

TABLE 2
Results of Assay and Tests in Evaluation of the Endocrine Disrupting
Activities in Fish (*Medaka*)

17beta-Estradiol

1. Vitellogenin Assay

Table 1 Results (Male)

Average measured concentration (ng/L)	Mortality (%)	Hepatosomatic Index (%)		Vitellogenin (ng/mg liver)	
		14 days	21 days	14 days	21 days
Control	0	2.3±0.72	2.0±0.44	ND	ND
5.84	3.3	2.4±0.53	2.4±0.52	ND	ND
10.8	0	2.2±0.58	1.9±0.48	2.6±3.5	4.5±9.5
21.9	3.3	2.3±0.48	2.3±0.53	36±56**	65±82**
40.8	0	2.1±0.48	2.1±0.47	300±210**	1,700±660**
84.2	3.3	2.5±0.96	2.5±0.59*	2,300±1,100**	4,300±1,300**

Data shows mean ± standard deviation.

Statistically significant differences from control group (** $p < 0.01$, * $p < 0.05$).

ND means not detected (< 1 ng/mg liver).

2. Partial Life Cycle Test

Table 2-A Results

Average measured concentration (ng/L)	Hatchability (%)	Time to hatching (Day)	Mortality (%)	Body length (mm)	Body weight (mg)
Control	97±2.9	11±0.58	17±8.3	21±1.8	170±40
0.914	97±5.8	12±0.63	19±5.4	22±1.7	170±30
2.51	98±2.9	12±1.7	15±10	21±1.6	150±29*
7.42	95±8.7	14±3.2	22±12	21±1.9	160±42
23.8	93±2.9	17±2.2**	39±12*	22±2.1	180±48
71.3	97±7.6	12±1.0	15±5.1	19±1.7**	120±28**

Table 2-B Results (Continued)

Average measured concentration (ng/L)	Gonadosomatic Index (%)		No. of fishes	Testis-ova
	Male	Female		
Control	0.66±0.43	2.7±3.4	20	0/10
0.914	0.74±0.23	2.5±3.1	20	0/10
2.51	0.75±0.30	1.9±2.0	20	0/11
7.42	0.72±0.76	1.0±0.64	20	0/9
23.8	0.39	1.7±2.8	20	1/1**
71.3	-	1.4±1.1	20	0/0

Table 2-C Results (Continued)

Average measured concentration (ng/L)	Hepatosomatic Index (%)		Vitellogenin (ng/mg liver)	
	Male	Female	Male	Female
Control	1.8±0.60	2.3±0.63	3.1±5.0	920±1,100
0.914	1.6±0.58	1.9±1.0	11±11**	1,100±1,500
2.51	1.8±0.78	5.0±1.7*	46±25**	540±630
7.42	4.3±2.3*	4.3±2.2*	970±1,400**	1,500±920
23.8	3.1	3.5±1.3*	2300	2,200±1,100**
71.3	-	4.6±6.0	-	2,000±4,200

Testis-ova means No. of Males with testis-ova/No. of Males.

Data shows mean ± standard deviation.

Statistically significant differences from control group (** $p < 0.01$, * $p < 0.05$).

Data not measured or performed (-).

3. Full Life Cycle Test

Table 3-A F₀ generation

Average measured concentration (ng/L)	Hatchability (%)	Time to hatching (Day)	Mortality (%)	Total length (mm)	Body weight (mg)	No. of fishes	Testis-ova
Control	98±3.3	9.2±0.1	5.0±6.4	30.2±1.4	269±43	20	0/9
0.939	98±3.3	9.4±0.3	25±6.6	31.2±1.3	302±51	20	0/8
2.86	95±6.4	9.5±0.3	22±15	32.1±1.0**	318±48*	20	0/14
8.66	100	9.4±0.2	22±8.4	32.2±1.2**	324±50**	20	1/14
27.9	100	9.5±0.3	15±18	30.7±1.6	294±53	20	7/10**
92.4	100	9.3±0.3	20±12	30.6±2.3	303±74	20	0/0

Table 3-B F₀ generation (Continued)

Average measured concentration (ng/L)	No. of eggs	Fertility (%)	Gonadosomatic Index (%)	
			Male	Female
Control	733±219	94±4.9	1.00±0.3	8.4±2.3
0.939	659±230	96±2.6	1.01±0.3	7.4±0.8
2.86	790±220	97±1.8	0.84±0.2	8.1±1.0
8.66	561±133	81±13*	1.23±0.2	8.1±1.2
27.9	58±75**	3.8±5.2**	0.33±0.2**	8.7±3.4
92.4	-	-	-	-

Table 3-C F₀ generation (Continued)

Average measured concentration (ng/L)	Hepatosomatic Index (%)		Vitellogenin (ng/mg liver)	
	Male	Female	Male	Female
Control	1.4±0.2	4.0±0.5	15±20	4,200±7,800
0.939	1.3±0.6	3.6±0.5	27±33	1,700±1,100
2.86	1.5±0.3	3.7±0.5	12±18	1,600±900
8.66	1.8±0.3	3.3±1.1	160±230*	2,000±1,300
27.9	2.1±0.2*	2.3±0.3*	3,600±1,200**	1,800±770
92.4	-	-	-	-

Table 3-D F₁ generation

Average measured concentration (ng/L)	Hatchability (%)	Time to hatching (Day)	Mortality (%)	Total length (mm)	Body weight (mg)	No. of fishes	Testis-ova
Control	95±4.3	8.2±0.7	1.7±3.3	27.2±1.4	183±32	20	0/8
0.939	91±7.5	8.6±0.6	8.3±3.3*	27.5±1.5	186±34	20	0/9
2.86	96±6.1	8.8±0.7	0	27.3±1.7	178±32	20	0/6
8.66	90±16	7.9±0.9	6.8±5.4	28.1±1.4**	197±32	20	0/9
27.9	-	-	-	-	-	-	-
92.4	-	-	-	-	-	-	-

Table 3-E F₁ generation (Continued)

Average measured concentration (ng/L)	Vitellogenin (ng/mg liver)	
	Male	Female
Control	1.9±2.4	2,400±1,400
0.939	ND	1,700±1,000
2.86	2.9±3.6	940±770*
8.66	9.0±7.4	2,500±860
27.9	-	-
92.4	-	-

Testis-ova means No. of Males with testis-ova/No. of Males.

Data shows mean ± standard deviation.

Statistically significant differences from control group (** $p < 0.01$, * $p < 0.05$).

ND means not detected (< 1 ng/mg liver).

Data not measured or performed (-).

Ethinylestradiol

1. Vitellogenin Assay

Table 1 Results (21 days)

Average measured concentration (ng/L)	Mortality (%)	Hepatosomatic Index (%)		Vitellogenin (ng/mg liver)	
		Male	Female	Male	Female
Control	0	-	-	ND	664±481
14.8	0	-	-	6.39±3.55**	1,200±724
32.1	0	-	-	250±305**	1,010±499
61.4	0	-	-	1,120±532**	2,750±803**
127	0	-	-	4,700±1,520**	4,040±1,250**
254	3.8	-	-	6,050±3,010**	6,270±2,410**

Data shows mean ± standard deviation.

Statistically significant differences from control and solvent control group (** $p < 0.01$).

ND means not detected (< 1 ng/mg liver).

Data not measured or performed (-).

2. Partial Life Cycle Test

Table 2-A Results

Average measured concentration (ng/L)	Hatchability (%)	Time to hatching (Day)	Mortality (%)	Total length (mm)	Body weight (mg)
Control	93±5.4	8.7±0.3	14±5.6	29.6±4.3	284±94
6.17	97±3.8	8.6±0.1	12±8.5	31.1±3.1	313±84
12.2	97±3.8	8.7±0.1	22±17	32.5±1.9**	337±52*
24.5	97±3.8	8.5±0.06	21±15	31.4±3.8*	335±120
49.9	95±3.3	8.8±0.3	19±6.8	30.5±4.3	325±120*
93.2	92±6.4	8.6±0.1	33±8.2	30.1±6.2	334±160

Table 2-B Results (Continued)

Average measured concentration (ng/L)	Gonadosomatic Index (%)		No. of fishes	Testis-ova
	Male	Female		
Control	0.77±0.26	8.3±2.1	20	0/9
6.17	1.4±0.53	9.3±2.4	20	0/9
12.2	0.79±0.43	11±2.7	20	0/6
24.5	0.92±0.39	15±8.2	20	8/10**
49.9	0.52±1.0	12±1.5	20	2/2**
93.2	5.4±3.5**	6.2±6.9	20	0/0

Table 2-C Results (Continued)

Average measured concentration (ng/L)	Hepatosomatic Index (%)		Vitellogenin (ng/mg liver)	
	Male	Female	Male	Female
Control	2.0±0.57	4.7±1.2	1.9±2.4	1,560±926
6.17	1.8±0.59	3.8±1.1	1.5±1.5	1,740±935
12.2	2.3±0.78	2.9±0.50**	13±13	2,340±800
24.5	3.5±0.86**	4.5±0.45	216±196**	2,210±1,040
49.9	4.7±1.2**	3.7±0.78	2,680±921**	2,820±1,530
93.2	4.4±0.72**	4.7±1.7	3,460±1,330**	4,590±1,900**

Testis-ova means No. of Males with testis-ova/No. of Males.

Data shows mean ± standard deviation.

Statistically significant differences from control group (** $p < 0.01$, * $p < 0.05$).

3. Full Life Cycle Test

Table 3-A F₀ generation

Average measured concentration (ng/L)	Hatchability (%)	Time to hatching (Day)	Mortality (%)	Body length (mm)	Body weight (mg)	No. of fishes	Testis-ova
Control	92±6.9	10±0.91	14±9.6	19±1.1	120±20	20	0/10
0.990	96±3.8	10±0.45	37±11	19±2.1	130±37	20	0/10
3.07	94±5.1	11±0.52	25±3.4	19±1.7	120±25	20	0/10
9.26	92±10	12±0.81	31±4.9	21±1.2**	150±31*	20	0/10
29.6	91±5.1	12±0.95	22±2.5	20±1.3	120±18	20	7/7**
93.5	79±8.4	14±1.7**	24±4.1	19±1.5	110±24	20	4/4**

Table 3-B F₀ generation (Continued)

Average measured concentration (ng/L)	No. of eggs	Fertility (%)	Gonadosomatic Index (%)	
			Male	Female
Control	199±88	92±11	0.87±0.40	1.3±0.90
0.990	166±64	89±8.4	0.92±0.49	0.88±0.48
3.07	127±99	67±23	0.49±0.32	0.75±0.47
9.26	96±61	21±30**	0.73±0.39	1.2±1.8
29.6	-	-	0.41±0.22	0.79±0.42
93.5	-	-	0.65±0.61	1.1±0.46

Table 3-C F₀ generation (Continued)

Average measured concentration (ng/L)	Hepatosomatic Index (%)		Vitellogenin (ng/mg liver)	
	Male	Female	Male	Female
Control	3.2±1.1	3.6±1.3	1.0±0.41	1,400±2,200
0.990	3.4±1.2	4.6±1.5	1.4±0.82	1,500±1,000
3.07	4.0±2.2	4.6±1.8	1.1±0.36	1,300±780
9.26	4.2±1.1	4.4±0.94	21±9.4**	2,400±1,200
29.6	4.2±1.3	5.0±1.2	1,100±810**	1,000±810
93.5	5.6±2.9	4.7±2.3	4,200±3,900**	2,900±2,200

Table 3-D F₁ generation

Average measured concentration (ng/L)	Hatchability (%)	Time to hatching (Day)	Mortality (%)	Body length (mm)	Body weight (mg)	No. of fishes	Testis-ova
Control	95	9±0.66	5.3±5.3	22±1.7	180±45	20	0/10
0.990	100	10±0.10	15±8.7	22±1.4	190±35	20	0/10
3.07	100	11±0.20**	13±7.6	22±1.3	180±32	20	0/10
9.26	100	8	0	24±0.77	230±3.4	20	0/1
29.6	-	-	-	-	-	-	-
93.5	-	-	-	-	-	-	-

Table 3-E F₁ generation (Continued)

Average measured concentration (ng/L)	Vitellogenin (ng/mg liver)	
	Male	Female
Control	ND	560±560
0.990	3.9±6.6**	1,200±610
3.07	7.1±7.6**	980±1,300
9.26	46	2,000
29.6	-	-
93.5	-	-

Testis-ova means No. of Males with testis-ova/No. of Males.

Data shows mean ± standard deviation.

Statistically significant differences from control group (** $p < 0.01$, * $p < 0.05$).

ND means not detected (< 1 ng/mg liver).

Data not measured or performed (-).

Aldrin

1. Vitellogenin Assay

Table 1 Results (Male)

Average measured concentration ($\mu\text{g/L}$)	Mortality (%)	Hepatosomatic Index (%)		Vitellogenin (ng/mg liver)	
		14 days	21 days	14 days	21 days
Control	0	2.0 \pm 0.38	2.0 \pm 0.44	1.3 \pm 1.3	ND
Solvent control	0	2.1 \pm 0.59	2.2 \pm 0.48	ND	ND
2.02	3.3	2.2 \pm 0.36	1.9 \pm 0.32	ND	ND
3.28	3.3	2.2 \pm 0.53	1.9 \pm 0.31	ND	ND
7.34	0	1.8 \pm 0.47	2.1 \pm 0.60	ND	ND
15.1	33	1.9 \pm 0.62	2.4 \pm 0.73	ND	1.8 \pm 0.94**
28.6	93	1.9 \pm 0.70	-	2.6 \pm 3.6	-

Data shows mean \pm standard deviation.

Statistically significant differences from control and solvent control group (** $p < 0.01$).

ND means not detected (< 1 ng/mg liver).

Data not measured or performed (-).

2. Partial Life Cycle Test

Table 2-A Results

Average measured concentration ($\mu\text{g/L}$)	Hatchability (%)	Time to hatching (Day)	Mortality (%)	Total length (mm)	Body weight (mg)
Control	83 \pm 5.8	11 \pm 0.092	3.9 \pm 3.4	29 \pm 2.1	340 \pm 82
Solvent control	82 \pm 2.9	11 \pm 0.59	8.2 \pm 3.7	28 \pm 2.1	320 \pm 70
0.069	92 \pm 7.6	11 \pm 1.0	14 \pm 5.0	30 \pm 2.5	350 \pm 93
0.225	87 \pm 7.6	12 \pm 1.4	18 \pm 6.6*	30 \pm 2.1*	360 \pm 89
0.686	83 \pm 14	13 \pm 0.42*	22 \pm 2.9**	30 \pm 2.0	360 \pm 85
2.23	77 \pm 14	12 \pm 0.69	18 \pm 6.6*	30 \pm 1.8*	360 \pm 87
7.10	92 \pm 2.9	10 \pm 0.73	64 \pm 7.0**	30 \pm 1.4	360 \pm 65

Table 2-B Results (Continued)

Average measured concentration ($\mu\text{g/L}$)	Gonadosomatic Index (%)		No. of fishes	Testis-ova
	Male	Female		
Control	0.91 \pm 0.11	7.9 \pm 2.2	20	0/9
Solvent control	0.88 \pm 0.27	3.7 \pm 2.2 ^a	20	2/8
0.069	1.0 \pm 0.20	8.9 \pm 3.1**	20	0/11
0.225	1.2 \pm 0.13**	8.7 \pm 2.0**	20	1/7
0.686	1.1 \pm 0.24*	6.7 \pm 4.3	20	0/10
2.23	0.84 \pm 0.17	8.8 \pm 2.3**	20	0/7
7.10	0.80 \pm 0.14	8.5 \pm 1.4**	20	0/10

Table 2-C Results (Continued)

Average measured concentration ($\mu\text{g/L}$)	Hepatosomatic Index (%)		Vitellogenin (ng/mg liver)	
	Male	Female	Male	Female
Control	2.2 \pm 0.55	5.5 \pm 0.57	ND	2,000 \pm 750
Solvent control	3.5 \pm 0.78 ^a	5.1 \pm 0.93	ND	1,300 \pm 1,000
0.069	2.0 \pm 0.41**	5.1 \pm 1.1	11 \pm 16**	1,700 \pm 730
0.225	2.3 \pm 0.44**	5.3 \pm 1.1	3.1 \pm 5.4	1,800 \pm 920
0.686	2.6 \pm 0.66**	4.9 \pm 1.2	2.6 \pm 3.7*	1,100 \pm 850
2.23	2.1 \pm 0.47**	5.3 \pm 1.0	6.9 \pm 8.6**	1,500 \pm 750
7.10	2.1 \pm 0.47**	4.7 \pm 1.7	ND	1,800 \pm 650

Testis-ova means No. of Males with testis-ova/No. of Males.

Data shows mean \pm standard deviation.

Statistically significant differences from solvent control group (** $p < 0.01$, * $p < 0.05$).

Statistically significant differences from control group (a).

ND means not detected (< 1 ng/mg liver).

Amitrole

1. Vitellogenin Assay

Table 1 Results (Male)

Average measured concentration ($\mu\text{g/L}$)	Mortality (%)	Hepatosomatic Index (%)		Vitellogenin (ng/mg liver)	
		14 days	21 days	14 days	21 days
Control	0	2.7 \pm 1.1	3.2 \pm 1.0	6.1 \pm 14	3.5 \pm 9.9
84	0	2.5 \pm 1.2	3.0 \pm 2.2	7.0 \pm 15	6.3 \pm 12
315	0	2.8 \pm 0.77	2.4 \pm 0.72	6.0 \pm 7.3	1.1 \pm 0.63
949	0	3.0 \pm 0.83	3.1 \pm 0.70	5.4 \pm 16	4.7 \pm 9.2
3,141	0	2.8 \pm 0.54	2.7 \pm 0.74	7.1 \pm 12	4.0 \pm 5.1
9,495	0	3.1 \pm 1.6	2.8 \pm 0.69	7.9 \pm 10	4.2 \pm 8.2

Data shows mean \pm standard deviation.

2. Partial Life Cycle Test

Table 2-A Results

Average measured concentration ($\mu\text{g/L}$)	Hatchability (%)	Time to hatching (Day)	Mortality (%)	Body length (mm)	Body weight (mg)
Control	98 \pm 2.9	11 \pm 1.6	19 \pm 10	22 \pm 1.9	180 \pm 42
7.6	98 \pm 2.9	11 \pm 1.3	14 \pm 6.4	22 \pm 2.0	170 \pm 48
28.9	93 \pm 2.9	11 \pm 0.21	16 \pm 5.3	22 \pm 2.1	180 \pm 47
100	100	11 \pm 1.7	20 \pm 5.0	22 \pm 1.7	180 \pm 38
323	97 \pm 2.9	10 \pm 0.68	22 \pm 5.7	22 \pm 2.1	190 \pm 44
1,027	97 \pm 5.8	11 \pm 2.2	17 \pm 6.5	22 \pm 2.0	180 \pm 50

Table 2-B Results (Continued)

Average measured concentration ($\mu\text{g/L}$)	Gonadosomatic Index (%)		No. of fishes	Testis-ova
	Male	Female		
Control	0.93 \pm 0.42	6.3 \pm 4.6	20	0/10
7.6	0.86 \pm 0.39	4.2 \pm 4.9	20	0/10
28.9	0.52 \pm 0.30	4.5 \pm 4.7	20	0/10
100	0.63 \pm 0.26	2.7 \pm 2.4	20	0/10
323	0.52 \pm 0.24	5.9 \pm 4.7	20	0/10
1,027	0.62 \pm 0.28	6.5 \pm 4.9	20	0/10

Table 2-C Results (Continued)

Average measured concentration ($\mu\text{g/L}$)	Hepatosomatic Index (%)		Vitellogenin (ng/mg liver)	
	Male	Female	Male	Female
Control	2.0 \pm 0.30	3.2 \pm 0.74	1.6 \pm 0.37	1,100 \pm 990
7.6	2.3 \pm 0.65	3.1 \pm 0.66	3.8 \pm 3.9	610 \pm 740
28.9	2.6 \pm 0.98	3.0 \pm 0.73	2.3 \pm 1.4	850 \pm 670
100	2.6 \pm 0.81	2.9 \pm 0.94	6.6 \pm 6.5	1,000 \pm 1,000
323	2.1 \pm 0.72	3.0 \pm 0.83	10 \pm 9.2**	860 \pm 700
1,027	1.7 \pm 0.54	2.9 \pm 0.74	12 \pm 10**	1,100 \pm 500

Testis-ova means No. of Males with testis-ova/No. of Males.

Data shows mean \pm standard deviation.

Statistically significant differences from control group (** p <0.01).

Benzophenone

1. Vitellogenin Assay

Table 1 Results (Male)

Average measured concentration ($\mu\text{g/L}$)	Mortality (%)	Hepatosomatic Index (%)		Vitellogenin (ng/mg liver)	
		14 days	21 days	14 days	21 days
Control	0	1.6 \pm 0.38	1.7 \pm 0.34	ND	ND
Solvent control	0	1.5 \pm 0.30	1.8 \pm 0.41	ND	ND
48.2	0	1.7 \pm 0.38	1.8 \pm 0.41	ND	ND
161	0	1.6 \pm 0.25	2.0 \pm 0.34	ND	ND
501	0	1.7 \pm 0.36	2.0 \pm 0.50	4.7 \pm 5.9**	2.3 \pm 3.0**
1,390	0	2.0 \pm 0.43**	2.2 \pm 0.56	700 \pm 480**	1,600 \pm 950**
4,650	40	2.1 \pm 0.57**	2.3 \pm 0.92*	4,600 \pm 2,900**	5,400 \pm 2,600**

Data shows mean \pm standard deviation.

Statistically significant differences from control and solvent control group (** p <0.01, * p <0.05).

ND means not detected (< 1 ng/mg liver).

