1-17-89

Accession No. 405010-10

DATA EVALUATION RECORD

1. **CHEMICAL:** HOE 039866
   Shaughnessey No. 110902

2. **TEST MATERIAL:** Technical: HOE 039866, 96.3% active ingredient, identification code: Hoe 039866 OH ZC96 0002, a white powder.

3. **STUDY TYPE:** Life-Cycle (21-Day Renewal) Chronic Test. Species Test: *Daphnia magna*.

4. **CITATION:** Fischer, R. 1987. The Effect of HOE-039866 (Substance Technical) to *Daphnia magna* (Waterflea) in a Life-Cycle (21-Day Renewal) Chronic Toxicity Test. Report No. A36208. Prepared by Hoechst AG, Federal Repuplic of Germany. Submitted by Hoechst Celanese Corporation, Somerville, NJ 08876. Accession No. 405010-10.

5. **REVIEWED BY:**

   Prapimpan Kosalwat, Ph.D.
   Staff Toxicologist
   KBN Engineering and
   Applied Sciences, Inc.

   Signature: P. Kosalwat
   Date: 10/4/88

6. **APPROVED BY:**

   Isabel C. Johnson, M.S.
   Principal Scientist
   KBN Engineering and
   Applied Sciences, Inc.

   Signature: Isabel C. Johnson
   Date: October 5, 1988

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

   Signature: Henry T. Craven
   Date: 1/17/89
   Curtis E. Kline 1-17-89

7. **CONCLUSIONS:** This study is scientifically sound and meets the guideline requirements for an invertebrate life-cycle chronic test. The MATC for *Daphnia magna* was determined to be between 32 and 56 mg a.i./L HOE 039866, based on the most sensitive parameter in the study (i.e., reproduction). The NOEC was 32 mg a.i./L.

8. **RECOMMENDATIONS:** N/A.

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9. **BACKGROUND:**

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

11. **MATERIALS AND METHODS:**

A. **Test Animals:** *Daphnia magna* used in this test were bred in Hoechst AG Laboratory. They were cultured in glass beakers, containing initially 20 adult animals in 2 liters of soft reconstituted water. The breeding temperature was 20 ± 2°C. The daphnids were fed a suspension of algae (*Scenedesmus subspicatus*). Once a week the food was supplemented with a suspension of dried fish food.

Prior to test initiation, daphnids (10-12 days old) were separated from the culture, put in a separate culture container and maintained for at least 21 days. Young daphnids (≤ 24 hours old) were obtained from this subculture and were used for the test.

B. **Test System:** The test was conducted in 500-ml glass beakers (containing 200 ml of test water), kept at 20 ± 1°C in a regulated water bath. The beakers had a diameter of 80 mm and a height of 140 mm. The depth of test water was between 35 and 45 mm. The beakers were covered with glass lids during the test. Soft reconstituted water used in the test had a conductivity of 156-217 umhos/cm, and a hardness and alkalinity of 44.5-49.9 and 29.3-31.6 mg/L as $CaCO_3$, respectively. Fluorescent lights, with a 16-hour daylight photoperiod, were used to illuminate the culture and test rooms.

C. **Dosage:** Life-cycle (21-day renewal) chronic test.

D. **Design:** Based on previously performed studies, five nominal concentrations of HOE-039866 (i.e., 10, 18, 32, 56, and 100 mg/L) were chosen for the definitive test. The concentrations were calculated based on 100% purity of the test material. The test solutions were prepared by dissolving the test material in dilution water (i.e., soft reconstituted water). Dilution water control was tested concurrently.

For each test concentration and the control, ten beakers with one replicate were prepared. One daphnid was placed into each of 7 beakers (for survival, growth, and reproduction observations) and 5 daphnids were placed into each of 3 remaining beakers (for survival

observation only). Therefore, 44 daphnids in 20 beakers were tested for each concentration.

The daphnids were fed and transferred into freshly prepared test solution three times a week. Dissolved oxygen, pH, temperature and conductivity were determined in one beaker of each concentration at each renewal time. In addition, the water temperature of the untreated control was recorded continuously during the whole test period.

The analysis of test substance concentrations, total hardness, total alkalinity and nitrite were made on test days 0, 2, 5, 7, 9, 12, 14, 16, and 19 from the freshly prepared and the aged test solutions.

E. Statistics: The maximum acceptable toxicant concentration (MATC) was determined by statistical analysis, employing analysis of variance, general linear models and Duncan's multiple range test procedures (SAS, 1979).

12. REPORTED RESULTS: Analyses of test concentration showed that there was no significant difference between the freshly prepared and the aged (at the time of renewal) test solution (Table 6.3.3, attached). The temperature stayed between 19 and 20.5°C during the 21-day exposure period. Dissolved oxygen concentrations ranged from 3.1 to 9.5 mg/L and pH from 6.8 to 7.8.

Although 6-18% mortalities occurred in offsprings, the mortalities did not appear to be concentration-dependent. Likewise, no concentration dependency was observed in growth of daphnids at different treatment levels. Survival of adults was also not affected by the test compound. No mortality of adults was observed in the control, 10-, and 18-mg/L levels; while 4.5%, 2.7%, and 6.8% adult mortalities were observed in 32-, 56-, and 100-mg/L test levels, respectively.

