(24DXY).
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Chemical of Concern: 24D; Habitat: A; Effect Codes: POP,BCM; Rejection Code: NO ENDPOINT(24D).
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Chemical of Concern: 24D; Habitat: A; Effect Codes: MOR; Rejection Code: NO ENDPOINT(24D).
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Chemical of Concern: SZ,24DXY,BMC; Habitat: A; Effect Codes: POP; Rejection Code: NO ENDPOINT(BMC,SZ,24DXY).
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Chemical of Concern: BT,CBF,EP,GYP,PSM,TBC,CYP,DM,FPP,FVL,PMR,TMT,24DXY,ATN,FNF,PAQT,MZB,Maneb,B TC,TBC,FNV,Zn; Habitat: A; Effect Codes: MOR; Rejection Code: NO FOREIGN(BT,CBF,EP,GYP,PSM,TBC,CYP,DM,FPP,FVL,PMR,TMT,24DXY,ATN,FNF,PAQT,M ZB,Maneb,BTC,TBC,FNV,Zn).
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Chemical of Concern: 24DXY; Habitat: A; Effect Codes: GRO,PHY; Rejection Code: NO
ENDPOINT,NO CONTROL(24DXY).
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Chemical of Concern: 24DXY,DU,CuS; Habitat: A; Effect Codes: POP,PHY; Rejection Code: NO
ENDPOINT(ALL CHEMS).
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Chemical of Concern: MCP1,GYP,24DXY,AMTL,LNR,DMB,BT; Habitat: T; Effect Codes: GRO; Rejection Code: OK TARGET(DMB),OK(LNR,GYP),NO
MIXTURE(24DXY,AMTL,BT,MCP1).
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Chemical of Concern: 24DXY,DPP1; Habitat: T; Effect Codes: CEL; Rejection Code: NO
ENDPOINT,NO CONTROL(24DXY,DPP1).
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Chemical of Concern: CFRM,24DXY,CQTC; Habitat: T; Effect Codes: BCM,GRO; Rejection Code: NO
ENDPOINT(ALL CHEMS).
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Chemical of Concern: 24DXY,BZO,PL; Habitat: A; Effect Codes: BEH; Rejection Code: NO

ENDPOINT(ALL CHEMS).

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Chemical of Concern: 24DXY; Habitat: T; Effect Codes: MOR; Rejection Code: NO
ENDPOINT,NO CONTROL(24DXY).
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Chemical of Concern: 24DXY; Habitat: T; Effect Codes: MOR; Rejection Code: NO
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Chemical of Concern: CdCl,Ni,PCP,24DXY; Habitat: A; Effect Codes: POP; Rejection Code: LITE
EVAL CODED(OW-TRV-Cu),OK(ALL CHEMS),NO CONTROL(24DXY).
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Chemical of Concern: 24DXY; Habitat: T; Effect Codes: PHY,GRO; Rejection Code: NO
ENDPOINT,NO CONTROL(24DXY).
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Chemical of Concern: DFPM,DFP,DFQ,24DXY,MCPA,MCPB; Habitat: T; Effect Codes: GRO,PHY; Rejection Code: NO
ENDPOINT(DFPM,DFP,DFQ,MCPA,MCPB-TARGET),NO
ENDPOINT,NO CONTROL(24DXY).
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Chemical of Concern: 24DXY; Habitat: T; Effect Codes: BCM,PHY; Rejection Code: NO
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Chemical of Concern: 24DXY,NAA; Habitat: T; Effect Codes: REP; Rejection Code: NO
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Chemical of Concern: DEAC,PL,BNZ,DBAC; Habitat: T; Effect Codes: PHY; Rejection Code: NO ENDPOINT(ALL CHEMS).
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Chemical of Concern: EDT,GYP,24D; Habitat: A; Effect Codes: GRO,POP; Rejection Code: NO ENDPOINT,NO CONTROL(24D,GYP).
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Chemical of Concern: DLD,24DXY; Habitat: T; Effect Codes: BCM; Rejection Code: NO COC(24D).
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Chemical of Concern: 24DXY; Habitat: T; Effect Codes: POP,BCM,GRO; Rejection Code: NO COC(24D).
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Chemical of Concern: 24DXY,CBZ,IAA; Habitat: T; Effect Codes: PHY; Rejection Code: NO ENDPOINT(CBZ,TARGET-IAA),NO ENDPOINT,NO CONTROL(24DXY).
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Chemical of Concern: 24DXY; Habitat: T; Effect Codes: MOR; Rejection Code: NO ENDPOINT,NO CONTROL(24DXY).
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Chemical of Concern: 24DXY; Habitat: T; Effect Codes: BCM; Rejection Code: NO ENDPOINT,NO CONTROL(24DXY).
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Chemical of Concern: ATZ,SZ,24DXY; Habitat: A; Effect Codes: POP; Rejection Code: NO ENDPOINT(ATZ,SZ),NO ENDPOINT,NO CONTROL(24DXY).

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Chemical of Concern: 24DIO; Habitat: A; Effect Codes: POP; Rejection Code: NO CONTROL,ENDPOINT(24DIO).
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Chemical of Concern: 24DXY,NAA; Habitat: T; Effect Codes: PHY; Rejection Code: NO ENDPOINT,NO CONTROL(24DXY).
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Chemical of Concern: 24DXY; Habitat: A; Effect Codes: MOR; Rejection Code: NO ENDPOINT,NO CONTROL(24DXY).
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Chemical of Concern: TBC,BTC,NaDPA; Habitat: A; Effect Codes: GRO,POP; Rejection Code: NO ENDPOINT(NaDPA).
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Chemical of Concern: 24D; Habitat: A; Effect Codes: POP,BCM,CEL; Rejection Code: NO ENDPOINT(24D).
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Chemical of Concern: 24D; Habitat: A; Effect Codes: POP.MOR,PHY; Rejection Code: NO ENDPOINT(24D).
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Chemical of Concern: 24DXYEE,MLN; Habitat: A; Effect Codes: POP; Rejection Code: NO ENDPOINT(24DXYEE,MLN).
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Chemical of Concern: 24DXY,OXT,IAA; Habitat: A; Effect Codes: POP; Rejection Code: NO ENDPOINT(24DXY,IAA).
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Chemical of Concern: 24DXY,PCL,PAQT,SZ,DU; Habitat: T; Effect Codes: POP; Rejection Code: NO ENDPOINT(ALL CHEMS).
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Chemical of Concern: 24DXY,DU,GYP,PQT,DBN; Habitat: A; Effect Codes: MOR; Rejection Code: NO CONTROL(24DXY).
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Chemical of Concern: DPP1,24DXY; Habitat: T; Effect Codes: GRO; Rejection Code: OK(ALL CHEMS),OK TARGET(DPP1),NO ENDPOINT(24DXY).
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Chemical of Concern: SZ,ATZ,24DXY,MLN; Habitat: A; Effect Codes: BCM; Rejection Code: LITE EVAL CODED(ATZ,SZ),NO ENDPOINT(MLN),NO ENDPOINT,NO CONTROL(24DXY).
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Chemical of Concern: TCDD,24D; Habitat: T; Effect Codes: GRO; Rejection Code: NO CONTROL,NO ENDPOINT,NO MIXTURE(24D).
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Chemical of Concern: 24DXY; Habitat: T; Rejection Code: NO GENETIC.
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Chemical of Concern: AMTL,TFN,DMB,DBN,BS,ATZ,24DXY,EDT; Habitat: T; Effect Codes: BCM; Rejection Code: NO ENDPOINT,NO CONTROL(ALL CHEMS).
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Chemical of Concern: 24DXY; Habitat: T; Effect Codes: PHY,GRO; Rejection Code: NO CONTROL,ENDPOINT(ALL CHEMS).
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Chemical of Concern:
Zineb,TXP,THM,PRT,CBL,PPHD,PRN,Nabam,PCB,MP,MXC,MLN,HCCH,PSM,HPT,AZ,Folpet,E N,DMT,DLN,AND,FNT,ATN,ATZ,DCTP, Habitat: T; Effect Codes: MOR; Rejection Code: NO CONTROL(CBL,MP,MLN,AZ,DMT,ATZ,24DXY,DZ,DS,THM).
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Chemical of Concern: NaCr,CN,FUR,Cu,CuS,BNZ,Pb,DEAC,PL,Cd,Hg,SA; Habitat: A; Effect Codes: MOR,PHY; Rejection Code: NO CONTROL(ALL CHEMS),LITE EVAL CODED(OW-TRV-Cu).
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Chemical of Concern: MCPA,24-DXY,24D; Habitat: T; Effect Codes: ACC,PHY; Rejection Code: NO CONTROL, NO ENDPOINT.
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Chemical of Concern: 24DXY; Habitat: A; Effect Codes: ACC; Rejection Code: NO ENDPOINT,NO CONTROL(24DXY).
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Chemical of Concern:
HCCH,CCA,FBM,Maneb,Zineb,Ziram,As,PRO,ABT,CPY,PRN,PPHD,DDT,MTAS,EDT,DMB,24D XY; Habitat: A; Effect Codes: GRO,MOR,ACC,BCM,REP; Rejection Code: NO CONTROL(ALL CHEMS),NO ENDPOINT(DDT).

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Chemical of Concern: 24DXY; Habitat: T; Effect Codes: GRO; Rejection Code: NO
ENDPOINT(24DXY).
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- EcoReference No.: 275
Chemical of Concern: 24DXY; Habitat: A; Effect Codes: POP; Rejection Code: NO
ENDPOINT(24DXY).
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Chemical of Concern: 24DXY; Habitat: T; Effect Codes: MOR,GRO,POP; Rejection Code: NO
ENDPOINT,NO CONTROL(24DXY).
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Chemical of Concern: 24DXY; Habitat: A; Effect Codes: ACC; Rejection Code: NO
ENDPOINT,NO CONTROL(24DXY).
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Chemical of Concern: 24DXY,AMTL,ATZ; Habitat: A; Effect Codes: ACC; Rejection Code: NO
ABSTRACT.
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Chemical of Concern: 24DXY; Habitat: T; Effect Codes: BCM; Rejection Code: NO
ENDPOINT,NO CONTROL(24DXY).
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Chemical of Concern: 24DXY,NAA; Habitat: T; Effect Codes: REP; Rejection Code: NO
ENDPOINT,NO CONTROL(24DXY).
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- EcoReference No.: 43086
Chemical of Concern: 24DXY; Habitat: T; Effect Codes: MOR; Rejection Code: NO
CONTROL(24DXY).

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Chemical of Concern: AZ,Captan,CPY,DEM,EN,MLN,MP,SID,24DXY,Maneb,MXC,BMC; Habitat: T; Effect Codes: MOR,CEL; Rejection Code: NO ENDPOINT(ALL CHEMS).
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Chemical of Concern: SZ,DMZ,24DXY,DU,NPP,TFN,DMZ,EPH,ASM,CQTC,DKGNa; Habitat: T; Effect Codes: GRO,POP,MOR,PHY; Rejection Code: NO ENDPOINT(ALL CHEMS),NO ENDPOINT,NO CONTROL(24DXY).
829. Zimakowska-Gnoinska, D. (1977). Toxicological and Physiological Aspects of the Action of Herbicide, Sodium Salt of 2,4-D on *Asellus aquaticus* L. (Isopoda). *Pol.Arch.Hydrobiol.* 24: 389-411.
- EcoReference No.: 6073
Chemical of Concern: 24DXY; Habitat: A; Effect Codes: PHY; Rejection Code: NO CONTROL(24DXY).

830. Zsoldos, F. and Haunold, E. (1979). Effects of pH Hydrogen-Ion Concentration Changes on Ion and Dichlorophenoxy Acetic Acid 2,4-D Uptake of Wheat Root. *Physiol.Plant.* 47: 77-80.
- EcoReference No.: 41711
 Chemical of Concern: 24DXY; Habitat: T; Effect Codes: GRO,PHY; Rejection Code: NO
 ENDPOINT,NO CONTROL(24DXY).
831. Zsoldos, F. and Haunold, E. (1978). Potassium Influx and Efflux of 2,4-D-and MCPA-Treated Rice Plants. *Plant Soil* 49: 219-228.
- EcoReference No.: 43845
 Chemical of Concern: 24DXY; Habitat: T; Effect Codes: PHY,GRO; Rejection Code: NO
 ENDPOINT,NO CONTROL(24DXY).
832. Zur, A. and Goren, R. (1977). Reducing Preharvest Drop of 'Temple' Orange Fruits by 2,4-D: Role of Cellulose in the Calyx Abscission Zone. *Scient Hort* 7: 237-248.
- EcoReference No.: 43901
 Chemical of Concern: 24DXY; Habitat: T; Effect Codes: PHY,BCM; Rejection Code: NO
 ENDPOINT,NO CONTROL(24DXY).
833. Zurfluh, L. L. and Guilfoyle, T. J. (1980). Auxin-Induced Changes in the Patterns of Protein Synthesis in Soybean (Glycine max Cultivar Wayne) Hypocotyl. *P Nas Us* 77: 357-361.
- EcoReference No.: 43257
 Chemical of Concern: 24DXY; Habitat: T; Effect Codes: BCM,GRO; Rejection Code: NO
 ENDPOINT,NO CONTROL(24DXY).

APPENDIX G

2,4-D

Papers that Were Excluded from ECOTOX

Excluded

1. 1989). EVALUATION OF THE BIODEGRADATION PREDICTIVE EQUATIONS IN EPA'S CHEMDAT6 MODEL WITH COVER LETTER DATED 041789. *EPA/OTS; Doc #FYI-AX-0489-0688*.
Rejection Code: FATE.
2. 1989). HYDROLYSIS OF 2,4-D IN AQUEOUS SOLUTIONS BUFFERED AT PH 3, 7, AND 11 WITH COVER LETTER. *EPA/OTS; Doc #40-8915218*.
Rejection Code: CHEM METHODS.
3. In Process Citation. *Bioorganicheskaya Khimiya* 30: 201-207.
Rejection Code: IN VITRO.
4. 2006). Let's open some mutton for tea... *The New Scientist* 191: 46-47.
Rejection Code: NO TOX DATA.
5. 1987). PHASE II - HYDROGEOLOGICAL IMPACT ASSESSMENT - WASTE DISPOSAL FACILITIES. *EPA/OTS; Doc #86-870002016*.
Rejection Code: NO TOX DATA.
6. 1991). Puget Sound pesticide reconnaissance survey, 1990.
Rejection Code: NO SPECIES.
7. 1990). SUBSURFACE INVESTIGATION GLENOLDEN LABORATORY GLENOLDEN, PENNSYLVANIA WITH COVER LETTER. *EPA/OTS; Doc #86-910000001*.
Rejection Code: NO TOX DATA.
8. SUPPORT DOCUMENT FOR THE SARA SECTION 110 "SECOND 100" LIST (DRAFT). *Epa/Ots Doc*.
Rejection Code: NO TOX DATA.
9. 1991). XENOBIOTIC MINERALISATION AT LOW CONCENTRATIONS IN ENVIRONMENTAL SAMPLES - A PRELIMINARY SURVEY WITH COVER LETTER DATED 112791. *EPA/OTS; Doc #86-920000484*.
Rejection Code: NO TOX DATA.
10. Abe, M. (1969). Effect of Pulse Treatment with Gibberellic Acid, Kinetin and 2,4-Dichlorophenoxyacetic Acid on the Growth of Excised Embryonic Axis of Soybean. *Bull.Yamagat Univ.(Nat.Sci.)* 7: 137-147.
Rejection Code: NON-ENGLISH.
11. Aberg, E. (1964). Susceptibility: Factors in the Plant Modifying the Response of a Given Species to Treatment. In: *L.J.Audus (Ed.), The Physiology and Biochemistry of Herbicides, Chapter 14, Acad.Press, London* 401-422.
Rejection Code: REFS CHECKED/REVIEW.
12. Abrol, B. K. and Audus, L. J. (1973). The Effects on N-1-Naphthylphthalamic Acid and (2-Chloroethyl)-Phosphonic Acid on the Gravity-Induced Lateral Transport of 2,4-Dichlorophenoxyacetic Acid. *J.Exp.Bot.* 24: 1224-1230.

Rejection Code: IN VITRO.

13. Abueva, A. A. (1970). The Effect of 2,4-D on the Growth of Micro-Organisms and on Nitrogen Metabolisms in a Derno-Podzolic Soil. *Khim.Sel'sk.Khoz.* 8: 601-604 (RUS).
Rejection Code: METABOLISM/NON-ENGLISH.
14. Addicott, F. T. and Carns, H. R. (1964). Abscission Responses to Herbicides. *In: L.J.Audus (Ed.), The Physiology and Biochemistry of Herbicides, Chapter 8, Acad.Press, London* 277-289.
Rejection Code: REVIEW.
15. Afza, Rownak , Shen, Mei, Zapata-Arias, Francisco Javier, Xie, Jiahua, Fundi, Haji Khamis, Lee, Kang-Seop, Bobadilla-Mucino, Eva, and Kodym, Andrea (2000). Effect of spikelet position on rice anther culture efficiency. *Plant Science* 153: 155-159.
Rejection Code: NO TOXICANT.
16. Agarwal, Sandhya, Kanwar, Kamlesh, Saini, N., and Jain, R. K. (2004). Agrobacterium tumefaciens mediated genetic transformation and regeneration of Morus alba L. *Scientia Horticulturae* 100: 183-191.
Rejection Code: NO TOXICANT.
17. Ahmed, E. U. , Hayashi, T., and Yazawa, S. (2004). Auxins increase the occurrence of leaf-colour variants in Caladium regenerated from leaf explants. *Scientia Horticulturae* 100: 153-159.
Rejection Code: IN VITRO.
18. Ait-Aissa, S., Porcher, J. M., Arrigo, A. P., and Lambre, C. (2000). Activation of the hsp70 promoter by environmental inorganic and organic chemicals: relationships with cytotoxicity and lipophilicity. *Toxicology* 145: 147-157.
Rejection Code: IN VITRO.
19. Akamine, E. K. (1948). Effect of 2,4-Dichlorophenoxyacetic Acid on Root Development in Bean Cotyledons. *Science* 108: 209.
Rejection Code: NO QUANTIFIABLE TOXICITY RESULTS.
20. Akcay, M., Soekmen, M., and Seker, Z. D. (Solid phase extraction enrichment of pesticide mixtures from aqueous solutions: A quantitative FT-IR analysis. *International Journal of Environmental Studies [Int. J. Environ. Stud.]*. Vol. 57, no. 6, pp. 683-693. 2000.
Rejection Code: CHEM METHODS.
21. Aksu, Z. and Kabasakal, E. (Adsorption Characteristics of 2,4-Dichlorophenoxyacetic Acid (2,4-D) From Aqueous Solution on Powdered Activated Carbon. *J environ sci health b*. 2005; 40(4):545-70. [Journal of environmental science and health. Part. B, pesticides, food contaminants, and agricultural wastes]: *J Environ Sci Health B*.
Rejection Code: CHEM METHODS.
22. AL-SULAIMAN, A. and IYER, V. (1988). THE EFFECTS OF DIPHENYLHYDANTOIN ON MYOTONIA INDUCED IN SKELETAL MUSCLE BY 2 4-D IN-VITRO STUDY. *40TH ANNUAL MEETING OF THE AMERICAN ACADEMY OF NEUROLOGY, CINCINNATI, OHIO, USA, APRIL 17-23, 1988. NEUROLOGY*; 38: 187.
Rejection Code: ABSTRACT.
23. Alam, J B, Dikshit, A K, and Bandyopadhyay, M (2002). Effect of different inorganic and organic compounds on sorption of 2,4-D and atrazine. *Journal Of Environmental Science And Health. Part. B, Pesticides, Food Contaminants, And Agricultural Wastes* 37: 541-560.
Rejection Code: FATE.
24. Albanis, T. A., Danis, T. G., and Kourgia, M. K. (1994). TRANSPORTATION OF PESTICIDES IN

ESTUARIES OF THE AXIOS LOUDIAS AND ALIAKMON RIVERS THERMAIKOS GULF
GREECE. *Science of the Total Environment* 156 : 11-22.
Rejection Code: FATE.

25. Aleem, A. and Malik, A. (2005). Genotoxicity of the Yamuna River Water at Okhla (Delhi), India. *Ecotoxicology and Environmental Safety [Ecotoxicol. Environ. Saf.]*. Vol. 61, no. 3, pp. 404-412. Jul 2005.
Rejection Code: BACTERIA.
26. Alexander, B. H., Mandel, J. S., Baker, B. A., Burns, C. J., Bartels, M. J., Acquavella, J. F., and Gustin, C. (Biomonitoring of 2,4-Dichlorophenoxyacetic Acid Exposure and Dose in Farm Families. *Environ health perspect.* 2007, mar; 115(3):370-6. [Environmental health perspectives]: *Environ Health Perspect.*
Rejection Code: HUMAN HEALTH.
27. Alfano, Orlando M., Brandi, Rodolfo J., and Cassano, Alberto E. (2001). Degradation kinetics of 2,4-D in water employing hydrogen peroxide and UV radiation. *Chemical Engineering Journal* 82: 209-218.
Rejection Code: FATE.
28. Aliyu, L., Lagoke, S. T. O., Carsky, R. J., Kling, J., Omotayo, O., and Shebayan, J. Y. (2004). Technical and Economic Evaluation of Some Striga Control Packages in Maize in the Nigerian Guinea Savanna. *Crop Prot.* 23: 65-69.
Rejection Code: MIXTURE.
29. Allard, A. S. and Neilson, A. H. (1997). Bioremediation of organic waste sites: A critical review of microbiological aspects. *International Biodeterioration & Biodegradation* 39 : 253-285.
Rejection Code: NO TOX DATA.
30. Almeida, W. F. (1974). Toxicological Aspects of the Herbicides 2,4-D and 2,4,5-T (Aspectos Toxicologicos dos Herbicidas 2,4-D e 2,4,5-T). *Biologico (San Paulo)* 40: 44-51 (POR).
Rejection Code: NON-ENGLISH.
31. Almendros, G. (1995). SORPTIVE INTERACTIONS OF PESTICIDES IN SOILS TREATED WITH MODIFIED HUMIC ACIDS. *European Journal of Soil Science* 46 : 287-301.
Rejection Code: FATE.
32. Altman, J. and Campbell, C. L. (1977). Effect of Herbicides on Plant Diseases. *Annu.Rev.Phytopathol.* 15: 361-385.
Rejection Code: REVIEW.
33. Amy, P. S., Staudaher, M. V., and Seidler, R. J. (1990). Comparison of a gene probe with classical methods for detecting 2,4-dichlorophenoxyacetic acid (2,4-D)-biodegrading bacteria in natural waters. *Current Microbiology [CURR. MICROBIOL.]* 21: 95-101.
Rejection Code: BACTERIA.
34. AMY PS, STAUDAHER MV, and SEIDLER RJ (1986). GENE PROBE PRODUCTION AND COMPARISON WITH CLASSICAL METHODS FOR DETECTION OF ENVIRONMENTAL 2 4-D DEGRADING BACTERIA. *86TH ANNUAL MEETING OF THE AMERICAN SOCIETY FOR MICROBIOLOGY, WASHINGTON, D.C., USA, MAR. 23-28, 1986. ABSTR ANNU MEET AM SOC MICROBIOL;* 86 : 309.
Rejection Code: BACTERIA.
35. An, Y. R., Li, X. G., Su, H. Y., and Zhang, X. S. (Pistil Induction by Hormones From Callus of Oryza Sativa in Vitro. *Plant cell rep.* 2004, dec; 23(7):448-52. [Plant cell reports]: *Plant Cell Rep.*
Rejection Code: IN VITRO.

36. Ananthakrishnan, G., Ravikumar, R., Girija, S., and Ganapathi, A. (2002). In vitro adventitious shoot formation from cotyledon explants of cashew (*Anacardium occidentale* L.). *Scientia Horticulturae* 93: 343-355.
Rejection Code: IN VITRO.
37. ANDERSON A-M , SAFFRAN KA, and BYRTUS, G. (1997). PESTICIDES IN ALBERTA SURFACE WATERS. 24TH ANNUAL AQUATIC TOXICITY WORKSHOP, NIAGARA FALLS, ONTARIO, CANADA, OCTOBER 20-22, 1997. CANADIAN TECHNICAL REPORT OF FISHERIES AND AQUATIC SCIENCES; 0 102-109.
Rejection Code: NO TOX DATA.
38. Anderson, J. P. Jr and Egler, F. E. (1984). Man-created stable low vegetation under a roadside utility line, Norfolk, Connecticut. *Phytologia* 55: 345-360.
Rejection Code: REVIEW.
39. Anderson, J. R. (1978). Pesticide Effects Non-target Soil Microorganisms. In: I.R.Hill and S.J.L.Wright (Eds.), *Pesticide Microbiology: Microbiological Aspects of Pesticide Behaviour in the Environment*, Chapter 7, Acad.Press, London 313, 501-533.
Rejection Code: REVIEW.
40. Andreae, W. A. (1963). Herbicides . In: R.M.Hochster and J.H.Quastel (Eds.), *Metabolic Inhibitors: A Comprehensive Treatise*, Chapter 26, Acad.Press Inc., New York, NY 2: 243-261.
Rejection Code: REFS CHECKED/REVIEW.
41. Andreae, W. A. (1967). Uptake and Metabolism of Indoleacetic Acid, Napthaleneacetic Acid, and 2,4-Dichlorophenoxyacetic Acid by Pea Root Segments in Relation to Growth Inhibition During and After Auxin Application. *Can.J.Bot.* 45: 737-753.
Rejection Code: IN VITRO/METABOLISM.
42. Angeles Sanchez-Sampedro, Maria, Fernandez-Tarrago, Jorge, and Corchete, Purificacion (2005). Enhanced Silymarin accumulation is related to calcium deprivation in cell suspension cultures of *Silybum marianum* (L.) Gaertn. *Journal of Plant Physiology* 162: 1177-1182.
Rejection Code: IN VITRO.
43. Anke, Heidrun and Weber, Roland W. S. (2006). White-rots, chlorine and the environment - a tale of many twists. *Mycologist* 20: 83-89.
Rejection Code: REVIEW.
44. Anklam, E., Berg, H., Mathiasson, L., Sharman, M., and Ulberth, F. (1998). SUPERCRITICAL FLUID EXTRACTION SEF IN FOOD ANALYSIS A REVIEW. *Food Additives and Contaminants* 15 : 729-750.
Rejection Code: HUMAN HEALTH.
45. Anonymous (1982). 2,4-D Use. *Chemical Regulation Reporter* 1207.
Rejection Code: NO TOX DATA.
46. Arbeli, Ziv and Fuentes, Cilia L. (Accelerated biodegradation of pesticides: An overview of the phenomenon, its basis and possible solutions; and a discussion on the tropical dimension. *Crop Protection* In Press, Corrected Proof: 94.
Rejection Code: FATE.
47. Arbonnier, P. and Delabrazé, P. (1971). Killing Hornbeam (*Carpinus Betulus* L.) with Herbicides Using A Tree Injector (La Devitalisation du Charme (*Carpinus Betulus* L.) par Depots de Phytocides a L'aide d'un Appareil-Injecteur). *Ann.Sci.For.* 28: 359-389 (FRE) (ENG ABS) .
Rejection Code: NON-ENGLISH.

48. Arbuckle, T. E., Bruce, D., Ritter, L., and Hall, J. C. (Indirect Sources of Herbicide Exposure for Families on Ontario Farms. *J expo sci environ epidemiol.* 2006, jan; 16(1):98-104. [*Journal of exposure science & environmental epidemiology*]: *J Expo Sci Environ Epidemiol.*
Rejection Code: HUMAN HEALTH.
49. Arbuckle, T. E., Cole, D. C., Ritter, L., and Ripley, B. D. (Biomonitoring of Herbicides in Ontario Farm Applicators. *Scand j work environ health.* 2005; 31 suppl 1:90-7; discussion 63-5. [*Scandinavian journal of work, environment & health*]: *Scand J Work Environ Health.*
Rejection Code: HUMAN HEALTH.
50. Arbuckle, T. E., Cole, D. C., Ritter, L., and Ripley, B. D. (Farm Children's Exposure to Herbicides: Comparison of Biomonitoring and Questionnaire Data. *Epidemiology.* 2004, mar; 15(2):187-94. [*Epidemiology (cambridge, mass.)*]: *Epidemiology.*
Rejection Code: HUMAN HEALTH.
51. Arbuckle, T. E. and Ritter, L. (Phenoxyacetic Acid Herbicide Exposure for Women on Ontario Farms. *J toxicol environ health a.* 2005, aug 13; 68(15):1359-70. [*Journal of toxicology and environmental health. Part a*]: *J Toxicol Environ Health A.*
Rejection Code: HUMAN HEALTH.
52. Ares, Jorge O., Del Valle, Hector F., and Olinuck, Jose A. (2006). Exploring improved pesticide management in sub-tropical environments with GIS-supported fate modeling. *Agricultural Systems* 91: 189-210.
Rejection Code: FATE.
53. Argeese, E., Bettiol, C., Marchetto, D., De Vettori, S., Zambon, A., Miana, P., and Ghetti, P. F. (2005). Study on the toxicity of phenolic and phenoxy herbicides using the submitochondrial particle assay. *Toxicology in Vitro* 19: 1035-1043.
Rejection Code: IN VITRO.
54. Armbrust, K. L. (2000). Pesticide hydroxyl radical rate constants: Measurements and estimates of their importance in aquatic environments. *Environmental toxicology and chemistry [environ. Toxicol. Chem.]*. Vol. 19, no. 9, pp. 2175-2180. Aug 2000.
Rejection Code: MODEL.
55. Armbrust, Kevin L and Peeler, Harold B (2002). Effects of formulation on the run-off of imidacloprid from turf. *Pest Management Science* 58: 702-706.
Rejection Code: FATE.
56. Artamonov, V. I. (1975). The Effect of 2,4-D on the Permeabilty of Plant Tissues (Beans). *D A N Ssr* 220: 1230-1233.
Rejection Code: NON-ENGLISH.
57. ARTIOLA JF (1996). WASTE DISPOSAL. *PEPPER, I. L., C. P. GERBA AND M. L. BRUSSEAU (ED.). POLLUTION SCIENCE. XXIV+397P. ACADEMIC PRESS, INC.: SAN DIEGO, CALIFORNIA, USA; LONDON, ENGLAND, UK. ISBN 0-12-550660-0.; 0: 135-149.*
Rejection Code: NO TOX DATA.
58. Arvy, L. and Lhoste, J. (1947). Etude de Quelques Anomalies Morphologiques Provoquees Par Le 2,4-Dichlorophenoxyacetate de Sodium. *Ann.Sci.Nat.Bot.* 8: 305-314 (FRE).
Rejection Code: NON-ENGLISH.
59. Arvy, L. and Lhoste, J. (1946). Sur L'Action des Solutions Aquenses de 2,4-Dichlorophenoxyacetate de Sodium Sur la Germination de Ble. *Soc,Biol.* 140: 74-76 (FRE).
Rejection Code: NON-ENGLISH.