2. Partial Life Cycle Test

Table 2-A Results

Average measured concentration ($\mu\text{g/L}$)	Hatchability (%)	Time to hatching (Day)	Mortality (%)	Total length (mm)	Body weight (mg)
Control	100	9.4 \pm 0.4	10 \pm 3.9	29.5 \pm 1.9	254 \pm 49
5.06	100	9.2 \pm 0.1	8.3 \pm 6.4	29.5 \pm 1.6	253 \pm 45
15.1	97 \pm 3.9	9.3 \pm 0.2	3.5 \pm 4.0	29.5 \pm 1.6	252 \pm 39
47.0	93 \pm 7.7	9.3 \pm 0.1	8.9 \pm 7.0	30.0 \pm 1.4	270 \pm 40
144	98 \pm 3.3	9.3 \pm 0.3	3.3 \pm 3.9	29.6 \pm 1.3	264 \pm 33
435	98 \pm 3.3	9.5 \pm 0.3	1.7 \pm 3.3	30.1 \pm 1.6	265 \pm 42

Table 2-B Results (Continued)

Average measured concentration ($\mu\text{g/L}$)	Gonadosomatic Index (%)		No. of fishes	Testis-ova
	Male	Female		
Control	0.97 \pm 0.3	4.0 \pm 3.1	20	0/7
5.06	0.55 \pm 0.2	4.5 \pm 2.9	20	1/10
15.1	0.77 \pm 0.2	3.0 \pm 2.6	20	0/8
47.0	0.64 \pm 0.4	6.0 \pm 2.5	20	2/11
144	0.58 \pm 0.2*	3.6 \pm 3.4	20	0/11
435	0.88 \pm 0.4	6.2 \pm 2.8	20	1/11

Table 2-C Results (Continued)

Average measured concentration ($\mu\text{g/L}$)	Hepatosomatic Index (%)		Vitellogenin (ng/mg liver)	
	Male	Female	Male	Female
Control	2.3 \pm 0.6	4.1 \pm 0.9	10 \pm 9.3	1,800 \pm 1,600
5.06	2.3 \pm 0.5	4.5 \pm 0.7	17 \pm 17	2,300 \pm 1,600
15.1	2.6 \pm 0.6	4.1 \pm 0.7	5.5 \pm 9.3	2,100 \pm 1,400
47.0	3.0 \pm 0.7*	3.7 \pm 0.6	6.4 \pm 4.9	3,100 \pm 1,600
144	2.2 \pm 0.4	3.3 \pm 0.9	3.3 \pm 3.2	2,200 \pm 1,400
435	2.3 \pm 0.4	3.8 \pm 0.4	56 \pm 69	3,700 \pm 2,000

Testis-ova means No. of Males with testis-ova/No. of Males.

Data shows mean \pm standard deviation.

Statistically significant differences from control group (* p <0.05).

Bisphenol A

1. Vitellogenin Assay

Table 1 Results (Male)

Average measured concentration ($\mu\text{g/L}$)	Mortality (%)	Hepatosomatic Index (%)		Vitellogenin (ng/mg liver)	
		14 days	21 days	14 days	21 days
Control	0	1.4 \pm 0.24	2.0 \pm 0.28	ND	ND
Solvent control	0	1.4 \pm 0.32	1.7 \pm 0.23	ND	ND
58.5	0	1.4 \pm 0.36	1.8 \pm 0.34	ND	ND
141	0	1.5 \pm 0.27	1.8 \pm 0.29	1.9 \pm 4.3	1.3 \pm 2.7
334	0	1.6 \pm 0.38	2.1 \pm 0.54***	2.8 \pm 6.1	17 \pm 43*
772	3.3	1.5 \pm 0.41	1.8 \pm 0.23	30 \pm 62**	8.5 \pm 25**
1,740	13	1.7 \pm 0.29*	2.4 \pm 0.64****	32 \pm 65**	280 \pm 430**

Data shows mean \pm standard deviation.

Statistically significant differences from control and solvent control group (** p <0.01, * p <0.05).

Statistically significant differences from solvent control group (**** p <0.01, *** p <0.05), but not statistically significant differences from control group.

ND means not detected (< 1 ng/mg liver).

2. Partial Life Cycle Test

Table 2-A Results

Average measured concentration ($\mu\text{g/L}$)	Hatchability (%)	Time to hatching (Day)	Mortality (%)	Body length (mm)	Body weight (mg)
Control	92 \pm 2.9	12 \pm 0.42	15 \pm 8.6	20 \pm 2.4	150 \pm 53
Solvent control	92 \pm 5.8	13 \pm 0.31	22 \pm 8.6	21 \pm 1.9	180 \pm 92
220	78 \pm 2.9	12 \pm 0.68	13 \pm 11	22 \pm 2.2	190 \pm 48*
470	88 \pm 13	15 \pm 1.6	29 \pm 19	22 \pm 1.8**	190 \pm 45**
890	90 \pm 5.0	13 \pm 0.36	29 \pm 7.3	22 \pm 2.3*	180 \pm 52
2,120	92 \pm 7.6	14 \pm 2.0	23 \pm 20	20 \pm 1.9	140 \pm 41
4,410	93 \pm 2.9	18 \pm 0.84**	34 \pm 10	18 \pm 2.8	120 \pm 54**

Table 2-B Results (Continued)

Average measured concentration ($\mu\text{g/L}$)	Gonadosomatic Index (%)		No. of fishes	Testis-ova
	Male	Female		
Control	0.78 \pm 0.41	4.0 \pm 7.4	20	0/10
Solvent control	0.69 \pm 0.34	2.5 \pm 3.5	20	0/10
220	0.73 \pm 0.36	1.5 \pm 0.92	20	0/10
470	1.0 \pm 0.34	2.2 \pm 3.7	20	0/10
890	0.92 \pm 0.73	1.2 \pm 0.49	20	4/10*
2,120	0.87 \pm 0.53	1.6 \pm 1.0	20	3/4**
4,410	1.4 \pm 1.1	1.4 \pm 0.62	20	5/6**

Table 2-C Results (Continued)

Average measured concentration ($\mu\text{g/L}$)	Hepatosomatic Index (%)		Vitellogenin (ng/mg liver)	
	Male	Female	Male	Female
Control	2.4 \pm 0.63	3.1 \pm 0.52	1.5 \pm 0.33	450 \pm 540
Solvent control	2.9 \pm 0.61	2.7 \pm 1.1	2.6 \pm 2.3 ^a	440 \pm 620
220	2.8 \pm 0.65	2.8 \pm 0.45	11 \pm 32	440 \pm 730
470	2.5 \pm 0.92	3.5 \pm 0.62	18 \pm 24*	130 \pm 380
890	2.6 \pm 0.58	2.5 \pm 1.1	590 \pm 740**	900 \pm 820
2,120	3.1 \pm 0.70	3.8 \pm 0.93*	1,600 \pm 1,400*	2,400 \pm 640**
4,410	4.5 \pm 0.42**	5.8 \pm 3.0**	2,700 \pm 610*	2,700 \pm 740**

Testis-ova means No. of Males with testis-ova/No. of Males.

Data shows mean \pm standard deviation.

Statistically significant differences from solvent control group (** p <0.01, * p <0.05).

Statistically significant differences from control group (a).

3. Full Life Cycle Test

Table 3-A F₀ generation

Average measured concentration (µg/L)	Hatchability (%)	Time to hatching (Day)	Mortality (%)	Total length (mm)	Body weight (mg)	No. of fishes	Testis-ova
Control	95±5.0	11±1.3	12±3.1	31±1.7	320±59	20	0/9
Solvent control	90	11±0.13	11±5.6	31±1.5	320±57	20	0/10
2.03	95±5.0	13±1.1	21±4.9	30±2.4	290±79	20	0/13
9.24	92±2.9	12±0.81	11±5.7	31±2.2	320±74	20	0/9
50.4	90±5.0	12±0.51	11±6.1	30±2.5	280±79	20	0/14
248	90±8.7	12±0.99	15±1.9	31±1.5	320±52	20	0/9
1,185	95±5.0	12±0.66	28±3.3**	31±2.6	340±86	20	0/12

Table 3-B F₀ generation (Continued)

Average measured concentration (µg/L)	No. of eggs	Fertility (%)	Gonadosomatic Index (%)	
			Male	Female
Control	1,100 ± 210	96±5.3	1.0±0.21	11±3.9
Solvent control	1,300±190	97±5.8	1.1±0.32	8.7±0.66*
2.03	1,100±190	95±2.5	0.90±0.25	9.7±1.4
9.24	1,100±230	88±16	0.88±0.15	8.8±4.9
50.4	1,000±360	90±10	1.0±0.27	12±5.0
248	1,000±370	96±3.0	1.1±0.14	9.0±3.0
1,185	1,100±110	95±3.3	1.4±0.43	9.1±1.2

Table 3-C F₀ generation (Continued)

Average measured concentration (µg/L)	Hepatosomatic Index (%)		Vitellogenin (ng/mg liver)	
	Male	Female	Male	Female
Control	1.8±0.48	5.2±1.5	36±27	1,600±930
Solvent control	1.6±0.42	4.9±1.0	21±16	1,800±1,700
2.03	2.3±0.74	5.4±0.54	37±37	1,500±480
9.24	1.6±0.52	4.4±1.4	11±13	1,400±1,000
50.4	2.9±0.94**	4.9±2.0	22±26	1,400±600
248	2.7±1.3	4.5±2.1	36±34	1,600±830
1,185	3.6±2.1*	5.4±0.81	116±85	2,000±480

Table 3-D F₁ generation

Average measured concentration (µg/L)	Hatchability (%)	Time to hatching (Day)	Mortality (%)	Total length (mm)	Body weight (mg)	No. of fishes	Testis-ova
Control	95±5.0	12±4.1	12±2.4	31±2.3	320±77	20	0/12
Solvent control	98±2.9	15±2.9	17±6.1	30±2.3	300±77	20	0/11
2.03	85±10*	10±2.4	17±9.8	32±1.1**	360±61**	20	0/12
9.24	100	14±2.6	2.0±2.7	29±1.5	290±63	20	0/9
50.4	90	14±2.9	22±15	31±1.3**	350±52*	20	0/10
248	97±2.9	17±0.53	33 ± 15	30±2.1	330±76	20	0/10
1,185	88±7.6	17±4.7	36±26	32±2.1**	360±76**	20	2/10*

Table 3-E F₁ generation (Continued)

Average measured concentration (µg/L)	Hepatosomatic Index (%)		Vitellogenin (ng/mg liver)	
	Male	Female	Male	Female
Control	1.9±0.46	3.9±1.6	ND	1,100±920
Solvent control	2.4±0.52	3.6±1.4	ND	940±740
2.03	2.4±0.42	4.0±0.82	ND	1,700±880
9.24	2.1±0.51	3.6±0.82	ND	1,500±1,000
50.4	2.9±1.1	4.2±1.1	ND	1,100±830
248	2.5±1.0	3.3±1.0	4.5±8.5	2,300±1,600
1,185	2.3±0.86	4.0±1.2	24±30**	1,800±850

Testis-ova means No. of Males with testis-ova/No. of Males.

Data shows mean ± standard deviation.

Statistically significant differences from control and solvent control group (** $p < 0.01$, * $p < 0.05$).

ND means not detected (< 1 ng/mg liver).

Butylbenzyl phthalate

1. Vitellogenin Assay

Table 1 Results (Male)

Average measured concentration ($\mu\text{g/L}$)	Mortality (%)	Hepatosomatic Index (%)		Vitellogenin (ng/mg liver)	
		14 days	21 days	14 days	21 days
Control	0	2.1 \pm 0.56	1.9 \pm 0.62	ND	1.5 \pm 0.70
14	0	2.4 \pm 0.49	1.7 \pm 0.70	ND	1.3 \pm 0.58
27	0	1.9 \pm 0.31	2.0 \pm 0.44	ND	1.3 \pm 0.50
70	3.3	1.9 \pm 0.42	1.7 \pm 0.46	1.1 \pm 0.88	1.5 \pm 0.50
337	0	2.4 \pm 0.61	2.1 \pm 1.0	ND	1.3 \pm 0.51
1,045	0	2.5 \pm 0.85	2.2 \pm 0.87	2.6 \pm 2.0**	1.5 \pm 0.55

Data shows mean \pm standard deviation.

Statistically significant differences from control group (** p <0.01).

ND means not detected (< 1 ng/mg liver).

2. Partial Life Cycle Test

Table 2-A Results

Average measured concentration ($\mu\text{g/L}$)	Hatchability (%)	Time to hatching (Day)	Mortality (%)	Total length (mm)	Body weight (mg)
Control	98	13 \pm 9.4	16	20 \pm 1.5	130 \pm 33
0.74	94	11 \pm 6.5	17	20 \pm 1.9	140 \pm 34
2.7	89	15 \pm 10**	26	21 \pm 1.5**	160 \pm 35**
12	99	16 \pm 11**	31	21 \pm 1.5**	160 \pm 31**
29	96	12 \pm 7.4**	12	20 \pm 1.6	130 \pm 29
100	86	14 \pm 10	30	22 \pm 1.5**	180 \pm 36**

Table 2-B Results (Continued)

Average measured concentration ($\mu\text{g/L}$)	Gonadosomatic Index (%)		No. of fishes	Testis-ova
	Male	Female		
Control	0.83 \pm 0.24	7.4 \pm 0.89	20	0/10
0.74	0.97 \pm 0.37	7.6 \pm 0.74	20	0/10
2.7	1.1 \pm 0.27	7.6 \pm 0.66	20	0/10
12	1.1 \pm 0.29	7.4 \pm 0.96	20	0/10
29	1.2 \pm 0.31	7.5 \pm 0.81	20	0/10
100	1.2 \pm 0.25	7.5 \pm 1.1	20	0/10

Table 2-C Results (Continued)

Average measured concentration ($\mu\text{g/L}$)	Hepatosomatic Index (%)		Vitellogenin (ng/mg liver)	
	Male	Female	Male	Female
Control	2.1 \pm 0.51	2.5 \pm 0.66	1.1 \pm 0.36	380 \pm 700
0.74	2.1 \pm 0.69	2.6 \pm 0.62	1.5 \pm 1.2	460 \pm 570
2.7	2.7 \pm 0.95	3.0 \pm 0.84	1.4 \pm 0.83	140 \pm 340
12	2.4 \pm 1.1	3.6 \pm 1.3	1.6 \pm 0.79	91 \pm 98
29	2.8 \pm 1.2**	3.2 \pm 0.91	1.9 \pm 1.4	330 \pm 470
100	3.3 \pm 1.9	4.3 \pm 1.6	1.5 \pm 1.2	130 \pm 240

Testis-ova means No. of Males with testis-ova/No. of Males.

Data shows mean \pm standard deviation.

Statistically significant differences from control group (** p <0.01).

cis-Chlordane

1. Vitellogenin Assay

Table 1 Results (Male)

Average measured concentration ($\mu\text{g/L}$)	Mortality (%)	Hepatosomatic Index (%)		Vitellogenin (ng/mg liver)	
		14 days	21 days	14 days	21 days
Control	0	1.7 \pm 0.22	1.7 \pm 0.30	ND	ND
Solvent control	0	1.8 \pm 0.43	1.6 \pm 0.20	ND	ND
0.814	0	1.5 \pm 0.35*	1.6 \pm 0.48	ND	ND
1.73	0	1.6 \pm 0.30	1.8 \pm 0.32	ND	ND
3.97	3.3	1.5 \pm 0.29*	1.5 \pm 0.25	ND	ND
7.60	27	1.5 \pm 0.26	1.5 \pm 0.42	ND	ND
20.0	100	-	-	-	-

Data shows mean \pm standard deviation.

Statistically significant differences from control and solvent control group ($*p<0.05$).

ND means not detected (< 1 ng/mg liver).

Data not measured due to the 100% mortality (-).

2. Partial Life Cycle Test

Table 2-A Results

Average measured concentration ($\mu\text{g/L}$)	Hatchability (%)	Time to hatching (Day)	Mortality (%)	Total length (mm)	Body weight (mg)
Control	98 \pm 3.3	9.0 \pm 0.038	1.7 \pm 3.3	31 \pm 1.4	290 \pm 49
Solvent control	100	9.0	8.3 \pm 6.4	30 \pm 1.9	290 \pm 54
0.228	98 \pm 3.3	9.0	3.3 \pm 3.8	31 \pm 1.7	300 \pm 50
0.451	98 \pm 3.3	9.0 \pm 0.033	1.7 \pm 3.3	31 \pm 2.0	290 \pm 55
0.968	100	9.0 \pm 0.033	5.0 \pm 6.4	31 \pm 1.4	290 \pm 41
1.67	100	9.0 \pm 0.067	8.3 \pm 13	31 \pm 1.7	290 \pm 47
3.43	100	9.0	85 \pm 3.3**	30 \pm 1.1	280 \pm 42**

Table 2-B Results (Continued)

Average measured concentration ($\mu\text{g/L}$)	Gonadosomatic Index (%)		No. of fishes	Testis-ova
	Male	Female		
Control	0.95 \pm 0.36	7.4 \pm 2.1	20	0/10
Solvent control	0.99 \pm 0.30	7.0 \pm 1.4	20	0/10
0.228	0.90 \pm 0.30	8.0 \pm 0.91	20	0/8
0.451	1.1 \pm 0.17	7.6 \pm 2.5	20	0/10
0.968	0.74 \pm 0.28	6.7 \pm 2.3	20	0/13
1.67	0.90 \pm 0.38	7.7 \pm 1.1	20	0/10
3.43	0.86 \pm 0.67	8.3 \pm 5.1	9	0/3

Table 2-C Results (Continued)

Average measured concentration ($\mu\text{g/L}$)	Hepatosomatic Index (%)		Vitellogenin (ng/mg liver)	
	Male	Female	Male	Female
Control	1.6 \pm 0.24	3.3 \pm 0.72	1.1 \pm 1.1	1,800 \pm 660
Solvent control	1.7 \pm 0.23	3.4 \pm 0.68	1.0 \pm 1.5	1,800 \pm 320
0.228	2.1 \pm 0.34	3.4 \pm 0.62	1.8 \pm 1.4	2,100 \pm 510
0.451	1.6 \pm 0.21	3.5 \pm 0.77	ND	2,000 \pm 1,300
0.968	2.0 \pm 0.71	3.7 \pm 0.65	ND	1,800 \pm 420
1.67	1.9 \pm 0.54	3.5 \pm 0.76	1.2 \pm 0.81	2,300 \pm 380*
3.43	1.2 \pm 0.18	3.1 \pm 0.26	2.4 \pm 1.9	4,000 \pm 2,500

Testis-ova means No. of Males with testis-ova/No. of Males.

Data shows mean \pm standard deviation.

Statistically significant differences from control and solvent control group (** $p<0.01$, * $p<0.05$).

ND means not detected (< 1 ng/mg liver).

p,p'-DDD

1. Vitellogenin Assay

Table 1 Results (Male)

Average measured concentration (µg/L)	Mortality (%)	Hepatosomatic Index (%)		Vitellogenin (ng/mg liver)	
		14 days	21 days	14 days	21 days
Control	0	3.6±0.74	2.9±0.92	ND	ND
Solvent control	0	4.0±1.2	3.1±0.74	ND	ND
1.28	0	3.3±0.78	2.7±0.47	ND	ND
2.55	0	3.5±0.50	3.1±0.78	ND	ND
5.40	3.3	3.3±0.78	2.3±0.66*	ND	ND
10.2	0	3.8±1.2	2.7±0.75	ND	ND
21.3	0	3.3±0.70	2.2±0.41**	ND	ND

Data shows mean ± standard deviation.

Statistically significant differences from control and solvent control group (** $p < 0.01$, * $p < 0.05$).

ND means not detected (< 1 ng/mg liver).

2. Partial Life Cycle Test

Table 2-A Results

Average measured concentration (µg/L)	Hatchability (%)	Time to hatching (Day)	Mortality (%)	Total length (mm)	Body weight (mg)
Control	77±2.9	11±0.93	6.4±6.3	31±1.6	340±61
Solvent control	83±7.6	13±0.54	18±18	31±2.3	340±93
0.213	80±18	9.5±0.85	18±6.2	31±1.3	350±58
0.637	88±10	15±1.8	15±18	30±2.7	310±98
1.86	88±13	11±2.1	15±4.6	30±1.7	320±66
6.39	80±8.7	14±2.0	33±13	31±1.6	350±66
18.7	72±5.8	14±2.1	67±17**	31±2.0	370±70

Table 2-B Results (Continued)

Average measured concentration (µg/L)	Gonadosomatic Index (%)		No. of fishes	Testis-ova
	Male	Female		
Control	0.80±0.16	6.8±0.72	20	1/12
Solvent control	0.83±0.20	7.1±2.7	20	1/11
0.213	0.99±0.12*	8.5±1.6	20	1/10
0.637	0.94±0.37	6.3±3.4	20	0/9
1.86	0.88±0.30	5.9±1.7	20	0/7
6.39	0.96±0.26	7.9±1.9	20	0/12
18.7	1.2±0.25**	8.6±1.4	14	1/6

Table 2-C Results (Continued)

Average measured concentration (µg/L)	Hepatosomatic Index (%)		Vitellogenin (ng/mg liver)	
	Male	Female	Male	Female
Control	2.6±0.76	4.6±0.79	ND	1,400±600
Solvent control	2.4±0.93	6.4±3.1	21±40	1,000±460
0.213	1.9±0.54	5.1±1.5	2.1±2.6	1,300±560
0.637	2.4±0.67	4.4±0.80	9.0±6.2	1,400±880
1.86	2.4±0.50	5.2±3.4	63±130	1,200±720
6.39	2.3±0.67	4.1±0.68	19±36	1,200±270
18.7	2.4±0.37	4.6±0.70	51±57	1,100±330

Testis-ova means No. of Males with testis-ova/No. of Males.

