

1. **CHEMICAL:** Naled.
Shaughnessey No. 034401.

2. **TEST MATERIAL:** Naled Technical; CAS No. 300-76-5; Batch No. VS-6-5; 94.4% active ingredient; a clear liquid.

3. **STUDY TYPE:** 72-4. Freshwater Fish, Early Life-Stage, Flow-Through Toxicity Test. Species Tested: Fathead Minnow (*Pimephales promelas*).

4. **CITATION:** Bettencourt, M.J. 1992. Naled Technical - The Toxicity to Fathead Minnow (*Pimephales promelas*) During an Early Life-Stage Exposure. SLI Report No. 92-11-4499. Prepared by Springborn Laboratories, Inc., Wareham, MA. Submitted by Valent U.S.A. Corporation, Walnut Creek, CA. EPA MRID No. 426022-01.

5. **REVIEWED BY:**

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6. **APPROVED BY:**

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Date: 7/30/93

7. **CONCLUSIONS:** This study is scientifically sound and meets the guideline requirements for an early life-stage toxicity test using fathead minnows. Under the conditions of the test, the maximum acceptable toxicant concentration (MATC) was $> 2.9 < 36.3$ ppb naled (mean measured concentrations). The study authors reported the MATC as > 3.4 and < 6.9 μg Naled equivalents/l (mean measured concentrations) to account for the degradate DDVP. The geometric mean MATC was 4.8 μg Naled equivalents/l. EEB hazard assessments for Naled must also incorporate the separately compiled DDVP database.

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



2040663

9. BACKGROUND:**10. DISCUSSION OF INDIVIDUAL TESTS: N/A.****11. MATERIALS AND METHODS:**

- A. Test Animals:** Fathead minnow (*Pimephales promelas*) embryos were obtained from in-house cultures. At test initiation, the embryos were ≤ 24 hours old.
- B. Test System:** An intermittent-flow proportional diluter with a dilution factor of 50% was used. The diluter was equilibrated for two days prior to test initiation and delivered test solution to each replicate test aquarium at a rate of 8.5 volume replacements per day. The test aquaria were impartially positioned in a temperature-controlled water bath ($25 \pm 1^\circ\text{C}$) and illuminated (30-110 footcandles) with fluorescent tubes on a 16-hour light photoperiod. "Sudden transitions from light to dark and vice versa were avoided." Each aquarium measured 39 x 20 x 25 cm with a 19.5-cm high side drain (solution volume of 15 l).

The embryo incubation cups were glass jars (5-cm O.D., 8-cm high) with the bottoms replaced with 40-mesh Nitex® screens. Renewal of the solution in the cups was ensured using a rocker-arm apparatus which gently oscillated the cups.

The dilution water was well water which was supplemented, when necessary, with Town of Wareham untreated well water. The water was aerated and stored in an epoxy-coated concrete reservoir. During the study, the water had a hardness, alkalinity, pH, and specific conductance of 23-30 mg/l as CaCO_3 , 19-24 mg/l as CaCO_3 , 6.8-7.0, and 110-130 $\mu\text{mhos/cm}$, respectively.

The diluter stock solution (1.99 mg a.i./ml) was prepared in acetone and delivered to the diluter using a Fraser mechanism. The solution in the diluter mixing chamber (35 μg a.i./l) was continuously stirred and subsequently diluted to provide the four lower test concentrations.

- C. Dosage:** Thirty-five-day flow-through test. Based on preliminary testing, five nominal concentrations (2.2, 4.4, 8.7, 17, and 35 μg a.i./l), a solvent control, and a dilution water control were used. The solvent control solution contained 0.018 ml of acetone per

liter, which was equivalent to the solvent concentration in the highest treatment level.

- D. **Design:** Each treatment level and control consisted of two replicate aquaria. Sixty embryos were impartially transferred to each incubation cup, one cup per aquarium. When no more than 5 unhatched, viable embryos remained in any cup, hatch was considered complete. On day 5, 40 live larvae were impartially selected from the incubation cup and placed into their respective test aquaria. Larvae were offered an excess of brine shrimp nauplii three times daily on weekdays and twice daily on weekends. The aquaria were cleaned with a brush and siphon as needed. Beginning on day 21, an oxygen saturation column was used to increase the dissolved oxygen concentration (DO) of the dilution water.

Dead and live embryos were counted daily. The percent survival at hatch was determined based on the "number of live larvae and embryos per incubation cup after hatching was completed compared to the number of embryos per cup on test day 0." The behavior and appearance of the larvae were recorded daily. Larval survival was estimated at least twice weekly. Dead larvae were removed. At the end of the test (30 days post-hatch), the percent survival was determined and the fish were individually weighed (wet) and measured (total length).

Temperature, DO, and pH were measured daily in all test chambers. Hardness, alkalinity, and conductivity were measured on day 0 and weekly in alternating replicates of the dilution water control, solvent control, lowest, and highest test levels. The temperature in replicate A of the dilution water control was monitored continuously with a minimum/maximum thermometer.

Samples of the test solutions were collected on test days 0, 5, 12, 19, 26, 33, and 35. The samples were analyzed for Naled and dimethyl 2,2-dichlorovinyl phosphate (DDVP), a photolysis degradate, using gas chromatography.

- E. **Statistics:** Survival data were arcsine square root transformed prior to statistical analysis. Homogeneity of variance for each data set was checked using Bartlett's test ($\alpha=0.01$). Dilution water control and solvent control responses were compared using Student's t-test. The control data were pooled in each analysis.

The survival of control and exposed fish were compared using the Kruskal-Wallis test. All other comparisons was performed using Williams' test.

12. **REPORTED RESULTS:** No undissolved material was observed in any of the exposure vessels or the diluter during the study. The mean measured concentrations for the 35-day test were 1.6, 2.9, 6.3, 13, and 27 $\mu\text{g a.i./l}$. These values averaged 72% of nominal concentrations (Table 2, attached).

The concentration of DDVP in solution increased with exposure duration (Table 3, attached). If the concentration of Naled and DDVP are combined (total Naled equivalents), the mean measured concentrations were 1.7, 3.4, 6.9, 15, and 33 $\mu\text{g Naled equivalents/l}$ (Table 4, attached). The stability of a stock solution (22.8 mg a.i./ml) was determined over a twelve day period during the preliminary study. Measured concentrations ranged from 98 to 113% of nominal concentrations.

Hatch was complete in 5 days in all chambers and was unaffected by exposure to the test material. Compared to the pooled controls, larval survival at hatch and at the end of the test was unaffected by the concentration of Naled technical (Table 5, attached).

Mean larval length and weight data were presented in Table 6 (attached). The length of larvae exposed to the 15 and 33 $\mu\text{g Naled equivalents/l}$ test levels averaged 27 and 28 mm, respectively and was significantly lower than pooled control length (30 mm). The wet weight of larvae at these two levels (0.21 and 0.19 g, respectively) was also significantly lower than pooled control weights (0.24 g).

During the test, the pH ranged from 6.5 to 7.6. Mean DO was 7.5-8.5 mg/l. Based on continuous monitoring, the temperature range for the test period was 23-26°C.

13. **STUDY AUTHOR'S CONCLUSIONS/QUALITY ASSURANCE MEASURES:**

The maximum acceptable toxicant concentration (MATC) was >6.9 and <15 $\mu\text{g Naled equivalents/l}$ (mean measured concentrations). The geometric mean MATC was 10 $\mu\text{g Naled equivalents/l}$.

Quality Assurance and Good Laboratory Practices Compliance Statements were included in the report, indicating that the study was conducted in accordance with EPA Good Laboratory Practice Standards set forth in 40 CFR Part 160. Routine water and food contaminant analyses were not collected in accordance with GLP procedures. Information on the physical

characteristics of the test material is the responsibility of the study sponsor. The dates of quality assurance audits were reported.

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

- A. Test Procedure:** The test procedures were generally in accordance with the SEP or ASTM (1992), except for the following:

Raw data from DO measurements were not included in the report.

Four replicates per concentration are recommended in the SEP. Only two replicates were used in this test.