60. Aseeva, I. V., Gorcharuk, L. G., Altukhov, M. D., and Samokhvalov, A. N. (1973). Effect of Herbicide 2,4-D on the Chemical Composition of Plants. *Nauchn.Dokl.Vyshh.Shk.Biol.Nauk.* 16: 87-90 (RUS).
Rejection Code: NON-ENGLISH.
61. Asman, W. A. H., Jorgensen, A., Bossi, R., Vejrup, K. V. , Mogensen, B. B., and Glasius, M. (2005). Wet Deposition of Pesticides and Nitrophenols at Two Sites in Denmark: Measurements and Contributions From Regional Sources. *Chemosphere [Chemosphere]. Vol. 59, no. 7, pp. 1023-1031. May 2005.*
Rejection Code: FATE.
62. Asmussen, L. E., White, A. W. Jr., Hauser, E. W., and Sheridan, J. M. (1977). Reduction of 2,4-D Load in Surface Runoff Down a Grassed Waterway. *J Environ Qual* 6: 159-162.
Rejection Code: NO EFFECT.
63. Aspray, Thomas J., Hansen, Susse K., and Burns, Richard G. (2005). A soil-based microbial biofilm exposed to 2,4-D: bacterial community development and establishment of conjugative plasmid pJP4. *FEMS Microbiology Ecology* 54: 317-327.
Rejection Code: BACTERIA.
64. Audus, L. J. (1964). Herbicide Behaviour in the Soil II. Interactions with Soil Micro-Organisms. In: L.J.Audus (Ed.), *The Physiology and Biochemistry of Herbicides, Chapter 5, Acad.Press, London* 163-206.
Rejection Code: REFS CHECKED/REVIEW.
65. Aulbry, W. and Kearney, P. C. (1991). DEGRADATION OF PESTICIDES BY MICROORGANISMS AND THE POTENTIAL FOR GENETIC MANIPULATION. *Crop Prot* 10 : 334-346.
Rejection Code: BACTERIA.
66. Averitt, W. K. (1967). An Evaluation of the Persistence of 2,4-D Amine in Surface Waters in the State of Louisiana. In: *Proc.20th Annu.Meeting Southern Weed Conf.* 342-347.
Rejection Code: NO SPECIES.
67. Averitt, W. K. and Gangstad, E. O. (1976). Dissipation of Residues of 2,4-D in Static Water. *J.Environ.Qual.* 5: 145-147.
Rejection Code: NO SPECIES.
68. Ayranci, E. and Hoda, N. (Studies on Removal of Metribuzin, Bromacil, 2,4-D and Atrazine From Water by Adsorption on High Area Carbon Cloth. *J hazard mater. 2004, aug 9; 112(1-2):163-8. [Journal of hazardous materials]: J Hazard Mater.*
Rejection Code: CHEM METHODS.
69. Aziz, P. (1974). Some Observations on the Morphological Responses of Oryza Sativa to the Dilute Concentration of 2,4-Dichlorophenoxyacetic Acid. *Proc.Pak.Sci.Conf.* 25: C-4.
Rejection Code: NON-ENGLISH.
70. BÉcaert, V., Samson, R., Desch&Ecirc, and Nes, L. (Effect of 2,4-D Contamination on Soil Functional Stability Evaluated Using the Relative Soil Stability Index (Rssi). *Chemosphere. 2006, sep; 64(10):1713-21. [Chemosphere]: Chemosphere.*
Rejection Code: BACTERIA.
71. Bacaoui, Abdelaziz, Dahbi, Abderrahman, Yaacoubi, Abdelrani, Bennouna, Chakib, Maldonado-Hodar, Francisco J, Rivera-Utrilla, Jose, Carrasco-Marin, Francisco, and Moreno-Castilla, Carlos (2002). Experimental design to optimize preparation of activated carbons for use in water treatment. *Environmental Science & Technology* 36: 3844-3849.
Rejection Code: NO TOX DATA.
72. Badellino, C., Rodrigues, C. A., and Bertazzoli, R. (Oxidation of Pesticides by in Situ Electrogenated

- Hydrogen Peroxide: Study for the Degradation of 2,4-Dichlorophenoxyacetic Acid. *J hazard mater.* 2006, sep 21; 137(2):856-64. [*Journal of hazardous materials*]: *J Hazard Mater.*
Rejection Code: CHEM METHODS.
73. Baebler, Spela, Camloh, Marjana, Kovac, Maja, Ravnika, Maja, and Zel, Jana (2002). Jasmonic acid stimulates taxane production in cell suspension culture of yew (*Taxus x media*). *Planta Medica* 68: 475-476.
Rejection Code: IN VITRO.
74. Bagaev, V. B., Spesivtsev, L. G., and Zhukov, Y. P. (1971). Toxic Effect of the Butyl Ester of 2,4-D on Corn at Different Doses of Fertilization. *Agrokhimiya* 2: 120-128.
Rejection Code: NON-ENGLISH.
75. Baghestani, Mohammad Ali, Zand, Eskandar, Soufizadeh, Saeid, Bagherani, Naser, and Deihimfard, Reza (Weed control and wheat (*Triticum aestivum* L.) yield under application of 2,4-D plus carfentrazone-ethyl and florasulam plus flumetsulam: Evaluation of the efficacy. *Crop Protection* In Press, Corrected Proof: 94.
Rejection Code: NO SOURCE.
76. Balagu&Eacute, C, St&Uuml, Rtz, N., Rey, R., De Ruiz, C. S., Nader-Mac&Iacute, As, M. E., Duffard, R., and De Duffard, A. M. (Aryloxoalcanoic Compounds Induce Resistance to Antibiotic Therapy in Urinary Tract Infection Caused by *Escherichia Coli*. *Fems immunol med microbiol.* 2006, dec; 48(3):337-46. [*Fems immunology and medical microbiology*]: *FEMS Immunol Med Microbiol.*
Rejection Code: HUMAN HEALTH.
77. Balague, C., Stuert, N., Duffard, R., and de Duffard AME* (Effect of 2,4-dichlorophenoxyacetic acid herbicide on *Escherichia coli* growth, chemical composition, and cellular envelope. *Environmental Toxicology [Environ. Toxicol.]*. Vol. 16, no. 1, pp. 43-53. 2001.
Rejection Code: BACTERIA.
78. Balague, C and Vescovi, E G (2001). Activation of multiple antibiotic resistance in uropathogenic *Escherichia coli* strains by aryloxoalcanoic acid compounds. *Antimicrobial Agents And Chemotherapy* 45: 1815-1822.
Rejection Code: BACTERIA.
79. Balague, C. E., de Ruiz, C. S., Rey, R., de Duffard, A. M. E., and Nader-Macias, M. E. (Effect of the herbicide 2,4-dichlorophenoxyacetic acid on uropathogenic *Escherichia coli* virulence factors. *Toxicology [Toxicology]*. Vol. 177, no. 2-3, pp. 143-155. 15 Aug 2002.
Rejection Code: BACTERIA.
80. BALAJEE, S. and MAHADEVAN, A. (1989). EVIDENCE FOR A DISSIMILATORY PLASMID IN AZOTOBACTER-CHROOCOCCUM. *FEMS (FED EUR MICROBIOL SOC) MICROBIOL LETT*; 65: 223-228.
Rejection Code: BACTERIA.
81. BALAJEE, S. and MAHADEVAN, A. (1991). Influence of temperature on growth, 2,4-D degradation and plasmid transfer in *Azotobacter chroococcum*.
Rejection Code: BACTERIA.
82. BALAJEE, S. and MAHADEVAN, A. (1990). Utilization of chloroaromatic substances by *Azotobacter chroococcum*. *SYST APPL MICROBIOL*; 13: 194-198.
Rejection Code: BACTERIA.
83. Balestrazzi, A, Bernacchia, G, Pitto, L, Luccarini, G, and Carbonera, D (2001). Spatial expression of DNA topoisomerase I genes during cell proliferation in *Daucus carota*. *European Journal Of Histochemistry: EJH* 45: 31-38.

Rejection Code: IN VITRO.

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Rejection Code: IN VITRO.
85. BARRIUSO, E., FELLER, C., CALVET, R., and CERRI, C. (1992). Sorption of atrazine, terbutryn and 2,4-D herbicides in two Brazilian oxisols. *GEODERMA*; 53: 155-167.
Rejection Code: FATE.
86. Barriuso, E. , Houot, S., and Serra-Wittling, C. (1997). Influence of compost addition to soil on the behaviour of herbicides. *Pesticide Science* 49 : 65-75.
Rejection Code: FATE.
87. BASKARAN, S. , BOLAN NS, RAHMAN, A., and TILLMAN RW (1996). Effect of exogenous carbon on the sorption and movement of atrazine and 2,4-D by soils. *AUSTRALIAN JOURNAL OF SOIL RESEARCH*; 34: 609-622.
Rejection Code: FATE.
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Rejection Code: CHEM METHODS.
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Rejection Code: IN VITRO.

Open Literature Review Summary

Chemical Name: 2,4-D and 2,4-Dichlorophenol

CAS NO: 94-75-7

ECOTOX Record Number and Citation: 40531

Roberts, B.L. and H.W. Dorrough. 1984. Relative Toxicities of Chemicals to the Earthworm *Eisenia foetida*. *Environmental Toxicology and Chemistry*. 3:67-78.

Purpose of Review: Litigation/Endangered Species (030001)

Date of Review: 12/04/08

Brief Summary of Study Findings:

The objective of the study was to evaluate the toxicity of a large suite of chemicals (90) to the earthworm *Eisenia foetida*. 2,4-Dichlorophenol was more toxic than the parent compound 2,4-D acid, with an LC₅₀ values of 4.4 (95% CI: 3.2-5.9) µg/cm² and 61.6 (95% CI: 41.0-92.4) µg/cm².

Methods

Earthworms (*Eisenia foetida* and *Lumbricus rubellus*) were purchased from Bert's Bait Farm (Irvine, Kentucky) and Norb's Bait Farm (Norco, California), respectively, and maintained at 18°C in Nalgene boxes containing moist peat moss and rabbit manure. Cornmeal was added as a food source, and calcium carbonate was added to keep the pH of the soil above 5.5. Mature worms with a developed clitellum that weighed 370-450 mg (*E. foetida*) or 280-400 (*L. rubellus*) were selected for the toxicity tests. *E. foetida* was the test organism of interest, but *L. rubellus* was also used in the testing of select compounds.

Test material was obtained from either commercial sources or chemical stocks in the laboratory. The chemicals were either technical or analytical grade; technical grade solutions were adjusted to 100% active ingredient prior to use. Ninety chemicals were selected for use in the study.

The test system consisted of glass shell vials (22 x 85 mm) that were lined with Whatman No. 1 filter paper, and then placed in cardboard scintillation vial trays. The test chemicals were dissolved in acetone, and 1 mL of the resulting solution was pipetted into the vial. Control vials received 1 mL of acetone. The solvent was evaporated with the aid of a stream of warm air for 3 minutes, and then was air-dried for an additional 2 hours. Following this procedure, water (1 mL) was added to each vial to make the paper moist, and then one earthworm was placed in each vial. The test containers were capped, and stored horizontally in the dark for 48 hours.

Worm mortality was recorded if the earthworms did not respond to probing of the anterior end. Five logarithmically increasing test concentrations with 10 worms per test level (0.1 to 1,000 µg/cm²) were used to determine the range of acute toxicity. The lowest exposure that resulted in 50% or more mortality was classified as the lethal concentration. The LC₅₀ values were determined for select

chemicals using a geometric series of test concentrations (including the lethal dose), and was replicated such that ≥ 100 earthworms were used in the determination of each LC_{50} value. The slope and LC_{50} values with 95% confidence intervals were calculated with the Litchfield-Wilcoxon log dose-effect probit transformation method.

Results

Mortality in the solvent controls was low (1/200 *Eisenia foetida* worms). Mortality ranged from 5 to 15% in the *L. rubellus* controls. The study authors established a toxicity classification system for *Eisenia foetida* that was based on toxicity categories applied to mammals. All results that follow apply for the *Eisenia foetida* worms only, as chemicals of interest were only evaluated on *E. foetida* worms.

2,4-D had an LC_{50} range of 10 to 100 $\mu\text{g}/\text{cm}^2$, which falls into the ‘very toxic’ category. The actual LC_{50} value was 61.6 (95% CI: 41.0-92.4) $\mu\text{g}/\text{cm}^2$.

2,4-Dichlorophenol had an LC_{50} range of 1 to 10 $\mu\text{g}/\text{cm}^2$, which falls into the ‘extremely toxic’ category. The actual LC_{50} value was 4.4 (95% CI: 3.2-5.9) $\mu\text{g}/\text{cm}^2$.

The study authors concluded that 2,4-Dichlorophenol (a phenolic derivative) is more toxic to *Eisenia foetida* earthworms than the parent (2,4-D).

Description of Use in Document: Data can be used quantitatively to evaluate risk to earthworms (as surrogates for potential prey items of the CRLF) for 2,4-D. Data for 2,4-dichlorophenol can also be used quantitatively to estimate risk.

Rationale for Use: No earthworm data for any forms of 2,4-D were submitted by the registrant. This was the only earthworm study found in the ECOTOX literature searches.

Limitations of Study: Raw data was unavailable. Exact concentrations for the definitive toxicity tests were not provided.

Reviewer: Moncie Wright, Staff Scientist, Cambridge Environmental, Inc.

Secondary Reviewer: Christine Hartless, Wildlife Biologist, EFED/ERB1

Open Literature Summary

Chemical Name: 2,4-D

CAS NO:

ECOTOX Record Number and Citation: 61180

Brooke, L. 1989. Results of freshwater exposures with the chemicals 2, 4-D and diazinon to the larval leopard frog (*Rana pipiens*), juvenile fathead minnows (*Pimephales promelas*), larval midge (*Chironomus riparius*) and adult oligochaete worms (*Lumbriculus variegates*). Study conducted at the University of Wisconsin-Superior, Center for Lake Superior Environmental Studies. Superior, Wisconsin. Study report dated February 15, 1989.

Purpose of Review: Litigation/Endangered Species

Date of Review: February 10, 2009

Brief Summary of Study Findings:

The objective of the study was to evaluate the toxicity of 2,4-D acid at varying concentrations to larval frogs and juvenile fathead minnows in order to derive toxicity values for both. Two tests were conducted, one with non-pH adjusted solutions and the other with pH-adjusted test solutions; both were conducted with different sets of concentrations in a geometric series. In the test with non-pH adjusted solutions, the 96-hour LC₅₀ values were 181 mg a.e./L for the larval frogs, and 165 mg a.e./L for the juvenile fathead minnows. In the test with pH-adjusted solutions, the 96 hour LC₅₀ values were 1,962 mg a.e./L and 1,966 mg a.e./L for the larval frogs and juvenile fish, respectively.

Methods

Larval leopard frogs (*Rana pipiens*) were obtained as eggs from a pond (Douglas County, Wisconsin). Embryos were hatched, and the larvae were reared for 20 ± 2 and 43 ± 2 days in the laboratory. The larvae were acclimated to the test conditions (dechlorinated municipal water from the City of Superior and a test temperature of $20 \pm 2^\circ\text{C}$) for an unreported period of time. The larvae were fed live brine shrimp (*Artemia* spp.) three times a day for an unreported period of time before study initiation.

Fathead minnows (*Pimephales promelas*) were cultured and reared at the University of Wisconsin-Superior campus laboratory. They were hatched and reared in dechlorinated lab water at $22 \pm 2^\circ\text{C}$.

The test system consisted of a flow-through test chamber (21x31x26 cm) that contained a smaller chamber of 1/3 the size. Application of the test material was not reported, nor was its preparation. The study author did report using a stock solution. Larval frogs and fathead minnows were exposed in the same larger test chamber, with the fathead minnows placed inside the smaller chamber enclosed within the larger one. The smaller chamber received the exposure water, then flowed through stainless steel mesh sides into the larger chamber.

Two tests were conducted with the frogs and minnows. The first test was conducted with 20 ± 2 days old larval frogs and 28 ± 2 days old fathead minnows. Duplicate measured concentrations of 0

(controls), 17.1 ± 0.9 , 29.5 ± 2.5 , 61.4 ± 5.1 , 130 ± 5.1 , and 253 ± 6.9 mg/L of 2,4-D were used for the larval frogs. Fathead minnows were added 2 days before with measured test concentrations of 0 (controls), 15.2 ± 2.1 , 26.1 ± 5.7 , 57.6 ± 9.6 , 119 ± 16.3 , and 228 ± 33.3 mg/L of 2,4-D. Ten organisms of each species were added per chamber. The stock solution for this first test was not adjusted for pH, therefore the pH of the test solutions and 2,4-D concentrations were inversely rated. The following pH values were reported for each nominal test concentration:

Nominal test concentration	Measured pH
15.5 mg/L	7.23
31.2 mg/L	7.15
62.5 mg/L	6.90
125 mg/L	6.45
250 mg/L	3.72

For the first test, the average temperature for the test duration was $21.9 \pm 0.2^{\circ}\text{C}$. Dissolved oxygen was >80% of water saturation throughout the test.

The second test was conducted with 43 ± 2 days old larval frogs and 27 ± 4 days old fathead minnows. Duplicate measured pH –adjusted concentrations of 0 (controls), 197 ± 11.4 , 332 ± 33.4 , 635 ± 69.9 , 1445 ± 233 , and 2884 ± 168 mg/L of 2,4-D were used for both organisms. Eight larval frogs and ten fathead minnows were added to the appropriate chambers as described. The stock solution was adjusted with 0.1 N sodium hydroxide to raise the pH to 7.0-7.4. The study author reported that addition of the Na^+ ion increased specific conductance from 125 $\mu\text{mhos/cm}$ in the controls to 1,000 $\mu\text{mhos/cm}$ in the highest exposure chambers. The mean water temperature was $21.6 \pm 0.4^{\circ}\text{C}$, and dissolved oxygen was >60% of water saturation throughout the test. The average total hardness was 54.3 ± 3.4 mg/L CaCO_3 , alkalinity was 39.7 ± 8.8 mg/L CaCO_3 , and specific conductance was 360 ± 340 μmhos .

Analytical stock solutions of 2,4-D were prepared by dissolving the test material in acetonitrile. Water samples (in duplicate per treatment level) containing 2,4-D were collected with a pipet from mid-depth in the center of each test chamber. Aliquots were analyzed by HPLC with no prior manipulation or modification. Test chambers were sampled at 0, 48, and 96 hours and one replicate per treatment was sampled at 24 and 72 hours. The average recoveries were $99.8 \pm 0.3\%$ and $99.7 \pm 0.3\%$ for the first and second test, respectively.

The LC_{50} calculations were performed using the Spearman-Kärber method, according to a hand-written note on the first page of the study author's results.

Results

In the first test with non-adjusted pH test solutions, all the test organisms were dead at 24 hours in the highest test level (253 mg a.e./L). No other deaths were observed. The 96-hour LC_{50} values were 181 mg a.e./L for the larval frogs, and 165 mg a.e./L for the juvenile fathead minnows; the 95% confidence intervals could not be calculated by the study author, reportedly due to no partial mortalities.

In the second test with pH-adjusted test solutions, 50% of all the test organisms were dead at 24 hours in the highest test level (2,884 mg a.e./L). By 96 hours, almost all the larval frogs were dead in the

highest test level, and 12.5% were dead in the 1,445 mg/L test level (second highest). No other deaths were observed. The results were as follows:

	LC ₅₀ (mg a.e./L)	95% Confidence Limits
Unadjusted pH solutions		
Larval <i>Rana pipiens</i>	181	Not calculable
Juvenile <i>Pimephales promelas</i>	165	Not calculable
Adjusted pH solutions		
Larval <i>Rana pipiens</i>	1,962	1,657-2,325
Juvenile <i>Pimephales promelas</i>	1,966	1,826-2,116

Description of Use in Document: Qualitative

Rationale for Use: The LC₅₀'s obtained by the authors for juvenile fathead minnows are not the most sensitive when compared to other registrant-submitted and open literature studies. Because freshwater fish data provide more sensitive toxicity values than aquatic-phase amphibian data, the LC₅₀'s obtained by the authors for larval leopard frogs will be used to refine and characterize risks to the aquatic-phase CRLF

Limitations of Study:

The dechlorinated municipal water and dechlorinated lab water were not analyzed for concentrations of pesticides, metals, or other potential toxins. Daily chlorine analysis was not reported.

Total organic carbon and particulate matter were not reported for either water source.

Water hardness was not reported for the dechlorinated municipal water used in the first non-adjusted pH test.

It was not evident if the pH was adjusted before or after the addition of the test material.

The study author did not report when feeding of the test organisms was terminated.

The study author reports no control mortalities in the first test; it is assumed that there were no control mortalities in the second test due to the author's statement that no other deaths occurred.

Details regarding application of the test material were not reported.

The loading rate was not reported.

Culturing and rearing conditions of the test organisms was not adequately described.

Reviewer: Moncie Wright, Staff Scientist, Cambridge Environmental, Inc.

Secondary Reviewer: Anita Ullagaddi, EFED/ERB1

Open Literature Review Summary

Chemical Name(s): 2,4-Dichlorophenoxy Acetic Acid (2,4-D Acid) and its Isooctyl Ester; Dimethylamine Salt; Isobutyl Ester; Sodium Salt; Butoxyethanol Ester; and Butyl Ester

CAS No.: 94-75-7

ECOTOX Record Number and Citation: 93388

Gorzinski, S.J., *et al.* 1987. Acute, Pharmacokinetic, and Subchronic Toxicological Studies of 2,4-Dichlorophenoxyacetic Acid. *Fundam. Appl. Toxicol.* 9:423-435.

Purpose of Review: Litigation/Endangered Species

Date of Review: December 5, 2008

Summary of Study Findings: The acute oral and dermal toxicities of 2,4-dichlorophenoxyacetic acid (2,4-D) and its isooctyl ester, dimethylamine salt, isobutyl ester, sodium salt, butoxyethanol ester, and butyl ester were investigated in Fisher 344 rats. When calculated in salt or ester form, the (single-dose) acute oral LD₅₀ values ranged from 553 mg/kg (isobutyl ester in females) to 1090 mg/kg (dimethylamine salt in males). When converted to the acid equivalent, LD₅₀ values were similar, ranging from 424 mg ae/kg (isobutyl ester in females) to 840 mg ae/kg (sodium salt in females). The acute dermal toxicity of 2,4-D and its esters and salts was assessed in New Zealand white rabbits and was relatively low, exceeding >2000 mg/kg for all test substances.

Pharmacokinetics were studied in male Fischer 344 rats administered single oral doses of [¹⁴C]2,4-D at 10, 25, 50, 100, or 150 mg/kg. 2,4-D was eliminated primarily as unchanged 2,4-D in the urine. The amounts of 2,4-D found in the plasma, kidney, and urine 6 hours post-dosing indicated that the urinary excretion of 2,4-D was saturated in male rats at levels of >50 mg/kg.

Sub-chronic (13-week) studies were conducted in male and female Fischer 344 rats at dietary concentrations of 0, 15, 60, 100, or 150 mg/kg/day of purified (100% purity) or technical-grade (97.3% purity) 2,4-D. Results indicated that the sub-chronic toxicity of the two test materials was comparable. Reduced body weight gains of both sexes were observed at the higher treatment levels. The kidney was the primary target organ; kidney weights were increased in all treated male rats and in female rats given purified 2,4-D at the ≥60 mg/kg levels. Treatment-related mild microscopic cytoplasmic alterations were observed in the renal proximal convoluted tubules of male and female rats at the ≥60 mg/kg levels, and in some females at the 15 mg/kg level. More substantial degenerative changes were also observed in the descending part of the proximal tubules of male rats at the ≥60 mg/kg levels, and in some males at the 15 mg/kg level. Renal alternations were more extensive at the ≥60 mg/kg levels, where saturation of elimination was noted in pharmacokinetic studies, but were not associated with

alterations in urea nitrogen values or urinalysis data. At the 100 and 150 mg/kg levels, minimal swelling and increased staining homogeneity in the liver cells was observed, with associated slight elevations in liver weight and serum glutamic pyruvic transaminase activity. Also at the 100 and 150 mg/kg levels, decreases in total serum tetraiodothyronine (T₄) levels were observed in female, but not male rats; however, the morphology of the thyroid gland was normal. The NOAEL for male and female rats was <15 mg/kg/day for both purified and technical-grade test materials.

Methods:

Acute (Single-Dose) Studies: The test substances (obtained from the Industry Task Force on 2,4-D) used for the acute oral and dermal toxicity studies are presented in Table 1. Each test material was suspended in corn oil, and orally administered to groups of five young adult Fischer 344 rats per sex (Charles River Laboratory, Kingston, NY). The rats were fasted overnight (*ca.* 18 hours) prior to dosing and observed for mortality and clinical signs of toxicity for 2 weeks post-dosing. To assess dermal toxicity, the test materials were applied neat to the shorn abdominal skin (4-cm²) of young adult New Zealand white rabbits (Kuiper's Rabbit Ranch, Gary, IN or Langshaw Farms, Augusta, MI). Prior to application, the skin of one-half of the animals was abraded with a hypodermic needle. The test sites were occluded with gauze and the torso of each animal wrapped during the 24-hour exposure period. After 24 hours, the wrapping and residual test materials were removed, and the animals were observed for mortality and clinical signs of toxicity for 2 weeks.

Single-Dose Oral Pharmacokinetic Studies: A mixture of uniformly ring-labeled [¹⁴C]2,4-D (radiochemical purity 99%, specific activity 4.71 mCi/mmol, Pathfinder Labs, St. Louis, MO) and unlabeled 2,4-D acid (purity 99.9%, the Industry Task Force on 2,4-D) was prepared, converted to its sodium salt, and administered in an aqueous solution via oral gavage. Groups of six fasted (*ca.* 12 hours) adult male Fischer 344 rats (260 ± 8 g mean weight) were administered single doses at nominal concentrations of 10, 25, 50, 100, or 150 mg/kg per level. Food was returned 4 hours post-dosing. The concentrations of labeled and unlabeled 2,4-D in the dosing solutions were adjusted such that the targeted dose was administered in 5 mL/kg bw and each rat received *ca.* 5 µCi of radioactivity.

Six hours post-dosing, blood, kidneys, and all excreted urine (during the first 6 hours) were collected. Plasma was isolated using centrifugation, and blood plasma and urine were directly analyzed for total radioactive residues using LSC. Kidneys were oxidized and the resultant ¹⁴CO₂ was analyzed using LSC. Urine samples were analyzed for 2,4-D using reverse-phase HPLC equipped with UV detection. The HPLC procedural recovery efficiency was 98% of the applied radioactivity.

Additional groups of two rats per level were administered [¹⁴C]2,4-D at nominal levels of 10 or 150 mg/kg; urine was collected for 12 hours and analyzed for 2,4-D using HPLC.

Sub-chronic (13-Week) Dietary Studies: Technical-grade 2,4-D acid (97.3% purity; obtained from The Dow Chemical Company, Midland, MI) was re-crystallized once from ethyl benzene and twice from per-chloroethylene and vacuum-dried to produce purified 2,4-D (100% purity). Pre-mixes of the technical-grade and purified test substances were in Certified Purina Laboratory Chow No. 5002 (Ralston Purina Co., St. Louis, MO) at 1% (w:w). Serial dilutions were made using additional basal

diet and heavy-duty paddle mixers. Diets were prepared weekly, and adjusted according to group mean body weights and food consumption values to maintain concentrations levels on a mg/kg/day basis. Concentration verification was performed on the treated diets twice during each of the studies.

Four-week old male and female Fischer 344 rats (obtained from Charles River Breeding Laboratories, Inc., Wilmington, MA) were acclimated to laboratory conditions for 10 days. Although procured rats were the same age, the study using technical-grade 2,4-D was initiated 6 days prior to the start of the study using purified 2,4-D. One day prior to testing, rats were weighed and randomly assigned to test groups. Rats were housed individually in suspended, stainless steel cages and provided food and municipal tap water *ad libitum* throughout the studies. Animal rooms were maintained at *ca.* 22°C, 50% relative humidity, 10 air changes/hour, and on a 12-hour light/12-hour dark photoperiod.

Groups of 15 rats/sex/level were administered technical-grade or purified 2,4-D in the diet at nominal concentrations of 0 (control), 15, 60, 100, or 150 mg/kg/day for 13 weeks. Signs of toxicity were monitored daily.

Serum samples were obtained from cervical blood vessels of all animals at necropsy. Serum biochemistry determinations included urea nitrogen, glutamic pyruvic transaminase activity (SGPT), alkaline phosphatase activity (AP), glucose, total protein, albumin, globulin, and total thyroxine (tetraiodothyronine, T₄).

Blood samples were obtained 2 weeks prior to study termination from the orbital sinus of 10 rats/sex from the control and 150 mg/kg/day levels. Hematological determinations included packed cell volume, hemoglobin, red blood cell count, total white blood cell count, and white cell differential counts. Concurrently, urinalyses were conducted on the same rats and included specific gravity, and a semi-quantitative estimation of pH, glucose, protein, ketones, bilirubin, occult blood, and urobilinogen.

Rats were fasted overnight prior to study termination. All animals were subjected to a complete necropsy, and organ weights were obtained for the brain, heart, liver, kidneys, thymus, and testes. Preserved tissues from all organ systems of 10 rats/sex treated with technical-grade 2,4-D at the control and 150 mg/kg/day levels were examined microscopically. In addition, preserved sections of liver, kidneys, lungs, thyroid, and trachea from 10 rats/sex from the 15 and 60 mg/kg/day levels were examined microscopically. Histopathological examination was confined to the liver and kidneys (target organs) from 10 rats/sex/group treated with purified 2,4-D.

Statistical evaluation: Acute oral and dermal LD₅₀ values with associated 95% C.I. were calculated by the method of Litchfield and Wilcoxon (1949) or of Thompson and Weil (1952). ANOVA was used to evaluate body weight (including fasted values), food consumption, clinical biochemical values, appropriate hematological parameters, urine specific gravity, and absolute and relative organ weights. Differences between the treated and corresponding control groups were analyzed using Dunnett's test at $\alpha = 0.05$. Outlying values for body weight and food consumption data were identified using a sequential outlier method. Body weights, organ weights, clinical biochemical values, appropriate hematological parameters and urine specific gravity were also analyzed by two-way ANOVA to

determine whether the pattern of effects observed in the target organs were similar between the two test materials. No significant or meaningful dose-compound interaction was observed.

Results:

Acute (Single-Dose) Studies: Results from the acute oral toxicity tests are presented in Table 1. Acute oral LD₅₀ values were generally similar between the sexes and ranged from 553 mg/kg (isobutyl ester in females) to 1090 mg/kg (dimethylamine salt in males). Correction for the purity and acid equivalent of 2,4-D in the test substances revealed highly consistent oral LD₅₀ values. The acute dermal LD₅₀ for all compounds was >2000 mg/kg. Mortality was observed only with the dimethylamine salt of 2,4-D applied to abraded skin, and the acute dermal LD₅₀ was estimated at 2244 mg/kg.

Table 1. Single Dose Oral LD₅₀ Results for Technical-Grade 2,4-D Acid, Esters, and Salts of 2,4-D in Rats.

Test Material	Acid Equivalent ^(a)	Percent active ingredient (ai)	LD ₅₀ ± 95% C.I. (mg/kg)			
			Male		Female	
			Material tested	Acid equivalent ^(b)	Material tested	Acid equivalent ^(b)
2,4-D acid		95.0	639 (555-736)	607	764 (663-879)	726
Isooctyl ester	66.4	94.0	982 (865-1114)	612	>720 to <864 ^(c)	
Dimethylamine salt	83.7	67.9	1090 (959-1241)	619	863 (816-913)	490
Isobutyl ester	79.8	96.1	700 (652-751)	536	553 (513-597)	424
Sodium salt	94.9	90.8	876 (671-1143)	754	975 (856-1111)	840
Butoxyethanol ester	65.6	97.1	887 (810-951)	564	831 (688-1002)	565
Butyl ester	79.8	98.6	732 (593-904)	575	600 (545-798)	519

^(a) Ratio of 2,4-D molecular weight to test material molecular weight x 100.

^(b) Acid equivalent LD₅₀ = acid equivalent x percentage active x material tested ÷ 10,000.

^(c) Not calculable.

Single-Dose Oral Pharmacokinetic Studies: The concentrations of ¹⁴C in plasma and urine of rats 6 hours following administration of a single oral dose of [¹⁴C]2,4-D at nominal levels of 10, 25, 50, 100, or 150 mg/kg are presented in Figure 1. The amounts of radioactivity in the plasma and urine were proportional to the dose in rats at the ≤50 mg/kg levels; however, the concentration of radioactivity in the plasma was higher than expected and that in the urine was lower than expected in rats from the 100 and 150 mg/kg levels (based on the data from lower levels).

