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SUBJECT: Results of freshwater exposures with the chemicals atrazine, biphenyl, butachlor, carbaryl, carbazole, dibenzofuran, 3,3'-dichlorobenzidine, dichlorovos, 1,2-epoxyethylbenzene (styrene oxide), isophorone, isopropalin, oxychlordan, pentachloroanisole, propoxur (baygon), tetrabromobisphenol A, 1,2,4,5-tetrachlorobenzene, and 1,2,3-trichloropropane to selected freshwater organisms.

Acute flow-through and static renewal exposures with biphenyl, butachlor, carbazole, dibenzofuran, 3,3'-dichlorobenzidine, 1,2-epoxyethylbenzene (styrene oxide), isophorone, isopropalin, oxychlordan, pentachloroanisole, tetrabromobisphenol A, tetrachlorobenzene, and 1,2,3-trichloropropane were completed using the fathead minnow (Pimephales promelas). Acute static renewal exposures with butachlor, carbazole, 3,3'-dichlorobenzidine, 1,2-epoxyethylbenzene, isopropalin, oxychlordan, pentachloroanisole, and tetrabromobisphenol A were completed using the freshwater organism Daphnia magna. Acute and chronic (21-day) static renewal exposures with dichlorovos, carbaryl and propoxur (baygon) were also completed using D. magna. An acute 96-hr flow-through and two early life-stage (28-days) exposures were also completed with dichlorovos using the fathead minnow.

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Acute static renewal exposures with dichlorovos were also completed using an annelid (Lumbriculus variegatus), a snail (Physella virgata) and C. dubia. Acute flow-through exposures with atrazine were completed using annelids, stoneflies (Acroneuria sp.), an amphipod (Hyaella azteca), plus static renewal exposures to Hydra americana and a snail (Physella virgata). An acute static renewal exposure with propoxur was also conducted using an annelid (Lumbriculus variegatus).

METHODS

Test Organisms

Fathead minnows were cultured and reared at the UW-S campus laboratory. They were hatched and reared in dechlorinated lab water at 23 ± 2 C. The fish were fed live brine shrimp three times daily.

Daphnia magna and Ceriodaphnia dubia were cultured and reared at the UW-S laboratory. They were cultured in hard (160-180 mg/L CaCO_3) reconstituted water and renewed on a MWF regime. Daphnids were fed 7 mL/liter of Selenastrum capricornutum and YTC (Yeast-Trout Chow-Cerophyl[®]).

Annelids (Lumbriculus variegatus) were cultured and reared at the UW-S campus laboratory. They were cultured and reared in dechlorinated lab water at 20 ± 2 C. Annelids were fed beef liver and frozen brine shrimp on a MWF regime.

Hydra americana were cultured and reared at the UW-S campus laboratory. They were cultured and reared in dechlorinated lab water at 23 ± 2 C. Hyroids were fed live brine shrimp once daily.

Snails (Physella virgata) were cultured and reared at the UW-S laboratory. They were cultured in dechlorinated lab water at a temperature of 23 ± 2 C. They fed on algae and brine shrimp in holding aquaria.

Amphipods (Hyalella azteca) were cultured and reared at the UW-S laboratory in dechlorinated lab water at 20±2 C. They were fed leaves (Betula sp. and Populus sp.) as needed for food and substrate.

Stoneflies (Acroneuria sp.) were collected from the Eau Claire river in Gordon, WI, Douglas County. They were acclimated in lab water to test temperature (20 C) for 7 days prior to exposure.

Chemical Analysis

Two methods were used to analyze the test compounds in this study. High pressure liquid chromatography (HPLC) was used for the analysis of seven compounds (atrazine, biphenyl, carbaryl, carbazole, dibenzofuran, 3,3'-dichlorobenzidine and propoxur) and gas chromatography (GC) was used for the analysis of ten compounds (butachlor, dichlorovos, 1,2-epoxyethylbenzene, isophorone, isopropalin, oxychlordan, pentachloroanisole, tetrabromobisphenol A, 1,2,4,5-tetrachlorobenzene and 1,2,3-trichloropropane). The chemicals (Table 1) were obtained from either Chem Service, Inc. (West Chester, PA) or Aldrich Chemical Company, Inc. (Milwaukee, WI). Pentachloroanisole and oxychlordan were obtained as reference standards from the Environmental Protection Agency (EPA; Research Triangle Park, NC). Solvents used for preparation of stock solutions and standards, water sample extractions and HPLC mobile phases were obtained from American Burdick & Jackson (Muskegon, MI), J.T. Baker Chemical Company (Philipsburg, NC) or EM Science (Gibbstown, NJ).

High Pressure Liquid Chromatography - For all the tests, except the carbaryl and propoxur daphnid tests, the HPLC system consisted of two Waters M-45 pumps, a Waters Automated Gradient Controller, a Waters M-490 UV detector (Waters Associates; Millford, MA), a Micromeritics Model 725 autoinjector with a 10 µL injection loop (Micromeritics Instrument Corp.; Norcross, GA), and a

Spectra-Physics SP4270 Integrator (Spectra Physics; San Jose, CA). The mobile phases (Table 2) were composed of acetonitrile (CH₃CN) and Milli-Q (DIW) water (Millipore Corporation; Bedford, MA) and the flow rate was 1 mL/min. The column was a LiChroCART 125-4 with LiChrospher 100 RP-18 (5 μM) packing (EM Science; Cherry Hill, NJ).

Analytical stock solutions were prepared in appropriate reagent grade solvents (Table 3). Standards were made up in acetonitrile for most of the tests, but 3,3'-dichlorobenzidine standards were made up in water, because the absorbance of the solution was affected by the solvent. Also, standards for the propoxur and carbaryl daphnid tests were made up in DIW water because of the nature of the analyses (see below). At least four concentrations of standard were used to construct the calibration curves that covered the range of sample concentrations.

Tests of the carbamates, carbaryl and propoxur, with Daphnia magna required special conditions. The concentrations of chemical for these tests were very low requiring on-column concentration to reduce the detection limit to the range of the test solutions. The HPLC system was modified from the previous analyses with these changes. A 5.2 mL injection loop was made from ~200 cm of 3.175 mm stainless steel tubing. Full loop injections were made by injecting 15-20 mL of solution into the loop with a 20 mL plastic syringe. The solution was preceded by an air gap to minimize mixing with the solvent in the loop. A Valco C6W injection valve (Valco Instrument Company, Inc.; Houston, TX) was used to make manual injections. An Alltech Direct Connect Cartridge Guard Column with an Adsorbosphere C-18 5U cartridge (Alltech Associates, Inc.; Deerfield, IL) was used to concentrate the analyte. A PRP-1 cartridge was sometimes used, but it gave broader peaks.

Gradients (Table 2), beginning with 100% water, allowed the relatively

non-polar carbamates to be adsorbed on the guard column while eluting the polar components of the sample. The analytes were then eluted by ramping to an appropriate acetonitrile concentration. Non-polar contaminants were eluted by ramping to 100% acetonitrile. For propoxur, it was not necessary to clean up the column with 100% acetonitrile after every sample.

Gas Chromatography - All stock solutions were prepared by dissolving the test compound in reagent grade acetone. A minimum of four working standards were prepared with the same reagent grade solvents that were used in the extraction procedure. All water samples were extracted with toluene, except 1,2,3-trichloropropane, which was extracted with hexane. The extractions were carried out by stirring vigorously for 45 minutes on magnetic stir plates. Isopropalin became coated on the stir bars, so it was extracted by shaking for 45 minutes on a G10 Gyrotory Shaker (New Brunswick Scientific; Edison, NJ) at 150 rpm. The extractant was added by volumetric dispenser, in various solvent/sample ratios (Table 4) to obtain concentrations of the chemical in the extracts that fit the range of the standards.

Analyses for most of the chemicals were carried out using a Hewlett-Packard 5794A GC with an HP 3390A Integrator, HP 7617A Autosampler and flame ionization detector (FID) (Hewlett-Packard; Avondale, PA). The capillary column was a J&W DB-5 fused silica column 30 m x 0.25 mm I.D. with a 0.25 μ m film thickness (J&W Scientific; Folsom, CA).

A Hewlett-Packard 5880A GC with a Level Four Terminal, 7672A Autosampler, and electron capture detector (ECD) were used to analyze oxychlordan samples. The column for this analysis was a J&W DB-5 fused silica capillary column 60 m x 0.32 mm I.D. with a 0.25 μ m film thickness.

A Tracor 540 GC equipped with an ECD and a J&W SE-54 capillary column 15 m x 0.25 mm I.D. with a 0.25 μ m film thickness was used for the analysis of

the dichlorovos tests with Daphnia magna (Table 5).

Water Sampling Schedule

All water samples were taken at mid-depth near the center of each exposure chamber. Water samples for the tests analyzed by GC were collected with pipets ranging from 10 to 100 mL. The tips of the pipets were cut back slightly to speed up sampling and reduce clogging. The water samples were pipetted into clean solvent-rinsed glass bottles with plastic lined caps. Samples were extracted the same day they were taken and generally analyzed immediately, but occasionally the extracts were stored in a freezer for not more than two days before analysis.

Water samples from the test containers were injected directly for all HPLC tests except biphenyl and dibenzofuran. These samples were mixed with an equal volume of acetonitrile before injection to improve reproducibility and recovery. Water samples for the propoxur and carbaryl daphnid tests were collected in the same type of plastic cups used for the tests. All other water samples were collected in clean solvent-rinsed glassware or directly in unused autosampler vials. They were run the same day except that one set of dibenzofuran samples was kept refrigerated overnight in 50 percent acetonitrile after first checking that this preservation was stable for at least two days.

For the daphnid tests, samples of the new (fresh) solutions were taken from the stock solutions before dispensing to individual test containers. A composite sample for each exposure concentration was made from the replicates of the old (24-hr old) solutions. For acute tests, samples of the fresh solution were analyzed at the time of preparation, 0 and 24 hours. The old solutions were sampled at 24 and 48 hours. For the chronic tests, the fresh solutions were generally analyzed on renewal days (Monday, Wednesday and

Friday). Old solutions were run on days of renewal and on the last day of the test.

The flow-through tests with fathead minnows, annelids, amphipods and stoneflies, and the static tests with fathead minnows, were sampled as follows: all tanks at 0, 48 and 96 hours and half, one of each replicate, at 24 and 72 hours.

For the renewal tests with annelids, snails and hydra, the new solutions were sampled at 0, 24, 48 and 72 hours and the old solutions were sampled at 24, 48, 72 and 96 hours. The dichlorovos acute test with snails and annelids was only renewed at 48 hours, so new solutions were analyzed at 0 and 48 hours.

Duplicate samples and spikes were prepared and analyzed at every sampling (Table 4). At least one set of standards was run with every set of samples.

For the dichlorovos Daphnia magna 21-day chronic test, the only concentration measured was the new solution from the high exposure. All other exposure concentrations, including the old high solutions after 24 hours or more, were below the detection limit of 70 $\mu\text{g/L}$.

Exposure Conditions

Flow-through fathead minnow acutes were conducted in a modified Benoit mini-diluter. Chambers were glass aquaria 24x14x10 cm with a volume of 2.4 L. Static fathead tests were conducted in glass aquaria 20x20x16 cm or four liter glass beakers with a 4 liter volume. Mean temperature for fathead minnow exposures ranged from 21.1 to 23.3 C. Total hardness and alkalinity means ranged from 36.0 to 75.8 mg/L CaCO_3 and 38.0 to 70.9 mg/L CaCO_3 , respectively (Table 7).

Early life-stage tests were conducted in a modified mini-diluter using

fathead minnow embryos <24 hr post-fertilization. Eggs were placed into glass incubation cups (1 cup per exposure chamber). The bottoms of the egg cups were nylon mesh. The eggs were gently raised and lowered in the exposure water by a rocker arm assembly. Upon hatching, 15 fry were transferred from the egg cups into each exposure chamber (10x14x24 cm) containing 2.4 L of water. Young fish were fed three times daily live brine shrimp. Young fish were continuously exposed for 28 days.

Observations were made for egg hatchability, survival of fry, development abnormalities, behavior effects, wet and dry weight and length. Data were statistically analyzed by one-way analysis of variance in conjunction with Dunnett's procedure. Test water characteristics were monitored throughout the test according to procedures in "Standard Methods" (Table 7).

Daphnia magna were conducted in 118 ml plastic Solo[®] cups containing 50 mL solution, except for the D. magna exposure to isopropalin which was conducted in 100 mL glass beaker containing 50 mL solution. C. dubia were conducted in 30 mL plastic Solo[®] cups containing 15 mL. Acute exposures were renewed at 24 hr and chronic exposures on a MWF regime. Temperature was maintained at 22 ± 2 C with percent dissolved oxygen above 75% in both acutes and chronics. Test water characteristics were monitored throughout the test according to procedures in "Standard Methods" (Table 7).

Annelid flow-through exposures were conducted in 250 mL glass beakers with screened holes on the sides. The beakers were suspended in 10x14x24 cm tank and suspended beneath the delivery tube at a level to contain 200 mL. Static renewal exposures were conducted in 250 mL glass beakers containing 200 mL solution. Temperatures were maintained at 21 ± 2 C and percent dissolved oxygen above 60%. Total hardness and alkalinity ranged from 51.9 to 73.8 and

44.0 to 58.0 mg/L CaCO₃, respectively (Table 7).

Hydra static renewal exposures were also conducted in 250 mL glass beakers containing 200 mL of the test solution. Temperature was maintained at 21.1 ± 0.3 C with the mean percent dissolved oxygen of 90.1 ± 3.7 . Hardness and alkalinity means were 48.9 ± 3.8 and 45.0 ± 3.8 , respectively (Table 7). Mean pH was 7.26 ± 0.10 and conductance ranged from 125 to 130 umhos.

Snail exposures were conducted in 250 mL glass beakers containing 200 mL of the test solution. Snails were first placed in 3x12 cm screen cage then placed in the glass beaker with solution. Snail exposure temperature was maintained at 22 ± 1 C with dissolved oxygen above 67%. Hardness ranged from 43.9 to 79.8 mg/L CaCO₃ and alkalinity from 40.0 to 52.0 mg/L CaCO₃ (Table 7). Mean pH ranged from 7.37 ± 0.08 to 7.26 ± 0.10 and specific conductance ranged from 125 to 130 umhos/cm.

Amphipod flow-through exposure was conducted in 250 mL glass beakers with screened holes on the sides. The beakers were suspended in 10x14x24 cm glass aquaria beneath the delivery tube of the diluter at a level to contain 200 mL. A siphon tube was placed over the glass outer chamber in such a way as to siphon the suspended beaker volume to 100 mL. Hyallolella exposures were maintained in the range of 19.0 to 21.0 C with the percent dissolved oxygen above 73.0%. Hardness and alkalinity ranged from 47.9 to 89.8 mg/L CaCO₃ and 36.0 to 64.0 mg/L CaCO₃, respectively. Mean pH was 7.18 ± 0.18 and specific conductivity of 112 ± 5 umhos/cm (Table 7).

Stonefly flow-through exposures were conducted in a modified Benoit mini-diluter. Chambers were glass aquaria 24x14x10 cm with a volume of 2.4 L. A 10 cm long by 3.5 cm diameter pvc pipe was placed in each chamber for cover. Temperature for the stonefly exposure was 19.7 ± 0.4 C and the dissolved oxygen was at or above 73.0% saturated throughout the exposure. Mean total

hardness and alkalinity was 67.4 ± 19.0 and 50.0 ± 14.0 mg/L CaCO_3 , respectively. The mean pH was 7.18 ± 0.13 and the mean specific conductivity was 112 ± 5 umhos/cm (Table 7).

RESULTS

Atrazine

Static renewal - Adult snails (Physella virgata); (mean weight 0.052 ± 0.022 g) were exposed at the UW-S campus laboratory to five concentrations (2100 ± 100 , 4300 ± 300 , 8600 ± 600 , $17,200 \pm 1200$ and $34,100 \pm 2200$ ug/L) of atrazine, plus controls in duplicate. Deaths began occurring within 72 hours of the initial exposure with 20% mortality in the highest ($34,100$ ug/L), 5% in the second highest ($17,200$ ug/L), 15% in the third highest (8600 ug/L) and 10% in the fourth highest (4300 ug/L) at 96 hours (Table 8). There were no mortalities in the lowest exposure (2100 ug/L) or the controls. The 96-hr LC50 estimate could not be calculated and would be greater than the highest exposure of $34,100$ ug/L.

Flow-through - Stonefly (Acroneuria sp.) nymphs, (mean weight, 0.145 ± 0.076 g) were exposed at the UW-S campus laboratory to five concentrations (1800 ± 670 , 2900 ± 1200 , 6000 ± 2600 , $11,400 \pm 4600$ and $21,000 \pm 7600$ ug/L) of atrazine, plus controls in duplicate. Deaths began occurring within 4 hours of the initial exposure with 100% mortality in the highest ($21,000$ ug/L), 90% in the second highest ($11,400$ ug/L), 35% in the third highest (6000 ug/L) and 25% in each of the two remaining exposures (2900 and 1800 ug/L) at 96 hours (Table 9). There was a 5% mortality in the controls. The 96-hr LC50 estimate and its 95% confidence limits were 6700 (5300 - 8400) ug/L (Table 6).

Static renewal - Hydra americana were exposed at the UW-S campus laboratory to five concentrations (2100 ± 100 , 4300 ± 300 , 8600 ± 600 , $17,200$

± 1200 and $34,100 \pm 2200$ ug/L) of atrazine, plus controls in duplicate.

Affected Hydra showed shortening of body column and tentacles. Effects were noticed within 24 hours of the initial exposure with 100% affected in the four highest (34,100, 17,200, 8600 and 4300 ug/L) exposures and 0% affected in the lowest (2100 ug/L) exposure or controls at 96 hours (Table 10). The 96-hr EC50 estimate was 3000 ug/L (Table 4). The 95% confidence limits could not be determined.

Flow-through - Adult annelids (Lumbriculus variegatus), (mean weight 0.003 g) were exposed at the UW-S campus laboratory to five concentrations (6300 ± 800 , $10,200 \pm 900$, $15,900 \pm 1400$, $22,300 \pm 1900$ and $37,100 \pm 2900$ ug/L) of atrazine, plus controls in duplicate. Affected annelids were laying motionless, scattered and pale in color. Annelids became affected immediately in the high exposure (37,100 ug/L) and remained affected throughout the entire test (Table 11). There were no mortalities in any of the exposures or controls. Three carriers were tried: acetone, hexane and DMF, but analysis of these stock solutions indicated that a carrier would not increase atrazine's solubility. The 96-hr LC50 estimate could not be calculated and would be greater than the highest (37,100 ug/L) exposure.

Flow-through - Hyallela adults, (mean weight 0.002 g), were exposed at the UW-S campus laboratory to five concentrations (1800 ± 670 , 2900 ± 1200 , 6000 ± 2600 , $11,400 \pm 4600$ and $21,000 \pm 7600$ ug/L) of atrazine, plus controls in duplicate. Deaths began occurring within 19 hours of the initial exposure with 75% mortality in the highest (21,000 ug/L), 20% in the second highest (11,400 ug/L), 35% in the third highest (6000 ug/L), 20% in the fourth highest (2900 ug/L) and 10% in the lowest (1800 ug/L) exposures at 96 hours (Table 12). No controls died. The 96-hr LC50 estimate and its 95% confidence limits were 14,700 (10,400-20,800) ug/L (Table 6).

Biphenyl

Flow-through - Fathead minnows, 30 ± 5 days old (mean standard length, 12 ± 2 mm; mean weight, 0.021 ± 0.011 g) were exposed at the UW-S campus laboratory to five concentrations (150 ± 19 , 415 ± 50 , 930 ± 100 , 2090 ± 170 , and 4090 ± 320 ug/L) of biphenyl, plus controls in duplicate. Deaths began occurring within 17 hours after the initial exposure with 100% mortality in the highest (4090 ug/L) and 55% in the second highest (2090 ug/L) exposure at 96 hours (Table 13). No deaths occurred in any of the other exposures or controls. The 96-hr LC50 estimate and its 95% confidence limits were 1950 ($1650-2290$) ug/L (Table 6).

Static - Fathead minnows, 30 ± 5 days old (mean standard length, 12 ± 2 mm; mean weight, 0.018 ± 0.007 g) were exposed to five nominal concentrations (390 , 790 , 158 , 3150 and 6300 ug/L) of biphenyl, plus controls in duplicate. Concentrations at 0 hr were 300 ± 15 , 650 ± 20 , 1290 ± 30 , 2680 ± 30 and 5260 ± 310 ug/L. Concentrations for all hours were 120 ± 150 , 260 ± 310 , 510 ± 480 , 1070 ± 1260 , and 3880 ± 1600 ug/L. Deaths began occurring within 18 hours after the initial exposure with 100% mortality in the highest (3880 ug/L), 30% in the second highest (1070 ug/L) and 5% in the third highest (510 ug/L) exposure at 96 hours (Table 14). No mortality occurred in the remaining two exposures or controls. The 96-hr LC50 estimate and its 95% confidence limits based on the nominal concentrations were 3500 ($2990-4090$) ug/L (Table 4). The 96-hr LC50 estimate and its confidence limits based on 0-hr and all concentrations were 2940 ($2500-3440$) ug/L and 1450 ($1170-1810$) ug/L, respectively (Table 6).

