MEMORANDUM

SUBJECT: Review of a Fish Full Life-Cycle Test (72-5, sheepshead minnow) from exposure to azinphos-methyl (Guthion). (Shaughnessey No. 058001)

FROM: Douglas J. Urban, Acting Chief
Ecological Effects Branch
Environmental Fate and Effects Division (H7507C)

TO: Larry Schnaubelt
Reregistration Branch
Special Review and Reregistration Division (H7508W)

The Ecological Effects Branch (EEB) has reviewed a sheepshead minnow full life-cycle study which was required for the reregistration of azinphos-methyl (Guthion).

The study was found to be scientifically sound but does not meet guideline requirements for a life-cycle chronic test using sheepshead minnows. Raw water quality and fish growth data were not included in the report. Offspring data for the control group are also missing. Based on the significant effect on minnow survival and hatching success of second generation embroyos at 0.41 μg/l, the maximum acceptable toxicant concentration was >0.2 and <0.41 μg/l (geometric mean MATC = 0.29 μ/l). The registrant should submit the raw water quality and the missing biological data for review. Please see enclosed data evaluat

Should you have any questions concerning this review, please contact Art Roybal at 305-5659.

DATA EVALUATION RECORD

1. **CHEMICAL:** Azinphos-methyl (Guthion).
Shaughnessey No. 058001.

2. **TEST MATERIAL:** 1) Guthion; Ref No. 9-04-0200; 92.5% active ingredient; tan flakes.
2) radiolabeled (C^{14}) Guthion; Vial No. C-107; 1.04 mCi, 46.9 mCi/mmole; a clear crystal.

3. **STUDY TYPE:** Fish Life-Cycle Toxicity Test. Species Tested: Sheepshead Minnow (*Cyprinodon variegatus*).

4. **CITATION:** Dionne, E. 1991. Guthion® - The Chronic Toxicity to the Sheepshead Minnow (*Cyprinodon variegatus*). Report No. 101297. Prepared by Springborn Laboratories, Inc., Wareham, MA. Submitted by Mobay Corporation, Kansas City, MO. EPA MRID No. 420216-01.

5. **REVIEWED BY:**

Louis M. Rifici, M.S.
Associate Scientist
KBN Engineering and
Applied Sciences, Inc.

Signature: Louis M. Rifici
Date: 12/20/91

Art Roybal
1/8/92

6. **APPROVED BY:**

Pim Kosalwat, Ph.D.
Senior Scientist
KBN Engineering and
Applied Sciences, Inc.

Signature: P. Kosalwat
Date: 12/20/91

Henry T. Craven, M.S.
Supervisor, EEB/EFED
USEPA

Signature: Anne Stavola
Date: 1/8/92

7. **CONCLUSIONS:** This study is scientifically sound but does not meet the guideline requirements for a life-cycle chronic toxicity test using sheepshead minnows. Raw water quality and fish growth data were not included in the report. Offspring data for the control group are also missing. Based on the significant effect on minnow survival and hatching success of second generation embryos at 0.41 µg/l, the maximum acceptable toxicant concentration was >0.2 and <0.41 µg/l (geometric mean MATC = 0.29 µg/l).

8. **RECOMMENDATIONS:** The registrant should submit the raw water quality and the missing biological data for review.

9. **BACKGROUND:**

10. **DISCUSSION OF INDIVIDUAL TESTS:** N/A.

11. **MATERIALS AND METHODS:**

A. **Test Animals:** Sheepshead minnow (*Cyprinodon variegatus*) embryos (≤24 hours old) were obtained from in-house cultures. Adult minnows were maintained in filtered natural seawater for approximately 4 months prior to spawning. The broodstock had been divided into 14 groups (5 females and 2 males each). Eggs from these groups were pooled and fertilization was determined to be 76%.

B. **Test System:** An intermittent flow proportional diluter (Mount and Brungs, 1967) with a dilution factor of 50% was used to deliver test solution to the individual test aquaria. The glass aquaria (60 x 30 x 30 cm) were arranged in upper and lower tiers, 14 tanks per tier. The upper tier was used for egg through adult exposure and the lower tier was used to hold spawning groups. Each tier was serviced by a temperature-controlled water bath set to maintain 30 ±2°C. The position of each aquarium in the water bath was assigned randomly. Each aquarium was equipped with a 15-cm high end-drain to maintain approximately 27 l of test solution.

The diluter was operated continuously for 2 months prior to test initiation. An analysis of concentrations in the test aquaria prior to test initiation indicated that the diluter was functioning properly. The system was maintained on a 12-hour light/12-hour dark photoperiod.

A Guthion stock solution was prepared in acetone using appropriate quantities of radiolabeled and unlabeled solid material. The stock was injected into the dilutor's mixing chamber using a calibrated mechanical injector. The concentration in the mixing chamber was equal to the highest nominal concentration tested (0.50 µg a.i./l) and was diluted further to give the lower concentrations. Flow-splitting chambers were used to distribute the test solutions to the aquaria. "During this study, the turnover rate was 6.1 when only the upper level was in use and 4.4 when both the upper and lower levels were in use."

Embryos were held in incubation cups. The cups were 5-cm diameter glass jars with 40-mesh Nitex screen

bottoms. Larval fish incubation chambers (16 x 7.5 x 7.5 cm) were attached at the inflow end of each upper level aquarium.

The test dilution water was filtered natural seawater collected from Cape Cod Canal, Bourne, MA. The water was recirculated in an epoxy-coated reservoir prior to being delivered to the diluter system. The salinity and pH of the water were 29-32 ppt (parts per thousand) and 7.7-8.1, respectively. The dilution water was warmed to approximately 28°C before delivery to the diluter.

C. **Dosage:** One-hundred and thirteen-day, flow-through, life-cycle toxicity test. Based on a preliminary embryo exposure, five nominal concentrations (0.031, 0.063, 0.13, 0.25, and 0.50 µg a.i./l), a solvent control, and a dilution water control were tested.

D. **Design:** Fifty sheepshead minnow embryos were indiscriminately distributed in groups of five to each of two cups per aquarium. Two replicate aquaria were used per concentration. Embryos were counted daily and dead embryos were discarded. Percent hatching success was calculated for each replicate aquarium. When hatching was complete (day 5), 25 newly-hatched larvae in each cup were impartially selected and placed into their respective growth chambers.

Following the post-hatch exposure (day 28 post-hatch), juvenile fish from the two growth chambers within each replicate aquarium were combined. From each combined group, 25 fish per replicate were randomly selected and released into the aquaria to continue the chronic exposure. The fish were photographed for length measurements. The fish remaining after thinning were euthanized, measured (mm), and weighed (mg).

On day 45 post-hatch, the fish were again photographed and survival determined. Upon maturation (days 52-55 post-hatch), spawning trials were initiated in the lower tier of test aquaria. Three spawning groups were used per aquaria. Each spawning group consisted of 2 males and 5 females. Spawns were removed and counted daily. "Females killed as a results of male aggression during spawning were not replaced in the group, however, (dead) males were replaced in order to maximize egg fertilization success." The mean reproductive success (number of eggs/female/spawning day) for each spawning group represents the mean of 14

consecutive daily egg production ratios. Hatching success of the spawned embryos was determined for the eggs used to initiate the second embryo-larvae exposure. Hatching success for several other spawning events was also determined.

Exposure of the first generation fish was terminated 108 days post-hatch. Each fish was measured, weighed (blotted dry), and internally examined to verify sex and gonadal condition.

The second embryo-larvae exposure was similar to the first. Twenty-eight days after hatch, percent survival was determined and the fish were measured and weighed.

During testing, larvae were fed live brine shrimp nauplii three times daily until 28 days post hatch. Juvenile and adult fish were fed a commercially available flake food and frozen brine shrimp twice daily

The dissolved oxygen concentration (DO), salinity, temperature, and pH were measured in each aquarium at test initiation. Temperature and DO were measured daily and pH and salinity were measured weekly in each aquarium. Temperature in one aquarium of each tier was also measured continuously using a minimum/maximum thermometer.

Water samples were collected from each replicate on days 0, 1, 5, and weekly thereafter until test termination for determination of C^{14}-Guthion by radiometric analysis (liquid scintillation counting). When the lower tier of exposure aquaria were in use, water samples from these aquaria were also analyzed. Samples from the highest test concentration were also analyzed using HPLC.

E. **Statistics:** Percent survival and percent hatch data were arcsine square-root transformed prior to analysis. For the survival, hatch, length, and weight data, differences between control and exposure groups were determined using William's test. Reproductive success (# eggs/female/day) was analyzed using two-factor factorial analyses of variance. For all data (except second generation hatch, survival, and growth data), the responses of dilution water control and solvent control data were pooled prior to means comparisons. The solvent control responses were used for comparison in analyses involving second generation biological

parameters. In all tests, significant differences were concluded when $P \leq 0.05$.

12. **REPORTED RESULTS:** All exposure solutions were continuously aerated from day 28 until test termination. The mean measured concentrations were 0.031, 0.046, 0.092, 0.20, and 0.41 µg/l (Table 2, attached). These values represent 100, 73, 71, 80, and 82% of nominal concentrations, respectively. Guthion was found in detectable quantities (0.0057-0.02 µg/l) in the dilution water control on days 0, 5, 103, and 110, and in the solvent control on days 0 and 12.

On day 61, the concentration of Guthion in upper level replicate B of test level 5 (0.50 µg/l, nominal), was 2.08 µg/l. The concentration in lower level replicate B of test level 5 was 0.38 µg/l. The author explained that the concentration in all replicates of level 5 were near nominal on day 62, the diluter was functioning normally during the period when the anomaly occurred, and that the reason for the anomaly was unclear.

The hatching success of parental generation embryos was unaffected by exposure to Guthion (Table 5, attached). After 28 and 45 days post-hatch, the survival of larvae in the highest test concentration was significantly lower than the pooled control data. Length and weight of parental generation larvae when measured at 28 days were unaffected by exposure to all test concentrations. After 45 days, the length of the fish was significantly lower than the pooled controls.

At termination of the adult exposure, the survival of parental generation sheepshead minnows was significantly lower in the highest test concentration than in the pooled controls (Table 6, attached). The lengths and weights of surviving male minnows and lengths of surviving female minnows exposed to Guthion were not significantly different from those of the pooled control. The weights of female minnows in the solvent and dilution water controls were significantly different. The weights of exposed females were statistically comparable to solvent control weights.