ASTM (1992) suggests that the embryonic stage at the beginning of the exposure be determined as precisely as possible. The precise embryonic stage was not reported.

The report did not indicate whether food was withheld from the fish during the last 24 hours of the test. The SEP recommends discontinuing feeding at least 24 hours prior to test termination.

The hardness of the dilution water during the test was 23-30 mg/l as CaCO_3 , a hardness between 40 and 200 mg/l is recommended.

- B. Statistical Analysis:** Survival (arcsine square root transformed) at hatch and at test termination were analyzed using Williams' test (printouts 1 and 2, attached). The concentration of the test material had no effect on either of these parameters. The reviewer analyzed the fish length and weight data using two-way ANOVA and Bonferroni's test (Systat Version 5.0). Based on comparisons to solvent control growth, larval fish growth was significantly affected at the two highest test levels (printouts 3-6, attached). Compared to the dilution water control, fish length was significantly lower in the three highest test levels (printout 7, attached).
- C. Discussion/Results:** The concentration of DDVP in several of the test solutions increased during the study (Table 3, attached). The author reported the MATC as μg Naled equivalents/l, a concentration reflective of Naled and its primary degradate, in order to "define the relative toxicity on a whole product

basis." In the reviewer's opinion, a separate study should be performed to determine the toxicity of DDVP. It is possible that the effects on growth are the result of DDVP-induced toxicity.

Several of the measured concentrations at test initiation were more than 30% greater than the time-weighted average concentration for the replicate. Measured concentrations throughout the remainder of the test were lower than measured concentrations at test initiation and fairly consistent.

The concentration of acetone in the test solutions was not the same for all test levels. The acetone concentration was 0.018 ml/l in the highest test concentration and decreased by approximately 50% with each lower test concentration. Since the concentration of acetone in the four lowest test concentrations was more like that of the dilution water control (≤ 0.009 ml/l), the statistical difference between the three highest concentrations and the dilution water control for length will be considered biologically significant by the reviewer. This conclusion leads to a conservative NOEC and LOEC of 3.4 and 6.9 μg Naled equivalents/l, respectively.

This study is scientifically sound but does not meet the guideline requirements for an early life-stage toxicity test using fathead minnows. Under the conditions of the test, the MATC was >3.4 and <6.9 μg Naled equivalents/l (mean measured concentrations). The geometric mean MATC was 4.8 μg Naled equivalents/l.

D. Adequacy of the Study:

- (1) **Classification:** Supplemental.
- (2) **Rationale:** The toxicity of DDVP, a primary degradate of Naled which was present all test solutions by test termination, is unknown and may have affected the test results.
- (3) **Repairability:** No.

15. COMPLETION OF ONE-LINER FOR STUDY: Yes, 02-10-93.

REFERENCES: ASTM. 1992. Standard guide for conducting early life-stage toxicity tests with fishes. E 1241-92.

Table 2. Results of the analyses of the exposure (replicate A/B) solutions for Naled during the early life-stage test with the fathead minnow (*Pimephales promelas*).

Nominal Concentration (µg A.I./L)	Measured Concentration (µg A.I./L) ^a													Mean(SD) ^b	TWA conc	
	Day:	0	5	5	7	12	7	19	7	26	7	33	2			35
35		32 36 ^c		30 31		24 28		27 23		28 28		27 26		20 21	27(4.3)	27.3 27.6
17		17 ^c 18 ^c		14 11		12 10		12 9.8		13 14		9.9 13		13 12	13(2.4)	12.7 11.9
8.7		8.1 ^c 8.4 ^c		7.2 5.4		5.2 6.7		5.1 6.0		6.1 6.2		6.2 6.2		5.4 5.4	6.3(1.0)	6.0 6.3
4.4		4.3 ^c 3.5		2.8 3.3		3.1 3.5		<0.54 ^c 2.3	2.9	2.9 1.6		3.0 2.7		1.9 2.9	2.9(0.71)	3.0 2.7
2.2		2.1 2.0		1.9 1.9		1.6 1.4		1.9 1.5		1.6 2.3		1.0 1.5		1.2 0.81 [*]	1.6(0.43)	1.7 1.7
Control		<0.46 <0.46		<0.57 <0.57		<0.32 <0.32		<0.43 <0.43		<0.56 <0.56		<0.34 <0.34		<0.19 <0.19		
Solvent Control		<0.46 <0.46		<0.57 <0.57		<0.32 <0.32		<0.43 <0.43		<0.56 <0.56		<0.34 <0.34		<0.19 <0.19		Value 30% greater than TWA conc
Stock Solution 2.0 mg A.I./mL		2.8		2.3		2.6		2.6		2.3		2.4		2.1		Value 50% less than TWA concentration
QC ^d #1		1.79 (2.00) ^e		1.40 (2.00)		1.63 (2.00)		1.54 (2.00)		1.73 (2.00)		1.60 (2.00)		1.51 (2.00)		
QC#2		8.56 (8.75)		8.47 (8.75)		8.51 (8.75)		5.62 (8.75)		7.48 (8.75)		9.20 (8.75)		7.42 (8.75)		
QC#3		31.4 (35.0)		24.9 (35.0)		30.5 (35.0)		27.3 (35.0)		30.2 (35.0)		45.5 ^f (35.0)		33.7 (35.0)		

^a Measured concentrations presented in this table have been corrected for average QC recovery at the request of the Study Sponsor.

^b Mean measured concentrations are presented with the standard deviations in parentheses and were calculated using the actual analytical (unrounded) results and not the rounded (two significant figures) values presented in this table.

^c Value below the limit of quantitation, believed attributable to sampling error. Value is not representative of exposure conditions and was excluded from mean measured calculations.

^d QC = Quality Control sample.

^e Nominal fortified concentration for each QC sample is presented in parentheses.

^f Percent recovery for this sample is outside the standard range accepted by this laboratory (i.e., ± 3 standard deviations from the mean recovery established during the method validation/recovery study, Appendix IV).

Table 3. Results of the analyses of the exposure (replicate A/B) solutions for DDVP during the early life-stage test with the fathead minnow (*Pimephales promelas*).

Nominal Concentration ($\mu\text{g A.I./L}$)	Measured Concentration ($\mu\text{g A.I./L}$)							
	Day: 0	5	12	19	26	33	35	Mean
35	<1.2 <1.2	2.8 2.9	2.6 3.3	2.9 2.5	3.2 3.0	5.7 6.7	5.4 4.3	3.2
17	<0.79 <0.79	<1.2 1.3	0.78 0.91	1.4 <1.3	<1.5 1.9	1.8 2.8	2.0 2.7	1.1
8.7	<0.59 <0.59	<0.88 <0.88	1.1 0.37	<0.97 <0.97	<1.1 <1.1	1.3 0.92	1.1 0.74	0.40
4.4	<0.30 <0.30	<0.44 <0.44	0.27 0.33	<0.49 <0.49	<0.56 0.64	0.66 0.51	0.52 0.37	0.24
2.2	<0.24 <0.24	<0.35 <0.35	<0.13 <0.13	<0.39 <0.39	<0.45 <0.45	<0.25 <0.25	0.37 0.15	0.037
Control	<0.24 <0.24	<0.35 <0.35	<0.13 <0.13	<0.39 <0.39	<0.45 <0.45	<0.25 <0.25	<0.15 <0.15	
Solvent Control	<0.24 <0.24	<0.35 <0.35	<0.13 <0.13	<0.39 <0.39	<0.45 <0.45	<0.25 <0.25	<0.15 <0.15	
Stock Solution 2.0 mg/mL	<0.12	<0.18	<0.067	<0.19	<0.22	<0.12	<0.075	
QC ^b #1	1.83 (1.76) ^c	1.53 (1.76)	1.79 (1.76)	1.69 (1.76)	1.71 (1.76)	1.57 (1.76)	1.54 (1.76)	
QC#2	8.77 (7.69)	8.79 (7.69)	8.87 ^d (7.69)	6.06 (7.69)	7.53 (7.69)	7.32 (7.69)	7.24 (7.69)	
QC#3	32.9 (30.8)	27.5 (30.8)	32.8 (30.8)	29.6 (30.8)	29.4 (30.8)	35.2 (30.8)	32.2 (30.8)	

^a Mean measured concentrations were calculated using the actual analytical (unrounded) results and not the rounded (two significant figures) values presented in this table.