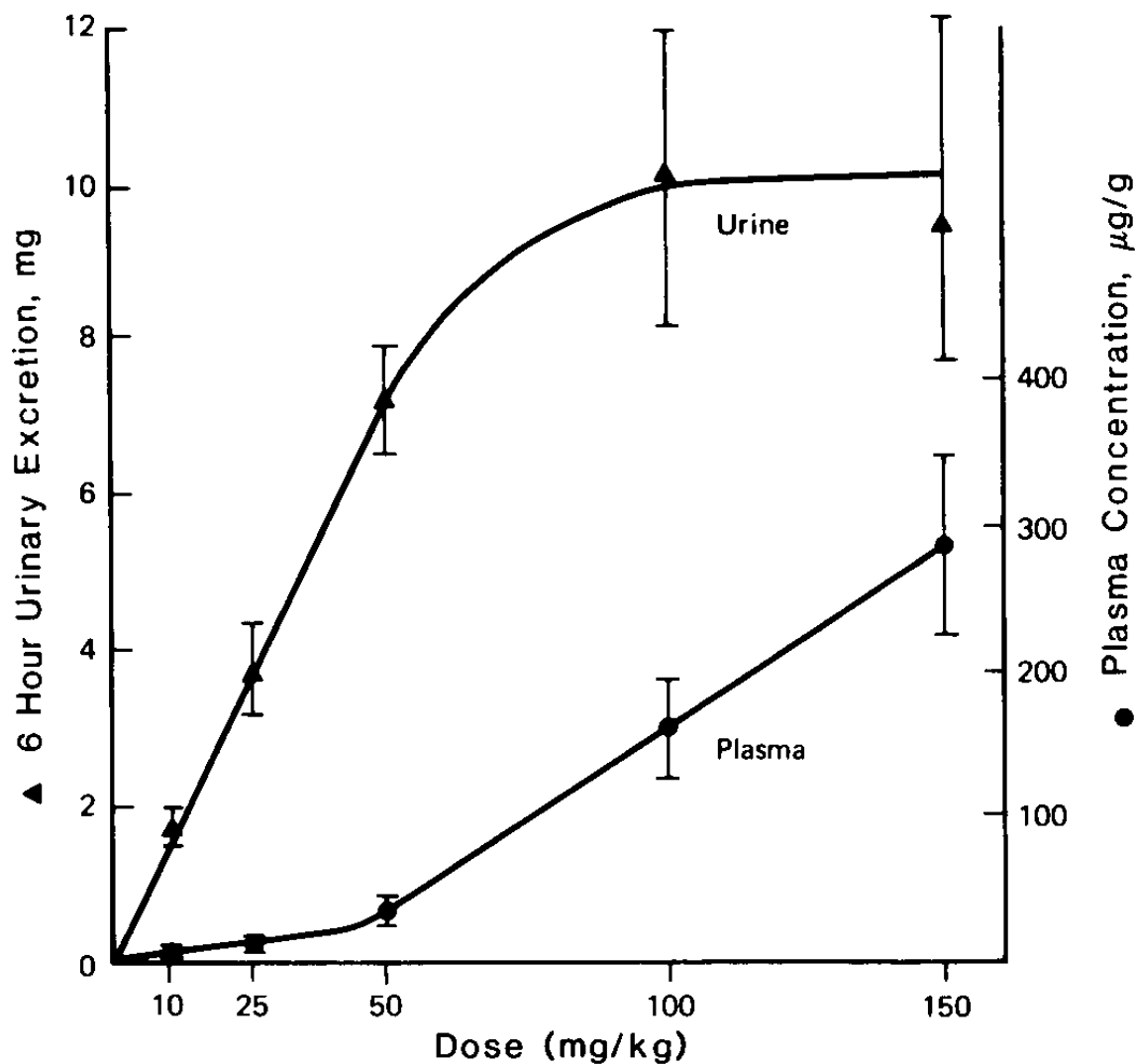


Figure 1. Plasma ^{14}C concentrations and amounts of ^{14}C excreted in the urine 6 hours after various single oral doses of [^{14}C]2,4-D. Each data point represents the means $\pm$ SD of six rats. Solid lines are drawn by inspection.

The concentrations of radioactivity in the kidneys did not increase in proportion to the levels of radioactivity in the plasma (Figure 2). The kidneys contained 6.6, 5.5, 3.7, 2.1, and 1.6 times the concentration of radioactivity found in the plasma from rats given 10, 25, 50, 100, or 150 mg/kg, respectively. These data, in conjunction with the plasma and urine data, indicate that organic acid transport system was saturated in rats given ≥ 50 mg/kg, and that the amount of 2,4-D in the rat will increase disproportionately at doses above 50 mg/kg. Consequently, the dose-response curve for 2,4-D would be expected to increase disproportionately.

Based upon data from the supplemental treatment groups, it was determined that all radioactivity excreted during the first 12 hours following oral administration of 10 or 150 mg/kg [^{14}C]2,4-D eluted from the HPLC column as a single peak with the same retention time as 2,4-D.

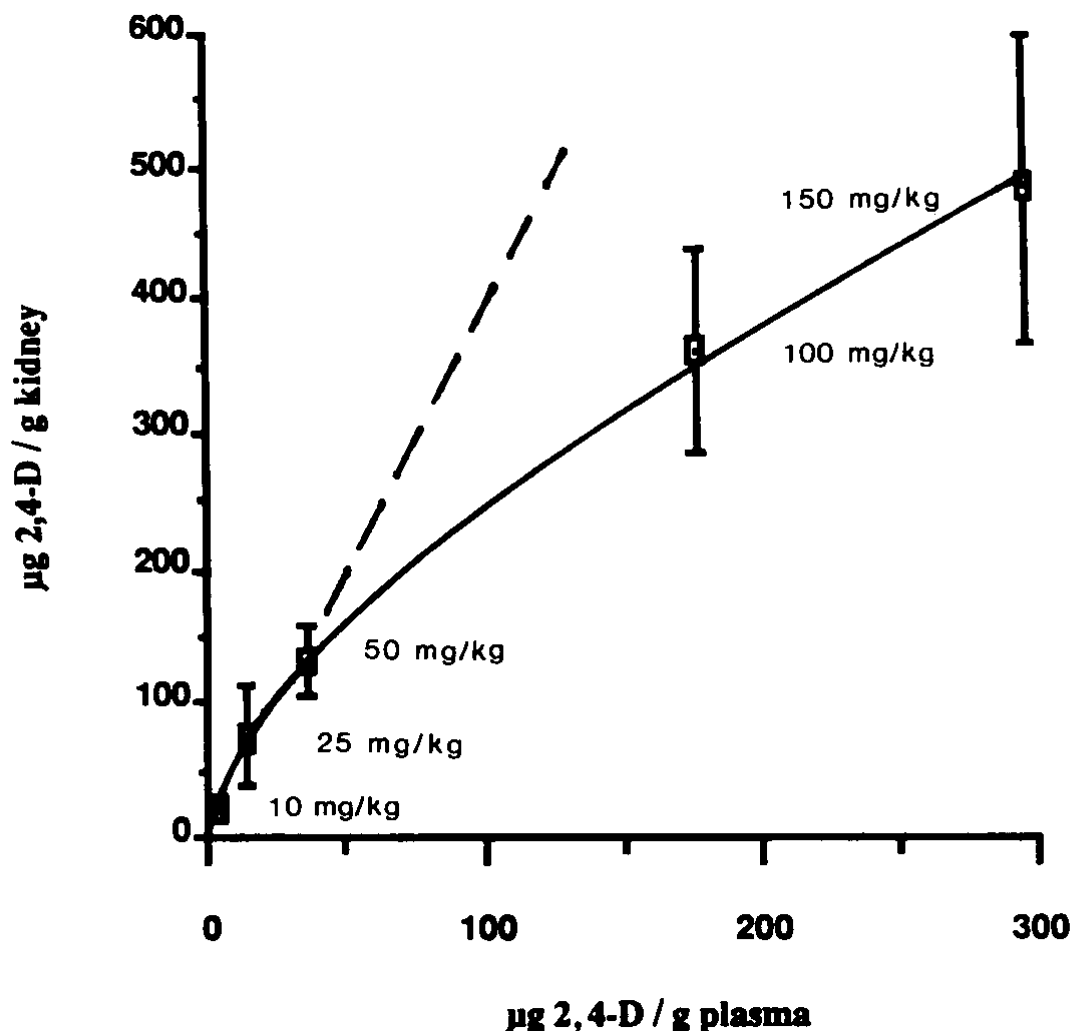


Figure 2. Kidney concentrations versus plasma concentrations of ^{14}C 6 hours after rats were given various doses of [^{14}C]2,4-D. Each data point represents the means $\pm$ SD kidney concentration versus the mean plasma concentration for six rats at each dose level. The solid line is drawn by inspection. The dashed line indicates the anticipated kidney concentrations if the kinetics of 2,4-D had remained first order.

Sub-chronic (13-Week) Dietary Studies: Analysis of the treated diets indicated that actual concentrations of 2,4-D in treated diets were 88 to 105% of target values. Overall, results from both test substances were comparable. No mortality was observed during the study, and no treatment-related signs of toxicity were indicated. Slight decreases in food consumption (not statistically-significant) were observed for male and female rats at the 150 mg/kg/day level for both test substances, in conjunction with statistically-significant reductions ($\alpha = 0.05$) in body weight gains for these animals (Table 2). Statistically-significant reductions ($\alpha = 0.05$) in body weight gain were also observed during the purified 2,4-D study in 60-mg/kg/day females and 100-mg/kg/day males and females.

Table 2. Body Weight Gain and Food Consumption for Rats Fed Purified or Technical-grade 2,4-D for 13 Weeks.

Parameter		Dose level (mg/kg/day)				
	Sex	0	15	60	100	150
Purified 2,4-D						
Body weight (g) ^(a)	Male	174 ± 12	174 ± 10	166 ± 9	162 ± 11*	150 ± 13*
	Female	73 ± 6	71 ± 7	65 ± 5*	65 ± 6*	57 ± 5*
Food consumption (g/rat/day) ^(b)	Male	17 ± 1.7	18 ± 1.4	17 ± 1.4	17 ± 1.3	16 ± 1.4
	Female	13 ± 2.7	13 ± 1.2	14 ± 1.6	12 ± 1.0	12 ± 1.2
Technical-grade 2,4-D						
Body weight (g) ^(a)	Male	208 ± 15	207 ± 5	199 ± 13	197 ± 13	189 ± 9*
	Female	82 ± 6	85 ± 5	80 ± 6	71 ± 19	65 ± 7*
Food consumption (g/rat/day) ^(b)	Male	18 ± 1.8	18 ± 2.3	18 ± 2.3	17 ± 1.5	17 ± 1.4
	Female	13 ± 1.7	13 ± 1.3	13 ± 1.2	12 ± 1.3	11 ± 1.1

^(a) Means ± SD for 15 rats/sex/group.

^(b) Means ± SD of the weekly group means.

* Statistically-significant difference from the control, $\alpha = 0.05$, two-sided.

Serum tetraiodothyronine (T4) level results were variable, and are presented in Figure 3. In males, statistically-significant increases ($\alpha = 0.05$) from the control were observed at the 15 and 60 mg/kg/day levels for the purified test material and at the 100 mg/kg/day level for both test compounds. No statistically-significant differences from the control were observed in males at the 150 mg/kg/day level for either compound. In females, statistically-significant increases ($\alpha = 0.05$) from the control were observed at the 15 and 60 mg/kg/day levels for the technical-grade material, while statistically-significant decreases ($\alpha = 0.05$) from the control were observed at the 60 mg/kg/day level for the purified material, and at the 100 and 150 mg/kg/day levels for both test compounds.

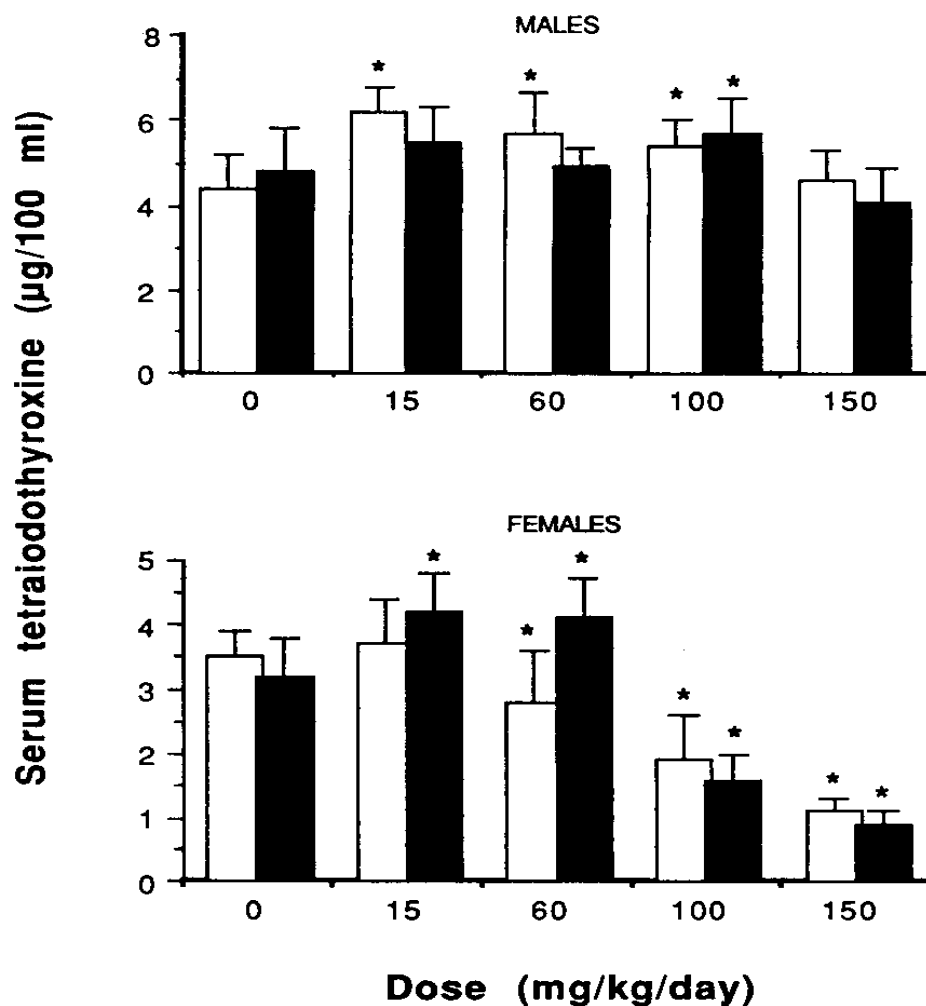


Figure 3. Serum tetraiodothyronine results for male and female rats fed purified (open bars) or technical-grade (solid bars) 2,4-D for 13 weeks. Data present mean and SD for 15 rats/group; *statistically identified difference from control value, $\alpha = 0.05$.

Other statistically-significant differences from controls were identified, but were reportedly only slightly different from control values (actual data not reported; Table 3). There were no treatment-related effects observed in any hematological or urinary parameter.

Table 3. Statistically-Significant Differences in Serum Biochemistry Parameters in Rats Fed Purified or Technical-grade 2,4-D for 13 Weeks.

Parameter		Dose level (mg/kg/day)				
	Sex	0	15	60	100	150
Purified 2,4-D						
SGPT	Male					↑*
	Female				↑*	
Albumin	Male					
	Female					↑*
Technical-grade 2,4-D						
SGPT	Male					↑*
	Female				↑*	↑*
Total protein	Male					
	Female					↑*
Albumin	Male					
	Female				↑*	↑*

* Statistically-significant difference from the control, $\alpha = 0.05$, two-sided.

Body and organ weight data are presented in Table 4. Body weights were significantly reduced compared to controls ($\alpha = 0.05$) for males and females treated at 150 mg/kg/day with either the purified or technical-grade 2,4-D, and for females treated at 60 mg/kg/day with the purified test substance.

Table 4. Mean Final Body and Organ Weights for Rats Fed Purified or Technical-Grade 2,4-D for 13 Weeks.^(a)

Dose level (mg/kg/day)	Fasted body weight (g)	Liver		Kidney	
		(g)	(g/100 g)	(g)	(g/100 g)
Purified 2,4-D					
Males – 0	300	7.94	2.65	2.13	0.71
15	301	8.13	2.70	2.25	0.75*
60	296	7.74	2.62	2.30*	0.78*
100	288	7.54	2.61	2.34*	0.81*
150	279*	7.15*	2.56*	2.19	0.79*
Females – 0	169	4.37	2.58	1.25	0.74
15	170	4.39	2.58	1.27	0.75
60	161*	4.34	2.70*	1.28	0.80*
100	163	4.40	2.70*	1.34*	0.82*
150	155*	4.33	2.79*	1.31	0.84*
Technical-grade 2,4-D					
Males – 0	310	8.37	2.70	2.18	0.70
15	311	8.38	2.69	2.29	0.74*
60	302	8.08	2.68	2.34*	0.77*
100	299	8.20	2.75	2.39*	0.80*
150	292*	7.72*	2.64	2.31*	0.79*
Females – 0	167	4.33	2.59	1.28	0.77
15	168	4.42	2.63	1.30	0.77
60	166	4.35	2.63	1.31	0.79
100	161	4.22	2.63	1.30	0.81
150	148*	4.29	2.90*	1.25	0.85*

^(a) Means for 15 rats/group.

* Statistically-significant difference from the control using Dunnett's test, $\alpha = 0.05$.

The relative liver weights of rats were statistically-increased in females given purified 2,4-D at 60, 100, or 150 mg/kg/day or technical-grade 2,4-D at 150 mg/kg/day (Table 4). Male rats administered either test compound at 150 mg/kg/day had decreased relative liver weights associated with decreases in body weight (with statistical significance observed in the purified 2,4-D 150 mg/kg/day level). Light microscopy revealed minor swelling and increased cytoplasmic homogeneity of hepatocytes, primarily in rats of both sexes administered 100 or 150 mg/kg/day of either test substance (Table 5); the responses, however, were considered nonspecific and minor.

Table 5.

HISTOPATHOLOGICAL RESULTS^a IN THE KIDNEY AND THE LIVER OF FISCHER 344 RATS FED
PURIFIED OR TECHNICAL-GRADE 2,4-D FOR 13 WEEKS

		Dose level (mg/kg/day)									
		0		15		60		100		150	
		P ^b	T	P	T	P	T	P	T	P	T
Kidney											
Males											
Increased epithelial cytoplasmic homogeneity, proximal convoluted tubules											
Diffuse		1	0	0	0	0	0	4	1	10	10
Multifocal to focal		3	0	2	0	6	8	6	9	0	0
Degeneration, descending proximal tubules											
Multifocal, moderate		0	0	0	0	1	2	7	9	10	10
Multifocal, slight		0	0	1	2	9	8	3	1	0	0
Females											
Epithelial cytoplasmic vacuolization, proximal convoluted tubules											
Multifocal, slight		1	0	4	0	10	7	10	9	10	10
Liver											
Males											
Swelling and increased homogeneity, hepatocytes											
Diffuse, slight		0	0	0	0	0	0	0	0	0	8
Diffuse, very slight		0	0	0	0	0	0	3	3	4	1
Females											
Swelling and increased homogeneity, hepatocytes											
Diffuse, slight		0	0	2	0	1	0	2	0	4	8
Diffuse, very slight		1	0	1	0	1	0	5	3	5	0

^a Pathology data presented as number of rats affected out of a group size of 10 per sex.

^b P indicates purified material; T indicates technical-grade material.

The kidney was the primary target organ. The relative kidney weights of male rats were statistically-increased at all dose levels compared to the controls in both the purified and technical-grade 2,4-D studies (Table 4). In females, the relative kidneys weights were statistically-increased in rats given purified 2,4-D at 60, 100, and 150 mg/kg/day. In addition, the relative kidney weight of female rats given technical-grade 2,4-D at 150 mg/kg/day was statistically-increased compared to the control; however, this difference may have been due to the lower mean body weight of this group, rather than a direct treatment-related effect. Light microscopy revealed treatment-related changes in the proximal convoluted tubules in rats of both sexes following treatment with both test materials. Changes were characterized as increased epithelial cytoplasmic homogeneity in male rats and increased cytoplasmic vacuolization in female rats. Furthermore, multifocal degeneration in the descending part of the proximal tubules was present in all male rats at the 60, 100, and 150 mg/kg/day levels, and some male rats at the 15 mg/kg/day level. The degeneration consisted of basophilic epithelial cells that were crowded due to decreased cytoplasm, and was accompanied by thickened basement membranes and interstitial fibrosis. Yellow-brown pigment (probably lipofuscin) was also observed in the cytoplasm

of some cells. In general, the degeneration involved only a portion of the circumference of an affected tubule.

Other than those described for the kidneys and liver, there were no treatment-related findings following detailed histologic examination of an extensive set of tissues. There were no treatment-related microscopic changes in the brain, spinal cord, or peripheral nerve of rats from any treatment group. Furthermore, there was no histologic correlate to the decreased T₄ values for the female, i.e., thyroid tissues were normal.

Description of Use in Document (QUAL, QUAN, INV): Qualitative

Rationale for Use:

1) LD₅₀s in this paper were less sensitive than those provided by the registrant and used for acute risk estimation for mammals.

2) Mortality and other symptoms in controls were not presented in the paper. This level of uncertainty precludes use of these endpoints in quantitative risk calculations. However, these data and toxicity relative to the endpoints used in the assessment can be discussed in the characterization.

Limitations of Study:

It was reported that statistical analyses were considered exploratory as there were no predefined hypotheses. The authors reported that the frequency of false-positive (Type I) errors was unknown because numerous measurements were statistically compared on the same set of animals; however, the frequency was greater than the nominal alpha level.

Primary Reviewer: Christie E. Padova, Dynamac Corporation

Secondary Reviewer: Christine Hartless, Wildlife Biologist, EFED/ERB1

Open Literature Review Summary

Chemical Name: 2,4-Dichlorophenoxy Acetic Acid (2,4-D) and the major metabolite 2,4-Dichlorophenol (2,4-DCP)

CAS No.: 94-75-7

ECOTOX Record Number and Citation: 93505

Amer, S.M., and F.A.E. Aly. 2001. Genotoxic effect of 2,4-dichlorophenoxy acetic acid and its metabolite 2,4-dichlorophenol in mouse. *Mutation Research* 494:1-12.

Purpose of Review: Litigation/Endangered Species

Date of Review: December 1, 2008

Summary of Study Findings: Male Swiss mice were administered 2,4-dichlorophenoxy acetic acid (2,4-D) via oral gavage for up to five consecutive days at 1.7, 3.3, or 33 mg/kg bw (equivalent to 1/200, 1/100, or 1/10 of LD₅₀, respectively) or its major metabolite 2,4-dichlorophenol (2,4-DCP) via intraperitoneal (ip) injection for up to five consecutive days at 36, 72, or 180 mg/kg bw (1/10, 1/5, or 1/2 of LD₅₀, respectively), and the cytogenetic effects of these compounds were studied in bone marrow and spermatocytes after 1, 2, and/or 7 days. To assess sperm-head abnormalities, 2,4-D was administered via oral gavage to mice for five consecutive days at 3.3, 33, and 82.5 mg/kg bw, and 2,4-DCP was administered via ip injection to mice for five consecutive days at 36, 72, and 180 mg/kg bw; animals were sacrificed 35 days following administration of the first dose.

Results indicate that 2,4-D is genotoxic in mice in vivo under the conditions of the study. Statistically-significant increases in chromosome aberrations in bone marrow and spermatocyte cells were observed following oral administration of 2,4-D at 3.3 mg/kg bw per day for three and five consecutive days, with maximums of 8.8 and 7.6% aberrations in bone marrow and spermatocyte cells after five days, respectively. Following a single oral administration of 2,4-D at 33 mg/kg bw, statistically-significant increases in chromosome aberrations of 10.8% ($p < 0.01$) and 9.8% ($p < 0.01$) were observed in bone marrow and spermatocyte cells, respectively. It was observed that the percentages of aberrations decreased with time. The most common type of abnormalities in spermatocytes was the presence of univalents. No statistically-significant effect on bone marrow or spermatocyte cells was indicated following up to five consecutive daily treatments with 2,4-D at the lowest tested level of 1.7 mg/kg bw per day. 2,4-D induced a dose-dependent increase in the percentage of sperm-head abnormalities; increases were statistically-significant at the 33 ($p < 0.05$) and 82.5 mg/kg bw ($p < 0.01$) levels compared to the control (6.93 and 8.56% compared to 4.05% for the control).

Results indicated that the genotoxic effect of 2,4-DCP was weaker than that of 2,4-D. Statistically-significant increases in chromosome aberrations in bone marrow of 7.2% ($p < 0.05$) and in spermatocyte cells of 7.0% ($p < 0.05$) were observed following a single ip injection of 2,4-DCP at 180 mg/kg bw. No

other statistically-significant differences from the controls were indicated at the lower treatment levels following up to five consecutive daily injections. Similarly, only the highest 2,4-DCP treatment level (180 mg/kg bw) induced statistically-increased ($p < 0.05$) sperm-head abnormalities (6.27% versus 3.11% for the control).

Methods:

Male Swiss mice were obtained from a closed random-bred colony at the National Research Center and placed on study at 9 to 12 weeks of age. Food and water (not further specified) were provided *ad libitum*.

The acute oral LD₅₀ of 2,4-dichlorophenoxy acetic acid (2,4-D) was reported in literature as 330 mg/kg bw. The acute intraperitoneal (ip) injection LD₅₀ of 2,4-dichlorophenol (2,4-DCP) was determined experimentally to be 360 mg/kg bw. Administration of 2,4-DCP via i.p. was found to be more effective than oral gavage in eliciting cytotoxicity and genetic toxicity, and therefore was used for 2,4-DCP administration. 2,4-D was administered orally via gavage.

Chromosome aberrations in somatic and germ cells: 2,4-D (98% purity) was dissolved in distilled water and administered via oral gavage to mice at 1.7, 3.3, and 33 mg/kg bw, corresponding to 1/200, 1/100, and 1/10 of the LD₅₀, respectively. The 1.7- and 3.3-mg/kg treatments (two lowest dosages) were repeated for 3 and 5 consecutive days. To monitor aberrations in bone-marrow, mice were sacrificed 1 and 2 days following treatment. To monitor aberrations in spermatocytes, animals were sacrificed and testes preparations made 1, 2, and 7 days following treatment. Similarly, 2,4-DCP (purity not reported) was administered in distilled water via ip injection at 36, 72, and 180 mg/kg bw, corresponding to 1/10, 1/5, and 1/2 of the LD₅₀, respectively. The 36-mg/kg treatment (lowest dosage) was repeated for 3 and 5 consecutive days, and mice were sacrificed 24 hours following the final treatment for bone-marrow and spermatocyte measurements. Untreated mice served as a negative control, and mice ip injected with mitomycin C at 1 mg/kg bw served as a positive control.

Sperm-head abnormalities: 2,4-D was administered via oral gavage to mice for 5 consecutive days at 3.3, 33, and 82.5 mg/kg bw, and 2,4-DCP was administered via ip injection to mice for 5 consecutive days at 36, 72, and 180 mg/kg bw. Animals were sacrificed 35 days following administration of the first dose. Untreated mice served as a negative control, and mice ip injected with mitomycin C at 1 mg/kg bw served as a positive control.

Slide preparation: Ca. 2 to 3 hours prior to sacrifice, mice were ip injected with cochicine. Bone marrow metaphases were prepared according to the method of Yosida and Amano [*Misima chromosoma* 16 (1965) 658-667]. Meiotic chromosome preparations were made according to the air-drying method of Evans *et al.* [*Cytogenetics* 3 (1964) 289-294]. Slides were stained with 7% Giemsa in phosphate buffer (pH 6.8). For sperm-head abnormalities, mice were sacrificed, and the epididymides were excised and minced in 2.2% isotonic sodium citrate solution. Smears were prepared after staining with Eosin Y.

Scoring: Groups of five mice were tested for each treatment and approximately 100 well-spread metaphases per animal were analyzed for chromosome aberrations. Aberrations recorded in bone marrow cells included gaps, fragments, and/or breaks, Robertsonian translocations, and poly-ploid metaphases. Aberrations recorded in diakinesis-metaphase I cells included sex-chromosomal univalents (X-Y), autosomal univalents, fragments or breaks, and translocations. At least 500 sperms per animal were assessed for morphological abnormalities.

Statistics: Treatment groups were compared to controls using the *t*-test ($p < 0.05$ and $p < 0.01$ levels of significance).

Results:

2,4-D:

To simulate potential human environmental exposure and to ensure that low concentrations of 2,4-D have no damaging effect on the chromosomes, multiple doses were tested at the 1.7 and 3.3 mg/kg bw levels (equivalent to 1/200th and 1/100th the LD₅₀). These levels were tested for up to five consecutive days. The 33 mg/kg bw level was tested once, and was considered an exploratory dose (equivalent to 1/10th the LD₅₀).

Bone marrow: A dose-dependent increase in chromosomal aberrations was observed following oral administration of 2,4-D at 1.7, 3.3, or 33 mg/kg bw (single and/or multiple treatments), and percentages of aberrations decreased with time (24 to 48 hours post-dosing; Table 1). Twenty-four hours following the first dose, the percentages of metaphases with chromosomal aberrations was 6.0, 6.8, and 10.8% for the 1.7, 3.3, and 33 mg/kg bw levels, respectively, compared to 4.6-4.8% for controls; the difference between the control and the 33 mg/kg bw level was statistically-significant ($p < 0.01$). Forty-eight hours following the first dose, the percent of aberrations was 8.2% at the 33 mg/kg bw level, remaining statistically-increased ($p < 0.01$).

No statistically-significant differences in chromosomal aberrations of bone marrow were observed following up to five consecutive daily treatments at 1.7 mg/kg bw per day (Table 1). At the 3.3 mg/kg bw level, multiple oral treatments resulted in statistically-significant increases in chromosomal aberrations (both including and excluding metaphases with gaps). Twenty-four hours following the third and fifth daily treatments at 3.3 mg/kg bw, the percent of metaphases with chromosomal aberrations was 7.4% ($p < 0.05$) and 8.8% ($p < 0.01$), respectively; although lower, the differences remained statistically-increased compared to controls at 48 hours.

Induced structural and numerical aberrations in bone marrow cells included chromatid gaps, fragments, breaks, deletions, Robertsonian translocations, and tetraploid metaphases.

Spermatocytes: A dose-dependent increase in chromosomal aberrations was observed following oral administration of 2,4-D at 1.7, 3.3, or 33 mg/kg bw (single and/or multiple treatments), and percentages of aberrations decreased with time (1, 2, and 7 days post-dosing; Table 2). One day

following the first dose, the percentages of chromosomal aberrations was 5.2, 6.0, and 9.8% for the 1.7, 3.3, and 33 mg/kg bw levels, respectively, compared to 4.0-4.4% for controls; the difference between the control and the 33 mg/kg bw level was statistically-significant ($p < 0.01$). Two days following the first dose, the percent of aberrations was 7.8% at the 33 mg/kg bw level, remaining statistically-increased ($p < 0.05$). One week following the first dose, the percent was 5.2% at the 33 mg/kg bw level, with no statistical significance observed.