The results of the spawning portion of the test are presented in Table 7 (attached). Temporal differences between spawning trials were not significant, therefore spawning from the three groups per replicate were pooled prior to further analysis. The reproduction (number of eggs per female per day) of Guthion-exposed sheepshead minnows was not significantly different from that of the pooled controls.

The second generation embryo-larvae exposure was initiated using 1-2 groups of 50 eggs per replicate except in replicate B of 0.41 µg/l where no eggs were incubated (Table 8, attached). Hatching success was determined using 1-11 groups of 50 eggs per replicate except at 0.41 µg/l. Hatching success of offspring generation embryos in the highest test concentration (39%) was visually determined to be different from that of the solvent control (76%). Larval survival, length, and weight at 28 days post-hatch in the exposure concentrations were statistically comparable to those of the solvent control.

Average water quality and ranges for each replicate are presented in Table 1 (attached).

13. **STUDY AUTHOR'S CONCLUSIONS/QUALITY ASSURANCE MEASURES:**
The LOEC value for parental generation survival after 28 and 45 days and at test termination was 0.41 µg/l. Hatching success of offspring generation was adversely affected at 0.41 µg/l, however, there was no effect noted in hatching at the same concentration for the parental generation. The author attributes this difference to the water hardening of the offspring generation embryos in the test solution (i.e., being dosed immediately) compared to the hardening of parental generation embryos in dilution water.

The maximum acceptable toxicant concentration (MATC) was >0.2 µg a.i./l and <0.41 µg a.i./l giving a geometric mean MATC of 0.29 µg a.i./l.

Quality Assurance and Good Laboratory Practice Compliance Statements were included in the report, indicating that the study was conducted in accordance with FIFRA Good Laboratory Practice Standards set forth in 40 CFR Part 160.

14. **REVIEWER'S DISCUSSION AND INTERPRETATION OF STUDY RESULTS:**

A. **Test Procedure:** At the present time, no ASTM Standard Guide is available for life-cycle tests with fish. Since a portion of the life-cycle test is essentially the same as an early life-stage test, adherence to the early life-stage protocol (ASTM, 1987) was considered in addition to the SEP. The test procedures were generally in accordance with the SEP or ASTM (1987), but deviated as follows:

No raw fish growth data were included in the report. This data should have been provided to allow independent statistical analysis by the reviewer.

No raw water chemistry data were included in the report. Time-weighted average temperature and DO for the test containers could not be determined.

Dilution water control data for the offspring generation were not included in the report (Table 8, attached). The author did not state whether a dilution water control was used or why no results were reported. A valid test should include a dilution water control and a solvent control, if solvent was used.

Chemical analysis of the flake fish food used during the test found detectable quantities of mercury (0.11 ppm), lead (0.5 ppm), cadmium (0.12 ppm), and arsenic (1.5 ppm).

Guthion was found in detectable quantities (0.0057-0.02 µg/l) in the dilution water control on days 0, 5, 103, and 110, and in the solvent control on days 0 and 12.

The SEP states that the second generation larval exposure period should be 8 weeks post-hatch. The exposure in this test was 28 days post-hatch.

The concentration of acetone used in the solvent control was not given in the report. The concentration of solvent should not exceed 0.1 ml/l.

The egg incubation cups were attached to the aquarium side. The SEP suggests that the cups be suspended in the aquaria and oscillated to facilitate solution renewal.

The test solutions were aerated beginning on day 28 until test termination. The SEP states that the test solutions should not be aerated.

A 12-hour light/12-hour dark photoperiod was used in the test. A 16-hour light/8-hour dark photoperiod is recommended in the SEP.

The report does not state if the accuracy of the flow splitting mechanism used to deliver the test solutions was checked regularly.

The light intensity used during the test was not given in the report. The SEP recommends a light intensity of 10-100 lux.

The SEP states that the dilution water used should be sterilized, preferably by UV light exposure, before use. The report does not indicate that sterilization was used.

ASTM recommends determining the dry weight of the surviving fishes after the exposure period. Only the wet weight of the fish was determined.

B. **Statistical Analysis:** No raw growth data were included in the report. This data should have been included in order to estimate the overall experimental error and allow the reviewer to use two-way analysis of variance (ANOVA). In the absence of raw data, the reviewer used methods similar to that of the author to analyze embryo hatching success, juvenile survival and weight (28 days post-hatch), adult survival and length 45 days post-hatch, adult survival and growth at termination, offspring hatching success, and offspring survival 28 days post-hatch. Adult length after 28 days and offspring growth after 28 days were not analyzed statistically because of obvious similarity between control and exposure groups (Tables 5 and 8, respectively). All data (except growth) were arcsine square root transformed and treatment means compared using an appropriate (parametric or non-parametric) procedure (see attached printouts 1-22). If data for one of the two replicates per concentration were missing, that concentration was not included in the analysis.

Adult fertility data were analyzed using two-way ANOVA. Only spawning trials where eggs were produced were included in the analysis. In general, the reviewer's independent analyses were in agreement with the author's.

C. **Discussion/Results:** Several points about the study should be noted. The egg incubation cups were not oscillated in the test solution. Whether the solutions in the egg cups were adequately renewed cannot be determined.

The embryo hatching in the controls (54-73%) was fairly low. The reviewer believes these values reflect the actual numbers with no adjustment for average egg viability in the population.

On several occasions, the test material was detected in the controls. The values were low compared to the mean

measured concentrations for the test and the detected concentrations were found fairly early (days 0, 5, and 12) and again fairly late (days 103 and 110) in the test. Taking into account the length of the exposure (113 days) and the infrequency of detection in the controls, the reviewer does not believe the results of the test were compromised.

According to the SEP, the offspring generation larval exposure was too short. Since the exposure used (28 days) was similar to that used in early life-stage tests, the length of exposure in this test probably did not affect the results of the test.

The summarized second generation larval growth data (Table 8, attached) did not include standard deviations for the replicate means. Since no raw data were included, the reviewer could not calculate the relative standard deviations to determine compliance with the guidelines. In addition, no dilution water control data were given in this table or in the text and the exposure groups were compared to the solvent control data only. This laboratory usually performs a t-test and pools control data when no difference is found between solvent and dilution water controls. It is unclear why no dilution water control data are present and may indicate a problem with the dilution water control data.

This study is scientifically sound but does not meet the guideline requirements for a life-cycle chronic toxicity test using sheepshead minnows. Raw water quality and fish growth data were not included in the report. Offspring data for the control group are also missing. Based on the significant effect on minnow survival and hatching success of second generation embryos at 0.41 µg/l, the maximum acceptable toxicant concentration was >0.2 and <0.41 µg/l (geometric mean MATC = 0.29 µg/l).

D. **Adequacy of the Study:**

(1) **Classification:** Supplemental.

(2) **Rationale:** Raw water quality, fish growth data, and offspring data for the control group were not included in the report.

(3) **Repairability:** This study may be upgraded to "core" upon satisfactory review of the DO,

temperature, fish growth data, and control offspring data.

15. **COMPLETION OF ONE-LINER FOR STUDY:** Yes, 12-11-91.

Table 1. **Results of water quality parameters measured during the chronic exposure of sheepshead minnow (*Cyprinodon variegatus*) to Guthion.**

Nominal Concentration (µg A.I./L)	Salinity[a] (°/oo)	Dissolved Oxygen[ab] (mg/L)	Temperature[a] (°C)	pH
0.50	30 ± 1 (29 - 31)	5.8 ± 0.4 (4.3 - 7.1)	30 ± 1 (28 - 31)	7.6 - 8.1
0.25	30 ± 1 (29 - 32)	5.9 ± 0.5 (4.4 - 7.3)	30 ± 1 (28 - 31)	7.6 - 8.2
0.13	30 ± 1 (29 - 31)	5.9 ± 0.6 (3.9 - 7.3)	30 ± 1 (28 - 31)	7.6 - 8.2
0.063	30 ± 1 (29 - 31)	5.9 ± 0.5 (3.9 - 7.4)	30 ± 1 (28 - 31)	7.6 - 8.1
0.031	30 ± 1 (29 - 32)	5.9 ± 0.5 (3.9 - 7.5)	30 ± 1 (28 - 31)	7.6 - 8.2
Solvent Control	30 ± 1 (29 - 32)	5.8 ± 0.4 (4.4 - 7.2)	30 ± 1 (28 - 31)	7.6 - 8.1
Control	30 ± 1 (29 - 32)	6.0 ± 0.5 (4.3 - 7.5)	30 ± 1 (28 - 31)	7.7 - 8.1

[a] Measurement presented as mean ± standard deviation with the range in parentheses.
[b] At a temperature of 30 °C and a salinity of 30 °/oo, a dissolved oxygen concentration of 6.4 mg/L is equal to 100% of saturation. The extremes of the reported range represent a single data point only.

Table 2. Concentrations of Guthion measured (radiometric analysis) during the full life cycle exposure of sheepshead minnow (*Cyprinodon variegatus*).

Day		Nominal Concentration (µg A.I./L) 0.50	0.25	0.13	0.063	0.031	Solvent Control	Control
		Measured Concentration (µg A.I./L)						
0	A	0.45	0.19	0.084	0.048	0.050X	<0.0050	<0.0050
	B	0.35	0.18	0.090	0.046	0.035	0.0077	0.020
1	A	0.46	0.24	0.11X	0.045	0.037	<0.0050	<0.0051
	B	0.46	0.23	0.093	0.060X	0.033	<0.0051	<0.0051
5	A	0.47	0.19	0.083	0.039	0.029	<0.0050	<0.0050
	B	0.48	0.20	0.083	0.044	0.033	<0.0049	0.011
12	A	0.39	0.21	0.11X	0.056	0.042X	0.0057	<0.0051
	B	0.40	0.21	0.11	0.054	0.033	<0.0051	<0.0051
19	A	0.46	0.20	0.092	0.042	0.031	<0.0049	<0.0049
	B	0.43	0.22	0.088	0.056	0.028	<0.0049	<0.0049
26	A	0.39	0.22	0.082	0.036	0.027	<0.0049	<0.0049
	B	0.40	0.16	0.078	0.042	0.030	<0.0049	<0.0049
33	A	0.40	0.21	0.076	0.046	0.030	<0.0049	<0.0049
	B	0.34	0.18	0.092	0.046	0.029	<0.0049	<0.0049
40	A	0.41	0.20	0.095	0.049	0.030	<0.0049	<0.0049
	B	0.42	0.21	0.093	0.046	0.028	<0.0049	<0.0049
47	A	0.37	0.18	0.089	0.045	0.028	<0.0049	<0.0049
	B	0.38	0.19	0.091	0.041	0.026	<0.0049	<0.0049
54	UA[a]	0.43	0.23	0.090	0.050	0.039X	<0.0049	<0.0049
	LA	0.40	0.20	0.11	0.057X	0.035	0.0066	<0.0049
61	UB	---[b]	0.22	0.094	0.048	0.029	<0.0049	<0.0049
	LB	0.38	0.20	0.11	0.045	0.036X	<0.0049	<0.0049