Reproduction rate proved to be the most sensitive parameter measured during the study. Reproduction was inhibited at 56 and 100 mg/L, while there was no significantly different from the control group at 10-32 mg/L. Therefore, the MATC was estimated to be 32 mg/L, based on the significantly different reproduction rate of control and treated groups.

13. STUDY AUTHOR'S CONCLUSIONS/QUALITY ASSURANCE MEASURES: No conclusion was made by the author. The study was conducted in compliance with the principles of Good Laboratory

Practice (GLP). A statement of compliance was included in the report and signed by the Study Director and Head of Testing Facility.

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

A. **Test Procedure:** The test procedure and the report were generally in accordance with the SEP, except for the following deviations:

o It was not known if the test organisms were randomly assigned to each test beaker.

o Total hardness of the test water was between 44.2 and 49.9 mg/L as $CaCO_3$. The SEP recommends the hardness between 40 and 48 mg/L as $CaCO_3$.

o The pH of the test solutions sometimes fell below the recommended values of 7.2-7.6.

o Green alga, *Scenedesmus subspicatus*, is not one of the food species recommended by the guidelines.

o Although the length of daphnids was reported as being determined with an accuracy of 0.01 mm, the reported results showed the length measurement only to the nearest 0.1 mm.

B. **Statistical Analysis:**
Adult survival The author did not attached statistical analysis results for adult survival (if performed). The reviewer analyzed the survival data using least squares analysis (attached). All data were included. Beakers containing 5 daphnids each were assigned "environmental factor 1" and the ones containing 1 daphnid each were assigned "environmental factor 2". The analysis showed no statistical difference either between two environmental factors or between control and each test level. Therefore, HOE 039866, within the range of concentrations tested, did not have any significant effect on daphnid survival.

Adult length The author performed statistical analysis on adult length using all data from the beakers with 5 daphnids each and from the ones with 1 daphnid each. According to the method, growth was supposed to be measured from only beakers containing 1 daphnid each. The reviewer reanalyzed the length data obtained from the beakers with 1 daphnid each, using Tukey's and Duncan's tests (attached). Tukey's test showed that the

length of daphnids in the control group was not significantly different from the length of daphnids in any test level. Duncan's test also showed no differences between the control and 10-, 18-, 32-, and 100-mg/L test levels. Daphnids in the 56-mg/L test level were significantly larger than those in the control and thus, the effect probably was not due to the test chemical.

Reproduction The reviewer reanalyzed the reproductive data (# young/adult/reproduction day) using Tukey's and Duncan's tests (attached). Tukey's test showed daphnid reproduction in the control as being significantly different from that at 100-mg/L test level. Duncan's test showed the same result as that done by the author (i.e., numbers of young per adult per reproduction day in 56- and 100-mg/L test levels were significantly different from those in the control group).

Therefore, reproduction is the most sensitive parameter tested in this study. The MATC was determined to be between 32 and 56 mg a.i./L HOE 039866.

C. **Discussion/Results:** The study is scientifically sound and appears to be well conducted. However, the length of daphnids should have been reported to the nearest 0.01 mm. The deviations from the SEP probably did not significantly affect the validity of the toxicity results of this study.

The author reported concentration of 32 mg/L as the MATC value. According to the test result, 32 mg/L was actually a no-observed-effect concentration (NOEC). Therefore, the MATC should be reported as being between 32 and 56 mg/L, based on the most sensitive parameter (i.e., reproduction) in the test.

D. **Adequacy of the Study:**

(1) **Classification:** Core.

(2) **Rationale:** See Section 14.C.

(3) **Repairability:** N/A.

15. **COMPLETION OF ONE-LINER:** Yes, October 3, 1988.

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TABLE 6.3.3. ANALYSES OF TEST SOLUTIONS

Values of the freshly prepared test solutions

mg/l given	mg/l active ingredient (96.3%) found on test day 0	2	5	7	9	12	14	16	19
10	9.4	9.8	9.6	9.3	9.8	8.7	9.1	9.0	9.8
18	17.7	17.3	17.9	18.3	17.8	17.3	17.5	17.2	18.3
32	31.5	31.3	31.5	32.0	31.5	31.6	31.7	32.0	32.5
56	55.7	54.9	55.8	55.9	55.3	56.0	56.1	56.0	55.6
100	99.4	97.5	98.8	99.2	97.9	99.5	100.1	100.2	101.9

Values of the aged test solutions

mg/l given	mg/l active ingredient (96.3%) found on test day 0	2	5	7	9	12	14	16	19
	2	5	7	9	12	14	16	19	21
10	8.9	10.0	9.6	9.1	8.7	8.8	8.6	9.2	9.3
18	17.7	17.7	17.7	18.0	17.2	17.1	16.7	17.1	17.0
32	31.4	31.9	31.6	31.9	31.7	31.4	30.3	30.9	30.7
56	55.9	55.8	55.5	55.8	55.5	55.2	55.8	56.3	55.3
100	100.2	100.3	98.9	100.0	98.4	99.4	100.6	100.4	101.8