^b QC = Quality Control sample.

^c Nominal fortified concentration for each QC sample is presented in parentheses.

^d Percent recovery for this sample is outside the standard range accepted by this laboratory (i.e., ± 3 standard deviations from the mean recovery established during the method validation/recovery study, Appendix IV).

Table 4. Mean measured concentrations of Naled (as active ingredient), DDVP and Naled equivalents (total product basis) obtained during the 35 day exposure of fathead minnow (*Pimephales promelas*) embryos and larvae.

Nominal Concentration (µg A.I./L) Naled Technical	Mean Measured Concentration		
	Naled ^a (µg A.I./L)	DDVP (µg/L)	Naled equivalents ^b (µg/L)
35	27	3.2	33
17	13	1.1	15
8.7	6.3	0.40	6.9
4.4	2.9	0.24	3.4
2.2	1.6	0.037	1.7

^a Measured concentrations presented in this table have been corrected for average QC recovery at the request of the Study Sponsor.

^b

$$\text{Concentration as Naled equivalents} = \text{Concentration as Naled} + \frac{\text{Concentration as DDVP}}{0.58}$$

where: 0.58 = molecular weight ratio of DDVP to Naled

Table 5. Organism survival at hatch and survival of fathead minnow larvae (*Pimephales promelas*) following 35 days exposure (30 days post-hatch) to Naled Technical.

Mean Measured Concentration ($\mu\text{g/L}$)		Organism Survival at Hatch (%)	Larval Survival at Test Termination (%)
33	A	85	85
	B	98	90
	Mean	92	88
15	A	90	85
	B	97	93
	Mean	94	89
6.9	A	97	90
	B	93	90
	Mean	95	90
3.4	A	93	98
	B	97	98
	Mean	95	98
1.7	A	90	85
	B	93	93
	Mean	92	89
Control	A	93	85
	B	95	98
	Mean	94	92
Solvent Control	A	100	95
	B	90	95
	Mean	95	95
Pooled Control		95	93

Table 6. Total length and wet weight of surviving larvae at test termination (30 days post-hatch) of the early life-stage exposure of fathead minnow (*Pimephales promelas*) to Naled Technical.

Mean Measured Concentration ($\mu\text{g/L}$)		Total Length (mm)	Wet Weight (g)
33	A	28(1.9)	0.20(0.043)
	B	27(2.3)	0.18(0.048)
	Mean	27(2.2) ^a	0.19(0.046) ^a
15	A	28(1.8)	0.20(0.049)
	B	28(1.7)	0.21(0.043)
	Mean	28(1.7) ^a	0.21(0.045) ^a
6.9	A	29(2.2)	0.23(0.040)
	B	29(3.1)	0.23(0.066)
	Mean	29(2.7)	0.23(0.054)
3.4	A	30(1.3)	0.25(0.045)
	B	29(2.6)	0.23(0.055)
	Mean	30(2.1)	0.24(0.051)
1.7	A	30(1.9)	0.27(0.055)
	B	30(1.7)	0.28(0.048)
	Mean	30(1.8)	0.27(0.051)
Control	A	29(2.3)	0.22(0.053) 24
	B	31(1.8)	0.28(0.051) 18
	Mean	30(2.2)	0.25(0.059)
Solvent Control	A	30(2.1)	0.23(0.052) 23
	B	29(2.2)	0.24(0.047) 20
	Mean	29(2.2)	0.23(0.050)
Pooled Control		30(0.96)	0.24(0.026)

% RSD

^a Significantly reduced ($p \leq 0.05$) as compared to pooled control, according to Williams' Test.

Ecological Effects Branch One-Linear Data Entry Form

Chemical Naled

Shaughnessy No. 034401

Pesticide Use

AQUATIC VERTEBRATE TOX.	% AI	LC ₅₀ (95%CL) SLOPE	HRS/ TYPE	NOEC	STUDY/REVIEW DATES	MRID/ CATEGORY	LAB	RC
1.								
2.								
3.								
4.								
5.								
6.								
7.								
CHRONIC TOX.	% AI	MATC LC₅₀	DAYS	AFFECTED PARA.	STUDY/REVIEW DATES	MRID/ CATEGORY	LAB	RC
1. <u>Pimephales promelas</u>	94.4	76.9 µg/l* 15 µg/l*	35	gout Length Weight	1992/1993	426022-01 Supplemental	SLI	LMP
2.								
3.								

COMMENTS: * mean measured concentrations of total Naled equivalents

aled, survival at hatch
02201.dtl Transform: ARC SINE(SQUARE ROOT(Y))

lks test for normality
normality test at P=0.01 level. Continue analysis.

test for homogeneity of variance
homogeneity test at 0.01 level. Continue analysis.

WILLIAMS TEST (Isotonic regression model) TABLE 1 OF 2				
IDENTIFICATION	N	ORIGINAL MEAN	TRANSFORMED MEAN	ISOTONIZED MEAN
solvent control	2	0.950	1.370	1.370
dilution contrl	2	0.940	1.324	1.325
1.7 µg/l	2	0.915	1.276	1.325
3.4	2	0.950	1.350	1.325
6.9	2	0.950	1.350	1.325
15	2	0.935	1.323	1.323
33	2	0.915	1.301	1.301

WILLIAMS TEST (Isotonic regression model) TABLE 2 OF 2				
IDENTIFICATION	ISOTONIZED MEAN	CALC. WILLIAMS	SIG P=.05	DEGREES OF FREEDOM
solvent control	1.370	0.414	1.89	k= 1, v= 7
dilution contrl	1.325	0.414	2.00	k= 2, v= 7
1.7 µg/l	1.325	0.414	2.04	k= 3, v= 7
3.4	1.325	0.414	2.06	k= 4, v= 7
6.9	1.325	0.414	2.07	k= 5, v= 7
15	1.323	0.433	2.08	k= 6, v= 7
33	1.301	0.632		

s = 0.110

Note: df used for table values are approximate when $v > 20$.

426022-01, naled, survival at test termination
 File: a:42602201.dt2 Transform: ARC SINE(SQUARE ROOT(Y))

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

Hartley test for homogeneity of variance
 Bartlett's 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.

WILLIAMS TEST (Isotonic regression model) TABLE 1 OF 2

GROUP	IDENTIFICATION	N	ORIGINAL MEAN	TRANSFORMED MEAN	ISOTONIZED MEAN
1	solvent control	2	0.950	1.345	1.345
2	dilution contrl	2	0.915	1.301	1.323
3	1.7 µg/l	2	0.890	1.238	1.323
4	3.4	2	0.980	1.429	1.323
5	6.9	2	0.900	1.249	1.249
6	15	2	0.890	1.238	1.238
7	33	2	0.875	1.211	1.211

WILLIAMS TEST (Isotonic regression model) TABLE 2 OF 2

IDENTIFICATION	ISOTONIZED MEAN	CALC. WILLIAMS	SIG P=.05	TABLE WILLIAMS	DEGREES OF FREEDOM
solvent control	1.345				
dilution contrl	1.323	0.261		1.89	k= 1, v= 7
1.7 µg/l	1.323	0.261		2.00	k= 2, v= 7
3.4	1.323	0.261		2.04	k= 3, v= 7
6.9	1.249	1.111		2.06	k= 4, v= 7
15	1.238	1.238		2.07	k= 5, v= 7
33	1.211	1.550		2.08	k= 6, v= 7

s = 0.087

Note: df used for table values are approximate when v > 20.