X = more than 30% higher than the Twa concentration

Table 2. Continued

Day		Nominal Concentration (µg A.I./L) 0.50	0.25	0.13	0.063	0.031	Solvent Control	Control
68	UA	0.59X	0.31X	0.13X	0.080X	0.040X	<0.0049	<0.0049
	LA	0.54X	0.24	0.14X	0.070X	0.049X	<0.0049	<0.0048
75	UB	0.46	0.27X	0.096	0.049	0.029	<0.0049	<0.0049
	LB	0.43	0.20	0.11	0.045	0.035	<0.0049	<0.0049
82	UA	0.43	0.24	0.10	0.052	0.035	<0.0049	<0.0049
	LA	0.45	0.20	0.084	0.038	0.029	<0.0049	<0.0049
89	UB	0.40	0.23	0.083	0.039	0.019	<0.0049	<0.0049
	LB	0.39	0.14	0.066	0.025	0.021	<0.0049	<0.0049
96	A	0.33	0.15	0.078	0.038	0.034	<0.0049	<0.0049
	B	0.39	0.19	0.078	0.039	0.024	<0.0049	<0.0049
103	A	0.36	0.19	0.086	0.047	0.030	<0.0049	0.0079
	B	0.38	0.19	0.086	0.041	0.027	<0.0049	<0.0049
110	A	0.35	0.18	0.078	0.043	0.026	<0.0049	<0.0048
	B	0.36	0.19	0.082	0.045	0.025	<0.0048	0.0085
113	A	0.33	0.14	0.073	0.038	0.024	<0.0049	<0.0049
	B	0.33	0.15	0.070	0.035	0.021	<0.0049	<0.0049
Mean[c]		0.41 (0.055)	0.20 (0.034)	0.092 (0.015)	0.046 (0.0097)	0.031 (0.0067)		
% of nominal		82	80	71	73	100		

[a] U = upper level of test system; L = lower level of test system

[b] Results rejected using Chauvenet's Criterion (see section 5.2.2).

[c] Mean measured concentrations are presented with the standard deviation in parentheses and were calculated using the actual analytical (unrounded) values and not the rounded (two significant figures) values presented in this table.

TWA Concentration A .37 .19 .084 .044 .029
B .38 .19 .086 .043 .027

X denotes values 30% greater than the time weighted average concentration.

Table 5. Embryo hatching success, larval survival and growth of the F_0 sheepshead minnow (*Cyprinodon variegatus*) after 28 and 45 days post-hatch exposure to Guthion.

Mean Measured Concentration (µg A.I./L)		Embryo Hatching[a] (%)	Day 28 Larval Survival (%)	Day 28 Total Length[b] (mm)	Day 28 Wet Weight[b] (mg)	Day 45 Larval Survival[c] (%)	Day 45 Total Length[b] (mm)
0.41	A	64	46[d]	26 ± 5	---[e]	84[d]	32 ± 5
	B	65	64[d]	24 ± 5	402 ± 232	92[d]	30 ± 7
0.20	A	68	98	25 ± 2	319 ± 94	100	33 ± 4
	B	63	100	25 ± 2	319 ± 82	100	33 ± 3
0.092	A	68	98	26 ± 3	307 ± 92	100	34 ± 3
	B	81	94	24 ± 2	312 ± 97	96	33 ± 3
0.046	A	75	98	25 ± 2	285 ± 75	96	33 ± 3
	B	69	94	26 ± 2	332 ± 83	100	33 ± 4
0.031	A	63	100	25 ± 2	303 ± 52	100	34 ± 4
	B	72	96	25 ± 3	306 ± 112	100	33 ± 4
Solvent Control	A	54	98	25 ± 3	338 ± 114	100	34 ± 4
	B	70	98	25 ± 3	321 ± 87	100	34 ± 4
Control	A	61	96	25 ± 2	333 ± 83	100	35 ± 4
	B	73	98	25 ± 2	327 ± 73	100	33 ± 2

[a] Percentage is based on the total number of eggs incubated in each replicate aquarium. A sub-sample viability determination indicated approximately 76% of these eggs were viable.
[b] Measurement presented as mean ± standard deviation.
[c] Percentage is based on the survival among larval groups of 25 which were established at day 28 post-hatch thinning of larvae.
[d] Significantly different ($p \leq 0.05$) as compared to the pooled control data.
[e] Reduced survival eliminated the availability of larval fish for weight determination.

Table 6. **Survival and growth of F_0 sheepshead minnow (*Cyprinodon variegatus*) at the termination (113 days) of the chronic exposure to Guthion.**

Mean Measured Concentration (µg A.I./L)		Percent Survival[a]	Mean Total Length[b] (mm) Male	Mean Total Length[b] (mm) Female	Mean Wet Weight[b] (grams) Male	Mean Wet Weight[b] (grams) Female
0.41	A	81[c]	43 (9)	41 (5)	1.85 (0.87)	1.55 (0.64)
	B	78[c]	47 (7)	41 (5)	2.42 (0.98)	1.42 (0.52)
0.20	A	92	48 (3)	41 (3)	2.64 (0.56)	1.40 (0.36)
	B	100	45 (3)	41 (4)	1.94 (0.39)	1.37 (0.39)
0.092	A	100	46 (2)	42 (4)	2.12 (0.31)	1.53 (0.36)
	B	100	47 (6)	42 (5)	2.35 (0.44)	1.56 (0.51)
0.046	A	96	45 (2)	42 (3)	2.21 (0.30)	1.58 (0.31)
	B	100	46 (2)	43 (3)	2.27 (0.41)	1.67 (0.48)
0.031	A	96	45 (4)	39 (3)	2.15 (0.54)	1.32 (0.39)
	B	100	48 (4)	42 (3)	2.55 (0.62)	1.63 (0.46)
Solvent Control	A	100	46 (3) 6.5	41 (3) 7.3	2.39 (0.46) 19.2	1.56 (0.45) 28.8
	B	100	47 (5) 10.6	42 (4) 9.5	2.35 (0.72) 30.6	1.57 (0.44) 28.0
Control	A	100	45 (4) 8.9	40 (4) 10	2.08 (0.61) 29.3	1.35 (0.38) 28.1
	B	100	46 (2) 4.3	40 (3) 7.5	2.24 (0.32) 14.3	1.42 (0.28) 19.7

[a] Percent survival of organisms between days 45 post-hatch and test termination. Mortalities occurring in active spawning groups were considered to be non-toxicant related and were not included in the determination of survival of F_0 adults during this period.

[b] Standard deviation is presented in parentheses.

[c] Significantly different ($p \leq 0.05$) as compared to the pooled control data.

Table 7. Number of eggs produced (total and # per female per day) during the full life cycle toxicity test exposing sheepshead minnow (*Cyprinodon variegatus*) to Guthion.

Mean Measured Concentration (µg A.I./L)		Total # Eggs Produced[a]	Mean # Eggs/Female/Day[b]	
			Replicate	Treatment[c]
0.41	A	613	4.4	2.7 (5.0)
	B	48	0.5	
0.20	A	1169	5.6	3.2 (5.0)
	B	170	0.8	
0.092	A	1275	6.1	5.1 (5.2)
	B	865	4.1	
0.046	A	2570	12.2	9.7 (10.2)
	B	950	6.6	
0.031	A	1039	5.1	8.6 (9.1)
	B	2091	12.6	
Solvent Control	A	683	3.3	2.6 (4.1)
	B	415	2.0	
Control	A	38	0.2	0.6 (1.6)
	B	179	1.0	

[a] Based on the production of 3 spawning groups for 14 days each.
[b] # eggs/female/day was calculated with the number of females alive on each day of spawning.
[c] Mean presented with the standard deviation in parentheses.

Table 8. Survival and growth (total length and wet weight) of F_1 sheepshead minnow (*Cyprinodon variegatus*) exposed for 32 days (28 days post-hatch) to Guthion.

Mean Measured Concentration (µg A.I./L)		Hatching Success (%)	N[a]	28 Day Post-hatch Larvae Survival (%)	Length (mm)	Weight (g)	N[b]
0.41	A	39[c]	4	100	20	0.18	1
	B	---[d]	---	---	---	---	---
0.20	A	84	8	100	23	0.26	1
	B	70	1	96	21	0.19	1
0.092	A	78	10	84	21	0.21	1
	B	80	2	96	20	0.17	2
0.046	A	77	11	92	22	0.21	2
	B	84	6	88	24	0.26	2
0.031	A	96	10	100	22	0.21	2
	B	68	11	100	21	0.17	2
Solvent Control	A	77	5	98	22	0.19	2
	B	74	1	96	21	0.19	1

[a] N = Number of egg groups (50 eggs/group) incubated and evaluated for percentage hatch.
[b] N = Number of larval groups (25 larvae/group) reared and evaluated for percentage survival and growth.
[c] Empirically estimated to be reduced compared to the solvent control.
[d] No spawns of > 50 eggs.

TITLE: 420216-01, GUTHION, PARENTAL EMBRYO HATCHING
FILE: A:42021601.DT1
TRANSFORM: ARC SINE(SQUARE ROOT(Y)) NUMBER OF GROUPS: 7

GRP	IDENTIFICATION	REP	VALUE	TRANS VALUE
1	SOLVENT CONTROL	1	0.5400	0.8254
1	SOLVENT CONTROL	2	0.7000	0.9912
2	CONTROL	1	0.6100	0.8963
2	CONTROL	2	0.7300	1.0244
3	0.031	1	0.6300	0.9169
3	0.031	2	0.7200	1.0132
4	0.046	1	0.7500	1.0472
4	0.046	2	0.6900	0.9803
5	0.092	1	0.8100	1.1198
5	0.092	2	0.6800	0.9695
6	0.2	1	0.6800	0.9695
6	0.2	2	0.6300	0.9169
7	0.41	1	0.6400	0.9273
7	0.41	2	0.6500	0.9377

Shapiro Wilks test for normality
Data PASS normality test at P=0.01 level. Continue analysis.

Bartletts test for homogeneity of variance
Data PASS homogeneity test at 0.01 level. Continue analysis.