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Key No. _____ Chemical Name HOE 039866 Chemical Class _____ Page 1 of 1

Study/Species/Lab/ Succession	Chemical % Active	Results					Reviewer/ Date	Validat Status
Avian Reproduction,		Group	Dose(ppm)	Effected/Parameters	Mort.(%)	%Che Inh.		
Species:		Control						
		Treatment I						
Lab:		Treatment II						
Acc*;		Treatment III						
		Study Duration:						
		Comments:						

Field Study(Simulated/Actual) Species:		Group	Rate(ai/a)	Treatment Interval	Total # Treatments	Mor.(%)		
		Control						
		Treatment I						
Lab:		Treatment II						
Acc.*;		Treatment III						
		Crop/Site:			Study Duration:			
		Comments:						

Chronic fish,		Concentrations Tested (pp__)= _____		
Species		MATC = >____ <____ pp___.	Effected Parameter = _____	
Lab:		Contr. Mort.(%)= _____	Sol. Contr. Mort.(%)= _____	
Acc.*;		Comments:		

Chronic invertebrate		Concentrations Tested (ppm)= 10, 18, 32, 56, 100 mg/L		
Species Daphnia magna	96.3	MATC => 32 < 56 ppm*.	Effected Parameter(s) reproduction	
Lab Hoechst AG		Contr. Mort.(%)= 0	Sol. Contr. Mort.(%)= N/A	PK/10-3-88 Core
Acc.* 405010-10		Comments: * active ingredient		

LEAST SQUARES ANALYSIS FOR HOESURV2 DATA SET

GENERAL LINEAR MODELS PROCEDURE

CLASS LEVEL INFORMATION

Adult Survival

CLASS	LEVELS	VALUES
ENV	2	1 2
TRT	6	1 2 3 4 5 6

NUMBER OF OBSERVATIONS IN DATA SET = 264

Env. 1 = 5 daphnids / beaker
2 = 1 " / beaker

Trt 1 = Control
2 = 10 mg/L
3 = 18 "
4 = 32 "
5 = 56 "
6 = 100 "

8

Survival data

beaker#	Trt	Env.	Survival
1	1	1	1
1	1	1	1
1	1	1	1
1	1	1	1
1	1	1	1
2	1	1	1
2	1	1	1
2	1	1	1
2	1	1	1
2	1	1	1
3	1	1	1
3	1	1	1
3	1	1	1
3	1	1	1
3	1	1	1
4	1	2	1
5	1	2	1
6	1	2	1
7	1	2	1
8	1	2	1
9	1	2	1
10	1	2	1
11	1	1	1
11	1	1	1
11	1	1	1
11	1	1	1
11	1	1	1
12	1	1	1
12	1	1	1
12	1	1	1
12	1	1	1
12	1	1	1
13	1	1	1
13	1	1	1
13	1	1	1
13	1	1	1
13	1	1	1
14	1	2	1
15	1	2	1
16	1	2	1
17	1	2	1
18	1	2	1
19	1	2	1
20	1	2	1
21	2	1	1
21	2	1	1
21	2	1	1
21	2	1	1
21	2	1	1
22	2	1	1
22	2	1	1
22	2	1	1
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22	2	1	1
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23	2	1	1
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23	2	1	1
23	2	1	1
24	2	2	1
25	2	2	1
26	2	2	1
27	2	2	1
28	2	2	1
29	2	2	1
30	2	2	1
31	2	1	1
31	2	1	1
31	2	1	1
31	2	1	1
31	2	1	1
32	2	1	1
32	2	1	1
32	2	1	1
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43	3	1	1
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43	3	1	1
44	3	2	1
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46	3	2	1
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51	3	1	1
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53	3	1	1
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56	3	2	1
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59	3	2	1
60	3	2	1
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61	4	1	1
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62	4	1	1
62	4	1	1
62	4	1	1
62	4	1	1
62	4	1	0
63	4	1	1
63	4	1	1
63	4	1	1
63	4	1	1
63	4	1	1
64	4	2	1
65	4	2	1
66	4	2	1
67	4	2	1
68	4	2	1
69	4	2	1
70	4	2	1
71	4	1	1
71	4	1	1
71	4	1	1
71	4	1	1
71	4	1	1
72	4	1	1
72	4	1	1
72	4	1	1
72	4	1	1
72	4	1	0
73	4	1	1
73	4	1	1
73	4	1	1
73	4	1	1
73	4	1	1
74	4	2	1
75	4	2	1
76	4	2	1
77	4	2	1
78	4	2	1
79	4	2	1
80	4	2	1
81	5	1	1
81	5	1	1
81	5	1	1
81	5	1	1
81	5	1	0
82	5	1	1
82	5	1	1
82	5	1	1
82	5	1	1
82	5	1	1
83	5	1	1
83	5	1	1
83	5	1	1
83	5	1	1
83	5	1	1
84	5	2	1
85	5	2	1
86	5	2	1
87	5	2	1
88	5	2	1
89	5	2	1
90	5	2	1
91	5	1	1
91	5	1	1
91	5	1	1
91	5	1	1
91	5	1	1
92	5	1	1
92	5	1	1
92	5	1	1
92	5	1	1
92	5	1	1
93	5	1	1
93	5	1	1
93	5	1	1
93	5	1	1
93	5	1	1
94	5	2	1
95	5	2	1
96	5	2	1
97	5	2	1
98	5	2	1
99	5	2	1
100	5	2	1
101	6	1	1
101	6	1	1
101	6	1	1
101	6	1	1
101	6	1	1
102	6	1	1
102	6	1	1
102	6	1	1
102	6	1	1
102	6	1	1
103	6	1	1
103	6	1	1
103	6	1	1
103	6	1	1
103	6	1	1
104	6	2	1
105	6	2	1
106	6	2	1
107	6	2	1
108	6	2	1
109	6	2	1
110	6	2	1
111	6	1	1
111	6	1	1
111	6	1	1
111	6	1	1
111	6	1	0
112	6	1	1
112	6	1	1
112	6	1	1
112	6	1	0
112	6	1	0
113	6	1	1
113	6	1	1
113	6	1	1
113	6	1	1
113	6	1	1
114	6	2	1
115	6	2	1
116	6	2	1
117	6	2	1
118	6	2	1
119	6	2	1
120	6	2	1