Data shows mean ± standard deviation.

Statistically significant differences from control and solvent group (** $p < 0.01$, * $p < 0.05$).

ND means not detected (< 1 ng/mg liver).

p,p'-DDE

1. Vitellogenin Assay

Table 1 Results (Male)

Average measured concentration ($\mu\text{g/L}$)	Mortality (%)	Hepatosomatic Index (%)		Vitellogenin (ng/mg liver)	
		14 days	21 days	14 days	21 days
Control	0	2.5 \pm 0.57	2.4 \pm 0.64	ND	ND
Solvent control	3.3	3.1 \pm 0.80	2.4 \pm 0.33	ND	ND
7.44	3.3	2.8 \pm 0.66	2.7 \pm 0.50	ND	ND
16.5	0	2.7 \pm 0.46	2.6 \pm 0.52	ND	ND
28.0	0	2.6 \pm 0.45	2.5 \pm 0.80	ND	ND
53.6	0	2.2 \pm 0.60	3.1 \pm 1.3	1.2 \pm 1.5**	34 \pm 36**
115	3.3	2.5 \pm 0.56	2.9 \pm 0.95	90 \pm 120**	360 \pm 570**

Data shows mean \pm standard deviation.

Statistically significant differences from control and solvent control group (** p <0.01).

ND means not detected (< 1 ng/mg liver).

2. Partial Life Cycle Test

Table 2-A Results

Average measured concentration ($\mu\text{g/L}$)	Hatchability (%)	Time to hatching (Day)	Mortality (%)	Total length (mm)	Body weight (mg)
Control	82 \pm 2.9	10 \pm 0.38	10 \pm 3.4	30 \pm 2.2	340 \pm 66
Solvent control	87 \pm 2.9	9.9 \pm 1.3	7.7 \pm 3.5	30 \pm 1.9	330 \pm 69
1.05	92 \pm 5.8	14 \pm 2.0*	20 \pm 13	30 \pm 2.3	320 \pm 86
3.48	83 \pm 2.9	14 \pm 2.6	20 \pm 15	30 \pm 1.8	360 \pm 69
11.1	87 \pm 7.6	13 \pm 1.5	19 \pm 11	31 \pm 1.7	350 \pm 68
32.4	78 \pm 12	16 \pm 2.6**	77 \pm 14**	31 \pm 1.4	370 \pm 49
111	75 \pm 8.7	14 \pm 0.97*	66 \pm 15**	31 \pm 1.4	390 \pm 55

Table 2-B Results (Continued)

Average measured concentration ($\mu\text{g/L}$)	Gonadosomatic Index (%)		No. of fishes	Testis-ova
	Male	Female		
Control	0.85 \pm 0.21	8.4 \pm 3.4	20	0/11
Solvent control	0.81 \pm 0.23	6.8 \pm 3.6	20	1/9
1.05	0.85 \pm 0.26	9.1 \pm 2.0	20	0/12
3.48	0.86 \pm 0.19	8.1 \pm 3.3	20	0/8
11.1	0.96 \pm 0.31	7.4 \pm 2.3	20	1/9
32.4	0.90 \pm 0.26	9.8 \pm 1.3	10	7/7**
111	1.4 \pm 1.6	9.5 \pm 1.1	15	8/9**

Table 2-C Results (Continued)

Average measured concentration ($\mu\text{g/L}$)	Hepatosomatic Index (%)		Vitellogenin (ng/mg liver)	
	Male	Female	Male	Female
Control	2.8 \pm 0.51	4.8 \pm 0.68	ND	2,100 \pm 1,100
Solvent control	3.1 \pm 0.66	6.2 \pm 0.94	7.4 \pm 10	1,300 \pm 660
1.05	2.9 \pm 0.90	4.6 \pm 0.91**	9.3 \pm 21	1,600 \pm 250
3.48	2.5 \pm 0.90	5.3 \pm 0.82*	19 \pm 21	1,800 \pm 720
11.1	3.0 \pm 0.92	4.9 \pm 0.92**	19 \pm 24	1,900 \pm 570
32.4	2.3 \pm 0.34*	4.9 \pm 0.61	210 \pm 170**	1,300 \pm 440
111	4.2 \pm 1.2**	4.0 \pm 0.77**	1,900 \pm 1,000**	2,600 \pm 820**

Testis-ova means No. of Males with testis-ova/No. of Males.

Data shows mean \pm standard deviation.

Statistically significant differences from control and solvent group (** p <0.01, * p <0.05).

ND means not detected (< 1 ng/mg liver).

3. Full Life Cycle Test

In progress

o,p'-DDT

1. Vitellogenin Assay

Table 1 Results (Male)

Average measured concentration ($\mu\text{g/L}$)	Mortality (%)	Hepatosomatic Index (%)		Vitellogenin (ng/mg liver)	
		14 days	21 days	14 days	21 days
Control	0	2.4 \pm 0.34	2.1 \pm 0.56	ND	ND
Solvent control	3.3	2.1 \pm 0.59	1.9 \pm 0.41	ND	ND
0.373	0	2.0 \pm 0.60	2.1 \pm 0.71	ND	ND
0.800	0	2.1 \pm 0.58	1.9 \pm 0.73	ND	ND
1.50	0	2.2 \pm 0.59	1.8 \pm 0.52	2.1 \pm 4.8	260 \pm 560**
3.20	0	2.5 \pm 0.89	2.2 \pm 0.40	510 \pm 1,800**	1,700 \pm 2,100**
6.55	0	2.7 \pm 0.62	2.7 \pm 0.44**	1,800 \pm 2,000**	9,300 \pm 9,700**

Data shows mean \pm standard deviation.

Statistically significant differences from control and solvent group (** p <0.01).

ND means not detected (< 1 ng/mg liver).

2. Partial Life Cycle Test

Table 2-A Results

Average measured concentration ($\mu\text{g/L}$)	Hatchability (%)	Time to hatching (Day)	Mortality (%)	Total length (mm)	Body weight (mg)
Control	100	9.4 \pm 0.21	8.3 \pm 10	31 \pm 2.1	290 \pm 50
Solvent control	100	9.7 \pm 0.15	6.7 \pm 7.7	30 \pm 3.4	280 \pm 70
0.195	100	9.8 \pm 0.21	5.0 \pm 6.4	31 \pm 1.3	300 \pm 41
0.366	100	10 \pm 0.58	5.0 \pm 6.4	31 \pm 1.7	300 \pm 52
0.830	100	10 \pm 0.28*	12 \pm 6.4	31 \pm 1.6**	310 \pm 59
1.69	100	9.8 \pm 0.11	8.3 \pm 6.4	31 \pm 2.2	300 \pm 58
3.36	98 \pm 3.3	9.7 \pm 0.091	18 \pm 10	28 \pm 3.5**	260 \pm 81

Table 2-B Results (Continued)

Average measured concentration ($\mu\text{g/L}$)	Gonadosomatic Index (%)		No. of fishes	Testis-ova
	Male	Female		
Control	0.98 \pm 0.37	7.1 \pm 2.9	20	0/13
Solvent control	1.2 \pm 0.26	6.7 \pm 3.7	20	0/11
0.195	1.6 \pm 1.3	6.0 \pm 3.3	20	2/11*
0.366	1.2 \pm 0.39	8.1 \pm 2.6	20	0/8
0.830	1.2 \pm 0.50	5.1 \pm 3.3	20	4/8**
1.69	1.2 \pm 0.25	4.1 \pm 2.5*	20	2/2**
3.36	-	1.9 \pm 1.6**	20	0/0

Table 2-C Results (Continued)

Average measured concentration ($\mu\text{g/L}$)	Hepatosomatic Index (%)		Vitellogenin (ng/mg liver)	
	Male	Female	Male	Female
Control	1.8 \pm 0.48	3.3 \pm 1.2	1.7 \pm 3.8	1,800 \pm 770
Solvent control	2.0 \pm 0.45	3.9 \pm 1.1	ND	1,700 \pm 1,000
0.195	1.9 \pm 0.46	3.7 \pm 0.75	2.1 \pm 4.8	1,700 \pm 970
0.366	2.0 \pm 0.40	3.4 \pm 0.50	2.5 \pm 2.6	2,300 \pm 1,200
0.830	2.0 \pm 0.55	3.9 \pm 1.1	3.4 \pm 3.1	4,200 \pm 2,400*
1.69	2.3 \pm 0.28	4.0 \pm 0.81	29 \pm 36	7,700 \pm 4,000**
3.36	-	4.5 \pm 0.90*	-	7,500 \pm 1,200**

Testis-ova means No. of Males with testis-ova/No. of Males.

Data shows mean \pm standard deviation.

Statistically significant differences from control and solvent control group (** p <0.01, * p <0.05).

ND means not detected (< 1 ng/mg liver).

Data not measured or performed (-).

3. Full Life Cycle Test

Table 3-A F₀ generation

Average measured concentration (µg/L)	Hatchability (%)	Time to hatching (Day)	Mortality (%)	Total length (mm)	Body weight (mg)	No. of fishes	Testis-ova
Control	97±3.8	9.9±0.060	0	30±1.3	280±49	20	0/8
Solvent control	95±3.3	10±0.033	7.0±0.24	31±1.0	290±43	20	0/11
0.0153	97±6.7	9.9±0.13	1.7±3.3	31±1.3	300±38	20	0/11
0.0474	98±3.3	9.9±0.054	3.3±3.8	31±0.94	300±26	20	0/8
0.145	100	10±0.19	5.0±6.4	31±1.7	290±49	20	0/10
0.522	98±3.3	9.8±0.20	5.1±6.4	31±1.0	300±34	20	6/11**
1.94	95±6.4	9.8±0.10	7.3±6.3	30±1.5	290±45	20	2/2**

Table 3-B F₀ generation (Continued)

Average measured concentration (µg/L)	No. of eggs	Fertility (%)	Gonadosomatic Index (%)	
			Male	Female
Control	1,200±130	98±1.0	0.95±0.25	9.9±1.2
Solvent control	1,100±140	99±0.27	1.0±0.32	11±2.3
0.0153	1,200±160	98±1.4	1.0±0.25	10±1.7
0.0474	1,100±170	98±2.5	1.0±0.37	9.5±1.2
0.145	1,000±210	98±0.77	1.2±0.32	9.8±2.0
0.522	1,000±380	80±33*	1.2±0.41	10±2.1
1.94	-	-	-	-

Table 3-C F₀ generation (Continued)

Average measured concentration (µg/L)	Hepatosomatic Index (%)		Vitellogenin (ng/mg liver)	
	Male	Female	Male	Female
Control	1.4±0.33	4.6±1.3	ND	1,200±340
Solvent control	1.7±0.53	4.1±0.83	ND	1,300±250
0.0153	1.4±0.41	3.7±0.98	ND	1,300±240
0.0474	1.4±0.48	3.9±0.88	ND	1,300±350
0.145	1.5±0.33	3.9±1.6	1.5±2.5	1,400±230
0.522	1.9±0.54	4.2±1.5	110±220**	1,700±390
1.94	-	-	-	-

Table 3-D F₁ generation

Average measured concentration (µg/L)	Hatchability (%)	Time to hatching (Day)	Mortality (%)	Total length (mm)	Body weight (mg)	No. of fishes	Testis-ova
Control	99±2.4	9.7±0.26	3.3±3.8	29±1.2	260±38	20	0/12
Solvent control	99±1.4	9.5±0.26	0	30±1.4	260±37	20	0/7
0.0153	91±12	9.7±0.43	3.3±3.8	30±1.7	260±52	20	0/9
0.0474	98±2.6	9.9±0.27**	3.3±6.7	30±1.4**	270±40	20	0/12
0.145	97±2.9	10±0.27**	0	30±1.7	270±35	20	0/7
0.522	96±5.5	9.9±0.24**	1.7 ± 3.3	30±1.7	260±45	20	2/8*
1.94	-	-	-	-	-	-	-

Table 3-E F₁ generation (Continued)

Average measured concentration (µg/L)	Hepatosomatic Index (%)		Vitellogenin (ng/mg liver)	
	Male	Female	Male	Female
Control	1.8±0.40	3.2±0.87	ND	1,400±340
Solvent control	1.9±0.30	3.4±0.70	11±34	1,200±590
0.0153	1.9±0.51	3.3±0.63	ND	1,100±620
0.0474	1.4±0.33**	3.0±0.55	1.0±1.6	1,200±570
0.145	1.7±0.36	2.9±0.71	1.2±1.2	1,800±1,500
0.522	1.8±0.26	3.3±0.58	1.4±1.9	1,900±690
1.94	-	-	-	-

Testis-ova means No. of Males with testis-ova/No. of Males.

Data shows mean ± standard deviation.

Statistically significant differences from control and solvent control group (** $p < 0.01$, * $p < 0.05$).

ND means not detected (< 1 ng/mg liver).

Data not measured or performed (-).

p,p'-DDT

1. Vitellogenin Assay

Table 1 Results (Male)

Average measured concentration (µg/L)	Mortality (%)	Hepatosomatic Index (%)		Vitellogenin (ng/mg liver)	
		14 days	21 days	14 days	21 days
Control	0	2.0±0.51	1.8±0.27	ND	ND
Solvent control	0	1.9±0.40	2.0±0.48	ND	ND
0.37	3.3	2.0±0.71	2.2±0.50	ND	ND
0.62	0	2.0±0.54	1.9±0.22	ND	ND
1.34	6.7	2.4±0.63	2.0±0.38	ND	ND
2.73	0	2.5±0.49*	2.2±0.51	ND	ND
5.26	0	2.4±0.90	1.8±0.60	ND	ND

Data shows mean ± standard deviation.

Statistically significant differences from control and solvent control group (* p <0.05).

ND means not detected (< 1 ng/mg liver).

2. Partial Life Cycle Test

Table 2-A Results

Average measured concentration (µg/L)	Hatchability (%)	Time to hatching (Day)	Mortality (%)	Total length (mm)	Body weight (mg)
Control	85±5	11±1.4	12±5.2	31±1.5	320±64
Solvent control	82±2.9	12±1.4	10±3.8	31±1.9	340±76
0.044	77±7.6	9.9±0.18	14±7.8	31±1.7	350±80
0.144	80±8.7	11±1.0	14±8.4	31±1.6	350±72
0.467	90	11±0.35	13±3.2	31±1.4	330±61
1.43	77±5.8	11±0.67	55±30**	32±1.1**	400±71**
4.72	87±2.9	9.9±0.34	100 (PDH8)	-	-

Table 2-B Results (Continued)

Average measured concentration (µg/L)	Gonadosomatic Index (%)		No. of fishes	Testis-ova
	Male	Female		
Control	0.84±0.11	7.9±1.0	20	0/13
Solvent control	0.89±0.29	8.5±2.5	20	0/11
0.044	1.0±0.24	7.9±2.6	20	0/7
0.144	1.0±0.30	8.2±3.0	20	0/10
0.467	1.1±0.28	7.7±2.6	20	0/9
1.43	1.1±0.32	8.4±1.4	20	0/10
4.72	-	-	-	-

Table 2-C Results (Continued)

Average measured concentration (µg/L)	Hepatosomatic Index (%)		Vitellogenin (ng/mg liver)	
	Male	Female	Male	Female
Control	1.9±0.65	4.3±0.92	ND	580±530
Solvent control	2.1±0.35	4.8±0.88	4.1±4.5	840±510
0.044	1.6±0.61	4.7±1.4	15±15	1,500±880
0.144	2.6±1.8	4.7±1.0	18±27	820±340
0.467	1.8±0.52	3.6±0.72*	5.8±9.1	1,500±910
1.43	2.0±0.58	4.1±0.66	3.3±2.6	1,300±320
4.72	-	-	-	-

Testis-ova means No. of Males with testis-ova/No. of Males.

Data shows mean ± standard deviation.

Statistically significant differences from control and solvent group (** p <0.01, * p <0.05).

ND means not detected (< 1 ng/mg liver).

Data not measured or performed (-).

Di-*n*-butyl phthalate

1. Vitellogenin Assay

Table 1 Results (21days)

Average measured concentration (µg/L)	Mortality (%)	Hepatosomatic Index (%)		Vitellogenin (ng/mg liver)	
		Male	Female	Male	Female
Control	0	1.9±0.4	4.6±0.9	ND	1,200±580
Solvent control	0	1.8±0.6	4.1±1.2	ND	1,200±580
24.4	0	2.0±0.6	4.1±1.2	ND	950±720
55.3	0	2.1±1.0	4.4±0.8	ND	1,200±560
133	0	2.3±0.7	4.5±1.1	ND	660±610
328	5	2.5±0.6*	5.6±1.8	ND	790±780
822	0	2.8±0.6**	4.3±0.9	ND	1,100±880

Data shows mean ± standard deviation.

Statistically significant differences from control and solvent control group (** $p < 0.01$, * $p < 0.05$).

ND means not detected (< 1 ng/mg liver).

2. Partial Life Cycle Test

Table 2-A Results

Average measured concentration (µg/L)	Hatchability (%)	Time to hatching (Day)	Mortality (%)	Total length (mm)	Body weight (mg)
Control	97±3.9	10±0.1	8.6±6.6	29.5±1.4	256±42
Solvent control	97±3.9	10±0.2	11±4.4	29.6±1.3	256±41
7.09	95±6.4	9.8±0.1	12±8.6	29.8±1.5	266±50
21.9	87±14	9.8±0.2	8.9±10	29.5±1.4	259±46
72.8	97±3.9	9.9±0.1	21±5.1*	30.1±1.5	269±38
235	100	10±0.3	48±18*	29.6±1.7	269±48
850	8.3±10*	16±0.7	100	-	-

Table 2-B Results (Continued)

Average measured concentration (µg/L)	Gonadosomatic Index (%)		No. of fishes	Testis-ova
	Male	Female		
Control	0.64±0.2	3.9±2.5	20	0/10
Solvent control	0.68±0.2	2.5±2.7	20	0/12
7.09	0.61±0.2	3.9±3.4	20	1/11
21.9	0.63±0.3	4.5±4.0	20	0/12
72.8	0.73±0.3	4.6±3.8	20	2/12*
235	0.63±0.3	2.8±3.6	20	0/9
850	-	-	-	-

Table 2-C Results (Continued)

Average measured concentration (µg/L)	Hepatosomatic Index (%)		Vitellogenin (ng/mg liver)	
	Male	Female	Male	Female
Control	3.4±0.9	4.1±0.6	2.4±3.8	1,200±950
Solvent control	3.2±1.0	5.0±1.4	ND	760±1,200
7.09	3.6±0.9	5.6±0.6*	3.5±3.3	1,400±1,200
21.9	3.5±1.2	4.4±1.0	1.2±2.6	1,400±840
72.8	3.2±1.1	4.3±0.8	4.1±8.0	1,200±1,300
235	3.4±0.8	4.2±1.0	3.7±5.6	360±730
850	-	-	-	-

Testis-ova means No. of Males with testis-ova/No. of Males.

Data shows mean ± standard deviation.

Statistically significant differences from control and solvent control group (* $p < 0.05$).

ND means not detected (< 1 ng/mg liver).

Data not measured or performed (-).

3. Full Life Cycle Test

Table 3-A F₀ generation

Average measured concentration (µg/L)	Hatchability (%)	Time to hatching (Day)	Mortality (%)	Total length (mm)	Body weight (mg)	No. of fishes	Testis-ova
Control	92±8.4	9.9±0.3	13	29.1±1.4	236±44	20	0/8
Solvent control	95±6.4	10±0.4	18	29.6±1.2	245±35	20	0/9
2.61	98±3.3	9.8±0.2	12	28.6±1.5	218±39	20	1/8
7.52	97±3.8	9.8±0.2	16	29.3±1.3	239±34	20	0/11
23.9	95±6.4	10±0.3	5.6	29.1±1.4	233±38	20	0/6
74.5	95±6.4	10±0.1	24	30.1±1.7	259±49	20	1/9
233	98±3.3	10±0.2	15	28.6±1.8	226±50	20	2/8 *

Table 3-B F₀ generation (Continued)

Average measured concentration (µg/L)	No. of eggs	Fertility (%)	Gonadosomatic Index (%)	
			Male	Female
Control	560±210	94±6.5	0.78±0.2	9.3±1.6
Solvent control	625±130	87±26	0.89±0.2	8.1±0.9
2.61	602±110	96±5.6	0.86±0.2	7.5±0.7
7.52	668±100	94±8.9	0.92±0.2	8.0±0.9
23.9	543±110	94±3.1	1.1±0.1*	9.0±0.5
74.5	554±180	97±1.6	0.92±0.2	7.8±1.1
233	539±240	91±11	0.97±0.3	9.4±2.6

Table 3-C F₀ generation (Continued)

Average measured concentration (µg/L)	Hepatosomatic Index (%)		Vitellogenin (ng/mg liver)	
	Male	Female	Male	Female
Control	1.3±0.4	4.2±0.8	14.0±30	2,000±2,000
Solvent control	1.5±0.3	4.2±0.7	7.0±6.3	1,600±950
2.61	1.4±0.3	4.0±0.7	9.9±9.5	1,500±890
7.52	1.4±0.2	4.0±0.3	15±9.4	1,400±330
23.9	1.3±0.4	4.5±0.6	8.1±7.4	1,800±470
74.5	1.6±0.4	3.8±1.3	13±13	1,700±520
233	1.8±0.2	4.4±1.0	4.6±4.0	2,100±2,200

Table 3-D F₁ generation

Average measured concentration (µg/L)	Hatchability (%)	Time to hatching (Day)	Mortality (%)	Total length (mm)	Body weight (mg)	No. of fishes	Testis-ova
Control	87±8.9	9.4±0.6	0	30.7±1.2	276±39	20	0/9
Solvent control	85±11	9.4±0.5	0	30.5±1.4	281±39	20	0/7
2.61	89±8.8	9.1±0.6	0	30.8±1.2	274±34	20	2/10
7.52	94±6.4**	9.4±0.5	1.7	31.7±1.1**	297±41*	20	2/13*
23.9	72±21	8.6±1.1	1.7	30.8±1.3	283±33	20	1/11
74.5	90±12	9.8±0.4*	0	30.8±1.3	290±31	20	1/14
233	94±6.6*	11±1.2**	3.3	30.2±1.2	292±39	20	0/9

Table 3-E F₁ generation (Continued)

Average measured concentration (µg/L)	Vitellogenin (ng/mg liver)	
	Male	Female
Control	ND	440±720
Solvent control	ND	470±1,000
2.61	3.8±5.0*	1,700±820**
7.52	9.1±8.5**	1,600±1,100*
23.9	14±29	1,200±580**
74.5	3.3±2.7**	850±790
233	2.5±3.0	730±570

Testis-ova means No. of Males with testis-ova/No. of Males.