Naled technical : fathead minnow larvae

TRT 1 = SOLVENT CONTROL

TRT 2 = DILUTION WATER CONTROL

TRT 3 = 1.7 µg Naled equivalents/l

TRT 4 = 3.4

TRT 5 = 6.9

TRT 6 = 15

TRT 7 = 33

ANOVA on Weights

LEVELS ENCOUNTERED DURING PROCESSING ARE:

TRT

1.0000 2.0000 3.0000 4.0000 5.0000 6.0000
7.0000

REP

1.0000 2.0000

ANALYSIS OF VARIANCE

SOURCE	SUM-OF-SQUARES	DF	MEAN-SQUARE	F-RATIO	P
TRT	0.3266	6	0.0544	21.8049	0.0000
REP	0.0053	1	0.0053	2.1106	0.1469
TRT*REP	0.0661	6	0.0110	4.4161	0.0002
ERROR	1.2406	497	0.0025		

LEAST SQUARES MEANS.

			MEAN	SD	(N)
TRT	=	1.0000	0.2342	0.0495	76
TRT	=	2.0000	0.2472	0.0586	73
TRT	=	3.0000	0.2731	0.0511	71
TRT	=	4.0000	0.2406	0.0507	78
TRT	=	5.0000	0.2305	0.0541	72
TRT	=	6.0000	0.2059	0.0453	71
TRT	=	7.0000	0.1880	0.0464	70
TRT	=	1.0000			
REP	=	1.0000	0.2266	0.0515	38
TRT	=	1.0000			
REP	=	2.0000	0.2418	0.0468	38
TRT	=	2.0000			
REP	=	1.0000	0.2189	0.0528	34
TRT	=	2.0000			
REP	=	2.0000	0.2755	0.0506	39
TRT	=	3.0000			
REP	=	1.0000	0.2712	0.0551	34
TRT	=	3.0000			
REP	=	2.0000	0.2750	0.0478	37
TRT	=	4.0000			

REP	=	1.0000	0.2471	0.0454	39
TRT	=	4.0000			
REP	=	2.0000	0.2341	0.0553	39
TRT	=	5.0000			
REP	=	1.0000	0.2331	0.0400	36
TRT	=	5.0000			
REP	=	2.0000	0.2279	0.0657	36
TRT	=	6.0000			
REP	=	1.0000	0.2040	0.0487	34
TRT	=	6.0000			
REP	=	2.0000	0.2078	0.0425	37
TRT	=	7.0000			
REP	=	1.0000	0.1961	0.0434	34
TRT	=	7.0000			
REP	=	2.0000	0.1800	0.0483	36

Post-hoc pairwise comparison of weight/Bonferroni.

USING LEAST SQUARES MEANS.
POST HOC TEST OF WEIGHT

MATRIX OF PAIRWISE MEAN DIFFERENCES:

	1	2	3	4	5
1	0.0000				
2	0.0130	0.0000			
3	0.0389	0.0259	0.0000		
4	0.0064	-0.0066	-0.0325	0.0000	
5	-0.0037	-0.0167	-0.0426	-0.0100	0.0000
6	-0.0283	-0.0413	-0.0673	-0.0347	-0.0247
7	-0.0462	-0.0592	-0.0851	-0.0526	-0.0425
	6	7			
6	0.0000				
7	-0.0179	0.0000			

BONFERRONI ADJUSTMENT.

MATRIX OF PAIRWISE COMPARISON PROBABILITIES:

	1	2	3	4	5
1	1.0000				
2	1.0000	1.0000			
3	0.0001	0.0420	1.0000		
4	1.0000	1.0000	0.0017	1.0000	
5	1.0000	0.9503	0.0000	1.0000	1.0000
6	0.0136	0.0000	0.0000	0.0006	0.0699
7	0.0000	0.0000	0.0000	0.0000	0.0000
	6	7			
6	1.0000				
7	0.7234	1.0000			

Greater than controls (pointing to row 2)

less than controls (pointing to row 7)

Naled technical : fathead minnow larvae

ANOVA on Lengths

LEVELS ENCOUNTERED DURING PROCESSING ARE:

TRT	1.0000	2.0000	3.0000	4.0000	5.0000	6.0000
	7.0000					
REP	1.0000	2.0000				

ANALYSIS OF VARIANCE					
SOURCE	SUM-OF-SQUARES	DF	MEAN-SQUARE	F-RATIO	P
TRT	467.4036	6	77.9006	17.6752	0.0000
REP	4.8424	1	4.8424	1.0987	0.2951
TRT*REP	138.0978	6	23.0163	5.2223	0.0000
ERROR	2190.4498	497	4.4073		

LEAST SQUARES MEANS.

			MEAN	SD	(N)
TRT	=	1.0000	29.3553	2.2133	76
TRT	=	2.0000	29.9947	2.2041	73
TRT	=	3.0000	30.1769	1.7753	71
TRT	=	4.0000	29.5000	2.1244	78
TRT	=	5.0000	28.7639	2.6563	72
TRT	=	6.0000	28.0970	1.7251	71
TRT	=	7.0000	27.2786	2.2178	70
TRT	=	1.0000			
REP	=	1.0000	29.9211	2.1102	38
TRT	=	1.0000			
REP	=	2.0000	28.7895	2.1953	38
TRT	=	2.0000			
REP	=	1.0000	29.1176	2.2531	34
TRT	=	2.0000			
REP	=	2.0000	30.8718	1.8235	39
TRT	=	3.0000			
REP	=	1.0000	30.0294	1.8502	34
TRT	=	3.0000			
REP	=	2.0000	30.3243	1.7168	37
TRT	=	4.0000			
REP	=	1.0000	30.0256	1.2667	39
TRT	=	4.0000			
REP	=	2.0000	28.9744	2.6406	39
TRT	=	5.0000			
REP	=	1.0000	28.6667	2.1647	36
TRT	=	5.0000			
REP	=	2.0000	28.8611	3.0998	36
TRT	=	6.0000			
REP	=	1.0000	28.0588	1.8081	34

TRT	=	6.0000			
REP	=	2.0000	28.1351	1.6694	37
TRT	=	7.0000			
REP	=	1.0000	28.0294	1.8987	34
TRT	=	7.0000			
REP	=	2.0000	26.5278	2.2739	36

Post-hoc pairwise comparison of length/Bonferroni.
USING LEAST SQUARES MEANS.

POST HOC TEST OF LENGTH

MATRIX OF PAIRWISE MEAN DIFFERENCES:

	1	2	3	4	5
1	0.0000				
2	0.6395	0.0000			
3	0.8216	0.1821	0.0000		
4	0.1447	-0.4947	-0.6769	0.0000	
5	-0.5914	-1.2308	-1.4130	-0.7361	0.0000
6	-1.2583	-1.8977	-2.0799	-1.4030	-0.6669
7	-2.0767	-2.7161	-2.8983	-2.2214	-1.4853

	6	7
6	0.0000	
7	-0.8184	0.0000

BONFERRONI ADJUSTMENT.

MATRIX OF PAIRWISE COMPARISON PROBABILITIES:

	1	2	3	4	5
1	1.0000				
2	1.0000	1.0000			
3	0.3815	1.0000	1.0000		
4	1.0000	1.0000	1.0000	1.0000	
5	1.0000	0.0097	0.0014	0.6804	1.0000
6	0.0066	0.0000	0.0000	0.0011	1.0000
7	0.0000	0.0000	0.0000	0.0000	0.0006

	6	7
6	1.0000	
7	0.4439	1.0000

Naled technical : fathead minnow larvae

THE FOLLOWING RESULTS ARE FOR:

TRT = 1.0000

TOTAL OBSERVATIONS: 76

	REP	WEIGHT	LENGTH
N OF CASES	76	76	76
MINIMUM	1.0000	0.1296	25.0000
MAXIMUM	2.0000	0.3913	35.0000
MEAN	1.5000	0.2342	29.3553
STANDARD DEV	0.5033	0.0495	2.2133

THE FOLLOWING RESULTS ARE FOR:

TRT = 2.0000

TOTAL OBSERVATIONS: 73

	REP	WEIGHT	LENGTH
N OF CASES	73	73	73
MINIMUM	1.0000	0.0879	22.0000
MAXIMUM	2.0000	0.4006	34.0000
MEAN	1.5342	0.2492	30.0548
STANDARD DEV	0.5023	0.0586	2.2041