Butachlor

Flow-through - Fathead minnows, 30 ± 2 days old (mean standard length,

18 ± 2 mm; mean weight, 0.083 ± 0.022 g) were exposed at the UW-S campus laboratory to five concentrations (230 ± 20, 420 ± 50, 870 ± 100, 1510 ± 190, and 3000 ± 150 ug/L) of butachlor, plus controls in duplicate. Deaths began occurring within 19 hours of the initial exposure with 100% mortality in the three highest concentrations (3000, 1510 and 870 ug/L) at 96 hours (Table 15). Mortalities of 85% and 35% occurred in the two lowest concentrations (420 and 230 ug/L). The 96-hr LC50 estimate and its 95% confidence limits were 280 (230-330) ug/L (Table 6).

Static - Fathead minnows, 30 ± 2 days old (mean standard length, 16 ± 2 mm; mean weight, 0.055 ± 0.021 g) were exposed to five nominal concentrations (300, 600, 1250, 2500, and 5000 ug/L) of butachlor, plus controls in duplicate. Concentrations at 0 hr were 310 ± 20, 640 ± 60, 1150 ± 70, 2300 ± 0 and 4670 ± 70 ug/L. Concentrations for all hours were (230 ± 70, 570 ± 100, 990 ± 100, 2300 ± 50 and 4620 ± 170 ug/L). Deaths began occurring within 20 hours of the initial exposure with 100% mortality occurring in the two highest exposures (4620 and 2300 ug/L) at 96 hours (Table 13). Mortalities of 80% and 40% occurred in the third and fourth highest (990 and 570 ug/L) exposures. There were no deaths in the lowest (230 ug/L) exposure or the controls. The 96-hr LC50 estimate and its 95% confidence limits based on the nominal concentrations were 750 (610-920) ug/L. The 96-hr LC50 estimate and its confidence limits based on 0-hr and all concentrations were 750 (620-900) ug/L and 640 (530-790) ug/L, respectively (Table 6).

Static renewal - D. magna, <24 hr old neonates were exposed at the UW-S campus to five concentrations (350 ± 240, 740 ± 380, 1500 ± 370, 3200 ± 800, 6900 ± 1440 ug/L) of butachlor, plus controls in quadruplicate. Deaths began occurring within 24 hours of the initial exposure with 90% mortality in the highest (6900 ug/L), 75% in the second highest (3200 ug/L), 85% in the third

highest (1500 ug/L), and 35% in the fourth highest (740 ug/L) exposure at 48 hours (Table 17). There were no mortalities in the lowest exposure (350 ug/L). There was a 10% mortality in the controls. The 48-hr EC50 estimate and its 95% confidence limits were 1050 (780-1430) ug/L (Table 6).

Butachlor is 3.8 times more toxic to fathead minnows than to D. magna.

Carbaryl

Static renewal - D. magna, <24-hr old neonates were exposed at the UW-S campus to five concentrations (3.9 ± 1.7 , 7.2 ± 3.5 , 15.6 ± 6.2 , 29.8 ± 12.1 and 65.2 ± 25.6 ug/L) of carbaryl, plus controls in quadruplicate. Deaths began occurring within 24 hours of the initial exposure with 90 and 70% mortalities in the two highest (65.2 and 29.8 ug/L) exposures at 24 hr, respectively. Mortalities of 65%, 40% and 5% had occurred by the end of the test in the three remaining exposures of 15.6, 7.2 and 3.9 ug/L, respectively (Table 18). There was 5% mortality of the control organisms. The 48-hr EC50 estimate and its 95% confidence limits were 10.1 (8.0-12.8) ug/L.

Static renewal - C. dubia, <24-hr old neonates were exposed at the UW-S campus to five concentrations (0.91 ± 0.45 , 1.06 ± 0.64 , 3.60 ± 1.41 , 7.28 ± 3.90 and 15.67 ± 6.24 ug/L) of carbaryl, plus controls in quadruplicate. Deaths began occurring within 24 hr of the initial exposure with 100% mortality in the two highest (15.67 and 7.28 ug/L) exposures. Mortalities of 50%, 5% and 0% occurred in the remaining exposures of 3.60, 1.06, and 0.91 ug/L, respectively, at the end of the test (Table 19). There were no mortalities in the controls. The 48-hr EC50 estimate and its 95% confidence limits were 3.06 (2.44-3.83) ug/L.

Chronic 21-day - D. magna < 24-hr old neonates were exposed for 21 days at the UW-S campus laboratory to five concentrations (0.29 ± 0.13 , $0.58 \pm$

0.35, 1.07 ± 0.87 , 2.16 ± 1.89 and 4.04 ± 3.37 ug/L) of carbaryl, plus controls (Table 20). Ten replicates with one neonate per replicate were used for each exposure and control. Percentage survival of adults and number of young produced at the termination of exposure was not significantly different from the controls at concentrations ≤ 4.04 ug/L (Table 21). Reproduction began on days 7-9 at all concentrations and the controls. The "no-effect" concentration range for D. magna exposed to carbaryl was between 4.04 ug/L and the 48-hr EC50 of 10.1 ug/L (Table 6).

Carbazole

Flow-through - Fathead minnows, 30 ± 5 days old (mean standard length, 17 ± 2 mm; mean weight, 0.077 ± 0.027 g) were exposed at the UW-S campus laboratory to five concentrations (60 ± 10 , 160 ± 20 , 310 ± 50 , 610 ± 130 , and 1250 ± 180 ug/L) of carbazole, plus controls in duplicate. Deaths began occurring within 24 hours of the initial exposure with 85% mortality in the highest (1250 ug/L) at 96 hours (Table 22). No deaths occurred in any of the other exposures or controls. The 96-hr LC50 estimate was 930 ug/L (Table 6). Due to no partial mortality, the 95% confidence limits could not be determined.

Static - Fathead minnows, 30 ± 4 days old (mean standard length, 17 ± 2 mm; mean weight, 0.084 ± 0.041 g) were exposed to five nominal concentrations (90, 190, 380, 750, and 1500 ug/L) of carbazole, plus controls in duplicate. Concentrations at 0-hr were (90 ± 0 , 200 ± 10 , 400 ± 30 , 790 ± 0 and 149 ± 60 ug/L). Concentrations for all hours were 70 ± 20 , 140 ± 40 , 280 ± 80 , 600 ± 150 and 1140 ± 230 ug/L. Deaths began occurring within 24 hours of the initial exposure with 40% mortality in the highest (1140 ug/L) exposure. There were no mortalities in the four remaining exposures (600, 280, 140 or 70

ug/L) (Table 23). No controls died. The 96-hr LC50 estimate and its 95% confidence limits could not be determined. The 96-hr LC50 estimate would be greater than 1140 ug/L based on all hour concentrations. (Table 6).

Static renewal - D. magna, <24-hr old neonates were exposed at the UW-S campus to five concentrations (270 ± 70 , 540 ± 140 , 660 ± 460 , 2030 ± 440 , and 3700 ± 880 ug/L) of carbazole, plus controls in quadruplicate. Deaths began occurring within 24 hours of the initial exposure with 55% of mortality in the highest (3700 ug/L) and 25% in the second highest (2030 ug/L) exposure at 48 hours (Table 24). There were no mortalities in the remaining three exposures (660 ± 460 , 540 ± 140 , 270 ± 70 ug/L). No controls died. The 48-hr EC50 estimate and its 95% confidence limits were 3350 (2300-4880) ug/L (Table 6).

Acetone was used as a carrier in the D. magna test with a high nominal concentration of 788,000 ug/L in the highest (3700 ug/L) exposure and control. Carbazole is 3.6 times more toxic to fathead minnows than D. magna.

Dibenzofuran

Flow-through - Fathead minnows, 30 ± 5 days old (mean standard length, 11 ± 2 mm; mean weight, 0.017 ± 0.008 g) were exposed at the UW-S campus laboratory to five concentrations ($<10 \pm 0$, 250 ± 100 , 1120 ± 120 , 2030 ± 90 , and 3390 ± 80 ug/L) of dibenzofuran, plus controls in duplicate. Deaths began occurring within 3 hours of the initial exposure with 100% mortality in the highest (3390 ug/L), 100% in the second highest (2030 ug/L) and 35% in the third highest (1120 ug/L) exposure at 96 hours (Table 25). No deaths occurred in any of the other exposures or controls. The 96-hr LC50 estimate and its 95% confidence limits were 1050 (840-1310) ug/L (Table 6).

Static - Fathead minnows, 30 ± 5 days old (mean standard length, 14 ± 3 mm; mean weight, 0.034 ± 0.015 g) were exposed to five nominal concentrations

(290, 580, 1150, 2300, and 4600 ug/L) of dibenzofuran, plus controls in duplicate. Concentrations at 0 hr were 190 ± 10 , 430 ± 0 , 960 ± 10 , 1910 ± 50 , and 3850 ± 50 ug/L. Concentrations for all hours were 60 ± 90 , 80 ± 40 , 360 ± 360 , 810 ± 870 , and 1360 ± 1410 ug/L. Deaths began occurring within 24 hours of the initial exposure, with 75% mortality in the highest (1360 ug/L) and 5% in the third highest (360 ug/L). There were no mortalities in the second highest (810 ug/L) or the two lowest concentrations (80 and 60 ug/L) (Table 26). No controls died. The 96-hr LC50 estimate and its 95% confidence limits based on the nominal concentrations were 3620 (3200-4100) ug/L. The 96-hr LC50 estimate and its confidence limits based on 0-hr and all concentrations were 3020 (2670-3430) ug/L and 1140 (1040-1250) ug/L, respectively (Table 6).

3,3'-Dichlorobenzidine

Static #1 - Fathead minnows, 30 ± 4 days old (mean standard length, 15 ± 2 mm; mean weight, 0.053 ± 0.024 g) were exposed to five nominal concentrations (290, 580, 1150, 2300 and 4600 ug/L) of 3,3'-dichlorobenzidine, plus controls in duplicate. Concentrations at 0-hr were 330 ± 0.01 , 580 ± 20 , 1060 ± 10 , 2000 ± 20 and 3860 ± 70 ug/L. Deaths began occurring within 17 hours of the initial exposure with 100% mortality in the highest (3560 ug/L) and 5% in the lowest (142 ug/L) exposures at 96 hours (Table 27). There were no mortalities in the fifth, fourth or third concentrations (1230, 530 and 290 ug/L). No controls died. The 96-hr LC50 estimates based on the nominal concentrations was 3240 ug/L. The 96-hr LC50 estimate based on 0-hr and all concentrations were 2770 and 2080 ug/L, respectively (Table 4). The 95% confidence limits could not be determined due to no partial mortality in the middle exposures.

Flow-through - Fathead minnows, 30 ± 2 days old (mean standard length, 19 ± 2 mm; mean weight, 0.103 ± 0.029 g) were exposed at the UW-S campus laboratory to five concentrations (140 ± 30 , 350 ± 60 , 750 ± 150 , 1410 ± 340 , and 2520 ± 770 ug/L) of 3,3'-dichlorobenzidine, plus controls in duplicate. Deaths began occurring within 17 hours of the initial exposure with 100% mortality in the highest (2520 ug/L) and 10% in the second highest (1410 ug/L) concentration at 96 hours (Table 28). No deaths occurred in any of the other exposures or controls. The 96-hr LC50 estimate and its 95% confidence limits were 1770 (1640-1920) ug/L (Table 6).

Static #2 - Fathead minnows, 30 ± 2 days old (mean standard length, 16 ± 2 mm; mean weight, 0.058 ± 0.024 g), were exposed to five nominal concentrations (290, 580, 1150, 2300, and 4600 ug/L) of 3,3'-dichlorobenzidine, plus controls in duplicate. Concentrations at 0-hr were 210 ± 20 , 480 ± 10 , 1000 ± 30 , 2000 ± 30 and 4140 ± 350 ug/L. Concentrations for all hours were 80 ± 100 , 70 ± 240 , 400 ± 370 , 1130 ± 680 and 3740 ± 520 ug/L. Deaths began occurring within 17 hours of the initial exposures, with 100% mortality in the highest (3740 ug/L) and 60% in the second highest (1130 ug/L) (Table 29). There were no mortalities in the three lowest (80, 170, 400 ug/L) exposures or controls. The 96-hr LC50 estimate and its 95% confidence limits based on the nominal concentrations were 2150 (1840-2500) ug/L. The 96-hr LC50 and its confidence limits based on 0-hr and all concentrations were 1880 (1610-2200) ug/L and 1050 (820-1340) ug/L, respectively (Table 6).

Static renewal - D. magna, <24 hr old neonates were exposed at the UW-S campus to five concentrations (70 ± 30 , 240 ± 70 , 520 ± 120 , 1040 ± 230 and 2160 ± 550 ug/L) of 3,3'-dichlorobenzidine, plus controls in quadruplicate. Deaths began occurring within 24 hours of the initial exposure with 100% mortality in the highest (2160 ug/L), 35% in the second highest (1040 ug/L),

20% in the third highest (520 ug/L), 5% in the fourth highest (240 ug/L) and 15% in the lowest (70 ug/L) exposure (Table 30). Mortalities of 10% occurred in the control. The 48-hr EC50 estimate and its 95% confidence limits were 1.05 (0.81-1.36) ug/L (Table 4).

Dichlorovos

↑
Should be
mg/L

↑
Should
be Table 6.

Static renewal - Annelid, (Lumbriculus variegatus), adult, (mean weight 0.002 g) were exposed at the UW-S campus laboratory to five concentrations (470 ± 70, 930 ± 140, 1590 ± 400, 3690 ± 480 and 7500 ± 940 ug/L) of dichlorovos, plus controls in duplicate. Deaths began occurring within 48 hours of the initial exposure with 100% mortality in the highest and second highest exposures, 7500 and 3690 ug/L, respectively and 15% in the third highest (1590 ug/L) exposure at 96 hours (Table 31). There were no mortalities in the two remaining exposures (930 and 470 ug/L) or the controls. The 96-hr LC50 estimate and its 95% confidence limits were 2180 (1960-2440) ug/L.

Static renewal - Snail, (Physella virgata), adults, (mean weight 0.1043 g) were exposed at the UW-S campus laboratory to five concentrations (90 ± 40, 150 ± 90, 290 ± 140, 650 ± 250 and 1420 ± 500 ug/L) of dichlorovos, plus controls in duplicate. Deaths began occurring within 24 hours of the initial exposure with 100% mortality occurring in the two highest (1420 and 650 ug/L) exposures, 90% in the third highest (290 ug/L) and 50% in the fourth highest (150 ug/L) exposure at 96 hours (Table 32). There were no mortalities in the lowest exposure (90 ug/L) or the controls. The 96-hr LC50 estimate and its 95% confidence limits were 170 (140-200) ug/L.

Static renewal - C. dubia, <24-hr old neonates were exposed at the UW-S campus laboratory to five concentrations (0.061 ± 0, 0.061 ± 0, 0.214 ± 17, 0.279 ± 0.021 and 0.498 ± 0.043 ug/L) of dichlorovos; plus controls in

quadruplicate. Deaths began occurring within 24 hours of the initial exposure with 100% mortality in the two highest exposures, 0.498 and 0.279 ug/L, respectively and 65% in the third highest (0.214 ug/L) exposure at 48 hours (Table 33). There were no mortalities in the two lowest exposures. These exposures were below the detectable limits of analysis. No controls died. The 48-hr EC50 estimate and its 95% confidence limits were 0.149 (0.127-0.175) ug/L.

Static renewal - D. magna, 24-hr old neonates were exposed at the UW-S campus laboratory to five concentrations (0.206 ± 0.053 , 0.227 ± 0.077 , 0.257 ± 0.068 , 0.418 ± 0.087 and 0.741 ± 0.209 ug/L) of dichlorovos, plus controls in quadruplicate. Deaths began occurring within 24 hours of the initial exposure with 100% mortality in each of the two highest (0.741 and 0.418 ug/L) exposures, 45% in the third highest (0.257 ug/L), 15% in the fourth highest (0.227 ug/L) and 5% in the lowest (0.206 ug/L) exposures at 48 hours (Table 34). There was a 5% mortality in the controls. The 48-hr EC50 estimate and its 95% confidence limits were 0.266 (0.246-0.286) ug/L.

Chronic 21-Day - D. magna <24-hr old neonates were exposed for 21 days at the UW-S campus laboratory to five nominal concentrations (0.008, 0.016, 0.032, 0.065 and 0.130 ug/L) of dichlorovos, plus controls. Ten replicates were used for each exposure and control. Due to analytical problems only the highest (0.130 ug/L) concentration could be measured (Table 35). The mean analytical concentration was measured at 0.109 ug/L. Percentage survival of daphnids and young reproduction at the termination of exposure was not significantly different from the controls at concentrations < 0.109 ug/L. The "no-effect" concentration range for D. magna exposed to dichlorovos was between 0.109 ug/L and the 48-hr EC50 value of 0.266 ug/L (Table 6).

Flow-through - Fathead minnows, 30 ± 4 day old (mean standard length, 11

± 1 mm; mean weight, 0.011 ± 0.003 g) were exposed at the UW-S campus laboratory to five concentrations (1840 ± 400 , 2720 ± 520 , 5120 ± 440 , 9770 ± 980 and $20,560 \pm 2860$ ug/L) of dichlorovos, plus controls in duplicate. Deaths began occurring within 1 hour of the initial exposure with 100% mortality in each of the two highest exposures ($20,560$ and 9770 ug/L), 95% in the third highest (5120 ug/L), 35% in the fourth highest (2720 ug/L) and 20% in the lowest exposure at 96 hours (Table 36). No controls died. The 96-hr LC50 estimate and its 95% confidence limits were 3090 ($2570-3730$) ug/L.

Early life-stage #1 - Fathead minnow embryos ≤ 24 hr old from UW-S and ERL-D stock fish were exposed to five concentrations (43 ± 39 , 70 ± 45 , 120 ± 59 , 260 ± 78 and 510 ± 130 ug/L) of dichlorovos, plus controls in quadruplicate. Exposures were of 34 days duration with hatching occurring on day 4 to 5. Percent hatch was not affected by these concentrations (Table 5). Percentage survival of fish at the termination of exposure was significantly ≥ 510 ug/L (Table 5). Mean fish wet weight and dry weight at the termination of the test was significantly ($p \leq 0.05$) different from the controls at concentrations of 120 and 260 ug/L, respectively (Table 37). Mean length was also significantly ($p \leq 0.05$) reduced at concentrations ≤ 260 ug/L. No significant effects were observed at concentrations ≤ 70 ug/L. The "no-effect" concentration range for fathead minnows exposed to dichlorovos was between 70 and 120 ug/L. Due to high zinc concentrations in dilution water, this exposure was repeated.

Early life-stage #2 - Fathead minnow embryos ≤ 24 hrs old from the UW-S test facility stock fish were exposed to five concentrations (76 ± 38 , 110 ± 50 , 190 ± 80 , 350 ± 110 and 540 ± 180 ug/L) of dichlorovos, plus controls in quadruplicate. Exposures were of 34 days duration with hatching occurring on day 4 to 5. Percent hatch was not affected by these concentrations (Table 6).

Percent survival of fish at the termination of exposure was significantly ($p \leq 0.01$) different from the controls at 540 ug/L. Mean fish wet weight at termination was not significantly different from the controls. However, mean fish dry weight was significantly ($p \leq 0.01$) different at concentrations ≥ 190 ug/L. Due to two large fish in one replicate in the 540 ug/L exposure it did not test significantly (Table 38). Mean fish length was also significantly ($p \leq 0.05$) different from the controls at concentrations ≤ 190 ug/L. No significant effects were observed at concentrations ≤ 110 ug/L. The "no-effect" concentration range for fathead minnows exposed to dichlorovos was between 110 and 190 ug/L.

1,2-Epoxyethylbenzene

Flow-through - Fathead minnows, 30 ± 5 days old (mean standard length, 17 ± 2 mm; mean weight, 0.082 ± 0.022 g) were exposed at the UW-S campus laboratory to five concentrations (720 ± 320 , 1300 ± 360 , 2700 ± 680 , 7640 ± 2160 and $27,890 \pm 3800$ ug/L) of 1,2-epoxyethylbenzene, plus controls in duplicate. Deaths began occurring within 17 hours of the initial exposure with 100% mortality in the two highest (7640 and $27,890$ ug/L) at 96 hours (Table 39). No deaths occurred in any of the other exposures or controls. The 96-hr LC50 estimate was 4540 ug/L (Table 6). Confidence limits could not be determined due to no partial mortality.