No statistically-significant differences in chromosomal aberrations of spermatocytes were observed following up to five consecutive daily treatments at 1.7 mg/kg bw per day (Table 2). At the 3.3 mg/kg bw level, multiple oral treatments resulted in statistically-significant increases in chromosomal aberrations through 2 days following treatment. One day following the third and fifth daily treatments at 3.3 mg/kg bw, the percent of chromosomal aberrations in spermatocytes was 7.2% ($p < 0.01$) and 7.6% ($p < 0.01$), respectively; percentages decreased over time (to 1 week post-dosing), although differences from the control remained statistically significant after 2 days (both levels).

The majority of chromosome aberrations in spermatocyte cells were the separation of univalents. However, the frequency of X-Y univalents was higher than autosomal univalents. The incidences of gaps, fragments, or breaks was low, and few diakinesis-metaphase I cells with chain IV were observed.

Table 1

Number and mean percentage of chromosome aberrations in mouse bone-marrow after oral treatment by gavage with different doses of 2,4-D

Treatment and doses	Treatment number	Mice killed after (h)	Number of cells counted	Chromosome aberration		Number of metaphases with				
				Including gaps (mean% $\pm$ S.E.)	Excluding gaps (mean% $\pm$ S.E.)	Chromatid gap	Fragment and/or break	Chromatid gap + fragment or break	Robertsonian translocations	Poly-ploidy
Mitomycin C	–	–	500	27.8 $\pm$ 0.91**	22.2 $\pm$ 0.66	27	66	33	8	5
i.p. injection with 1 mg kg ⁻¹ BW										
Positive control										
2,4-D										
1.7 mg kg ⁻¹ BW	One	24	500	6.0 $\pm$ 0.24	3.8 $\pm$ 0.37	11	17	–	–	4
	Three	24	500	6.4 $\pm$ 0.45	4.8 $\pm$ 0.51	8	20	–	–	2
	Five	24	500	7.0 $\pm$ 0.51	5.2 $\pm$ 0.87	9	19	3	2	2
Control (non-treated)			500	4.8 $\pm$ 0.58	2.4 $\pm$ 0.39	12	12	–	–	–
3.3 mg kg ⁻¹ BW	One	24	500	6.8 $\pm$ 0.73	4.6 $\pm$ 0.73	11	16	1	4	2
		48	500	6.4 $\pm$ 0.60	4.2 $\pm$ 0.97	11	16	2	3	–
	Three	24	500	7.4 $\pm$ 0.60*	5.4 $\pm$ 0.79*	10	20	3	3	1
		48	500	7.0 $\pm$ 0.84*	5.2 $\pm$ 0.37*	9	18	3	2	3
	Five	24	500	8.8 $\pm$ 0.87**	6.6 $\pm$ 0.79**	11	20	5	5	3
		48	500	8.2 $\pm$ 0.48**	6.0 $\pm$ 0.69*	11	20	4	3	3
Control (non-treated)			500	4.6 $\pm$ 0.68	2.6 $\pm$ 0.57	10	12	–	–	1
33 mg kg ⁻¹ BW	One	24	500	10.8 $\pm$ 0.87**	7.0 $\pm$ 0.67**	19	20	5	5	5
		48	500	8.2 $\pm$ 0.82**	5.6 $\pm$ 0.75*	13	16	6	4	2
Control (non-treated)			500	4.8 $\pm$ 0.36	2.8 $\pm$ 0.57	10	14	–	–	–

* Significant at 0.05 level.

** Significant at 0.01 level.

Table 2

Number and mean percentage of chromosome aberrations in mouse spermatocytes after oral treatment by gavage with different doses of 2,4-D

Treatment and doses	Treatment number	Mice killed after (h)	Number of cells counted	Chromosome aberration (mean% $\pm$ S.E.)	Number of metaphase with				
					Autosomal univalents	X-Y univalents	Autosomal + X-Y univalents	Fragment or break	Gap Chain IV
Mitomycin C	–	–	500	20.8 $\pm$ 0.98**	25	39	10	26	4 –
i.p. injection with 1 mg kg ⁻¹ BW									
Positive control									
2,4-D									
1.7 mg kg ⁻¹ BW	One	24	500	5.2 $\pm$ 0.97	8	12	–	2	4 –
	Three	24	500	6.0 $\pm$ 0.58	11	16	–	2	– 1
	Five	24	500	6.6 $\pm$ 0.74	13	14	2	–	2 2
Control (non-treated)			500	4.4 $\pm$ 0.60	9	13	–	–	– –
3.3 mg kg ⁻¹ BW	One	24	500	6.0 $\pm$ 0.81	8	18	–	2	2 –
		48	500	5.6 $\pm$ 0.58	11	17	–	–	– –
	Three	24	500	7.2 $\pm$ 0.44**	12	16	–	5	2 1
		48	500	6.6 $\pm$ 0.57*	10	20	2	1	– –
		One week	500	5.8 $\pm$ 0.66	10	15	–	–	4 –
	Five	24	500	7.6 $\pm$ 0.51**	14	14	2	7	– 1
Control (non-treated)		48	500	7.2 $\pm$ 0.48**	10	17	2	2	3 2
33 mg kg ⁻¹ BW		One week	500	5.6 $\pm$ 0.46	8	12	–	4	3 1
		–	500	4.0 $\pm$ 0.73	10	10	–	–	– –
Control (non-treated)	One	24	500	9.8 $\pm$ 0.46**	13	17	4	8	6 1
		48	500	7.8 $\pm$ 0.58*	11	13	3	7	5 –
		One week	500	5.2 $\pm$ 0.37	9	11	2	1	3 –
		–	500	4.0 $\pm$ 0.39	8	12	–	–	– –

* Significant at 0.05 level.

** Significant at 0.01 level.

Sperm-head abnormalities: In germ cell cytogenetic studies conducted at 1.7, 3.3, and 33 mg/kg bw, the percentage of abnormalities was 5.2, 6.0, and 9.8%, respectively, with statistical significance ($p < 0.01$) only observed at the 33 mg/kg bw level (Table 3). Therefore, for the study of sperm-head abnormalities, in addition to the 3.3 and 33 mg/kg bw levels, and higher dose of 82.5 mg/kg bw ($1/4^{\text{th}}$ of the LD_{50}) was also tested.

Table 3
Germ cell cytogenetic studies and sperm-head abnormality in mice after oral treatment by gavage with 2,4-D and i.p. injection with 2,4-DCP

Test	2,4-D		2,4-DCP	
	Dose (mg kg ⁻¹ BW)	% of abnormalities	Dose (mg kg ⁻¹ BW)	% of abnormalities
Chromosome aberrations in germ cells	33 (1/10 LD_{50})	9.8 ± 0.46**	180 (1/2 LD_{50})	7.0 ± 0.67*
	3.3 (1/100 LD_{50})	6.0 ± 0.81	72 (1/5 LD_{50})	5.6 ± 0.44
	1.7 (1/200 LD_{50})	5.2 ± 0.97	36 (1/10 LD_{50})	4.8 ± 0.58
Sperm-head abnormalities	82.5 (1/4 LD_{50})	8.56 ± 0.64**	180 (1/2 LD_{50})	6.27 ± 0.48*
	33 (1/10 LD_{50})	6.93 ± 0.73*	72 (1/5 LD_{50})	4.73 ± 0.36
	3.3 (1/100 LD_{50})	5.15 ± 0.52	36 (1/10 LD_{50})	3.69 ± 0.25

* Significant at 0.05 level.

** Significant at 0.01 level.

A statistically-significant increase in the mean percentage of sperm-head abnormalities was observed at the 33 ($p < 0.05$) and 82.5 mg/kg bw ($p < 0.01$) levels compared to the control (6.93 and 8.56% compared to 4.05% for the control), although the increases were much lower than that induced after ip injection with the positive control (16.26%; Table 4). The types of abnormalities included amorphous, without hook, triangular, banana shaped, small, big, and double head.

Table 4
Number and mean percentage of sperm-head abnormalities in control and 2,4-D treated mice

Treatment and doses	Number of sperms examined	Mean ± S.E. (%)	Types of sperm-head abnormality (number)						
			Amorphous	Without hook	Triangular	Banana shaped	Small head	Big head	Double head
Mitomycin C	2970	16.26 ± 1.10**	101	99	110	86	48	39	–
i.p injection with 1 mg kg ⁻¹ BW									
Positive control									
Control (non-treated)	2520	4.05 ± 0.27	24	38	14	4	13	9	–
2,4-D									
3.3 mg kg ⁻¹ BW	2797	5.15 ± 0.52	32	43	35	14	15	5	–
33 mg kg ⁻¹ BW	2741	6.93 ± 0.73*	67	50	20	22	10	13	8
82.5 mg kg ⁻¹ BW	2744	8.56 ± 0.64**	73	57	49	21	23	7	5

* Significant at 0.05 level.

** Significant at 0.01 level.

2,4-DCP:

The effect of a single ip injection at 36 mg/kg bw was used as an exploratory dose (equivalent to 1/10th the LD₅₀). As no statistically-significant differences were observed on chromosome aberrations, repeated doses were conducted, as well as single-dose testing using two higher levels, i.e., 72 and 180 mg/kg bw (1/5th and 1/2 the LD₅₀, respectively).

Bone marrow: A dose-dependent increase in chromosomal aberrations was observed 24 hours following single ip injections of 2,4-DCP at 36, 72, or 180 mg/kg bw (Table 5). Percentages of chromosomal aberrations were 4.4, 6.0, and 7.2% for the 36, 72, and 180 mg/kg bw levels, respectively, with a statistically-significant difference from the control (3.8-4.0%) observed only at the 180 mg/kg bw level ($p < 0.05$). No statistically-significant differences were observed following up to five consecutive daily injections at 36 mg/kg bw per day, with a maximum percent aberrations of 6.4% 24 hours following the fifth injection.

Induced structural and numerical aberrations in bone marrow cells included chromatid gaps, fragments, and/or breaks, Robertsonian translocations, and tetraploid metaphases.

Spermatocytes: A dose-dependent increase in chromosomal aberrations was observed following a single ip injection of 2,4-DCP at 36, 72, or 180 mg/kg bw (Table 6). Percentages of chromosomal aberrations were 4.8, 5.6, and 7.0% for the 36, 72, and 180 mg/kg bw levels, respectively, with a statistically-significant difference from the controls (3.4-3.6%) observed only at the 180 mg/kg bw level ($p < 0.05$). No statistically-significant differences were observed following up to five consecutive daily injections at 36 mg/kg bw per day, with a maximum percent aberrations of 6.0% 24 hours following the fifth injection.

Chromosome aberrations in spermatocyte cells included X-Y and autosomal univalents, gaps, and fragments or breaks. In addition, two diakinesis-metaphase I cells with chain IV were observed after single ip injection with 180 mg/kg bw (Table 6).

Table 5

Number and mean percentage of chromosome aberrations in mouse bone-marrow after i.p. injection with different doses of 2,4-DCP

Treatment and doses	Number of treatments	Mice killed after (h)	Number of cells counted	Chromosome aberration		Number of metaphase with				
				Including gaps (mean% $\pm$ S.E.)	Excluding gaps (mean $\pm$ S.E.)	Chromatid gap	Fragment and/or break	Chromatid gap, fragment or break	Robertsonian translocations	Poly-ploidy
Mitomycin C	–	–	500	27.8 $\pm$ 0.91**	2.22 $\pm$ 0.66	27	66	33	8	5
i.p. injection with										
1 mg kg ⁻¹ BW										
Positive control										
2,4-DCP										
36 mg kg ⁻¹ BW	One	24	500	4.4 $\pm$ 0.24	3.2 $\pm$ 0.37	6	16	–	–	–
	Three	24	500	5.8 $\pm$ 0.66	4.2 $\pm$ 0.63	8	16	–	3	2
	Five	24	500	6.4 $\pm$ 0.88	4.2 $\pm$ 0.93	11	12	4	3	2
Control (non-treated)			500	4.0 $\pm$ 0.55	2.0 $\pm$ 0.37	10	10	–	–	–
72 mg kg ⁻¹ BW	One	24	500	6.0 $\pm$ 0.67	3.8 $\pm$ 0.58	11	10	5	2	2
Control (non-treated)			500	4.0 $\pm$ 0.55	2.0 $\pm$ 0.37	10	10	–	–	–
180 mg kg ⁻¹ BW	One	24	500	7.2 $\pm$ 0.46*	4.2 $\pm$ 0.66*	15	9	4	5	3
Control (non-treated)			500	3.8 $\pm$ 0.58	2.0 $\pm$ 0.51	9	9	–	–	1

* Significant at 0.05 level.

** Significant at 0.01 level.

Table 6

Number and mean percentage of chromosome aberrations in mouse spermatocytes after i.p. injection with different doses of 2,4-DCP

Treatment and doses	Treatment number	Mice killed after (h)	Counted cells number	Chromosome aberrations (mean% $\pm$ S.E.)	Number of metaphase with					
					Autosomal univalents	X-Y univalents	Autosomal + X-Y univalents	Fragment or break	Gap	Chain IV
Mitomycin C i.p. injection with 1 mg kg ⁻¹ BW Positive control	—	—	500	20.8 $\pm$ 0.98 **	25	39	10	26	4	—
2,4-DCP										
36 mg kg ⁻¹ BW	One	24	500	4.8 $\pm$ 0.58	8	13	—	1	2	—
	Three	24	500	5.2 $\pm$ 0.32	6	16	—	2	2	—
	Five	24	500	6.0 $\pm$ 0.63	10	12	2	6	—	—
Control (non-treated)			500	3.6 $\pm$ 0.24	8	10	—	—	—	—
72 mg kg ⁻¹ BW	One	24	500	5.6 $\pm$ 0.44	9	11	—	6	2	—
	Control (non-treated)		500	3.6 $\pm$ 0.24	8	10	—	—	—	—
180 mg kg ⁻¹ BW	One	24	500	7.0 $\pm$ 0.67*	10	13	3	5	2	2
	Control (non-treated)		500	3.4 $\pm$ 0.48	7	10	—	—	—	—

* Significant at 0.05 level.

** Significant at 0.01 level.

Sperm-head abnormalities: Doses tested were the same as in the germ cell cytogenetic studies (Table 3). A statistically-significant increase ($p < 0.05$) in sperm-head abnormalities compared to the control was observed following a single ip injection with 2,4-DCP at 180 mg/kg bw (6.27% versus 3.11% for the control; Table 7). No statistical differences were observed from the control at the 36 (3.69%) or 72 (4.73%) mg/kg bw levels. The types of abnormalities included amorphous, without hook, triangular, banana shaped, and small and big head.

Table 7
Number and mean percentage of sperm-head abnormalities in control and 2,4-DCP treated mice

Treatment and doses	Number of sperms examined	Mean $\pm$ S.E. (%)	Types of sperm-head abnormalities (number)					
			Amorphous	Without hook	Triangular	Banana shaped	Small head	Big head
Mitomycin C i.p. injection with 1 mg kg ⁻¹ BW Positive control	2970	16.26 $\pm$ 1.10**	101	99	110	86	48	39
Control (non-treated)	2670	3.11 $\pm$ 0.73	35	25	10	6	7	–
2,4-DCP								
36 mg kg ⁻¹ BW	2760	3.69 $\pm$ 0.25	28	27	15	15	12	5
72 mg kg ⁻¹ BW	3470	4.73 $\pm$ 0.36	54	40	31	13	13	9
180 mg kg ⁻¹ BW	3540	6.27 $\pm$ 0.48*	74	53	44	26	18	7

* Significant at 0.05 level.

** Significant at 0.01 level.

Description of Use in Document (QUAL, QUAN, INV):

Qualitative

Rationale for Use:

This study was not utilized for risk estimation as frank reproductive effects were not evaluated. However, it does indicate that genotoxic effects may occur at doses lower than the NOAEC established in the 2-generation reproduction study submitted by the registrant. Also, genotoxic effects were evaluated for the degradate, 2,4-DCP. Results indicated that the genotoxic effect of 2,4-DCP was weaker than that of 2,4-D.

Limitations of Study:

None noted.

Primary Reviewer:

Christie E. Padova, Dynamac Corporation

Secondary Reviewer:

Christine Hartless, OPP/EFED/ERB1

Open Literature Review Summary

Chemical Name(s): 2,4-Dichlorophenoxyacetic Acid (2,4-D; 2,4-D Acid); Potassium (2,4-dichlorophenoxy)acetate (2,4-D Potassium Salt); 2,4-Dichlorophenol (DCP)

CAS No.: 94-75-7 (2,4-D); 14214-89-2 (Potassium Salt of 2,4-D)

ECOTOX Record Number and Citation: E000563

Birge, W.J., J.A. Black, and D.M. Bruser. 1979. Toxicity of Organic Chemicals to Embryo-Larval Stages of Fish. U.S. EPA Report No. 560/11-79-007. Report Issued June 1979.

Purpose of Review: Litigation/Endangered Species

Date of Review: December 12, 2008

Summary of Study Findings: The toxicities of eleven organic compounds, selected for their varying degrees of volatility and water solubility, were investigated on the embryo-larval stages of several fish species; tests were conducted at two levels of water hardness (50 and 200 mg/L CaCO_3) under a closed (devoid of air space) flow-through system. Included in these investigations, the toxicity of 2,4-dichlorophenoxyacetic acid (2,4-D; administered as the potassium salt) and 2,4-dichlorophenol (DCP) were assessed in largemouth bass (2,4-D only; *Micropterus salmoides*), channel catfish (DCP only; *Ictalurus punctatus*) goldfish (*Carassius auratus*), and rainbow trout (*Salmo gairdneri*).

Results indicated that rainbow trout was the most sensitive fish species, and that the embryo-larval stages of trout were *ca.* 2.5 times more sensitive to 2,4-D when tests were conducted in hard water, with LC_{50} values at hatching and at 4 days post-hatch of 11.0 mg/L in soft water (50 mg/L CaCO_3) and 4.2 mg/L in hard water (200 mg/L CaCO_3). When compared to 2,4-D, trout were over 100x more sensitive to DCP but water hardness had no effect, with LC_{50} values for DCP of 0.08 (0.07-0.10) mg/L and 0.07 (0.05-0.09) mg/L on days 0 and 4, respectively. Hardness did not notably affect largemouth bass, channel catfish, or goldfish species.

For largemouth bass (2,4-D exposed) at both hardness levels, LC_{50} values ranged from 161 to 165 mg/L at hatching and 82 to 109 mg/L at 4 days. For channel catfish (DCP exposed), LC_{50} values ranged from 1.70 to 1.85 mg/L at hatching and 1.07 to 1.35 mg/L at 4 days. Goldfish eggs were very tolerant of 2,4-D at both hardness levels, with LC_{50} values at hatching exceeding the highest exposure levels (187 to 201 mg/L). Goldfish larvae, however, were more sensitive than eggs, and post-hatch mortality was statistically-reduced compared to controls ($p < 0.05$). At 4 and 8 days post-hatch, depending on water hardness, LC_{50} values decreased to 119 to 133 mg/L and 58 to 68 mg/L, respectively. In contrast, goldfish were highly sensitive to DCP at both hardness levels, with LC_{50}

values of 1.24 to 1.76 mg/L at hatching and 0.26 to 0.39 at 4 days. In addition to increased embryonic and larval mortality, teratogenesis (specifically, defects of the vertebral column) was also more frequently observed at the higher treatment levels for all fish species.

At both hardness levels, calculated LC₁ values (determined 4 days post-hatch) for 2,4-D were 0.02-0.03, 3.2-13.1, and 8.2-8.9 mg/L for trout, bass, and goldfish, respectively, and compared favorably to previously-established MATC values for 2,4-D of 0.3-1.5 mg/L determined in a partial life-cycle study with fathead minnow (Mount & Stephan, 1967). For the more toxic DCP, calculated LC₁ values (determined 4 days post-hatch, at both hardness levels) were 0.002-0.003, 0.002-0.003, and 0.04-0.05 mg/L for trout, catfish, and goldfish, respectively.

Methods:

The potassium salt of 2,4-dichlorophenoxyacetic acid (2,4-D) and 2,4-dichlorophenol (DCP) were obtained from Aldrich Chemical Company (Milwaukee, WI). Concentrations were adjusted for the purity of the test substance (not further reported).

Gravid rainbow trout (*Salmo gairdneri*) were obtained from the Erwin National Fish Hatchery (Erwin, TN), and eggs and sperm were obtained by artificial spawning and milking procedures of Leitritz and Lewis (1976). The eggs were fertilized by mixing with milt for 20 minutes. Catfish (*Ictalurus punctatus*) spawn were obtained from either the Frankfort Hatchery or the Senecaville National Fish Hatchery (Senecaville, OH). Newly-fertilized eggs of largemouth bass (*Micropterus salmoides*) and goldfish (*Carassius auratus*) were obtained from the Frankfort National Fish Hatchery (Frankfort, KY). Exposure was initiated 20 minutes post-fertilization of trout, and 1 to 2 hours post-spawning for bass and goldfish, and 2 to 12 hours after spawning for catfish.

Re-constituted dilution water was prepared (at 50 and 200 mg/L CaCO₃) by adding reagent-grade calcium, magnesium, sodium, and potassium salts to distilled, double-deionized water. It was reported that cations and anions were within ranged published for freshwater sources in Arizona, Kentucky, and other areas of the United States. In addition, it was reported that the total chloride content, total dissolved solids, and the concentration of sodium plus potassium were under maximum levels of 170 mg/L, 400 mg/L, and 85 mg/L, respectively, observed for 95% of the U.S. waters found to support a good, mixed fish fauna. Physiochemical characteristics of the artificial test water is provided in Table 1.

Table 1. Select Characteristics of Reconstituted Test Water.

Physiochemical Characteristics ^(a)	Hardness (mg/L CaCO ₃)	
	50	200
Hardness, as mg/L CaCO ₃	53.3	197.5
pH	7.84	7.78
Total alkalinity, as mg/L CaCO ₃	66.7	65.3
Conductivity, µmhos/cm	133.6	282.0

Osmolarity, mOsm/kg H ₂ O	8.9	12.7
Total dissolved solids, mg/L	121.4	336.7
Dissolved oxygen, mg/L at 13.5°C	9.9	10.1

^(a) Mean of 10 replicates.

Four or more test levels plus an untreated control were tested per fish species, each at two levels of water hardness (50 and 200 mg/L CaCO₃). One hundred to 150 eggs per species were tested per level. Test vessels were constructed from 3-inch Pyrex pipe joints that were cut and sealed to give a 0.5-L capacity. The inlet was positioned near the bottom of the chamber, and an outlet tube annealed to the cover. The chamber was divided into an upper egg compartment and a lower stirring compartment by positioning a stainless steel screen 3 cm above the bottom of the vessel. Fish eggs were supported on the screen, and a Teflon-coated magnetic stirring bar was used in the lower section to provide moderate, continuous agitation of the test water. An upper outlet screen was used to maintain the organisms.

A unique continuous-flow through system was developed which was devoid of an air-water interface and utilized mechanical homogenization of the test article. As such, no co-solvents were necessary. Toxicant was delivered to a mixing chamber via a syringe pump, where it was combined with test water delivered to the mixing chamber by a regulated-flow peristaltic pump. Continuous aeration was supplied to the peristaltic pump reservoirs, which maintained the dissolved oxygen levels during the studies. The treated water was mixed by mechanical stirring or homogenization, and delivered to the test chamber under positive pressure. The flow rate was adjusted to 200 mL/hour, providing a chamber turnover every 2.5 hours.

Eggs were examined daily for development and to remove dead specimens. Cumulative percent survival was determined at hatching and at 4 days post-hatch. In addition, teratogenesis was determined at hatching, was and expressed as the percent of survivors affected by gross, debilitating abnormalities likely to result in mortality. Percent hatchability was also reported, and included all embryos which survived to complete the hatching process.

For analysis of the test water for 2,4-D samples (0.05 to 0.5 L) and DCP samples (0.25 L) were collected daily and extracted several times with chloroform, which was evaporated to dryness. Samples of the 2,4-D methyl ester were analyzed using gas chromatography with flame-ionization detection (GC/FID). The analytical limit of detection (LOD) for this process was 50 µg/L. Samples of DCP were analyzed using a Varian-Techtron 635 spectrophotometer set to 470 nm with a detection limit of 1.0 µg/L.

Temperature, dissolved oxygen, specific conductivity, water hardness, and pH of the test solutions were measured at regular intervals.

Statistics: Log probit analysis (Finney, 1971) was used to calculate LC₅₀ and LC₁ values with 95% confidence intervals for 0 (hatching) and 4 days post-hatch. Teratic larvae were included as lethals, and values were adjusted for control mortality. The LC₁ values were used as a basis for estimating threshold concentrations for toxic effects.

Results:

The time to hatch averaged 23 days for trout, 4.5 days for catfish, 4 days for goldfish, and 3.5 days for bass. Percent hatchability and survival data are provided in the Appendix of this DER, and LC₅₀ and LC₁ values are provided in Tables 2 and 3, respectively. All treatment level survival data were adjusted for control mortality, which ranged from 89 to 99% for 2,4-D or 92 to 96% for DCP.

Rainbow trout were the most sensitive species with respect to both 2,4-D and DCP (with DCP being much more toxic. Rainbow trout was also the only species to which there were clear effects of water hardness on toxic response to 2,4-D (but not to DCP). Trout embryo-larval stages were *ca.* 2.5 times more sensitive to 2,4-D when tests were conducted in hard water, with LC₅₀ values at hatching and at 4 days post-hatch of 11.0 mg/L in soft water (50 mg/L CaCO₃) and 4.2 mg/L in hard water (200 mg/L CaCO₃). Calculated LC₁ values (4 days post-hatch) were 21.9 and 32.5 µg/L in hard and soft water, respectively.

Bass eggs were less sensitive to 2,4-D than trout, and unlike trout, water hardness did not notably affect mortality. LC₅₀ values ranged from 161 to 165 mg/L at hatching and 82 to 109 mg/L at 4 days. Calculated LC₁ values (4 days post-hatch) were 3,214 and 13,102 µg/L in hard and soft water, respectively. Goldfish eggs were very tolerant of 2,4-D at both hardness levels. The LC₅₀ values at hatching exceeded the highest exposure levels (187 to 201 mg/L). Goldfish larvae, however, were more sensitive than eggs, and post-hatch mortality was statistically significant compared to controls (*p*<0.05). At 4 and 8 days post-hatch, depending on water hardness, LC₅₀ values decreased to 119 to 133 mg/L and 58 to 68 mg/L, respectively. Calculated LC₁ values at 4 days post-hatch were 8,851 and 8,210 µg/L in hard and soft water, respectively.

DCP was highly toxic to all three fish species. Rainbow trout was the most sensitive, with LC₅₀ values for DCP of 0.08 (0.07-0.10) mg/L and 0.07 (0.05-0.09) mg/L on days 0 and 4, respectively. Catfish and goldfish were similarly sensitive (Table 3). The LC₅₀ values for DCP for catfish (1.07 to 1.85 mg/L) were higher than they were for Rainbow trout, but the LC₁ values at 4 days post-hatch were similar for the two species (0.002-0.003 mg/L; Table 3).

Table 2. Log Probit LC₅₀ Values at 0 and 4 Days Post-Hatch for 2,4-D.

Species	Exposure Day Post-Hatch	50 mg/L as CaCO ₃		200 mg/L as CaCO ₃	
		LC ₅₀ (mg/L)	95% C.I. (mg/L)	LC ₅₀ (mg/L)	95% C.I. (mg/L)
2,4-D					
Goldfish	0	>187	---	>201	---
	4	133.1	108.6-174.8	119.1	98.5-150.6
Largemouth Bass	0	165.4	130.6-274.1	160.7	122.9-230.6
	4	108.6	92.5-138.4	81.6	64.8-103.5
Rainbow Trout	0	11.0	7.8-15.1	4.2	2.8-5.9
	4	11.0	7.8-15.1	4.2	2.8-5.9
DCP					
Goldfish	0	1.76	1.26-2.48	1.24	0.78-1.85
	4	0.39	0.29-0.62	0.26	0.17-0.97
Channel Catfish	0	1.85	1.25-2.82	1.70	1.08-2.65
	4	1.35	0.94-2.02	1.07	0.68-1.66
Rainbow Trout	0	0.08	0.07-0.10	0.07	0.05-0.09
	4	0.08	0.07-0.10	0.07	0.05-0.09

Table 3. Log Probit LC₁ Values at 4 Days Post-Hatch for 2,4-D.

Species	Exposure Day Post-Hatch	50 mg/L as CaCO ₃		200 mg/L as CaCO ₃	
		LC ₁ (µg/L)	95% C.I. (µg/L)	LC ₁ (µg/L)	95% C.I. (µg/L)
2,4-D					
Goldfish	4	8,210	2,677-15,027	8,851	3,835-14,637
Largemouth Bass	4	13,102	4,418-21,886	3,214	1,218-5,989
Rainbow Trout	4	32.5	8.9-83.6	21.9	6.2-55.4
DCP					

Species	Exposure Day Post-Hatch	50 mg/L as CaCO ₃		200 mg/L as CaCO ₃	
		LC ₁ (µg/L)	95% C.I. (µg/L)	LC ₁ (µg/L)	95% C.I. (µg/L)
Goldfish	4	48.1	20.6-75.5	39.8	0.1-68.9
Channel Catfish	4	2.8	1.0-5.9	1.6	0.4-4.8
Rainbow Trout	4	2.8	1.4-4.8	1.7	0.7-3.2

In addition to increased embryonic and larval mortality at the higher treatment levels, teratogenesis (specifically, defects of the vertebral column) was also more frequently observed for species exposed to 2,4-D. It was reported that teratic organisms were ≤1% in control groups. The most common types of spinal defects were acute lordosis, scoliosis, kyphosis, and extreme rigid coiling of the vertebral column (observations specific to 2,4-D were not reported). For DCP, up to 24% of goldfish larvae displayed teratic symptoms and detection for trout and catfish was as low as 1 µg/L. The low LC₁ values for catfish and trout (Table 3) were reportedly comparable to fish flesh tainting thresholds of 0.1 to 15 µg/L, established by EPA¹ for 2,4-D (similar thresholds had not been established for DCP as of the publishing of this study).

It was noted that when incidences of teratogenesis were combined with embryonic and larval lethality, probit LC₁ values (Table 4) were in good agreement with MATC's established in a previously-conducted partial life-cycle test; the MATC in the cited study (Mount & Stephan, 1967) ranged from 0.3 to 1.5 mg/L (300 to 1,500 µg/L) for fathead minnow. The test substance used in the partial life-cycle test was the butoxyethanol ester of 2,4-D.

Temperature and dissolved oxygen levels ranged from 12.5 to 14.5°C and 9.1 to 10.5 mg/L, respectively for trout; 25.9 to 29.6 °C and 5.8 to 6.8 mg/L, respectively, for catfish; and 18.2 to 25.8°C and 6.5 to 8.9 mg/L, respectively, for both bass and goldfish. See the Appendix of this review for a table detailing the water characteristics in studies with 2,4-D and DCP test compounds.

Description of Use in Document (QUAL, QUAN, INV):

Qualitative

Rationale for Use:

This study provides further evidence of chronic toxicity of 2,4-D to fish. It also provides comparative toxicity information for 2,4-D and 2,4-DCP, a degradate.

¹ US EPA (1976). Quality Criteria for Water. United States Environmental Protection Agency, Washington, D.C. 256p.

Limitations of Study: Replicate data were not presented nor were the details available for the reviewer to conduct an independent statistical verification of the results. EFED was not able to determine a NOAEC from the provided data, and a NOAEC is the endpoint used in risk estimation. Provided study endpoints were LC₅₀ and LC₁.

Primary Reviewer:

Christie E. Padova, Dynamac Corporation

Secondary Reviewer:

Christine Hartless, OPP/EFED/ERB1

APPENDIX: TABLES FROM STUDY REPORT ON HATCH AND SURVIVAL

Table 14. Toxicity of 2,4-dichlorophenol (DCP) to embryo-larval stages of fish.