Trt 1 = Control
2 = 10 mg/L
3 = 18 "
4 = 32 "
5 = 56 "
6 = 100 "

Env. = Environmental factor
Env 1 = 5 daphnids/bea
Env. 2 = 1 daphnid/bea

Survival
1 = Survive (alive
0 = dead.

LEAST SQUARES ANALYSIS FOR HOESURV2 DATA SET

Adult Survival

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GENERAL LINEAR MODELS PROCEDURE

DEPENDENT VARIABLE: SUR

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE
MODEL	7	252.38181818	36.05454545
ERROR	257	5.61818182	0.02186063
UNCORRECTED TOTAL	264	258.00000000	

MODEL F = 1649.29 PR > F = 0.0001

R-SQUARE	C.V.	ROOT MSE	SUR MEAN
0.041860	15.1292	0.14785341	0.97727273

SOURCE	DF	TYPE I SS	F VALUE	PR > F
INTERCEPT	1	252.13636364	11533.81	0.0001
ENV	1	0.06363636	2.91	0.0892
TRT	5	0.18181818	1.66	0.1439

SOURCE	DF	TYPE III SS	F VALUE	PR > F
INTERCEPT	1	221.51818182	10133.20	0.0001
ENV	1	0.06363636	2.91	0.0892
TRT	5	0.18181818	1.66	0.1439

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LEAST SQUARES ANALYSIS FOR HOESUR2 DATA SET

Adult Survival #

GENERAL LINEAR MODELS PROCEDURE

Tukey's Test

TUKEY'S STUDENTIZED RANGE (HSD) TEST FOR VARIABLE: SUR
NOTE: THIS TEST CONTROLS THE TYPE I EXPERIMENTWISE ERROR RATE

ALPHA=0.05 CONFIDENCE=0.95 DF=257 MSE=.0218606
CRITICAL VALUE OF STUDENTIZED RANGE=2.785

COMPARISONS SIGNIFICANT AT THE 0.05 LEVEL ARE INDICATED BY '***'

ENV COMPARISON	SIMULTANEOUS LOWER CONFIDENCE LIMIT	DIFFERENCE BETWEEN MEANS	SIMULTANEOUS UPPER CONFIDENCE LIMIT
2 - 1	-0.00514	0.03333	0.07181
1 - 2	-0.07181	-0.03333	0.00514

LEAST SQUARES ANALYSIS FOR HUESURV2 DATA SET

Adult Survival

5

GENERAL LINEAR MODELS PROCEDURE

Tukey's Test

TUKEY'S STUDENTIZED RANGE (HSD) TEST FOR VARIABLE: SUR
NOTE: THIS TEST CONTROLS THE TYPE I EXPERIMENTWISE ERROR RATE,
BUT GENERALLY HAS A HIGHER TYPE II ERROR RATE THAN REGWQ

ALPHA=0.05 DF=257 MSE=.0218606
CRITICAL VALUE OF STUDENTIZED RANGE=2.785
MINIMUM SIGNIFICANT DIFFERENCE=.03847

WARNING: CELL SIZES ARE NOT EQUAL.
HARMONIC MEAN OF CELL SIZES=114.545

MEANS WITH THE SAME LETTER ARE NOT SIGNIFICANTLY DIFFERENT.

TUKEY GROUPING	MEAN	N	ENV
A	1.00000	84	2
A			
A	0.96667	180	1

Env. (= Environment factor)

Env1 = 5 daphnids/beaker

Env. 2 = 1 daphnid/beaker.

Conclusion:

There is no different between 2 environmental factors.