ANOVA TABLE

SOURCE	DF	SS	MS	F
Between	6	0.027	0.004	0.756
Within (Error)	7	0.042	0.006	
Total	13	0.068		

Critical F value = 3.87 (0.05,6,7)
Since F < Critical F FAIL TO REJECT Ho:All groups equal

DUNNETTS TEST - TABLE 1 OF 2 Ho:Control<Treatment

GROUP	IDENTIFICATION	TRANSFORMED MEAN	MEAN CALCULATED IN ORIGINAL UNITS	T STAT	SIG
1	SOLVENT CONTROL	0.908	0.620		
2	CONTROL	0.960	0.670	-0.676	
3	0.031	0.965	0.675	-0.737	
4	0.046	1.014	0.720	-1.369	
5	0.092	1.045	0.745	-1.770	
6	0.2	0.943	0.655	-0.453	
7	0.41	0.933	0.645	-0.314	

Dunnett table value = 2.82 (1 Tailed Value, P=0.05, df=7,6)

420216-01, GUTHION, PARENTAL EMBRYO HATCHING
File: A:42021601.DT1 Transform: ARC SINE(SQUARE ROOT(Y))

DUNNETTS TEST - TABLE 2 OF 2 Ho:Control<Treatment

GROUP	IDENTIFICATION	NUM OF REPS	Minimum Sig Diff (IN ORIG. UNITS)	% of CONTROL	DIFFERENCE FROM CONTROL
1	SOLVENT CONTROL	2			
2	CONTROL	2	0.215	34.7	-0.050
3	0.031	2	0.215	34.7	-0.055
4	0.046	2	0.215	34.7	-0.100
5	0.092	2	0.215	34.7	-0.125
6	0.2	2	0.215	34.7	-0.035
7	0.41	2	0.215	34.7	-0.025

t-test of Solvent and Blank Controls Ho:GRP1 MEAN = GRP2 MEAN

GRP1 (SOLVENT CRTL) MEAN =	0.9083	CALCULATED t VALUE =	-0.4970
GRP2 (BLANK CRTL) MEAN =	0.9604	DEGREES OF FREEDOM =	2
DIFFERENCE IN MEANS =	-0.0521		

TABLE t VALUE (0.05 (2), 2) = 4.303 NO significant difference at alpha=0.05
TABLE t VALUE (0.01 (2), 2) = 9.925 NO significant difference at alpha=0.01

420216-01, GUTHION, PARENTAL SURVIVAL DAY 28
File: A:42021601.DT2 Transform: ARC SINE(SQUARE ROOT(Y))

GRP	IDENTIFICATION	N	MIN	MAX	MEAN
1	SOLVENT CONTROL	2	1.429	1.429	1.429
2	0.031	2	1.369	1.500	1.435
3	0.046	2	1.323	1.429	1.376
4	0.092	2	1.323	1.429	1.376
5	0.2	2	1.429	1.500	1.464
6	0.41	2	0.745	0.927	0.836

GRP	IDENTIFICATION	VARIANCE	SD	SEM
1	SOLVENT CONTROL	0.000	0.000	0.000
2	0.031	0.009	0.092	0.065
3	0.046	0.006	0.075	0.053
4	0.092	0.006	0.075	0.053
5	0.2	0.003	0.050	0.036
6	0.41	0.017	0.129	0.091

Shapiro Wilks test for normality
Data PASS normality test at P=0.01 level. Continue analysis.

Hartley test for homogeneity of variance
Bartletts test for homogeneity of variance
T' e two tests can not be performed because at least one group has
z variance.
Data FAIL to meet homogeneity of variance assumption.

ANOVA TABLE

SOURCE	DF	SS	MS	F
Between	5	0.572	0.114	17.720
Within (Error)	6	0.039	0.006	
Total	11	0.611		

Critical F value = 4.39 (0.05,5,6)
Since F > Critical F REJECT Ho:All groups equal

DUNNETTS TEST - TABLE 1 OF 2 Ho:Control<Treatment

GROUP	IDENTIFICATION	TRANSFORMED MEAN	MEAN CALCULATED IN ORIGINAL UNITS	T STAT	SIG
1	SOLVENT CONTROL	1.429	0.980		
2	0.031	1.435	0.980	-0.073	
3	0.046	1.376	0.960	0.657	
4	0.092	1.376	0.960	0.657	
	0.2	1.464	0.990	-0.443	
	0.41	0.836	0.550	7.373	*

Dunnett table value = 2.83 (1 Tailed Value, P=0.05, df=6,5)

420216-01, GUTHION, PARENTAL SURVIVAL DAY 28
File: A:42021601.DT2 Transform: ARC SINE(SQUARE ROOT(Y))

DUNNETTS TEST - TABLE 2 OF 2 Ho:Control<Treatment

GROUP	IDENTIFICATION	NUM OF REPS	Minimum Sig Diff (IN ORIG. UNITS)	% of CONTROL	DIFFERENCE FROM CONTROL
1	SOLVENT CONTROL	2			
2	0.031	2	0.110	11.3	-0.000
3	0.046	2	0.110	11.3	0.020
4	0.092	2	0.110	11.3	0.020
5	0.2	2	0.110	11.3	-0.010
6	0.41	2	0.110	11.3	0.430

KRUSKAL-WALLIS ANOVA BY RANKS - TABLE 1 OF 2 (p=0.05)

GROUP	IDENTIFICATION	TRANSFORMED MEAN	MEAN CALCULATED IN ORIGINAL UNITS	RANK SUM
1	SOLVENT CONTROL	1.429	0.980	16.000
2	0.031	1.435	0.980	16.500
3	0.046	1.376	0.960	11.500
4	0.092	1.376	0.960	11.500
5	0.2	1.464	0.990	19.500
6	0.41	0.836	0.550	3.000

lculated H Value = 7.000 Critical H Value Table = 11.070
ıce Calc H < Crit H FAIL TO REJECT Ho:All groups are equal.

DUNNS MULTIPLE COMPARISON - KRUSKAL-WALLIS - TABLE 2 OF 2 (p=0.05)

GROUP	IDENTIFICATION	TRANSFORMED MEAN	ORIGINAL MEAN	GROUP 6	4	3	1	2	5
6	0.41	0.836	0.550	\					
4	0.092	1.376	0.960	.	\				
3	0.046	1.376	0.960	.	.	\			
1	SOLVENT CONTROL	1.429	0.980	.	.	.	\		
2	0.031	1.435	0.980	.	.	.	.	\	
5	0.2	1.464	0.990	.	.	.	.	.	\

* = significant difference (p=0.05) . = no significant difference
Table q value (0.05,6) = 2.936 SE = 3.464

TITLE: 420216-01, GUTHION, PARENTAL 28-DAY WET WEIGHT
FILE: A:42021601.DT3
TRANSFORM: NO TRANSFORM NUMBER OF GROUPS: 5

GRP	IDENTIFICATION	REP	VALUE	TRANS VALUE
1	SOLVENT CONTROL	1	338.0000	338.0000
1	SOLVENT CONTROL	2	321.0000	321.0000
2	0.031	1	303.0000	303.0000
2	0.031	2	306.0000	306.0000
3	0.046	1	285.0000	285.0000
3	0.046	2	332.0000	332.0000
4	0.092	1	307.0000	307.0000
4	0.092	2	312.0000	312.0000
5	0.2	1	319.0000	319.0000
5	0.2	2	319.0000	319.0000

Shapiro Wilks test for normality
Data PASS normality test at P=0.01 level. Continue analysis.

Hartley test for homogeneity of variance
Bartletts test for homogeneity of variance

These two tests can not be performed because at least one group has zero variance.

Data FAIL to meet homogeneity of variance assumption.
Additional transformations are useless.

ANOVA TABLE

SOURCE	DF	SS	MS	F
Between	4	811.600	202.900	0.801
Within (Error)	5	1266.000	253.200	
Total	9	2077.600		

Critical F value = 5.19 (0.05,4,5)
Since F < Critical F FAIL TO REJECT Ho:All groups equal

420216-01, GUTHION, PARENTAL 28-DAY WET WEIGHT
File: A:42021601.DT3 Transform: NO TRANSFORMATION

DUNNETTS TEST - TABLE 1 OF 2 Ho:Control<Treatment

GROUP	IDENTIFICATION	TRANSFORMED MEAN	MEAN CALCULATED IN ORIGINAL UNITS	T STAT	SIG
1	SOLVENT CONTROL	329.500	329.500		
2	0.031	304.500	304.500	1.571	
3	0.046	308.500	308.500	1.320	
4	0.092	309.500	309.500	1.257	
5	0.2	319.000	319.000	0.660	

Dunnett table value = 2.85 (1 Tailed Value, P=0.05, df=5,4)

DUNNETTS TEST - TABLE 2 OF 2 Ho:Control<Treatment

GROUP	IDENTIFICATION	NUM OF REPS	Minimum Sig Diff (IN ORIG. UNITS)	% of CONTROL	DIFFERENCE FROM CONTROL
1	SOLVENT CONTROL	2			
2	0.031	2	45.350	13.8	25.000
3	0.046	2	45.350	13.8	21.000
4	0.092	2	45.350	13.8	20.000
5	0.2	2	45.350	13.8	10.500

KRUSKAL-WALLIS ANOVA BY RANKS - TABLE 1 OF 2 (p=0.05)

GROUP	IDENTIFICATION	TRANSFORMED MEAN	MEAN CALCULATED IN ORIGINAL UNITS	RANK SUM
1	SOLVENT CONTROL	329.500	329.500	18.000
2	0.031	304.500	304.500	5.000
3	0.046	308.500	308.500	10.000
4	0.092	309.500	309.500	9.000
5	0.2	319.000	319.000	13.000

Calculated H Value = 5.159 Critical H Value Table = 7.418
Since Calc H < Crit H FAIL TO REJECT Ho:All groups are equal.