THE FOLLOWING RESULTS ARE FOR:

TRT = 3.0000

TOTAL OBSERVATIONS: 71

	REP	WEIGHT	LENGTH
N OF CASES	71	71	71
MINIMUM	1.0000	0.1728	26.0000
MAXIMUM	2.0000	0.4020	34.0000
MEAN	1.5211	0.2732	30.1831
STANDARD DEV	0.5031	0.0511	1.7753

THE FOLLOWING RESULTS ARE FOR:

TRT = 4.0000

TOTAL OBSERVATIONS: 78

	REP	WEIGHT	LENGTH
N OF CASES	78	78	78
MINIMUM	1.0000	0.1212	21.0000
MAXIMUM	2.0000	0.3394	34.0000
MEAN	1.5000	0.2406	29.5000
STANDARD DEV	0.5032	0.0507	2.1244

THE FOLLOWING RESULTS ARE FOR:

TRT = 5.0000

TOTAL OBSERVATIONS: 72

	REP	WEIGHT	LENGTH
N OF CASES	72	72	72
MINIMUM	1.0000	0.0626	19.0000
MAXIMUM	2.0000	0.4175	40.0000
MEAN	1.5000	0.2305	28.7639
STANDARD DEV	0.5035	0.0541	2.6563

THE FOLLOWING RESULTS ARE FOR:

TRT = 6.0000

TOTAL OBSERVATIONS: 71

	REP	WEIGHT	LENGTH
N OF CASES	71	71	71
MINIMUM	1.0000	0.1330	25.0000
MAXIMUM	2.0000	0.3435	33.0000
MEAN	1.5211	0.2060	28.0986
STANDARD DEV	0.5031	0.0453	1.7251

THE FOLLOWING RESULTS ARE FOR:

TRT = 7.0000

TOTAL OBSERVATIONS: 70

	REP	WEIGHT	LENGTH
N OF CASES	70	70	70
MINIMUM	1.0000	0.0683	18.0000
MAXIMUM	2.0000	0.2976	31.0000
MEAN	1.5143	0.1878	27.2571
STANDARD DEV	0.5034	0.0464	2.2178

SUMMARY STATISTICS FOR REP

BARTLETT TEST FOR HOMOGENEITY OF GROUP VARIANCES

CHI-SQUARE = 0.0006 DF= 6 PROBABILITY = 1.0000

ANALYSIS OF VARIANCE

SOURCE	SUM OF SQUARES	DF	MEAN SQUARE	F	PROBABILITY
BETWEEN GROUPS	0.0806	6	0.0134	0.0531	0.9994
WITHIN GROUPS	127.5867	504	0.2531		

SUMMARY STATISTICS FOR WEIGHT

BARTLETT TEST FOR HOMOGENEITY OF GROUP VARIANCES

CHI-SQUARE = 6.6900 DF= 6 PROBABILITY = 0.3505

ANALYSIS OF VARIANCE

SOURCE	SUM OF SQUARES	DF	MEAN SQUARE	F	PROBABILITY
BETWEEN GROUPS	0.3333	6	0.0555	21.3384	0.0000
WITHIN GROUPS	1.3120	504	0.0026		

SUMMARY STATISTICS FOR LENGTH

BARTLETT TEST FOR HOMOGENEITY OF GROUP VARIANCES

CHI-SQUARE = 18.0592 DF= 6 PROBABILITY = 0.0061

ANALYSIS OF VARIANCE

SOURCE	SUM OF SQUARES	DF	MEAN SQUARE	F	PROBABILITY
BETWEEN GROUPS	482.8970	6	80.4828	17.3795	0.0000
WITHIN GROUPS	2333.9758	504	4.6309		

KOLMOGOROV-SMIRNOV ONE SAMPLE TEST USING STANDARD NORMAL DISTRIBUTION

VARIABLE	N-OF-CASES	MAXDIF	PROBABILITY (2-TAIL)
LENGTH	511.0000	1.0000	0.0000
REP	511.0000	0.8413	0.0000
WEIGHT	511.0000	0.5377	0.0000

TITLE: 426022-01, naled, survival at hatch

FILE: a:42602201.dt1

TRANSFORM: ARC SINE(SQUARE ROOT(Y))

NUMBER OF GROUPS: 7

GRP	IDENTIFICATION	REP	VALUE	TRANS VALUE
1	solvent control	1	1.0000	1.4917
1	solvent control	2	0.9000	1.2490
2	dilution contrl	1	0.9300	1.3030
2	dilution contrl	2	0.9500	1.3453
3	1.7 µg/l	1	0.9000	1.2490
3	1.7 µg/l	2	0.9300	1.3030
4	3.4	1	0.9300	1.3030
4	3.4	2	0.9700	1.3967
5	6.9	1	0.9700	1.3967
5	6.9	2	0.9300	1.3030
6	15	1	0.9000	1.2490
6	15	2	0.9700	1.3967
7	33	1	0.8500	1.1731
7	33	2	0.9800	1.4289

TITLE: 426022-01, naled, survival at test termination

FILE: a:42602201.dt2

TRANSFORM: ARC SINE(SQUARE ROOT(Y))

NUMBER OF GROUPS: 7

GRP	IDENTIFICATION	REP	VALUE	TRANS VALUE
1	solvent control	1	0.9500	1.3453
1	solvent control	2	0.9500	1.3453
2	dilution contrl	1	0.8500	1.1731
2	dilution contrl	2	0.9800	1.4289
3	1.7 µg/l	1	0.8500	1.1731
3	1.7 µg/l	2	0.9300	1.3030
4	3.4	1	0.9800	1.4289
4	3.4	2	0.9800	1.4289
5	6.9	1	0.9000	1.2490
5	6.9	2	0.9000	1.2490
6	15	1	0.8500	1.1731
6	15	2	0.9300	1.3030
7	33	1	0.8500	1.1731
7	33	2	0.9000	1.2490