Static - Fathead minnows, 30 ± 5 days old (mean standard length, 17 ± 2 mm; mean weight, 0.074 ± 0.031 g) were exposed to five nominal concentrations (4375 , 8750 , $17,500$, $35,000$ and $70,000$ ug/L) of 1,2-epoxyethylbenzene, plus controls in duplicate. Concentrations at 0 hr were 4340 ± 0 , 8120 ± 0 , $22,250 \pm 7870$, $31,150 \pm 1570$ and $65,070 \pm 790$ ug/L. Concentrations of daily measurements were 1800 ± 1980 , 3330 ± 3740 , 6400 ± 9110 , $17,980 \pm 15,240$ and

46,400 ± 21,500 ug/L. Deaths began occurring within 17 hours of the initial exposure with 100% mortality in the two highest exposures at 96 hours (Table 40). No other mortalities occurred in any of the remaining exposures or controls. The 96 hr LC50 estimate based on the nominal concentrations was 24,800 ug/L. The 96 hr LC50 estimate based on 0-hr and all concentrations were 45,000 and 10,700 ug/L, respectively (Table 6). Confidence limits could not be determined due to no partial mortalities.

Static renewal - D. magna, <24-hr old neonates were exposed at the UW-S campus to five concentrations (3800 ± 1300, 6500 ± 2700, 8900 ± 7400, 21,600 ± 11,100 and 38,000 ± 26,500 ug/L) of 1,2-epoxyethylbenzene, plus controls in quadruplicate. Deaths began occurring within 24 hours of the initial exposure with 100% mortality in the highest (38,000 ug/L) and second highest (21,600 ug/L) at 48 hours (Table 41). Mortality of 30% occurred in the middle (8900 ug/L) exposure and no deaths in any other exposure or in the control at 48 hours. The 48-hr EC50 estimate and its 95% confidence limits were 11,600 (10,200-13,100) ug/L (Table 6).

Isophorone

Flow-through - Fathead minnows, 30 ± 5 days old (mean standard length, 18 ± 2 mm; mean weight, 0.088 ± 0.032 g) were exposed at the UW-S campus laboratory to five concentrations (27,200 ± 740, 54,700 ± 1780, 105,000 ± 5800, 206,000 ± 7680, and 376,000 ± 16,800 ug/L) of isophorone, plus controls in duplicate. Deaths began occurring within 3 hours of the initial exposure with 100% mortality in the highest (376,000 ug/L) and 15% in the second highest (206,000 ug/L) exposure (Table 42). No deaths occurred in any of the other exposures or controls. The 96-hr LC50 estimate and its 95% confidence limits were 253,000 (228,000-280,000 ug/L) (Table 6).

Static - Fathead minnows, 30 ± 5 days old (mean standard length, 15 ± 1 mm; mean weight, 0.048 ± 0.020 g) were exposed to five nominal concentrations (31,200, 62,500, 125,000, 250,000, and 500,000 ug/L) of isophorone, plus controls in duplicate. Concentrations at 0-hr were $25,400 \pm 0$, $49,800 \pm 1560$, $106,000 \pm 3100$, $216,000 \pm 7000$ and $412,000 \pm 26,100$ ug/L. Concentrations for all hours were $22,300 \pm 2,600$, $44,100 \pm 5100$, $90,800 \pm 15,400$, $176,000 \pm 34,100$ and $412,000 \pm 26,100$ ug/L. Deaths began occurring within 3 hours of the initial exposure with 100% mortality in the highest ($412,000 \pm 26,100$ ug/L) and 15% in the second highest ($176,000$ ug/L). There were no mortalities in the three lowest exposures ($22,300$, $44,100$ and $90,800$ ug/L), or the controls (Table 43). The 96-hr LC50 estimate and its 95% confidence limits based on the nominal concentrations were $319,000$ ($285,000$ - $356,000$) ug/L. The 96-hr LC50 estimate and its confidence limits based on 0-hr and all concentrations were $275,000$ ($246,000$ - $308,000$) ug/L and $240,000$ ($213,000$ - $271,000$) ug/L, respectively (Table 6).

Isopropalin

Flow-through - Fathead minnows, 30 ± 2 days old (mean standard length, 16 ± 2 mm; mean weight, 0.050 ± 0.020 g) were exposed at the UW-S campus laboratory to five concentrations (98 ± 41 , 190 ± 50 , 300 ± 80 , 530 ± 110 , and 1150 ± 110 ug/L) of isopropalin, plus controls in duplicate. Deaths began occurring within 18 hours of the initial exposure, with 95% mortality in the highest (1150 ug/L), 90% in the second highest (530 ug/L), 60% in the third highest (300 ug/L), 20% in the fourth highest (190 ug/L) and 30% in the lowest (98 ug/L) exposure at 96 hours (Table 44). The 96-hr LC50 estimate and its 95% confidence limits were 270 (220 - 330 ug/L). There were no mortalities in the controls at 96 hours.

Static - Fathead minnows, 30 ± 2 days old (mean standard length, 18 ± 3 mm; mean weight, 0.082 ± 0.034 g) were exposed to five nominal concentrations (190, 375, 750, 1500, and 3000 ug/L) of isopropalin, plus controls in duplicate. Concentrations at 0 hr were 244 ± 14 , 424 ± 11 , 803 ± 14 , 1580 ± 70 and 3050 ± 0 ug/L. Concentrations for all hours were 131 ± 130 , 260 ± 200 , 299 ± 318 , 677 ± 713 and 1480 ± 1090 ug/L. Deaths began occurring within 20 hours of the initial exposure, with 100% mortality in the highest (1480 ug/L), 95% in the second highest (677 ug/L), 75% in the third highest (299 ug/L) and 10% in the fourth highest (260 ug/L) concentration at 96 hours (Table 45). There were no mortalities in the lowest exposure or the controls. The 96 hr LC50 estimate and its 95% confidence limits based on the nominal concentrations were 610 (510-730) ug/L. The 96-hr LC50 estimate and its confidence limits based on 0-hr and all concentrations were 670 (560-790) ug/L and 310 (280-360) ug/L, respectively (Table 6).

Static renewal - D. magna, <24 hr old neonates were exposed at the UW-S campus to five concentrations (19 ± 0 , 32 ± 11 , 51 ± 24 , 164 ± 128 , and 414 ± 135 ug/L) of isopropalin, plus controls in quadruplicate. Deaths began occurring within 24 hours of the initial exposure, with 100% mortality in the highest (414 ug/L), 80% in the second highest (164 ug/L), 95% in the third highest (51 ug/L), 50% in the fourth highest (51 ug/L) and 5% in the lowest (19 ug/L) exposure at 48 hours (Table 46). There were no mortalities in the controls. The 48-hr EC50 estimate and its 95% confidence limits were 30 (22-40) ug/L (Table 4).

Oxychlordan

Flow-through - Fathead minnows, 30 ± 2 days old (mean standard length, 16 ± 2 mm; mean weight, 0.048 ± 0.014 g) were exposed at the UW-S campus

laboratory to five concentrations (0.26 ± 0.15 , 0.58 ± 0.19 , 0.93 ± 0.20 , 1.69 ± 0.44 , and 3.41 ± 0.66 ug/L) of oxychlordan, plus controls in duplicate. Deaths began occurring within 24 hours of the initial exposure with 95% mortality in the highest (3.42 ± 0.66 ug/L) at 96-hours (Table 47). No deaths occurred in any of the other exposures or controls. The 96-hr LC50 estimate was 2.45 ug/L (Table 6). Confidence limits could not be determined due to no partial mortalities.

Static - Fathead minnows, 30 ± 2 days old (mean standard length, 15 ± 2 mm; mean weight, 0.043 ± 0.026 g) were exposed to five nominal concentrations (0.88, 1.75, 3.5, 7, and 14 ug/L) of oxychlordan, plus controls in duplicate. Concentrations at 0-hr were 1.10 ± 0 , 2.38 ± 0.18 , 5.28 ± 0.07 , 10.09 ± 0.36 and 21.30 ± 0.58 ug/L. Concentrations for all hours were 0.52 ± 0.49 , 0.96 ± 1.12 , 1.64 ± 1.98 , 6.10 ± 4.62 , 11.82 ± 7.46 ug/L. Deaths began occurring within 24 hours of the initial exposure, with 100% mortality in the highest (11.82 ug/L), 100% in the second highest (6.10 ± 4.62 ug/L) and 20% in the third highest (1.64 ± 1.98 ug/L) exposures at 96 hours (Table 48). There were no mortalities in the two lowest exposures, 0.52 ± 0.49 ug/L and 0.96 ± 1.12 ug/L, or in the controls. The 96-hr LC50 estimate and its 95% confidence limits based on the nominal concentrations were 4.31 (3.81-4.88) ug/L. The 96-hr LC50 estimate and its confidence limits based on 0-hr and all concentrations were 6.32 (5.55-7.19) ug/L and 2.63 (2.23-3.10) ug/L, respectively (Table 6).

Static renewal - D. magna, <24 hr old neonates were exposed at the UW-S campus to five concentrations (340 ± 340 , 710 ± 770 , 1500 ± 1600 , 2400 ± 2600 and 5200 ± 5800 ug/L) of oxychlordan, plus controls in quadruplicate. Deaths began occurring within 48 hr of the initial exposure with 95% mortality in the highest (5200 ug/L), 60% in the second highest (2400 ug/L), 60% in the third

highest (1500 ug/L), 30% in the fourth highest (710 ug/L) and 20% in the lowest (340 ug/L) exposure at 48 hours (Table 49). There was 10% mortality in the controls. The 48-hr EC50 estimate and its 95% confidence limits were 1300 (860-1960) ug/L (Table 6).

Pentachloroanisole

Flow-through - Fathead minnows, 30 ± 4 days old (mean standard length, 17 ± 2 mm; mean weight, 0.071 ± 0.024 g) were exposed at the UW-S campus laboratory to five concentrations (30 ± 20 , 80 ± 30 , 150 ± 60 , 360 ± 120 , and 830 ± 210 ug/L) of pentachloroanisole, plus controls in duplicate. Deaths began occurring within 72 hours of the initial exposure with 65% mortality in the highest (830 ug/L) and 15% in the second highest (360 ug/L) exposure at 96 hours (Table 50). No deaths occurred in any of the other exposures or controls. The 96-hr LC50 estimate and its 95% confidence limits were 650 (500-840) ug/L. The test was conducted at 10 times solubility using a nominal concentration of 500 mg/L acetone.

Static - Fathead minnows, 30 ± 4 days old (mean standard length, 17 ± 2 mm; mean weight, 0.065 ± 0.042 g) were exposed to three nominal concentrations (375, 750, 1500 ug/L) of pentachloroanisole, plus controls in duplicate. Concentrations at 0 hr were 290 ± 10 , 570 ± 0 and 1190 ± 0 ug/L. Concentrations for all hours were 78 ± 115 , 210 ± 280 , 330 ± 450 ug/L. Deaths began occurring within 72 hours of the initial exposure with 40% mortality in the highest (330 ug/L) (Table 51). No deaths occurred in the remaining exposures or controls. The 96-hr LC50 estimate and its 95% confidence limits cannot be calculated because not enough deaths occurred but would be greater than 1190 ug/L (Table 6). The test was conducted at 10 times solubility using a 500 mg/L acetone carrier.

Static renewal - D. magna, <24 hr old neonates were exposed at the UW-S campus to five concentrations (30 ± 20 , 80 ± 70 , 120 ± 120 , 280 ± 250 and 530 ± 440 ug/L) of pentachloroanisole, plus controls in quadruplicate. Deaths began occurring within 48 hours of the initial exposure with 95% mortality in the highest (530 ug/L), 95% in the second highest (280 ug/L), 5% in the third highest (120 ug/L) and 5% in the lowest (30 ug/L) exposure at 48 hours (Table 52). There were no mortalities in the fourth highest (80 ug/L) exposure or the control. The 48-hr EC50 estimate and its 95% confidence limits were 180 ($170-200$) ug/L (Table 6). The test was conducted using a nominal concentration of 500 mg/L acetone in the high exposure and control.

Propoxur (bagon)

Static renewal - D. magna, <24 hr old neonates were exposed at the UW-S campus to five concentrations (12.3 ± 2.2 , 21.8 ± 0.6 , 51.9 ± 2.2 , 99.8 ± 6.1 , and 195.2 ± 16.8 ug/L) of propoxur, plus controls in quadruplicate. Deaths began occurring within 24 hours of the initial exposure with 100% mortality in the three highest (195.2 , 99.8 and 51.9 ug/L) exposures. Mortalities of 30% and 25% occurred in the two lowest exposures (21.8 and 12.3 ug/L) (Table 53). There was a 10% mortality in the controls. The 48-hr EC50 estimate and its 95% confidence limits were 27.2 ($20.9-36.5$) ug/L (Table 6).

Chronic 21-day - D. magna <24-hr old neonates were exposed for 21 days at the UW-S campus test facility to five concentrations (0.9 ± 0.4 , 2.2 ± 0.9 , 5.0 ± 2.5 , 9.5 ± 2.7 , and 18.0 ± 5.0 ug/L) of propoxur, plus controls. Ten replicates with one organism per replicate were used for each exposure and control. Percentage survival of daphnids and number young produced at the termination of exposure was not significantly different from the controls at concentrations ≤ 17.2 ug/L (Table 54). The "no-effect" concentration range

for D. magna exposed to propoxur was between 17.2 ug/L and the 48-hr EC50 of 27.2 ug/L (Table 6).

Annelid static renewal - Adult annelids (Lumbriculus variegatus), were exposed at the UW-S campus to five concentrations (13,070 ± 600, 26,180 ± 950, 52,490 ± 1440, 103,110 ± 2390 and 205,710 ± 10,170 ug/L) of propoxur, plus controls in duplicate. Deaths began occurring within 24 hours of the initial exposure with 100% mortality in the highest (205,710 ug/L) exposure at 96 hours (Table 55). There were no mortalities in the four remaining exposures or controls. The 96-hr LC50 estimate was 146,000 ug/L. Confidence limits could not be determined due to no partial mortality.

Tetrabromobisphenol A

Flow-through - Fathead minnows, 26 ± 2 days old (mean standard length, 17 ± 3 mm; mean weight, 0.076 ± 0.032 g) were exposed at the UW-S campus laboratory to five concentrations (250 ± 30, 510 ± 70, 750 ± 100, 1370 ± 230, and 2340 ± 0 ug/L) of tetrabromobisphenol A, plus controls in duplicate. Deaths began occurring within 18 hours of the initial exposure with 100% mortality in the highest (2340 ug/L) and 95% in the second highest (1370 ug/L) exposure at 96 hours (Table 56). No deaths occurred in any of the other exposures or controls. The 96-hr LC50 estimate and its 95% confidence limits were 1040 (990 ± 1100) ug/L (Table 6).

Static - Fathead minnows, 30 ± 2 days old (mean standard length, 19 ± 2 mm; mean weight, 0.093 ± 0.035 g) were exposed to five nominal concentrations (125, 250, 500, 1000, and 2000 ug/L) of tetrabromobisphenol A, plus controls in duplicate. Concentrations at 0 hr were 260 ± 0, 380 ± 30, 680 ± 0, 1170 ± 140 and 2150 ± 140 ug/L. Concentrations for all hours were 150 ± 70, 340 ± 40, 380 ± 190, 950 ± 190 and 2040 ± 200 ug/L. Deaths began occurring with 16

hours of the initial exposure with 100% mortality in the two highest (2040 and 950 ug/L) exposures (Table 57). There were no mortalities in the remaining three exposures or controls. The 96-hr LC50 estimate based on the nominal concentrations was 710 ug/L. The 96-hr LC50 estimate and its confidence limits based on 0-hr and all concentrations were 890 ug/L and 600 ug/L, respectively (Table 6). The 95% confidence limits could not be determined due to no partial mortality.

Static renewal - D. magna, <24-hr old neonates were exposed at the UW-S campus to five concentrations (1400 ± 100 , 2300 ± 200 , 4300 ± 300 , 9300 ± 600 and $18,800 \pm 2400$ ug/L) of tetrabromobisphenol A, plus controls in quadruplicate. Deaths began occurring within 24 hours of the initial exposure with 100% mortality in the highest (18,800 ug/L) and 70% in the second highest (9300 ug/L) exposure at 48 hours (Table 58). There were no mortalities in the three remaining exposures or controls. The 48-hr EC50 estimate and its 95% confidence limits were 7900 (6800-9200) ug/L. Stock solutions had to be made with hard reconstituted water for all three tests. The hard reconstituted water raised the solubility of the compound tetrabromobisphenol A.

1.2.4.5-Tetrachlorobenzene

Flow-through - Fathead minnows, 30 ± 5 days old (mean standard length, 15 ± 1 mm; mean weight, 0.045 ± 0.016 g) were exposed at the UW-S campus laboratory to five concentrations (42 ± 11 , 86 ± 9 , 140 ± 10 , 220 ± 25 , and 380 ± 40 ug/L) of 1,2,4,5-tetrachlorobenzene, plus controls in duplicate. Deaths began occurring within 17 hours of the initial exposure with 75% mortality in the highest (380 ug/L) at 96 hours (Table 59). No deaths occurred in any of the other exposures or controls. The 96-hr LC50 estimate was 320 ug/L (Table 6). The 95% confidence limits could not be determined.

Static - Fathead minnows, 30 ± 5 days old (mean standard length, 13 ± 2 mm; mean weight, 0.040 ± 0.022 g) were exposed to five nominal concentrations (29, 58, 115, 230, and 460 ug/L) of 1,2,4,5-tetrachlorobenzene, plus controls in duplicate. Concentrations at 0-hr were 15 ± 1 , 37 ± 3 , 81 ± 1 , 167 ± 7 , and 320 ± 7 ug/L. Concentrations for all hours were 7 ± 6 , 13 ± 15 , 27 ± 30 , 68 ± 78 , and 89 ± 120 ug/L (Table 60). There were no mortalities in any of the exposures or controls. The 96-hr LC50 estimate could not be calculated because 50% or greater mortality did not occur. The 96-hr LC50 estimate would be greater than >89 ug/L based on all hours (Table 6).

1,2,3-Trichloropropane

Flow-through - Fathead minnows, 30 ± 4 days old (mean standard length, 14 ± 2 mm; mean weight, 0.032 ± 0.020 g) were exposed at the UW-S campus laboratory to five concentrations (4170 ± 490 , $10,900 \pm 960$, $20,100 \pm 2210$, $36,900 \pm 6060$, and $65,560 \pm 6580$ ug/L) of 1,2,3-trichloropropane, plus controls in duplicate. Deaths began occurring within 1 hour of the initial exposure and continued throughout the test period with 90% mortality in the highest ($65,560$ ug/L) at 96 hours (Table 61). No other deaths occurred in any of the other exposures or controls although fish in the second highest ($36,900$ ug/L) were lying on the bottom of the chamber at 96 hours. The 96-hr LC50 estimate was $50,800$ ug/L, due to no partial mortalities; the 95% confidence limits could not be determined.

Static - Fathead minnows, 30 ± 4 days old (mean standard length, 13 ± 2 mm; mean weight, 0.026 ± 0.015 g) were exposed at the UW-S campus laboratory to five nominal concentrations (6,100, 12,200, 24,400, 48,800, and 97,500 ug/L) of 1,2,3-trichloropropane, plus controls in duplicate. Concentrations at 0-hr were 4940 ± 360 , $10,440 \pm 1020$, $18,580 \pm 410$, $41,100 \pm 950$ and $78,700$

± 1860 ug/L. Concentrations of daily measurements were 2450 ± 2370 , 4510 ± 4710 , 7570 ± 6310 , $17,100 \pm 16,760$ and $42,310 \pm 29,940$ ug/L. Deaths began occurring within 3 hours of the initial exposure. No other mortalities occurred after 3 hours of exposure with 95% mortality in the highest exposure at 96-hr (Table 62). The 96-hr LC50 estimate and 95% confidence limits based on nominal concentrations were 69,900 (67,100-72,900) ug/L (Table 4). The 96-hr LC50 estimate and its 95% confidence limits based on 0-hr and all concentrations were 57,600 (55,400-59,900) ug/L and 27,400 (25,900-28,900) ug/L, respectively (Table 6). No control mortalities occurred.

Static renewal - D. magna, <24-hr neonates were exposed at the UW-S campus laboratory to five concentrations ($8,600 \pm 8,800$, $16,100 \pm 15,400$, $33,500 \pm 28,600$, $72,900 \pm 51,900$ and $118,400 \pm 82,100$ ug/L) of 1,2,3-trichloropropane, plus controls in quadruplicate. Deaths began occurring within 24 hours of the initial exposure with 100% mortality in the highest ($118,400$ ug/L), 90% in the second highest ($72,900$ ug/L), 55% in the third highest ($33,500$ ug/L) and 5% in the fourth highest ($16,100$ ug/L) exposure at 48 hours (Table 63). No other deaths occurred in any of the exposures or control. The 48-hr EC50 estimate and its 95% confidence limits were 33,800 (27,800-41,100) ug/L (Table 6).