~~LEAST SQUARES ANALYSIS FOR HOESURV2 DATA SET~~

Adult survival

Tukey's Test

GENERAL LINEAR MODELS PROCEDURE

TUKEY'S STUDENTIZED RANGE (HSD) TEST FOR VARIABLE: SUR
NOTE: THIS TEST CONTROLS THE TYPE I EXPERIMENTWISE ERROR RATE

ALPHA=0.05 CONFIDENCE=0.95 DF=257 MSE=.0218606
CRITICAL VALUE OF STUDENTIZED RANGE=4.061
MINIMUM SIGNIFICANT DIFFERENCE=.09051

COMPARISONS SIGNIFICANT AT THE 0.05 LEVEL ARE INDICATED BY '***'

	TRT COMPARISON	SIMULTANEOUS LOWER CONFIDENCE LIMIT	DIFFERENCE BETWEEN MEANS	SIMULTANEOUS UPPER CONFIDENCE LIMIT
	1 - 2	-0.09051	0.00000	0.09051
	1 - 3	-0.09051	0.00000	0.09051
C	1 - 5	-0.06778	0.02273	0.11324
	1 - 4	-0.04506	0.04545	0.13597
	1 - 6	-0.02233	0.06818	0.15869
10	2 - 1	-0.09051	0.00000	0.09051
	2 - 3	-0.09051	0.00000	0.09051
	2 - 5	-0.06778	0.02273	0.11324
	2 - 4	-0.04506	0.04545	0.13597
	2 - 6	-0.02233	0.06818	0.15869
	3 - 1	-0.09051	0.00000	0.09051
	3 - 2	-0.09051	0.00000	0.09051
18	3 - 5	-0.06778	0.02273	0.11324
	3 - 4	-0.04506	0.04545	0.13597
	3 - 6	-0.02233	0.06818	0.15869
	5 - 1	-0.11324	-0.02273	0.05778
	5 - 2	-0.11324	-0.02273	0.06778
5	5 - 3	-0.11324	-0.02273	0.06778
	5 - 4	-0.06778	0.02273	0.11324
	5 - 6	-0.04506	0.04545	0.13597
	4 - 1	-0.13597	-0.04545	0.04506
	4 - 2	-0.13597	-0.04545	0.04506
32	4 - 3	-0.13597	-0.04545	0.04506
	4 - 5	-0.11324	-0.02273	0.06778
	4 - 6	-0.06778	0.02273	0.11324
	6 - 1	-0.15869	-0.06818	0.02233
	6 - 2	-0.15869	-0.06818	0.02233
100	6 - 3	-0.15869	-0.06818	0.02233
	6 - 5	-0.13597	-0.04545	0.04506
	6 - 4	-0.11324	-0.02273	0.06778

LEAST SQUARES ANALYSIS FOR HOESUNV2 DATA SET

Adult survival

7

GENERAL LINEAR MODELS PROCEDURE

Tukey's Test

TUKEY'S STUDENTIZED RANGE (HSD) TEST FOR VARIABLE: SUR
NOTE: THIS TEST CONTROLS THE TYPE I EXPERIMENTWISE ERROR RATE,
BUT GENERALLY HAS A HIGHER TYPE II ERROR RATE THAN REGWQ

ALPHA=0.05 DF=257 MSE=.0218606
CRITICAL VALUE OF STUDENTIZED RANGE=4.061
MINIMUM SIGNIFICANT DIFFERENCE=.09051

MEANS WITH THE SAME LETTER ARE NOT SIGNIFICANTLY DIFFERENT.

TUKEY GROUPING	MEAN	N	TRT
A	1.00000	44	1
A A	1.00000	44	2
A A A	1.00000	44	3
A A A	0.97727	44	5
A A A	0.95455	44	4
A A	0.93132	44	6

Conclusion:

No difference between control and any test levels.

LEAST SQUARES ANALYSIS FOR HUPSURV2 DATA SET

Adult survival 8

GENERAL LINEAR MODELS PROCEDURE

Duncan's Test

DUNCAN'S MULTIPLE RANGE TEST FOR VARIABLE: SUR

NOTE: THIS TEST CONTROLS THE TYPE I COMPARISONWISE ERROR RATE, NOT THE EXPERIMENTWISE ERROR RATE

ALPHA=0.05 DF=257 MSE=.0218606

WARNING: CELL SIZES ARE NOT EQUAL.
HARMONIC MEAN OF CELL SIZES=114.545

NUMBER OF MEANS 2
CRITICAL RANGE 0.038811

MEANS WITH THE SAME LETTER ARE NOT SIGNIFICANTLY DIFFERENT.

DUNCAN GROUPING	MEAN	N	ENV
A	1.00000	84	2
A			
A	0.96667	180	1

No different between 2 environmental factors.

LEAST SQUARES ANALYSIS FOR HOESURV2 DATA SET

Adult survival

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GENERAL LINEAR MODELS PROCEDURE

Duncan's Test

DUNCAN'S MULTIPLE RANGE TEST FOR VARIABLE: SUR
NOTE: THIS TEST CONTROLS THE TYPE I COMPARISONWISE ERROR RATE,
NOT THE EXPERIMENTWISE ERROR RATE

ALPHA=0.05 DF=257 MSE=.0218606

NUMBER OF MEANS	2	3	4	5	6
CRITICAL RANGE	0.0626207	0.0658495	0.0679271	0.0694879	0.0708014

MEANS WITH THE SAME LETTER ARE NOT SIGNIFICANTLY DIFFERENT.