	TRT	REP	LENGTH	WEIGHT
CASE 1	1.0000	1.0000	30.0000	0.2355
CASE 2	1.0000	1.0000	31.0000	0.2863
CASE 3	1.0000	1.0000	29.0000	0.2185
CASE 4	1.0000	1.0000	31.0000	0.2633
CASE 5	1.0000	1.0000	28.0000	0.1847
CASE 6	1.0000	1.0000	30.0000	0.2417
CASE 7	1.0000	1.0000	29.0000	0.1760
CASE 8	1.0000	1.0000	27.0000	0.1822
CASE 9	1.0000	1.0000	31.0000	0.2282
CASE 10	1.0000	1.0000	31.0000	0.2674
CASE 11	1.0000	1.0000	35.0000	0.3913
CASE 12	1.0000	1.0000	26.0000	0.1296
CASE 13	1.0000	1.0000	27.0000	0.1499
CASE 14	1.0000	1.0000	33.0000	0.2471
CASE 15	1.0000	1.0000	29.0000	0.2183
CASE 16	1.0000	1.0000	28.0000	0.1978
CASE 17	1.0000	1.0000	30.0000	0.2281
CASE 18	1.0000	1.0000	31.0000	0.2506
CASE 19	1.0000	1.0000	28.0000	0.1628
CASE 20	1.0000	1.0000	32.0000	0.2528
CASE 21	1.0000	1.0000	26.0000	0.1384
CASE 22	1.0000	1.0000	33.0000	0.3044
CASE 23	1.0000	1.0000	31.0000	0.2173
CASE 24	1.0000	1.0000	28.0000	0.1846
CASE 25	1.0000	1.0000	32.0000	0.2880
CASE 26	1.0000	1.0000	33.0000	0.2958
CASE 27	1.0000	1.0000	32.0000	0.2737
CASE 28	1.0000	1.0000	29.0000	0.2177
CASE 29	1.0000	1.0000	30.0000	0.2151
CASE 30	1.0000	1.0000	29.0000	0.2064
CASE 31	1.0000	1.0000	28.0000	0.2138
CASE 32	1.0000	1.0000	33.0000	0.2805
CASE 33	1.0000	1.0000	29.0000	0.1797
CASE 34	1.0000	1.0000	32.0000	0.2600
CASE 35	1.0000	1.0000	30.0000	0.2136
CASE 36	1.0000	1.0000	28.0000	0.1853
CASE 37	1.0000	1.0000	29.0000	0.2159
CASE 38	1.0000	1.0000	29.0000	0.2072
CASE 39	1.0000	2.0000	32.0000	0.2943
CASE 40	1.0000	2.0000	28.0000	0.2424
CASE 41	1.0000	2.0000	30.0000	0.2652
CASE 42	1.0000	2.0000	35.0000	0.3837
CASE 43	1.0000	2.0000	27.0000	0.1744
CASE 44	1.0000	2.0000	32.0000	0.3192
CASE 45	1.0000	2.0000	32.0000	0.2791
CASE 46	1.0000	2.0000	30.0000	0.2433
CASE 47	1.0000	2.0000	31.0000	0.2742
CASE 48	1.0000	2.0000	28.0000	0.2144
CASE 49	1.0000	2.0000	29.0000	0.2365
CASE 50	1.0000	2.0000	27.0000	0.1787
CASE 51	1.0000	2.0000	28.0000	0.2287
CASE 52	1.0000	2.0000	30.0000	0.2763
CASE 53	1.0000	2.0000	31.0000	0.2511
CASE 54	1.0000	2.0000	29.0000	0.2201
CASE 55	1.0000	2.0000	30.0000	0.2772
CASE 56	1.0000	2.0000	30.0000	0.2372
CASE 57	1.0000	2.0000	25.0000	0.1765
CASE 58	1.0000	2.0000	30.0000	0.2672
CASE 59	1.0000	2.0000	29.0000	0.2520
CASE 60	1.0000	2.0000	27.0000	0.1758
CASE 61	1.0000	2.0000	26.0000	0.1950
CASE 62	1.0000	2.0000	30.0000	0.2828
CASE 63	1.0000	2.0000	30.0000	0.2673
CASE 64	1.0000	2.0000	30.0000	0.2834
CASE 65	1.0000	2.0000	28.0000	0.2353
CASE 66	1.0000	2.0000	28.0000	0.2071
CASE 67	1.0000	2.0000	28.0000	0.2059

CASE	68	1.0000	2.0000	27.0000	0.2338
CASE	69	1.0000	2.0000	29.0000	0.3017
CASE	70	1.0000	2.0000	25.0000	0.2398
CASE	71	1.0000	2.0000	30.0000	0.2344
CASE	72	1.0000	2.0000	25.0000	0.1867
CASE	73	1.0000	2.0000	28.0000	0.2693
CASE	74	1.0000	2.0000	28.0000	0.2451
CASE	75	1.0000	2.0000	26.0000	0.1692
CASE	76	1.0000	2.0000	26.0000	0.1650
CASE	77	2.0000	1.0000	29.0000	0.2421
CASE	78	2.0000	1.0000	28.0000	0.1798
CASE	79	2.0000	1.0000	28.0000	0.1715
CASE	80	2.0000	1.0000	33.0000	0.3441
CASE	81	2.0000	1.0000	31.0000	0.2520
CASE	82	2.0000	1.0000	32.0000	0.2610
CASE	83	2.0000	1.0000	26.0000	0.1490
CASE	84	2.0000	1.0000	31.0000	0.2382
CASE	85	2.0000	1.0000	33.0000	0.3279
CASE	86	2.0000	1.0000	30.0000	0.2761
CASE	87	2.0000	1.0000	31.0000	0.2327
CASE	88	2.0000	1.0000	27.0000	0.1727
CASE	89	2.0000	1.0000	28.0000	0.1513
CASE	90	2.0000	1.0000	27.0000	0.1635
CASE	91	2.0000	1.0000	29.0000	0.2359
CASE	92	2.0000	1.0000	28.0000	0.1871
CASE	93	2.0000	1.0000	27.0000	0.1788
CASE	94	2.0000	1.0000	30.0000	0.2368
CASE	95	2.0000	1.0000	29.0000	0.2644
CASE	96	2.0000	1.0000	30.0000	0.2179
CASE	97	2.0000	1.0000	29.0000	0.2285
CASE	98	2.0000	1.0000	30.0000	0.2538
CASE	99	2.0000	1.0000	30.0000	0.1974
CASE	100	2.0000	1.0000	31.0000	0.2502
CASE	101	2.0000	1.0000	26.0000	0.2277
CASE	102	2.0000	1.0000	26.0000	0.1568
CASE	103	2.0000	1.0000	30.0000	0.1469
CASE	104	2.0000	1.0000	29.0000	0.2103
CASE	105	2.0000	1.0000	22.0000	0.2341
CASE	106	2.0000	1.0000	30.0000	0.0879
CASE	107	2.0000	1.0000	28.0000	0.2139
CASE	108	2.0000	1.0000	30.0000	0.2272
CASE	109	2.0000	1.0000	32.0000	0.2515
CASE	110	2.0000	1.0000	30.0000	0.2746
CASE	111	2.0000	2.0000	30.0000	0.2971
CASE	112	2.0000	2.0000	31.0000	0.2279
CASE	113	2.0000	2.0000	30.0000	0.2606
CASE	114	2.0000	2.0000	29.0000	0.2731
CASE	115	2.0000	2.0000	33.0000	0.2429
CASE	116	2.0000	2.0000	33.0000	0.3350
CASE	117	2.0000	2.0000	29.0000	0.3642
CASE	118	2.0000	2.0000	30.0000	0.2248
CASE	119	2.0000	2.0000	31.0000	0.2418
CASE	120	2.0000	2.0000	28.0000	0.2606
CASE	121	2.0000	2.0000	33.0000	0.2350
CASE	122	2.0000	2.0000	34.0000	0.3053
CASE	123	2.0000	2.0000	33.0000	0.3420
CASE	124	2.0000	2.0000	31.0000	0.3551
CASE	125	2.0000	2.0000	28.0000	0.2505
CASE	126	2.0000	2.0000	34.0000	0.1953
CASE	127	2.0000	2.0000	29.0000	0.3489
CASE	128	2.0000	2.0000	30.0000	0.1830
CASE	129	2.0000	2.0000	32.0000	0.2407
CASE	130	2.0000	2.0000	32.0000	0.2930
CASE	131	2.0000	2.0000	29.0000	0.2775
CASE	132	2.0000	2.0000	32.0000	0.2041
CASE	133	2.0000	2.0000	30.0000	0.2796
CASE	134	2.0000	2.0000	31.0000	0.2647
CASE	135	2.0000	2.0000	28.0000	0.3084
CASE	136	2.0000	2.0000	34.0000	0.3305