Table 1. Chemical Names, Chemical Abstracts Service (CAS) Numbers, Suppliers, Lot Numbers, and Some Physical and Chemical Properties of Test Compounds.

Chemical Name (CAS Number)	Supplier	Lot Number	Purity (%)	Molecular Weight	Density (g/cm ³)	Melting Point (C)	Boiling Point (C)
Atrazine (1912-24-9)	Chem Ser. Inc.	25-132 25-142C	98.5 99.5	215.68	1.187	171-174	-
Biphenyl (92-52-4)	Aldrich Chem Co.	04207MV	99	154.21	1.041	69-71	254-255
Butachlor (23184-66-9)	Chem Ser. Inc.	34-96D	97.7	311.86	1.070	-	-
Carbaryl (63-25-2)	Chem Ser. Inc.	34-49A	98	201.22	1.232	142-145	-
Carbazole (86-74-8)	Aldrich Chem. Co.	09431CW	98.9	167.21	1.10	245	355
Dibenzofuran (132-64-9)	Aldrich Chem. Co.	LV06511TT	99+	168.18	1.0886	86-87	287
3,3'-Dichloro- benzidine (91-94-1)	Chem Ser. Inc.	35-14	98.0	253.13	-	132-133	-
Dichlorovos (62-73-7)	Chem Ser. Inc.	17-114H	99.0	220.98	1.415	-	-
1,2-Epoxyethyl- benzene (96-09-3)	Aldrich Chem. Co.	07326JV	97.0	120.15	1.054	-37	194
Isophorone (78-59-1)	Aldrich Chem. Co.	01314HM	98.0	138.21	0.923	-8	213-214

Table 1 Cont. Chemical Names, Chemical Abstracts Service (CAS) Numbers, Suppliers, Lot Numbers, and Some Physical and Chemical Properties of Test Compounds.

Chemical Name (CAS Number)	Supplier	Lot Number	Purity (%)	Molecular Weight	Density (g/cm ³)	Melting Point (C)	Boiling Point (C)
Isopropalin (33820-53-0)	Chem Ser. Inc.	27-35A	98.0	98.02	-	-	-
Oxychlorthane (27304-13-8)	EPA Ref. Std.	J04G	99.9	423.80	-	-	-
Pentachloroanisole (1825-21-4)	EPA Ref. Std.	905A	100.0	280.35	-	-	-
Propoxur (114-26-1)	Chem Ser. Inc.	35-29	99.0	209.24	-	91.5	Decomposes
Tetrabromobis- phenol A (79-94-7)	Chem Ser. Inc.	41-93A	97.7	543.90	-	179-182	-
1,2,4,5-Tetra- chlorobenzene (95-94-3)	Aldrich Chem. Co.	00411PM	98.0	215.89	-	139-142	240-246
1,2,3-Trichloro- propane (96-18-4)	Aldrich Chem. Co.	01610CT	99+	147.43	1.387	-14	156

TABLE 2. HPLC Gradient Profiles for Carbamate Analyses.

Time min	PROPOXUR GRADIENT			CARBARYL GRADIENT				
	Flow mL/min	% CH ₃ CN	% DIW	Time min	Flow mL/min	% CH ₃ CN	% DIW	Curve
0	1	0	100	0	1	0	100	*
2	1	0	100	2	1	0	100	6
4	2	40	60	3	2	26	74	2
7.5	2	40	60	5	2	26	74	6
9	2	0	100	6	2.5	36	64	2
12.5	2	0	100	9.5	2.5	36	64	6
13	1	0	100	10	2.7	100	0	4
				12.5	3	100	0	6
				14	3	0	100	5
				16.5	2.5	0	100	8
				17	1	0	100	5

CH₃CN = Acetonitrile

DIW = Milli-Q water

Curve = Curve number from Waters Automated Gradient Controller indicating how the percentage of CH₃CN and flow rate change with time.

TABLE 3. Analytical Conditions Used in the Analysis of Test Chemicals by HPLC.

Chemical	Test Type	Stock Solvent	Mobile Phase CH ₃ CN/DIW	Wave Length (nm)	Detection Limit (ug/L)	Duplicate Agreement (%)	Recovery (%)
Atrazine	All tests	methanol	70:30	263	500	98.8±0.9 n=15	100.5±6.3 n=15
Biphenyl	Fathead minnow acute	acetonitrile	90:10	254	10	96.7±3.5 n=9	97.3±4.2 n=8
Carbaryl	Daphnid acute	acetone	See Table 3	222	1.0	97.0±0.4 n=12	100.4±5.3 n=35
	Daphnid chronic		See Table 3	222	0.5	94.9±4.2 n=12	110.2±21.7 n=35
Carbazole	Fathead minnow acute	acetonitrile	90:10	248	40	96.8±2.8 n=8	88.4±2.8 n=8
	Daphnid acute					97.6±2.6 n=4	89.3±19.2 n=4
Dibenzofuran	Fathead minnow acute	acetonitrile	90:10	248	20	96.7±4.8 n=8	92.3±3.8 n=9
3,3'-Dichloro-benzidine	Fathead minnow acute	acetone	75:25	275	20	98.2±1.3 n=7	120.3±31.6 n=7
	Daphnid acute					98.3±1.2 n=3	102.4±6.4 n=3
Propoxur	Annelid acute	acetone	60:40	220	300	99.6±0.3 n=9	95.7±10.1 n=8
	All daphnid		See Table 3	270	1.1	89.2±9.6 n=12	101.5±7.8 n=16

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TABLE 4. Analytical Conditions Used in the Analysis of Test Chemicals by GC.

Chemical Test Organism and Type	Extraction Ratio*	Oven Temp (C)	Detection Limit (ug/L)	Duplicate Agreement (%)	Recovery (%)
Butachlor					
Fathead minnow acute	5:20	240	20	95.3±4.3 n=9	95.7±8.0 n=9
Daphnid acute	5:10	240	20	97.3±0.0 n=1	96.4±13 n=2
Dichlorovos					
Fathead minnow acute	5:100	130	93	97.7±1.2 n=5	89.2±13 n=8
Fathead minnow chronic	5:200	130	46.5	97.0±2.1 n=2	88.5±16 n=12
Daphnid acute	5:50	130	0.035	80.0±12 n=2	73.9±4.2 n=2
Daphnid chronic	5:100	110	0.070	89.9±6.7 n=7	93.3±6.7 n=6
Snail acute	5:100	110	0.070	96.0±3.2 n=5	105.1±8.9 n=5
Annelid acute	5:100	130	93	86.8±21 n=5	90.7±17 n=5
1,2-Epoxyethylbenzene					
Fathead minnow acute	5:20	80	500	97.6±2.2 n=9	90.6±2.8 n=10
Daphnid acute	5:10	80	250	90.4±17 n=4	93.5±3.6 n=4
Isophorone					
Fathead minnow acute	5:10	130	3980	98.3±1.4 n=10	91.8±7.0 n=10

TABLE 4 Cont. Analytical Conditions Used in the Analysis of Test Chemicals by GC.

Chemical Test Organism and Type	Extraction Ratio ^a	Oven Temp (C)	Detection Limit (ug/L)	Duplicate Agreement (%)	Recovery (%)
Isophorone Fathead minnow acute	5:50	220	36	94.2±7.3 n=9	97.8±8.0 n=10
Daphnid acute	5:10	220	7.2	88.8±16 n=4	94.9±4.4 n=3
Oxychlorodane Fathead minnow acute	5:50	275	0.11	92.3±7.4 n=10	94.1±7.1 n=10
Daphnid acute	5:10	275	0.023	88.8±11 n=5	101.0±28 n=5
Pentachloroanisole Fathead minnow acute	5:100	200	10	93.3±8.2 n=8	94.4±10 n=7
Daphnid acute				97.6±0.6 n=2	122.8±7.9 n=3
Tetrabromobisphenol A Fathead minnow acute	5:200	285	150	94.2±2.2 n=10	100.5±6.9 n=10
Daphnid acute	5:50	285	75	93.7±3.2 n=7	90.3±10 n=7
1,2,4,5-Tetrachlorobenzene Fathead minnow acute	5:200	130	120	91.9±7.2 n=5	100.8±10 n=5

TABLE 4 Cont. Analytical Conditions Used in the Analysis of Test Chemicals by GC.

Chemical Test Organism and Type	Extraction Ratio ^a	Oven Temp (C)	Detection Limit (ug/L)	Duplicate Agreement (%)	Recovery (%)
1,2,3-Trichloropropane Fathead minnow acute	5:50	80	130	94.1±5.0 n=10	102.3±22 n=10
Daphnid acute	5:10	80	26	95.9±3.2 n=4	102.2±2.6 n=4

^a Ratio of organic solvent volume to water sample volume used to extract the chemical.

TABLE 5. Gas Chromatograph Settings and Parameters for Analysis of Test Compounds Used in Toxicity Studies.

Analytical Instrument	Injector Temp. (C)	Detector Temp. (C)	Carrier Gas Flow (mL/min)	Makeup Gas and Flow (mL/min)	Septum Purge Gas and Flow (mL/min)	Split Vent Gas and Flow (mL/min)	FID Air Flow (mL/min)	FID H ₂ Flow (mL/min)
Hewlett-Packard 5794A	250*	300	H ₂ 1-5	N ₂ 26-30	N ₂ 2-7	N ₂ 30-50	120-150	28-32
Hewlett-Packard 5880A	250	315	H ₂ 2.0	Ar/CH ₄ 40	Ar/CH ₄ 1.8	Ar/CH ₄ 7.5	-	-
Tracor 540	225	300	He 2.0	Ar/CH ₄ 31	Ar/CH ₄ 3.1	Ar/CH ₄ 57	-	-

* 300° C for Tetrabromobisphenol A.

TABLE 6. Summary of Toxicity.

<u>Compound</u>	<u>Test Organism</u>	<u>Stage or Age</u>	<u>Type of Test</u>	<u>96-H LC50 (95% CI) ug/L</u>
Atrazine	Stonefly (<u>Acroneuria</u> sp.)	nymphs	Flow-thru acute	6700 (5300-8400)
Atrazine	<u>Hyallolela azteca</u>	adults	Flow-thru acute	14700 (10400-20800)
Atrazine	Annelid (<u>Lumbriculus variegatus</u>)	adults	Flow-thru acute	>37100
Atrazine	Snail (<u>Physella virgata</u>)	adults	Static renewal 96-hr acute	>34100
Atrazine	<u>Hydra americana</u>	adults	Static renewal 96-hr acute	3000 ^f
Biphenyl	Fathead minnow	30 ± 5 day	Flow-thru acute	1950 (1650-2290)
Biphenyl	Fathead minnow	30 ± 5 day	Static acute ¹	3500 (2990-4090)
Biphenyl	Fathead minnow	30 ± 5 day	Static acute ²	2940 (2500-3440)
Biphenyl	Fathead minnow	30 ± 5 day	Static acute ³	1450 (1170-1810)
Butachlor	Fathead minnow	30 ± 2 day	Flow-thru acute	280 (230-330)
Butachlor	Fathead minnow	30 ± 2 day	Static acute ¹	750 (610-920)
Butachlor	Fathead minnow	30 ± 2 day	Static acute ²	750 (620-900)
Butachlor	Fathead minnow	30 ± 2 day	Static acute ³	640 (530-790)
Butachlor	<u>D. magna</u>	<24-hr	Static renewal	1050 (750-1430)
Carbaryl	<u>C. dubia</u>	<24-hr	Static renewal 48-hr acute	3.06 ^b (2.44-3.83)

TABLE 6 Cont. Summary of Toxicity.

Compound	Test Organism	Stage or Age	Type of Test	96-H LC50 (95% CI) ug/L
Carbaryl	<u>D. magna</u>	<24-hr	Static renewal 48-hr acute	10.1 ^b (7.95-12.8)
Carbaryl	<u>D. magna</u>	<24-hr	21-day chronic	- ^d
Carbazole	Fathead minnow	30 ± 5 day	Flow-thru acute	930 ^a
Carbazole	Fathead minnow	30 ± 4 day	Static acute ¹	<1500
Carbazole	Fathead minnow	30 ± 4 day	Static acute ²	<1490
Carbazole	Fathead minnow	30 ± 4 day	Static acute ³	<1140
Carbazole	<u>D. magna</u>	<24-hr	Static renewal 48- hr acute	3350 ^b (2300-4880)
Dibenzofuran	Fathead minnow	30 ± 5 day	Flow-thru acute	1050 (840-1310)
Dibenzofuran	Fathead minnow	30 ± 5 day	Static acute ¹	3620 (3200-4100)
Dibenzofuran	Fathead minnow	30 ± 2 day	Static acute ²	3020 750 (2670-3430)
Dibenzofuran	Fathead minnow	30 ± 5 day	Static acute ³	1140 (1040-1250)
3,3'-Dichloro- benzene	Fathead minnow	30 ± 4 day	Static acute ¹ #1	3240 ^a
3,3'-Dichloro- benzene	Fathead minnow	30 ± 4 day	Static acute ² #1	2770 ^a
3,3'-Dichloro- benzene	Fathead minnow	30 ± 4 day	Static acute ³ #1	2080 ^a
3,3'-Dichloro- benzene	<u>D. magna</u>	<24-hr	Static renewal 48-hr acute	1050 (810-1360)

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Should be
3,3'-Dichlorobenzene

TABLE 6 Cont. Summary of Toxicity.

Compound	Test Organism	Stage or Age	Type of Test	96-H LC50 (95% CI) ug/L
3,3'-Dichloro- benzene	Fathead minnow	30 ± 2 day	Flow-thru acute	1770 (1640-1920)
3,3'-Dichloro- benzidine	Fathead minnow	30 ± 2 day	Static acute ¹ #2	2150 (1840-2500)
3,3'-Dichloro- benzidine	Fathead minnow	30 ± 2 day	Static acute ² #2	1880 (1610-2200)
3,3'-Dichloro- benzidine	Fathead minnow	30 ± 2 day	Static acute ³ #2	1050 (820-1340)
Dichlorovos	Annelids (<u>Lumbriculus variegatus</u>)	adults	Static renewal 96-hr acute	2180 (1960-2440)
Dichlorovos	Snail (<u>Chysella virgata</u>)	adults	Static renewal 96-hr acute	170 (140-200)
Dichlorovos	<u>C. dubia</u>	<24-hr	Static renewal 48-hr acute	0.149 ^b (0.127-0.175)
Dichlorovos	<u>D. magna</u>	<24-hr	Static renewal 48-hr acute	0.266 ^b (0.244-0.286)
Dichlorovos	<u>D. magna</u>	<24-hr	21-day chronic	>0.109 ^d
Dichlorovos	Fathead minnow	30 ± 4 day	Flow-thru acute	3090 (2570-3730)
Dichlorovos	Fathead minnow #1	<24-hr	28-day post hatch chronic flow-thru	- ^d
Dichlorovos	Fathead minnow #2	<24-hr	28-day post hatch chronic flow-thru	- ^d

Should be 3,3'-Dichlorobenzene

TABLE 6 Cont. Summary of Toxicity.

Compound	Test Organism	Stage or Age	Type of Test	96-H LC50 (95% CI) ug/L
1,2-Epoxyethyl- benzene (Styrene Oxide)	Fathead minnow	30 ± 5 day	Flow-thru acute	4540*
1,2-Epoxyethyl- benzene	Fathead minnow	30 ± 5 day	Static acute ¹	13800*
1,2-Epoxyethyl- benzene	Fathead minnow	30 ± 5 day	Static acute ²	26330*
1,2-Epoxyethyl- benzene	Fathead minnow	30 ± 5 day	Static acute ³ 4hr	10700*
1,2-Epoxyethyl- benzene	<u>D. magna</u>	<24-hr	Static renewal 48-hr acute	11600 ^b (10200-13100)
Isophorone	Fathead minnow	30 ± 5 day	Flow-thru acute	253000 (228000-280000)
Isophorone	Fathead minnow	30 ± 5 day	Static acute ¹	319000 (285000-356000)
Isophorone	Fathead minnow	30 ± 5 day	Static acute ²	275000 (246000-308000)
Isophorone	Fathead minnow	30 ± 2 day	Static acute ³	240000 (213000-271000)
Isophorone	Fathead minnow	30 ± 2 day	Flow-thru acute	270 (220- 330) 330
Isopropalin	Fathead minnow	30 ± 2 day	Static acute ¹	610 (510-730)
Isopropalin	Fathead minnow	30 ± 2 day	Static acute ²	670 (560-790)
Isopropalin	Fathead minnow	30 ± 2 day	Static acute ³	310 (280-360)
Isopropalin	<u>D. magna</u>	<24-hr	Acute renewal 48-hr acute	30 ^b (22-40)

TABLE 6 Cont. Summary of Toxicity.

Compound	Test Organism	Stage or Age	Type of Test	96-H LC50 (95% CI) ug/L
Oxychlordane	Fathead minnow	30 ± 2 day	Flow-thru acute	2.45 ^a
Oxychlordane	Fathead minnow	30 ± 2 day	Static acute ¹	4.31 (3.81-4.88)
Oxychlordane	Fathead minnow	30 ± 2 day	Static acute ²	6.32 (5.55-7.19)
Oxychlordane	Fathead minnow	30 ± 2 day	Static acute ³	2.63 (2.23-3.10)
Oxychlordane	<u>D. magna</u>	<24-hr	Static renewal 48-hr acute	1300 (860-1960)
Pentachloroanisole	Fathead minnow	30 ± 4 day	Flow-thru acute	650 (500-840)
Pentachloroanisole	Fathead minnow	30 ± 4 day	Static acute	>1190
Pentachloroanisole	<u>D. magna</u>	<24-hr	Static renewal 48-hr acute	180 ^b (170-200)
Propoxur (baygon)	Annelid	Adults	Static renewal 96-hr acute	146000 ^a
Propoxur	<u>D. magna</u>	<24-hr	Static renewal 48-hr acute	27.2 ^b (20.9-36.5)
Propoxur	<u>D. magna</u>	<24-hr	21-day chronic	>17.2 ^d
Tetrabromobis- phenol A	Fathead minnow	26 ± 2 day	Flow-thru acute	1040 (999-1100)
Tetrabromobis- phenol A	Fathead minnow	30 ± 2 day	Static acute ¹	710 ^a
Tetrabromobis- phenol A	Fathead minnow	30 ± 2 day	Static acute ²	890 ^a

TABLE 6 Cont. Summary of Toxicity.

Compound	Test Organism	Stage or Age	Type of Test	96-H LC50 (95% CI) ug/L
Tetrabromobis-phenol A	Fathead minnow	30 ± 2 day	Static acute ³	60 ^a
Tetrabromobis-phenol A	<u>D. magna</u>	<24 hr	Static renewal 48-hr acute	7900 ^b (6800 ⁹ -200)
1,2,4,5-Tetra-chlorobenzene	Fathead minnow	30 ± 5 day	Flow-thru acute	320 ^a
1,2,4,5-Tetra-chlorobenzene	Fathead minnow	30 ± 5 day	Static acute ¹	>460
1,2,4,5-Tetra-chlorobenzene	Fathead minnow	30 ± 5 day	Static acute ²	>320
1,2,4,5-Tetra-chlorobenzene	Fathead minnow	30 ± 5 day	Static acute	>89
1,2,3-Trichloro-propane	Fathead minnow	30 ± 4 day	Flow-thru acute	50800 ^a
1,2,3-Trichloro-propane	Fathead minnow	30 ± 4 day	Static acute ¹	69900 (67100-72900)
1,2,3-Trichloro-propane	Fathead minnow	30 ± 4 day	Static acute ²	57600 (55400-59900)
1,2,3-Trichloro-propane	Fathead minnow	30 ± 4 day	Static acute ³	27400 (25900-28900)
1,2,3-Trichloro-propane	<u>D. magna</u>	<24-hr	Static renewal 48-hr acute	33800 ^b (27800-41100)

^a Due to no partial mortalities, the 95% confidence intervals could not be determined.

^b 48-hr EC50.

^c 96-hr EC50.

^d NOEC.

¹ LC50 based on nominal concentrations.

² LC50 based on 0-hr concentrations.

³ LC50 based on all concentrations.

TABLE 7. Summary of Water Characteristics.