DUNCAN GROUPING	MEAN	N	TRT
A	1.00000	44	1
A			
A	1.00000	44	2
A			
A	1.00000	44	3
A			
A	0.97727	44	5
A			
A	0.95455	44	4
A			
A	0.93182	44	6

No different between control and any test levels.

ANOVA FOR MDELENG2 DATA SET

Length.

ANALYSIS OF VARIANCE PROCEDURE

CLASS LEVEL INFORMATION

CLASS	LEVELS	VALUES
TRT	6	1 2 3 4 5 6

NUMBER OF OBSERVATIONS IN DATA SET = 84

Trt. 1 = Control

2 = 10 mg/L

3 = 18 "

4 = 32 "

5 = 56 "

6 = 100 "

Length data

Trt	Length (mm)
1	3.8
1	3.9
1	3.7
1	3.8
1	3.9
1	3.6
1	3.1
1	3.6
1	3.7
1	3.9
1	3.9
1	4.0
1	4.8
1	3.9
2	3.2
2	3.6
2	3.6
2	3.8
2	3.7
2	3.8
2	3.3
2	3.6
2	3.3
2	3.9
2	3.9
2	3.2
2	4.2
2	4.1
3	4.1
3	4.0
3	3.8
3	3.9
3	3.8
3	3.8
3	3.8
3	3.7
3	3.7
3	3.7
3	3.9
3	3.8
3	3.9
3	3.5
4	4.0
4	4.3
4	3.9
4	4.0
4	3.8
4	3.8
4	3.6
4	4.1
4	3.8
4	4.0
4	3.9
4	3.9
4	3.8
4	3.6
5	4.0
5	3.9
5	3.9
5	3.8
5	4.0
5	4.1
5	4.1
5	4.0
5	4.2
5	4.0
5	4.2
5	4.2
5	4.2
5	4.1
6	3.9
6	3.9
6	3.9
6	3.9
6	4.1
6	3.8
6	3.9
6	4.0
6	4.0
6	3.9
6	4.0
6	4.1
6	3.9
6	4.0

Trt 1 = Control
2 = 10 mg/L
3 = 18 "
4 = 32 "
5 = 56 "
6 = 100 "

ANOVA FOR HOELENG2 DATA SET

Length

ANALYSIS OF VARIANCE PROCEDURE

DEPENDENT VARIABLE: LEN

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE
MODEL	6	1256.37071429	209.39511905
ERROR	78	4.03928571	0.05178571
UNCORRECTED TOTAL	84	1260.41000000	

MODEL F = 4043.49 PR > F = 0.0001

R-SQUARE	C.V.	ROOT MSE	LEN MEAN
0.236413	5.8871	0.22756475	3.86547619

SOURCE	DF	ANOVA SS	F VALUE	PR > F
INTERCEPT	1	1255.12011905	24236.80	0.0001
TRT	5	1.25059524	4.83	0.0007

ANOVA FOR HOELENG2 DATA SET

Length

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ANALYSIS OF VARIANCE PROCEDURE

TUKEY'S STUDENTIZED RANGE (HSD) TEST FOR VARIABLE: LEN
NOTE: THIS TEST CONTROLS THE TYPE I EXPERIMENTWISE ERROR RATE

ALPHA=0.05 CONFIDENCE=0.95 DF=78 MSE=.0517857
CRITICAL VALUE OF STUDENTIZED RANGE=4.132
MINIMUM SIGNIFICANT DIFFERENCE=0.2513

COMPARISONS SIGNIFICANT AT THE 0.05 LEVEL ARE INDICATED BY '***'

TRT COMPARISON	SIMULTANEOUS LOWER CONFIDENCE LIMIT	DIFFERENCE BETWEEN MEANS	SIMULTANEOUS UPPER CONFIDENCE LIMIT	
5 - 6	-0.15130	0.10000	0.35130	
5 - 4	-0.09416	0.15714	0.40845	
5 - 1	-0.02987	0.22143	0.47273	
5 - 3	-0.01559	0.23571	0.48702	
5 - 2	0.14155	0.39286	0.64416	***
6 - 5	-0.35130	-0.10000	0.15130	
6 - 4	-0.19416	0.05714	0.30845	
6 - 1	-0.12987	0.12143	0.37273	
6 - 3	-0.11559	0.13571	0.38702	
6 - 2	0.04155	0.29286	0.54416	***
4 - 5	-0.40845	-0.15714	0.09416	
4 - 6	-0.30845	-0.05714	0.19416	
4 - 1	-0.18702	0.06429	0.31559	
4 - 3	-0.17273	0.07857	0.32987	
4 - 2	-0.01559	0.23571	0.48702	
1 - 5	-0.47273	-0.22143	0.02987	
1 - 6	-0.37273	-0.12143	0.12987	
1 - 4	-0.31559	-0.06429	0.18702	
1 - 3	-0.23702	0.01429	0.26559	
1 - 2	-0.07987	0.17143	0.42273	
3 - 5	-0.48702	-0.23571	0.01559	
3 - 6	-0.38702	-0.13571	0.11559	
3 - 4	-0.32987	-0.07857	0.17273	
3 - 1	-0.26559	-0.01429	0.23702	
3 - 2	-0.09416	0.15714	0.40845	
2 - 5	-0.64416	-0.39286	-0.14155	***
2 - 6	-0.54416	-0.29286	-0.04155	***
2 - 4	-0.48702	-0.23571	0.01559	
2 - 1	-0.42273	-0.17143	0.07987	
2 - 3	-0.40845	-0.15714	0.09416	