Species	Water Hardness (mg/l CaCO_3)	DCP Concentration Mean $\pm$ S.E. (mg/l)	Percent Hatchability ^{1,2}	Percent Normal Survival ¹	
				Hatching	4 Days Posthatching
Goldfish	50	0.017 $\pm$ 0.005	96	96	96
		0.036 $\pm$ 0.004	96	96	95
		0.17 $\pm$ 0.02	87	87	82
		4.84 $\pm$ 0.74	51(14)	47	0
		27.5 $\pm$ 2.1	0	0	0
	200	0.015 $\pm$ 0.004	97	97	94
		0.025 $\pm$ 0.004	97	97	95
		0.11 $\pm$ 0.02	89	89	84
		4.24 $\pm$ 0.69	43(24)	33	0
		25.5 $\pm$ 3.3	0	0	0
Channel Catfish	50	$\leq$ 0.001	99(2)	97	97
		0.008 $\pm$ 0.006	99(4)	95	95
		0.024 $\pm$ 0.011	101(12)	89	89
		0.24 $\pm$ 0.01	89(10)	80	79
		3.52 $\pm$ 0.18	72(8)	66	55
		25.9 $\pm$ 3.1	0	0	0
	200	$\leq$ 0.001	98(1)	97	97
		0.008 $\pm$ 0.002	96(6)	90	92
		0.016 $\pm$ 0.006	93(6)	87	86
		0.082 $\pm$ 0.015	92(10)	82	80
		0.10 $\pm$ 0.03	88(9)	80	79
Rainbow Trout	50	3.05 $\pm$ 0.36	68(6)	62	51
		24.6 $\pm$ 3.6	0	0	0
	200	0.026 $\pm$ 0.004	83(1)	82	82
		0.052 $\pm$ 0.002	62(1)	61	61
		0.072 $\pm$ 0.007	65(1)	64	64
Rainbow Trout	50	0.47 $\pm$ 0.01	22(9)	20	20
		0.86 $\pm$ 0.08	0	0	0
		4.64 $\pm$ 0.59	0	0	0
		27.4 $\pm$ 4.7	0	0	0
	200	0.024 $\pm$ 0.004	85	85	85
		0.048 $\pm$ 0.002	51	51	51
		0.071 $\pm$ 0.006	61(1)	60	60
		0.51 $\pm$ 0.01	24(9)	22	20
		0.81 $\pm$ 0.07	0	0	0
	200	6.35 $\pm$ 0.97	0	0	0
		34.4 $\pm$ 5.0	0	0	0

¹Frequency determined as survival in experimental population/control. Control survival at 4 days posthatching averaged 96, 96, and 92% for goldfish, channel catfish, and rainbow trout, respectively.

²Frequency of teratic survivors in hatched population is given parenthetically.

Table 15. Toxicity of 2,4-dichlorophenoxyacetic acid (2,4-D) to embryo-larval stages of fish.

Species	Water Hardness (mg/l CaCO_3)	2,4-D Concentration Mean $\pm$ S.E. (mg/l)	Percent Hatchability ^{1,2}	Percent Normal Survival ¹	
				Hatching	4 Days Posthatching
Goldfish	50	0.20 $\pm$ 0.03	100(1)	99	96
		5.12 $\pm$ 0.56	97(1)	96	91
		37.5 $\pm$ 3.8	93(4)	89	83
		78.0 $\pm$ 6.0	91(7)	85	71
		187 $\pm$ 4	76(11)	68	34
	200	0.28 $\pm$ 0.08	100	100	97
		4.95 $\pm$ 0.28	97	97	93
		37.1 $\pm$ 4.4	93(3)	90	84
		61.3 $\pm$ 7.4	91(10)	82	72
		201 $\pm$ 8	73(12)	64	30
Largemouth Bass	50	$\leq$ 1.00	100	99	99
		2.59 $\pm$ 0.39	98	98	97
		51.0 $\pm$ 3.0	89	89	79
		119 $\pm$ 22	65(3)	63	47
	200	$\leq$ 1.00	100(1)	99	98
		5.07 $\pm$ 0.84	97	97	94
		35.6 $\pm$ 5.0	88(1)	87	78
		178 $\pm$ 61	49(15)	42	30
	50	$<$ 0.05	96(1)	95	95
		0.32 $\pm$ 0.04	86	86	86
		5.66 $\pm$ 0.54	69(2)	68	68
		36.0 $\pm$ 2.3	45(4)	43	43
		82.2 $\pm$ 10.4	30(15)	26	26
Rainbow Trout	50	144 $\pm$ 21	0	0	0
	200	$<$ 0.05	91	91	91
		0.63 $\pm$ 0.07	72(2)	71	71
		9.54 $\pm$ 0.94	55(4)	53	53
		47.9 $\pm$ 0.3	33(24)	25	24
	200	78.5 $\pm$ 8.5	6(100)	0	0
		134 $\pm$ 12	0	0	0

¹Frequency determined as survival in experimental population/control. Control survival at 4 days posthatching averaged 98, 99, and 89% for goldfish, largemouth bass, and rainbow trout, respectively.

²Frequency of teratic survivors in hatched population is given parenthetically.

Table 3. Water quality characteristics observed during toxicity tests with organic compounds.

Embryo-Larval Bioassays		Observed Test Parameters (Mean $\pm$ Standard Error)			
Compound	Designated Water Hardness (mg/l CaCO_3)	Water Hardness (mg/l CaCO_3)	pH	Conductivity ($\mu\text{mhos/cm}$)	Flow Rate (ml/hr)
Aniline	50	46.9 $\pm$ 3.4	7.7 $\pm$ 0.1	121.3 $\pm$ 2.0	206.7 $\pm$ 13.7
	200	195.3 $\pm$ 14.3	7.7 $\pm$ 0.1	257.7 $\pm$ 17.5	207.8 $\pm$ 7.7
Atrazine	50	51.3 $\pm$ 1.1	8.0 $\pm$ 0.1	106.2 $\pm$ 0.8	179.5 $\pm$ 10.2
	200	201.9 $\pm$ 0.2	7.9 $\pm$ 0.1	240.7 $\pm$ 4.4	178.8 $\pm$ 16.8
Capacitor 21	50	49.5 $\pm$ 0.2	7.8 $\pm$ 0.1	109.9 $\pm$ 1.0	200.4 $\pm$ 11.0
	200	204.0 $\pm$ 1.7	7.6 $\pm$ 0.1	240.8 $\pm$ 4.9	204.0 $\pm$ 5.6
Chlorobenzene	50	51.2 $\pm$ 1.2	7.6 $\pm$ 0.0	104.2 $\pm$ 1.9	216.2 $\pm$ 4.0
	200	203.4 $\pm$ 3.3	7.6 $\pm$ 0.1	260.3 $\pm$ 13.9	213.3 $\pm$ 5.9
Chloroform	50	48.8 $\pm$ 0.7	7.3 $\pm$ 0.0	91.8 $\pm$ 1.4	191.8 $\pm$ 1.8
	200	210.2 $\pm$ 1.2	7.3 $\pm$ 0.0	223.4 $\pm$ 1.1	190.7 $\pm$ 1.5
2,4-Dichlorophenol	50	50.0 $\pm$ 0.9	7.8 $\pm$ 0.1	124.2 $\pm$ 13.0	193.9 $\pm$ 2.3
	200	200.0 $\pm$ 2.2	7.8 $\pm$ 0.1	263.1 $\pm$ 19.6	191.8 $\pm$ 4.2
2,4-Dichloro-phenoxyacetic acid	50	50.8 $\pm$ 1.5	7.8 $\pm$ 0.2	122.4 $\pm$ 1.3	185.4 $\pm$ 6.2
	200	200.1 $\pm$ 2.9	7.7 $\pm$ 0.1	259.2 $\pm$ 4.4	170.0 $\pm$ 11.0

Open Literature Summary

Chemical Name: 2,4-D acid

CAS NO: 94-75-7

ECOTOX Record Number and Citation: E006387

Vardia, H.K. & V.S. Durve. The toxicity of 2,4-D to *Cyprinus carpio* var. *Communis* in relation to the seasonal variation in temperature. *Hydrobiologia*, 77(2): 155-159 (1981).

Study conducted at the Department of Limnology and Fisheries, University of Udaipur, India from 1978-1979.

Purpose of Review: Litigation/Endangered Species

Date of Review: February 17, 2009

Brief Summary of Study Findings:

The purpose of the study was to examine how the seasonal variation in temperature affects the toxicity of 2,4-D acid when exposed to *Cyprinus carpio*. The authors observed a 7- to 7.5-fold increase in toxicity with the rise in temperature from 17°C in February to 39°C in May. The authors reported several LC₅₀'s for various months throughout the year, including an LC₅₀ of 24.15 mg a.e./L in a 96-hour study in November.

Methods

Fish were acclimatized for seven to ten days and then exposed to ten liters of the test concentrations for 96 hours. Test solutions were renewed every 24 hours and mortality was observed at 24-hour intervals. The study was conducted during the following months at the given temperature: May (39°C), July (33°C), September (28.5°C), November (25°C), December (20°C), and February (17°C).

Concentrations of technical grade 2,4-D were adjusted at each temperature due to the observed increase in mortality with increasing temperature. In May, tested concentrations were 18, 10, 5.6, and 3.2 ppm. In July, tested concentrations were 20, 18, 10, and 5.6 ppm. In September, tested concentrations were 40, 35, 30, 25, 20, and 18 ppm. In November, tested concentrations were 40, 35, 30, 25, and 20 ppm. In December, tested concentrations were 40, 35, 30, and 25 ppm. In February, tested concentrations were 45, 40, 35, 30, and 25 ppm. Thirty fish were tested at each concentration. In addition, a control and solvent control test was conducted for each temperature. The study authors stated they followed the standard methods of the APHA (American Public Health Association. 1975. Standard methods for the examination of water and waste water. 14th Ed. New York, NY).

Results

The authors reported average mortality of test fish, which is shown in Table 2. LC₅₀'s are shown in Table 3.

Table 2. Average mortality of test fishes at varied temperatures in different months of the year 1978-79.

Month	Temperature °C	Concentration ppm	No. of fish	Percent mortality at hours			
				24	48	72	96
May	39.0	18	30	100	—	—	—
		10	30	60	100	—	—
		5.6	30	0	0	60	60
		3.2	30	0	0	0	0
		Control	30	0	0	0	0
		Solvent control	30	0	0	0	0
July	33.0	20	30	50	90	100	—
		18	30	20	40	60	60
		10	30	0	20	30	30
		5.6	30	0	0	0	0
		Control	30	0	0	0	0
		Solvent control	30	0	0	0	0
September	28.5	40	30	100	—	—	—
		35	30	40	100	—	—
		30	30	20	100	—	—
		25	30	0	80	80	100
		20	30	0	40	50	50
		18	30	0	0	0	0
		Control	30	0	0	0	0
		Solvent control	30	0	0	0	0
November	25.0	40	30	100	—	—	—
		35	30	40	60	80	100
		30	30	0	60	80	100
		25	30	0	60	60	60
		20	30	0	0	0	0
		Control	30	0	0	0	0
		Solvent control	30	0	0	0	0
December	20.0	40	30	60	100	—	—
		35	30	20	40	80	80
		30	30	0	40	60	80
		25	30	0	0	40	40
		Control	30	0	0	0	0
		Solvent control	30	0	0	0	0
February	17.0	45	30	50	60	60	60
		40	30	10	40	50	90
		35	30	0	0	0	50
		30	30	0	0	0	10
		25	30	0	0	0	0
		Control	30	0	0	0	0
		Solvent control	30	0	0	0	0

Table 3. Mean summary table of median tolerance limits (T_{lm}).

Month	T _{lm} at hours in ppm			
	24	48	96	Mean
May	5.93	5.80	5.10	5.60
July	20.00	18.40	15.30	17.90
September	35.72	21.30	20.00	25.67
November	35.72	35.72	24.15	31.86
December	38.72	35.83	31.25	35.27
February	45.00	42.50	35.00	40.83
Mean	30.18	26.59	21.80	

The authors concluded that the toxicity of 2,4-D increased with an increase in temperature from winter to summer. They suspected that the increased toxicity may be due to increased oxygen demand at higher temperatures accompanied by the lower solubility of oxygen in water at higher temperatures. The findings imply that the temperature at which 2,4-D is applied for weed control is important to consider for the safety of fish.

Description of Use in Document: Quantitative

Rationale for Use: The November temperature most closely matches guideline temperature requirements. The 96-hour LC50 of 24.15 mg a.e./L provides the most sensitive, scientifically-sound toxicity value for freshwater fish.

Limitations of Study: Some detailed information was not available (*e.g.*, source of fish, measured concentrations of test material).

Reviewer: Anita Ullagaddi, EFED/ERB1

Secondary Reviewer: Christine Hartless, EFED/ERB1

Open Literature Review Summary

Chemical Name: 2,4-D

CAS NO: 94-75-7

ECOTOX Record Number and Citation: E74985

Roshon, R.D. 1997. A toxicity test for the effects of chemicals on the non-target submersed aquatic macrophyte, *Myriophyllum sibiricum* komarov. Doctoral Thesis, University of Guelph, Canada. National Library of Canada. UMI Dissertation Services. Accessed through ProQuest. Printed in 2003.

Purpose of Review: Litigation/Endangered Species

Date of Assessment: 12/3/08

Brief Summary of Study Findings:

The objective of the study was to develop a laboratory toxicity test for the submersed aquatic macrophyte *Myriophyllum sibiricum*, and to use a suite of pesticides and reference chemicals to validate the methods developed. Two expected environmental concentration (EEC) studies were conducted at the highest application rate, and a dilution series test was conducted with a negative control and seven test concentrations. 2,4-D had a significant effect on the aquatic macrophyte species *M. sibiricum*. At the effective environmental concentration (EEC) of 1.47 mg/L, all endpoints evaluated were affected by the test material, with the exception of weight in experiment 2, possibly due to differing culture mediums being used for the two EEC experiments. In the dilution series experiment, The most sensitive endpoint was root length, with NOAEC and EC₅₀ values of 2.0 and 13.1 µg a.i./L, respectively. When comparing the toxic effects of 2,4-D technical to *M. sibiricum* to other aquatic plants such as algae and floating aquatic macrophytes, the EC₅₀ value calculated for *M. sibiricum* root length is the most sensitive, both within the category of submersed aquatic macrophytes, and throughout the three aquatic species categories selected for comparison by the study author.

Methods

Species Selection and Culturing Conditions

Myriophyllum sibiricum was selected as the aquatic macrophyte species of choice for use in the toxicity test due to its sensitivity to toxicants, ecological importance, commercial availability, good taxonomic characterization, and ability to grow rapidly under laboratory conditions. This species also has a growth habit that is easily measured. *M. sibiricum* turions were collected from the shallows of Puslinch Lake (15 km SW of Guelph, Ontario) on November 2 and 25, 1990. The turions were transported to the laboratory, where they were washed in distilled water and stored in the dark at 4°C. Aquaria (20 L) were filled with sediment (5 cm) and distilled water (18 L). *M. sibiricum* turions (10) were placed in the sediment December 6, 1990. The aquaria were aerated and maintained at 15°C for a constant supply. Based on past research, the study author decided to culture *M. sibiricum* axenically. For the first expected environmental concentration (EEC) experiment, stock plants were cultured in Murashige & Skoog medium, and for the second, they were cultured in modified Andrews' medium. Tests tubes containing plants and growth medium were placed in a growth cabinet for a 16h light:8 h

dark photoperiod at temperatures of 25°C:20°C for *ca.* 10-12 days, when shoots at least 3 cm long should be present. Any plants growing in media contaminated with bacteria or fungi were not used for the test.

Test Conditions

2,4-D Technical (acid) was tested for a 14 day period at an expected environmental concentration (EEC) of 1.47 mg/L, which was based on the maximum recommended label rate of 2.2 kg/ha. The EEC experiment was conducted twice (February 21, 1994, and February 9, 1995). Based on the EEC experiment results, a dilution series test was conducted on February 9, 1995, using a negative control and concentrations of 2.0, 6.0, 18.1, 54.3, 163, 489, and 1,467 µg 2,4-D technical/L for 14 days. 2,4-D technical was reported as having water solubilities of 890 and 900 mg/L, based on its mode of action as an Auxin Mimic, and DNA, RNA, and protein disrupter, respectively. 2,4-D technical (acid) was dissolved in sterile water before addition to the growth medium. Prior to autoclaving and addition of test material, an iron and chelator (EDTA) stock solution (10 mL/L) were added to the modified Andrews' medium. The test medium was adjusted to a pH of 5.8. The conductivity and pH of the media in each tube was measured at test initiation and termination. Hexane or methanol was used as the solvent carrier of choice.

Individual test tubes (5 replicates per treatment group and the control) were prepared with 3 g of Turface (established as optimal due to preliminary work) and spiked nutrient medium (40 mL). The stock plants (10-12 days old; cultured in Andrews' medium) were prepared by cutting 3 cm apical lengths and removing all buds, branches, and roots. The apices were transferred to the test tubes, and measuring rods were inserted into the tubes. The test media was not aerated, and the carbon source was sucrose (chosen based on preliminary tests). The test tubes were placed in a growth cabinet under the same conditions used for culturing of *M. sibiricum*. Optimal light fluence rate was established as 100 µmol·m⁻²·s⁻¹, and a mixture of incandescent and fluorescent lighting was chosen based on preliminary testing.

Endpoints of Interest (Not all inclusive)

Area under the growth curve was determined using a glass measuring rod that consisted of a 15 cm length of Westergren Blood Sedimentation Tube. This measuring rod was inserted into experimental test tubes containing *M. sibiricum* (3 cm apical segments). Initial plant height was measured using the rod (to the nearest mm), and the height was measured every 2 days thereafter until 14 days posttreatment. Growth curves were plotted using the length data, and the area under the curve was determined by the following equation (IH = increase in height from test initiation; T = time at each subsequent period in hours from time zero):

$$\text{Area} = \sum_{i=2}^n \frac{IH_{i-1} + IH_i}{2} \cdot (T_i - T_{i-1}) ; n = 8$$

Primary production was estimated by measuring dissolved oxygen concentrations. Healthy plants' solutions were treated with 30 g/L sucrose prior to autoclaving. A Corning Portable Checkmate Dissolved Oxygen Meter was used to measure the percentage of oxygen present in the liquid medium on an hourly basis. The dissolved oxygen concentrations were plotted over time.

Fresh weight was measured by removing each replicate plant from the medium, blotting with paper towels, and weighing. Total dry weights were not determined, but dry weights of tissue used for measuring other parameters were determined.

Plant area was determined by removing individual plants from the growth medium, blotting them dry with paper towels, and photocopying each plant on translucent acetate photocopy sheets. The photocopies were cut out of the acetate sheet, and the area of the darkened image was determined using a Li-Cor LI-3000 Portable Area Meter or a Li-Cor 3100 Area Meter. The area was determined 5x per plant and the numbers averaged.

Chlorophyll/carotenoid content was determined by cutting of the apexes to 50 ± 2 mg, and placing them into glass scintillation vials with ethanol (80%, 10 mL) for extraction of the plant pigments. The vials were stored in the dark for 24 hours at 4°C.

Membrane permeability was determined by taking the next 100 ± 5 mg of the shoot, rinsing it in nanopure water (3 x), and placing in a flat bottom tube containing nanopure water (20 mL) for 24 hours. The conductivity of the water/plant solutions were measured using a Corning Checkmate 90 Field System conductivity meter. The tubes were boiled (20 min), and then allowed to cool to room temperature before conductivity measurements were taken again. Membrane injury was calculated by dividing initial conductivity (before boiling) by final conductivity and multiplying by 100.

Reported Statistics

The study author defined the NOAEC as the highest concentration that did not significantly differ from the control, and the LOAEC as the concentration beyond which all the concentrations differed from the control. The NOAEC and LOAEC were determined using a one-way ANOVA for normal data and the Kruskal-Wallis test for non-normal data, followed by multiple comparison tests using the statistical program Systat. EC_{50} values were calculated using the appropriate non-linear regression analysis under the Weibull method, the cumulative normal analysis, or various curve fitting techniques using the programs Lotus 1-2-3 and Excel.

Results

Expected Environmental Concentration

Phytotoxic effects of 2,4-D were observed within 2 days posttreatment, and were reported as continuing until study termination. The study author reported symptoms such as leaves folding downwards, stem rupture, and pigmentation reductions. In the first EEC experiment (plants cultured using M & S medium), percent inhibition as compared to the control was relatively high to very high (44.8 to 100%) across all the growth parameters tested with the exception of membrane integrity (29.7%; Table 1). For height, *M. sibiricum* control and treatment growth rates differ, but divergence occurs beyond 96 hours (Figure 1). In the second EEC experiment (plants cultured using modified Andrews' medium), percent inhibition as compared to the control ranged from mild to very high (29.4 to 100%), and there was promotion of fresh weight. Overall, the direction of the parameter response between EEC experiments was consistent, with treatment causing significant inhibition in both experiments. The study author noted that fresh weight was the only parameter where the two experiments diverged, and attributed it to the differing culture media. Root endpoints were the most sensitive in both experiments, exhibiting 100% inhibition in both number and length. Table 2 shows the EEC values for the controls and the 1.47 mg/L treatment groups for both experiments.

Figure 1. Growth Curves for *M. sibiricum* from First EEC Experiment with 2,4-D Technical (Acid).

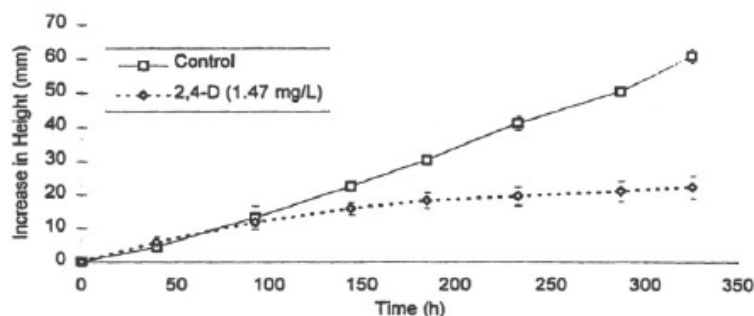


Table 1. A Comparison of Inhibition of Endpoints in the Expected Environmental Concentration Experiments.

GROWTH PARAMETER	PERCENT INHIBITION (mean $\pm$ s.d.)	
	First Experiment	Second Experiment
Area Under the Growth Curve	45.3 $\pm$ 6.4	29.4 $\pm$ 5.9
Increase in Shoot Length	56.8 $\pm$ 4.6	36.7 $\pm$ 2.1
Root Number	100.0 $\pm$ 0.0	100.0 $\pm$ 0.0
Root Length	100.0 $\pm$ 0.0	100.0 $\pm$ 0.0
Fresh Weight	44.8 $\pm$ 9.2	-5.8 $\pm$ 8.4
Membrane Integrity	29.7 $\pm$ 7.0	47.0 $\pm$ 7.6
Plant Area	79.4 $\pm$ 5.5	37.2 $\pm$ 7.8
Chlorophyll <i>a</i> (fresh)	90.7 $\pm$ 1.3	92.4 $\pm$ 1.5
Chlorophyll <i>b</i> (fresh)	85.6 $\pm$ 3.2	94.9 $\pm$ 3.0
Carotenoid (fresh)	87.9 $\pm$ 0.8	89.4 $\pm$ 1.3
Chlorophyll <i>a</i> (dry)	Not measured	94.2 $\pm$ 1.2
Chlorophyll <i>b</i> (dry)	Not measured	96.1 $\pm$ 2.2
Carotenoid (dry)	Not measured	91.8 $\pm$ 1.2

Table 2. Effects of 2,4-D on *M. sibiricum* After 14 Days.

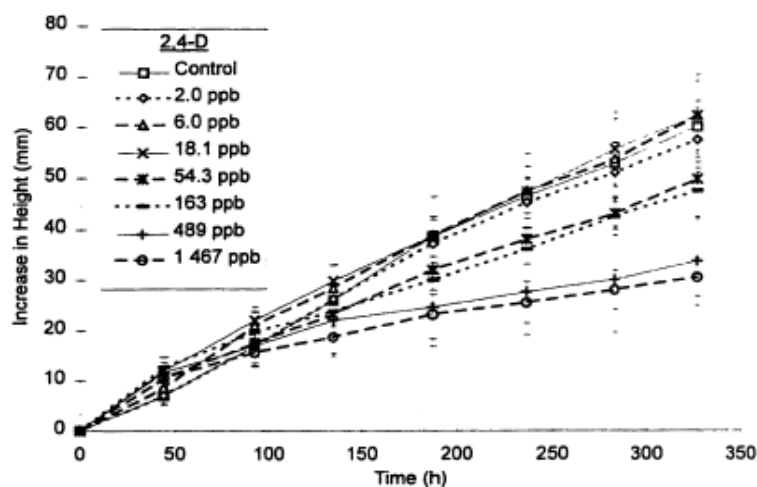
Treatment	Area under the growth curve	Increase in Plant Length (mm)	Root Number	Total Root Length (mm)	Fresh Weight (mg)	Chlorophyll <i>a</i> Content (mg/g fresh weight)	Chlorophyll <i>b</i> Content (mg/g fresh weight)	Carotenoid Content (mg/g fresh weight)	Membrane Permeability (%)	Plant Area (cm ²)
First Expected Environmental Concentration Experiment										
Control	8 939.3 $\pm$ 283.2 ^a	62.4 $\pm$ 2.1 ^a	6.3 $\pm$ 1.5 ^a	377.6 $\pm$ 60.1 ^a	541.9 $\pm$ 60.8 ^a	0.48 $\pm$ 0.02 ^a	0.18 $\pm$ 0.007 ^a	0.16 $\pm$ 0.005 ^a	8.0 $\pm$ 0.9 ^a	10.7 $\pm$ 2.1 ^a
2,4-D	4 888.5 $\pm$ 569.3 ^b	26.9 $\pm$ 2.9 ^b	0.0 $\pm$ 0.0 ^b	0.0 $\pm$ 0.0 ^b	299.0 $\pm$ 49.8 ^b	0.04 $\pm$ 0.006 ^b	0.03 $\pm$ 0.006 ^b	0.02 $\pm$ 0.001 ^b	22.9 $\pm$ 3.5 ^b	2.2 $\pm$ 0.6 ^b
Second Expected Environmental Concentration Experiment										
Control	8 816.2 $\pm$ 542.2 ^a	54.7 $\pm$ 1.2 ^a	8.0 $\pm$ 1.2 ^a	455.3 $\pm$ 72.0 ^a	796.8 $\pm$ 89.8 ^a	0.59 $\pm$ 0.05 ^a	0.22 $\pm$ 0.02 ^a	0.20 $\pm$ 0.02 ^a	8.0 $\pm$ 0.8 ^a	14.2 $\pm$ 1.5 ^a
2,4-D	6 223.2 $\pm$ 517.8 ^b	34.6 $\pm$ 1.2 ^b	0.0 $\pm$ 0.0 ^b	0.0 $\pm$ 0.0 ^b	842.8 $\pm$ 86.9 ^a	0.04 $\pm$ 0.009 ^b	0.01 $\pm$ 0.007 ^b	0.02 $\pm$ 0.003 ^b	31.6 $\pm$ 3.8 ^b	8.9 $\pm$ 1.1 ^b

* Any two means in the same column with the same superscript were not significantly different ($\alpha = 0.05$).

Dilution Series Experiment

M. sibiricum showed visual epinasty at concentrations of $\geq 18.1 \mu\text{g a.i./L}$, which began within 48 hours posttreatment and continued to study termination. *M. sibiricum* height and area under the growth curve demonstrated delayed response to the test material through the first 7 days (168 hours), and at ca. 8 days began to demonstrate significant responses in comparison to the control (Figure 2). The most sensitive endpoint was root length, with NOAEC and EC_{50} values of 2.0 and $13.1 \mu\text{g a.i./L}$, respectively (Table 3). Fresh weight was inhibited at lower test concentrations more so than at the highest, which the study author hypothesizes is due to the mode of action of 2,4-D by stimulating shoot growth, which would negatively impact yield despite being a promotion of growth.

Figure 2. Growth Curves for *M. sibiricum* from the Dilution Series with 2,4-D Technical (Acid).



* Fungal contamination led to plant losses. The values represented in the graphs are the averages of five replicates (negative control, 2, 6, and $18.1 \mu\text{g/L}$), four replicates (54.3 , 163 , and $1,467 \mu\text{g/L}$), and three replicates ($489 \mu\text{g/L}$).

Table 3. Summary of Statistical Results from the Dilution Series Effects of 2,4-D Technical (Acid) on *M. sibiricum*

GROWTH PARAMETER	NOEC (µg/L)	% I at NOEC	IC25 (µg/L)	IC50 (µg/L)
Area Under the Growth Curve	18.1	-8.3 ± 8.8	355.7 (145.9; 867.2) ^b	> 1 467 ^{a,c}
Increase in Shoot Length	6.0	-5.1 ± 4.7	409.9 (210.8; 797.8) ^b	> 1 467 ^{a,c}
Root Length	2.0	4.3 ± 13.0	5.1 (2.6; 10.0) ^c	13.1 (8.3; 20.6) ^c
Root Number	2.0	10.0 ± 11.1	7.8 (3.7; 16.17) ^b	17.7 (10.4; 30.1) ^b
Fresh Weight ^a	Fluctuated	Fluctuated	> 1 467 ^c	> 1 467 ^c
Membrane Integrity	18.1	-9.2 ± 11.1	228.3 (198.5; 262.5) ^c	801.3 (725.3; 885.2) ^c
Plant Area	18.1	-0.9 ± 10.5	73.7 (12.5; 436.1) ^c	957.4 (221.5; 4 138.0) ^c
Chlorophyll a (fresh wt)	54.3	-6.3 ± 21.5	166.2 (109.8; 251.5) ^b	313.7 (238.2; 413.1) ^b
Chlorophyll b (fresh wt)	54.3	-33.3 ± 97.4	152.3 (75.8; 306.0) ^b	253.7 (112.5; 572.1) ^b
Carotenoid (fresh wt)	54.3	6.7 ± 10.1	146.1 (111.1; 192.1) ^c	308.5 (256.2; 371.4) ^c
Chlorophyll a (dry wt)	18.1	7.2 ± 16.5	42.6 (30.1; 60.5) ^b	123.8 (96.2; 159.2) ^b
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Carotenoid (dry wt)	18.1	6.0 ± 13.9	34.5 (21.2; 56.3) ^b	109.6 (75.7; 158.8) ^b

a The total plant fresh fluctuated from an average control weight of 813.0 ± 75.4 mg down to an average low of 581.3 ± 60.0 mg at a 2,4-D concentration of 163 µg/L and then increased to an average of 800.7 ± 44.0 mg at the EEC. No NOEC could be calculated and the cumulative normal program estimated the IC25 and IC50 to be greater than 1467 µg/L.

b IC_p values and 95% confidence intervals calculated with the weibull method.

c IC_p and 95% confidence values calculated with the cumulative normal distribution model.

Aquatic plant toxicity comparisons

In comparison to other aquatic plants such as algae and floating macrophytes, the submersed macrophytes are the most sensitive. With regard to the results of this study, *M. sibiricum* was the most sensitive species, based on root length, both within the submersed macrophytes category and across all three categories (Table 4). Using the NOAEC as measure of sensitivity, *M. sibiricum* was far more sensitive to 2,4-D technical than the similar submersed aquatic macrophyte species *M. spicatum* (Table 5).