Data shows mean ± standard deviation.

Statistically significant differences from control and solvent control group (** $p < 0.01$, * $p < 0.05$).

ND means not detected (< 1 ng/mg liver).

2,4-Dichlorophenol

1. Vitellogenin Assay

Table 1 Results (Male)

Average measured concentration ($\mu\text{g/L}$)	Mortality (%)	Hepatosomatic Index (%)		Vitellogenin (ng/mg liver)	
		14 days	21 days	14 days	21 days
Control	0	2.4 \pm 1.9	2.2 \pm 0.61	3.0 \pm 3.2	ND
33.5	0	2.0 \pm 1.7	2.3 \pm 0.69	1.3 \pm 0.99	ND
105	0	2.2 \pm 1.5	2.3 \pm 0.66	2.2 \pm 3.3	ND
324	0	2.7 \pm 1.8	2.9 \pm 0.78	1.6 \pm 1.5	3.3 \pm 4.2**
946	0	2.0 \pm 1.3	2.2 \pm 0.64	60 \pm 48**	74 \pm 67**
3,280	10	1.5 \pm 1.2	2.9 \pm 1.1	180 \pm 72**	170 \pm 86**

Data shows mean \pm standard deviation.

Statistically significant differences from control group (** p <0.01).

ND means not detected (< 1 ng/mg liver).

2. Partial Life Cycle Test

Table 2-A Results

Average measured concentration ($\mu\text{g/L}$)	Hatchability (%)	Time to hatching (Day)	Mortality (%)	Body length (mm)	Body weight (mg)
Control	87 \pm 5.8	14 \pm 1.0	15 \pm 2.4	19 \pm 2.8	130 \pm 52
0.24	90 \pm 5.0	14 \pm 0.93	27 \pm 13	20 \pm 2.5	160 \pm 52
0.76	90 \pm 5.0	13 \pm 0.58	32 \pm 8.2	21 \pm 2.6	160 \pm 59
2.84	85 \pm 8.7	15 \pm 1.1	34 \pm 6.5	21 \pm 2.1	170 \pm 55
8.92	92 \pm 2.9	13 \pm 0.47	29 \pm 8.7	20 \pm 2.1	140 \pm 47
27.3	83 \pm 13	14 \pm 1.2	29 \pm 7.2	20 \pm 2.4	150 \pm 49

Table 2-B Results (Continued)

Average measured concentration ($\mu\text{g/L}$)	Gonadosomatic Index (%)		No. of fishes	Testis-ova
	Male	Female		
Control	0.97 \pm 0.44	1.2 \pm 0.73	20	0/10
0.24	0.52 \pm 0.38	2.1 \pm 2.3	20	0/10
0.76	1.1 \pm 0.36	2.4 \pm 2.9	20	0/10
2.84	0.61 \pm 0.37	1.3 \pm 1.2	20	0/10
8.92	1.1 \pm 0.35	2.6 \pm 2.6	20	0/10
27.3	0.59 \pm 0.24*	2.2 \pm 3.0	20	0/10

Table 2-C Results (Continued)

Average measured concentration ($\mu\text{g/L}$)	Hepatosomatic Index (%)		Vitellogenin (ng/mg liver)	
	Male	Female	Male	Female
Control	2.9 \pm 0.77	3.2 \pm 1.1	ND	180 \pm 310
0.24	2.7 \pm 0.88	3.1 \pm 1.0	4.1 \pm 3.1**	550 \pm 560
0.76	2.7 \pm 0.50	3.4 \pm 0.82	14 \pm 30**	550 \pm 620
2.84	2.6 \pm 0.73	3.5 \pm 1.8	27 \pm 33**	300 \pm 440
8.92	2.2 \pm 0.61	2.5 \pm 0.56	2.2 \pm 2.3**	600 \pm 600
27.3	2.5 \pm 0.86	2.9 \pm 0.85	2.0 \pm 1.4*	490 \pm 590

Testis-ova means No. of Males with testis-ova/No. of Males.

Data shows mean \pm standard deviation.

Statistically significant differences from control group (** p <0.01, * p <0.05).

ND means not detected (< 1 ng/mg liver).

Dicyclohexyl phthalate

1. Vitellogenin Assay

Table 1 Results (Male)

Average measured concentration ($\mu\text{g/L}$)	Mortality (%)	Hepatosomatic Index (%)		Vitellogenin (ng/mg liver)	
		14 days	21 days	14 days	21 days
Control	0	1.6 \pm 0.13	1.4 \pm 0.20	ND	ND
Solvent control	0	1.7 \pm 0.21	1.4 \pm 0.26	ND	ND
17.9	0	1.6 \pm 0.28	1.4 \pm 0.18	ND	ND
38.2	0	1.6 \pm 0.23	1.6 \pm 0.22*	ND	ND
87.2	0	1.9 \pm 0.37*	1.6 \pm 0.21	ND	ND
188	0	1.8 \pm 0.26*	1.5 \pm 0.20	ND	ND
388	0	2.0 \pm 0.37**	1.6 \pm 0.39	ND	ND

Data shows mean \pm standard deviation.

Statistically significant differences from control group (** p <0.01, * p <0.05).

ND means not detected (< 1 ng/mg liver).

2. Partial Life Cycle Test

Table 2-A Results

Average measured concentration ($\mu\text{g/L}$)	Hatchability (%)	Time to hatching (Day)	Mortality (%)	Total length (mm)	Body weight (mg)
Control	98 \pm 3.3	9.7 \pm 0.2	0	28.0 \pm 1.4	220 \pm 36
Solvent control	92 \pm 13	9.2 \pm 0.3	3.3 \pm 6.7	27.3 \pm 2.8	250 \pm 50
0.429	100	9.1 \pm 0.1	1.8 \pm 3.6	28.8 \pm 1.5**	225 \pm 41***
1.41	93 \pm 9.4	9.1 \pm 0.1	7.6 \pm 11	28.4 \pm 2.3	241 \pm 44
4.39	92 \pm 8.4	9.1 \pm 0.1	5.6 \pm 7.3	30.0 \pm 1.6**	250 \pm 47
13.3	100	9.3 \pm 0.4	0 \pm 0	29.0 \pm 1.7**	237 \pm 45
35.8	90 \pm 8.6	9.1 \pm 0.1	13 \pm 10	29.8 \pm 1.8**	265 \pm 48

Table 2-B Results (Continued)

Average measured concentration ($\mu\text{g/L}$)	Gonadosomatic Index (%)		No. of fishes	Testis-ova
	Male	Female		
Control	0.75 \pm 0.2	4.3 \pm 3.3	20	0/13
Solvent control	0.74 \pm 0.2	5.2 \pm 3.3	20	0/12
0.429	0.83 \pm 0.2	5.5 \pm 3.1	20	0/13
1.41	0.69 \pm 0.2	2.9 \pm 2.6	20	0/13
4.39	0.85 \pm 0.3	5.8 \pm 3.7	20	0/14
13.3	0.76 \pm 0.2	3.9 \pm 2.8	20	0/11
35.8	1.1 \pm 0.3**	5.9 \pm 3.1	20	1/10

Table 2-C Results (Continued)

Average measured concentration ($\mu\text{g/L}$)	Hepatosomatic Index (%)		Vitellogenin (ng/mg liver)	
	Male	Female	Male	Female
Control	2.7 \pm 0.7	3.6 \pm 1.0	1.8 \pm 2.4	1,600 \pm 1,500
Solvent control	2.5 \pm 0.4	4.0 \pm 0.7	2.2 \pm 2.4	1,800 \pm 1,300
0.429	2.4 \pm 0.4	3.6 \pm 0.9	3.8 \pm 3.4	2,100 \pm 1,100
1.41	2.4 \pm 0.6	3.0 \pm 0.5	4.7 \pm 4.7	1,600 \pm 1,400
4.39	2.2 \pm 0.6	3.6 \pm 0.5	12 \pm 16**	1,800 \pm 660
13.3	2.1 \pm 0.5	3.2 \pm 0.7	1.3 \pm 2.0	2,400 \pm 1,900
35.8	2.2 \pm 0.9	3.7 \pm 1.0	2.7 \pm 2.1	2,900 \pm 3,300

Testis-ova means No. of Males with testis-ova/No. of Males.

Data shows mean \pm standard deviation.

Statistically significant differences from control and solvent control group (** p <0.01, * p <0.05).

Statistically significant differences from solvent control group (***) p <0.05, but not statistically significant differences from control group.

Dieldrin

1. Vitellogenin Assay

Table 1 Results (Male)

Average measured concentration ($\mu\text{g/L}$)	Mortality (%)	Hepatosomatic Index (%)		Vitellogenin (ng/mg liver)	
		14 days	21 days	14 days	21 days
Control	3.3	2.0 \pm 0.40	2.3 \pm 0.44	1.6 \pm 0.47	1.6 \pm 0.80
Solvent control	6.7	2.0 \pm 0.40	2.5 \pm 0.43	1.4 \pm 0.65	1.8 \pm 0.65
0.27	0	2.0 \pm 0.47	2.2 \pm 0.37	1.8 \pm 0.58	3.1 \pm 1.7**
0.70	3.3	2.0 \pm 0.47	2.2 \pm 0.40	1.7 \pm 0.49	2.7 \pm 1.3*
2.26	0	2.2 \pm 0.36	2.2 \pm 0.26	1.6 \pm 0.73	2.4 \pm 1.1*
7.23	16.7	2.2 \pm 0.52	2.2 \pm 0.33	2.0 \pm 0.79*	2.6 \pm 1.4
24.2	100(PDH9)	-	-	-	-

Data shows mean \pm standard deviation.

Statistically significant differences from control and solvent control group (** p <0.01, * p <0.05).

Data not measured or performed (-).

2. Partial Life Cycle Test

Table 2-A Results

Average measured concentration ($\mu\text{g/L}$)	Hatchability (%)	Time to hatching (Day)	Mortality (%)	Total length (mm)	Body weight (mg)
Control	93 \pm 7.6	13 \pm 1.1	13 \pm 3.0	29 \pm 2.0	290 \pm 61
Solvent control	88 \pm 16	11 \pm 0.95	13 \pm 4.8	29 \pm 1.8	280 \pm 55
0.023	93 \pm 7.6	13 \pm 0.77	16 \pm 1.4	29 \pm 2.4	300 \pm 75
0.073	85 \pm 5.0	16 \pm 1.5**	31 \pm 12**	29 \pm 2.2	280 \pm 69
0.230	83 \pm 12	16 \pm 1.9**	17 \pm 10	29 \pm 2.6	290 \pm 82
0.754	80 \pm 8.7	14 \pm 1.8	4.3 \pm 3.8	30 \pm 2.0	300 \pm 69
2.33	87 \pm 7.6	14 \pm 1.0	29 \pm 4.6*	29 \pm 1.6	290 \pm 53

Table 2-B Results (Continued)

Average measured concentration ($\mu\text{g/L}$)	Gonadosomatic Index (%)		No. of fishes	Testis-ova
	Male	Female		
Control	0.74 \pm 0.23	7.7 \pm 1.1	20	0/12
Solvent control	0.83 \pm 0.22	6.4 \pm 2.1	20	0/9
0.023	0.92 \pm 0.17	7.8 \pm 3.3	20	1/8
0.073	1.1 \pm 0.32**	6.1 \pm 3.8	20	1/13
0.230	0.84 \pm 0.32	6.2 \pm 3.6	20	0/9
0.754	0.76 \pm 0.27	8.2 \pm 2.7	20	0/11
2.33	0.80 \pm 0.19	6.9 \pm 3.2	20	0/12

Table 2-C Results (Continued)

Average measured concentration ($\mu\text{g/L}$)	Hepatosomatic Index (%)		Vitellogenin (ng/mg liver)	
	Male	Female	Male	Female
Control	3.0 \pm 0.44	5.4 \pm 0.66	ND	1,500 \pm 320
Solvent control	2.9 \pm 0.52	5.8 \pm 0.58	ND	1,700 \pm 580
0.023	2.4 \pm 0.47*	5.3 \pm 0.68	ND	2,000 \pm 700
0.073	2.6 \pm 0.56	5.4 \pm 0.84	1.5 \pm 1.9*	1,900 \pm 550
0.230	3.0 \pm 0.58	5.7 \pm 0.68	ND	2,000 \pm 1,300
0.754	2.7 \pm 0.56	5.8 \pm 1.2	ND	2,100 \pm 720*
2.33	2.8 \pm 0.42	5.1 \pm 1.1	2.5 \pm 4.0*	2,100 \pm 790

Testis-ova means No. of Males with testis-ova/No. of Males.

Data shows mean \pm standard deviation.

Statistically significant differences from control and solvent control group (** p <0.01, * p <0.05).

ND means not detected (< 1 ng/mg liver).

Di-(2-ethylhexyl) adipate

1. Vitellogenin Assay

Table 1 Results (Male)

Average measured concentration ($\mu\text{g/L}$)	Mortality (%)	Hepatosomatic Index (%)		Vitellogenin (ng/mg liver)	
		14 days	21 days	14 days	21 days
Control	0	2.3 \pm 0.68	2.6 \pm 0.38	ND	ND
2.4	0	2.5 \pm 0.65	2.2 \pm 0.55*	ND	ND
7.9	0	2.8 \pm 0.82	2.3 \pm 0.48	ND	ND
22	0	2.6 \pm 0.60	2.5 \pm 0.51	ND	ND
182	0	2.5 \pm 0.46	2.6 \pm 0.39	ND	ND
454	0	2.2 \pm 0.57	2.4 \pm 0.79	ND	ND

Data shows mean \pm standard deviation.

Statistically significant differences from control group (* p <0.05).

ND means not detected (< 1 ng/mg liver).

2. Partial Life Cycle Test

Table 2-A Results

Average measured concentration ($\mu\text{g/L}$)	Hatchability (%)	Time to hatching (Day)	Mortality (%)	Total length (mm)	Body weight (mg)
Control	97 \pm 3.9	8.3 \pm 0.1	3.5 \pm 4.0	30.1 \pm 2.1	260 \pm 56
Solvent control	92 \pm 8.4	8.4 \pm 0.2	7.5 \pm 8.8	31.0 \pm 1.5	277 \pm 51
0.711	98 \pm 3.3	8.1 \pm 0.2	1.8 \pm 3.6	30.0 \pm 2.4	261 \pm 64
2.33	95 \pm 3.3	8.2 \pm 0.2	6.8 \pm 9.4	31.0 \pm 1.7	286 \pm 55
7.88	92 \pm 3.3	8.1 \pm 0.3	13 \pm 13	31.2 \pm 1.9	301 \pm 71**
26.3	95 \pm 6.4	8.2 \pm 0.1	5.1 \pm 6.4	31.1 \pm 1.3	280 \pm 44
87.1	95 \pm 6.4	8.3 \pm 0.2	4.0 \pm 4.6	31.1 \pm 1.6	280 \pm 54

Table 2-B Results (Continued)

Average measured concentration ($\mu\text{g/L}$)	Gonadosomatic Index (%)		No. of fishes	Testis-ova
	Male	Female		
Control	1.1 \pm 0.2	6.9 \pm 2.9	20	0/8
Solvent control	1.2 \pm 0.4	9.1 \pm 1.9	20	1/14
0.711	1.1 \pm 0.4	6.7 \pm 2.7	20	0/10
2.33	1.3 \pm 0.4	8.6 \pm 2.7	20	0/6
7.88	1.2 \pm 0.2	7.5 \pm 2.7	20	1/9
26.3	1.0 \pm 0.3	6.7 \pm 3.0	20	0/13
87.1	1.0 \pm 0.2	5.7 \pm 3.6	20	0/12

Table 2-C Results (Continued)

Average measured concentration ($\mu\text{g/L}$)	Hepatosomatic Index (%)		Vitellogenin (ng/mg liver)	
	Male	Female	Male	Female
Control	1.8 \pm 0.5	3.6 \pm 0.604	6.3 \pm 13	2,100 \pm 680
Solvent control	1.9 \pm 0.5	3.3 \pm 0.4	1.3 \pm 1.6	2,500 \pm 1,900
0.711	1.9 \pm 0.4	3.1 \pm 0.7	1.6 \pm 2.0	2,000 \pm 1,300
2.33	1.8 \pm 0.2	3.4 \pm 0.8	3.0 \pm 4.7	2,600 \pm 1,300
7.88	1.8 \pm 0.3	3.7 \pm 0.8	1.8 \pm 1.6	1,600 \pm 610
26.3	1.8 \pm 0.5	3.6 \pm 0.8	5.4 \pm 9.1	2,100 \pm 390
87.1	1.8 \pm 0.3	3.1 \pm 0.3	1.4 \pm 1.2	1,500 \pm 980

Testis-ova means No. of Males with testis-ova/No. of Males.

Data shows mean \pm standard deviation.

Statistically significant differences from control and solvent control group (** p <0.01).

Di-(2-ethylhexyl) phthalate

1. Vitellogenin Assay

Table 1 Results (Male)

Average measured concentration ($\mu\text{g/L}$)	Mortality (%)	Hepatosomatic Index (%)		Vitellogenin (ng/mg liver)	
		14 days	21 days	14 days	21 days
Control	0	1.6 \pm 0.27	1.4 \pm 0.21	ND	ND
Solvent control	0	1.5 \pm 0.27	1.5 \pm 0.24	ND	ND
19.2	0	1.5 \pm 0.33	1.6 \pm 0.19	ND	ND
42.4	0	1.7 \pm 0.27	1.3 \pm 0.28	ND	ND
95.6	0	1.6 \pm 0.38	1.6 \pm 0.32	ND	ND
210	0	1.5 \pm 0.18	1.4 \pm 0.34	ND	ND
405	0	1.7 \pm 0.22	1.4 \pm 0.31	ND	ND

Data shows mean \pm standard deviation.
ND means not detected (< 1 ng/mg liver).

2. Partial Life Cycle Test

Table 2-A Results

Average measured concentration ($\mu\text{g/L}$)	Hatchability (%)	Time to hatching (Day)	Mortality (%)	Total length (mm)	Body weight (mg)
Control	93 \pm 7.7	8.8 \pm 0.5	0	30.3 \pm 1.5	271 \pm 43
Solvent control	98 \pm 3.3	9.2 \pm 0.2	1.9 \pm 3.9	30.4 \pm 1.6	275 \pm 52
11.0	93	9.0 \pm 0.3	1.8 \pm 3.6	30.7 \pm 1.5	290 \pm 45
28.4	100	9.1 \pm 0.1	0	30.1 \pm 2.0	270 \pm 58
73.4	95 \pm 10	9.1 \pm 0.1	0	30.5 \pm 1.6	263 \pm 49
186	95 \pm 6.4	9.0 \pm 0.1	1.8 \pm 3.6	30.2 \pm 2.0	261 \pm 51
446	95 \pm 6.8	9.0 \pm 0.2	2.1 \pm 4.2	30.3 \pm 2.0	264 \pm 48

Table 2-B Results (Continued)

Average measured concentration ($\mu\text{g/L}$)	Gonadosomatic Index (%)		No. of fishes	Testis-ova
	Male	Female		
Control	0.78 \pm 0.21	5.0 \pm 2.7	20	0/13
Solvent control	0.71 \pm 0.23	6.2 \pm 3.6	20	0/10
11.0	0.82 \pm 0.27	3.8 \pm 2.6	20	0/12
28.4	0.97 \pm 0.40	4.3 \pm 2.9	20	0/10
73.4	0.83 \pm 0.26	5.2 \pm 3.4	20	1/11
186	0.76 \pm 0.26	6.4 \pm 3.9	20	0/10
446	0.86 \pm 0.37	6.0 \pm 3.3	20	0/12

Table 2-C Results (Continued)

Average measured concentration ($\mu\text{g/L}$)	Hepatosomatic Index (%)		Vitellogenin (ng/mg liver)	
	Male	Female	Male	Female
Control	2.2 \pm 0.7	3.7 \pm 0.4	1.3 \pm 1.4	1,100 \pm 730
Solvent control	2.0 \pm 0.2	3.9 \pm 0.4	2.8 \pm 3.6	1,600 \pm 1,000
11.0	1.8 \pm 0.6	3.9 \pm 1.3	2.5 \pm 4.1	1,100 \pm 890
28.4	1.6 \pm 0.7	3.5 \pm 0.5	3.5 \pm 5.4	1,500 \pm 920
73.4	2.6 \pm 0.9	3.7 \pm 0.4	ND	1,500 \pm 1,100
186	2.3 \pm 0.6	4.2 \pm 0.9	ND	1,700 \pm 1,100
446	2.3 \pm 0.7	3.9 \pm 0.5	4.3 \pm 9.3	1,200 \pm 570

Testis-ova means No. of Males with testis-ova/No. of Males.