CASE 137	2.0000	2.0000	32.0000	0.4006
CASE 138	2.0000	2.0000	30.0000	0.3142
CASE 139	2.0000	2.0000	31.0000	0.2286
CASE 140	2.0000	2.0000	29.0000	0.3051
CASE 141	2.0000	2.0000	29.0000	0.2512
CASE 142	2.0000	2.0000	28.0000	0.2689
CASE 143	2.0000	2.0000	33.0000	0.2190
CASE 144	2.0000	2.0000	32.0000	0.3057
CASE 145	2.0000	2.0000	33.0000	0.2802
CASE 146	2.0000	2.0000	31.0000	0.3231
CASE 147	2.0000	2.0000	29.0000	0.2360
CASE 148	2.0000	2.0000	31.0000	0.2157
CASE 149	2.0000	2.0000	32.0000	0.2547
CASE 150	3.0000	1.0000	31.0000	0.3254
CASE 151	3.0000	1.0000	31.0000	0.2639
CASE 152	3.0000	1.0000	27.0000	0.1770
CASE 153	3.0000	1.0000	27.0000	0.2965
CASE 154	3.0000	1.0000	31.0000	0.2682
CASE 155	3.0000	1.0000	30.0000	0.2482
CASE 156	3.0000	1.0000	32.0000	0.3049
CASE 157	3.0000	1.0000	32.0000	0.3142
CASE 158	3.0000	1.0000	30.0000	0.2501
CASE 159	3.0000	1.0000	30.0000	0.2479
CASE 160	3.0000	1.0000	29.0000	0.2212
CASE 161	3.0000	1.0000	32.0000	0.3208
CASE 162	3.0000	1.0000	32.0000	0.3207
CASE 163	3.0000	1.0000	30.0000	0.2379
CASE 164	3.0000	1.0000	30.0000	0.2616
CASE 165	3.0000	1.0000	30.0000	0.2417
CASE 166	3.0000	1.0000	27.0000	0.1842
CASE 167	3.0000	1.0000	29.0000	0.2143
CASE 168	3.0000	1.0000	30.0000	0.3069
CASE 169	3.0000	1.0000	30.0000	0.3354
CASE 170	3.0000	1.0000	26.0000	0.1821
CASE 171	3.0000	1.0000	27.0000	0.1967
CASE 172	3.0000	1.0000	32.0000	0.1960
CASE 173	3.0000	1.0000	31.0000	0.3457
CASE 174	3.0000	1.0000	29.0000	0.2671
CASE 175	3.0000	1.0000	33.0000	0.2451
CASE 176	3.0000	1.0000	32.0000	0.4020
CASE 177	3.0000	1.0000	28.0000	0.3418
CASE 178	3.0000	1.0000	29.0000	0.2875
CASE 179	3.0000	1.0000	30.0000	0.2638
CASE 180	3.0000	1.0000	30.0000	0.2827
CASE 181	3.0000	1.0000	30.0000	0.2514
CASE 182	3.0000	1.0000	30.0000	0.2534
CASE 183	3.0000	1.0000	34.0000	0.3660
CASE 184	3.0000	2.0000	28.0000	0.2494
CASE 185	3.0000	2.0000	27.0000	0.2176
CASE 186	3.0000	2.0000	27.0000	0.2128
CASE 187	3.0000	2.0000	28.0000	0.3598
CASE 188	3.0000	2.0000	33.0000	0.3432
CASE 189	3.0000	2.0000	32.0000	0.2626
CASE 190	3.0000	2.0000	33.0000	0.3418
CASE 191	3.0000	2.0000	29.0000	0.2688
CASE 192	3.0000	2.0000	30.0000	0.2341
CASE 193	3.0000	2.0000	31.0000	0.2634
CASE 194	3.0000	2.0000	31.0000	0.2724
CASE 195	3.0000	2.0000	30.0000	0.2864
CASE 196	3.0000	2.0000	28.0000	0.1728
CASE 197	3.0000	2.0000	29.0000	0.1962
CASE 198	3.0000	2.0000	31.0000	0.3073
CASE 199	3.0000	2.0000	30.0000	0.3168
CASE 200	3.0000	2.0000	28.0000	0.1910
CASE 201	3.0000	2.0000	31.0000	0.2557
CASE 202	3.0000	2.0000	31.0000	0.2709
CASE 203	3.0000	2.0000	32.0000	0.3533
CASE 204	3.0000	2.0000	31.0000	0.2588
CASE 205	3.0000	2.0000	31.0000	0.2787

CASE	206	3.0000	2.0000	31.0000	0.2768
CASE	207	3.0000	2.0000	31.0000	0.2634
CASE	208	3.0000	2.0000	32.0000	0.3258
CASE	209	3.0000	2.0000	32.0000	0.2902
CASE	210	3.0000	2.0000	32.0000	0.3446
CASE	211	3.0000	2.0000	32.0000	0.3300
CASE	212	3.0000	2.0000	30.0000	0.2531
CASE	213	3.0000	2.0000	28.0000	0.2311
CASE	214	3.0000	2.0000	31.0000	0.3281
CASE	215	3.0000	2.0000	28.0000	0.2240
CASE	216	3.0000	2.0000	30.0000	0.2771
CASE	217	3.0000	2.0000	33.0000	0.3099
CASE	218	3.0000	2.0000	32.0000	0.2902
CASE	219	3.0000	2.0000	30.0000	0.2919
CASE	220	3.0000	2.0000	29.0000	0.2256
CASE	221	4.0000	1.0000	31.0000	0.2763
CASE	222	4.0000	1.0000	28.0000	0.2488
CASE	223	4.0000	1.0000	29.0000	0.2699
CASE	224	4.0000	1.0000	30.0000	0.2017
CASE	225	4.0000	1.0000	30.0000	0.2302
CASE	226	4.0000	1.0000	27.0000	0.1380
CASE	227	4.0000	1.0000	29.0000	0.2487
CASE	228	4.0000	1.0000	33.0000	0.3321
CASE	229	4.0000	1.0000	30.0000	0.2474
CASE	230	4.0000	1.0000	29.0000	0.2247
CASE	231	4.0000	1.0000	30.0000	0.2474
CASE	232	4.0000	1.0000	30.0000	0.2403
CASE	233	4.0000	1.0000	29.0000	0.2207
CASE	234	4.0000	1.0000	29.0000	0.2473
CASE	235	4.0000	1.0000	29.0000	0.2058
CASE	236	4.0000	1.0000	30.0000	0.2667
CASE	237	4.0000	1.0000	29.0000	0.2133
CASE	238	4.0000	1.0000	32.0000	0.2814
CASE	239	4.0000	1.0000	31.0000	0.2621
CASE	240	4.0000	1.0000	30.0000	0.2581
CASE	241	4.0000	1.0000	31.0000	0.3050
CASE	242	4.0000	1.0000	31.0000	0.1743
CASE	243	4.0000	1.0000	30.0000	0.2133
CASE	244	4.0000	1.0000	31.0000	0.2965
CASE	245	4.0000	1.0000	31.0000	0.3065
CASE	246	4.0000	1.0000	32.0000	0.3367
CASE	247	4.0000	1.0000	31.0000	0.1598
CASE	248	4.0000	1.0000	30.0000	0.2787
CASE	249	4.0000	1.0000	31.0000	0.2750
CASE	250	4.0000	1.0000	30.0000	0.2607
CASE	251	4.0000	1.0000	28.0000	0.2488
CASE	252	4.0000	1.0000	29.0000	0.1899
CASE	253	4.0000	1.0000	31.0000	0.2787
CASE	254	4.0000	1.0000	30.0000	0.2348
CASE	255	4.0000	1.0000	30.0000	0.2701
CASE	256	4.0000	1.0000	29.0000	0.1862
CASE	257	4.0000	1.0000	31.0000	0.2720
CASE	258	4.0000	1.0000	32.0000	0.3027
CASE	259	4.0000	1.0000	28.0000	0.1866
CASE	260	4.0000	2.0000	31.0000	0.3233
CASE	261	4.0000	2.0000	27.0000	0.1843
CASE	262	4.0000	2.0000	26.0000	0.1645
CASE	263	4.0000	2.0000	31.0000	0.2630
CASE	264	4.0000	2.0000	31.0000	0.2810
CASE	265	4.0000	2.0000	30.0000	0.2133
CASE	266	4.0000	2.0000	27.0000	0.1614
CASE	267	4.0000	2.0000	30.0000	0.2679
CASE	268	4.0000	2.0000	30.0000	0.2751
CASE	269	4.0000	2.0000	28.0000	0.2002
CASE	270	4.0000	2.0000	29.0000	0.2548
CASE	271	4.0000	2.0000	29.0000	0.2157
CASE	272	4.0000	2.0000	23.0000	0.1212
CASE	273	4.0000	2.0000	26.0000	0.1822
CASE	274	4.0000	2.0000	29.0000	0.2333