Table 4. A Summary of 2,4-D EC₅₀ Values for Aquatic Plants

Species	Endpoint	Exposure Duration	EC ₅₀ or IC ₅₀	Reference
Algae				
<i>Anabaena variabilis</i>	Growth	48 hours	100.0 mg/L	Hutber <i>et al.</i> (1979)
<i>Chlorella pyrenoidosa</i>	Growth	5 days	33.9 mg/L	Gramlich and Frans (1964)
<i>Chlorella pyrenoidosa</i>	Cell Count	10 - 14 days	56 mg/L	Baarschers <i>et al.</i> (1988)
<i>Chlorella vulgaris</i>	Cell Count	10 - 14 days	19 mg/L	Baarschers <i>et al.</i> (1988)
<i>Selenastrum capricornutum</i>	Population Growth (flask assay)	96 hours	25.9 mg/L	St. Laurent <i>et al.</i> (1992)
<i>Selenastrum capricornutum</i>	Population Growth (microplate)	96 hours	24.2 mg/L	St. Laurent <i>et al.</i> (1992)
Floating Macrophytes				
<i>Lemna paucicostata</i>	Leaf Surface Area	10 days	0.75 mg/L	Retzlaff (1992)
<i>Salvinia natans</i> (L.) All.	Wet Weight	4 weeks	6.5 mg/L	Göncü and Sencic (1994)
<i>Salvinia natans</i>	Chlorophyll	4 weeks	0.3 mg/L	Göncü and Sencic (1994)
Macrophytes				
<i>Oryza sativa</i>	Root Length	96 hours	0.1 mg/L	Hardcastle and Wilkinson (1970)
<i>Myriophyllum spicatum</i>	Branch Number	5 days	0.04 mg/L	Bird (1993)
<i>Myriophyllum sibiricum</i>	Root Length	14 days	0.01 mg/L	This Document
<i>Myriophyllum sibiricum</i>	Carotenoid (dry)	14 days	0.11 mg/L	This Document

Table 5. A Comparison of NOAEC Values for Two Submersed Aquatic Species

Species	Endpoint	Exposure Duration	NOEC	Reference
Macrophytes				
<i>Myriophyllum spicatum</i>	New Buds	5 days	80 µg/L	Christopher and Bird (1992)
<i>Myriophyllum spicatum</i>	Root Number	5 days	20 µg/L	Christopher and Bird (1992)
<i>Myriophyllum spicatum</i>	Number of Branches	5 days	20 µg/L	Christopher and Bird (1992)
<i>Myriophyllum spicatum</i>	Total Number of New Structures	5 days	20 µg/L	Christopher and Bird (1992)
<i>Myriophyllum sibiricum</i>	Root Length	14 days	2.0 µg/L	This Document
<i>Myriophyllum sibiricum</i>	Root Number	14 days	2.0 µg/L	This Document
<i>Myriophyllum sibiricum</i>	Increase in Shoot Height	14 days	6.0 µg/L	This Document
<i>Myriophyllum sibiricum</i>	Plant Area	14 days	18.1 µg/L	This Document

In summary, 2,4-D had a significant effect on the aquatic macrophyte species *M. sibiricum*. At the effective environmental concentration (EEC) of 1.47 mg/L, all endpoints evaluated were affected by the test material, with the exception of weight in experiment 2, possibly due to differing culture mediums being used for the two EEC experiments. In the dilution series experiment, The most sensitive endpoint was root length, with NOAEC and EC₅₀ values of 2.0 and 13.1 µg a.i./L, respectively. When comparing the toxic effects of 2,4-D technical to *M. sibiricum* to other aquatic plants such as algae and floating aquatic macrophytes, the EC₅₀ value calculated for *M. sibiricum* root length is the most sensitive, both within the category of submersed aquatic macrophytes, and throughout the three aquatic species categories.

Description of Use in Document: Quantitative

Rationale for Use: This study provided the most sensitive EC₅₀ for vascular aquatic plants. These data will be used for RQ calculation in the risk assessment. Although raw data were not available, the study was of good quality.

Limitations of Study:

This study was a doctoral dissertation with a major objective of developing appropriate methods for conducting toxicity tests with a submersed aquatic macrophyte species, *M. sibiricum*. While some of

the test methods are standard with regard to EPA and other guidelines, some were independently developed by the study author.

Additional information regarding the toxicity of 2,4-D to *M. sibiricum* would be beneficial, given the potential for exposure concentrations at least 10-fold higher in the field, compared to the highest concentration tested in this study.

Raw data were not available.

Reviewer: Moncie Wright, Staff Scientist, Cambridge Environmental, Inc.

Secondary Reviewer: Christine Hartless, Wildlife Biologist, EFED/ERB1

Open Literature Review Summary

Chemical Name: 2,4-D

CAS NO: 94-75-7

ECOTOX Record Number and Citation: E74985

Roshon, R.D. 1997. A toxicity test for the effects of chemicals on the non-target submersed aquatic macrophyte, *Myriophyllum sibiricum* komarov. Doctoral Thesis, University of Guelph, Canada. National Library of Canada. UMI Dissertation Services. Accessed through ProQuest. Printed in 2003.

Purpose of Review: Litigation/Endangered Species

Date of Assessment: 12/3/08

Brief Summary of Study Findings:

The objective of the study was to develop a laboratory toxicity test for the submersed aquatic macrophyte *Myriophyllum sibiricum*, and to use a suite of pesticides and reference chemicals to validate the methods developed. Two expected environmental concentration (EEC) studies were conducted at the highest application rate, and a dilution series test was conducted with a negative control and seven test concentrations. 2,4-D had a significant effect on the aquatic macrophyte species *M. sibiricum*. At the effective environmental concentration (EEC) of 1.47 mg/L, all endpoints evaluated were affected by the test material, with the exception of weight in experiment 2, possibly due to differing culture mediums being used for the two EEC experiments. In the dilution series experiment, The most sensitive endpoint was root length, with NOAEC and EC₅₀ values of 2.0 and 13.1 µg a.i./L, respectively. When comparing the toxic effects of 2,4-D technical to *M. sibiricum* to other aquatic plants such as algae and floating aquatic macrophytes, the EC₅₀ value calculated for *M. sibiricum* root length is the most sensitive, both within the category of submersed aquatic macrophytes, and throughout the three aquatic species categories selected for comparison by the study author.

Methods

Species Selection and Culturing Conditions

Myriophyllum sibiricum was selected as the aquatic macrophyte species of choice for use in the toxicity test due to its sensitivity to toxicants, ecological importance, commercial availability, good taxonomic characterization, and ability to grow rapidly under laboratory conditions. This species also has a growth habit that is easily measured. *M. sibiricum* turions were collected from the shallows of Puslinch Lake (15 km SW of Guelph, Ontario) on November 2 and 25, 1990. The turions were transported to the laboratory, where they were washed in distilled water and stored in the dark at 4°C. Aquaria (20 L) were filled with sediment (5 cm) and distilled water (18 L). *M. sibiricum* turions (10) were placed in the sediment December 6, 1990. The aquaria were aerated and maintained at 15°C for a constant supply. Based on past research, the study author decided to culture *M. sibiricum* axenically. For the first expected environmental concentration (EEC) experiment, stock plants were cultured in Murashige & Skoog medium, and for the second, they were cultured in modified Andrews' medium. Tests tubes containing plants and growth medium were placed in a growth cabinet for a 16h light:8 h

dark photoperiod at temperatures of 25°C:20°C for *ca.* 10-12 days, when shoots at least 3 cm long should be present. Any plants growing in media contaminated with bacteria or fungi were not used for the test.

Test Conditions

2,4-D Technical (acid) was tested for a 14 day period at an expected environmental concentration (EEC) of 1.47 mg/L, which was based on the maximum recommended label rate of 2.2 kg/ha. The EEC experiment was conducted twice (February 21, 1994, and February 9, 1995). Based on the EEC experiment results, a dilution series test was conducted on February 9, 1995, using a negative control and concentrations of 2.0, 6.0, 18.1, 54.3, 163, 489, and 1,467 µg 2,4-D technical/L for 14 days. 2,4-D technical was reported as having water solubilities of 890 and 900 mg/L, based on its mode of action as an Auxin Mimic, and DNA, RNA, and protein disrupter, respectively. 2,4-D technical (acid) was dissolved in sterile water before addition to the growth medium. Prior to autoclaving and addition of test material, an iron and chelator (EDTA) stock solution (10 mL/L) were added to the modified Andrews' medium. The test medium was adjusted to a pH of 5.8. The conductivity and pH of the media in each tube was measured at test initiation and termination. Hexane or methanol was used as the solvent carrier of choice.

Individual test tubes (5 replicates per treatment group and the control) were prepared with 3 g of Turface (established as optimal due to preliminary work) and spiked nutrient medium (40 mL). The stock plants (10-12 days old; cultured in Andrews' medium) were prepared by cutting 3 cm apical lengths and removing all buds, branches, and roots. The apexes were transferred to the test tubes, and measuring rods were inserted into the tubes. The test media was not aerated, and the carbon source was sucrose (chosen based on preliminary tests). The test tubes were placed in a growth cabinet under the same conditions used for culturing of *M. sibiricum*. Optimal light fluence rate was established as 100 µmol·m⁻²·s⁻¹, and a mixture of incandescent and fluorescent lighting was chosen based on preliminary testing.

Endpoints of Interest (Not all inclusive)

Area under the growth curve was determined using a glass measuring rod that consisted of a 15 cm length of Westergren Blood Sedimentation Tube. This measuring rod was inserted into experimental test tubes containing *M. sibiricum* (3 cm apical segments). Initial plant height was measured using the rod (to the nearest mm), and the height was measured every 2 days thereafter until 14 days posttreatment. Growth curves were plotted using the length data, and the area under the curve was determined by the following equation (IH = increase in height from test initiation; T = time at each subsequent period in hours from time zero):

$$\text{Area} = \sum_{i=2}^n \frac{IH_{i-1} + IH_i}{2} \cdot (T_i - T_{i-1}) ; n = 8$$

Primary production was estimated by measuring dissolved oxygen concentrations. Healthy plants' solutions were treated with 30 g/L sucrose prior to autoclaving. A Corning Portable Checkmate Dissolved Oxygen Meter was used to measure the percentage of oxygen present in the liquid medium on an hourly basis. The dissolved oxygen concentrations were plotted over time.

Fresh weight was measured by removing each replicate plant from the medium, blotting with paper towels, and weighing. Total dry weights were not determined, but dry weights of tissue used for measuring other parameters were determined.

Plant area was determined by removing individual plants from the growth medium, blotting them dry with paper towels, and photocopying each plant on translucent acetate photocopy sheets. The photocopies were cut out of the acetate sheet, and the area of the darkened image was determined using a Li-Cor LI-3000 Portable Area Meter or a Li-Cor 3100 Area Meter. The area was determined 5x per plant and the numbers averaged.

Chlorophyll/carotenoid content was determined by cutting of the apexes to 50 ± 2 mg, and placing them into glass scintillation vials with ethanol (80%, 10 mL) for extraction of the plant pigments. The vials were stored in the dark for 24 hours at 4°C.

Membrane permeability was determined by taking the next 100 ± 5 mg of the shoot, rinsing it in nanopure water (3 x), and placing in a flat bottom tube containing nanopure water (20 mL) for 24 hours. The conductivity of the water/plant solutions were measured using a Corning Checkmate 90 Field System conductivity meter. The tubes were boiled (20 min), and then allowed to cool to room temperature before conductivity measurements were taken again. Membrane injury was calculated by dividing initial conductivity (before boiling) by final conductivity and multiplying by 100.

Reported Statistics

The study author defined the NOAEC as the highest concentration that did not significantly differ from the control, and the LOAEC as the concentration beyond which all the concentrations differed from the control. The NOAEC and LOAEC were determined using a one-way ANOVA for normal data and the Kruskal-Wallis test for non-normal data, followed by multiple comparison tests using the statistical program Systat. EC_{50} values were calculated using the appropriate non-linear regression analysis under the Weibull method, the cumulative normal analysis, or various curve fitting techniques using the programs Lotus 1-2-3 and Excel.

Results

Expected Environmental Concentration

Phytotoxic effects of 2,4-D were observed within 2 days posttreatment, and were reported as continuing until study termination. The study author reported symptoms such as leaves folding downwards, stem rupture, and pigmentation reductions. In the first EEC experiment (plants cultured using M & S medium), percent inhibition as compared to the control was relatively high to very high (44.8 to 100%) across all the growth parameters tested with the exception of membrane integrity (29.7%; Table 1). For height, *M. sibiricum* control and treatment growth rates differ, but divergence occurs beyond 96 hours (Figure 1). In the second EEC experiment (plants cultured using modified Andrews' medium), percent inhibition as compared to the control ranged from mild to very high (29.4 to 100%), and there was promotion of fresh weight. Overall, the direction of the parameter response between EEC experiments was consistent, with treatment causing significant inhibition in both experiments. The study author noted that fresh weight was the only parameter where the two experiments diverged, and attributed it to the differing culture media. Root endpoints were the most sensitive in both experiments, exhibiting 100% inhibition in both number and length. Table 2 shows the EEC values for the controls and the 1.47 mg/L treatment groups for both experiments.

Figure 1. Growth Curves for *M. sibiricum* from First EEC Experiment with 2,4-D Technical (Acid).

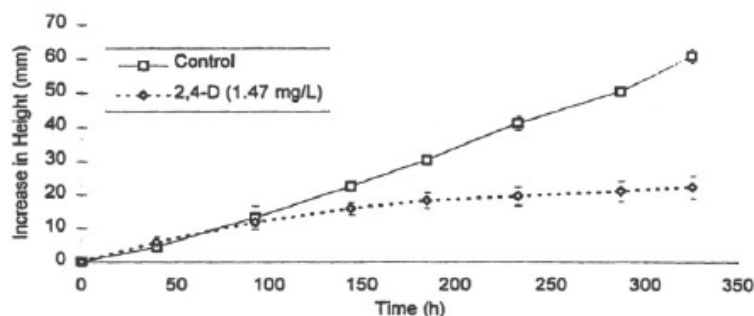


Table 1. A Comparison of Inhibition of Endpoints in the Expected Environmental Concentration Experiments.

GROWTH PARAMETER	PERCENT INHIBITION (mean $\pm$ s.d.)	
	First Experiment	Second Experiment
Area Under the Growth Curve	45.3 $\pm$ 6.4	29.4 $\pm$ 5.9
Increase in Shoot Length	56.8 $\pm$ 4.6	36.7 $\pm$ 2.1
Root Number	100.0 $\pm$ 0.0	100.0 $\pm$ 0.0
Root Length	100.0 $\pm$ 0.0	100.0 $\pm$ 0.0
Fresh Weight	44.8 $\pm$ 9.2	-5.8 $\pm$ 8.4
Membrane Integrity	29.7 $\pm$ 7.0	47.0 $\pm$ 7.6
Plant Area	79.4 $\pm$ 5.5	37.2 $\pm$ 7.8
Chlorophyll <i>a</i> (fresh)	90.7 $\pm$ 1.3	92.4 $\pm$ 1.5
Chlorophyll <i>b</i> (fresh)	85.6 $\pm$ 3.2	94.9 $\pm$ 3.0
Carotenoid (fresh)	87.9 $\pm$ 0.8	89.4 $\pm$ 1.3
Chlorophyll <i>a</i> (dry)	Not measured	94.2 $\pm$ 1.2
Chlorophyll <i>b</i> (dry)	Not measured	96.1 $\pm$ 2.2
Carotenoid (dry)	Not measured	91.8 $\pm$ 1.2

Table 2. Effects of 2,4-D on *M. sibiricum* After 14 Days.

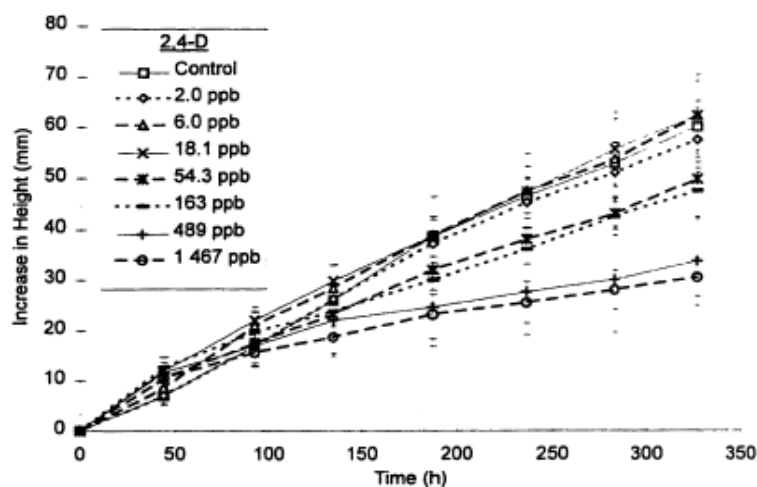
Treatment	Area under the growth curve	Increase in Plant Length (mm)	Root Number	Total Root Length (mm)	Fresh Weight (mg)	Chlorophyll <i>a</i> Content (mg/g fresh weight)	Chlorophyll <i>b</i> Content (mg/g fresh weight)	Carotenoid Content (mg/g fresh weight)	Membrane Permeability (%)	Plant Area (cm ²)
First Expected Environmental Concentration Experiment										
Control	8 939.3 $\pm$ 283.2 ^a	62.4 $\pm$ 2.1 ^a	6.3 $\pm$ 1.5 ^a	377.6 $\pm$ 60.1 ^a	541.9 $\pm$ 60.8 ^a	0.48 $\pm$ 0.02 ^a	0.18 $\pm$ 0.007 ^a	0.16 $\pm$ 0.005 ^a	8.0 $\pm$ 0.9 ^a	10.7 $\pm$ 2.1 ^a
2,4-D	4 888.5 $\pm$ 569.3 ^b	26.9 $\pm$ 2.9 ^b	0.0 $\pm$ 0.0 ^b	0.0 $\pm$ 0.0 ^b	299.0 $\pm$ 49.8 ^b	0.04 $\pm$ 0.006 ^b	0.03 $\pm$ 0.006 ^b	0.02 $\pm$ 0.001 ^b	22.9 $\pm$ 3.5 ^b	2.2 $\pm$ 0.6 ^b
Second Expected Environmental Concentration Experiment										
Control	8 816.2 $\pm$ 542.2 ^a	54.7 $\pm$ 1.2 ^a	8.0 $\pm$ 1.2 ^a	455.3 $\pm$ 72.0 ^a	796.8 $\pm$ 89.8 ^a	0.59 $\pm$ 0.05 ^a	0.22 $\pm$ 0.02 ^a	0.20 $\pm$ 0.02 ^a	8.0 $\pm$ 0.8 ^a	14.2 $\pm$ 1.5 ^a
2,4-D	6 223.2 $\pm$ 517.8 ^b	34.6 $\pm$ 1.2 ^b	0.0 $\pm$ 0.0 ^b	0.0 $\pm$ 0.0 ^b	842.8 $\pm$ 86.9 ^a	0.04 $\pm$ 0.009 ^b	0.01 $\pm$ 0.007 ^b	0.02 $\pm$ 0.003 ^b	31.6 $\pm$ 3.8 ^b	8.9 $\pm$ 1.1 ^b

* Any two means in the same column with the same superscript were not significantly different ($\alpha = 0.05$).

Dilution Series Experiment

M. sibiricum showed visual epinasty at concentrations of $\geq 18.1 \mu\text{g a.i./L}$, which began within 48 hours posttreatment and continued to study termination. *M. sibiricum* height and area under the growth curve demonstrated delayed response to the test material through the first 7 days (168 hours), and at ca. 8 days began to demonstrate significant responses in comparison to the control (Figure 2). The most sensitive endpoint was root length, with NOAEC and EC_{50} values of 2.0 and $13.1 \mu\text{g a.i./L}$, respectively (Table 3). Fresh weight was inhibited at lower test concentrations more so than at the highest, which the study author hypothesizes is due to the mode of action of 2,4-D by stimulating shoot growth, which would negatively impact yield despite being a promotion of growth.

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Fresh Weight ^a	Fluctuated	Fluctuated	> 1 467 ^c	> 1 467 ^c
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Plant Area	18.1	-0.9 ± 10.5	73.7 (12.5; 436.1) ^c	957.4 (221.5; 4 138.0) ^c
Chlorophyll a (fresh wt)	54.3	-6.3 ± 21.5	166.2 (109.8; 251.5) ^b	313.7 (238.2; 413.1) ^b
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Chlorophyll a (dry wt)	18.1	7.2 ± 16.5	42.6 (30.1; 60.5) ^b	123.8 (96.2; 159.2) ^b
Chlorophyll b (dry wt)	54.3	12.5 ± 63.3	67.2 (38.9; 116.2) ^b	141.3 (101.8; 196.1) ^b
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a The total plant fresh fluctuated from an average control weight of 813.0 ± 75.4 mg down to an average low of 581.3 ± 60.0 mg at a 2,4-D concentration of 163 µg/L and then increased to an average of 800.7 ± 44.0 mg at the EEC. No NOEC could be calculated and the cumulative normal program estimated the IC25 and IC50 to be greater than 1467 µg/L.

b IC_p values and 95% confidence intervals calculated with the weibull method.

c IC_p and 95% confidence values calculated with the cumulative normal distribution model.

Aquatic plant toxicity comparisons

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Species	Endpoint	Exposure Duration	EC ₅₀ or IC ₅₀	Reference
Algae				
<i>Anabaena variabilis</i>	Growth	48 hours	100.0 mg/L	Hutber <i>et al.</i> (1979)
<i>Chlorella pyrenoidosa</i>	Growth	5 days	33.9 mg/L	Gramlich and Frans (1964)
<i>Chlorella pyrenoidosa</i>	Cell Count	10 - 14 days	56 mg/L	Baarschers <i>et al.</i> (1988)
<i>Chlorella vulgaris</i>	Cell Count	10 - 14 days	19 mg/L	Baarschers <i>et al.</i> (1988)
<i>Selenastrum capricornutum</i>	Population Growth (flask assay)	96 hours	25.9 mg/L	St. Laurent <i>et al.</i> (1992)
<i>Selenastrum capricornutum</i>	Population Growth (microplate)	96 hours	24.2 mg/L	St. Laurent <i>et al.</i> (1992)
Floating Macrophytes				
<i>Lemna paucicostata</i>	Leaf Surface Area	10 days	0.75 mg/L	Retzlaff (1992)
<i>Salvinia natans</i> (L.) All.	Wet Weight	4 weeks	6.5 mg/L	Göncü and Sencic (1994)
<i>Salvinia natans</i>	Chlorophyll	4 weeks	0.3 mg/L	Göncü and Sencic (1994)
Macrophytes				
<i>Oryza sativa</i>	Root Length	96 hours	0.1 mg/L	Hardcastle and Wilkinson (1970)
<i>Myriophyllum spicatum</i>	Branch Number	5 days	0.04 mg/L	Bird (1993)
<i>Myriophyllum sibiricum</i>	Root Length	14 days	0.01 mg/L	This Document
<i>Myriophyllum sibiricum</i>	Carotenoid (dry)	14 days	0.11 mg/L	This Document

Table 5. A Comparison of NOAEC Values for Two Submersed Aquatic Species

Species	Endpoint	Exposure Duration	NOEC	Reference
Macrophytes				
<i>Myriophyllum spicatum</i>	New Buds	5 days	80 µg/L	Christopher and Bird (1992)
<i>Myriophyllum spicatum</i>	Root Number	5 days	20 µg/L	Christopher and Bird (1992)
<i>Myriophyllum spicatum</i>	Number of Branches	5 days	20 µg/L	Christopher and Bird (1992)
<i>Myriophyllum spicatum</i>	Total Number of New Structures	5 days	20 µg/L	Christopher and Bird (1992)
<i>Myriophyllum sibiricum</i>	Root Length	14 days	2.0 µg/L	This Document
<i>Myriophyllum sibiricum</i>	Root Number	14 days	2.0 µg/L	This Document
<i>Myriophyllum sibiricum</i>	Increase in Shoot Height	14 days	6.0 µg/L	This Document
<i>Myriophyllum sibiricum</i>	Plant Area	14 days	18.1 µg/L	This Document

In summary, 2,4-D had a significant effect on the aquatic macrophyte species *M. sibiricum*. At the effective environmental concentration (EEC) of 1.47 mg/L, all endpoints evaluated were affected by the test material, with the exception of weight in experiment 2, possibly due to differing culture mediums being used for the two EEC experiments. In the dilution series experiment, The most sensitive endpoint was root length, with NOAEC and EC₅₀ values of 2.0 and 13.1 µg a.i./L, respectively. When comparing the toxic effects of 2,4-D technical to *M. sibiricum* to other aquatic plants such as algae and floating aquatic macrophytes, the EC₅₀ value calculated for *M. sibiricum* root length is the most sensitive, both within the category of submersed aquatic macrophytes, and throughout the three aquatic species categories.

Description of Use in Document: Quantitative

Rationale for Use: This study provided the most sensitive EC₅₀ for vascular aquatic plants. These data will be used for RQ calculation in the risk assessment. Although raw data were not available, the study was of good quality.

Limitations of Study:

This study was a doctoral dissertation with a major objective of developing appropriate methods for conducting toxicity tests with a submersed aquatic macrophyte species, *M. sibiricum*. While some of

the test methods are standard with regard to EPA and other guidelines, some were independently developed by the study author.

Additional information regarding the toxicity of 2,4-D to *M. sibiricum* would be beneficial, given the potential for exposure concentrations at least 10-fold higher in the field, compared to the highest concentration tested in this study.

Raw data were not available.

Reviewer: Moncie Wright, Staff Scientist, Cambridge Environmental, Inc.

Secondary Reviewer: Christine Hartless, Wildlife Biologist, EFED/ERB1

Open Literature Review Summary

Chemical Name: 2,4 D acid, 99% ai

CAS No: 94-75-7

ECOTOX Record Number and Citation: 2008. Reylea, R.A. A cocktail of contaminants: how mixtures of pesticides at low concentrations affect aquatic communities. *Oecologia* 11, 2008, DOI 10.1007/s00442-008-1213-9.

Purpose of Review: Litigation (030001)

Date of Review: 12/03/08

Summary of Study Findings:

This study was conducted to examine the effects of multiple pesticides applied at low doses to aquatic communities. Tests were conducted using five insecticides (malathion, carbaryl, chlorpyrifos, diazinon and endosulfan) and five herbicides (glyphosate, atrazine, acetochlor, metolachlor and 2,4-D acid) and the aquatic communities consisted of zooplankton, phytoplankton, periphyton and larval amphibians (gray tree frogs, *Hyla versicolor* and leopard frogs, *Rana pipiens*). Multiple trials were conducted by evaluating effects of each pesticide singly, a mix of all insecticides, a mix of all herbicides and a mix of all ten compounds on outdoor experimental mesocosm ponds. There were no remarkable effects of 2,4 D on any population in the aquatic mesocosm communities. Generally, herbicides played a much weaker role in controlling population dynamics of the aquatic communities, compared to insecticides.

Effects on amphibians varied between species and endpoints (survival, time to metamorphosis and mass at metamorphosis); gray tree frogs exhibited no significant inhibitions to any pesticide and leopard frogs were only affected by insecticides. The effects pesticide mixtures on zooplankton and algae were able to be predicted from the results of the individual pesticide trials. For zooplankton, no herbicides yielded any inhibitions in abundance, while insecticides (individually and mixed) and all ten pesticides yielded significant inhibitions. Insecticides, however, yielded varying response among the different zooplankton species. Phytoplankton exhibited significant effects of treatment and time, but no treatment-by-time interaction. Periphyton exhibited significant effects of treatment, time and treatment-by-time interaction. The overall results of this study suggest that wetland communities can be markedly affected by low concentrations of pesticides, particularly insecticides (both separate and combined). Table 3 from the study report (below) shows the statistical results from response variables and treatment, time and treatment-by-time ANOVA trials.

Table 3 Results of ANOVAs and repeated-measure ANOVAs that examined how the pesticide treatments affected a number of biotic and abiotic response variables. *F*-values are given; *P*-values are in parentheses

Response variable	Treatment	Time	Treatment × time
Tree frog survival	1.6 (0.103)		
Tree frog mass at metamorphosis	4.5 (<0.001)		
Tree frog time to metamorphosis	2.3 (0.019)		
Leopard frog survival	56.1 (<0.001)		
Leopard frog mass at metamorphosis	7.4 (<0.001)		
Leopard frog time to metamorphosis	2.0 (0.053)		
<i>Daphnia pulex</i> abundance	13.9 (<0.001)	<0.1 (0.895)	1.3 (0.243)
<i>Ceriodaphnia</i> abundance	4.1 (<0.001)	<0.1 (0.982)	1.4 (0.212)
<i>Skistodiaptomus oregonensis</i> abundance	11.0 (<0.001)	<0.1 (0.971)	1.1 (0.421)
<i>Leptodiaptomus minutus</i> abundance	8.5 (<0.001)	<0.1 (0.999)	1.7 (0.098)
Phytoplankton (chlorophyll <i>a</i>)	3.9 (<0.001)	158 (<0.001)	1.1 (0.385)
Periphyton biomass	3.4 (<0.001)	6.0 (0.019)	2.5 (0.012)
Temperature	1.1 (0.404)	655 (<0.001)	1.1 (0.411)
pH	5.1 (0.001)	23.8 (<0.001)	3.0 (0.003)
Dissolved oxygen	9.5 (<0.001)	11.4 (0.002)	3.5 (0.001)

Methods:

Experiments were conducted in outdoor mesocosms at the University of Pittsburgh's Pymatuning Laboratory of Ecology in northwestern Pennsylvania. A randomized block design was established for the 15 treatments with the control being replicated 3 times and all treatments being replicated 4 times for a total of 59 experimental units. Treatments included a negative control, a vehicle control (ethanol), one of the five insecticides applied separately, one of the five herbicides applied separately, a mix of the five insecticides, a mix of the five herbicides and a mix of all ten pesticides. Insecticides included carbaryl, malathion, chlorpyrifos, diazinon and endosulfan. Herbicides included acetochlor, metolachlor, glyphosate, 2,4-D and atrazine. Table 2 shows the purity of each test material, actual concentrations obtained (nominal concentrations were 10 ppb) and comparisons to US EPA drinking water standards.

Mesocosm units were 1,300 L cattle watering tanks. Tanks were filled with ~1,000 L of well water (pH=8) on 15-19 May 2006. Water containing zooplankton, phytoplankton and periphyton from a mixture of nearby ponds was added on June 7. Leaf litter (~300 g, *Quercus* sp.) and commercial rabbit chow were added on the following day. On June 16, two unglazed clay tiles were added to serve as periphyton samplers. Tanks were allowed to acclimate for 18 days prior to the addition of tadpoles. Tadpoles were obtained from wild-caught egg masses which were hatched in 200 L wading pools. Egg masses were collected at different times and the two species were of different ages when experiments were initiated. All tadpoles were fed rabbit chow *ad libitum* prior to being introduced into the mesocosms. Twenty tadpoles of each species were added to each tank from a mixture of all egg masses (initial mass ± SE: gray tree frogs = 77 ± 4 mg, leopard frogs = 134 ± 12 mg) resulting in a density of 9/m² for each species. Tadpoles were acclimated for two days prior to application of the pesticides at 10 ppb by dissolving test materials in ethanol and then appropriate amounts of test water; ethanol concentrations did not exceed 0.0003%. Approximately 1 hour after introduction of the pesticides, samples were collected from all tanks except control tanks and analyzed using HPLC. Results from analytical verifications are summarized in Table 2 from the study report (below). Analyses of well water used to fill the tanks indicated that no pesticides were present in the water prior to the start of the study.