DUNNS MULTIPLE COMPARISON - KRUSKAL-WALLIS - TABLE 2 OF 2 (p=0.05)

GROUP	IDENTIFICATION	TRANSFORMED MEAN	ORIGINAL MEAN	GROUP 0 2	0 3	0 4	0 5	0 1
2	0.031	304.500	304.500	\				
3	0.046	308.500	308.500	.	\			
4	0.092	309.500	309.500	.	.	\		
5	0.2	319.000	319.000	.	.	.	\	
1	SOLVENT CONTROL	329.500	329.500	.	.	.	.	\

significant difference (p=0.05) . = no significant difference
Table q value (0.05,5) = 2.807 SE = 3.018

TITLE: 420216-01, GUTHION, PARENTAL 45-DAY SURVIVAL
FILE: A:42021601.DT4
TRANSFORM: ARC SINE(SQUARE ROOT(Y)) NUMBER OF GROUPS: 6

GRP	IDENTIFICATION	REP	VALUE	TRANS VALUE
1	SOLVENT CONTROL	1	1.0000	1.4706
1	SOLVENT CONTROL	2	1.0000	1.4706
2	0.031	1	1.0000	1.4706
2	0.031	2	1.0000	1.4706
3	0.046	1	0.9600	1.3694
3	0.046	2	1.0000	1.4706
4	0.092	1	1.0000	1.4706
4	0.092	2	0.9600	1.3694
5	0.2	1	1.0000	1.4706
5	0.2	2	1.0000	1.4706
6	0.41	1	0.8400	1.1593
6	0.41	2	0.9200	1.2840

Shapiro Wilks test for normality

Data PASS normality test at P=0.01 level. Continue analysis.

Hartley test for homogeneity of variance
Bartletts test for homogeneity of variance

These two tests can not be performed because at least one group has
zero variance.

Data FAIL to meet homogeneity of variance assumption.
Additional transformations are useless.

ANOVA TABLE

SOURCE	DF	SS	MS	F
Between	5	0.093	0.019	6.215
Within (Error)	6	0.018	0.003	
Total	11	0.111		

Critical F value = 4.39 (0.05,5,6)
Since F > Critical F REJECT Ho:All groups equal

DUNNETTS TEST - TABLE 1 OF 2 Ho:Control<Treatment

GROUP	IDENTIFICATION	TRANSFORMED MEAN	MEAN CALCULATED IN ORIGINAL UNITS	T STAT	SIG
1	SOLVENT CONTROL	1.471	1.000		
2	0.031	1.471	1.000	0.000	
3	0.046	1.420	0.980	0.923	
4	0.092	1.420	0.980	0.923	
5	0.2	1.471	1.000	0.000	
6	0.41	1.222	0.880	4.543	*

Dunnett table value = 2.83 (1 Tailed Value, P=0.05, df=6,5)

420216-01, GUTHION, PARENTAL 45-DAY SURVIVAL
File: A:42021601.DT4 Transform: ARC SINE(SQUARE ROOT(Y))

DUNNETTS TEST - TABLE 2 OF 2 Ho:Control<Treatment

GROUP	IDENTIFICATION	NUM OF REPS	Minimum Sig Diff (IN ORIG. UNITS)	% of CONTROL	DIFFERENCE FROM CONTROL
1	SOLVENT CONTROL	2			
2	0.031	2	0.054	5.4	0.000
3	0.046	2	0.054	5.4	0.020
4	0.092	2	0.054	5.4	0.020
5	0.2	2	0.054	5.4	0.000
6	0.41	2	0.054	5.4	0.120

KRUSKAL-WALLIS ANOVA BY RANKS - TABLE 1 OF 2 (p=0.05)

GROUP	IDENTIFICATION	TRANSFORMED MEAN	MEAN CALCULATED IN ORIGINAL UNITS	RANK SUM
1	SOLVENT CONTROL	1.471	1.000	17.000
2	0.031	1.471	1.000	17.000
3	0.046	1.420	0.980	12.000
4	0.092	1.420	0.980	12.000
5	0.2	1.471	1.000	17.000
6	0.41	1.222	0.880	3.000

lculated H Value = 8.209 Critical H Value Table = 11.070
nce Calc H < Crit H FAIL TO REJECT Ho:All groups are equal.

DUNNS MULTIPLE COMPARISON - KRUSKAL-WALLIS - TABLE 2 OF 2 (p=0.05)

GROUP	IDENTIFICATION	TRANSFORMED MEAN	ORIGINAL MEAN	GROUP 0 0 0 0 0 0 6 4 3 2 5 1
6	0.41	1.222	0.880	\
4	0.092	1.420	0.980	. \
3	0.046	1.420	0.980	. . \
2	0.031	1.471	1.000	. . . \
5	0.2	1.471	1.000	. . . . \
1	SOLVENT CONTROL	1.471	1.000	. . . . . \

* = significant difference (p=0.05) . = no significant difference
Table q value (0.05,6) = 2.936 SE = 3.023

TITLE: 420216-01, GUTHION, PARENTAL LENGTH AFTER 45 DAYS
FILE: A:42021601.DT5
NSFORM: NO TRANSFORM NUMBER OF GROUPS: 6

GRP	IDENTIFICATION	REP	VALUE	TRANS VALUE
1	SOLVENT CONTROL	1	34.0000	34.0000
1	SOLVENT CONTROL	2	34.0000	34.0000
2	0.031	1	33.0000	33.0000
2	0.031	2	34.0000	34.0000
3	0.046	1	33.0000	33.0000
3	0.046	2	33.0000	33.0000
4	0.092	1	33.0000	33.0000
4	0.092	2	34.0000	34.0000
5	0.2	1	33.0000	33.0000
5	0.2	2	33.0000	33.0000
6	0.41	1	30.0000	30.0000
6	0.41	2	32.0000	32.0000

Shapiro Wilks test for normality

Data PASS normality test at P=0.01 level. Continue analysis.

Hartley test for homogeneity of variance
Bartletts test for homogeneity of variance

These two tests can not be performed because at least one group has
z ero variance.
FAIL to meet homogeneity of variance assumption.
Additional transformations are useless.

ANOVA TABLE

SOURCE	DF	SS	MS	F
Between	5	11.000	2.200	4.400
Within (Error)	6	3.000	0.500	
Total	11	14.000		

Critical F value = 4.39 (0.05,5,6)
Since F > Critical F REJECT Ho:All groups equal

DUNNETTS TEST - TABLE 1 OF 2 Ho:Control<Treatment

GROUP	IDENTIFICATION	TRANSFORMED MEAN	MEAN CALCULATED IN ORIGINAL UNITS	T STAT	SIG
1	SOLVENT CONTROL	34.000	34.000		
2	0.031	33.500	33.500	0.707	
3	0.046	33.000	33.000	1.414	
4	0.092	33.500	33.500	0.707	
	0.2	33.000	33.000	1.414	
	0.41	31.000	31.000	4.243	*

Dunnett table value = 2.83 (1 Tailed Value, P=0.05, df=6,5)

420216-01, GUTHION, PARENTAL LENGTH AFTER 45 DAYS
File: A:42021601.DT5 Transform: NO TRANSFORMATION

DUNNETTS TEST - TABLE 2 OF 2 Ho:Control<Treatment

GROUP	IDENTIFICATION	NUM OF REPS	Minimum Sig Diff (IN ORIG. UNITS)	% of CONTROL	DIFFERENCE FROM CONTROL
1	SOLVENT CONTROL	2			
2	0.031	2	2.001	5.9	0.500
3	0.046	2	2.001	5.9	1.000
4	0.092	2	2.001	5.9	0.500
5	0.2	2	2.001	5.9	1.000
6	0.41	2	2.001	5.9	3.000

KRUSKAL-WALLIS ANOVA BY RANKS - TABLE 1 OF 2 (p=0.05)

GROUP	IDENTIFICATION	TRANSFORMED MEAN	MEAN CALCULATED IN ORIGINAL UNITS	RANK SUM
1	SOLVENT CONTROL	34.000	34.000	21.000
2	0.031	33.500	33.500	16.000
3	0.046	33.000	33.000	11.000
4	0.092	33.500	33.500	16.000
5	0.2	33.000	33.000	11.000
6	0.41	31.000	31.000	3.000

lculated H Value = 8.672 Critical H Value Table = 11.070
ıce Calc H < Crit H FAIL TO REJECT Ho:All groups are equal.

DUNNS MULTIPLE COMPARISON - KRUSKAL-WALLIS - TABLE 2 OF 2 (p=0.05)

GROUP	IDENTIFICATION	TRANSFORMED MEAN	ORIGINAL MEAN	GROUP 0 6	0 5	0 3	0 2	0 4	0 1
6	0.41	31.000	31.000	\					
5	0.2	33.000	33.000	.	\				
3	0.046	33.000	33.000	.	.	\			
2	0.031	33.500	33.500	.	.	.	\		
4	0.092	33.500	33.500	.	.	.	.	\	
1	SOLVENT CONTROL	34.000	34.000	.	.	.	.	.	\

* = significant difference (p=0.05) . = no significant difference
Table q value (0.05,6) = 2.936 SE = 3.310

TITLE: 420216-01, GUTHION, PARENTAL SURVIVAL AT TERMINATION
FILE: A:42021601.DT6
TRANSFORM: ARC SINE(SQUARE ROOT(Y)) NUMBER OF GROUPS: 6

GRP	IDENTIFICATION	REP	VALUE	TRANS VALUE
1	SOLVENT CONTROL	1	1.0000	1.4706
1	SOLVENT CONTROL	2	1.0000	1.4706
2	0.031	1	0.9600	1.3694
2	0.031	2	1.0000	1.4706
3	0.046	1	0.9600	1.3694
3	0.046	2	1.0000	1.4706
4	0.092	1	1.0000	1.4706
4	0.092	2	1.0000	1.4706
5	0.2	1	0.9200	1.2840
5	0.2	2	1.0000	1.4706
6	0.41	1	0.8100	1.1198
6	0.41	2	0.7800	1.0826

Shapiro Wilks test for normality

Data PASS normality test at P=0.01 level. Continue analysis.

Hartley test for homogeneity of variance
Bartletts test for homogeneity of variance

These two tests can not be performed because at least one group has
z variance.
L FAIL to meet homogeneity of variance assumption.
Additional transformations are useless.