Data shows mean \pm standard deviation.
ND means not detected (< 1 ng/mg liver).

Diethyl phthalate

1. Vitellogenin Assay

Table 1 Results (Male)

Average measured concentration ($\mu\text{g/L}$)	Mortality (%)	Hepatosomatic Index (%)		Vitellogenin (ng/mg liver)	
		14 days	21 days	14 days	21 days
Control	0	2.5 \pm 0.43	1.6 \pm 0.52	4.4 \pm 4.1	1.2 \pm 0.50
8.1	0	2.0 \pm 0.75*	1.7 \pm 1.3	2.1 \pm 0.97	2.3 \pm 2.4
27	0	1.9 \pm 0.51*	1.7 \pm 0.43	4.8 \pm 5.6	1.8 \pm 2.0
120	0	2.0 \pm 0.60*	2.4 \pm 2.9	2.7 \pm 3.0	2.2 \pm 3.1
356	0	1.9 \pm 0.55*	1.6 \pm 0.37	2.4 \pm 1.7	1.0 \pm 0.38
1,053	0	2.0 \pm 0.42*	1.8 \pm 0.25	2.5 \pm 2.6*	1.2 \pm 0.77

Data shows mean \pm standard deviation.

Statistically significant differences from control group (* p <0.05).

2 Partial Life Cycle Test

Table 2-A Results

Average measured concentration ($\mu\text{g/L}$)	Hatchability (%)	Time to hatching (Day)	Mortality (%)	Total length (mm)	Body weight (mg)
Control	81	11 \pm 2.8	8.6	21 \pm 2.7	170 \pm 57
0.6	80	12 \pm 3.7	3.8	21 \pm 2.0	160 \pm 47
2.5	83	12 \pm 4.0*	13	21 \pm 1.8	170 \pm 38
8.4	91	12 \pm 4.4*	18	21 \pm 1.7	170 \pm 36
36	92	12 \pm 2.8*	5.4	20 \pm 1.7**	140 \pm 35**
122	88	11 \pm 2.4	2.3	20 \pm 1.9*	140 \pm 34**

Table 2-B Results (Continued)

Average measured concentration ($\mu\text{g/L}$)	Gonadosomatic Index (%)		No. of fishes	Testis-ova
	Male	Female		
Control	1.1 \pm 0.25	7.5 \pm 0.64	20	0/10
0.6	0.87 \pm 0.34	7.4 \pm 0.74	20	0/10
2.5	1.0 \pm 0.20	7.3 \pm 0.65	20	0/10
8.4	0.85 \pm 0.26	7.5 \pm 0.51	20	0/10
36	0.92 \pm 0.37	7.1 \pm 0.72	20	0/10
122	0.90 \pm 0.38	6.9 \pm 0.72	20	0/10

Table 2-C Results (Continued)

Average measured concentration ($\mu\text{g/L}$)	Hepatosomatic Index (%)		Vitellogenin (ng/mg liver)	
	Male	Female	Male	Female
Control	4.5 \pm 1.7	4.2 \pm 2.1	ND	230 \pm 300
0.6	4.2 \pm 1.2	3.8 \pm 1.8	ND	120 \pm 270
2.5	3.9 \pm 1.4	4.4 \pm 1.5	1.3 \pm 2.4	180 \pm 250
8.4	4.0 \pm 1.5	3.8 \pm 1.7	1.1 \pm 1.6	120 \pm 380
36	4.5 \pm 1.6	4.8 \pm 1.1	1.7 \pm 2.9	63 \pm 140*
122	5.0 \pm 1.0	4.3 \pm 1.3	ND	60 \pm 150*

Testis-ova means No. of Males with testis-ova/No. of Males.

Data shows mean \pm standard deviation.

Statistically significant differences from control group (** p <0.01, * p <0.05).

ND means not detected (< 1 ng/mg liver).

Dihexyl phthalate

1. Vitellogenin Assay

Table 1 Results (Male)

Average measured concentration ($\mu\text{g/L}$)	Mortality (%)	Hepatosomatic Index (%)		Vitellogenin (ng/mg liver)	
		14 days	21 days	14 days	21 days
Control	0	2.2 \pm 0.47	2.2 \pm 0.34	ND	ND
Solvent control	0	2.2 \pm 0.55	2.0 \pm 0.43	ND	ND
1.50	0	2.1 \pm 0.50	2.3 \pm 0.49	ND	ND
4.06	0	2.0 \pm 0.34	2.1 \pm 0.41	ND	ND
15.6	0	2.1 \pm 0.48	2.6 \pm 0.46**	ND	ND
58.1	0	2.0 \pm 0.45	2.4 \pm 0.62	ND	ND
143	0	2.2 \pm 0.43	2.5 \pm 0.47	ND	ND

Data shows mean \pm standard deviation.

Statistically significant differences from control and solvent control group (** $p < 0.01$).

ND means not detected (< 1 ng/mg liver).

2. Partial Life Cycle Test

Table 2-A Results

Average measured concentration ($\mu\text{g/L}$)	Hatchability (%)	Time to hatching (Day)	Mortality (%)	Total length (mm)	Body weight (mg)
Control	95 \pm 6.4	10.2 \pm 0.09	8.7 \pm 3.1	30 \pm 1.6	280 \pm 42
Solvent control	98 \pm 3.3	10.2 \pm 0.1	5.2 \pm 6.8	31 \pm 1.5	280 \pm 39
0.693	98 \pm 3.3	10.1 \pm 0.09	6.7 \pm 9.4	30 \pm 2.6	280 \pm 61
2.25	95 \pm 6.4	10.3 \pm 0.2	8.6 \pm 6.3	31 \pm 1.4	290 \pm 43
6.83	95 \pm 10	10.2 \pm 0.2	5.0 \pm 10	30 \pm 2.5	280 \pm 61
23.7	97 \pm 3.8	10.2 \pm 0.08	7.1 \pm 10	30 \pm 1.9	280 \pm 58
71.5	87 \pm 5.4	10.1 \pm 0.06	12 \pm 13	31 \pm 2.5	300 \pm 70

Table 2-B Results (Continued)

Average measured concentration ($\mu\text{g/L}$)	Gonadosomatic Index (%)		No. of fishes	Testis-ova
	Male	Female		
Control	0.93 \pm 0.3	4.3 \pm 3.1	20	0/9
Solvent control	0.88 \pm 0.3	4.7 \pm 2.4	20	0/11
0.693	1.2 \pm 0.5	4.4 \pm 2.3	20	0/10
2.25	0.76 \pm 0.3	3.4 \pm 2.6	20	0/10
6.83	0.81 \pm 0.5	4.1 \pm 3.1	20	0/11
23.7	0.63 \pm 0.3	5.9 \pm 2.1	20	0/11
71.5	0.96 \pm 0.3	6.3 \pm 3.1	20	0/10

Table 2-C Results (Continued)

Average measured concentration ($\mu\text{g/L}$)	Hepatosomatic Index (%)		Vitellogenin (ng/mg liver)	
	Male	Female	Male	Female
Control	2.0 \pm 0.5	3.1 \pm 0.5	1.1 \pm 2.2	1,900 \pm 1,400
Solvent control	1.9 \pm 0.5	3.1 \pm 0.5	1.4 \pm 2.4	2,000 \pm 860
0.693	1.6 \pm 0.4	2.7 \pm 0.4	1.7 \pm 2.1	1,900 \pm 1,300
2.25	1.7 \pm 0.5	3.1 \pm 0.7	ND	2,500 \pm 2,700
6.83	2.0 \pm 0.4	3.1 \pm 0.4	1.4 \pm 2.0	1,900 \pm 1,500
23.7	1.8 \pm 0.3	3.1 \pm 0.4	1.9 \pm 2.2	2,500 \pm 1,000
71.5	2.1 \pm 0.5	3.6 \pm 0.8	3.1 \pm 2.1	2,600 \pm 1,500

Testis-ova means No. of Males with testis-ova/No. of Males.

Data shows mean \pm standard deviation.

ND means not detected (< 1 ng/mg liver).

Dipentyl phthalate

1. Vitellogenin Assay

Table 1 Results (Male)

Average measured concentration ($\mu\text{g/L}$)	Mortality (%)	Hepatosomatic Index (%)		Vitellogenin (ng/mg liver)	
		14 days	21 days	14 days	21 days
Control	0	1.8 \pm 0.38	1.8 \pm 0.54	ND	ND
Solvent control	0	1.6 \pm 0.67	1.5 \pm 0.32	ND	ND
4.78	0	1.5 \pm 0.34	1.4 \pm 0.34	ND	ND
14.2	0	1.4 \pm 0.26	1.6 \pm 0.16	ND	ND
50.6	0	1.4 \pm 0.37	1.5 \pm 0.25	ND	ND
161	0	1.7 \pm 0.35	1.7 \pm 0.32	ND	ND
583	0	1.8 \pm 0.35	1.7 \pm 0.45	ND	ND

Data shows mean \pm standard deviation.
ND means not detected (< 1 ng/mg liver).

2. Partial Life Cycle Test

Table 2-A Results

Average measured concentration ($\mu\text{g/L}$)	Hatchability (%)	Time to hatching (Day)	Mortality (%)	Total length (mm)	Body weight (mg)
Control	95 \pm 10	9.7 \pm 0.7	20 \pm 4.8	31 \pm 1.6	310 \pm 53
Solvent control	95 \pm 6.4	9.3 \pm 0.1	5.1 \pm 6.4	31 \pm 1.3	290 \pm 39
0.814	98 \pm 3.3	9.4 \pm 0.1	12 \pm 10	31 \pm 1.4	300 \pm 45
2.39	92 \pm 10	9.3 \pm 0.2	7.5 \pm 8.8	32 \pm 1.8	310 \pm 55
8.15	93 \pm 5.4	9.5 \pm 0.4	3.8 \pm 7.7	31 \pm 1.3	290 \pm 44
23.1	95 \pm 10	9.4 \pm 0.2	12 \pm 9.8	32 \pm 1.7	320 \pm 59*
80.6	98 \pm 3.3	9.6 \pm 0.1	6.7 \pm 9.4	30 \pm 2.0**	280 \pm 50

Table 2-B Results (Continued)

Average measured concentration ($\mu\text{g/L}$)	Gonadosomatic Index (%)		No. of fishes	Testis-ova
	Male	Female		
Control	1.0 \pm 0.2	7.1 \pm 3.5	20	0/10
Solvent control	0.92 \pm 0.4	5.9 \pm 2.4	20	0/9
0.814	1.1 \pm 0.4	7.2 \pm 2.3	20	0/10
2.39	1.0 \pm 0.4	6.9 \pm 2.6	20	0/10
8.15	1.1 \pm 0.3	6.3 \pm 3.1	20	0/10
23.1	1.2 \pm 0.2	8.6 \pm 2.1	20	0/10
80.6	1.1 \pm 0.3	8.0 \pm 3.1	20	0/13

Table 2-C Results(Continued)

Average measured concentration ($\mu\text{g/L}$)	Hepatosomatic Index (%)		Vitellogenin (ng/mg liver)	
	Male	Female	Male	Female
Control	2.2 \pm 0.4	4.2 \pm 0.5	1.9 \pm 1.9	1,600 \pm 1,100
Solvent control	2.1 \pm 0.4	3.4 \pm 0.5	4.4 \pm 2.2	2,100 \pm 1,300
0.814	2.0 \pm 0.7	3.4 \pm 0.4	1.5 \pm 1.1	2,000 \pm 1,000
2.39	1.8 \pm 0.4	3.6 \pm 0.7	1.8 \pm 3.2	2,300 \pm 630
8.15	1.8 \pm 0.4	3.7 \pm 0.4	6.1 \pm 13	2,200 \pm 1,700
23.1	1.9 \pm 0.2	3.9 \pm 0.4	2.8 \pm 3.0	2,900 \pm 890
80.6	2.0 \pm 0.6	3.2 \pm 0.8	2.2 \pm 3.0	2,700 \pm 510

Testis-ova means No. of Males with testis-ova/No. of Males.

Data shows mean \pm standard deviation.

Statistically significant differences from control and solvent control group (** p <0.01, * p <0.05).

Dipropyl phthalate

1. Vitellogenin Assay

Table 1 Results (Male)

Average measured concentration (µg/L)	Mortality (%)	Hepatosomatic Index (%)		Vitellogenin (ng/mg liver)	
		14 days	21 days	14 days	21 days
Control	0	2.0±0.30	1.9±0.31	ND	ND
Solvent control	0	1.6±0.45	1.5±0.45	ND	ND
12.7	0	1.7±0.49	1.7±0.32	ND	ND
43.4	0	1.7±0.33	1.7±0.63	ND	ND
158	0	1.7±0.33	1.7±0.36	ND	ND
572	0	2.0±0.37	1.6±0.40	ND	ND
1,690	3.3	1.8±0.31	2.0±0.34*	ND	ND

Data shows mean ± standard deviation.

Statistically significant differences from solvent control group (* p <0.05), but not statistically significant differences from control group

ND means not detected (< 1 ng/mg liver).

2. Partial Life Cycle Test

Table 2-A Results

Average measured concentration (µg/L)	Hatchability (%)	Time to hatching (Day)	Mortality (%)	Total length (mm)	Body weight (mg)
Control	93±7.7	8.6±0.2	14±13	31±2.0	300±69
Solvent control	92±3.3	8.8±0.2	11±7.1	31±1.8	300±59
0.869	97±3.8	9.1±0.1*	5.0±6.4	30±1.5**	280±38
2.57	97±3.8	9.0±0.03*	5.0±6.4	30±2.1*	280±57
8.34	98±3.3	8.8±0.2	6.7±9.4	30±2.0	280±60
24.7	92±3.3	9.0±0.04	7.4±6.3	31±1.6	290±50
74.8	98±3.3	9.1±0.07*	5.0±3.3	30±1.5	280±37

Table 2-B Results (Continued)

Average measured concentration (µg/L)	Gonadosomatic Index (%)		No. of fishes	Testis-ova
	Male	Female		
Control	1.1±0.2	8.4±2.2	20	0/10
Solvent control	0.99±0.2	8.2±3.6	20	0/10
0.869	1.2±0.2	7.7±3.7	20	0/10
2.57	0.90±0.3	9.3±2.6	20	0/10
8.34	1.1±0.3	8.1±2.7	20	0/8
24.7	1.1±0.4	9.1±1.0	20	0/10
74.8	1.0±0.2	6.9±3.3	20	0/12

Table 2-C Results (Continued)

Average measured concentration (µg/L)	Hepatosomatic Index (%)		Vitellogenin (ng/mg liver)	
	Male	Female	Male	Female
Control	2.2±0.2	4.8±0.9	4.3±3.4	2,000±670
Solvent control	2.2±0.6	4.5±0.7	3.9±4.7	1,500±750
0.869	2.0±0.4	3.5±0.7*	2.9±3.0	2,100±1,300
2.57	1.7±0.6	3.6±0.8*	1.7±2.5	2,500±1,700
8.34	2.1±0.3	4.4±0.5	3.2±4.5	1,600±720
24.7	2.1±0.3	4.3±0.4	2.8±3.7	1,800±620
74.8	2.1±0.4	4.3±1.9	3.1±2.5	1,500±1,100

Testis-ova means No. of Males with testis-ova/No. of Males.

Data shows mean ± standard deviation.

Statistically significant differences from control and solvent control group (** p <0.01, * p <0.05).

Endrin

1. Vitellogenin Assay

Table 1 Results (Male)

Average measured concentration ($\mu\text{g/L}$)	Mortality (%)	Hepatosomatic Index (%)		Vitellogenin (ng/mg liver)	
		14 days	21 days	14 days	21 days
Control	0	1.9 \pm 0.27	1.9 \pm 0.27	1.6 \pm 0.85	ND
Solvent control	0	2.0 \pm 0.36	2.2 \pm 0.42 ^a	1.9 \pm 0.76	ND
0.037	10	2.0 \pm 0.35	2.0 \pm 0.30	2.3 \pm 1.25	ND
0.075	3.3	1.8 \pm 0.24	2.0 \pm 0.32	1.8 \pm 0.72	ND
0.144	3.3	1.8 \pm 0.34	2.0 \pm 0.37	1.6 \pm 0.67	ND
0.309	13.3	2.0 \pm 0.52	2.0 \pm 0.41	2.0 \pm 0.80	ND
0.648	83.3	1.8 \pm 0.34	-	2.1 \pm 0.39	-

Data shows mean \pm standard deviation.

Statistically significant differences from control group (a).

ND means not detected (< 1 ng/mg liver).

Data not measured or performed (-).

2. Partial Life Cycle Test

Table 2-A Results

Average measured concentration ($\mu\text{g/L}$)	Hatchability (%)	Time to hatching (Day)	Mortality (%)	Total length (mm)	Body weight (mg)
Control	83 \pm 7.6	9.3 \pm 1.2	7.8 \pm 8.4	29 \pm 2.6	310 \pm 99
Solvent control	72 \pm 10	12 \pm 2.4	15 \pm 14	29 \pm 2.0	300 \pm 80
0.0188	88 \pm 5.8	10 \pm 1.0	23 \pm 11	29 \pm 2.2	300 \pm 82
0.0058	88 \pm 2.9	12 \pm 2.0	17 \pm 9.4	29 \pm 2.3	300 \pm 82
0.0178	83 \pm 7.6	14 \pm 3.7	24 \pm 2.3	28 \pm 2.6*	280 \pm 87
0.0562	73 \pm 7.6	12 \pm 1.0	22 \pm 22	29 \pm 2.2	300 \pm 85
0.19	80 \pm 15	12 \pm 2.4	28 \pm 7.5	28 \pm 2.9	280 \pm 90

Table 2-B Results (Continued)

Average measured concentration ($\mu\text{g/L}$)	Gonadosomatic Index (%)		No. of fishes	Testis-ova
	Male	Female		
Control	0.98 \pm 0.18	6.9 \pm 3.2	20	0/11
Solvent control	1.0 \pm 0.27	6.5 \pm 4.2	20	0/9
0.0188	0.95 \pm 0.27	8.6 \pm 2.8	20	0/13
0.0058	0.82 \pm 0.33	7.8 \pm 3.1	20	0/10
0.0178	1.1 \pm 0.34	5.8 \pm 3.4	20	0/9
0.0562	1.0 \pm 0.22	5.6 \pm 4.0	20	0/13
0.19	0.82 \pm 0.26	7.3 \pm 4.2	20	0/12

Table 2-C Results (Continued)

Average measured concentration ($\mu\text{g/L}$)	Hepatosomatic Index (%)		Vitellogenin (ng/mg liver)	
	Male	Female	Male	Female
Control	3.3 \pm 0.46	6.1 \pm 1.2	ND	3,200 \pm 2,300
Solvent control	2.8 \pm 0.55 ^a	5.8 \pm 1.5	ND	3,200 \pm 2,300
0.0188	2.9 \pm 0.86	5.5 \pm 0.56	ND	2,800 \pm 1,700
0.0058	3.3 \pm 0.69	6.4 \pm 1.0	3.4 \pm 5.1**	2,300 \pm 1,100
0.0178	2.8 \pm 0.82	5.4 \pm 0.76	9.1 \pm 21**	2,400 \pm 1,700
0.0562	2.9 \pm 0.57	5.8 \pm 0.98	2.0 \pm 0.70**	3,200 \pm 2,800
0.19	2.8 \pm 1.0	5.1 \pm 0.97	1.5 \pm 0.31**	2,200 \pm 1,600

Testis-ova means No. of Males with testis-ova/No. of Males.

Data shows mean \pm standard deviation.

Statistically significant differences from solvent control group (** p <0.01, * p <0.05).

Statistically significant differences from control group (a).

ND means not detected (< 1 ng/mg liver).

Heptachlor

1. Vitellogenin Assay

Table 1 Results (Male)

Average measured concentration ($\mu\text{g/L}$)	Mortality (%)	Hepatosomatic Index (%)		Vitellogenin (ng/mg liver)	
		14 days	21 days	14 days	21 days
Control	0	1.8 \pm 0.42	1.9 \pm 0.39	ND	ND
Solvent control	0	1.8 \pm 0.43	1.7 \pm 0.33	ND	ND
0.674	0	1.4 \pm 0.28*	2.0 \pm 0.39	ND	ND
1.29	0	1.8 \pm 0.37	1.9 \pm 0.36	ND	ND
2.52	0	1.6 \pm 0.20	1.9 \pm 0.40	1.5 \pm 2.5	1.1 \pm 2.2
5.66	0	2.0 \pm 0.49	2.0 \pm 0.50	ND	ND
11.4	23	1.8 \pm 0.23	1.9 \pm 0.35	ND	ND

Data shows mean \pm standard deviation.

Statistically significant differences from control and solvent control group ($*p<0.05$).

ND means not detected (< 1 ng/mg liver).