ANOVA FOR HOELENC2 DATA SET

length

Tukey's Test

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ANALYSIS OF VARIANCE PROCEDURE

TUKEY'S STUDENTIZED RANGE (HSD) TEST FOR VARIABLE: LEN
NOTE: THIS TEST CONTROLS THE TYPE I EXPERIMENTWISE ERROR RATE,
BUT GENERALLY HAS A HIGHER TYPE II ERROR RATE THAN REGWQ

ALPHA=0.05 DF=78 MSE=.0517857
CRITICAL VALUE OF STUDENTIZED RANGE=4.132
MINIMUM SIGNIFICANT DIFFERENCE=0.2513

MEANS WITH THE SAME LETTER ARE NOT SIGNIFICANTLY DIFFERENT.

TUKEY GROUPING		MEAN	N	TRT
	A	4.05000	14	5
	A			
	A	3.95000	14	6
	A			
B	A	3.89286	14	4
B	A			
B	A	3.82857	14	1
B	A			
B	A	3.81429	14	3
B				
B		3.65714	14	2

Conclusion:

Control is not significantly different than any test levels.

ANOVA FOR HDELENG2 DATA SET

Length

ANALYSIS OF VARIANCE PROCEDURE

Duncan's Test

DUNCAN'S MULTIPLE RANGE TEST FOR VARIABLE: LEN
NOTE: THIS TEST CONTROLS THE TYPE I COMPARISONWISE ERROR RATE,
NOT THE EXPERIMENTWISE ERROR RATE

ALPHA=0.05 DF=78 MSE=.0517857

NUMBER OF MEANS	2	3	4	5	6
CRITICAL RANGE	0.171411	0.180244	0.185988	0.190203	0.193738

MEANS WITH THE SAME LETTER ARE NOT SIGNIFICANTLY DIFFERENT.

DUNCAN GROUPING		MEAN	N	TRT	Conc
	A A	4.05000	14	5	56
B B	A A	3.95000	14	6	100
B B	A	3.89286	14	4	32
B B B	C C	3.82857	14	1	Control
B	C C	3.81429	14	3	18
	C	3.65714	14	2	10

Conclusion:

1) Control is not significantly different from 10-, 18-, 32-, and 100-mg/L test levels.

2) Daphnids at 56-mg/L test level are significantly longer than those in the control group.

ANOVA FOR HOERTPR2 DATA SET

ANALYSIS OF VARIANCE PROCEDURE

Reproduction

young/adult/rep. day.

CLASS LEVEL INFORMATION

CLASS	LEVELS	VALUES
TRT	6	1 2 3 4 5 6

NUMBER OF OBSERVATIONS IN DATA SET = 84

Trt 1 = Control

2 = 10 mg/L

3 = 18 "

4 = 32 "

5 = 56 "

6 = 100 "

Reproduction data

Trt	Y/A/DAY
1	4.8
1	3.5
1	6.5
1	7.7
1	1.8
1	2.1
1	4.0
1	1.6
1	2.4
1	6.8
1	2.0
1	0.6
1	3.4
1	5.7
2	1.5
2	0.9
2	5.3
2	5.0
2	5.2
2	5.2
2	3.3
2	1.7
2	1.5
2	4.8
2	6.3
2	3.4
2	6.7
2	4.5
3	3.1
3	4.3
3	5.5
3	6.8
3	5.9
3	6.8
3	4.1
3	2.3
3	4.7
3	2.1
3	4.2
3	3.0
3	5.4
3	4.0
4	2.9
4	1.3
4	6.9
4	1.2
4	2.0
4	1.9
4	3.2
4	3.8
4	4.0
4	3.5
4	4.2
4	2.0
4	3.1
4	2.6
5	1.5
5	2.5
5	0.8
5	1.3

Trt	Y/A/DAY
5	2.0
5	1.6
5	1.8
5	0.2
5	3.3
5	1.3
5	2.3
5	1.5
5	2.2
5	5.4
6	2.2
6	1.2
6	0.3
6	0.4
6	2.7
6	0.2
6	0.1
6	0.0
6	1.4
6	1.2
6	2.8
6	4.2
6	2.2
6	2.2

Trt 1 = Control
2 = 10 mg/L
3 = 18 "
4 = 32 "
5 = 56 "
6 = 100 "

ANOVA FOR HOURREPR2 DATA SET

Reproduction

ANALYSIS OF VARIANCE PROCEDURE

DEPENDENT VARIABLE: REP

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE
MODEL	6	910.90000000	151.81666667
ERROR	78	209.20000000	2.68205128
UNCORRECTED TOTAL	84	1120.10000000	