Compound	Organism and Type of Test	Temperature (C) x ± s.d. (range)	D.O. % Saturation x ± s.d. (range)	Total Hardness (mg/L as CaCO ₃) x ± s.d. (range)	Alkalinity (mg/L as CaCO ₃) x ± s.d. (range)	pH x ± s.d. (range)	Spec. Cond. (mhos/cm) x ± s.d. (range)
Atrazine	Snail	21.1±0.3 (20.4-21.3)	90.1±3.7 (85.0-95.2)	48.9±3.8 (43.9-51.9)	45.0±3.8 (40.0-48.0)	7.26±0.10 (7.15-7.45)	126±2 (125-130)
	Static renewal Acute	n=60	n=12	n=4	n=4	n=12	n=4
	Stonefly Flow-thru Acute	19.7±0.4 (19.0-21.0)	85.9±6.0 (73.0-93.4)	67.4±19.0 (47.9-89.8)	50.0±14.0 (36.0-64.0)	7.18±0.13 (6.99-7.34)	112±5 (105-115)
Hydra	Static renewal Acute	21.1±0.3 (20.4-21.3)	90.1±3.7 (85.0-95.2)	48.9±3.8 (43.9-51.9)	45.0±3.8 (40.0-48.0)	7.26±0.10 (7.15-7.45)	126±2 (125-130)
	n=60	n=12	n=4	n=4	n=4	n=12	n=4
	Annelid Flow-thru Acute	20.4±0.4 (19.6-21.3)	90.8±1.9 (87.7-94.4)	67.3±4.7 (63.8-73.8)	56.0±2.8 (52.0-58.0)	7.40±0.20 (7.10-7.65)	125±0 (125-125)
Hyallolela	Flow-thru Acute	19.7±0.4 (19.0-21.0)	85.9±6.0 (73.0-93.4)	67.4±19.3 (47.9-89.8)	50.0±14.0 (36.0-64.0)	7.18±0.13 (6.99-7.34)	112±5 (105-115)
	n=60	n=12	n=4	n=4	n=4	n=12	n=4
	Fathead minnow Flow-thru Acute	22.2±0.3 (21.4-22.8)	93.9±3.1 (87.2-98.8)	60.8±9.4 (47.0-68.0)	41.0±2.0 (40.0-44.0)	7.44±0.10 (7.27-7.57)	132±1 (132-134)
Biphenyl	Static Acute	21.9±0.9 (20.4-23.1)	71.5±25.5 (27.0-99.0)	69.0±2.0 (68.0-72.0)	49.5±5.5 (44.0-56.0)	7.19±0.22 (6.91-7.66)	134±4 (131-140)
	n=60	n=12	n=4	n=4	n=12	n=4	n=4
	Fathead minnow Flow-thru Acute	22.5±0.6 (21.5-23.5)	85.7±2.2 (82.6-88.8)	73.7±2.1 (71.9-75.8)	48.0±0.0 (48.0-48.0)	7.40±0.15 (7.10-7.60)	130±0 (130-130)
Butachlor	Static Acute	22.2±0.2 (21.9-23.0)	83.3±5.7 (74.2-90.8)	66.4±8.5 (59.9-79.8)	51.0±2.0 (48.0-52.0)	7.40±0.06 (7.30-7.50)	132±3 (130-135)
	n=60	n=12	n=4	n=4	n=12	n=4	n=4
	D. magna Static renewal Acute	20.6±0.3 (20.2-20.9)	91.7±2.3 (87.2-95.7)	171.8±5.4 (168.0-175.6)	94.0±2.8 (92.0-96.0)	8.18±0.02 (8.16-8.20)	500±0 (500-500)

TABLE 7 Cont. Summary of Water Characteristics.

Compound	Organism and Type of Test	Temperature (C) x ± s.d. (range)	D.O. % Saturation x ± s.d. (range)	Total Hardness (mg/L as CaCO ₃) x ± s.d. (range)	Alkalinity (mg/L as CaCO ₃) x ± s.d. (range)	pH x ± s.d. (range)	Spec. Cond. (mhos/cm) x ± s.d. (range)
Carbaryl	<u>D. magna</u> Static renewal Acute	21.5±3.9 (21.7-22.1) n=16	94.9±6.5 (86.5-105.2) n=11	181.8±7.8 (171.0-192.0) n=12	107.6±8.4 (98.0-123.0) n=12	8.20±0.08 (7.50-8.40) n=12	500±0 (500-500) n=12
	<u>D. magna</u> Static renewal Chronic	21.4±0.7 (20.0-22.6) n=80	94.3±3.0 (89.8-98.4) n=35	201.5±42.0 (144.0-311.0) n=18	120.8±33.5 (86.0-208.0) n=20	8.21±0.17 (7.70-8.40) n=31	550±91 (500-750) n=7
	<u>C. dubia</u> Static renewal	21.5±0.1 (21.3-21.6) n=8	99.5±2.0 (96.0-101.5) n=8	169.0±6.0 (162.0-179.0) n=8	88.0±3.0 (94.0-84.0) n=8	8.20±0.05 (7.80-8.60) n=7	700±0 (700-700) n=8
Carbazole	Fathead minnow Flow-thru Acute	23.2±1.0 (21.0-24.4) n=60	78.1±4.5 (68.9-83.2) n=12	48.9±1.2 (47.9-49.9) n=4	42.5±0.6 (42.0-43.0) n=4	7.06±0.14 (6.84-7.35) n=12	135±0 (135-135) n=4
	Fathead minnow Static Acute	22.6±0.3 (22.0-23.0) n=48	75.6±8.0 (62.2-85.1) n=12	53.9±2.3 (51.9-55.9) n=4	44.0±0.8 (43.0-45.0) n=4	7.23±0.25 (6.82-7.51) n=12	140±0 (140-140) n=4
	<u>D. magna</u> Static renewal Acute	21.2±2.0 (21.0-21.4) n=21	96.1±4.6 (93.5-113.0) n=21	159.6±30.4 (113.0-200.0) n=14	102.3±10.8 (81.0-117.0) n=4	8.31±0.20 (8.10-8.60) n=4	not recorded
Dibenzofuran	Fathead minnow Flow-thru Acute	22.4±0.4 (21.7-23.4) n=60	101.4±2.5 (95.3-104.1) n=12	67.0±3.8 (64.0-72.0) n=4	48.0±0.0 (48.0-48.0) n=4	7.42±0.11 (7.24-7.53) n=11	138±4 (133-140) n=4
	Fathead minnow Static Acute	21.8±0.3 (21.3-22.3) n=60	94.4±2.6 (90.6-98.0) n=12	65.0±2.0 (64.0-68.0) n=4	54.0±5.2 (48.0-60.0) n=4	7.47±0.18 (7.21-7.68) n=12	147±2 (145-150) n=4
3,3'-Dichloro- benzidine	Fathead minnow Flow-thru Acute	21.5±0.35 (20.7-22.0) n=60	81.2±3.2 (74.3-85.4) n=12	50.9±1.2 (50.1-52.7) n=4	49.6±2.4 (46.4-51.2) n=4	6.83±0.21 (6.55-7.11) n=12	130±0 (130-130) n=4
	Fathead minnow Static Acute #1	22.0±0.2 (21.7-22.5) n=60	83.1±5.6 (73.7-88.5) n=12	51.6±0.5 (50.9-51.9) n=4	43.0±4.7 (36.0-46.0) n=4	7.24±0.33 (6.76-7.54) n=12	123±2 (122-125) n=4

TABLE 7 Cont. Summary of Water Characteristics.

Compound	Organism and Type of Test	Temperature (C) x ± s.d. (range)	D.O. % Saturation x ± s.d. (range)	Total Hardness (mg/L as CaCO ₃) x ± s.d. (range)	Alkalinity (mg/L as CaCO ₃) x ± s.d. (range)	pH x ± s.d. (range)	Spec. Cond. (µmhos/cm) x ± s.d. (range)
Dichlorovos	Fathead minnow Static Acute #2	22.3±0.2 (21.8-22.7) n=60	76.7±3.8 (67.3-84.0) n=12	49.0±0.8 (47.9-49.9) n=4	49.7±1.3 (48.4-51.2) n=4	6.67±0.08 (6.45-6.77) n=12	133±4 (130-138) n=4
	<u>D. magna</u> Static renewal Acute	22.3±0.2 (22.0-22.6) n=18	98.4±2.0 (94.8-100.8) n=12	170.0±8.0 (163.0-183.0) n=8	108.0±13.8 (88.0-131.0) n=8	8.43±0.07 (8.33-8.61) n=12	not recorded
	Annelid Static renewal Acute	21.8±0.43 (21.3-22.6) n=60	84.6±12.7 (60.5-94.4) n=12	51.9±0.0 (51.9-51.9) n=4	49.0±3.8 (44.0-52.0) n=4	7.45±0.41 (6.40-8.00) n=16	152±15 (130-160) n=4
	Snail Static renewal Acute	22.1±0.4 (21.6-22.8) n=72	85.2±12.0 (67.4-98.2) n=16	65.9±9.7 (51.9-79.8) n=6	56.0±7.0 (48.0-68.0) n=6	7.37±0.08 (7.20-7.50) n=16	130±0 (130-130) n=6
	<u>C. dubia</u> Static renewal Acute	20.4±0.1 (20.4-20.6) n=16	91.1±3.7 (88.5-97.4) n=12	183.0±3.0 (180.0-187.0) n=8	114.0±8.0 (99.0-121.0) n=8	8.34±0.04 (8.25-8.37) n=8	500±0 (500-500) n=8
	<u>D. magna</u> Static renewal Acute	21.5±0.2 (21.2-21.8) n=12	92.3±1.6 (89.6-94.9) n=16	181.0±7.1 (176.0-186.0) n=2	101.5±3.5 (99.0-104.0) n=2	8.32±0.10 (8.20-8.40) n=4	550±0 (550-550) n=4
	<u>D. magna</u> Renewal Chronic	21.5±0.6 (20.4-22.8) n=108	93.8±2.0 (89.7-97.4) n=36	194.0±27.0 (163.0-231.0) n=14	125.0±39.0 (94.8-214.0) n=14	8.27±0.12 (8.10-8.60) n=48	488±39 (425-575) n=21
	Fathead minnow Flow-thru Acute	22.4±0.7 (21.0-23.5) n=60	88.4±7.5 (75.0-98.4) n=12	62.0±2.3 (60.0-64.0) n=4	42.0±1.6 (40.0-44.0) n=4	7.39±0.09 (7.25-7.45) n=12	136±1 (135-138) n=4
	Fathead minnow Flow-thru Chronic	25.3±0.4 (21.8-28.3) n=792	80.4±8.1 (57.0-93.7) n=32	54.2±7.3 (38.9-68.0) n=24	41.9±5.3 (26.0-52.0) n=24	7.26±0.22 (6.98-7.61) n=44	149±6 (130-160) n=24
	Fathead minnow Flow-thru Chronic	24.5±0.3 (22.8-26.3) n=864	85.5±4.9 (69.7-94.0) n=4	54.3±5.6 (48.0-67.5) n=24	46.6±4.7 (42.0-64.0) n=24	7.14±0.19 (6.67-7.48) n=4	140±3 (132-146) n=20

TABLE 7 Cont. Summary of Water Characteristics.

Compound	Organism and Type of Test	Temperature (C) x ± s.d. (range) n	D.O. % Saturation x ± s.d. (range) n	Total Hardness (mg/L as CaCO ₃) x ± s.d. (range) n	Alkalinity (mg/L as CaCO ₃) x ± s.d. (range) n	pH x ± s.d. (range) n	Spec. Cond. (µmhos/cm) x ± s.d. (range) n
1,2-Epoxyethylbenzene (Styrene oxide)	Fathead minnow Flow-thru Acute	23.3±0.6 (22.5-24.8) n=60	85.5±5.0 (72.9-92.3) n=12	53.4±1.0 (51.9-53.9) n=4	40.5±1.0 (40.0-42.0) n=4	6.90±0.09 (6.75-7.04) n=12	120±0 (120-120) n=4
	Fathead minnow Static Acute	22.3±0.2 (22.0-22.6) n=60	59.4±3.6 (25.6-73.0) n=12	53.2±3.6 (49.9-57.9) n=4	38.0±6.8 (31.0-42.0) n=4	6.82±0.19 (6.53-7.12) n=12	120±1 (118-120) n=4
	D. magna Static renewal Acute	23.7±0.6 (23.0-24.5) n=17	86.2±7.8 (75.9-95.3) n=12	287.2±98.7 (168-437) n=4	174.2±60.7 (104-261) n=4	8.34±0.31 (7.67-8.63) n=10	not recorded
Isophorone	Fathead minnow Flow-thru Acute	21.7±0.3 (21.2-22.3) n=60	86.1±2.4 (82.9-91.5) n=12	67.5±8.14 (59.5-77.8) n=8	43.0±2.1 (40.0-44.8) n=4	7.10±0.05 (7.03-7.16) n=12	126±2 (125-28) n=4
	Fathead minnow Static	22.1±0.08 (21.9-22.3) n=60	86.4±2.6 (83.4-91.3) n=12	65.0±7.6 (54.8-72.8) n=4	45.1±3.0 (42.4-49.2) n=4	7.24±0.31 (6.81-7.66) n=12	138±5 (135-145) n=4
Isopropalin	Fathead minnow Flow-thru Acute	21.5±2.4 (20.7-22.3) n=60	76.7±11.9 (49.4-88.5) n=12	70.9±4.74 (65.9-75.8) n=4	44.2±10.1 (36.0-59.0) n=4	7.31±0.19 (7.02-7.57) n=12	130±0 (130-130) n=4
	Fathead minnow Static Acute	21.4±1.2 (20.0-24.3) n=60	73.8±12.0 (51.5-90.4) n=12	64.4±3.41 (59.9-68.0) n=4	56.0±7.8 (40.0-64.0) n=4	7.11±0.37 (6.56-7.50) n=12	144±3 (140-148) n=4
Oxychloridane	D. magna Static renewal Acute	22.4±0.3 (22.2-23.0) n=18	91.9±3.6 (85.9-95.3) n=6	171.5±16.5 (149.0-196.0) n=12	116.8±9.1 (101.0-133.0) n=12	8.25±0.10 (8.10-8.40) n=6	not recorded
	Fathead minnow Flow-thru Acute	21.6±0.29 (21.1-22.3) n=60	93.4±2.6 (90.4-97.5) n=12	75.8±15.7 (59.8-95.8) n=4	47.5±1.9 (46.0-50.0) n=4	7.56±0.14 (7.36-7.80) n=12	121.1±2.5 (120-125) n=4
	Fathead minnow Static Acute	21.6±0.14 (21.4-22.0) n=60	86.8±7.2 (75.7-95.3) n=12	61.8±4.3 (57.8-67.8) n=4	44.5±7.2 (34.0-50.0) n=4	7.47±0.10 (7.21-7.55) n=12	130±4 (125-135) n=4

TABLE 7 Cont. Summary of Water Characteristics.

Compound	Organism and Type of Test	Temperature (C) x ± s.d. (range)	D.O. % Saturation x ± s.d. (range)	Total Hardness (mg/L as CaCO ₃) x ± s.d. (range)	Alkalinity (mg/L as CaCO ₃) x ± s.d. (range)	pH x ± s.d. (range)	Spec. Cond. (mhos/cm) x ± s.d. (range)
Pentachloro-anisole	D. magna Static renewal Acute	21.4±0.1 (21.1-21.5) n=12	91.6±2.0 (88.5-95.8) n=16	170.0±4.0 (165.0-175.0) n=4	97.2±4.0 (93.0-102.0) n=4	8.04±0.19 (7.80-8.30) n=12	500±0 (500-500) n=4
	Fathead minnow Flow-thru Acute	20.9±0.4 (19.8-21.7) n=60	72.3±13.7 (50.2-85.8) n=12	36.0±11.2 (26.0-52.0) n=4	70.9±9.3 (61.9-83.8) n=4	7.24±0.20 (7.00-7.54) n=12	140±0 (140-140) n=4
	Fathead minnow Static Acute	22.7±1.0 (21.2-24.3) n=40	66.6±15.3 (50.6-85.4) n=12	44.0±8.6 (32.0-52.0) n=4	69.9±5.2 (63.9-75.8) n=4	7.10±0.19 (6.86-7.38) n=12	150±0 (150-150) n=4
	D. magna Static renewal Acute	21.9±0.2 (21.5-22.1) n=12	91.3±0.9 (90.0-92.6) n=8	202.0±22.2 (181.0-227.0) n=8	111.5±14.4 (97.0-128) n=8	8.15±0.04 (8.09-8.24) n=8	450±58 (400-500) n=4
	Annelid Static renewal Acute	22.6±0.5 (21.8-23.5) n=60	87.0±4.6 (81.8-91.2) n=12	84.0±14.2 (63.9-95.8) n=4	50.0±5.2 (44.0-56.0) n=4	7.60±0.09 (7.39-7.73) n=12	120±0 (120-120) n=4
	D. magna Static renewal Acute	21.0±0.2 (20.8-21.4) n=11	88.2±5.0 (81.1-94.6) n=15	105.0±9.9 (98.0-112.0) n=2	175.7±4.9 (172.0-179.0) n=2	8.55±0.21 (8.40-8.70) n=2	500±0 (500-500) n=4
Tetrabromo-bisphenol-A	D. magna Static renewal Chronic	20.0±2.0 (20.2-21.8) n=70	95.0±3.4 (89.0-101.7) n=32	207.1±25.5 (155.6-307.4) n=10	123.9±25.5 (140.4-155.6) n=9	8.31±0.16 (8.00-8.60) n=29	496±106 (410-725) n=7
	Fathead minnow Flow-thru Acute	21.8±0.6 (20.4-22.7) n=60	92.8±5.0 (87.8-100.0) n=12	63.8±2.9 (59.7-66.5) n=4	51.1±4.1 (46.2-55.8) n=4	7.42±0.19 (7.10-7.70) n=12	157±39 (120-225) n=8
	Fathead minnow Static Acute	22.0±1.1 (21.1-25.5) n=60	86.0±13.4 (73.6-105.2) n=12	57.9±6.9 (51.9-67.9) n=4	56.0±4.6 (52.0-60.0) n=4	7.53±0.33 (7.10-8.00) n=2	132±4 (130-140) n=12
	D. magna Static renewal Acute	21.3±0.3 (20.8-21.9) n=12	91.4±3.5 (86.3-95.3) n=12	184.6±6.0 (179.6-191.6) n=4	108.0±26.7 (80.0-144.0) n=4	8.02±0.08 (7.90-8.10) n=6	500±0 (500-500) n=8

TABLE 7 Cont. Summary of Water Characteristics.

Compound	Organism and Type of Test	Temperature (C) x ± s.d. (range)	D.O. % Saturation x ± s.d. (range)	Total Hardness (mg/L as CaCO ₃) x ± s.d. (range)	Alkalinity (mg/L as CaCO ₃) x ± s.d. (range)	pH x ± s.d. (range)	Spec. Cond. (mhos/cm) x ± s.d. (range)
1,2,4,5-Tetra-chlorobenzene	Fathead minnow Flow-thru Acute	22.4±0.7 (21.1-23.8) n=60	82.1±0.7 (55.4-90.3) n=12	54.5±4.1 (54.0-60.0) n=4	55.0±6.0 (48.0-60.0) n=4	7.28±0.21 (6.88-7.46) n=12	135±2 (135-138) n=4
	Fathead minnow Static Acute	22.0±0.2 (21.7-22.5) n=60	84.2±5.5 (74.1-88.8) n=12	65.5±5.5 (62.0-72.0) n=4	47.5±2.5 (44.0-50.0) n=4	7.50±0.25 (7.10-7.73) n=12	140±1 (140-142) n=4
1,2,3-Tri-chloropropane	Fathead minnow Flow-thru Acute	21.2±0.7 (19.9-22.1) n=60	89.4±1.5 (88.0-91.6) n=12	75.0±26.5 (52.0-113.2) n=4	46.0±5.6 (42.8-54.4) n=4	7.49±0.34 (6.68-7.74) n=12	120±1 (120-122) n=4
	Fathead minnow Static Acute	21.5±0.9 (20.3-23.4) n=60	82.2±6.1 (80.1-90.0) n=12	63.1±11.7 (52.8-79.9) n=4	42.6±11.5 (25.6-50.0) n=4	7.32±0.21 (7.05-7.69) n=12	130±5 (130-140) n=4
	D. magna Static renewal Acute	22.2±0.0 (22.0-22.2) n=18	92.6±0.2 (90.7-92.7) n=12	142.3±14.8 (125.0-176.0) n=12	96.2±8.9 (82.0-107.0) n=12	8.23±0.13 (8.00-8.40) n=12	348±23 (320-400) n=12

TABLE 8. Concentrations (ug/L) of Atrazine in the Snail (*Physella virgata*) 96 hr Static Renewal Exposure and Percent Mortality in Parenthesis.