2. Partial Life Cycle Test

Table 2-A Results

Average measured concentration ($\mu\text{g/L}$)	Hatchability (%)	Time to hatching (Day)	Mortality (%)	Total length (mm)	Body weight (mg)
Control	98 \pm 3.3	10 \pm 0.16	1.8 \pm 3.6	30 \pm 1.8	290 \pm 49
Solvent control	100	9.9 \pm 0.054	3.3 \pm 3.8	30 \pm 1.6	280 \pm 46
0.0649	100	10 \pm 0.11	1.7 \pm 3.3	30 \pm 1.3	280 \pm 41
0.120	100	10 \pm 0.19	1.7 \pm 3.3	30 \pm 1.5	280 \pm 42
0.252	100	10 \pm 0.11*	1.7 \pm 3.3	30 \pm 1.6	290 \pm 45
0.538	95 \pm 6.4	10 \pm 0.064	3.7 \pm 4.3	30 \pm 3.1	290 \pm 64
1.04	98 \pm 3.3	10 \pm 0.18	1.8 \pm 3.6	30 \pm 1.4	280 \pm 33

Table 2-B Results (Continued)

Average measured concentration ($\mu\text{g/L}$)	Gonadosomatic Index (%)		No. of fishes	Testis-ova
	Male	Female		
Control	1.0 \pm 0.17	5.2 \pm 3.6	20	0/9
Solvent control	1.0 \pm 0.36	6.0 \pm 2.8	20	0/10
0.0649	0.91 \pm 0.29	6.9 \pm 3.3	20	0/8
0.120	1.0 \pm 0.44	7.1 \pm 2.4	20	0/10
0.252	1.0 \pm 0.21	5.1 \pm 3.2	20	0/7
0.538	1.2 \pm 0.35	6.2 \pm 3.8	20	0/10
1.04	0.87 \pm 0.29	7.1 \pm 3.8	20	0/10

Table 2-C Results (Continued)

Average measured concentration ($\mu\text{g/L}$)	Hepatosomatic Index (%)		Vitellogenin (ng/mg liver)	
	Male	Female	Male	Female
Control	2.0 \pm 0.45	3.2 \pm 0.66	ND	1,700 \pm 1,100
Solvent control	1.9 \pm 0.40	4.3 \pm 2.1	ND	1,800 \pm 1,200
0.0649	2.0 \pm 0.27	3.7 \pm 1.0	ND	1,500 \pm 800
0.120	1.7 \pm 0.34	3.5 \pm 0.72	ND	1,500 \pm 770
0.252	1.9 \pm 0.66	3.4 \pm 0.89	2.7 \pm 1.7	2,200 \pm 1,000
0.538	1.9 \pm 0.44	3.6 \pm 0.50	1.0 \pm 0.74	2,200 \pm 1,400
1.04	1.6 \pm 0.33	3.6 \pm 0.69	ND	1,600 \pm 1,000

Testis-ova means No. of Males with testis-ova/No. of Males.

Data shows mean \pm standard deviation.

Statistically significant differences from control and solvent control group ($*p<0.05$).

ND means not detected (< 1 ng/mg liver).

Hexachlorobenzene

1. Vitellogenin Assay

Table 1 Results (Male)

Average measured concentration ($\mu\text{g/L}$)	Mortality (%)	Hepatosomatic Index (%)		Vitellogenin (ng/mg liver)	
		14 days	21 days	14 days	21 days
Control	3.3	2.6 \pm 0.79	2.1 \pm 0.55	ND	ND
Solvent control	0	2.2 \pm 0.55	2.4 \pm 0.69	ND	ND
1.79	0	2.3 \pm 0.74	2.7 \pm 0.73	ND	ND
4.13	0	1.8 \pm 0.56*	2.5 \pm 0.62	ND	ND
7.98	0	2.6 \pm 0.54	2.3 \pm 0.44	ND	ND
16.1	0	2.4 \pm 0.55	2.4 \pm 0.56	ND	ND
35.2	0	2.4 \pm 0.58	2.2 \pm 0.55	ND	ND

Data shows mean \pm standard deviation.

Statistically significant differences from control and solvent group (* p <0.05).

ND means not detected (< 1 ng/mg liver).

2. Partial Life Cycle Test

Table 2-A Results

Average measured concentration ($\mu\text{g/L}$)	Hatchability (%)	Time to hatching (Day)	Mortality (%)	Total length (mm)	Body weight (mg)
Control	97 \pm 3.8	9.0 \pm 0.15	1.7 \pm 3.3	30 \pm 1.5	270 \pm 47
Solvent control	95 \pm 3.3	8.6 \pm 0.21	12 \pm 6.8	30 \pm 2.1	270 \pm 48
0.309	93 \pm 5.4	8.9 \pm 0.22	8.8 \pm 9.0	30 \pm 1.5	280 \pm 46
0.615	95 \pm 3.3	8.9 \pm 0.21	11 \pm 9.2	30 \pm 2.3	270 \pm 65
1.29	95 \pm 3.3	8.8 \pm 0.10	14 \pm 5.9	30 \pm 2.0	280 \pm 51
2.86	97 \pm 3.8	9.0 \pm 0.12*	8.8 \pm 14	30 \pm 3.1	290 \pm 73
5.75	100	9.1 \pm 0.084**	3.6 \pm 7.1	30 \pm 2.3	290 \pm 56

Table 2-B Results (Continued)

Average measured concentration ($\mu\text{g/L}$)	Gonadosomatic Index (%)		No. of fishes	Testis-ova
	Male	Female		
Control	1.0 \pm 0.34	5.1 \pm 3.0	20	0/11
Solvent control	0.95 \pm 0.26	5.4 \pm 3.0	20	1/10
0.309	0.82 \pm 0.37	4.9 \pm 3.1	20	1/10
0.615	0.76 \pm 0.28	6.3 \pm 3.6	20	0/10
1.29	1.0 \pm 0.48	4.1 \pm 3.0	20	0/10
2.86	1.0 \pm 0.31	5.8 \pm 3.6	20	0/7
5.75	1.1 \pm 0.37	4.8 \pm 3.5	20	0/9

Table 2-C Results (Continued)

Average measured concentration ($\mu\text{g/L}$)	Hepatosomatic Index (%)		Vitellogenin (ng/mg liver)	
	Male	Female	Male	Female
Control	2.3 \pm 0.85	4.2 \pm 0.79	ND	800 \pm 550
Solvent control	1.9 \pm 0.54	3.3 \pm 0.59	1.6 \pm 2.3	1,100 \pm 770
0.309	2.1 \pm 0.59	3.8 \pm 0.55	ND	750 \pm 560
0.615	1.3 \pm 0.49**	3.4 \pm 1.0	1.5 \pm 2.0	1,100 \pm 620
1.29	2.1 \pm 0.19	3.8 \pm 0.68	ND	1,000 \pm 980
2.86	2.2 \pm 0.38	3.5 \pm 0.87	1.0 \pm 0.54	1,200 \pm 730
5.75	2.1 \pm 0.16	3.9 \pm 0.69	3.6 \pm 8.1	1,100 \pm 950

Testis-ova means No. of Males with testis-ova/No. of Males.

Data shows mean \pm standard deviation.

Statistically significant differences from control and solvent control group (** p <0.01, * p <0.05).

ND means not detected (< 1 ng/mg liver).

beta-Hexachlorocyclohexane

1. Vitellogenin Assay

Table 1 Results (Male)

Average measured concentration ($\mu\text{g/L}$)	Mortality (%)	Hepatosomatic Index (%)		Vitellogenin (ng/mg liver)	
		14 days	21 days	14 days	21 days
Control	3.3	2.0 \pm 0.28	2.2 \pm 0.37	ND	ND
Solvent control	0	1.7 \pm 0.31	1.9 \pm 0.27	ND	ND
0.974	0	1.7 \pm 0.32	2.1 \pm 0.71	ND	ND
3.04	0	2.0 \pm 0.28*	1.7 \pm 0.40	ND	ND
9.18	3.3	1.7 \pm 0.24	1.9 \pm 0.38	ND	ND
30.6	3.3	2.0 \pm 0.51	1.8 \pm 0.42	ND	ND
95.4	0	2.6 \pm 1.0**	2.6 \pm 0.48**	ND	ND

Data shows mean \pm standard deviation.

Statistically significant differences from solvent control group (** p <0.01, * p <0.05).

ND means not detected (< 1 ng/mg liver).

2. Partial Life Cycle Test

Table 2-A Results

Average measured concentration ($\mu\text{g/L}$)	Hatchability (%)	Time to hatching (Day)	Mortality (%)	Total length (mm)	Body weight (mg)
Control	100	9.9 \pm 0.14	8.3 \pm 13	31 \pm 2.0	280 \pm 59
Solvent control	98 \pm 3.3	9.9 \pm 0.11	8.3 \pm 8.4	30 \pm 2.4	280 \pm 60
0.495	100	9.9 \pm 0.064	13 \pm 14	31 \pm 1.9	300 \pm 56
1.54	98 \pm 3.3	9.9 \pm 0.10	3.3 \pm 3.8	31 \pm 2.4	300 \pm 50
4.75	98 \pm 3.3	9.9 \pm 0.14	10 \pm 13	30 \pm 2.9	290 \pm 69
14.6	98 \pm 3.3	10 \pm 0.033	8.5 \pm 8.4	31 \pm 2.2	310 \pm 68
43.8	100	10 \pm 0.10	20	30 \pm 1.4	290 \pm 47

Table 2-B Results (Continued)

Average measured concentration ($\mu\text{g/L}$)	Gonadosomatic Index (%)		No. of fishes	Testis-ova
	Male	Female		
Control	0.88 \pm 0.46	7.3 \pm 2.0	20	0/12
Solvent control	0.85 \pm 0.20	6.7 \pm 2.7	20	0/8
0.495	0.80 \pm 0.45	4.3 \pm 3.4	20	1/9
1.54	0.84 \pm 0.34	3.8 \pm 2.8	20	1/10
4.75	0.76 \pm 0.23	5.7 \pm 3.6	20	0/10
14.6	0.83 \pm 0.44	4.8 \pm 3.3	20	0/9
43.8	1.0 \pm 0.41	6.8 \pm 3.2	20	0/11

Table 2-C Results (Continued)

Average measured concentration ($\mu\text{g/L}$)	Hepatosomatic Index (%)		Vitellogenin (ng/mg liver)	
	Male	Female	Male	Female
Control	1.9 \pm 0.52	3.3 \pm 0.56	1.0 \pm 1.4	1,700 \pm 600
Solvent control	2.2 \pm 0.60	3.4 \pm 0.58	ND	1,300 \pm 590
0.495	2.3 \pm 0.56	3.7 \pm 0.53	ND	850 \pm 770
1.54	1.7 \pm 0.40	2.9 \pm 0.69	3.4 \pm 6.6	1,000 \pm 760
4.75	2.2 \pm 0.40	3.6 \pm 0.45	ND	1,600 \pm 1,100
14.6	2.1 \pm 0.70	2.9 \pm 0.76	1.2 \pm 1.4	1,400 \pm 580
43.8	2.6 \pm 0.48*	4.5 \pm 0.84**	1.7 \pm 2.1	1,300 \pm 520

Testis-ova means No. of Males with testis-ova/No. of Males.

Data shows mean \pm standard deviation.

Statistically significant differences from control and solvent control group (** p <0.01, * p <0.05).

ND means not detected (< 1 ng/mg liver).

p,p'-Kelthane

1. Vitellogenin Assay

Table 1 Results (Male)

Average measured concentration ($\mu\text{g/L}$)	Mortality (%)	Hepatosomatic Index (%)		Vitellogenin (ng/mg liver)	
		14 days	21 days	14 days	21 days
Control	0	2.6 \pm 0.60	2.4 \pm 0.35	ND	ND
Solvent control	0	2.2 \pm 0.55	2.0 \pm 0.38	ND	ND
3.03	0	2.4 \pm 0.67	2.2 \pm 0.53	ND	ND
4.48	0	2.3 \pm 0.37	2.2 \pm 0.43	ND	ND
6.68	0	2.3 \pm 0.38	2.1 \pm 0.41	ND	ND
10.4	0	2.3 \pm 0.44	2.5 \pm 0.53	ND	ND
14.6	6.7	2.0 \pm 0.48	2.1 \pm 0.31	ND	8.1 \pm 7.7**

Data shows mean \pm standard deviation.

Statistically significant differences from control and solvent control group (** p <0.01).

ND means not detected (< 1 ng/mg liver).

2. Partial Life Cycle Test

Table 2-A Results

Average measured concentration ($\mu\text{g/L}$)	Hatchability (%)	Time to hatching (Day)	Mortality (%)	Total length (mm)	Body weight (mg)
Control	93 \pm 5.4	9.6 \pm 0.14	11 \pm 12	30 \pm 1.6	270 \pm 43
Solvent control	97 \pm 3.8	9.1 \pm 0.10	14 \pm 11	30 \pm 1.4	280 \pm 42
0.275	98 \pm 3.3	9.3 \pm 0.18	10 \pm 4.1	30 \pm 1.8	290 \pm 58
0.550	98 \pm 3.3	9.2 \pm 0.12	10 \pm 8.6	30 \pm 1.4	280 \pm 37
1.10	100	9.4 \pm 0.084	6.7 \pm 9.4	30 \pm 1.9	280 \pm 53
2.18	95 \pm 6.4	9.2 \pm 0.20	17 \pm 6.4	30 \pm 2.5	280 \pm 54
4.52	97 \pm 6.7	9.5 \pm 0.15**	8.8 \pm 4.4	30 \pm 1.3	280 \pm 33

Table 2-B Results (Continued)

Average measured concentration ($\mu\text{g/L}$)	Gonadosomatic Index (%)		No. of fishes	Testis-ova
	Male	Female		
Control	0.87 \pm 0.23	5.0 \pm 3.0	20	0/8
Solvent control	1.0 \pm 0.43	7.5 \pm 2.7	20	0/11
0.275	1.1 \pm 0.34	5.4 \pm 4.0	20	0/10
0.550	1.1 \pm 0.39	3.7 \pm 3.3	20	0/12
1.10	1.1 \pm 0.17	5.1 \pm 3.4	20	0/7
2.18	0.93 \pm 0.36	2.8 \pm 3.1	20	0/12
4.52	1.0 \pm 0.54	6.5 \pm 1.1	20	0/12

Table 2-C Results (Continued)

Average measured concentration ($\mu\text{g/L}$)	Hepatosomatic Index (%)		Vitellogenin (ng/mg liver)	
	Male	Female	Male	Female
Control	1.7 \pm 0.35	3.2 \pm 0.77	ND	1,200 \pm 660
Solvent control	1.8 \pm 0.79	4.0 \pm 0.57	ND	1,400 \pm 410
0.275	1.9 \pm 0.50	3.7 \pm 0.50	ND	1,200 \pm 760
0.550	2.2 \pm 0.76	3.6 \pm 0.61	ND	620 \pm 890
1.10	1.7 \pm 0.31	3.4 \pm 1.3	ND	1,100 \pm 810
2.18	1.7 \pm 0.80	3.2 \pm 0.60	1.1 \pm 1.8	570 \pm 830
4.52	2.1 \pm 0.58	4.0 \pm 0.62	1.3 \pm 1.8	1,600 \pm 340

Testis-ova means No. of Males with testis-ova/No. of Males.

Data shows mean \pm standard deviation.

Statistically significant differences from solvent control group (** p <0.01).

ND means not detected (< 1 ng/mg liver).

Malathion

1. Vitellogenin Assay

Table 1 Results (Male)

Average measured concentration ($\mu\text{g/L}$)	Mortality (%)	Hepatosomatic Index (%)		Vitellogenin (ng/mg liver)	
		14 days	21 days	14 days	21 days
Control	0	2.1 \pm 0.26	2.4 \pm 0.29	ND	ND
Solvent control	0	2.1 \pm 0.33	2.3 \pm 0.33	ND	ND
1.49	0	2.2 \pm 0.40	2.0 \pm 0.27	ND	ND
4.57	0	1.8 \pm 0.31*	2.2 \pm 0.39	ND	ND
15.1	0	1.9 \pm 0.27*	2.2 \pm 0.55	ND	ND
45.6	0	1.9 \pm 0.14	2.2 \pm 0.29	ND	ND
148	0	2.0 \pm 0.34	2.2 \pm 0.36	ND	ND

Data shows mean \pm standard deviation.

Statistically significant differences from control and solvent control group (* p <0.05).

ND means not detected (< 1 ng/mg liver).

2. Partial Life Cycle Test

Table 2-A Results

Average measured concentration ($\mu\text{g/L}$)	Hatchability (%)	Time to hatching (Day)	Mortality (%)	Total length (mm)	Body weight (mg)
Control	100	9.9 \pm 0.18	1.7 \pm 3.3	29 \pm 1.7	260 \pm 43
Solvent control	100	10 \pm 0.033	0	30 \pm 2.3	270 \pm 63
0.375	100	9.9 \pm 0.094	0	29 \pm 1.6	260 \pm 47
0.781	98 \pm 3.3	10 \pm 0.16	1.7 \pm 3.3	30 \pm 2.0	270 \pm 52
1.62	100	10 \pm 0.064	0	30 \pm 1.0	270 \pm 31
2.77	98 \pm 3.3	10 \pm 0.11	5.0 \pm 6.4	30 \pm 2.7	280 \pm 54
6.26	100	10	3.3 \pm 3.8	30 \pm 1.5	270 \pm 48

Table 2-B Results (Continued)

Average measured concentration ($\mu\text{g/L}$)	Gonadosomatic Index (%)		No. of fishes	Testis-ova
	Male	Female		
Control	1.0 \pm 0.32	6.2 \pm 3.5	20	0/11
Solvent control	1.0 \pm 0.23	7.2 \pm 3.1	20	0/9
0.375	1.1 \pm 0.20	8.0 \pm 1.7	20	0/9
0.781	0.96 \pm 0.25	8.5 \pm 2.6	20	0/9
1.62	1.2 \pm 0.40	9.4 \pm 1.6	20	0/11
2.77	1.2 \pm 0.30	7.4 \pm 3.4	20	0/11
6.26	1.1 \pm 0.22	8.7 \pm 2.1	20	0/9

Table 2-C Results (Continued)

Average measured concentration ($\mu\text{g/L}$)	Hepatosomatic Index (%)		Vitellogenin (ng/mg liver)	
	Male	Female	Male	Female
Control	2.3 \pm 0.73	3.3 \pm 0.67	ND	1,500 \pm 860
Solvent control	1.9 \pm 0.54	3.7 \pm 0.33	ND	1,600 \pm 720
0.375	1.7 \pm 0.36	3.5 \pm 0.81	ND	1,800 \pm 550
0.781	1.4 \pm 0.56	3.8 \pm 0.76	ND	1,900 \pm 510
1.62	1.9 \pm 0.70	3.8 \pm 0.75	ND	1,400 \pm 310
2.77	1.9 \pm 0.42	3.9 \pm 1.0	ND	1,300 \pm 440
6.26	2.1 \pm 0.67	3.7 \pm 0.57	ND	1,100 \pm 290*

Testis-ova means No. of Males with testis-ova/No. of Males.

Data shows mean \pm standard deviation.

Statistically significant differences from control and solvent control group (* p <0.05).

ND means not detected (< 1 ng/mg liver).

Mirex

1. Vitellogenin Assay

Table 1 Results (Male)

Average measured concentration ($\mu\text{g/L}$)	Mortality (%)	Hepatosomatic Index (%)		Vitellogenin (ng/mg liver)	
		14 days	21 days	14 days	21 days
Control	3.3	1.8 \pm 0.41	1.9 \pm 0.23	ND	ND
Solvent control	0	1.7 \pm 0.36	1.9 \pm 0.28	ND	ND
1.07	0	1.7 \pm 0.28	2.0 \pm 0.26	ND	ND
2.99	0	1.7 \pm 0.28	2.0 \pm 0.27	ND	ND
8.36	0	1.8 \pm 0.39	1.7 \pm 0.25	ND	ND
23.8	0	1.9 \pm 0.37	1.9 \pm 0.30	ND	ND
65.6	0	1.7 \pm 0.31	1.8 \pm 0.29	ND	ND

Data shows mean \pm standard deviation.
ND means not detected (< 1 ng/mg liver).

2. Partial Life Cycle Test

Table 2-A Results

Average measured concentration ($\mu\text{g/L}$)	Hatchability (%)	Time to hatching (Day)	Mortality (%)	Total length (mm)	Body weight (mg)
Control	100	9.7 \pm 0.16	0	30 \pm 1.7	280 \pm 48
Solvent control	100	9.8 \pm 0.14	6.7 \pm 5.4	30 \pm 1.2	270 \pm 37
0.0809	100	9.7 \pm 0.054	5.0 \pm 10	30 \pm 1.9	270 \pm 46
0.222	98 \pm 3.3	9.7 \pm 0.16	3.3 \pm 3.8	30 \pm 1.4	280 \pm 45
0.549	100	9.5 \pm 0.24	5.0 \pm 6.4	30 \pm 1.1	270 \pm 41
1.61	100	9.5 \pm 0.42	3.3 \pm 3.8	30 \pm 1.5	270 \pm 42
4.05	97 \pm 3.8	9.5 \pm 0.22	5.0 \pm 10	30 \pm 0.92	260 \pm 29

Table 2-B Results (Continued)

Average measured concentration ($\mu\text{g/L}$)	Gonadosomatic Index (%)		No. of fishes	Testis-ova
	Male	Female		
Control	0.98 \pm 0.32	6.4 \pm 3.3	20	0/8
Solvent control	0.89 \pm 0.19	6.7 \pm 2.4	20	0/9
0.0809	1.2 \pm 0.27	7.4 \pm 2.2	20	0/10
0.222	1.0 \pm 0.25	6.1 \pm 3.1	20	1/10
0.549	0.99 \pm 0.23	7.7 \pm 1.1	20	1/12
1.61	1.1 \pm 0.20	7.5 \pm 3.0	20	0/9
4.05	0.76 \pm 0.31	7.5 \pm 2.7	20	0/12

Table 2-C Results (Continued)

Average measured concentration ($\mu\text{g/L}$)	Hepatosomatic Index (%)		Vitellogenin (ng/mg liver)	
	Male	Female	Male	Female
Control	1.7 \pm 0.45	3.2 \pm 1.1	ND	1,500 \pm 740
Solvent control	1.6 \pm 0.64	4.0 \pm 2.1	ND	1,900 \pm 690
0.0809	1.6 \pm 0.71	3.2 \pm 0.56	1.3 \pm 2.5	1,600 \pm 620
0.222	1.8 \pm 0.27	3.2 \pm 0.63	ND	1,600 \pm 870
0.549	2.1 \pm 0.59	3.9 \pm 1.0	ND	1,800 \pm 500
1.61	1.8 \pm 0.29	3.4 \pm 0.85	1.3 \pm 2.5	1,700 \pm 430
4.05	1.7 \pm 0.26	3.2 \pm 0.98	ND	1,800 \pm 710

Testis-ova means No. of Males with testis-ova/No. of Males.