MODEL F = 56.60 PR > F = 0.0001

R-SQUARE	C.V.	ROOT MSE	REP MEAN
0.312197	52.5464	1.63769694	3.11666667

SOURCE	DF	ANOVA SS	F VALUE	PR > F
INTERCEPT	1	815.94333333	304.22	0.0001
TRT	5	94.95666667	7.08	0.0001

Reproduction

ANALYSIS OF VARIANCE PROCEDURE

TUKEY'S STUDENTIZED RANGE (HSD) TEST FOR VARIABLE: REP
NOTE: THIS TEST CONTROLS THE TYPE I EXPERIMENTWISE ERROR RATE

ALPHA=0.05 CONFIDENCE=0.95 DF=78 MSE=2.68205
CRITICAL VALUE OF STUDENTIZED RANGE=4.132
MINIMUM SIGNIFICANT DIFFERENCE=1.8085

COMPARISONS SIGNIFICANT AT THE 0.05 LEVEL ARE INDICATED BY '***'

TRT COMPARISON	SIMULTANEOUS LOWER CONFIDENCE LIMIT	DIFFERENCE BETWEEN MEANS	SIMULTANEOUS UPPER CONFIDENCE LIMIT	
3 - 2	-1.3157	0.4929	2.3014	
3 - 1	-1.1442	0.6643	2.4728	
3 - 4	-0.4085	1.4000	3.2085	
3 - 5	0.6558	2.4643	4.2728	***
3 - 6	1.1272	2.9357	4.7442	***
2 - 3	-2.3014	-0.4929	1.3157	
2 - 1	-1.6371	0.1714	1.9800	
2 - 4	-0.9014	0.9071	2.7157	
2 - 5	0.1629	1.9714	3.7800	***
2 - 6	0.6343	2.4429	4.2514	***
1 - 3	-2.4728	-0.6643	1.1442	
1 - 2	-1.9800	-0.1714	1.6371	
1 - 4	-1.0728	0.7357	2.5442	
1 - 5	-0.0085	1.8000	3.6085	
1 - 6	0.4629	2.2714	4.0800	*** ✓
4 - 3	-3.2085	-1.4000	0.4085	
4 - 2	-2.7157	-0.9071	0.9014	
4 - 1	-2.5442	-0.7357	1.0728	
4 - 5	-0.7442	1.0643	2.8728	
4 - 6	-0.2728	1.5357	3.3442	
5 - 3	-4.2728	-2.4643	-0.6558	***
5 - 2	-3.7800	-1.9714	-0.1629	***
5 - 1	-3.6085	-1.8000	0.0085	
5 - 4	-2.8728	-1.0643	0.7442	
5 - 6	-1.3371	0.4714	2.2800	
6 - 3	-4.7442	-2.9357	-1.1272	***
6 - 2	-4.2514	-2.4429	-0.6343	***
6 - 1	-4.0800	-2.2714	-0.4629	***
6 - 4	-3.3442	-1.5357	0.2728	
6 - 5	-2.2800	-0.4714	1.3371	

ANOVA FOR HOCREPR2 DATA SET

Reproduction.

ANALYSIS OF VARIANCE PROCEDURE

TUKEY'S STUDENTIZED RANGE (HSD) TEST FOR VARIABLE: REP

Tukey's Test

NOTE: THIS TEST CONTROLS THE TYPE I EXPERIMENTWISE ERROR RATE, BUT GENERALLY HAS A HIGHER TYPE II ERROR RATE THAN REGWQ

ALPHA=0.05 DF=78 MSE=2.68205
CRITICAL VALUE OF STUDENTIZED RANGE=4.132
MINIMUM SIGNIFICANT DIFFERENCE=1.8085

MEANS WITH THE SAME LETTER ARE NOT SIGNIFICANTLY DIFFERENT.

TUKEY GROUPING				MEAN	N	TRT	
		A		4.4429	14	3	18 mg/L
		A					
		A		3.9500	14	2	10 "
		A					
	B	A		3.7786	14	1	control
	B	A					
	B	A	C	3.0429	14	4	32 mg/L
	B		C				
	B		C	1.9786	14	5	56 "
			C				
			C	1.5071	14	6	100 "

Conclusion:

Control is significantly different from 100 mg/L test level

ANOVA FOR HOEPEPR2 DATA SET

Reproduction

Duncan's Test

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ANALYSIS OF VARIANCE PROCEDURE

DUNCAN'S MULTIPLE RANGE TEST FOR VARIABLE: REP
NOTE: THIS TEST CONTROLS THE TYPE I COMPARISONWISE ERROR RATE,
NOT THE EXPERIMENTWISE ERROR RATE

ALPHA=0.05 DF=78 MSE=2.68205

NUMBER OF MEANS	2	3	4	5	6
CRITICAL RANGE	1.23358	1.29715	1.33849	1.36882	1.39426

MEANS WITH THE SAME LETTER ARE NOT SIGNIFICANTLY DIFFERENT.

DUNCAN GROUPING		MEAN	N	TRT	Conc.
	A	4.4429	14	3	18 mg/L
	A				
B	A	3.9500	14	2	10 mg/L
B	A				
B	A	3.7786	14	1	Control
B					
B	C	3.0429	14	4	32 mg/L
	C				
D	C	1.9786	14	5	56 mg/L
D					
D		1.5071	14	6	100 mg/L

Conclusion:

Control is significantly different from 56 and 100 mg/L.