Exposure Time (Hr)	Measured Concentrations				
	1,900	4,000	7,800	15,400	30,700
0	1,900	4,000	7,800	15,400	30,700
24	2,000 (0) ^a	4,100 (0)	8,300 (0)	16,800 (0)	33,400 (0)
48	2,200 (0)	4,400 (0)	9,000 (0)	17,900 (0)	35,600 (0)
72	2,200 (0)	4,500 (10)	9,000 (15)	18,200 (5)	35,800 (15)
96	2,100 (0)	4,700 (10)	9,600 (15)	19,200 (5)	37,700 (20)
% Spike Recovery	101.8±3.2				
Corrected ^b Concentration Mean ± (s.d.)	2,100 (100)	4,300 (300)	8,600 (600)	17,200 (1,200)	34,100 (2,200)
Nominal (ug/L)	2,400	4,800	9,500	19,000	38,000

^a Percent mortality of twenty organisms per treatment.

^b Means and standard deviation corrected for percent recovery of spiked samples.

TABLE 9. Concentrations ($\mu\text{g/L}$) of Atrazine in the Stonefly (*Acroneuria* sp.) 96 hr Flow-Through Exposure and Percent Affected in Parenthesis.

Exposure Time (Hr)	Measured Concentrations				
0	2,300	3,500	6,400/ 6,700	12,600/ 12,700	24,600/ 25,000
24	1,500 (0) ^a	2,000 (0)	4,900 (10)	10,000 (30)	18,300 (95)
48	2,100 (15)	3,600/ 3,900 (10)	8,600/ 8,100 (15)	14,900/ 16,700 (75)	28,300/ 28,300 (100)
72	2,200 (15)	4,000 (15)	8,200 (30)	13,600 (90)	25,000 (100)
96	760/ 700 (15)	1,100/ 1,200 (15)	2,300 (30) 2,300 (30)	4,500/ 4,800 (90)	9,350/ 9,900 (100)
% Spike Recovery	99.5 \pm 8.8				
Corrected ^b Concentration Mean \pm (s.d.)	1,800 (670)	2,900 (1,200)	6,000 (2,600)	11,400 (4,600)	21,000 (7,600)
Nominal ($\mu\text{g/L}$)	1,400	2,800	5,500	11,000	22,000

^a Percent mortality of twenty organisms per treatment.

^b Mean and standard deviation corrected for percent recovery of spike samples.

TABLE 10. Concentrations (ug/L) of Atrazine in the Hydra americana 96 hr Static Renewal Exposure and Percent Affected in Parenthesis.

Exposure Time (Hr)	Measured Concentrations				
0	1,900	4,000	7,800	15,400	30,700
24	2,200/ 1,900 (0) ^a	4,300/ 3,900 (100)	8,700/ 7,900 (100)	17,500/ 16,000 (100)	34,800/ 32,000 (100)
48	2,200 (0)	4,400 (100)	8,900/ 9,100 (100)	17,900 (100)	35,200/ 36,000 (100)
72	2,100/ 2,300 (0)	4,500 (100)	8,800/ 9,200 (100)	18,000/ 18,500 (100)	35,800/ 35,900 (100)
96	2,100 (0)	4,700 (100)	9,600 (100)	19,200 (100)	37,700 (100)
% Spike Recovery	101.8±3.2				
Corrected ^b Concentration Mean ± (s.d.)	2,100 (100)	4,300 (300)	8,600 (600)	17,200 (1,200)	34,000 (2,200)
Nominal (ug/L)	2,400	4,800	9,500	19,000	38,000

^a Percent affect of twenty organisms per treatment.

^b Mean and standard deviation corrected for percent recovery of spike samples.

TABLE 11. Concentrations ($\mu\text{g/L}$) of Atrazine in the Annelid (Lumbriculus variegatus) 96 hr Flow-Through Exposure and Percent Affected in Parenthesis.

Exposure Time (Hr)	Measured Concentrations				
0	7,500/ 7,600	11,500/ 11,400	17,400/ 18,000	23,400	36,900/ 37,300
24	6,200 (0) ^a	9,800 (0)	15,700 (0)	21,400 (0)	38,100 (100)
48	5,500/ 5,750 (6)	10,100/ 10,200 (0)	15,800/ 16,300 (100)	22,100/ 22,800 (100)	39,800/ 40,400 (100)
72	6,100 (0)	10,500 (0)	16,200 (0)	25,600 (100)	38,500 (100)
96	5,800/ 6,000 (0)	9,200 (0)	14,000/ 14,200 (0)	20,000 (100)	32,900/ 32,850 (100)
% Spike Recovery	100.1 \pm 7.0				
Corrected ^b Concentration Mean \pm (s.d.)	6,300 (800)	10,200 (4,800)	15,900 (9,500)	22,300 (1,900)	37,100 (2,200)
Nominal ($\mu\text{g/L}$)	2,400	4,800	9,500	19,000	38,000

^a Percent mortality of twenty organisms per treatment.

^b Mean and standard deviation corrected for percent recovery of spike samples.

TABLE 12. Concentrations (ug/L) of atrazine in the amphipod (*Hyallela azteca*) 96 hr Flow-Through Test and Percent Affected in Parenthesis.

Exposure Time (Hr)	Measured Concentrations				
0	2,250/ 2,300	3,500	6,400/ 6,700	12,600/ 12,700	24,600/ 25,000
24	1,500 (0) ^a	2,000 (0)	4,900 (15)	10,000 (0)	18,300 (15)
48	2,100/ 2,150 (0)	3,800/ 3,400 (0)	8,600/ 8,100 (20)	14,900/ 16,700 (20)	26,700/ 28,300 (40)
72	2,200 (10)	4,000 (10)	8,200 (30)	13,600 (20)	25,000 (60)
96	760/ 710 (10)	1,100/ 1,200 (20)	2,300 (35)	4,500/ 4,800 (20)	9,350/ 9,900 (75)
% Spike Recovery	99.5±8.8				
Corrected ^b Concentration Mean ± (s.d.)	1,800 (670)	2,900 (1,200)	6,000 (2,600)	11,400 (4,600)	21,000 (7,600)
Nominal (ug/L)	1,400	2,800	5,500	11,000	22,000

^a Percent mortality of twenty organisms per treatment.

^b Mean and standard deviation corrected for percent recovery of spike samples.

TABLE 13. Concentrations ($\mu\text{g/L}$) of Biphenyl in the Fathead Minnow (Pimephales promelas) 96 hr Flow-Through Test and Percent Mortality in Parenthesis.

Exposure Time (Hr)	Measured Concentrations				
0	128/ 154	436/ 382	884/ 1,100	2,028/ 2,124	3,656/ 3,978
24	170 (0) ^a	458 (0)	876 (0)	2,064 (40)	4,296 (100)
48	166/ 142 (0)	434/ 452 (0)	887/ 981 (0)	1,996/ 2,292 (50)	-
72	138 (0)	390 (0)	866 (0)	2,148 (50)	-
96	125/ 128 (0)	343/ 336 (0)	808/ 798 (0)	1,751/ 1,885 (55)	-
% Spike Recovery	97.3 \pm 4.5				
Corrected ^b Concentration Mean. \pm (s.d.)	150 (20)	420 (50)	930 (100)	2,090 (170)	4,090 (320)
Nominal ($\mu\text{g/L}$)	380	750	1,500	3000	6,000

^a Percent mortality of twenty organisms per treatment.

^b Means and standard deviation corrected for percent recovery of spiked samples.

TABLE 14. Concentrations (ug/L) of Biphenyl in the Fathead Minnow (Pimephales promelas) 96 hr Static Test and Percent Mortality in Parenthesis.

Exposure Time (Hr)	Measured Concentrations				
0	297/ 284	624/ 652	1,276/ 1,244	2,630/ 2,586	4,904/ 5,328
24	- (0) ^a	- (0)	720/ 652 (5)	- (30)	2,548/ 2,316 (100)
48	23/ 25 (0)	63/ 109 (0)	412/ 224 (5)	448/ 373 (30)	-
72	- (0)	- (0)	161/ 118 (5)	- (30)	-
96	- (0)	20/ 49 (0)	92/ 62 (5)	96/ 124 (30)	-
% Spike Recovery	97.3±6.3				
Corrected ^b Concentration Mean ± (s.d.)	120 (150)	260 (310)	510 (480)	1,070 (1,260)	3,880 (1,600)
Nominal (ug/L)	380	750	1,500	3,000	6,000

^a Percent mortality of twenty organisms per treatment.

^b Mean and standard deviation corrected for percent recovery of spiked samples.

TABLE 15. Concentrations ($\mu\text{g/L}$) of Butachlor in the Fathead Minnow (Pimephales promelas) 96 hr Flow-Through Exposure and Percent Mortality in Parenthesis.

Exposure Time (Hr)	Measured Concentrations				
0	250	420/ 415	830/ 780	1,500	2,800/ 3,000
24	200 (0) ^a	310 (0)	190 (0)	1,200 (55)	2,900 (100)
48	250/ 220 (0)	390/ 420 (5)	840/ 860 (60)	1,400/ 1,600 (95)	2,900/ 3,200 (100)
72	210 (0)	450 (55)	925 (100)	1,800 (100)	-
96	230/ 250 (35)	480 (85)	99/ 100 (100)	-	-
% Spike Recovery	95.0 \pm 8.9				
Corrected ^b Concentration Mean \pm (s.d.)	230 (20)	420 (50)	870 (100)	1,510 (190)	3,000 (150)
Nominal ($\mu\text{g/L}$)	190	380	750	1,500	3,000

^a Percent mortality of twenty organisms per treatment.

^b Mean and standard deviation corrected for percent recovery of spiked samples.

TABLE 16. Concentrations ($\mu\text{g/L}$) of Butachlor in the Fathead Minnow (Pimephales promelas) 96 hr Static Exposure and Percent Mortality in Parenthesis.

Exposure Time (Hr)	Measured Concentrations				
	310	620	1,250	2,500	5,000
0	290/ 320	690/ 605	1,200/ 1,100	2,300	4,600/ 4,700
24	- (0) ^a	- (5)	930/ 960 (10)	- (85)	4,400/ 4,550 (0)
48	230/ 235 (0)	640/ 520 (40)	960/ 1,030 (70)	2,300/ 2,200 (100)	4,600/ 4,900 (100)
72	- (0)	- (40)	1,030/ 960 (80)	-	-
96	150 (0)	540/ 470 (40)	850/ 930 (80)	-	-
% Spike Recovery	96.2 \pm 8.2				
Corrected ^b Concentration Mean \pm (s.d.)	230 (70)	570 (100)	990 (100)	2,300 (50)	4,620 (170)
Nominal ($\mu\text{g/L}$)	310	620	1,250	2,500	5,000

^a Percent mortality of twenty organisms per treatment.

^b Mean and standard deviation corrected for percent recovery of spiked samples.

TABLE 17. Concentrations of Butachlor with *Daphnia magna* in a 48-hr Static Renewal Test, Percent Organisms Affected in Parenthesis.

Exposure Time (Hr)	Measured Concentrations (ug/L)							
	Old ^a	New ^a	Old	New	Old	New		
0	-	500	-	1700	-	3900	-	7800
24	200	520(0) ^b	740	1400	2900	3400(10)	5600	7900(40)
48	200	- (0)	200	- (35)	1000	2100	(75) 5300	- (90)
% Recovery		96.4±12.9						
Corrected ^c mean ± (s.d.)	370 (180)	740 (380)	1500 (370)	3000 (800)	6900 (1440)			
Nominal (ug/L)	600	1200	2500	5000	10000			

a Old refers to solutions after 24 hr exposure; new refers to solutions prepared that day.

b Percent affected of twenty organisms per treatment.

c Mean and standard deviation corrected for percent recovery of spiked samples.

TABLE 18. Concentrations ($\mu\text{g/L}$) of Carbaryl with Daphnia magna in a 48-hr Static Renewal Test, Percent Organisms Affected in Parenthesis.

Exposure Time (Hr)	Measured Concentrations ($\mu\text{g/L}$)						
	Old	New	Old	New	Old	New	
0	-	5.7	-	10.7	-	40.9	92.3
24	3.2	4.9 (5) ^b	4.6	9.7 (0)	20.8	39.9 (70)	82.3 (90)
48	1.8	- (5)	3.8	- (40)	9.7	- (100)	41.8 - (100)
% Recovery	100.35±5.3						
Corrected ^c mean	3.9		7.2		29.8		65.2
± (s.d.)	(1.7)		(3.5)		(12.1)		(25.6)
Nominal ($\mu\text{g/L}$)	5	10	20	40	80		

a Old refers to solutions after 24 hr exposure; new refers to solutions prepared that day.

b Percent affected of twenty organisms per treatment.

c Mean and standard deviation corrected for percent recovery of spiked samples.

TABLE 19. Concentrations of Carbazole with *C. dubia* in a 48-hr Static Renewal Test, Percent Affected Organisms in Parenthesis.

Exposure Time (Hr)	Measured Concentrations (ug/)								
	Old ^b	New ^b	Old	New	Old	New	Old	New	
0	-	1.46	-	-	4.62	-	9.25	-	18.52
24	a	- (0) ^c	a	1.66 (0)	3.47 (5)	4.17	- (100)	10.38	- (100)
48	a	- (0)	a	- (5)	1.52	-	(50)		
% Recovery		92.2±16.9							
Corrected ^d mean ± (s.d.)		0.91 (0.45)		1.06 (0.64)		3.60 (1.41)		7.28 (3.90)	
Nominal (ug/L)	1.25		2.50		5.0		10.0		20.0

a Below detection limit (1.27 ug/L), one-half D.L. was used to determine the corrected concentration mean.
b Old refers to solutions after 24 hr exposure; new refers to solutions prepared that day.
c Percent affected of twenty organisms per treatment.
d Mean and standard deviation corrected for percent recovery of spiked samples.

TABLE 20. Concentrations of Carbaryl with Daphnia magna in a Static Renewal 21-day Exposure.

Exposure Time (Hr)	Measured Concentration ($\mu\text{g/L}$)					
	Old ^b	New ^b	Old	New	Old	New
0	-	a	-	0.86	-	1.86
2	a	a	a	0.79	0.58	1.79
4	a	a	a	0.61	a	1.74
7	a	a	-	0.86	a	2.07
9	a	0.76	-	1.31	0.89	2.44
11	a	a	-	1.27	a	3.30
14	a	a	-	a	a	0.90
16	a	a	a	0.58	a	1.32
18	a	0.63	a	1.00	a	2.37
21	a	-	a	-	a	-
% Recovery		110.2±21.7				
Corrected ^c mean						
± (s.d.)		0.29 (0.13)		0.58 (0.35)	1.07 (0.87)	2.16 (1.89)
Nominal ($\mu\text{g/L}$)	0.5		1.0		2.0	
					4.0	8.0
					0.74	
						3.72
						3.33
					a	3.67
					a	4.15
					0.61	5.24
					-	6.92
					a	2.70
					a	2.39
					a	3.28
					a	0.90
					a	0.74

^a Below detection limit (0.54 $\mu\text{g/L}$), one-half D.L. was used to determine the corrected mean.
^b Old refers to solutions after 48 hours exposure; new are solutions prepared that day.
^c Mean and standard deviations are corrected for percent recovery of spiked samples.

TABLE 21. Survival and Reproduction of *Daphnia magna* Exposed to Carbaryl for 21 Days.

	0	0.29+0.31	0.58+0.35	1.07+0.87	2.16+1.89	4.04+3.37
Percent survival	90	100	100	100	70	100
Mean number of young/surviving adult after 21 days	96	109	104	108	122	135

TABLE 22. Concentrations (ug/L) of Carbazole in the Fathead Minnow (Pimephales promelas) 96 hr Flow-Through Test with Percent Mortality in Parenthesis.

Exposure Time (Hr)	Measured Concentrations (ug/L)				
0	70/ 60	170/ 140	340/ 320	640/ 680	1,310/ 1,150
24	60 (0) ^a	150 (0)	290 (0)	570 (0)	1,170 (75)
48	20/ 20 (0)	40/ 40 (0)	90/ 70 (0)	140/ 150 (0)	50/ 48 (85)
72	40 (0)	130 (0)	260 (0)	520 (0)	1,170 (85)
96	50/ 60 (0)	120 (0)	230/ 220 (0)	420/ 400 (0)	890/ 950 (85)
% Spike Recovery	88.4±7.7				
Corrected ^b Concentration Mean ± (s.d.)	60 (10)	160 (20)	310 (50)	610 (130)	1,250 (180)
Nominal	80	160	310	620	1,250

^a Percent mortality of twenty organisms per treatment.

^b Mean and standard deviation corrected for percent recovery of spiked samples.

TABLE 23. Concentrations ($\mu\text{g/L}$) of Carbazole in the Fathead Minnow (Pimephales promelas) 96 hr Static Test with Percent Mortality in Parenthesis.

Exposure Time (Hr)	Measured Concentrations $\mu\text{g/L}$ (% Mortality)				
0	80	170/ 180	370/ 330	750	1,350/ 1,280
24	- (0) ^a	- (0)	290/ 240 (0)	- (0)	970/ 1,130 (40)
48	40/ 50 (0)	90/ 110 (0)	240/ 160 (0)	460/ 440 (0)	860/ 100 (40)
72	- (0)	- (0)	290/ 210 (0)	- (0)	760/ 920 (40)
96	50 (0)	90/ 120 (0)	210/ 160 (0)	420/ 460 (0)	760/ 1,010 (40)
% Spike Recovery	88.4 \pm 7.7				
Corrected ^b Concentration Mean \pm (s.d.)	70 (20)	140 (40)	280 (80)	600 (150)	1,140 (230)
Nominal ($\mu\text{g/L}$)	90	190	380	750	1,500

^a Percent mortality of twenty organisms per treatment.

^b Mean and standard deviation corrected for percent recovery of spiked samples.

TABLE 24. Concentrations ($\mu\text{g/L}$) of Carbazole with Daphnia magna in a 48-hr Static Renewal Test
Percent Affected Organisms in Parenthesis.

Exposure Time (Hr)	Measured Concentrations ($\mu\text{g/L}$)					
	Old ^a	New ^a	Old	New	Old	New
0	-	150	-	480	-	1,220
24	280	250 (5)	510	1,030 (0)	1,970	2,010 (5)
48	300	- (5)	580	- (0)	2,040	3,560
% Recovery	89.3±19.2					
Corrected ^c mean	270		540	660	2,030	3,700
± (s.d.)	(70)		(140)	(460)	(444)	(880)
Nominal ($\mu\text{g/L}$)	620		1,250	2,500	5,000	10,000

a Old refers to solutions after 24 hours exposure; new are solutions prepared that day.

b Percent affected of twenty organisms per treatment.

c Mean and standard deviation corrected for percent recovery of spiked samples.

TABLE 25. Concentrations of Dibenzofuran in the Fathead Minnow (Pimephales promelas) 96 hr Static Test with Percent Mortality in Parenthesis.

Exposure Time (Hr)		Measured Concentrations ($\mu\text{g/L}$)			
0	^a	330/ 310	950/ 932	1,720/ 1,830	3,100/ 3,080
24	^a (0) ^b	160 (0)	1,090 (0)	1,900 (40)	3,270 (100)
48	^a (0)	295/ 310 (0)	960/ 980 (0)	1,920/ 1,950 (60)	3,200/ 3,130 (100)
72	^a (0)	230 (0)	1,010 (0)	1,950 (85)	- (100)
96	^a (0)	100 (0)	1,220/ 1,160 (35)	1,860/ 1,960 (100)	- (100)
% Spike Recovery		92.2 \pm 4.0			
Corrected ^c Concentration Mean \pm (s.d.)	10 (0)	250 (100)	1,120 (120)	2,030 (90)	3,390 (80)
Nominal ($\mu\text{g/L}$)	250	500	1,000	2,000	4,000

^a Below detection limit (10 $\mu\text{g/L}$), one-half D.L. was used to determine the corrected concentration mean.

^b Percent affected of twenty organisms per treatment.

^c Mean and standard deviation corrected for percent recovery of spiked samples.

TABLE 26. Concentrations of Dibenzofuran in the Fathead Minnow (*Pimephales promelas*) 96 hr Static Test with Percent Mortality in Parenthesis.

Exposure Time (Hr)	Measured Concentrations ($\mu\text{g/L}$)				
0	182/ 173	408/ 406	895/ 884	1,747/ 1,804	3,558/ 3,618
24	- (0) ^b	- (0)	475/ 470 (5)	- (0)	1,490/ 1,530 (70)
48	40 (0)	70/ 110 (0)	230/ 190 (5)	470/ 350 (0)	570/ 830 (75)
72	- (0)	- (0)	60/ 40 (5)	- (0)	290/ 310 (75)
96	^a (0)	30/ 20 (0)	50/ 30 (5)	90/ 60 (0)	200/ 220 (75)
% Spike Recovery	92.2 \pm 4.0				
Corrected ^c Concentration Mean \pm (s.d.)	60 (90)	80 (40)	360 (360)	810 (870)	1,360 (1,410)
Nominal ($\mu\text{g/L}$)	290	580	1,150	2,300	4,600

^a Below detection limit (10 $\mu\text{g/L}$), one-half D.L. was used to determine the corrected concentration mean.