Table 2 The purity of the ten pesticides used in the experiment, the actual concentrations achieved (nominal concentrations = 10 p.p.b.), and comparisons to current US Environmental Protection Agency (EPA) drinking water standards

Pesticide	Technical grade purity (%)	Actual concentration (p.p.b.)	Maximum concentrations observed in water bodies (p.p.b.)	Maximum contaminant level or lifetime health advisory (p.p.b.) ^g	Criteria for continuous concentration (p.p.b.) ^h
Carbaryl	99.5	6.9	2,500 ^c	No standard	No standard
Malathion	99	5.8	583 ^e	100	0.1
Chlorpyrifos	99.5	3.2	2 ^f	2	0.041
Diazinon	99.5	2.1	33,000 ^f	1	0.17
Endosulfan	99.3	6.4	9 ^b	No standard	0.056
Acetochlor	98.0	10.0	21 ^d	No standard	No standard
Metolachlor	97.1	7.4	124 ^d	70	No standard
Glyphosate	98	6.9	5,200 ^a	700	No standard
2,4-D	99	16.0	692 ^f	70	No standard
Atrazine	98.1	6.4	172 ^d	3	No standard

^a Edwards et al. (1980)

^b Muschal (1997)

^c Norris et al. (1983)

^d Battaglin et al. (2003)

^e California Department of Fish and Game (1982)

^f Hazardous Substances Data Bank (<http://toxnet.nlm.nih.gov/cgi-bin/sis/htmlgen?HSDB>)

^g EPA (2006)

^h Defined by the EPA as “the highest concentration of a material in surface water to which an aquatic community can be exposed indefinitely without resulting in an unacceptable effect” (<http://www.epa.gov/waterscience/criteria/wqcriteria.html#cmc>)

Response Variables

On days 10 and 35, temperature, pH and dissolved oxygen in each tank were quantified. On days 16 and 36 zooplankton from each tank were sampled by collecting 1 L of sampled water (a combination of four samples in each cardinal direction and one from the center) and filtering through a 62-µm Nitex screen and preserving the specimens in 70% ethanol. Zooplankton were classified to species and twelve taxonomic groups of cladocerans and copepods were detected, but the community was dominated (91%) by two species of cladocerans (*Daphnia pulex* and *Ceriodaphnia* sp.) and two species of copepods (*Skistodiaptomus oregonensis* and *Leptodiaptomus minutus*). Therefore, abundance of these four groups was analyzed.

Phytoplankton were sampled on days 16 and 35 by collecting 500 mL from the middle of the water column and filtering. Chlorophyll *a* concentrations were determined using a calibrated fluorometer following the protocol, including acidification, of Arar and Collins (1997).

Periphyton was sampled on days 25 and 36 by scrubbing one side of the tile into a tub of filtered water and vacuum filtering the slurry. Following filtration, filters were dried and reweighed to determine the biomass of algae present on each tile.

Amphibian metamorphs were collected from the tanks daily beginning on day 21 (17 July); metamorphs were removed when at least one emerged forelimb was present. All collected individuals were held in the lab until tail restoration was complete, at which point the number of days until complete metamorphosis was recorded. Each animal was then euthanized in 2% MS-222, preserved and later weighed. Response variables included percent survival, mean time to metamorphosis and mean mass at metamorphosis. From days 50 to 57, water was removed from each tank (120 L/day) to

simulate pond drying, which can accelerate metamorphosis. All remaining amphibians were collected to determine how many had died and how many failed to emerge due to slow growth and development. Tadpoles were considered a successful metamorph if they contained at least one emerged forelimb and were held until metamorphosis was complete as described above.

Statistical Analyses

Data were analyzed using multivariate ANOVA (MANOVA) composed of second measurements of all abiotic variables, cladoceran and copepod abundance, phytoplankton abundance (as measured via chlorophyll *a*), periphyton biomass, amphibian survival, and size and time to metamorphosis of gray tree frogs. Due to nearly 100% mortality in two of the pesticide treatments for leopard frogs, there were no life history data in these treatments. Therefore, to prevent the first MANOVA from excluding all of the other food web data from these two treatments, the leopard frog life history responses were analyzed in a separated MANOVA. Following significant multivariate results, each univariate response variable was analyzed using either an ANOVA (for responses that were measured at the end of the experiment: tree frog mass, tree frog time to metamorphosis, tree frog survival, and leopard frog survival) or a repeated-measures ANOVA (for responses measured twice during the experiment: temperature, dissolved oxygen, and pH as well as the abundance of cladocerans, copepods, phytoplankton and periphyton). When necessary, data were log-transformed. Because the zooplankton data had heteroscedastic errors, these data were ranked prior to analysis. Multivariate analyses controlled the experiment-wise error rate at $\alpha = 0.05$, to maximize the power, post hoc comparisons were conducted using Fisher's LSD test which preserves the comparison-wise error rate at $\alpha = 0.05$.

Results:

Amphibians

Gray tree frog tadpoles did not experience any significant declines in survival or time to metamorphosis with any of the treatments; however, mass at metamorphosis was significantly greater in the atrazine, five insecticides and all 10 pesticide treatments as these treatments significantly inhibited survival of leopard frogs allowing more resources for the gray tree frogs.

For leopard frogs, no herbicide or the combination of all five herbicides caused any significant differences for any of the endpoints. Diazinon significantly reduced % survival (76% relative to 96% in the control) and mass at metamorphosis while endosulfan significantly reduced % survival (16% relative to 96% in the control) but significantly increased mass at metamorphosis. Percent survival with the mix of five insecticides and ten pesticides was approximately 1% (Figures 1 and 2, below). The mix of five insecticides and all ten pesticides caused significantly higher mortality than the endosulfan treatment ($P = 0.031$). Relative to the control, mass at metamorphosis was significantly reduced in the diazinon treatment ($P = 0.011$) but significantly greater in the endosulfan treatment ($P < 0.001$). Time to metamorphosis was not significantly different at any treatment level relative to the control.

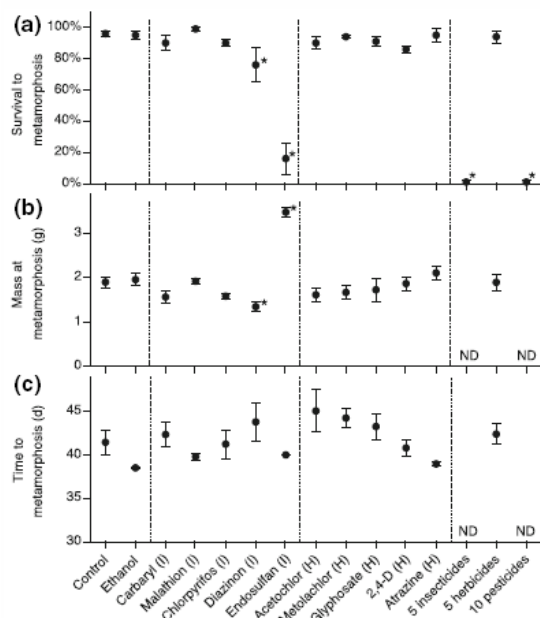


Fig. 1 Changes in the **a** survival, **b** mass at metamorphosis, and **c** time to metamorphosis of leopard frog tadpoles (*Rana pipiens*) in outdoor mesocosms exposed to no pesticides (control), solvent only (ethanol), five separate insecticides (*I*) (carbaryl, malathion, chlorpyrifos, diazinon, and endosulfan), five separate herbicides (*H*) (acetochlor, metolachlor, glyphosate, 2,4-D, and atrazine), a mixture of the five insecticides, a mixture of the five herbicides, and a mixture of all ten pesticides. In two of the treatments, there were no life history data (ND) due to a lack of surviving animals. Data are mean $\pm$ 1 SE. Asterisks indicate treatments that are significantly different from the no-pesticide treatment ($P < 0.05$ using Fisher's LSD test)

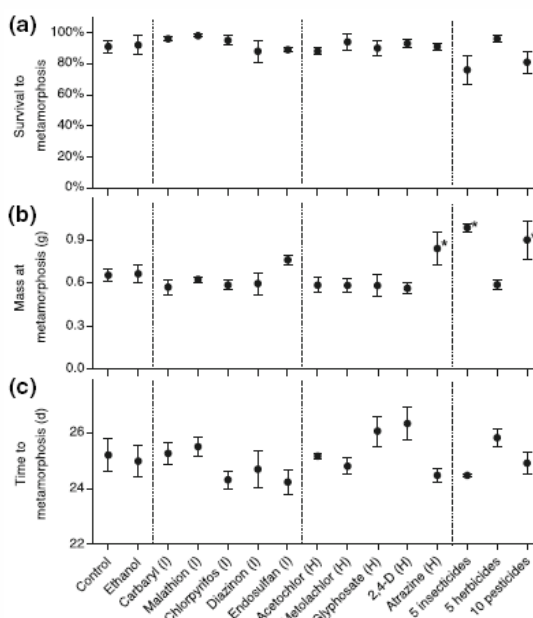


Fig. 2 Changes in the **a** survival, **b** mass at metamorphosis, and **c** time to metamorphosis of gray tree frog tadpoles (*Hyla versicolor*) in outdoor mesocosms exposed to no pesticides (control), solvent only (ethanol), five separate insecticides, five separate herbicides, and a mixture of all ten pesticides. Data are mean $\pm$ 1 SE. Asterisks indicate treatments that are significantly different from the no-pesticide treatment ($P < 0.05$ using Fisher's LSD test). For abbreviations, see Fig. 1

($P > 0.06$). In summary, gray tree frogs exhibited no differences in survival or time to metamorphosis, but they did

Zooplankton

All four species exhibited significant effects of treatment, but no effects of time or treatment-by-time interactions (Figure 3, below). With the exception of *Skistodiaptomus oregonensis*, abundance was not significantly reduced for any species exposed to the individual herbicide treatments or the mix of the five herbicides. For *S. oregonensis*, there was a slight but significant inhibition in abundance when exposed to a mixture of the five herbicides and an even larger, significant drop in abundance when treated with the single insecticide endosulfan, or mixtures of the five insecticides or ten pesticide treatments, relative to the non-pesticide control. All species experienced significant declines in abundance in the mix of five insecticide treatments and in the mix of all ten pesticide treatments. *Ceriodaphnia* were sensitive to all five insecticides, *D. pulex* was sensitive to chlorpyrifos and diazinon, and both copepods were significantly affected by endosulfan. No zooplankton species was affected by treatment with 2,4-D.

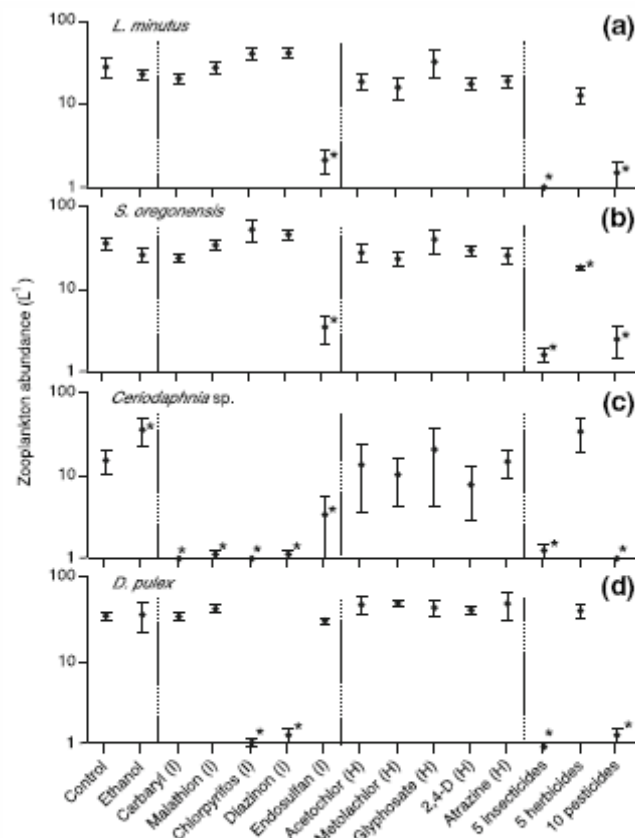


Fig. 3 Changes in the abundance of copepods (a *Leptodiaptomus minutus* and b *Skistodiaptomus oregonensis*) and cladocerans (c *Ceriodaphnia* sp. and d *Daphnia pulex*) in outdoor mesocosms exposed to no pesticides (control), solvent only (ethanol), five separate insecticides, five separate herbicides, and a mixture of all ten pesticides. Data are mean $\pm$ 1 SE, averaged over two sample periods (day 16 and 36), on a log scale. Asterisks indicate treatments that are significantly different from the no-pesticide treatment ($P < 0.05$ using Fisher's LSD test). For abbreviations, see Fig. 1

Phytoplankton and Periphyton

For phytoplankton, day 16 chlorophyll *a* concentrations were only significantly inhibited by acetochlor (an herbicide) and the mix of five herbicides ($P \leq 0.014$); insecticides, singly or mixed together and mixed with the herbicides did not yield significant declines in chlorophyll *a* concentrations relative to control levels. In fact, endosulfan (an insecticide) significantly increased chlorophyll *a* concentrations relative to the control levels ($P = 0.043$) (Figure 4, below).

Periphyton analyses indicated significant effects of treatment, time and a treatment-by-time interaction. On day 25, there was a significant effect of the treatments ($F_{14,44} = 4.3$, $P < 0.001$) with biomass being significantly inhibited in the chlorpyrifos, diazinon and endosulfan treatments, as well as the mixture of five insecticides ($P \leq 0.028$). On the second sampling day, there was also an effect of the treatments ($F_{14,44} = 2.3$, $P = 0.020$) with biomass being significantly inhibited in the chlorpyrifos and diazinon treatment groups ($P \leq 0.043$) (Figure 4). Periphyton abundance was often inhibited by chlorpyrifos, diazinon, endosulfan and the effects of the mixing of the five insecticides were predictable from the individual pesticide effects.

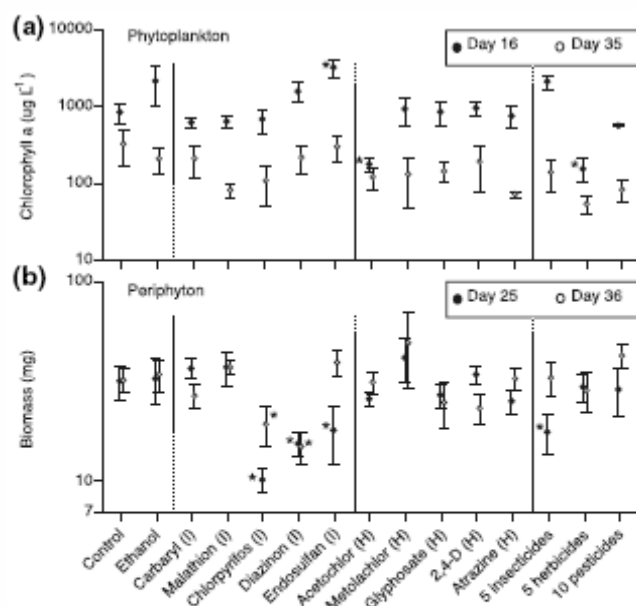


Fig. 4 The abundance of a phytoplankton (measured as chlorophyll *a* concentration) and b periphyton (measured as dry biomass on a clay tile) over time in outdoor mesocosms exposed to no pesticides (control), solvent only (ethanol), five separate insecticides, five separate herbicides, and a mixture of all ten pesticides. Data are mean $\pm$ 1 SE on a log scale. Within each sample date, *asterisks* indicate treatments that are significantly different from the no-pesticide treatment ($P < 0.05$ using Fisher's LSD test). For abbreviations, see Fig. 1

Description of Use in Document: Qualitative

Rationale for Use: This study provides information about the effects of 2,4-D on a mesocosm. 2,4-D alone did not have any effects on survival and mass at metamorphosis of larval leopard frogs and gray tree frogs. In addition, 2,4-D alone did not have any effects on zooplankton, periphyton, or phytoplankton. One species of zooplankton, *S. oregonensis*, was significantly inhibited by the mixture of all five herbicides; this mixture also significantly inhibited chlorophyll *a* concentration. It is not possible to determine if the effects of the mixture of herbicides and the all ten pesticides were synergistic.

Limitations of Study:

No analytical verification was conducted on the water from the control tanks; therefore, any potential cross-contamination was not noted.

With the study design employed, it is not possible to determine if the observed effects were the result of interactive or synergistic effects from the multiple pesticides.

Primary Reviewer: John Marton, Cambridge Environmental, Inc.

Secondary Reviewer: Anita Ullagaddi, EFED/ERB1

Open Literature Summary

Chemical Name: 2,4-D Na (sodium salt), Dicopur powder (AI: 2,4-D) and Hedonal (AI: 2,4-D Na)

CAS NO: 2,4-D Na (2702-72-9)

ECOTOX Record Number and Citation: 39264

Wahl, O. and K. Ulm. 1983. Influence of pollen feeding and physiological condition on pesticide sensitivity of the honey bee *Apis mellifera carnica*. *Oecologia*. 59:106-128.

Purpose of Review: Litigation/Endangered Species

Date of Review: February 9, 2009

Brief Summary of Study Findings: The toxicity of 2,4-D Na (AI: 2,4-D) was tested in young, old, and non-age determined bees fed pollen with varying levels of protein, inadequate amounts of pollen, pollen substitute, and sugar feed. Protein deficiency in bees after emergence increases the toxicity of pesticides such as 2,4-D Na to honey bees; however, brood protein quality did not have a significant effect on imagines. More specifically, sensitivity to 2,4-D Na increased as pollen quality decreased from high quality pollen to lower quality pollen, no pollen or reduced pollen, and pollen substitutes. These findings were replicated repeatedly in the study, under various conditions and with different groups of bees, both young and old. Even when the LD₅₀ values were adjusted for variation in bee weight, the differences between the differently fed groups were apparent. Further, bees emerging during or after good food supply conditions were less sensitive to 2,4-D Na than their counterparts emerging from colonies with a lower quality or inadequate food supply. However, protein feed quality effects on the larval stage have not been demonstrated for this study.

Methods

Honeybee colonies (*Apis mellifera carnica*) were obtained annually from the Federal Institute from Mid-May to August). These colonies were incubated to obtain bees and brood combs.

Pollen was collected from traps in pellet form and dried in the laboratory at room temperature. The pellets were refrigerated in closed jars at 4°C and usually used in the same year. For feeding purposes, the pellets were mixed with honey to create a thick paste. A pollen substitute was also used for feeding. For the first years of the experiments, this substitute consisted of dried skimmed milk and soya flour. In later years, "Fukopoll" was used (mixture of soya flour, dried yeast, and skimmed milk). These substitutes were mixed with twice the weight of honey before feeding.

Various pesticides were tested, consisting of herbicides, fungicides, and insecticides. Purities and physico-chemical properties were not reported. The herbicide 2,4-D was listed in three different forms, representing three of the twenty pesticides used in the study. The first was 2,4-D in powder form, referred to as Dicopur. The second was 2,4-D Na salt or 2,4-D Natrium (Latin for sodium). This salt is a derivative or transformation product of 2,4-D. The third was 2,4-D in fluid form, referred to as Hedonal. Testing with Hedonal was performed with pure 2,4-D Na.

Bee preparation for sensitivity tests

Freshly emerged bees were contained in small wood boxes at 34-35°C. Various groups of tests were conducted to determine possible pollen feeding effects on the sensitivity of bees to pesticides. For the first group, bees were reared under the same conditions, but were then assigned different feeding parameters. For the first type of test in this group, water and honey-sugar dough were provided uniformly, but protein was provided in varying amounts or differing nutritional values. For the second test, the same pollen mixture was fed to certain bees *ad libitum* and, for another set of bees, was rationed at 1/8 to 1/2 the amounts consumed by the *ad libitum* groups. For the third test, pollens with differing nutrient values were given, or pollen was compared to a substitute. In some tests, an additional group received sugar feed only. Boxes of a series were equally filled with usually 100 bees (range 80-120 bees). The boxes were checked daily for dead organisms and food and water replenishment. Bees were usually 7-9 days old at the time of testing.

For the second group of tests, bees were bred under differing protein regimes or other conditions and were then fed uniformly with pollen, pollen substitute, or sugar feed. These bees were also incubated until emergence in separately caged brood combs, and then contained as described for 7-8 days. For the third group, older bees fed differing proteins post-emergence were used. Small re-queened colonies were allowed to brood for weeks on food with differing protein quality in flight cages in open space. The colonies were composed of newly emerged bees (some in three-comb mating boxes, some in nucleus colony boxes). All sealed brood were removed before emergence. For additional tests, hive bees of unknown age were collected from the larger colonies.

Test Material Administration

The study authors followed the official guidelines of Stute (1969) for testing effects of pesticides on bees. They reported deviating from the guideline due to the bees' failure to consume the test material, especially those that had not been receiving enough pollen or none at all. Tests conducted in the 1970s revealed that Dicopur (ai: 2,4-D) dissolved in honey-water solutions was ingested faster than sugar-water solutions. Therefore, honey dilution was used beginning in 1971 and was continued thereafter (1:0.8, honey:water; in the last years, dilution switched to 50% sugar content).

A second deviation was reported with regard to test material administration. The study authors reported that in "official tests", they fed the bees the test material individually using a graduated pipette (10 µL/bee, independent of concentration). Large numbers of bees were tested and rate of ingestion of the poison solution by younger bees was too low considering the time allotted. Feeding bees in groups resulted in food sharing, regardless of individual administration, resulting in development of a different feeding method by the study authors. They did not report which tests used which methods in the study or if the new method replaced the original entirely. They only stated that they organized a poison test, which proceeds as follows: Bees were fasted for 2-3 hours (young bees) or 5-6 hours (old bees). Bees were placed into groups of ten in the poison boxes (inner size 8.5 x 6 x 3.5 cm). When control bees accepted the honey-water solutions, feeding with the pesticide solutions was initiated with a measuring pipette containing 100 µL of poison feed via a one-hole glass elbow tube attached to each box (average 10 µL/bee). The tube was replaced with a larger, three-hole glass tube as used in the "official" tests. Sugar-water solutions (1:1; *ad libitum*) were added to these tubes 1.5-2 hours after administration of the test material and were also provided to the control bees. Approximately 10 to 50 control bees were fed pure honey solution for each group of tests. All the boxes were then placed in a climatic chamber at a temperature of 25 ± 1°C. The LD₅₀ was determined 24 hours after treatment.

Determination of LD₅₀ Values and Bee Weight

Young bees from feeding series and old bees from test colonies in the flight cages were weighed to determine the relationship between their weights and the LD₅₀s of pesticides tested with same-age bees. Bees were taken from the feeding series that was poison-tested on the same day, or they were identically-fed, same-age bees from the same brood combs as the test bees. Flight cage colony bees were grouped for determination of the LD₅₀ and weight on the same day. Bees were narcotized with CO₂, and pressure was applied to the thorax to induce mortality. Bees were usually eviscerated. Groups of bees were weighed thereafter; in tests with large numbers, the bees were prepared in batches to ensure fresh conditions for weighing. Boxed bees can not empty their gut, so removal is necessary in their case because differing protein diets could affect measurements. It was not necessary to eviscerate flight cage bees because they could fly regularly.

Statistical Analysis

A probit analysis was used to calculate the LD₅₀ or LD₁₀ and the confidence intervals using the computer program of Zavoina and McKelvey. In cases where the LD_x values did not vary for two or more bee types, a logit analysis was performed using the program MSLR. The dose response relationship was estimated using the maximum-likelihood procedure in both programs. In 1970s preliminary tests or later tests with small numbers of bees, mortality results were checked with the chi-squared test or Fisher's exact test.

Results

A preliminary test conducted with 0.3% Dicopur (AI: 2,4-D) in sugar water for 24 hours with young bees (8-9 days old) demonstrated that bees that were fed pollen *ad libitum*, rape pollen, or mixed pollen had lower % mortality than bees fed inadequate pollen, sugar water, dandelion pollen, or dried skimmed milk (Table 1). Control mortality ranged between 0 and 3%. The study authors concluded that the younger bees demonstrated increasing pesticide resistance as food quality increased.

Table 1. Preliminary 24 hour 0.3% Dicopur feed tests with 8-9 day old bees fed different proteins.

Protein feed	% Mortality	
	Treatment	Control
Pollen <i>ad libitum</i>	13.3	0
Inadequate pollen	34.5	2
Sugar feed	40.7	0
Rape pollen	22.0	1
Dandelion pollen	36.0	3
Sugar feed	56.0	3
Mixed pollen	4.0	0
Dried skim milk	35.0	2
Sugar feed	37.0	1

Single tests (4) were conducted in 1971 with 2,4-D Na (AI: 2,4-D) under similar conditions as the preliminary test, only with two separate uniform doses of 2,4-D Na (administration technique not specified). Similar results were obtained and confirmed the results obtained in preliminary testing (Table 2). Significant differences were detected between the high quality pollen groups and the other nutrient sources that they were compared to (lower quality dandelion pollen and sugar feed in one group, and dried skim milk and sugar feed in another) in the four separate tests that were conducted ($p < 0.01$ for 7 comparisons and $p < 0.05$ for 1).

Table 2. 24 hour 2,4-D Na (AI: 2,4-D) uniform dose test with 8-9 day old bees fed different protein diets.

Protein Feed	36 µg a.e./bee (n = 100)	Control (n = 10)	46 µg a.e./bee (n = 100)	Control (n = 10)
	% mortality	% mortality	% mortality	% mortality
Rape pollen	4	0	14	0
Dandelion pollen	16	0	29	1
Sugar feed	26	0	78	0
Mixed pollen	1	0	9	0
Dried skim milk	10	0	28	1
Sugar feed	50	0	68	0

The main experiments conducted from 1971-1973 with 2,4-D Na (AI: 2,4-D) verify the preliminary and single experimental results. The LD₅₀s of bees given pollen *ad libitum* were significantly higher than those of bees given inadequate amounts of pollen or sugar feed, when comparisons were made between bees fed pollen *ad libitum* to those fed inadequate amounts of pollen in 1971 (p<0.01) and 1973 (p<0.05). In 1972 groups, no significant difference was found when comparing the LD₅₀s (confidence intervals too large), but the difference in % mortality was found to be significant in a logit analysis. This same situation held true for a comparison of the pollen *ad libitum* group and the sugar feed group in the 1971 test.

Table 3. 2,4-D Na (AI: 2,4-D) uniform dose test with 8-9 day old bees fed different pollen regimes.

Protein Feed	1971		1972		1973	
	LD ₅₀ µg a.e./bee	Control LD ₅₀	LD ₅₀ µg a.e./bee	Control LD ₅₀	LD ₅₀ µg a.e./bee	Control LD ₅₀
Pollen <i>ad libitum</i>	56.5	0	79	0	72.7	0
Inadequate amount of pollen	38.9*	4	65.1*	1	63.4*	5
Sugar feed	34.3*	5	--	--	--	--

* Significant differences found between two treatment groups, either between the LD₅₀s or % mortalities.

-- Not tested.

In the next test series, the same results were obtained again with groups of bees fed differing types of pollen, substitutes, and sugar feeds. The LD₅₀s of bees given good quality pollen or just pollen in general were higher than those of the other groups tested (Table 4). No significant difference was found when comparing the LD₅₀s for the mixed or rape pollen group with the sugar fed and substitute pollen group (confidence intervals too large), but the difference in % mortality was found to be significant in a logit analysis. Significant differences were found between the LD₅₀s of the mixed or rape pollen group and the dandelion (p<0.05) and substitute pollen (p<0.01) groups.

Table 4. 2,4-D Na (AI: 2,4-D) dose test with 8-9 day old bees fed different types of pollen.

Protein Feed	LD ₅₀ µg a.e./bee n = 100/60	Control LD ₅₀	Protein Feed	LD ₅₀ µg a.e./bee n = 100	Control LD ₅₀	LD ₅₀ µg a.e./bee n = 10	Control LD ₅₀
Mixed or rape pollen	84	1	Mixed or rape pollen	74.4	0	66.2	0
Dandelion pollen	66.0*	3	Substitute (Soya flour)	58.6*	2	51.4*	0
Sugar feed	39.5*	2	Sugar feed	--	--	--	--

* Significant differences found between two treatment groups, either between the LD₅₀s or % mortalities.

-- Not tested.

Small single dose tests were conducted with 2,4-D Na (uniform doses, 46-55 µg a.e./bee) using bees from the re-queened colonies (older bees of known age). As with the young bees, these older bees also demonstrated higher mortalities with decreasing food quality. Significant differences in mortality ($p<0.01$) were detected in all treatment comparisons (Table 5). The number of brood cells sealed by each group was interpreted as a measure of nutrient quality. The study authors checked for signs of *Nosema apis* (intestinal parasite) in random sample tests and examinations of poisoned bees to verify that this condition did not contribute to mortality in the older bees.

Table 5. 24 hour 2,4-D Na (AI: 2,4-D) uniform dose test with older bees fed different protein diets.

Protein Feed	55 µg a.e./bee	Brood	Protein Feed	46 µg a.e./bee	Brood
	% mortality	No. sealed brood cells		% mortality	No. sealed brood cells
24-28 days old (n = 200)					
Rape pollen	32.5	412			
Soya flour	60.0*	0			
48-52 days old (n = 220)					
Rape pollen	14.5	616			
Soya flour	44.1*	0			
30-40 days old (n= 200)			21-30 days old (n = 200)		
Mixed pollen	15	1,948	Mixed pollen	9.5	932
Fukopoll (pollen substitute)	58*	395	Dandelion pollen	28.5*	463

* Significant differences found between two treatment groups, either between the LD₅₀s or % mortalities.

Calculating the LD₅₀s based on per g bee results in lower differences between the higher quality pollen feed and the other sources of protein, but the apparent pesticide sensitivities are still present (Table 6). The study authors conclude that poison sensitivity depends partly on body weight.

Table 6. Weight-Adjusted LD₅₀s of 2,4-D Na (AI: 2,4-D) dose tests with ≥8-9 day old bees fed different protein regimes.

Protein Feed	1971	1972
	LD ₅₀ µg a.e./g bee	LD ₅₀ µg a.e./g bee
Pollen <i>ad libitum</i> , mixed, & rape pollen	710	1,108.8 1,037.3 959.2
Inadequate amount of pollen	601	964
Dandelion pollen	--	844.8
Soya flour/Fukopoll	--	915.6
Sugar feed	560	601.1

-- Not analyzed/tested.

Tests were done with bees fed on differing protein diets conducted at several week intervals; the same dose of poison was administered to each group in the time series and the bees were fed uniformly. Mortality was higher in the young bees emerging earlier in the summer as compared to those emerging later in the summer. This trend was observed across doses ranging from 27 to 55 µg a.e./bee (Table 7). Significant differences were found in % mortality between groups that emerged on different dates.

Table 7. 2,4-D Na (AI: 2,4-D) 24 hour seasonal mortality test with 8-9 day old bees fed with sugar.

Date	27 µg a.e./bee		Date	36 µg a.e./bee		Date	55 µg a.e./bee	
	Mortality (%)	n		Mortality (%)	n		Mortality (%)	n
July 23	21.2*	80	July 14	60	80	July 1	91.1*	90
August 16	8.0*	50	August 11	50*	100	August 9	62.5*	80
August 25	4.0*	100	August 16	26*	100	August 23	57.0	100

*Significant differences were found between groups (p<0.01 and p<0.05).

Based on the results of the previous experiments, the study authors designed an additional experiment to discern any effects on pesticide sensitivity due to food quality in different breeding conditions. They also tested the effects of colony conditions on pesticide sensitivity. Significant differences were observed between mortalities in the rape and mixed pollen-bred groups, as well as between the mixed pollen and Fukopoll-bred groups (p<0.01). In both cases, the mixed pollen-bred group had lower mortality (Table 8).

Further, a significant difference in mortality was found between the flight cage/nuclear colony and the normal colony; the normal colony had lower mortality (p<0.01).

Table 8. Synopsis of 2,4-D Na (AI: 2,4-D) 24 hour single dose tests with 8-9 day old bees bred with differing protein sources and different colony conditions.