Data shows mean \pm standard deviation.
ND means not detected (< 1 ng/mg liver).

4-Nitrotoluene

1. Vitellogenin Assay

Table 1 Results (Male)

Average measured concentration ($\mu\text{g/L}$)	Mortality (%)	Hepatosomatic Index (%)		Vitellogenin (ng/mg liver)	
		14 days	21 days	14 days	21 days
Control	0	1.4 \pm 0.25	2.0 \pm 0.49	ND	ND
Solvent control	0	1.4 \pm 0.38	1.8 \pm 0.42	ND	ND
19.5	0	1.2 \pm 0.21	1.8 \pm 0.35	ND	ND
58.4	0	1.5 \pm 0.36	1.9 \pm 0.32	ND	ND
182	0	1.6 \pm 0.51	2.1 \pm 0.51	ND	ND
600	0	1.4 \pm 0.37	1.8 \pm 0.42	ND	ND
1,920	0	1.5 \pm 0.33	1.6 \pm 0.26	ND	ND

Data shows mean \pm standard deviation.
ND means not detected (< 1 ng/mg liver).

2. Partial Life Cycle Test

Table 2-A Results

Average measured concentration ($\mu\text{g/L}$)	Hatchability (%)	Time to hatching (Day)	Mortality (%)	Total length (mm)	Body weight (mg)
Control	93 \pm 9.4	8.9 \pm 0.3	14 \pm 7.5	30 \pm 2.8	290 \pm 68
0.99	95 \pm 3.3	8.8 \pm 0.2	17 \pm 13	31 \pm 2.2	290 \pm 61
3.01	95 \pm 6.4	8.6 \pm 0.2	13 \pm 13	31 \pm 2.3	290 \pm 64
9.22	93 \pm 5.4	8.6 \pm 0.3	16 \pm 7.4	30 \pm 2.6	300 \pm 61
26.6	90 \pm 8.6	8.5 \pm 0.3	27 \pm 8.5	32 \pm 2.1	320 \pm 71
87.5	88 \pm 6.4	8.5 \pm 0.2	21 \pm 14	31 \pm 3.3	310 \pm 86

Table 2-B Results (Continued)

Average measured concentration ($\mu\text{g/L}$)	Gonadosomatic Index (%)		No. of fishes	Testis-ova
	Male	Female		
Control	1.3 \pm 0.3	8.3 \pm 2.1	20	0/10
0.99	0.86 \pm 0.3**	9.1 \pm 2.1	20	0/8
3.01	0.96 \pm 0.2*	8.7 \pm 1.4	20	0/11
9.22	1.1 \pm 0.2	8.7 \pm 2.3	20	2/13
26.6	1.1 \pm 0.3	7.3 \pm 2.7	20	0/10
87.5	1.1 \pm 0.3	7.9 \pm 0.9	20	0/10

Table 2-C Results (Continued)

Average measured concentration ($\mu\text{g/L}$)	Hepatosomatic Index (%)		Vitellogenin (ng/mg liver)	
	Male	Female	Male	Female
Control	2.3 \pm 0.5	4.4 \pm 0.4	3.7 \pm 8.5	2,400 \pm 920
0.99	1.8 \pm 0.6	3.6 \pm 0.9	2.6 \pm 2.5	2,400 \pm 810
3.01	1.8 \pm 0.5	3.1 \pm 0.8**	4.9 \pm 10	2,300 \pm 940
9.22	2.1 \pm 0.3	3.9 \pm 0.5	1.7 \pm 1.8	2,600 \pm 1,600
26.6	2.1 \pm 0.6	3.4 \pm 0.7*	2.9 \pm 5.1	2,400 \pm 1,500
87.5	2.1 \pm 0.3	4.2 \pm 1.0	4.1 \pm 5.5	2,300 \pm 640

Testis-ova means No. of Males with testis-ova/No. of Males.

Data shows mean \pm standard deviation.

Statistically significant differences from control group (** p <0.01, * p <0.05).

trans-Nonachlor

1. Vitellogenin Assay

Table 1 Results (Male)

Average measured concentration ($\mu\text{g/L}$)	Mortality (%)	Hepatosomatic Index (%)		Vitellogenin (ng/mg liver)	
		14 days	21 days	14 days	21 days
Control	0	1.8 \pm 0.26	1.9 \pm 0.26	ND	ND
Solvent control	0	1.7 \pm 0.21	1.9 \pm 0.30	ND	ND
0.788	0	1.5 \pm 0.30	1.8 \pm 0.30	ND	ND
1.88	0	1.8 \pm 0.29	1.9 \pm 0.20	ND	ND
4.28	0	1.8 \pm 0.26	1.9 \pm 0.27	ND	ND
9.69	0	1.6 \pm 0.23	2.0 \pm 0.18	ND	ND
21.6	0	1.8 \pm 0.34	2.4 \pm 0.51**	ND	3.6 \pm 12

Data shows mean \pm standard deviation.

Statistically significant differences from control and solvent control group (** p <0.01).

ND means not detected (< 1 ng/mg liver).

2. Partial Life Cycle Test

Table 2-A Results

Average measured concentration ($\mu\text{g/L}$)	Hatchability (%)	Time to hatching (Day)	Mortality (%)	Total length (mm)	Body weight (mg)
Control	100	9.1 \pm 0.064	13 \pm 9.4	30 \pm 2.6	280 \pm 61
Solvent control	100	9.1 \pm 0.064	1.7 \pm 3.3	29 \pm 2.6	280 \pm 37
0.203	100	9.0 \pm 0.038	0	30 \pm 3.1	300 \pm 71
0.380	98 \pm 3.3	9.1 \pm 0.064	0	31 \pm 1.5**	300 \pm 46
0.803	100	9.1 \pm 0.064	1.7 \pm 3.3	31 \pm 2.3**	290 \pm 58
1.53	98 \pm 3.3	9.0 \pm 0.033	6.9 \pm 5.8	31 \pm 1.9**	300 \pm 49
3.05	98 \pm 3.3	9.0 \pm 0.033	3.3 \pm 3.8	31 \pm 1.7**	300 \pm 51

Table 2-B Results (Continued)

Average measured concentration ($\mu\text{g/L}$)	Gonadosomatic Index (%)		No. of fishes	Testis-ova
	Male	Female		
Control	0.90 \pm 0.099	7.6 \pm 2.4	20	0/8
Solvent control	0.91 \pm 0.26	6.5 \pm 2.8	20	0/11
0.203	0.85 \pm 0.28	4.8 \pm 3.0	20	0/9
0.380	0.88 \pm 0.31	4.7 \pm 3.5	20	0/8
0.803	0.97 \pm 0.29	7.0 \pm 3.1	20	0/9
1.53	0.87 \pm 0.31	6.8 \pm 2.9	20	0/11
3.05	1.1 \pm 0.15	7.2 \pm 3.8	20	0/12

Table 2-C Results (Continued)

Average measured concentration ($\mu\text{g/L}$)	Hepatosomatic Index (%)		Vitellogenin (ng/mg liver)	
	Male	Female	Male	Female
Control	1.9 \pm 0.89	3.8 \pm 0.92	1.2 \pm 0.80	2,700 \pm 3,100
Solvent control	1.8 \pm 0.51	3.0 \pm 0.85	ND	2,500 \pm 1,100
0.203	1.6 \pm 0.29	3.3 \pm 0.37	1.3 \pm 2.0	2,400 \pm 3,100
0.380	1.9 \pm 0.40	3.3 \pm 0.93	1.0 \pm 0.80	2,000 \pm 1,600
0.803	1.8 \pm 0.49	3.3 \pm 0.59	1.4 \pm 1.1	2,100 \pm 1,300
1.53	2.1 \pm 0.57	3.5 \pm 0.75	1.2 \pm 1.1	1,600 \pm 940
3.05	1.9 \pm 0.28	3.4 \pm 0.64	1.3 \pm 1.1	2,200 \pm 1,100

Testis-ova means No. of Males with testis-ova/No. of Males.

Data shows mean \pm standard deviation.

Statistically significant differences from control and solvent control group (** p <0.01).

ND means not detected (< 1 ng/mg liver).

4-Nonylphenol (branched)

1. Vitellogenin Assay

Table 1 Results (21 days)

Average measured concentration ($\mu\text{g/L}$)	Mortality (%)	Hepatosomatic Index (%)		Vitellogenin (ng/mg liver)	
		Male	Female	Male	Female
Control	0	2.82 \pm 0.951	5.23 \pm 0.923	2.06 \pm 1.84	1,130 \pm 288
Solvent control	0	2.20 \pm 0.747	4.92 \pm 0.764	1.85 \pm 1.92	1,130 \pm 307
7.40	0	2.86 \pm 1.00	4.68 \pm 0.814	1.24 \pm 1.32	1,400 \pm 232
12.8	0	2.62 \pm 1.13	5.17 \pm 1.22	5.36 \pm 10.8	1,150 \pm 514
22.5	0	3.27 \pm 1.11	6.02 \pm 1.55	26.9 \pm 35.7*	1,280 \pm 341
56.2	0	3.11 \pm 1.40	5.36 \pm 1.23	113 \pm 167*	1,330 \pm 319
118	0	3.07 \pm 1.30	4.38 \pm 2.34	2,990 \pm 2,090**	2,620 \pm 1,130**

Data shows mean \pm standard deviation.

Statistically significant differences from control and solvent control group (** p <0.01, * p <0.05).

2. Partial Life Cycle Test

Table 2-A Results

Average measured concentration ($\mu\text{g/L}$)	Hatchability (%)	Time to hatching (Day)	Mortality (%)	Total length (mm)	Body weight (mg)
Control	96.7 \pm 3.9	9.3 \pm 0.1	5.24 \pm 3.50	28.7 \pm 2.0	232 \pm 40
Solvent control	100	9.3 \pm 0.1	3.57 \pm 7.14	29.1 \pm 1.1	282 \pm 28
3.30	100	9.2 \pm 0.1	1.67 \pm 3.33	29.4 \pm 1.2	230 \pm 31
6.08	100	9.2 \pm 0.1	1.67 \pm 3.33	29.1 \pm 1.1	231 \pm 31
11.6	100	9.2 \pm 0.1	5.00 \pm 6.38	29.1 \pm 1.2	229 \pm 31
23.5	100	9.2 \pm 0.1	3.33 \pm 3.85	28.4 \pm 1.0	209 \pm 20**
44.7	100	9.2 \pm 0.1	0	27.8 \pm 1.2**	201 \pm 23**

Table 2-B Results (Continued)

Average measured concentration ($\mu\text{g/L}$)	Gonadosomatic Index (%)		No. of fishes	Testis-ova
	Male	Female		
Control	0.680 \pm 0.265	3.32 \pm 2.56	20	0/8
Solvent control	0.627 \pm 0.248	4.47 \pm 3.20	20	0/10
3.30	0.726 \pm 0.197	3.61 \pm 3.29	20	0/9
6.08	0.666 \pm 0.229	3.79 \pm 3.77	20	0/10
11.6	0.512 \pm 0.254	4.10 \pm 2.94	20	4/13*
23.5	0.441 \pm 0.269	3.55 \pm 2.39	20	9/11**
44.7	0.396 \pm 0.105	2.94 \pm 3.41	20	4/5**

Table 2-C Results (Continued)

Average measured concentration ($\mu\text{g/L}$)	Hepatosomatic Index (%)		Vitellogenin (ng/mg liver)	
	Male	Female	Male	Female
Control	2.39 \pm 0.271	3.84 \pm 1.60	8.00 \pm 5.06	851 \pm 690
Solvent control	1.80 \pm 0.596	3.00 \pm 0.935	1.81 \pm 1.75	1,770 \pm 1,380
3.30	2.50 \pm 0.789	4.23 \pm 1.18	ND	1,350 \pm 1,230
6.08	2.58 \pm 0.749*	3.71 \pm 0.558	8.97 \pm 9.39	1,350 \pm 1,060
11.6	2.46 \pm 0.501	3.55 \pm 0.515	19.2 \pm 21.6*	3,100 \pm 1,270**
23.5	2.53 \pm 0.408	3.45 \pm 0.552	80.4 \pm 96.7**	5,350 \pm 1,230**
44.7	2.66 \pm 0.933	3.48 \pm 0.751	98.2 \pm 79.6**	3,750 \pm 2,470**

Testis-ova means No. of Males with testis-ova/No. of Males.

Data shows mean \pm standard deviation.

Statistically significant differences from control and solvent control group (** p <0.01, * p <0.05).

ND means not detected (< 1 ng/mg liver).

3. Life Cycle Test

Table 3-A F₀ generation

Average measured concentration (µg/L)	Hatchability (%)	Time to hatching (Day)	Mortality (%)	Total length (mm)	Body weight (mg)	No. of fishes	Testis-ova
Control	90.0±8.6	9.4±0.2	1.7±3.4	26.4±1.7	178±36	20	0/9
Solvent control	93.3±5.4	9.9±0.3	9.5±7.1	25.9±1.8	170±45	20	0/8
4.2	95.0±6.4	9.5±0.02	3.9±4.5	26.0±1.4	167±33	20	0/12
8.2	90.0±8.6	9.6±0.2	8.7±6.8	26.9±2.0	197±44	20	0/14
17.7	88.3±6.4	10.2±0.4	21.1±4.7*	26.1±2.3	179±48	20	4/9**
51.5	93.3±7.7	10.2±0.6	33.2±17.0**	25.2±1.9	167±42	20	8/8**
183	46.7±18.1**	9.6±0.3	100	-	-	-	-

Table 3-B F₀ generation (Continued)

Average measured concentration (µg/L)	No. of eggs	Fertility (%)	Gonadosomatic Index (%)	
			Male	Female
Control	572±100	98.9±1.2	1.03±0.0721	8.81±0.829
Solvent control	630±97	98.9±0.8	1.04±0.266	9.24±0.614
4.2	582±90	98.0±2.6	1.19±0.180	9.91±1.11
8.2	672±99	97.4±2.2	1.14±0.243	10.0±0.581*
17.7	591±104	78.5±33	0.893±0.296	11.1±0.983**
51.5	-	-	-	-
183	-	-	-	-

Table 3-C F₀ generation (Continued)

Average measured concentration (µg/L)	Hepatosomatic Index (%)		Vitellogenin (ng/mg liver)	
	Male	Female	Male	Female
Control	-	-	-	-
Solvent control	-	-	-	-
4.2	-	-	-	-
8.2	-	-	-	-
17.7	-	-	-	-
51.5	-	-	-	-
183	-	-	-	-

Table 3-D F₁ generation

Average measured concentration (µg/L)	Hatchability (%)	Time to hatching (Day)	Mortality (%)	Total length (mm)	Body weight (mg)	No. of fishes	Testis-ova
Control	74.4	10.2	1.7±3.4	26.5±1.4	169±38	20	0/7
Solvent control	76.4	10.7	10.0±6.7	26.6±1.8	174±40	20	0/11
4.2	74.0	10.4	10.0±11.5	26.9±1.5	177±35	20	0/9
8.2	76.9	10.6	18.3±6.4	27.5±3.2	178±46	20	2/12
17.7	85.4	11.6	6.7	25.9±1.9	171±38	20	5/9**
51.5	-	-	-	-	-	-	-
183	-	-	-	-	-	-	-

Table 3-E F₁ generation (Continued)

Average measured concentration (µg/L)	Vitellogenin (ng/mg liver)	
	Male	Female
Control	-	-
Solvent control	-	-
4.2	-	-
8.2	-	-
17.7	-	-
51.5	-	-
183	-	-

Testis-ova means No. of Males with testis-ova/No. of Males.

Data shows mean ± standard deviation.

Statistically significant differences from control and solvent control group (** $p < 0.01$, * $p < 0.05$).

Data not measured or performed (-).

Octachlorostyrene

1. Vitellogenin Assay

Table 1 Results (Male)

Average measured concentration ($\mu\text{g/L}$)	Mortality (%)	Hepatosomatic Index (%)		Vitellogenin (ng/mg liver)	
		14 days	21 days	14 days	21 days
Control	0	1.3 \pm 0.29	1.6 \pm 0.27	ND	ND
Solvent control	0	1.4 \pm 0.30	1.5 \pm 0.20	ND	ND
0.235	0	1.4 \pm 0.38	1.4 \pm 0.28	ND	ND
0.493	0	1.6 \pm 0.21	1.7 \pm 0.41	ND	ND
1.07	0	1.4 \pm 0.30	1.6 \pm 0.21	ND	ND
2.82	0	1.4 \pm 0.32	1.5 \pm 0.27	ND	ND
6.56	0	1.5 \pm 0.27	1.5 \pm 0.15	ND	ND

Data shows mean \pm standard deviation.
ND means not detected (< 1 ng/mg liver).

2. Partial Life Cycle Test

Table 2-A Results

Average measured concentration ($\mu\text{g/L}$)	Hatchability (%)	Time to hatching (Day)	Mortality (%)	Total length (mm)	Body weight (mg)
Control	97 \pm 3.9	9.1 \pm 0.2	1.8 \pm 3.6	30.5 \pm 1.8	267 \pm 61
Solvent control	97 \pm 3.9	9.2 \pm 0.1	6.8 \pm 5.5	30.8 \pm 1.9	279 \pm 55
0.0519	95 \pm 6.4	9.1 \pm 0.1	1.8 \pm 3.6	29.9 \pm 1.7	280 \pm 44
0.148	98 \pm 3.3	9.0 \pm 0.1	7.1 \pm 10	30.4 \pm 1.6	274 \pm 48
0.388	95 \pm 3.3	9.1 \pm 0.2	0	30.5 \pm 2.6	282 \pm 60
1.30	95 \pm 3.3	9.1 \pm 0.1	0	30.5 \pm 1.8	269 \pm 53
5.31	98 \pm 3.6	9.0 \pm 0.03	12 \pm 9.2	30.2 \pm 1.4	259 \pm 45

Table 2-B Results (Continued)

Average measured concentration ($\mu\text{g/L}$)	Gonadosomatic Index (%)		No. of fishes	Testis-ova
	Male	Female		
Control	0.82 \pm 0.3	4.7 \pm 3.5	20	0/11
Solvent control	0.78 \pm 0.2	3.7 \pm 3.8	20	0/9
0.0519	0.82 \pm 0.3	3.5 \pm 3.0	20	0/7
0.148	0.84 \pm 0.6	4.9 \pm 4.0	20	0/13
0.388	0.84 \pm 0.4	5.2 \pm 4.0	20	0/12
1.30	0.82 \pm 0.2	3.9 \pm 3.6	20	0/9
5.31	0.70 \pm 0.3	7.7 \pm 3.5	20	0/13

Table 2-C Results (Continued)

Average measured concentration ($\mu\text{g/L}$)	Hepatosomatic Index (%)		Vitellogenin (ng/mg liver)	
	Male	Female	Male	Female
Control	2.8 \pm 0.3	3.5 \pm 0.9	6.6 \pm 11.1	1,100 \pm 980
Solvent control	2.8 \pm 0.5	3.9 \pm 1.0	7.7 \pm 8.8	980 \pm 1,100
0.0519	2.2 \pm 0.8	3.7 \pm 0.9	2.0 \pm 2.0	1,600 \pm 1,400
0.148	2.0 \pm 0.8**	3.6 \pm 0.8	1.5 \pm 3.3**	1,600 \pm 1,300
0.388	2.5 \pm 0.6	3.9 \pm 0.8	1.2 \pm 1.8*	1,800 \pm 1,200
1.30	2.5 \pm 0.7	3.9 \pm 1.1	5.0 \pm 6.1	1,500 \pm 1,100
5.31	2.6 \pm 0.7	4.3 \pm 1.0	ND	1,500 \pm 660

Testis-ova means No. of Males with testis-ova/No. of Males.

Data shows mean \pm standard deviation.

Statistically significant differences from control and solvent control group (** $p < 0.01$, * $p < 0.05$).

ND means not detected (< 1 ng/mg liver).

4-*t*-Octylphenol

1. Vitellogenin Assay

Table 1 Results (21days)

Average measured concentration (µg/L)	Mortality (%)	Hepatosomatic Index (%)		Vitellogenin (ng/mg liver)	
		Male	Female	Male	Female
Control	0	1.9±1.0	4.8±1.0	3.6±3.5	1,500±320
Solvent control	0	1.8±0.9	4.0±1.1	1.4±1.2	1,800±1,300
12.7	0	2.0±0.6	4.4±0.8	1.9±1.2	1,800±540
27.8	0	1.8±0.3	4.0±0.6	3.6±4.4	1,900±510
64.1	0	2.2±0.8	4.3±1.1	190±370**	1,500±400
129	6.3	2.6±0.3	3.8±0.9	2,300±1,100**	3,000±2,900
296	0	2.8±0.6	4.2±0.9	6,100±1,800**	3,300±1,900**

Data shows mean ± standard deviation.

Statistically significant differences from control and solvent control group (** $p < 0.01$).