^b Percent affected of twenty organisms per treatment.

^c Mean and standard deviation corrected for percent recovery of spiked samples.

TABLE 27. Concentrations of 3,3'-Dichlorobenzidine #1 in the Fathead Minnow (*Pimephales promelas*) 96 hr Static Test with Percent Mortality in Parenthesis.

Exposure Time (Hr)	Measured Concentrations ($\mu\text{g/L}$)				
0	360/ 380	630/ 660	1,190/ 1,180	2,240/ 2,240	4,240/ 4,350
24	- (0) ^a	- (0)	770/ 750 (0)	- (0)	3,260/ 3,960 (100)
48	40/ 70 (0)	110/ 290 (0)	600/ 390 (0)	1,030/ 1,090 (0)	2,000/ 3,320 (100)
72	- (0)	- (0)	410/ 250 (0)	- (0)	2,040/ 2,570 (100)
96	50 (5)	70/ 160 (0)	330/ 160 (0)	800/ 850 (10)	1,600/ 2,300 (100)
% Spike Recovery	111.1 \pm 48.0				
Corrected ^b Concentration Mean \pm (s.d.)	142 (148)	290 (230)	530 (330)	1,230 (600)	3,560 (440)
Nominal ($\mu\text{g/L}$)	290	580	1,150	2,300	4,600

^a Percent mortality of twenty organisms per treatment.

^b Mean and standard deviations corrected for percent recovery of spiked samples.

TABLE 28. Concentrations of 3,3'-Dichlorobenzidine in the Fathead Minnow (Pimephales promelas) 96 hr Flow-Through Test with Percent Mortality in Parenthesis.

Exposure Time (Hr)	Measured Concentrations ($\mu\text{g/L}$)				
0	170/ 200	450/ 490	1,030/ 1,050	2,120/ 2,170	3,760 3,910
24	200 (0) ^a	510 (0)	1,130 (0)	2,210 (0)	3,870 (95)
48	90/ 150 (0)	280/ 370 (0)	700/ 600 (0)	1,240 (0)	1,930/ 2,070 (95)
72	120 (0)	380 (0)	830 (0)	1,480 (0)	2,790 (100)
96	190 (0)	440/ 470 (0)	940/ 910 (0)	1,520/ 1,570 (10)	2,620/ 2,700 (100)
% Spike Recovery	120.3 \pm 31.6				
Corrected ^b Concentration Mean \pm (s.d.)	140 (30)	350 (60)	750 (150)	1,410 (340)	2,520 (770)
Nominal ($\mu\text{g/L}$)	190	380	750	1,500	3,000

^a Below detection limit (10 $\mu\text{g/L}$), one-half D.L. was used to determine the corrected concentration mean.

^b Percent affected of twenty organisms per treatment.

TABLE 29. Concentrations of 3,3'-Dichlorobenzidine #2 in the Fathead Minnow (Pimephales promelas) 96 hr Static Test with Percent Mortality in Parenthesis.

Exposure Time (Hr)	Measured Concentrations ($\mu\text{g/L}$)				
0	270/ 240	570/ 590	1,230/ 1,180	2,430/ 2,380	4,690/ 5,280
24	- (0) ^a	- (0)	770/ 670 (0)	- (0)	3,800/ 4,250 (100)
48	BDL ^b (0)	100 (0)	350/ 200 (0)	890/ 990 (0)	1,740/ 2,280 (100)
72	- (0)	- (0)	190/ 100 (0)	- (60)	1,400/ 1,970 (100)
96	BDL (0)	20 (0)	120/ 50 (0)	660/ 790 (60)	1,240/ 1,740 (100)
% Spike Recovery	120.3 \pm 31.6				
Corrected ^c Concentration Mean \pm (s.d.)	80 (100)	170 (240)	400 (370)	1,130 (680)	3,740 (520)
Nominal ($\mu\text{g/L}$)	290	580	1,150	2,300	4,600

^a Percent mortality of twenty organisms per treatment.

^b Below detection limit.

^c Mean and standard deviation corrected for percent recovery of spiked samples.

TABLE 30. Concentrations ($\mu\text{g/L}$) of 3,3'-Dichlorobenzidine with Daphnia magna in a 48-hr Static Renewal Test, Percent Affected in Parenthesis.

Exposure Time (Hr)	Measured Concentrations ($\mu\text{g/L}$)									
	Old ^a	New ^a	Old	New	Old	New	Old	New	Old	New
0	-	60	-	220	-	520	-	1080	-	2160
24	60	120 (0) ^b	160	340 (0)	380	660 (0)	820	1380 (25)	1680	2800 (100)
48	40	- (15)	250	- (5)	590	- (20)	1000	- (35)	-	- (100)
% Recovery	102.4 \pm 6.4									
Corrected mean	70									
\pm (s.d.)	(30)									
Nominal ($\mu\text{g/L}$)	290									
	240		520		1040		2160		4600	
	(70)		(120)		(230)		(550)			
	580		1150		2300		4600			

^a Old refers to solutions after 24 hours exposure; new are solutions prepared that day.

^b Percent mortality of twenty organisms per treatment.

^c Mean and standard deviations corrected for percent recovery of spiked samples.

TABLE 31. Concentrations of Dichlorovos in the Annelid (Lumbriculus variegatus) 96 hr Static Renewal Test with Percent Mortality in Parenthesis.

Exposure Time (Hr)	Measured Concentrations ($\mu\text{g/L}$)				
0	480	950	960	3,700	7,400
24	- (0) ^a	- (0)	- (0)	- (0)	- (55)
48	460/ 450 (0)	820/ 940 (0)	1,600/ 1,800 (0)	3,200/ 3,700 (40)	6,200/ 7,300 (100)
72	- (0)	- (0)	- (0)	- (80)	- (100)
96	330 (0)	930 (0)	1,400 (15)	2,800 (100)	5,800/ 5,500 (100)
% Spike Recovery	90.7 \pm 17.0				
Corrected ^b Concentration Mean \pm (s.d.)	470 (70)	930 (140)	1,590 (400)	3,690 (480)	7,500 (940)
Nominal ($\mu\text{g/L}$)	440	875	1,750	3,500	7,000

^a Percent mortality of twenty organisms per treatment.

^b Mean and standard deviations corrected for percent recovery of spiked samples.

TABLE 32. Concentrations of Dichlorovos in the Snail (*Physa*) 96 hr Static Renewal Repeat Test with Percent Mortality in Parenthesis.

Exposure Time (Hr)	Measured Concentrations ($\mu\text{g/L}$)				
0	110	220	430	920	1,800
24	- (0) ^a	- (0)	- (0)	- (0)	- (55)
48	90/ 140 (0)	100/ 250 (0)	185/ 440 (25)	420/ 885 (55)	790/ 1,900 (100)
72	- (0)	- (50)	- (90)	- (100)	- (100)
96	40 (0)	40 (50)	170 (90)	500 (100)	1,100/ 1,200 (100)
% Spike Recovery	105.1 \pm 38.9				
Corrected ^b Concentration Mean \pm (s.d.)	90 (40)	150 (90)	290 (140)	650 (250)	1,420 (580)
Nominal ($\mu\text{g/L}$)	125	250	500	1,000	2,000

^a Percent mortality of twenty organisms per treatment.

^b Below detection limit.

TABLE 33. Concentrations of Dichlorovos with Ceriodaphnia dubia in a 48-hr Acute Renewal Test, Percent Affected Organisms in Parenthesis.

Exposure Time (Hr)	New ^a		Old		New		Old		New		Old		New	
	Old ^a	New ^a	Old	New	Old	New	Old	New	Old	New	Old	New	Old	New
0	-	BDL ^b	-	LDL	-	0.051	-	0.074	-	0.130	-	-	-	-
24	BDL	BDL (0) ^c	0.072	BDL (0)	0.101	0.049 (0)	0.126	0.064 (70)	0.193	0.126(100)	-	-	-	-
48	BDL	- (0)	BDL	- (0)	0.057	-	-	0.067 (85)	-	0.110(100)	-	-	-	-
% Recovery		24.5±6.790												
Corrected ^d mean ± (s.d.)		0.061 (0)		0.061 (0)		0.214 (0.017)		0.498 (0.021)		15.67 (0.043)				
Nominal(ug/L)		0.035		0.070		0.142		0.285		0.570				

^a Old refers to solutions after 24 hours exposure; new are solutions prepared that day.

^b Below detection limit.

^c Percent affected of twenty organisms per treatment.

^d Mean and standard deviations corrected for percent recovery of spiked samples.

TABLE 34. Concentrations of Dichloroovos with Daphnia magna in a 48-hr Acute Renewal Test, Percent Affected Organisms in Parenthesis.

Exposure Time (Hr)	Measured Concentrations ($\mu\text{g/L}$)					
	Old ^a	New ^a	Old	New	Old	New
0	-	0.200	-	0.250	-	0.400
24	.170	.120(0) ^b	.120	.150(0)	0.250	0.285 (0)
48	.120	- (5)	.150	- (45)	0.300	- (100) 0.400
% Recovery	73.9 \pm 4.2					
Corrected ^c mean	.206					
\pm (s.d.)	(.053)					
Nominal ($\mu\text{g/L}$)	0.025					
				.227	.418	.741
				(.077)	(.087)	(.209)
				0.050	0.200	0.400

a Old refers to solutions after 24 hours exposure; new are solutions prepared that day.
 b Percent affected of twenty organisms per treatment.
 c. Mean and standard deviations corrected for percent recovery of spiked sampled.

TABLE 35. Concentrations of Dichlorovos with Daphnia magna in a Chronic 21-Day Exposure.

Exposure Time (Day)	Measured Concentrations ($\mu\text{g/L}$)					
	Old ^b	New ^b	Old	New	Old	New
0	-	a	-	a	-	a
2	a	a	a	a	a	a
4	a	a	a	a	a	a
8	a	a	a	a	a	a
10	a	a	a	a	a	a
12	a	a	a	a	a	a
16	a	a	a	a	a	a
18	a	a	a	a	a	a
21	a	a	a	a	a	a
% Recovery	93.3 \pm 6.7					
Corrected ^b mean						
\pm (s.d.)	a	a	a	a	a	0.108

a Below detection limit (0.070 $\mu\text{g/L}$), one-half D.L. was used to determine the corrected mean.

b Old refers to solutions after 24 hours exposure; new are solutions prepared that day.

c Mean and standard deviations corrected for percent recovery of spiked samples.

TABLE 36. Concentrations of Dichlorovos in the Fathead Minnows (Pimephales promelas) 96 hr Flow-Through Test with Percent Mortality in Parenthesis.

Exposure Time (Hr)	Measured Concentrations ($\mu\text{g/L}$)				
0	1,920	2,580/ 3,024	5,060/	80,800/ 88,500	17,140/ 16,870
24	2,300 (5) ^a	3,100 (0)	4,800/ 4,900 (0)	7,200 (50)	15,400 (75)
48	1,400/ 1,500 (5)	2,200/ 2,200 (0)	4,400/ 4,300 (40)	9,100/ 8,500 (95)	18,600/ 18,500 (100)
72	1,300 (5)	1,900 (5)	4,100 (65)	9,700 (100)	22,950 (100)
96	1,300/ 1,500 (20)	2,200/ 2,300 (35)	4,300/ 4,400 (95)	9,600/ 9,250 (100)	- (100)
% Spike Recovery					
Corrected ^b Concentration Mean \pm (s.d.)	1,840 (400)	2,720 (520)	6,300 (5,120)	9,770 (980)	20,560 (2,860)
Nominal ($\mu\text{g/L}$)	1,580	3,150	6,300	12,600	25,200

^a Percent mortality of twenty organisms per treatment.

^b Mean and standard deviations corrected for percent recovery of spiked samples.

TABLE 37. Hatchability, Survival and Growth of Fathead Minnows (Pimephales promelas) Exposed to Dichlorovos #1 for 34 Days Post-Fertilization.

	Mean Dichlorovos Concentration (ug/L)					
	0	43+39	70+45	120+59	260+78	510+130
Mean percent hatch ^a	90.8	90.0	88.4	80.0	92.5	81.7
Mean percent survival at 28 days post-hatch ^b	98.3	88.3	100	96.6	93.3	63.4**
Mean wet weight (mg) at 28 days post-hatch	124	128	104	99.8*	82.8**	72.5**
Mean dry weight (mg) at 28 days post-hatch	22.8	24.4	20.9	19.6	16.7**	15.2**
Mean standard length (mm) at 28 days post-hatch	17.6	18.2	17.3	17.6	15.8*	14.6**

^a Live fry/total eggs.

^b Percent survival of 15 individuals transferred from egg cups to exposure chambers on day 5.

* Statistically significant difference with $p \geq 95\%$.

** Statistically significant difference with $p \geq 99\%$.

TABLE 38. Hatchability, Survival and Growth of Fathead Minnows (Pimephales promelas) Exposed to Dichlorovos #2 for 34 Days Post-Fertilization.

	Mean Dichlorovos Concentration (ug/L)					
	0	76+38	110+50	190+80	350+110	540+180
Mean percent hatch ^a	82.7	74.9	79.7	84.0	81.0	78.0
Mean percent survival at 28 days post-hatch ^b	96.7	100	95.0	93.3	96.7	73.3**
Mean wet weight (mg) at 28 days post-hatch	80.2	69.8	74.0	70.0	62.2	67.5
Mean dry weight (mg) at 28 days post-hatch	16.8	14.8	15.2	13.0**	13.0**	14.2 ^c
Mean standard length (mm) at 28 days post-hatch	17.2	16.3	16.4	15.8*	15.4**	15.4**

^a Live fry/total eggs.

^b Percent survival of 15 individuals transferred from egg cups to exposure chambers on day 5.

^c Two large unrepresented fish in one replicate.

* Statistically significant difference with $p \geq 95\%$.

** Statistically significant difference with $p \geq 99\%$.

TABLE 39. Concentrations of 1,2-Epoxyethylbenzene (Styrene Oxide) in the Fathead Minnows (*Pimephales promelas*) 96 hr Flow-Through Test with Percent Mortality in Parenthesis.

Exposure Time (Hr)	Measured Concentrations (ug/L)				
0	740	1,200/ 1,400	2,800/ 2,900	8,600/ 8,900	29,000
24	BDL ^a (0) ^b	1,500 (0)	1,800 (0)	6,200/ 5,900 (0)	21,000 (60)
48	500/ 890 (0)	820/ 890 (0)	2,000 (0)	6,200/ 6,300 (30)	25,000/ 23,750 (100)
72	BDL (0)	720 (0)	1,800 (0)	7,500 (95)	- (100)
96	930/ 960 (0)	1,350/ 1,600 (0)	3,200 (0)	3,300/ 8,300 (100)	- (100)
% Spike Recovery	91.3±3.3				
Corrected ^c Concentration Mean ± (s.d.)	7,200 (320)	1,300 (360)	2,700 (680)	7,640 (2,160)	27,890 (3,800)
Nominal	3,125	6,250	12,500	25,000	50,000

^a Below detection limit.

^b Percent mortality of twenty organisms per treatment.

^c Mean and standard deviations corrected for percent recovery of spiked samples.

TABLE 40. Concentrations of 1,2-Epoxyethylbenzene (Styrene Oxide) in the Fathead Minnows (*Pimephales promelas*) 96 hr Static Test with Percent Mortality in Parenthesis.

Exposure Time (Hr)	Measured Concentrations (ug/L)				
	3,900	7,300	25,000/ 15,000	27,000/ 29,000	58,000/ 59,000
0					
24	- (0) ^a	- (0)	6,400 (0)	- (0)	25,000 (100)
48	710/ 700 (0)	1,300/ 1,200 (0)	2,300/ 1,900 (0)	4,950/ 3,700 (100)	11,000/ 10,100 (100)
72	- (0)	- (0)	BDL (0)	- (100)	- (100)
96	BDL ^b (0)	950 (0)	BDL (10)	-	-
% Spike Recovery	89.9±2.3				
Corrected ^c Concentration Mean ± (s.d.)	1,800 (1,980)	3,330 (3,740)	6,400 (6,110)	17,980 (15,240)	34,870 (24,480)
Nominal (ug/L)	4,380	8,750	17,500	35,000	70,000

^a Percent mortality of twenty organisms per treatment.

^b Below detection limit.

^c Means and standard deviations corrected for percent recovery of spiked samples.

TABLE 41. Concentrations of 1,2-Epoxyethylbenzene with Daphnia magna in a 48-hr Acute Renewal Test, Percent Affected Organisms in Parenthesis.

Exposure Time (Hr)	Measured Concentration ($\mu\text{g/L}$)									
	Old ^a	New ^a	Old	New	Old	New	Old	New		
0	-	3985	-	7750	-	14,010	-	28,300	-	52,700
24	2000	4900 (0) ^b	3100	8600 (0)	5900	17,800 (5)	11,800	30,200(70)	18,000	60,400 (100)
48	3200	- (0)	4800	- (0)	8200	- (30)	10,700	- (100)	5,150	- (100)
% Recovery	93.5 \pm 3.6									
Corrected ^c mean	3800									
\pm (s.d.)	(1300)									
Nominal ($\mu\text{g/L}$)	5000									
			6500		8900		21,600		38,000	
			(2700)		(7400)		(11,100)		(26,500)	
			10,000		20,000		40,000		80,000	

^a Old refers to solutions after 24 hours exposure; new are solutions prepared that day.

^b Percent affected of twenty organisms per treatment.

^c Means and standard deviations corrected for percent recovery of spiked samples.

TABLE 42. Concentrations of Isophorone in the Fathead Minnows (Pimephales promelas) 96 hr Flow-Through Test with Percent Mortality in Parenthesis.

Exposure Time (Hr)	Measured Concentrations ($\mu\text{g/L}$)				
0	26,000/ 25,000	24,000/ 26,000	90,000/ 96,000	181,000 187,000	345,000/ 338,000
24	26,000 (0) ^a	52,000 (0)	103,000 (0)	193,500(15)	368,000 (100)
48	25,000 (0)	50,500/ 49,000 (0)	97,500/ 92,000 (0)	186,000/ 193,000(15)	367,000/ 346,000 (100)
72	25,000 (0)	52,000 (0)	105,500 (0)	195,000(15)	- (100)
96	26,000 (0)	53,000 (0)	101,000 (0)	200,000/ 202,000 (15)	- (100)
% Spike-Recovery	93.1 \pm 6.3				
Corrected ^b Concentration Mean \pm (s.d.)	27,100 (7,400)	54,700 (1,750)	105,000 (5,800)	206,000 (7,680)	376,000 (16,800)
Nominal ($\mu\text{g/L}$)	31,200	62,500	125,000	250,000	500,000

^a Percent mortality of twenty organisms per treatment.

^b Means and standard deviations corrected for percent recovery of spiked samples.

TABLE 43. Concentrations of Isophorone in the Fathead Minnows (Pimephales promelas)
96 hr Static Test with Percent Mortality in Parenthesis.

Exposure Time (Hr)	Measured Concentrations ($\mu\text{g/L}$)				
0	23,000	46,000/ 44,000	94,000/ 98,000	200,000/ 191,000	398,000/ 386,000
24	- (0) ^a	- (0)	104,000/ 89,000 (0)	- (10)	352,000(100)
48	20,000/ 19,000 (0)	39,000(0)	81,000/ 76,000 (0)	153,000/ 155,000(15)	- (100)
72	- (0)	- (0)	75,550/ 66,000 (0)	- (15)	- (100)
96	19,000/ 17,000 (0)	38,000/ 33,000(0)	74,000/ 61,000 (0)	125,000/ 130,000(15)	- (100)
% Spike Recovery	90.4 \pm 8.2				
Corrected ^b Concentration Mean \pm (s.d.)	22,300 (2,600)	44,100 (5,100)	90,800 (15,400)	176,000 (34,100)	412,000 (26,100)
Nominal ($\mu\text{g/L}$)	31,200	62,500	125,000	250,000	500,000

^a Percent mortality of twenty organisms per treatment.

^b Means and standard deviations corrected for percent recovery of spiked samples.

TABLE 44. Concentrations of Isopropalin in the Fathead Minnows (Pimephales promelas)
96 hr Flow-Through Test with Percent Mortality in Parenthesis.

Exposure Time (Hr)	Measured Concentrations ($\mu\text{g/L}$)				
0	150/ 120	220/ 250	370	670/ 640	1,100
24	110 (0) ^a	210 (0)	330 (10)	590 (20)	1,100 (30)
48	110 (10)	210/ 180 (10)	300/ 330 (25)	520/ 530 (46)	1,000/ 990 (45)
72	82 (25)	160 (20)	270 (55)	450 (90)	1,200 (85)
96	62/ 22 (30)	110/ 130 (20)	190/ 160 (60)	350/ 390 (90)	1,200/ 1,250 (95)
% Spike Recovery	97.2 \pm 8.0				
Corrected ^b Concentration Mean \pm (s.d.)	98 (41)	190 (50)	300 (80)	530 (110)	1,150 (110)
Nominal ($\mu\text{g/L}$)	95	190	375	750	1,500

^a Percent mortality of twenty organisms per treatment.