ANOVA TABLE

SOURCE	DF	SS	MS	F
Between	5	0.195	0.039	8.241
Within (Error)	6	0.028	0.005	
Total	11	0.223		

Critical F value = 4.39 (0.05,5,6)
Since F > Critical F REJECT Ho:All groups equal

DUNNETTS TEST - TABLE 1 OF 2 Ho:Control<Treatment

GROUP	IDENTIFICATION	TRANSFORMED MEAN	MEAN CALCULATED IN ORIGINAL UNITS	T STAT	SIG
1	SOLVENT CONTROL	1.471	1.000		
2	0.031	1.420	0.980	0.736	
3	0.046	1.420	0.980	0.736	
	0.092	1.471	1.000	0.000	
	0.2	1.377	0.960	1.358	
	0.41	1.101	0.795	5.376	*

Dunnett table value = 2.83 (1 Tailed Value, P=0.05, df=6,5)

420216-01, GUTHION, PARENTAL SURVIVAL AT TERMINATION
File: A:42021601.DT6 Transform: ARC SINE(SQUARE ROOT(Y))

DUNNETTS TEST - TABLE 2 OF 2 Ho:Control<Treatment

GROUP	IDENTIFICATION	NUM OF REPS	Minimum Sig Diff (IN ORIG. UNITS)	% of CONTROL	DIFFERENCE FROM CONTROL
1	SOLVENT CONTROL	2			
2	0.031	2	0.074	7.4	0.020
3	0.046	2	0.074	7.4	0.020
4	0.092	2	0.074	7.4	0.000
5	0.2	2	0.074	7.4	0.040
6	0.41	2	0.074	7.4	0.205

KRUSKAL-WALLIS ANOVA BY RANKS - TABLE 1 OF 2 (p=0.05)

GROUP	IDENTIFICATION	TRANSFORMED MEAN	MEAN CALCULATED IN ORIGINAL UNITS	RANK SUM
1	SOLVENT CONTROL	1.471	1.000	18.000
2	0.031	1.420	0.980	13.500
3	0.046	1.420	0.980	13.500
4	0.092	1.471	1.000	18.000
5	0.2	1.377	0.960	12.000
6	0.41	1.101	0.795	3.000

lculated H Value = 7.277 Critical H Value Table = 11.070
ice Calc H < Crit H FAIL TO REJECT Ho:All groups are equal.

DUNNS MULTIPLE COMPARISON - KRUSKAL-WALLIS - TABLE 2 OF 2 (p=0.05)

GROUP	IDENTIFICATION	TRANSFORMED MEAN	ORIGINAL MEAN	GROUP 0 6	0 5	0 2	0 3	0 1	0 4
6	0.41	1.101	0.795	\					
5	0.2	1.377	0.960	.	\				
2	0.031	1.420	0.980	.	.	\			
3	0.046	1.420	0.980	.	.	.	\		
1	SOLVENT CONTROL	1.471	1.000	.	.	.	.	\	
4	0.092	1.471	1.000	.	.	.	.	.	\

* = significant difference (p=0.05) . = no significant difference
Table q value (0.05,6) = 2.936 SE = 3.226

TITLE: 420216-01, GUTHION, OFFSPRING HATCHING SUCCESS
FILE: A:42021601.DT7
TRANSFORM: ARC SINE(SQUARE ROOT(Y)) NUMBER OF GROUPS: 5

GRP	IDENTIFICATION	REP	VALUE	TRANS VALUE
1	SOLVENT CONTROL	1	0.7700	1.0706
1	SOLVENT CONTROL	2	0.7400	1.0357
2	0.031	1	0.9600	1.3694
2	0.031	2	0.6800	0.9695
3	0.046	1	0.7700	1.0706
3	0.046	2	0.8400	1.1593
4	0.092	1	0.7800	1.0826
4	0.092	2	0.8000	1.1071
5	.2	1	0.8400	1.1593
5	.2	2	0.7000	0.9912

Shapiro Wilks test for normality

Data PASS normality test at P=0.01 level. Continue analysis.

Bartletts test for homogeneity of variance

Data PASS homogeneity test at 0.01 level. Continue analysis.

ANOVA TABLE

SOURCE	DF	SS	MS	F
Between	4	0.016	0.004	0.199
Within (Error)	5	0.099	0.020	
Total	9	0.115		

Critical F value = 5.19 (0.05,4,5)
Since F < Critical F FAIL TO REJECT Ho:All groups equal

DUNNETTS TEST - TABLE 1 OF 2 Ho:Control<Treatment

GROUP	IDENTIFICATION	TRANSFORMED MEAN	MEAN CALCULATED IN ORIGINAL UNITS	T STAT	SIG
1	SOLVENT CONTROL	1.053	0.755		
2	0.031	1.169	0.820	-0.827	
3	0.046	1.115	0.805	-0.439	
4	0.092	1.095	0.790	-0.296	
5	.2	1.075	0.770	-0.157	

Dunnett table value = 2.85 (1 Tailed Value, P=0.05, df=5,4)

420216-01, GUTHION, OFFSPRING HATCHING SUCCESS
File: A:42021601.DT7 Transform: ARC SINE(SQUARE ROOT(Y))

DUNNETTS TEST - TABLE 2 OF 2 Ho:Control<Treatment

GROUP	IDENTIFICATION	NUM OF REPS	Minimum Sig Diff (IN ORIG. UNITS)	% of CONTROL	DIFFERENCE FROM CONTROL
1	SOLVENT CONTROL	2			
2	0.031	2	0.387	51.2	-0.065
3	0.046	2	0.387	51.2	-0.050
4	0.092	2	0.387	51.2	-0.035
5	.2	2	0.387	51.2	-0.015

KRUSKAL-WALLIS ANOVA BY RANKS - TABLE 1 OF 2 (p=0.05)

GROUP	IDENTIFICATION	TRANSFORMED MEAN	MEAN CALCULATED IN ORIGINAL UNITS	RANK SUM
1	SOLVENT CONTROL	1.053	0.755	7.500
2	0.031	1.169	0.820	11.000
3	0.046	1.115	0.805	13.000
4	0.092	1.095	0.790	13.000
5	.2	1.075	0.770	10.500

Calculated H Value = 1.132 Critical H Value Table = 7.418
Since Calc H < Crit H FAIL TO REJECT Ho:All groups are equal.

NS MULTIPLE COMPARISON - KRUSKAL-WALLIS - TABLE 2 OF 2 (p=0.05)

GROUP	IDENTIFICATION	TRANSFORMED MEAN	ORIGINAL MEAN	GROUP 0 0 0 0 0 1 5 4 3 2
1	SOLVENT CONTROL	1.053	0.755	\
5	.2	1.075	0.770	. \
4	0.092	1.095	0.790	. . \
3	0.046	1.115	0.805	. . . \
2	0.031	1.169	0.820	. . . . \

* = significant difference (p=0.05) . = no significant difference
Table q value (0.05,5) = 2.807 SE = 3.009

TITLE: 420216-01, GUTHION, OFFSPRING SURVIVAL AFTER 28 DAYS
FILE: A:42021601.DT8
TRANSFORM: ARC SINE(SQUARE ROOT(Y)) NUMBER OF GROUPS: 5

GRP	IDENTIFICATION	REP	VALUE	TRANS VALUE
1	SOLVENT CONTROL	1	0.9800	1.4289
1	SOLVENT CONTROL	2	0.9600	1.3694
2	0.031	1	1.0000	1.4706
2	0.031	2	1.0000	1.4706
3	0.046	1	0.9200	1.2840
3	0.046	2	0.8800	1.2171
4	0.092	1	0.8400	1.1593
4	0.092	2	0.9600	1.3694
5	0.2	1	0.9600	1.3694
5	0.2	2	1.0000	1.4706

Shapiro Wilks test for normality

Data PASS normality test at P=0.01 level. Continue analysis.

Hartley test for homogeneity of variance
Bartletts test for homogeneity of variance

These two tests can not be performed because at least one group has zero variance.
Data FAIL to meet homogeneity of variance assumption.
Additional transformations are useless.

ANOVA TABLE

SOURCE	DF	SS	MS	F
Between	4	0.077	0.019	3.084
Within (Error)	5	0.031	0.006	
Total	9	0.108		

Critical F value = 5.19 (0.05,4,5)
Since F < Critical F FAIL TO REJECT Ho:All groups equal

DUNNETTS TEST - TABLE 1 OF 2 Ho:Control<Treatment

GROUP	IDENTIFICATION	TRANSFORMED MEAN	MEAN CALCULATED IN ORIGINAL UNITS	T STAT	SIG
1	SOLVENT CONTROL	1.399	0.970		
2	0.031	1.471	1.000	-0.904	
3	0.046	1.251	0.900	1.881	
4	0.092	1.264	0.900	1.706	
5	0.2	1.420	0.980	-0.264	

Dunnett table value = 2.85 (1 Tailed Value, P=0.05, df=5,4)

420216-01, GUTHION, OFFSPRING SURVIVAL AFTER 28 DAYS
File: A:42021601.DT8 Transform: ARC SINE(SQUARE ROOT(Y))

DUNNETTS TEST - TABLE 2 OF 2 Ho:Control<Treatment

GROUP	IDENTIFICATION	NUM OF REPS	Minimum Sig Diff (IN ORIG. UNITS)	% of CONTROL	DIFFERENCE FROM CONTROL
1	SOLVENT CONTROL	2			
2	0.031	2	0.120	12.4	-0.030
3	0.046	2	0.120	12.4	0.070
4	0.092	2	0.120	12.4	0.070
5	0.2	2	0.120	12.4	-0.010

KRUSKAL-WALLIS ANOVA BY RANKS - TABLE 1 OF 2 (p=0.05)

GROUP	IDENTIFICATION	TRANSFORMED MEAN	MEAN CALCULATED IN ORIGINAL UNITS	RANK SUM
1	SOLVENT CONTROL	1.399	0.970	12.000
2	0.031	1.471	1.000	18.000
3	0.046	1.251	0.900	5.000
4	0.092	1.264	0.900	6.000
5	0.2	1.420	0.980	14.000

Calculated H Value = 6.879 Critical H Value Table = 7.418
Since Calc H < Crit H FAIL TO REJECT Ho:All groups are equal.