2. Partial Life Cycle Test

Table 2-A Results

Average measured concentration (µg/L)	Hatchability (%)	Time to hatching (Day)	Mortality (%)	Total length (mm)	Body weight (mg)
Control	98±3.3	9.1±0.3	5.0±3.3	26.2±2.1	188±35
Solvent control	98±3.3	9.0±0.1	5.0±6.4	26.2±2.0	157±35
6.94	95±6.4	8.9±0.1	3.6±4.2	26.6±1.8	163±37
11.4	98±3.3	9.0	5.1±6.4	26.6±1.5	169±34
23.7	100	8.9±0.1	20±12*	27.3±1.6**	187±39****
48.1	95±6.4	9.0	1.9±3.9	26.1±1.7	167±34
94.0	97±6.7	9.0	5.5±7.3	25.5±2.1	159±39

Table 2-B Results (Continued)

Average measured concentration (µg/L)	Gonadosomatic Index (%)		No. of fishes	Testis-ova
	Male	Female		
Control	0.47±0.2	1.8±1.8	20	0/10
Solvent control	0.85±0.9	2.9±2.9	20	0/9
6.94	0.78±0.3	4.5±2.9	20	0/10
11.4	0.88±0.4	4.4±3.0	20	1/9
23.7	0.71±0.3	3.2±3.3	20	2/10*
48.1	0.64±0.2	2.8±2.4	20	3/10*
94.0	0.39±0.4	0.60±0.5**	20	5/10**

Table 2-C Results (Continued)

Average measured concentration (µg/L)	Hepatosomatic Index (%)		Vitellogenin (ng/mg liver)	
	Male	Female	Male	Female
Control	2.2±0.6	3.1±0.5	1.9±1.8	810±600
Solvent control	2.1±0.7	3.5±0.6	ND	810±770
6.94	2.8±0.6*	3.8±0.8	5.4±4.5	1,600±1,000
11.4	2.7±0.5	3.3±0.8	13±9.4**	2,300±1,700
23.7	2.8±0.8*	4.1±0.7*	17±19**	1,700±1,300
48.1	2.4±0.7	3.9±0.7	140±190**	3,600±1,400**
94.0	3.3±0.6**	4.0±0.9	500±880**	4,000±790**

Testis-ova means No. of Males with testis-ova/No. of Males.

Data shows mean ± standard deviation.

Statistically significant differences from control and solvent control group (** $p < 0.01$, * $p < 0.05$).

Statistically significant differences from solvent control group (**** $p < 0.01$), but not statistically significant differences from control group.

ND means not detected (< 1 ng/mg liver).

3. Full Life Cycle Test

Table 3-A F₀ generation

Average measured concentration (µg/L)	Hatchability (%)	Time to hatching (Day)	Mortality (%)	Total length (mm)	Body weight (mg)	No. of fishes	Testis-ova
Control	100	8.5±0.3	1.7	30.5±1.3	269±32	20	0/8
Solvent control	97±3.9	8.4±0.2	6.7	31.6±1.4	307±43	20	0/9
1.68	88±11	8.1±0.2	8.4	31.7±1.8	310±62	20	0/10
4.27	92±8.4	8.2±0.4	5.8	31.5±1.2	298±35	20	0/10
9.92	97±6.7	8.4±0.1	12	32.0±1.2	301±42	20	1/10
30.4	88±6.4	8.3±0.4	11	32.1±1.5	322±50	20	5/7**
82.3	92±8.4	8.2±0.1	5.8	31.7±1.5	310±44	20	7/8**

Table 3-B F₀ generation (Continued)

Average measured concentration (µg/L)	No. of eggs	Fertility (%)	Gonadosomatic Index (%)	
			Male	Female
Control	653±89	97±3.3	0.81±0.1	7.5±1.5
Solvent control	500±170	90±15	0.65±0.2	7.7±1.7
1.68	659±130	97±1.2	0.86±0.2	7.6±1.5
4.27	667±60	98±2.1	0.98±0.2	8.0±0.7
9.92	631±80	93±7.4	0.93±0.2	8.3±1.2
30.4	520±150	92±8.0	0.92±0.3	7.8±1.9
82.3	45±87**	35±36*	1.0±0.3	8.2±3.8

Table 3-C F₀ generation (Continued)

Average measured concentration (µg/L)	Hepatosomatic Index (%)		Vitellogenin (ng/mg liver)	
	Male	Female	Male	Female
Control	1.7±0.6	5.5±1.8	10±15	1,600±740
Solvent control	1.6±0.4	4.1±0.7	8.6±8.8	1,600±1,300
1.68	1.4±0.5	4.2±1.5	8.5±8.8	1,700±780
4.27	1.4±0.2	3.8±0.4	16±10	2,100±1,100
9.92	1.8±0.8	3.5±0.7	290±640**	2,600±2,400
30.4	1.9±0.1	4.5±0.8	630±850**	4,900±2,600**
82.3	2.6±0.7**	3.9±0.7	2,800±2,800**	11,000±6,700**

Table 3-D F₁ generation

Average measured concentration (µg/L)	Hatchability (%)	Time to hatching (Day)	Mortality (%)	Total length (mm)	Body weight (mg)	No. of fishes	Testis-ova
Control	94±7.6	9.7±0.4	1.7	28.7±1.6	252±45	20	0/11
Solvent control	80±29	9.4±0.6	6.7	28.9±1.7	253±41	20	0/12
1.68	90±14	9.2±0.4	6.7	28.2±1.7	242±39	20	0/14
4.27	92±7.8	9.4±0.5	8.3	28.7±1.7	243±37	20	0/11
9.92	96±6.8	9.5±0.6	0	28.3±2.1	243±27	20	0/8
30.4	97±7.4	9.5±0.5	0	28.7±1.1	243±30	20	4/8**
82.3	51±49	9.6±0.3	6.1	28.8±1.0	252±28	20	10/15**

Table 3-E F₁ generation (Continued)

Average measured concentration (µg/L)	Vitellogenin (ng/mg liver)	
	Male	Female
Control	3.1±2.6	1,700±1,000
Solvent control	4.3±5.0	1,500±1,000
1.68	3.1±4.4	990±920
4.27	6.5±19	2,300±1,100
9.92	24±22**	3,200±1,200**
30.4	42±29**	4,300±2,000**
82.3	22±22*	6,200±540**

Testis-ova means No. of Males with testis-ova/No. of Males.

Data shows mean ± standard deviation.

Statistically significant differences from control and solvent control group (** $p < 0.01$, * $p < 0.05$).

Pentachlorophenol

1. Vitellogenin Assay

Table 1 Results (Male)

Average measured concentration ($\mu\text{g/L}$)	Mortality (%)	Hepatosomatic Index (%)		Vitellogenin (ng/mg liver)	
		14 days	21 days	14 days	21 days
Control	0	2.8 \pm 1.1	2.4 \pm 0.54	ND	1.3 \pm 0.59
1.2	0	2.7 \pm 1.2	2.1 \pm 0.60	ND	1.3 \pm 0.61
2.5	0	2.3 \pm 0.54	2.2 \pm 0.79	ND	1.2 \pm 0.40
10.1	0	2.0 \pm 0.62	2.6 \pm 1.4	ND	1.3 \pm 1.4
28.6	0	3.1 \pm 1.8	2.1 \pm 0.75	ND	1.5 \pm 0.70
95.0	3.3	2.1 \pm 0.94	2.5 \pm 0.94	ND	1.1 \pm 0.44

Data shows mean \pm standard deviation.

ND means not detected (< 1 ng/mg liver).

2. Partial Life Cycle Test

Table 2-A Results

Average measured concentration ($\mu\text{g/L}$)	Hatchability (%)	Time to hatching (Day)	Mortality (%)	Body length (mm)	Body weight (mg)
Control	95	14 \pm 1.7	11 \pm 5.3	24 \pm 1.5	250 \pm 52
0.13	97 \pm 2.9	15 \pm 0.25	31 \pm 1.5	24 \pm 2.3	260 \pm 81
0.34	93 \pm 2.9	13 \pm 2.1	14 \pm 2.7	25 \pm 1.7	270 \pm 54
1.00	92 \pm 2.9	14 \pm 1.6	11 \pm 5.7	25 \pm 1.9	260 \pm 70
3.40	97 \pm 2.9	15 \pm 1.5	29 \pm 17	24 \pm 2.1	260 \pm 73
10.92	97 \pm 5.8	14 \pm 0.50	17 \pm 7.2	25 \pm 2.2	280 \pm 79

Table 2-B Results (Continued)

Average measured concentration ($\mu\text{g/L}$)	Gonadosomatic Index (%)		No. of fishes	Testis-ova
	Male	Female		
Control	0.90 \pm 0.54	5.0 \pm 5.1	20	0/7
0.13	0.87 \pm 0.21	6.9 \pm 5.2	20	0/6
0.34	0.72 \pm 0.21	5.4 \pm 4.2	20	0/9
1.00	0.82 \pm 0.39	2.8 \pm 4.1	20	0/10
3.40	0.78 \pm 0.36	4.9 \pm 5.5	20	0/12
10.92	0.81 \pm 0.25	5.5 \pm 5.3	20	0/12

Table 2-C Results (Continued)

Average measured concentration ($\mu\text{g/L}$)	Hepatosomatic Index (%)		Vitellogenin (ng/mg liver)	
	Male	Female	Male	Female
Control	2.3 \pm 0.27	2.9 \pm 0.84	4.9 \pm 10	230 \pm 290
0.13	2.9 \pm 0.78	3.3 \pm 0.71	1.1 \pm 0.0045	580 \pm 710
0.34	2.3 \pm 0.59	3.5 \pm 0.61	1.2 \pm 0.053	460 \pm 390
1.00	2.9 \pm 0.76	3.3 \pm 0.50	1.1 \pm 0.0092	130 \pm 170
3.40	2.5 \pm 0.54	3.5 \pm 1.3	1.1 \pm 0.013	420 \pm 590
10.92	2.7 \pm 0.43	4.0 \pm 1.8	ND	660 \pm 920

Testis-ova means No. of Males with testis-ova/No. of Males.

Data shows mean \pm standard deviation.

ND means not detected (< 1 ng/mg liver).

Permethrin (mixture)
(*cis*-Permethrin:*trans*-Permethrin=40:60)

1. Vitellogenin Assay

Table 1 Results (Male)

Average measured concentration ($\mu\text{g/L}$)	Mortality (%)	Hepatosomatic Index (%)		Vitellogenin (ng/mg liver)	
		14 days	21 days	14 days	21 days
Control	0	2.2 \pm 0.59	2.1 \pm 0.40	ND	ND
Solvent control	0	2.4 \pm 0.53	2.0 \pm 0.45	ND	ND
0.279	0	2.0 \pm 0.52	1.9 \pm 0.49	ND	ND
0.632	0	2.2 \pm 0.63	2.1 \pm 0.45	ND	ND
1.29	0	2.3 \pm 0.52	2.2 \pm 0.55	ND	ND
2.19	0	2.1 \pm 0.46	2.1 \pm 0.47	ND	ND
5.49	3.3	2.2 \pm 0.65	2.0 \pm 0.49	ND	ND

Data shows mean \pm standard deviation.
ND means not detected (< 1 ng/mg liver).

2. Partial Life Cycle Test

Table 2-A Results

Average measured concentration ($\mu\text{g/L}$)	Hatchability (%)	Time to hatching (Day)	Mortality (%)	Total length (mm)	Body weight (mg)
Control	100	9.8 \pm 0.14	3.3 \pm 3.8	30 \pm 1.5	270 \pm 41
Solvent control	100	9.5 \pm 0.15	3.3 \pm 3.8	30 \pm 1.4	260 \pm 46
0.177	98 \pm 3.3	9.5 \pm 0.32	3.5 \pm 4.0	30 \pm 2.0	250 \pm 40
0.279	98 \pm 3.3	9.4 \pm 0.22	1.8 \pm 3.6	29 \pm 1.9	260 \pm 45
0.424	100	9.1 \pm 0.23	5.0 \pm 3.3	30 \pm 1.5	270 \pm 41
0.636	100	9.6 \pm 0.12	1.7 \pm 3.3	30 \pm 1.5	270 \pm 41
0.907	95 \pm 6.4	9.6 \pm 0.27	3.6 \pm 7.1	30 \pm 1.4	260 \pm 43

Table 2-B Results (Continued)

Average measured concentration ($\mu\text{g/L}$)	Gonadosomatic Index (%)		No. of fishes	Testis-ova
	Male	Female		
Control	0.97 \pm 0.23	7.9 \pm 1.2	20	0/11
Solvent control	0.90 \pm 0.30	7.6 \pm 3.3	20	0/11
0.177	0.93 \pm 0.24	7.8 \pm 1.7	19	0/9
0.279	0.98 \pm 0.19	9.6 \pm 1.5	20	1/11
0.424	1.2 \pm 0.33*	6.1 \pm 3.2	20	1/13
0.636	1.2 \pm 0.22	6.2 \pm 2.4	20	0/7
0.907	1.2 \pm 0.30	8.9 \pm 2.4	20	0/10

Table 2-C Results (Continued)

Average measured concentration ($\mu\text{g/L}$)	Hepatosomatic Index (%)		Vitellogenin (ng/mg liver)	
	Male	Female	Male	Female
Control	2.2 \pm 0.43	3.5 \pm 0.76	ND	1,100 \pm 530
Solvent control	2.2 \pm 0.49	3.8 \pm 1.3	ND	1,300 \pm 740
0.177	1.8 \pm 0.67	3.6 \pm 0.73	ND	1,800 \pm 930
0.279	2.0 \pm 0.58	3.6 \pm 0.81	ND	1,400 \pm 320
0.424	2.0 \pm 0.73	3.2 \pm 1.3	ND	1,700 \pm 660
0.636	1.8 \pm 0.33	3.2 \pm 1.2	ND	1,500 \pm 320
0.907	2.0 \pm 0.70	3.6 \pm 0.85	ND	1,700 \pm 540

Testis-ova means No. of Males with testis-ova/No. of Males.

Data shows mean \pm standard deviation.

Statistically significant differences from control and solvent control group (* p <0.05).

ND means not detected (< 1 ng/mg liver).

Tributyltin chloride

1. Vitellogenin Assay

Table 1 Results (21 days)

Average measured concentration ($\mu\text{g/L}$)	Mortality (%)	Hepatosomatic Index (%)		Vitellogenin (ng/mg liver)	
		Male	Female	Male	Female
Control	0	2.25 \pm 0.337	4.90 \pm 1.42	ND	642 \pm 580
Solvent control	0	1.88 \pm 0.560	4.37 \pm 1.22	ND	861 \pm 790
0.117	0	2.49 \pm 0.583	4.68 \pm 1.43	ND	873 \pm 545
0.269	0	2.99 \pm 1.51*	5.11 \pm 1.23	ND	1,160 \pm 631
0.606	0	3.27 \pm 1.08**	4.86 \pm 0.741	ND	978 \pm 531
1.64	0	3.37 \pm 0.519**	5.54 \pm 0.850	ND	1,080 \pm 913
4.00	0	4.81 \pm 1.07**	5.51 \pm 1.05	ND	1,230 \pm 422

Data shows mean \pm standard deviation.

Statistically significant differences from control and solvent control group (** p <0.01, * p <0.05).

ND means not detected (< 1 ng/mg liver).

2. Partial Life Cycle Test

Table 2-A Results

Average measured concentration ($\mu\text{g/L}$)	Hatchability (%)	Time to hatching (Day)	Mortality (%)	Total length (mm)	Body weight (mg)
Control	90.0 \pm 12.8	9.8 \pm 0.24	7.27 \pm 5.58	28.8 \pm 2.1	219 \pm 61
Solvent control	93.3 \pm 5.4	9.6 \pm 0.10	5.12 \pm 6.43	28.5 \pm 1.3	206 \pm 36
0.0201	95.0 \pm 10.0	9.7 \pm 0.25	6.67 \pm 9.43	28.3 \pm 2.3	209 \pm 54
0.0641	88.3 \pm 3.3	9.5 \pm 0.17	5.49 \pm 6.89	28.6 \pm 1.7	212 \pm 45
0.205	96.7 \pm 3.9	9.5 \pm 0.22	12.1 \pm 6.90	28.2 \pm 1.5	206 \pm 45
0.594	98.3 \pm 3.3	9.6 \pm 0.27	10.1 \pm 8.55	27.4 \pm 1.8**	196 \pm 41
1.650	96.7 \pm 3.9	9.8 \pm 0.27	43.0 \pm 19.0**	25.9 \pm 2.5**	175 \pm 51**

Table 2-B Results (Continued)

Average measured concentration ($\mu\text{g/L}$)	Gonadosomatic Index (%)		No. of fishes	Testis-ova
	Male	Female		
Control	0.855 \pm 0.215	6.05 \pm 2.29	20	0/12
Solvent control	0.769 \pm 0.230	5.37 \pm 3.32	20	0/14
0.0201	0.648 \pm 0.260	5.93 \pm 1.26	20	0/11
0.0641	0.712 \pm 0.194	4.06 \pm 2.29	20	0/7
0.205	0.647 \pm 0.271	5.91 \pm 2.77	20	0/10
0.594	0.773 \pm 0.187	4.62 \pm 2.42	20	0/7
1.650	0.825 \pm 0.393	5.52 \pm 4.40	20	0/8

Table 2-C Results (Continued)

Average measured concentration ($\mu\text{g/L}$)	Hepatosomatic Index (%)		Vitellogenin (ng/mg liver)	
	Male	Female	Male	Female
Control	2.27 \pm 0.414	4.62 \pm 0.894	2.65 \pm 1.99	1,700 \pm 627
Solvent control	2.18 \pm 0.437	4.20 \pm 0.750	ND	1,650 \pm 1,170
0.0201	2.27 \pm 0.380	3.49 \pm 1.27	5.76 \pm 4.83****	1,600 \pm 899
0.0641	2.24 \pm 0.716	3.60 \pm 0.434	5.85 \pm 2.37****	2,150 \pm 2,590
0.205	2.35 \pm 0.491	3.56 \pm 0.711	7.12 \pm 4.76****	2,160 \pm 767
0.594	3.49 \pm 0.823**	5.24 \pm 1.32	1.05 \pm 0.301****	1,340 \pm 711
1.650	4.47 \pm 1.58**	5.96 \pm 1.04**	1.96 \pm 1.59****	921 \pm 751

Testis-ova means No. of Males with testis-ova/No. of Males.

Data shows mean \pm standard deviation.

Statistically significant differences from control and solvent control group (** p <0.01).

Statistically significant differences from solvent control group (**** p <0.01), but not statistically significant differences from control group.

ND means not detected (< 1 ng/mg liver).

Triphenyltin chloride

1. Vitellogenin Assay

Table 1 Results (Male)

Average measured concentration ($\mu\text{g/L}$)	Mortality (%)	Hepatosomatic Index (%)		Vitellogenin (ng/mg liver)	
		14 days	21 days	14 days	21 days
Control	3.3	2.6 \pm 0.86	2.7 \pm 1.9	1.6 \pm 1.1	1.6 \pm 0.88
0.12	0	2.7 \pm 0.67	3.5 \pm 1.5	1.1 \pm 0.38	1.2 \pm 0.58
0.28	0	2.8 \pm 0.74	3.2 \pm 1.5	1.5 \pm 0.68	1.5 \pm 0.58
0.93	0	3.2 \pm 0.74	4.3 \pm 2.7	ND	ND
2.89	0	3.5 \pm 1.3	3.9 \pm 1.5	ND	ND
8.87	100	-	-	-	-

Data shows mean \pm standard deviation.

ND means not detected (< 1 ng/mg liver).

Data not measured or performed (-).

2. Partial Life Cycle Test

Table 2-A Results

Average measured concentration ($\mu\text{g/L}$)	Hatchability (%)	Time to hatching (Day)	Mortality (%)	Total length (mm)	Body weight (mg)
Control	95	10 \pm 1.6	9.5	21 \pm 1.5	170 \pm 36
0.028	93	10 \pm 2.8	5.4	21 \pm 1.7	160 \pm 37
0.080	87	11 \pm 3.5**	11.5	21 \pm 0.94	180 \pm 36
0.18	80	12 \pm 4.7**	12.5	22 \pm 1.6	180 \pm 42
0.62	83	17 \pm 8.4**	25.3	22 \pm 1.6*	190 \pm 47*
1.9	88	13 \pm 5.5**	17.1	20 \pm 1.8*	150 \pm 40*

Table 2-B Results (Continued)

Average measured concentration ($\mu\text{g/L}$)	Gonadosomatic Index (%)		No. of fishes	Testis-ova
	Male	Female		
Control	1.1 \pm 0.29	7.6 \pm 0.60	20	0/10
0.028	1.1 \pm 0.39	7.7 \pm 0.67	20	0/10
0.080	1.1 \pm 0.30	7.5 \pm 0.76	20	0/10
0.18	1.1 \pm 0.26	7.5 \pm 0.77	20	0/10
0.62	1.1 \pm 0.33	7.2 \pm 0.70	20	0/10
1.9	1.1 \pm 0.37	7.3 \pm 0.63	20	0/10

Table 2-C Results (Continued)

Average measured concentration ($\mu\text{g/L}$)	Hepatosomatic Index (%)		Vitellogenin (ng/mg liver)	
	Male	Female	Male	Female
Control	3.6 \pm 1.5	4.1 \pm 0.88	1.3 \pm 0.75	300 \pm 410
0.028	3.5 \pm 1.3	4.0 \pm 1.0	1.6 \pm 1.9	250 \pm 350
0.080	3.3 \pm 1.4	3.7 \pm 1.2	1.1 \pm 0.48	280 \pm 350
0.18	2.7 \pm 0.59	3.9 \pm 1.0	1.2 \pm 0.47	340 \pm 520
0.62	3.5 \pm 1.3	5.1 \pm 0.78	1.4 \pm 1.7	180 \pm 270
1.9	4.4 \pm 1.0	4.9 \pm 1.4	1.2 \pm 1.4	43 \pm 72

Testis-ova means No. of Males with testis-ova/No. of Males.

Data shows mean \pm standard deviation.

Statistically significant differences from control group (** $p < 0.01$, * $p < 0.05$).