^b Means and standard deviations corrected for percent recovery of spiked samples.

TABLE 45. Concentrations of Isopropalin in the Fathead Minnows (Pimephales promelas) 96 hr Static Test with Percent Mortality in Parenthesis.

Exposure Time (Hr)	Measured Concentrations ($\mu\text{g/L}$)				
0	230/ 250	410/ 425	740/ 780	1,500/ 1,600	3,000
24	- (0) ^a	- (10)	330 (15)	- (45)	1,630 (40)
48	BDL (0)	170 (10)	- (65)	430/ 340 (95)	313/ 1,100 (100)
72	- (0)	- (10)	74/ 53 (75)	- (95)	490/ 450 (400)
96	- (0)	- (10)	76 (75)	110 (95)	- (100)
% Spike Recovery	98.4 \pm 8.8				
Corrected ^b Concentration Mean \pm (s.d.)	130 (130)	260 (200)	300 (320)	680 (710)	1,480 (1,090)
Nominal ($\mu\text{g/L}$)	190	375	750	1,500	3,000

^a Percent mortality of twenty organisms per treatment.

^b Means and standard deviations corrected for percent recovery of spiked samples.

TABLE 46. Concentrations of Isopropalin with Daphnia magna in a 48-hr Acute Renewal Test, Percent Affected Organisms in Parenthesis.

Exposure Time (Hr)	Old ^a		New ^a		Measured Concentrations ($\mu\text{g/L}$)				
	Old	New	New	Old	New	Old	New	Old	New
0	-	27	43	-	62	-	245	-	540
24	18	18 (0) ^b	35 (0)	26	45 (0)	69	270 (10)	280	460 (20)
48	18	- (5)	- (20)	18	9 (70)	18	- (100)	29	- (100)
% Recovery		94.9±4.4							
Corrected ^c mean		19	32		51		164		414
± (s.d.)		(0)	(11)		(24)		(128)		(135)
Nominal ($\mu\text{g/L}$)		156	312		625		1,250		2,500

a Old refers to solutions after 24 hours exposure; new are solutions prepared that day.

b Percent affected of twenty organisms per treatment.

c Means and standard deviations corrected for percent recovery of spiked samples.

TABLE 47. Concentrations of Oxychlordane in the Fathead Minnows (Pimephales promelas) 96 hr Flow-Through Test with Percent Mortality in Parenthesis.

Exposure Time (Hr)	Measured Concentrations ($\mu\text{g/L}$)				
0	0.41/ 0.43	0.75/ 0.82	1.1	0.22/ 0.21	0.40/ 0.38
24	0.26 (0) ^a	0.53 (0)	0.94 (0)	1.45 (0)	3.0 (5)
48	0.22 (0)	0.44 (0)	0.72/ 0.69 (0)	1.1/ 1.3 (0)	2.50/ 2.60 (20)
72	0.21 (0)	0.47 (0)	0.80 (0)	1.3 (0)	2.4 (35)
96	<DL (0)	0.33/ 0.38 (0)	0.71/ 0.69 (0)	1.4 (0)	3.0/ 3.4 (95)
% Spike Recovery	90.5 \pm 5.7				
Corrected ^b Concentration Mean \pm (s.d.)	0.26 (0.15)	0.58 (0.19)	0.93 (0.20)	1.69 (0.44)	3.41 (0.66)
Nominal ($\mu\text{g/L}$)	0.19	0.38	0.75	1.5	3.0

^a Percent mortality of twenty organisms per treatment.

^b Means and standard deviations corrected for percent recovery of spiked samples.

TABLE 48. Concentrations of Oxychlordane in the Fathead Minnows (*Pimephales promelas*)
96 hr Static Test with Percent Mortality in Parenthesis.

Exposure Time (Hr)	Measured Concentrations (ug/L)				
0	1.1	2.20/ 2.45	5.1/ 5.2	9.6/ 10.1	20.4/ 21.2
24	- (0) ^a	- (0)	1.6/ 1.3 (5)	- (100)	7.9/ 8.65 (100)
48	0.34/ 0.37 (0)	0.45/ 0.47 (0)	1.1/ 0.61 (20)	2.3/ 1.8 (100)	5.6/ 5.5 (100)
72	-	-	0.51/ 0.34 (20)	- (100)	3.5 (100)
96	BDL ^b (0)	BLD (0)	0.23 (20)	.755/ .40 (100)	2.1/ 1.6 (100)
% Spike Recovery	97.6±6.9				
Corrected ^c Concentration Mean ± (s.d.)	0.52 (0.49)	0.96 (1.12)	1.64 (1.98)	6.10 (4.62)	11.82 (7.46)
Nominal (ug/L)	0.88	1.75	3.5	7.0	14.0

^a Percent mortality of twenty organisms per treatment.

^b Below detection limit.

^c Means and standard deviations corrected for percent recovery of spiked samples.

TABLE 49. Concentrations of Oxychlorodane with Daphnia magna in a 48-hr Acute Renewal Test, Mortality in Parenthesis.

Exposure Hour	New ^a		Old		Measured Concentration (ug/L)		New		Old	
	Old ^a	New ^a	Old	New	Old	New	Old	New	Old	New
0	-	660	-	1050	-	2700	-	4400	-	9500
24	50	630 (0) ^b	100	1700 (0)	170	3150 (0)	270	5100 (0)	3150	11100 (0)
48	50	- (5)	87	- (30)	130	- (60)	110	- (60)	140	- (95)
% Recovery	101.0±28.4									
Corrected ^c mean	340		710		1500		2400		5200	
± (s.d.)	(340)		(770)		(1600)		(2600)		(5800)	
Nominal (ug/L)	630		1250		2500		5000		10,000	

a Old refers to solutions after 24 hours exposure; new are solutions prepared that day.

b Percent affected of twenty organisms per treatment.

c Means and standard deviations corrected for percent recovery of spiked samples.

TABLE 50. Concentrations of Pentachloroanisole in the Fathead Minnows (*Pimephales promelas*) 96 hr Flow-Through Test with Percent Mortality in Parenthesis

Exposure Time (Hr)	Measured Concentrations (ug/L)				
0	50/ 60	110/ 100	200	430/ 450	890/ 930
24	20 (0) ^a	70 (0)	130 (0)	340 (0)	740 (0)
48	30 (0)	80 (0)	150/ 170 (0)	370/ 360 (0)	730/ 760 (0)
72	BDL (0)	20 (0)	30 (0)	90 (5)	330 (15)
96	30 (0)	80 (0)	150/ 140 (0)	360 (15)	940/ 920 (25)
% Spike Recovery	94.4±10.4				
Corrected ^b Concentration Mean ± (s.d.)	30 (20)	80 (30)	150 (60)	360 (120)	830 (210)
Nominal (ug/L)	94	187.5	375	750	1,500

^a Percent mortality of twenty organisms per treatment.

^b Means and standard deviations corrected for percent recovery of spiked samples.

TABLE 51. Concentrations of Pentachloroanisole in the Fathead Minnows (*Pimephales promelas*) 96 hr Static Test with Percent Mortality in Parenthesis

Exposure Time (Hr)	Measured Concentrations ($\mu\text{g/L}$)				
0	a	a	270/ 280	540	1120
24	a	a	60/ 70 (0) ^b	- (0)	200/ 230 (0)
48	a	a	20 (0)	50/ 40 (0)	100/ 130 (0)
72	a	a	a (0)	- (0)	60/ 70 (20)
96	a	a	a (0)	20 (0)	50/ 70 (40)
% Spike Recovery	94.4 \pm 10.4				
Corrected ^c Concentration Mean \pm (s.d.)	a	a	78 (115)	210 (28)	300 (450)
Nominal ($\mu\text{g/L}$)	94	188	375	750	1500

^a Below detection limit.

^b Percent mortality of twenty organisms per treatment.

^c Means and standard deviations corrected for percent recovery of spiked samples.

TABLE 52. Concentrations of Pentachloroanisole with Daphnia magna in a 48-hr Acute Renewal Test, Percent Affected Organisms in Parenthesis.

Exposure Hour	New ^a		Old		Measured Concentration* (ug/L)		New		Old		New	
	Old ^a	New ^a	Old	New	Old	New	Old	New	Old	New	Old	New
0	-	60	-	200	-	260	-	520	-	-	-	1090
24	30	60 (0) ^b	40	140 (0)	40	280 (0)	90	680 (0)	150	1150 (0)		
48	LDL	- (5)	LDL	- (0)	LDL	- (5)	70	- (45)	220	- (70)		
% Recovery		122.8±7.9										
Corrected ^c mean		30		80		120		280		530		
± (s.d.)		(20)		(70)		(120)		(250)		(440)		
Nominal (ug/L)		125		250		500		1000		2000		

^a Old refers to solutions after 24 hours exposure; new are solutions prepared that day.

^b Percent affected of twenty organisms per treatment.

^c Means and standard deviations corrected for percent recovery of spiked samples.

TABLE 53. Concentrations of Propoxur with Daphnia magna in a 48-hr Static Renewal Test, Percent of Organisms Affected in Parenthesis.

Exposure Time (Hr)	Old ^a		New ^a		Measured Concentrations (ug/L)		Percent of Organisms Affected			
	Old	New	Old	New	Old	New	Old	New		
0	-	13.01	-	22.49	-	52.84	-	105.69	210.14	
24	11.56	15.23(0) ^b	21.63	22.79(0)	52.19	55.49(45)	96.95	- (100)	- (100)	
48	10.14	- (20)	21.71	- (30)	50.13	- (100)	- (100)	- (100)	- (100)	
% Recovery	101.5±0.6									
Corrected ^c mean ± (s.d.)	12.30 (2.14)		21.82 (0.56)		51.88 (2.18)		99.81 (6.07)		195.17 (16.78)	
Nominal (ug/L)	12.5		25		50		100		200	

^a Old refers to solutions after 24 hours exposure; new are solutions prepared that day.

^b Percent affected of twenty organisms.

^c Means and standard deviation corrected for percent recovery of spiked samples.

TABLE 54. Survival and Reproduction of Daphnia magna Exposed to Propoxur for 21 days.

	Mean ^a Propoxur Concentration (ug/L)					
	<1.1	0.9	2.2	5.0	9.5	18.0
Percent survival	100	100	90	90	100	90
Mean number of young/ surviving adult female after 21 days	81.1	69.6	79.4	83.4	74.5	69.7

^a Corrected for 101.5 ± 9.4 percent recovery of spiked samples.

TABLE 55. Concentrations of Propoxur with an Annelid (*Lumbriculus variegatus*) in a 96-hr Static Renewal Test, Percent of Organisms Affected in Parenthesis.

Exposure Time (Hr)	Old ^a	New ^a	Measured Concentrations (ug/L)				Old	New	Percent Affected
			Old	New	Old	New			
0	-	11.8	24.2	48.6	-	96.3	-	196.6	
24	11.5	12.6 (0) ^b	25.0 (0)	49.4 (0)	4.90	100.5 (0)	192.8	190.6 (100)	
48	13.0	12.7 (0)	25.7 (0)	50.8 (0)	49.8	99.4 (0)	207.4	- (100)	
72	13.0	12.8 (0)	25.8 (0)	51.7 (0)	50.8	100.6 (0)	-	- (100)	
96	12.8	- (0)	- (0)	- (0)	51.6	- (0)	99.6	- (100)	
% Recovery	95.7±10.1								
Corrected ^c mean ± (s.d.)	13.07 (0.60)	26.18 (0.95)	52.49 (1.44)	103.11 (2.39)				205.71 (10.17)	
Nominal (ug/L)	12.5	25	50	100				200	

^a Old refers to solutions after 24 hours exposure; new are solutions prepared that day.

^b Percent affected of twenty organisms.

^c Means and standard deviation corrected for percent recovery of spiked samples.

TABLE 56. Concentrations of Tetrabromobisphenol A in the Fathead Minnows (Pimephales promelas) 96 hr Acute Flow-Through Test with Percent Mortality in Parenthesis.

Exposure Time (Hr)	Measured Concentrations (ug/L)				
0	210/ 220	430/ 450	640/ 710	1100/ 1200	2300
24	200 (0) ^a	410 (0)	650 (0)	1500 (95)	- (100)
48	270 (0)	595/ 570 (0)	890/ 860 (0)	1700 (95)	- (100)
72	270 (0)	560 (0)	790 (0)	1400 (95)	- (100)
96	270/ 240	500/ 520	690/ 700	1200 (95)	- (100)
% Spike Recovery	98.5±5.3				
Corrected ^b Concentration Mean ± (s.d.)	250 (30)	510 (70)	750 (100)	1370 (230)	2340 (0.0)
Nominal (ug/L)	125	250	500	1000	2000

^a Percent mortality of twenty organisms per treatment.

^b Means and standard deviations corrected for percent recovery of spiked samples.

TABLE 57. Concentrations of Tetrabromobisphenol A in the Fathead Minnows (Pimephales promelas) 96 hr Static Test with Percent Mortality in Parenthesis

Exposure Time (Hr)	Measured Concentrations (ug/L)				
0	260	-	680	1100/ 1300	2100/ 2300
24	- (0) ^a	- (0)	110/ 120 (0)	- (75)	1800/ 2150 (100)
48	160 (0)	- (0)	390 (0)	780/ 950 (90)	- (100)
72	- (0)	- (0)	425/ 380 (0)	- (100)	- (100)
96	120 (0)	- (0)	370/ 320 (0)	815/ 890 (100)	- (100)
% Spike Recovery ^b	102.5±8.4				
Corrected Concentration Mean ± (s.d.)	150 (70)	340 (40)	380 (190)	950 (190)	2040 (200)
Nominal (ug/L)	125	250	500	1000	2000

^a Percent mortality of twenty organisms per treatment.

^b Means and standard deviations corrected for percent recovery of spiked samples.

TABLE 58. Concentrations of Tetrabromobisphenol A with Daphnia magna in a 48-hr Static Renewal Test, Percent of Organisms Affected in Parenthesis.

Exposure Time (Hr.)	Old ^a		New ^a		Measured Concentrations (ug/L)		Percent of Organisms Affected		
	Old	New	Old	New	Old	New	Old	New	
0	-	1,200	-	1,800	-	3,900	-	8,400	16,400
24	1,300	1,200 (0) ^b	2,200	2,000 (0)	4,300	3,700 (0)	7,900	9,050 (45)	14,300
48	1,400	- (0)	2,200	- (0)	3,800	- (0)	8,100	- (70)	18,100
% Recovery	90.3±10.0								
Corrected ^c mean ± (s.d.)	1,400 (100)		2,300 (200)		4,300 (300)		9,300 (600)		18,800 (2,400)
Nominal (ug/L)	1,120		2,250		4,500		9,000		18,000

^a Old refers to solutions after 24 hours exposure; new are solutions prepared that day.

^b Percent affected of twenty organisms.

^c Means and standard deviation corrected for percent recovery of spiked samples.

TABLE 59. Concentrations of 1,2,4,5-Tetrachlorobenzene in the Fathead Minnows (Pimephales promelas) 96 hr Flow-Through Test with Percent Mortality in Parenthesis

Exposure Time (Hr)	Measured Concentrations (ug/L)				
0	43	84/ 82.5	126/ 110	219/ 226	320/ 308
24	55 (0) ^a	81 (0)	150 (0)	180 (0)	370 (0)
48	52/ 43	79/ 65	140/ 132	190 (0)	370 (0)
72	35 (0)	93 (0)	128.5 (0)	516 (0)	406 (0)
96	28 (0)	91/ 90 (0)	140/ 130 (0)	230/ 240 (0)	400/ 425 (75)
% Spike Recovery	97.1±5.6				
Corrected ^b Concentration Mean ± (s.d.)	42 (10)	86 (9)	140 (10)	220 (25)	380 (40)
Nominal (ug/L)	25	50	100	200	400

^a Percent mortality of twenty organisms per treatment.

^b Means and standard deviations corrected for percent recovery of spiked samples.

TABLE 60. Concentrations of 1,2,4,5-Tetrachlorobenzene in the Fathead Minnows (Pimephales promelas) 96 hr Static Test with Percent Mortality in Parenthesis.

Exposure Time (Hr)	Measured Concentrations (ug/L)				
0	15/ 16	6/ 38.5	84/ 86	170/ 180	340/ 330
24	- (0) ^a	- (0)	30/ 22 (0)	- (0)	82/ 72 (0)
48	6 (0)	6/ 22 (0)	28/ 24 (0)	41/ 30 (0)	45/ 38 (0)
72	- (0)	- (0)	6 (0)	- (0)	10/ 9 (0)
96	BDL (0)	BDL (0)	BDL (0)	BDL (0)	BDL (0)
% Spike Recovery	104.5±22.4				
Corrected ^b Concentration Mean ± (s.d.)	150 (70)	340 (40)	380 (190)	950 (190)	2040 (200)
Nominal (ug/L)	25	50	100	200	400

^a Percent mortality of twenty organisms per treatment.

^b Below detection limits.

^c Means and standard deviations corrected for percent recovery of spiked samples.

TABLE 61. Concentrations of 1,2,3-Trichloropropane in the Fathead Minnows (Pimephales promelas) 96 hr Acute Flow-Through Test with Percent Mortality in Parenthesis.

Exposure Time (Hr)	Measured Concentrations (ug/L)				
0	3,700/ 3,850	9,800/ 10,200	17,000/ 16,700	31,000 27,700	60,200/ 56,400
24	- (0)	- (0)	21,050/ 20,300 (0)	- (0)	63,600/ 68,500 (75)
48	4,400/ 3,900 (0)	10,450/ 11,600 (0)	23,300/ 20,500 (0)	34,900/ 41,600 (0)	66,000/ 64,000 (90)
72	3,700 (0)	11,300 (0)	19,500 (0)	44,300 (0)	68,650 (90)
96	4,800 (0)	11,800/ 12,300 (0)	23,000/ 19,900 (0)	40,300/ 40,500 (0)	78,800/ 77,400 (90)
% Spike Recovery	100.8±6.4				
Corrected ^b Concentration Mean ± (s.d.)	4170 (490)	10,900 (960)	20,100 (2,210)	36,900 (6,060)	45,560 (6,580)

^a Percent mortality of twenty organisms per treatment.

^b Means and standard deviations corrected for percent recovery of spiked samples.

TABLE 62. Concentrations of 1,2,3-Trichloropropane in the Fathead Minnows (Pimephales promelas) 96 hr Static Flow-Through Test with Percent Mortality in Parenthesis.

Exposure Time (Hr)	Measured Concentrations (ug/L)				
0	5,050/ 5,300	10,100/ 11,600	19,000/ 19,600	42,000 43,400	79,700/ 83,900
24	- (5)	2,500 (0)	10,300/ 9,800 (0)	(0)	49,700/ 47,700 (95)
48	1,300/ 700 (5)	2,800/ 2,500 (0)	5,000/ 4,700 (0)	10,950/ 11,100 (0)	23,900/ 27,400 (95)
72	- (5)	- (0)	2,700 (0)	(0)	14,900/ 15,850 (95)
96	200 (5)	770/ 440 (0)	1,400 (0)	3,100/ 2,900 (0)	7,900/ 9,100 (95)
% Spike Recovery	103.9±6.5				
Corrected ^b Concentration Mean ± (s.d.)	4940 (360)	10,440 (1,020)	18,580 (410)	41,100 (950)	78,700 (1,860)
Nominal (ug/L)	6100	12,200	24,400	48,800	97,500

^a Percent mortality of twenty organisms per treatment.

^b Means and standard deviations corrected for percent recovery of spiked samples.

TABLE 63. Concentrations of 1,2,3-Trichloropropane with Daphnia magna in a 48-hr Static Renewal Test, Percent of Organisms Affected in Parenthesis.

Exposure Time (Hr)	Old ^a	New ^b	Measured Concentrations (ug/L)							
			Old	New	Old	New	Old	New		
0	-	16,300	-	26,650	-	50,600	-	101,000	-	206,000
24	<127	18,500(0)	2,000	33,000 (0)	6,500	66,000 (5)	19,000	135,000(10)	21,000	172,000 (10)
48	2,000	- (0)	4,100	- (5)	14,000	- (55)	43,000	- (90)	85,000	- (100)
% Recovery	102.2±2.6									
Corrected ^c mean ± (s.d.)	8,600 (8,800)		16,100 (15,400)		33,500 (28,600)		72,900 (51,900)		118,400 (82,100)	
Nominal (ug/L)	12,500		25,000		50,000		100,000		200,000	

^a Old refers to solutions after 24 hours exposure; new are solutions prepared that day.

^b Percent affected of twenty organisms.

^c Means and standard deviation corrected for percent recovery of spiked samples.