Sources and different colony conditions						
Test year	Bred		Feed	No. of tests x dose/bee	Treatment Mortality	Control mortality
	In	On			%	%
1972	Flight cage		Sugar	1 x 18 ug 2 x 27 ug	16.8* 3.5	0 0
	Small colony	Rape pollen				
	with 3 combs	Mixed pollen				
1973	Rape pollen		Fukopoll	2 x 46 ug	21.2 22.1	1 0
	Flight cage	Dandelion				
	Nuclear colony	pollen				
1973	Flight cage		Fukopoll	1 x 27 ug 1 x 32 ug 2 x 36 ug	17.8 27.3*	0 4
	Small colony	Mixed pollen				
	with 3 combs	Fukopoll				
1973	Flight cage/nuclear		Sugar	1 x 27 ug	25.8* 12.9	1 0
	Normal colony	Mixed pollen				
1973	Flight cage/nuclear		Fukopoll	3 x 46 ug 3 x 55 ug	43.9 41.8	3 0
	Normal colony	Mixed pollen				

Further analysis was conducted with colonies from Lunz and Vienna (these two colonies supplied the bees used in the 1971-1976 research projects) as these colonies demonstrated different sensitivities to 2,4-D (Table 9). The study authors believe that this effect was due to differing quality of food supply, which could have affected bee sensitivity to 2,4-D, thus resulting in lower or higher LD₅₀s. The Lunz colonies clearly were more sensitive to 2,4-D (the difference between the Lunz and Vienna colony LD₅₀s acquired at similar dates ranged from *ca.* 20-30 ug a/bee). Based on a comparison of the Lunz and Vienna colony LD₅₀s, the study authors designed targeted studies on newly acquired brood combs from the two colonies. The reported 24.6% mortality in the 36 µg a.e./bee treatment group composed of young bees from colonies lacking early food supply, and 14.6% mortality for those bees that had been fed on rape. There was 54.4% mortality and 22.8% mortality at the 46 µg a.e./bee treatment level in the colonies lacking early food supply and those that had been fed rape, respectively. A table was presented in the study (Table 17, p. 118), but the study authors reported that the results in this table were questionable because of *Nosema* infection, and the results from the table were not explained clearly enough in the report to be sufficiently captured in this review.

Table 9. Synopsis of 2,4-D Na (AI: 2,4-D) dose tests with bees of unknown age from different colonies.

Date	May 21-23 1973	May 23-24 1973	June 16-Aug. 7 1971	April 6 1973	May 27-June 5 1972	May 29 1973
	LD ₅₀ in ug a.e./bee					
Lunz Colonies	55.2	59.5	62.9	64	65.9	67.7
99% Confidence Interval	51.1-58.4	57.1-62.1	61.3-63.7	60.2-69.3	62.8-69.5	65.2-72.3
Date	May 26 1976	May 28 1976	July 19 1976	June 7/12 1973		
	LD ₅₀ in ug a.e./bee					
Vienna Colonies	75.1	77.5	84.1	87.5		
99% Confidence Interval	72.4-77.1	76.1-96.4	81.9-90.5	85.4-101.3		

The study authors concluded that protein deficiency in bees post-brood increases the toxicity of pesticides such as 2,4-D Na to honey bees. They found that brood protein quality did not have a significant effect on imagines. More specifically, sensitivity to 2,4-D Na increased as pollen quality decreased from high quality pollen to lower quality pollen, no pollen or reduced pollen, and pollen substitutes. These findings were replicated repeatedly in the study, under various conditions and with different groups of bees, both young and old. The study authors suggest that the reason for the effects observed with inadequate pollen is that there is inhibition of enzymatic decomposition of the pesticide, thus detoxification takes longer in under-nourished bees. Even when the LD₅₀ values were adjusted for variation in bee weight, the differences between the differently fed groups were apparent. Further, bees emerging during or after good food supply conditions were less sensitive than their counterparts emerging from colonies with adequate food supply. However, protein feed quality effects on the larval stage have not been demonstrated for this study. Pesticides that are pure stomach poisons can be approved as practically harmless when the LD₅₀ is at least 25 µg/bee. Analysis of Hedonal (a pure stomach poison) in terms of pure 2,4-D Na (AI: 2,4-D) demonstrates that even the LD₁₀ is higher than the minimum toxicity value cited in both normally fed and protein-deficient bees (range, 60.3-108.7 µg a.e./bee; Table 10). The study authors conclude that if this pesticide is used correctly on weeds already in flower, there should be low bee mortality.

Table 10. Toxicity of Hedonal in terms of pure 2,4-D Na (AI: 2,4-D) to summer hive bees fed normally and fed with inadequate protein.

LD ₀ in ug a.e./bee		LD ₀ in ug a.e./bee	
Normal Feed	Protein shortfall	Normal Feed	Protein shortfall
134-138.2	103.1-106.5	90-108.7	60.3-72.8

Description of Use in Document: Qualitative. The OPPTS 850.3020 guideline specifies that honey bee acute toxicity be evaluated by contact rather than dietary methods. In addition, the study uses formulations of 2,4-D rather than the TGAI.

Rationale for Use: The authors observed LD₅₀'s of 34.3 µg a.e./bee and 39.5 µg a.e./bee when fed sugar water and a 2,4-D Na formulation.

Limitations of Study:

While bees appear to be obtained from the same source (Federal Institute), they were actually obtained from two separate colonies (Lunz and Vienna). The study authors state that they estimated the LD₅₀ repeatedly in 1971-1976 in various research projects with Lunz bees usually, and that for two years they used colonies from Vienna. There were obvious differences in sensitivity between the two colonies as demonstrated in Table 9, but the study authors did not specify throughout the rest of the study what colonies were used for which tests. It is very likely that the use of more or less sensitive bees would affect the LD₅₀s acquired, as proven by the study authors themselves throughout the study.

It was not clear if the study authors abandoned the individual application of 2,4-D Na to the bees for the mass administration technique referenced or if both were used.

Reviewer: Moncie Wright, Staff Scientist, Cambridge Environmental, Inc.

Secondary Reviewer: Anita Ullagaddi, ERB1

Open Literature Review Summary

Chemical Name: 2,4 D

CAS No: 94-75-7

ECOTOX Record Number and Citation: 400946-02. Johnson, W.; Finley, M. (1980) Handbook of Acute Toxicity of Chemicals to Fish and Aquatic Invertebrates: Resource Publication 137. US Fish and Wildlife Service, Washington, D.C. 106 p.

Purpose of Review: Litigation; most sensitive species was glass shrimp exposed to 2,4D DMA salt (030019)

Date of Review: 12/03/08

Summary of Study Findings:

The "Handbook of Acute Toxicity of Chemicals to Fish and Aquatic Invertebrates" summarizes results of over 1500 acute toxicity tests conducted on 271 different chemicals with 28 species of fish and 30 species of aquatic invertebrates. Among these were tests conducted with the Phenoxy herbicides. This review summarizes these results of acute toxicity tests conducted with the various forms of 2,4-D and mixtures of the derivatives of 2,4-D and 2,4,5-T. *Palaeomonetes kadlakensis* (glass shrimp) was the most sensitive species, with a 48-h EC₅₀ (with 95% C.I.) of 0.15 (0.11-0.20) mg ai/L for exposure to the dimethyl amine salt (DMA) of 2,4-D (liquid, 49%).

Methods:

All toxicity tests were conducted at the Columbia National Fisheries Research Laboratory between 1965 and 1978. Fish were supplied by Federal and State hatcheries at the egg or fry stage. Original stocks of invertebrates were collected from wild populations with no known contamination and cultured in the laboratory. Laboratory cultures were replenished regularly. For all species tested, the age or weight of the organism, water temperature, and form of 2,4 D were specified. For the most sensitive species, mature glass shrimp (*Paleomonetes kadlakensis*) were tested at 21°C with the dimethyl amine salt (DMA) of 2,4-D. The test material had a reported purity of 49% and toxicity values were corrected for the percent active ingredient. While it was not specified for the different forms of 2,4-D, if stock solutions were prepared with a solvent, commercial grade acetone was used; occasionally, ethanol or DMF were substituted. When used, the solvent concentration never exceeded 0.5 mL/L in the dilution water.

For all tests, the dilution water was reconstituted from deionized water. Water was buffered to maintain a pH of 7.2-7.5, an alkalinity of 30-35 mg/L and a hardness of 40-50 mg/L as CaCO₃. Test water was mixed thoroughly and aerated prior to test initiation. Fish and invertebrates were acclimated to test water over a period of 1 to 3 days or 4 to 6 hours, respectively. All tests were conducted under

static conditions with no aeration and temperature was maintained at within 1°C of the target temperature for that species. Test organisms were not fed during acclimation or testing.

The size and fill volume of the tests were not specified for fish or invertebrates species. Rather, the study authors stated that the size of the test vessel varied depending on the size of the organism, but each vessel contained at least 10 organisms and 0.25-4 liters of dilution water and that a minimum of 6 concentrations were tested. Tests were conducted for 96 or 48 hours with observations for mortality and sub-lethal effects being made at test initiation and every 24 hours thereafter. The LC₅₀ and associated 95% confidence limits were determined using statistical methods described by Litchfield and Wilcoxon (1949).

Results:

Overall, the toxicity of the Phenoxy herbicides was dependent on pH. The 2,4-D acid, butyl ester, and the dimethyl amine salt forms were half as toxic to fish at a pH of 8.5, compared to a pH of 6.5. In contrast, dodecyltetradodecyl amine was four times as toxic to fathead minnow at a pH of 8.5. Furthermore, within the pH range of 2.4 to 9.4, there was a general trend of increasing 96-h LC₅₀ with reductions in pH.

Another interactive factor with the toxicity of some forms was the age of the test solutions. Solutions aging of up to 21 days affected the toxicity of the butyl ester and propylene glycol butyl, while the toxicity of the two amine salts to fathead minnow was not affected by solution aging. Additionally, fry and fingerlings were more sensitive to the two amine salts than eggs, as evidenced by a range of 96-h LC₅₀ values for fathead minnows of 320 to 630 mg ai/L for fingerlings and swim-up fry and an LC₅₀ value of >1400 mg ai/L for eggs. For the dodecyltetradodecyl amine, 96-h LC₅₀ values for rainbow trout ranged from 1.4 to 7.6 mg/L for fingerlings and fry, but was 47 mg ai/L for eggs.

The most sensitive species was the glass shrimp *Palaemonetes kadlakensis*. Acute exposure (48 hours) to the dimethyl amine salt resulted in an EC₅₀ (with 95% C.I.) of 0.15 (0.11-0.20) mg ai/L. The 96-hour LC₅₀ (with 95% C.I.) for the same species exposed to the propylene glycol butyl ether ester form (2,4 D PGBEE) was 0.4 (0.09-1.4) mg ai/L.

The most sensitive species among tests conducted with the Phenoxy herbicide mixtures of 2,4 D and 2,4,5-T derivatives was bluegill sunfish, with a 96-h LC₅₀ (with 95% C.I.) of 0.16 (0.08-0.29) mg ai/L for fish weighing 0.6 g exposed to a mixture of 12.1% 2,4-D:6.1% 2,4,5-T under 18°C. No other effects pertaining to sub-lethal toxicity were noted in this handbook.

Description of Use in Document: Invalid

Rationale for Use: Raw data was not provided; although the study provides a more sensitive LC₅₀ than the registrant-submitted study, the lack of sufficient data precludes quantitative use of the LC₅₀ in the assessment.

Limitations of Study:

No details were provided pertaining to the sub-lethal effects observed during the course of the 48- or 96-hour acute toxicity tests. Furthermore, it was not specified if analytical verification was conducted to determine actual concentrations of the test material in the dilution water. Raw data were not provided, thereby preventing the reviewer from verifying the statistical results. Also, it was not specified if the reported EC/LC₅₀ values were obtained by comparing treatment data to negative control, the solvent control or the pooled control. The pH and dissolved oxygen levels throughout the test were not specified; the study authors only reported that the target temperature was maintained to within 1°C.

Primary Reviewer: John Marton, Cambridge Environmental, Inc.

Secondary Reviewer: Anita Ullagaddi, EFED/ERB1

Open Literature Review Summary

Chemical Name: 2,4 D BEE ester

CAS No: 1929-73-3

ECOTOX Record Number and Citation: 400980-01. Mayer Jr., F.L. and M.R. Ellersieck. 1986. Manual of Acute Toxicity: Interpretation and Data Base for 410 Chemicals and 66 Species of Freshwater Animals. U.S. Fish and Wildlife Service, Resource Publication 160.

Purpose of Review: Litigation/Endangered Species

Date of Review: 12/02/08

Summary of Study Findings:

The “Manual of Acute Toxicity: Interpretation and Data Base for 410 Chemicals and 66 Species of Freshwater Animals” summarizes and interpret results from multiple acute toxicity tests conducted at the Columbia National Fisheries Research Laboratory. The purpose of this DER is to summarize the effects of 2,4-D butoxyethanol ester (BEE) on *Gammarus fasciatus* and Fowler’s toads. Two separate 96-hour acute tests were conducted *G. fasciatus* with differing environmental conditions: the first test was conducted at a temperature of 15.0°C and a water hardness of 272 mg/L, while the second test was conducted at a temperature of 21.0°C and a water hardness of 44 mg/L. The LC₅₀ values (and 95% C.I.) for *G. fasciatus* from the first and second tests were 6,100 (4,480-8,300) and 440 (310-620) µg/L, respectively. One 96-hour acute test was conducted with Fowler’s toad tadpoles at a temperature of 15.0°C and a water hardness of 44 mg/L. The resulting LC₅₀ value (with 95% C.I.) for Fowler’s toad tadpoles was >10,000 µg/L.

Methods:

All toxicity tests were conducted at the Columbia National Fisheries Research Laboratory between 1965 and 1978. Specific bioassay methodologies (e.g., test vessel size, water treatment, culturing practices, etc.) were not outlined in the study report. Tests were conducted using the technical material (purity of 62.50%) of 2,4-D butoxyethanol ester.

Taxonomic comparisons were made using one-way ANOVA that included the effect of category (species, family or class) for each chemical. Data were log transformed to meet the normality assumption. Interspecies correlations were evaluated using Model least squares methodology on daphnids, rainbow trout, bluegills and fathead minnows; analyses were conducted using log-transformed toxicity values.

Results:

Gammarus fasciatus

After 96-hours of exposure to the test material in 15.0°C water with a pH and hardness of 7.4 and 272 mg/L, respectively, immature *G. fasciatus* exhibited an LC₅₀ (with 95% C.I.) of 6,100 (4,800-8,300) µg/L. After 96-hours of exposure to the test material in 21.0°C water with a pH and hardness of 7.4 and 44 mg/L, respectively, immature *G. fasciatus* exhibited an LC₅₀ (with 95% C.I.) of 440 (310-620) µg/L.

Fowler's Toad

After 96-hours of exposure to the test material in 15.0°C water with a pH and hardness of 7.4 and 44 mg/L, respectively, Fowler's Toad tadpoles exhibited an LC₅₀ value of >10,000 µg/L.

Taxonomic Comparisons

Analyses used to determine sensitivity ranking (compared by sum of ranks/*n*) indicated that only stoneflies were, in general, more sensitive than *G. fasciatus* and Fowler's toads were the least sensitive. These analyses included a subset of the overall toxicity database using 63 species and 174 chemicals. These results only suggest trends and not absolute order of ranking as not all species were tested with each chemical. However, correlations were detected between the toxicity values of both the amphipods and Fowler's toads using interspecies correlations. Correlation coefficients ranged from 0.10-0.82 for amphipods and from 0.16-0.70 for Fowler's toads (Table 1).

Table 1. Correlation coefficients from interspecies analyses.

Species	Correlation Coefficient (r)			
	Daphnid	Bluegill	Fathead Minnow	Rainbow Trout
<i>G. fasciatus</i>	0.82	0.49	0.10	0.36
Fowler's Toad	0.65	0.44	0.16	0.70

Typically, intertaxonomic analyses indicated that amphipods were some of the more sensitive organisms; however, all chemicals were not incorporated into the analyses, including 2,4-D BEE. Therefore, with increasing the number of species/families and chemicals in the analyses, the relative sensitivity of the amphipods may be altered.

Description of Use in Document (QUAL, QUAN, INV):

Invalid

Rationale for Use: Raw data not provided.

Limitations of Study:

No details were provided pertaining to the sub-lethal effects observed during the course of the 48-hour acute toxicity test. Furthermore, it was not specified if analytical verification was conducted to determine actual concentrations of the test material in the dilution water. Raw data were not provided, thereby preventing the reviewer from verifying the statistical results. Also, it was not specified if the reported LC₅₀ value was obtained by comparing treatment data to negative control, the solvent control or the pooled control. The pH and dissolved oxygen levels throughout the test were not specified; the study authors only reported that the target temperature was maintained to within 1°C.

The taxonomic and interspecies correlations were not conducted for each individual species and chemical. Therefore, while amphipods were typically found to be more sensitive than the majority of the other species, the determined sensitivity ranking could shift by including all toxicity values into the model.

Primary Reviewer: John Marton, Cambridge Environmental, Inc.

Secondary Reviewer: Yan Donovan, EFED/ERB1

Open Literature Review Summary

Chemical Name: 2,4-Dichlorophenol

CAS NO: unknown

ECOTOX Record Number and Citation: J001646

Yin, D., Jin, H., Yu, L., and S. Hu. 2003. Deriving freshwater quality criteria for 2,4-dichlorophenol for protection of aquatic life in China. *Environmental Pollution*. 122: 217-222.

Purpose of Review: Litigation/Endangered Species (030001)

Date of Review: 12/04/08

Brief Summary of Study Findings:

The objective of the study was to develop water quality criteria (WQC) for 2,4-dichlorophenol based on acute and chronic toxicity to domestic freshwater fish, invertebrates, and algae in China. *Daphnia magna* was the most sensitive aquatic animal species in the acute toxicity tests, with a 48-hr LC₅₀ value of 2.12 (95% CI: 1.79-2.51) mg/L. In the chronic tests, *Carassius auratus* was the most sensitive species with NOAEC (UCL) and LOAEC (LCL) values for survival of 0.5 and 0.25 mg/L, respectively. Chronic effects on *D. magna* survival and reproduction were equally sensitive endpoints in the 21 day life-cycle toxicity test. For the cyprinid species, *Carassius auratus* and *Ctenopharyngodon idellus*, survival was the most sensitive endpoint in the 30-day embryo-larval and 60-day fry stage tests, respectively. For the toad species *B. bufo gargarizans*, the most sensitive endpoint was weight. In contrast, the algal species *Scenedesmus obliquus* was the least sensitive to the test material, with NOAEC and LOAEC values of 10 and 5 mg/L. Using the results of the four chronic toxicity tests, a final acute-to-chronic ratio (FACR) and a final chronic value (FCV) of 11.8 and 0.212 mg 2,4-dichlorophenol/L, respectively, were calculated. A criteria maximum concentration (CMC) of 1.25 mg 2,4-dichlorophenol/L was calculated and the criterion continuous concentration (CCC) selected was 0.212 mg 2,4-dichlorophenol/L.

Methods

The test material was analytical grade 2,4-dichlorophenol (purity 99%) that was purchased from Shanghai No. 1 Chemical Reagent Factory. Dilution water used for all of the tests was tap water that was dechlorinated with activated carbon (pH 7.0 ± 0.5; DO 8.0 ± 0.34 mg/L; TOC 0.02 mg/L; hardness 1.86 ± 0.08 mg/L as calcium carbonate).

Following EPA guidelines (1985) that require at least 8 aquatic animals from 8 families and one aquatic plant, the study authors selected the following nine aquatic species and algae:

Bufo bufo gargarizans (bufonid);

Rana nigromaculata (ranid);

Radix pliculata (lymnaeid)

Chironomus sp. (chironomid); and

Limnodrilus hoffmeisteri (tubificid), collected from the Aquatic Farm Ponds of Nanjing; and

Carassius auratus (cyprinid);

Ctenopharyngodon idellus (cyprinid);
Tilapia mossambica (cichlid);
Daphnia magna (daphnid);
Scenedesmus obliquus (algae), collected from the Freshwater Fisheries Institute in Jiangsu Province.
Daphnia magna and *Scenedesmus obliquus* were cultured in the laboratory.

Acute toxicity tests

All tests were conducted as static renewals (except for *D. magna*, *Chironomus*, and *L. hoffmeisteri*); test solutions were renewed every 24 hours. Five test concentrations and a control were used for all tests, with three replicates per treatment containing 10 organisms each. A photoperiod of 12 hours light:12 hours dark was used. Various LC₅₀ values were calculated for the organisms, ranging from 48 to 96 hour calculations depending on the species.

Table 1. Summary of Experimental Design for Acute Toxicity Tests with Aquatic Animals.

Species	Age &/or size	Test vessel/Test volume	Temperature	Other conditions
	Juveniles:	Glass container/ 5 L test solution		
<i>C. auratus</i>	Ca . 43.6 mg		21 ± 3°C	
<i>C. idellus</i>	Ca . 33.6 mg		25 ± 3°C	
<i>T. mossambica</i>	Ca . 1790 mg		25 ± 2°C	
<i>B. bufo gargarizans</i>	2-3 day old	Beakers/500 mL		
<i>R. nigromaculata</i>	tadpoles	test solution	18 ± 3°C	
	Neonates	Beakers/100 mL		
<i>D. magna</i>	≤24 hrs old	test solution	19 ± 3°C	
	Juveniles			Adults were reared, and the juveniles
<i>R. pliculata</i>	2-3 days old	Beakers	20 ± 2°C	obtained from the eggs
	3rd instar larvae	Glass tubes with cotton		
<i>Chironomus</i> sp.	1-2 cm length	stoppers/20 mL test solution	20 ± 2°C	
		Glass tubes/20 mL test		Each treatment group
<i>L. hoffmeisteri</i>	1-2 cm long	solution	20 ± 2°C	had 10 tubes

Chronic toxicity tests

Test concentrations for the chronic toxicity tests were selected based on the results from the acute toxicity tests. Five test concentrations and a control were used for all tests, with three replicates per treatment containing 10 organisms each. A photoperiod of 12 hrs light:12 hours dark was used.

Table 2. Summary of Experimental Design for Chronic Toxicity Tests with Aquatic Animals.

Species	Test	Age	Test vessel/Test volume	Temperature	Duration	Other conditions
<i>D. magna</i>	Survival-reproduction	Neonates <24 hrs old	Beakers/100 mL test solution	24 ± 1°C	21 days	Fed green algae Renewal
<i>C. auratus</i>	Embryo-larval	Newly spawned	Beakers/100 mL test solution	22 ± 1°C	30 days	Renewal Fed commercial dry water flea Uneaten food and waste periodically siphoned out & surfaces cleaned
<i>C. idellus</i>	Flow-through	Fry	Artificial stream chambers (88 x 39 x 15 cm; water depth 10 cm) 2,4-DCP stock soln pumped at 1.5 mL/min; dilution water delivered at a rate of 300 mL/min	20 ± 3°C	60 days	Fed green-leaf vegetable Renewal Containers cleaned daily
<i>B. bufo gargarizans</i>	Early life stage	3 day old tadpoles	Beakers/1,000 mL test solution	20 ± 3°C	30 days	Containers cleaned daily

In addition, a 96-hour growth inhibition test was conducted with *S. obliquus*, which was obtained from a stock culture with HB-4 medium. When the algae were in the logarithmic growth phase, they were diluted with HB-4 medium to produce a cell concentration of 2.0×10^4 cells/mL. Five test concentrations and a control were prepared, with three replicate flasks per treatment. Test solutions contained algae suspension (50 mL) and 2,4-dichlorophenol solution (50 mL). The tests were conducted with a photoperiod of 12L:12D at $22 \pm 2^\circ\text{C}$. The test flasks were agitated by hand several times per day and cell densities in each flask were determined daily using a microscope.

48- and 96-hour LC_{50} values and their 95% confidence intervals were calculated using the Probit Program Version 1.5 (USEPA) or the Trimmed-Spearman-Kärver (TSK) program. Chronic test and algal toxicity data were analyzed using the Dunnett Program (Ibid), and the highest concentrations causing significant effects (upper confidence limit; UCL) and causing no significant effects (lower confidence limit; LCL) for the most sensitive endpoints were estimated. Toxicity data was interpreted using USEPA guidelines (1985). A final acute value (FAV) was determined using the FAV equation from the guideline. The chronic value (CHV) was determined by calculating the geometric mean from the corresponding LCL and UCL. The acute-to-chronic ratio (ACR) for each species was determined by dividing the appropriate LC_{50} value by the appropriate chronic value (CHV). A final acute-to-chronic ratio (FACR) was determined by calculating the average of all acute-to-chronic ratios (ACRs). The final chronic value (FCV) was determined by dividing the final acute value (FAV) by the final acute to chronic ratio (FACR). The final plant value (FPV) was designated the chronic value (CHV) that was obtained in the algal toxicity test. The criteria maximum concentration (CMC) was determined by dividing the final acute value (FAV) by 2. The criterion continuous concentration (CCC) was considered the lower value of the final chronic value (FCV) and final plant value (FPV).

Results

Acute toxicity tests

D. magna was the most sensitive aquatic animal species in the acute toxicity tests, with a 48-hr LC_{50} value of 2.12 mg/L (95% CI: 1.79-2.51; Table 3). A final acute value (FAV) for 2,4-dichlorophenol was estimated to be 2.49 mg/L.

Table 3. Summary of Acute Toxicity of 2,4-Dichlorophenol to 9 Aquatic Animal Species.

Rank	Species	48h-LC ₅₀ (mg/l)	96 h-LC ₅₀ (mg/l)
1	<i>Daphnia magna</i>	2.12 (1.79–2.51)	–
2	<i>Chironomus</i> sp.	–	2.74 (2.27–3.30)
3	<i>Radix plicatula</i>	–	3.37 (2.88–3.96)
4	<i>Ctenopharyngodon idellus</i>	5.84 (5.94–6.22)	5.25 (4.83–5.70)
5	<i>Carassius auratus</i>	10.3 (9.02–11.7)	7.94 (6.63–8.92)
6	<i>Tilapia mossambica</i>	13.1 (11.0–15.7)	8.35 (7.09–9.84)
7	<i>Bufo bufo gargarizans</i>	–	9.46 (9.11–9.83)
8	<i>Rana nigromaculata</i>	–	9.85 (8.90–10.9)
9	<i>Limnodrilus hoffmeisteri</i>	–	9.89 (8.35–11.7)

* Values are given as means with 95% confidence limits in parentheses.

Chronic toxicity tests

For the species *D. magna*, survival and reproduction were similarly the most sensitive endpoints in the 21 day life-cycle toxicity test. The study authors reported lower and upper confidence limits of 0.4 and 0.8 mg 2,4-dichlorophenol/L, respectively, for both endpoints (Table 4). All animals in the control survived at study termination, with a reproduction rate of 117 ± 12 offspring per adult. This result is reported to satisfy USEPA and China NEPA requirements for tests with this species. The study authors obtained a chronic value (CHV) and an acute-to-chronic ratio (ACR) of 0.566 mg 2,4-dichlorophenol/L and 3.74, respectively, for this species (Table 4).

For the species *C. auratus*, survival was the most sensitive endpoint in the 30 day embryo-larval test, with lower and upper confidence limits of 0.25 and 0.5 mg 2,4-dichlorophenol/L, respectively (Table 4). The study authors obtained a chronic value (CHV) and an acute-to-chronic ratio (ACR) of 0.354 mg 2,4-dichlorophenol/L and 22.5, respectively. Hatching/survival rates were greatly affected by 2,4-dichlorophenol at the higher test concentrations (Table 6).

For the species *B. bufo gargarizans*, the most sensitive endpoint was weight, with lower and upper confidence limits of 0.5 and 1.0 mg 2,4-dichlorophenol/L, respectively (Table 4). Using the results of the four chronic toxicity tests, a final acute-to-chronic ratio (FACR) and a final chronic value (FCV) of 11.8 and 0.212 mg 2,4-dichlorophenol/L, respectively, were calculated. The lowest UCL in the four tests (0.5 mg 2,4-dichlorophenol/L) was reported as being higher than the LOEL (0.336 mg 2,4-dichlorophenol/L) found in the EPA's Water Quality Criteria Summary (1991).

The study authors analyzed the data in Table 4, and found that survival was the most sensitive endpoint in three out of the four tests. However, growth was more sensitive than survival in the early life stages of *B. bufo gargarizans*.

Table 4. Comparison of Chronic Toxicity to Different Parameters of 4 Freshwater Species

Species	LCL/UCL (mg/l)					
	Survival	Reproduction	Hatching	Length	Weight	Hind-leg development
<i>Daphnia magna</i>	0.4/0.8	0.4/0.8	–	–	–	–
<i>Carassius auratus</i>	0.25/0.5	–	4.0/–	–	–	–
<i>Ctenopharyngodon idellus</i>	0.5/1	–	–	1.0/2.0	1.0/2.0	–
<i>Bufo bufo gargarizans</i>	2.0/4.0	–	–	–	0.5/1.0	2.0/4.0

Table 5. LC₅₀s, Chronic Values, and Acute to Chronic Ratios for 4 Freshwater Species

Species	LC ₅₀ (mg/l)	LCL (mg/l)	UCL (mg/l)	CHV (mg/l)	ACR
<i>Daphnia magna</i>	2.12	0.4	0.8	0.566	3.74
<i>Carassius auratus</i>	7.94	0.25	0.5	0.354	22.5
<i>Ctenopharyngodon idellus</i>	5.25	0.5	1.0	0.707	7.42
<i>Bufo bufo gargarizans</i>	9.46	0.5	1.0	0.707	13.4

Table 6. Effect of 2,4-Dichlorophenol on *Carassius auratus* Hatching and Survival Rate
Mean hatching/survival rate (%)

Exposure time (days)	control	0.25 mg/l	0.5 mg/l	1.0 mg/l	2.0 mg/l	4.0 mg/l
1	2.50	2.50	2.50	0.00	0.00	0.00
2	50.0	25.0	17.5	10.0	0.00	0.00
3	87.5	70.0	85.0	87.5	87.5	75.0
4	95.0	92.5	92.5	82.5	65.0	52.5 ^a
7	92.5	92.5	87.5	67.5	55.0	50.0
30	90.0	92.5	60.0 ^b	52.5 ^b	22.5 ^b	2.50 ^b

^a Significant effect on hatching ($\alpha = 0.05$).

^b Significant effect on survival ($\alpha = 0.05$).

Algal Toxicity

In the 96-hour growth inhibition test using *S. obliquus*, the study authors obtained lower and upper confidence limits of 5.0 and 10.0 mg 2,4-dichlorophenol/L, respectively. A chronic value (CHV) and final chronic value (FCV) of 7.07 mg 2,4-dichlorophenol/L were obtained. In comparison to the aquatic animals studied, *S. obliquus* was the least sensitive to the test material.

Criteria for 2,4-dichlorophenol

A criteria maximum concentration (CMC) of 1.25 mg 2,4-dichlorophenol/L was obtained, and the criterion continuous concentration (CCC) chosen was 0.212 mg 2,4-dichlorophenol/L. The study authors conclude that these two values will assist in the derivation of national and local water quality criteria for 2,4-dichlorophenol.

Description of Use in Document: Invalid

Rationale for Use: Insufficient information on control responses.

Limitations of Study:

The algal medium used in the algal toxicity test with *S. obliquus* was not characterized. The actual test concentrations were not reported and EC_x values were not reported.

Effects on growth were not assessed in the chronic daphnid study.

The physicochemical properties of the test material were not reported.

The results of a periodic screening analysis of the dilution water and/or nutrient medium were not reported.

The pH of the test solutions throughout the experimental period was not reported.

While the study authors reported using negative controls, little data were provided on the details of the effects on the controls.

Raw data were not provided for any species or endpoint assessed; therefore, the reviewer could not independently confirm the results.

Reviewer: Moncie Wright, Staff Scientist, Cambridge Environmental, Inc.

Secondary Reviewer: Yan Donovan EFED/ERB1