NS MULTIPLE COMPARISON - KRUSKAL-WALLIS - TABLE 2 OF 2 (p=0.05)

GROUP	IDENTIFICATION	TRANSFORMED MEAN	ORIGINAL MEAN	GROUP 0 0 0 0 0 3 4 1 5 2
3	0.046	1.251	0.900	\
4	0.092	1.264	0.900	. \
1	SOLVENT CONTROL	1.399	0.970	. . \
5	0.2	1.420	0.980	. . . \
2	0.031	1.471	1.000	. . . . \

* = significant difference (p=0.05) . = no significant difference
Table q value (0.05,5) = 2.807 SE = 2.953

Male length termination

Analysis of Variance File: guthlen Date: 12-11-1991

TER: Delete if SEX = 2

s, means and standard deviations based on dependent variable: LENGTH

* Indicates statistics are collapsed over this factor

Factors: C	N	Mean	S.D.
*	14	46.0000	1.3587
1	2	46.5000	0.7071
2	2	45.5000	0.7071
3	2	46.5000	2.1213
4	2	45.5000	0.7071
5	2	46.5000	0.7071
6	2	46.5000	2.1213
7	2	45.0000	2.8284

áá
Fmax for testing homogeneity of between subjects variances: 16.00
Number of variances= 7 df per variance= 1.
áá
Analysis of Variance Dependent variable: LENGTH

Source	df	SS (H)	MSS	F	P
Between Subjects	13	24.0000			
C (CONC)	6	5.0000	0.8333	0.307	0.9149
Subj w Groups	7	19.0000	2.7143		

Post-hoc tests for factor C (CONC)

vel	Mean	Level	Mean
1	46.500	6	46.500
2	45.500	7	45.000
3	46.500		
4	45.500		
5	46.500		

Comparison	Bon-ferroni	Dunnett
1 > 2		
1 = 3		
1 > 4		
1 = 5		
1 = 6		
1 > 7		
2 < 3		N.A.
2 = 4		N.A.
2 < 5		N.A.
2 < 6		N.A.
2 > 7		N.A.
3 > 4		N.A.
3 = 5		N.A.
3 = 6		N.A.
3 > 7		N.A.
4 < 5		N.A.
4 < 6		N.A.
4 > 7		N.A.
5 = 6		N.A.
5 > 7		N.A.
6 > 7		N.A.

For Dunnett's test only the P-values .05 and .01 are possible and only for comparisons with the control mean (level 1).

male weight at termination

Analysis of Variance File: guthlen Date: 12-11-1991

FILTER: Delete if SEX = 2

, means and standard deviations based on dependent variable: WEIGHT

* Indicates statistics are collapsed over this factor

Factors: C	N	Mean	S.D.
*	14	2.2543	0.2191
1	2	2.3700	0.0283
2	2	2.1600	0.1131
3	2	2.3500	0.2828
4	2	2.2400	0.0424
5	2	2.2350	0.1626
6	2	2.2900	0.4950
7	2	2.1350	0.4031

Fmax for testing homogeneity of between subjects variances: 306.24
Number of variances= 7 df per variance= 1.

Analysis of Variance Dependent variable: WEIGHT

Source	df	SS (H)	MSS	F	P
Between Subjects	13	0.6243			
C (CONC)	6	0.0950	0.0158	0.209	0.9626
Subj w Groups	7	0.5293	0.0756		

Post-hoc tests for factor C (CONC)

Level	Mean	Level	Mean
1	2.370	6	2.290
2	2.160	7	2.135
3	2.350		
4	2.240		
5	2.235		

Comparison	Bon-ferroni	Dunnett
1 > 2		
1 > 3		
1 > 4		
1 > 5		
1 > 6		
1 > 7		
2 < 3		N.A.
2 < 4		N.A.
2 < 5		N.A.
2 < 6		N.A.
2 > 7		N.A.
3 > 4		N.A.
3 > 5		N.A.
3 > 6		N.A.
3 > 7		N.A.
4 > 5		N.A.
4 < 6		N.A.
4 > 7		N.A.
5 < 6		N.A.
5 > 7		N.A.
6 > 7		N.A.

For Dunnett's test only the P-values .05 and .01 are possible and only for comparisons with the control mean (level 1).

female lengths at termination

Analysis of Variance File: guthlen Date: 12-11-1991

FILTER: Delete if SEX = 1

N, means and standard deviations based on dependent variable: LENGTH

* Indicates statistics are collapsed over this factor

Factors: C	N	Mean	S.D.
*	14	41.2143	1.0509
1	2	41.5000	0.7071
2	2	40.0000	0.0000
3	2	40.5000	2.1213
4	2	42.5000	0.7071
5	2	42.0000	0.0000
6	2	41.0000	0.0000
7	2	41.0000	0.0000

áá
Fmax for testing homogeneity of between subjects variances: Not defined
áá
Analysis of Variance Dependent variable: LENGTH

Source	df	SS (H)	MSS	F	P
Between Subjects	13	14.3571			
C (CONC)	6	8.8571	1.4762	1.879	0.2127
Subj w Groups	7	5.5000	0.7857		

Post-hoc tests for factor C (CONC)

Level	Mean	Level	Mean
1	41.500	6	41.000
2	40.000	7	41.000
3	40.500		
4	42.500		
5	42.000		

Comparison	Bon-ferroni	Dunnett
1 > 2		
1 > 3		
1 < 4		
1 < 5		
1 > 6		
1 > 7		
2 < 3		N.A.
2 < 4		N.A.
2 < 5		N.A.
2 < 6		N.A.
2 < 7		N.A.
3 < 4		N.A.
3 < 5		N.A.
3 < 6		N.A.
3 < 7		N.A.
4 > 5		N.A.
4 > 6		N.A.
4 > 7		N.A.
5 > 6		N.A.
5 > 7		N.A.
6 = 7		N.A.

For Dunnett's test only the P-values .05 and .01 are possible and only for comparisons with the control mean (level 1).

Analysis of Variance female weight at termination File: guthlen Date: 12-11-1991

TER: Delete if SEX = 1

N s, means and standard deviations based on dependent variable: WEIGHT

* Indicates statistics are collapsed over this factor

Factors: C	N	Mean	S.D.
*	14	1.4950	0.1116
1	2	1.5650	0.0071
2	2	1.3850	0.0495
3	2	1.4750	0.2192
4	2	1.6250	0.0636
5	2	1.5450	0.0212
6	2	1.3850	0.0212
7	2	1.4850	0.0919

Fmax for testing homogeneity of between subjects variances: 961.00
Number of variances= 7 df per variance= 1.

Analysis of Variance Dependent variable: WEIGHT

Source	df	SS (H)	MSS	F	P
Between Subjects	13	0.1619			
C (CONC)	6	0.0980	0.0163	1.788	0.2305
Subj w Groups	7	0.0639	0.0091		

Post-hoc tests for factor C (CONC)

vel	Mean	Level	Mean
1	1.565	6	1.385
2	1.385	7	1.485
3	1.475		
4	1.625		
5	1.545		

Comparison	Bon-ferroni	Dunnett
1 > 2		
1 > 3		
1 < 4		
1 > 5		
1 > 6		
1 > 7		
2 < 3		N.A.
2 < 4		N.A.
2 < 5		N.A.
2 = 6		N.A.
2 < 7		N.A.
3 < 4		N.A.
3 < 5		N.A.
3 > 6		N.A.
3 < 7		N.A.
4 > 5		N.A.
4 > 6		N.A.
4 > 7		N.A.
5 > 6		N.A.
5 > 7		N.A.
6 < 7		N.A.

For Dunnett's test only the P-values .05 and .01 are possible and only for comparisons with the control mean (level 1).

Analysis of Variance fish Reproduction File: guthrepr Date: 12-10-1991

F R: None

N's, means and standard deviations based on dependent variable: REPROD

* Indicates statistics are collapsed over this factor

Factors: C	R	N	Mean	S.D.
*	*	340	7.3774	7.6984
1	*	46	4.7739	4.6180
2	*	26	1.9885	2.4513
3	*	62	10.7774	9.0461
4	*	68	10.8441	10.3046
5	*	65	6.5846	5.0652
6	*	45	5.9511	5.5150
7	*	28	4.8429	6.0300
*	1	167	8.2335	8.5152
*	2	173	6.5509	6.7402
1	1	29	4.7103	5.1707
1	2	17	4.8824	3.6291
2	1	10	0.9100	0.7279
2	2	16	2.6625	2.9047
3	1	27	7.9593	8.5692
3	2	35	12.9514	8.9157
4	1	35	14.6857	11.9757
4	2	33	6.7697	6.0565
5	1	26	9.8077	5.1844
5	2	39	4.4359	3.6989
6	1	31	7.5419	5.6380
6	2	14	2.4286	3.1922
7	1	9	1.2889	0.6528
7	2	19	6.5263	6.7115

áá

Fmax for testing homogeneity of between subjects variances: 336.57

Number of variances= 14 df per variance= 19.

áá

Analysis of Variance Dependent variable: REPROD

Source	df	SS (H)	MSS	F	P
Between Subjects	339	20091.0312			
C (CONC)	6	2913.0776	485.5129	10.662	0.0000
R (REP)	1	268.1166	268.1166	5.888	0.0158
CR	6	2065.1577	344.1930	7.559	0.0000
Subj w Groups	326	14844.6797	45.5358		

1 = Solvent control
2 = Control
3 = 0.031 µg/L
4 = 0.14/L
5 = 0.42
6 = 0.2
7 = 0.11

Analysis of Variance File: guthrepr Date: 12-10-1991

F R: None fetal reproduction

Post-hoc tests for factor C (CONC)

Level	Mean	Level	Mean
1	4.774	6	5.951
2	1.988	7	4.843
3	10.777		
4	10.844		
5	6.585		

Comparison	Bon-ferroni	Dunnett
1 > 2		
1 < 3	0.0000	0.0100
1 < 4	0.0000	0.0100
1 < 5		
1 < 6		
1 < 7		
2 < 3	0.0000	N.A.
2 < 4	0.0000	N.A.
2 < 5	0.0751	N.A.
2 < 6		N.A.
2 < 7		N.A.
3 < 4		N.A.
3 > 5	0.0115	N.A.
3 > 6	0.0067	N.A.
3 > 7	0.0031	N.A.
4 > 5	0.0070	N.A.
4 > 6	0.0043	N.A.
4 > 7	0.0021	N.A.
5 > 6		N.A.
5 > 7		N.A.
6 > 7		N.A.

For Dunnett's test only the P-values .05 and .01 are possible and only for comparisons with the control mean (level 1).

Shaughnessey # 058001 Chemical Name Azinphos-methyl (Guthion) Chemical Class _____ Page 1 of 1

Study/Species/Lab/ MRID #	Chemical % a.i.	Results	Reviewer/ Date	Validation Status
Life cycle Chronic Fish	92.5	Concentrations Tested (pp b*) = 0.031, 0.046, 0.092, 0.20, 0.41	LMR 12/11/91	Supplemental
Species: Cyprinodon variegatus		MATC = > 0.20 < 0.41 pp b.		
Lab: Springborn Laboratories		Effected Parameters = Survival, length (45 days post-hatch) Hatching success of second generation embryos		
MRID # 420216-01		Adult Control Mortality (%) = 100 (113 days post-hatch) Adult Solvent Control Mortality (%) = 100 (113 days post-hatch)		
		Comments: * mean measured concentrations		
Chronic Invertebrate		Concentrations Tested (pp___) =		
Species:		MATC = >_____<_____ PP___.		
Lab:		Effected Parameters =		
MRID #		Control Mortality (%) = Solvent Control Mortality (%) =		
		Comments:		

Fc
Growth
by Rep

Data listing File: guthlen Date: 12-10-1991

] ER: None

Obs.	CONC	REP	SEX	LENGTH	WEIGHT
1	1	1	1	46	2.39
2	1	2	1	47	2.35
3	1	1	2	41	1.56
4	1	2	2	42	1.57
5	2	1	1	45	2.08
6	2	2	1	46	2.24
7	2	1	2	40	1.35
8	2	2	2	40	1.42
9	3	1	1	45	2.15
10	3	2	1	48	2.55
11	3	1	2	39	1.32
12	3	2	2	42	1.63
13	4	1	1	45	2.21
14	4	2	1	46	2.27
15	4	1	2	42	1.58
16	4	2	2	43	1.67
17	5	1	1	46	2.12
18	5	2	1	47	2.35
19	5	1	2	42	1.53
20	5	2	2	42	1.56
21	6	1	1	48	2.64
22	6	2	1	45	1.94
23	6	1	2	41	1.40
24	6	2	2	41	1.37
25	7	1	1	43	1.85
26	7	2	1	47	2.42
27	7	1	2	41	1.55
28	7	2	2	41	1.42

Fe Repro
by Rep

Data listing File: guthrepr Date: 12-10-1991

F :R: None

Obs.	CONC	REP	REPROD
1	1	1	1.00
2	1	1	9.60
3	1	1	16.20
4	1	1	17.60
5	1	1	9.60
6	1	1	11.00
7	1	1	10.80
8	1	1	4.40
9	1	1	2.80
10	1	1	1.40
11	1	1	0.20
12	1	1	0.40
13	1	1	0.40
14	1	1	0.40
15	1	1	0.40
16	1	1	0.40
17	1	1	0.20
18	1	1	0.40
19	1	1	1.00
20	1	1	1.40
21	1	1	8.60
22	1	1	9.60
3	1	1	11.60
[illegible]	1	1	5.00
25	1	1	2.20
26	1	1	4.80
27	1	1	2.60
28	1	1	1.20
29	1	1	1.40
30	1	2	9.40
31	1	2	7.80
32	1	2	8.00
33	1	2	0.60
34	1	2	4.80
35	1	2	1.40
36	1	2	1.60
37	1	2	0.40
38	1	2	6.00
39	1	2	0.80
40	1	2	4.00
41	1	2	0.20
42	1	2	3.00
43	1	2	8.40
44	1	2	10.80
45	1	2	7.20
46	1	2	8.60
47	2	1	1.30
48	2	1	2.30
)	2	1	1.50
50	2	1	0.30
51	2	1	0.80
52	2	1	0.30

53	2	1	1.60
54	2	1	0.20
55	2	1	0.60

Data listing File: guthrepr Date: 12-10-1991

F ER: None

Obs.	CONC	REP	REPROD
56	2	1	0.20
57	2	2	7.80
58	2	2	0.30
59	2	2	0.50
60	2	2	0.80
61	2	2	0.60
62	2	2	0.20
63	2	2	0.80
64	2	2	2.50
65	2	2	0.80
66	2	2	6.50
67	2	2	5.30
68	2	2	8.30
69	2	2	5.20
70	2	2	1.80
71	2	2	0.60
72	2	2	0.60
73	3	1	3.20
74	3	1	14.00
75	3	1	23.00
76	3	1	24.20
77	3	1	25.60
78	3	1	19.40
79	3	1	13.00
80	3	1	17.60
81	3	1	17.00
82	3	1	14.80
83	3	1	4.80
84	3	1	0.20
85	3	1	1.80
86	3	1	0.40
87	3	1	0.20
88	3	1	0.40
89	3	1	0.80
90	3	1	0.80
91	3	1	13.30
92	3	1	6.00
93	3	1	2.00
94	3	1	2.80
95	3	1	0.50
96	3	1	4.00
97	3	1	0.50
98	3	1	2.80
99	3	1	1.80
100	3	2	12.60
101	3	2	15.00
102	3	2	13.40
103	3	2	1.00
4	3	2	30.00
105	3	2	12.00
106	3	2	8.20
107	3	2	6.60

108	3	2	9.60
109	3	2	7.40
110	3	2	6.40

Data listing File: guthrepr Date: 12-10-1991

1 ER: None

Obs.	CONC	REP	REPROD
111	3	2	5.80
112	3	2	7.60
113	3	2	6.80
114	3	2	27.30
115	3	2	4.00
116	3	2	19.00
117	3	2	11.50
118	3	2	2.50
119	3	2	8.00
120	3	2	8.00
121	3	2	4.00
122	3	2	0.20
123	3	2	1.00
124	3	2	9.60
125	3	2	8.80
126	3	2	15.40
127	3	2	22.40
128	3	2	22.60
129	3	2	18.60
130	3	2	29.60
131	3	2	21.00
132	3	2	20.40
`3	3	2	28.60
4	3	2	28.40
135	4	1	6.20
136	4	1	26.20
137	4	1	28.40
138	4	1	30.60
139	4	1	34.00
140	4	1	32.20
141	4	1	25.40
142	4	1	23.60
143	4	1	32.80
144	4	1	30.00
145	4	1	3.80
146	4	1	13.40
147	4	1	9.40
148	4	1	5.80
149	4	1	5.20
150	4	1	21.80
151	4	1	3.60
152	4	1	13.80
153	4	1	11.20
154	4	1	31.80
155	4	1	37.40
156	4	1	23.00
157	4	1	6.40
158	4	1	15.00
9	4	1	3.80
160	4	1	4.80
161	4	1	6.40
162	4	1	6.00

163	4	1	1.00
164	4	1	2.40
165	4	1	4.80

Data listing File: guthrepr Date: 12-10-1991

ER: None

Obs.	CONC	REP	REPROD
166	4	1	9.00
167	4	1	1.80
168	4	1	2.20
169	4	1	0.80
170	4	2	7.00
171	4	2	9.80
172	4	2	18.60
173	4	2	13.80
174	4	2	15.60
175	4	2	11.00
176	4	2	9.60
177	4	2	3.40
178	4	2	18.50
179	4	2	1.00
180	4	2	1.00
181	4	2	7.40
182	4	2	3.20
183	4	2	3.40
184	4	2	1.60
185	4	2	2.20
186	4	2	3.00
187	4	2	3.60
?8	4	2	3.40
9	4	2	1.80
ı90	4	2	1.20
191	4	2	1.60
192	4	2	1.80
193	4	2	7.60
194	4	2	0.80
195	4	2	7.00
196	4	2	5.70
197	4	2	13.30
198	4	2	22.30
199	4	2	14.70
200	4	2	5.00
201	4	2	3.00
202	4	2	0.50
203	5	1	11.80
204	5	1	18.60
205	5	1	15.00
206	5	1	15.60
207	5	1	14.00
208	5	1	13.00
209	5	1	6.20
210	5	1	2.40
211	5	1	5.40
212	5	1	2.60
?13	5	1	4.40
4	5	1	0.40
ı5	5	1	6.00
216	5	1	6.00
217	5	1	12.40

218	5	1	19.20
219	5	1	13.20
220	5	1	12.80

Data listing File: guthrepr Date: 12-10-1991

ER: None

Obs.	CONC	REP	REPROD
221	5	1	16.80
222	5	1	11.60
223	5	1	9.80
224	5	1	5.80
225	5	1	8.60
226	5	1	7.60
227	5	1	11.00
228	5	1	4.80
229	5	2	1.60
230	5	2	0.20
231	5	2	0.40
232	5	2	1.80
233	5	2	3.20
234	5	2	5.60
235	5	2	1.20
236	5	2	4.60
237	5	2	1.20
238	5	2	0.60
239	5	2	0.60
240	5	2	0.20
241	5	2	5.80
242	5	2	0.80
43	5	2	0.20
4	5	2	14.00
245	5	2	12.00
246	5	2	8.60
247	5	2	6.80
248	5	2	7.60
249	5	2	6.80
250	5	2	7.20
251	5	2	9.60
252	5	2	2.40
253	5	2	7.40
254	5	2	7.00
255	5	2	0.60
256	5	2	0.60
257	5	2	0.60
258	5	2	2.60
259	5	2	1.80
260	5	2	9.80
261	5	2	8.80
262	5	2	7.00
263	5	2	6.80
264	5	2	5.20
265	5	2	5.20
266	5	2	1.40
267	5	2	5.20
268	6	1	2.00
9	6	1	0.20
70	6	1	0.80
271	6	1	0.20
272	6	1	0.80

273	6	1	0.60
274	6	1	4.80
275	6	1	1.80

Data listing File: guthrepr Date: 12-10-1991

. .ER: None

Obs.	CONC	REP	REPROD
276	6	1	15.00
277	6	1	15.80
278	6	1	15.20
279	6	1	9.60
280	6	1	6.00
281	6	1	7.20
282	6	1	6.60
283	6	1	6.00
284	6	1	5.80
285	6	1	0.20
286	6	1	6.00
287	6	1	1.20
288	6	1	7.00
289	6	1	7.80
290	6	1	19.80
291	6	1	15.20
292	6	1	13.40
293	6	1	12.80
294	6	1	8.40
295	6	1	14.00
296	6	1	12.80
297	6	1	7.80
?8	6	1	9.00
9	6	2	1.00
?00	6	2	1.00
301	6	2	7.20
302	6	2	11.00
303	6	2	0.40
304	6	2	5.00
305	6	2	1.60
306	6	2	3.00
307	6	2	1.20
308	6	2	1.20
309	6	2	0.20
310	6	2	0.60
311	6	2	0.20
312	6	2	0.40
313	7	1	1.00
314	7	1	2.00
315	7	1	0.50
316	7	1	1.30
317	7	1	1.30
318	7	1	0.80
319	7	1	0.80
320	7	1	2.60
321	7	1	1.30
322	7	2	6.00
?23	7	2	17.60
4	7	2	12.80
?5	7	2	13.20
326	7	2	1.00
327	7	2	2.40

328	7	2	1.80
329	7	2	0.60
330	7	2	0.60

Data listing File: guthrepr Date: 12-10-1991

. ER: None

Obs.	CONC	REP	REPROD
331	7	2	0.80
332	7	2	0.20
333	7	2	21.20
334	7	2	17.00
335	7	2	9.80
336	7	2	6.60
337	7	2	5.60
338	7	2	2.20
339	7	2	2.30
340	7	2	2.30