CASE	275	4.0000	2.0000	29.0000	0.2110
CASE	276	4.0000	2.0000	30.0000	0.2522
CASE	277	4.0000	2.0000	26.0000	0.1471
CASE	278	4.0000	2.0000	34.0000	0.3150
CASE	279	4.0000	2.0000	31.0000	0.2495
CASE	280	4.0000	2.0000	28.0000	0.1814
CASE	281	4.0000	2.0000	29.0000	0.2803
CASE	282	4.0000	2.0000	32.0000	0.3099
CASE	283	4.0000	2.0000	31.0000	0.2793
CASE	284	4.0000	2.0000	31.0000	0.2286
CASE	285	4.0000	2.0000	30.0000	0.1818
CASE	286	4.0000	2.0000	25.0000	0.1335
CASE	287	4.0000	2.0000	32.0000	0.2519
CASE	288	4.0000	2.0000	30.0000	0.1966
CASE	289	4.0000	2.0000	28.0000	0.3117
CASE	290	4.0000	2.0000	21.0000	0.2605
CASE	291	4.0000	2.0000	30.0000	0.2598
CASE	292	4.0000	2.0000	29.0000	0.2698
CASE	293	4.0000	2.0000	33.0000	0.3394
CASE	294	4.0000	2.0000	31.0000	0.2756
CASE	295	4.0000	2.0000	26.0000	0.1804
CASE	296	4.0000	2.0000	27.0000	0.2255
CASE	297	4.0000	2.0000	31.0000	0.2714
CASE	298	4.0000	2.0000	29.0000	0.1748
CASE	299	5.0000	1.0000	27.0000	0.2060
CASE	300	5.0000	1.0000	27.0000	0.1970
CASE	301	5.0000	1.0000	28.0000	0.2304
CASE	302	5.0000	1.0000	26.0000	0.1809
CASE	303	5.0000	1.0000	28.0000	0.2374
CASE	304	5.0000	1.0000	27.0000	0.1805
CASE	305	5.0000	1.0000	30.0000	0.3004
CASE	306	5.0000	1.0000	29.0000	0.2382
CASE	307	5.0000	1.0000	30.0000	0.2326
CASE	308	5.0000	1.0000	29.0000	0.2010
CASE	309	5.0000	1.0000	30.0000	0.2173
CASE	310	5.0000	1.0000	30.0000	0.2057
CASE	311	5.0000	1.0000	26.0000	0.1900
CASE	312	5.0000	1.0000	27.0000	0.2013
CASE	313	5.0000	1.0000	29.0000	0.2182
CASE	314	5.0000	1.0000	31.0000	0.2773
CASE	315	5.0000	1.0000	30.0000	0.2308
CASE	316	5.0000	1.0000	28.0000	0.2374
CASE	317	5.0000	1.0000	31.0000	0.2383
CASE	318	5.0000	1.0000	29.0000	0.1860
CASE	319	5.0000	1.0000	30.0000	0.2892
CASE	320	5.0000	1.0000	30.0000	0.2724
CASE	321	5.0000	1.0000	28.0000	0.2030
CASE	322	5.0000	1.0000	25.0000	0.1796
CASE	323	5.0000	1.0000	30.0000	0.2412
CASE	324	5.0000	1.0000	29.0000	0.2376
CASE	325	5.0000	1.0000	21.0000	0.2959
CASE	326	5.0000	1.0000	30.0000	0.2595
CASE	327	5.0000	1.0000	30.0000	0.2743
CASE	328	5.0000	1.0000	29.0000	0.2391
CASE	329	5.0000	1.0000	28.0000	0.2236
CASE	330	5.0000	1.0000	29.0000	0.2731
CASE	331	5.0000	1.0000	30.0000	0.2687
CASE	332	5.0000	1.0000	30.0000	0.1944
CASE	333	5.0000	1.0000	34.0000	0.3477
CASE	334	5.0000	1.0000	27.0000	0.1870
CASE	335	5.0000	2.0000	29.0000	0.2364
CASE	336	5.0000	2.0000	29.0000	0.2157
CASE	337	5.0000	2.0000	25.0000	0.1433
CASE	338	5.0000	2.0000	40.0000	0.4175
CASE	339	5.0000	2.0000	30.0000	0.2478
CASE	340	5.0000	2.0000	26.0000	0.1614
CASE	341	5.0000	2.0000	27.0000	0.2078
CASE	342	5.0000	2.0000	30.0000	0.2583
CASE	343	5.0000	2.0000	30.0000	0.3013

CASE 344	5.0000	2.0000	30.0000	0.2744
CASE 345	5.0000	2.0000	29.0000	0.2312
CASE 346	5.0000	2.0000	31.0000	0.2864
CASE 347	5.0000	2.0000	30.0000	0.2188
CASE 348	5.0000	2.0000	31.0000	0.3025
CASE 349	5.0000	2.0000	30.0000	0.2624
CASE 350	5.0000	2.0000	32.0000	0.3398
CASE 351	5.0000	2.0000	19.0000	0.0626
CASE 352	5.0000	2.0000	31.0000	0.3154
CASE 353	5.0000	2.0000	30.0000	0.2526
CASE 354	5.0000	2.0000	27.0000	0.1572
CASE 355	5.0000	2.0000	30.0000	0.2387
CASE 356	5.0000	2.0000	26.0000	0.1357
CASE 357	5.0000	2.0000	27.0000	0.1688
CASE 358	5.0000	2.0000	29.0000	0.2057
CASE 359	5.0000	2.0000	29.0000	0.1949
CASE 360	5.0000	2.0000	28.0000	0.2247
CASE 361	5.0000	2.0000	29.0000	0.2376
CASE 362	5.0000	2.0000	30.0000	0.2285
CASE 363	5.0000	2.0000	28.0000	0.1984
CASE 364	5.0000	2.0000	30.0000	0.2287
CASE 365	5.0000	2.0000	28.0000	0.2351
CASE 366	5.0000	2.0000	26.0000	0.1602
CASE 367	5.0000	2.0000	25.0000	0.1513
CASE 368	5.0000	2.0000	28.0000	0.1974
CASE 369	5.0000	2.0000	28.0000	0.2120
CASE 370	5.0000	2.0000	32.0000	0.2953
CASE 371	6.0000	1.0000	27.0000	0.1788
CASE 372	6.0000	1.0000	29.0000	0.2202
CASE 373	6.0000	1.0000	32.0000	0.2750
CASE 374	6.0000	1.0000	25.0000	0.1330
CASE 375	6.0000	1.0000	29.0000	0.2133
CASE 376	6.0000	1.0000	27.0000	0.1837
CASE 377	6.0000	1.0000	28.0000	0.2015
CASE 378	6.0000	1.0000	29.0000	0.2011
CASE 379	6.0000	1.0000	28.0000	0.1681
CASE 380	6.0000	1.0000	29.0000	0.1994
CASE 381	6.0000	1.0000	26.0000	0.1775
CASE 382	6.0000	1.0000	26.0000	0.1534
CASE 383	6.0000	1.0000	28.0000	0.1626
CASE 384	6.0000	1.0000	30.0000	0.3088
CASE 385	6.0000	1.0000	28.0000	0.2404
CASE 386	6.0000	1.0000	29.0000	0.2163
CASE 387	6.0000	1.0000	29.0000	0.2421
CASE 388	6.0000	1.0000	25.0000	0.1484
CASE 389	6.0000	1.0000	28.0000	0.1933
CASE 390	6.0000	1.0000	30.0000	0.3099
CASE 391	6.0000	1.0000	28.0000	0.1725
CASE 392	6.0000	1.0000	28.0000	0.1971
CASE 393	6.0000	1.0000	27.0000	0.1537
CASE 394	6.0000	1.0000	25.0000	0.1611
CASE 395	6.0000	1.0000	33.0000	0.3435
CASE 396	6.0000	1.0000	30.0000	0.2074
CASE 397	6.0000	1.0000	28.0000	0.1852
CASE 398	6.0000	1.0000	30.0000	0.2402
CASE 399	6.0000	1.0000	27.0000	0.1783
CASE 400	6.0000	1.0000	26.0000	0.1560
CASE 401	6.0000	1.0000	28.0000	0.2283
CASE 402	6.0000	1.0000	28.0000	0.2265
CASE 403	6.0000	1.0000	27.0000	0.1674
CASE 404	6.0000	1.0000	27.0000	0.1913
CASE 405	6.0000	2.0000	26.0000	0.1546
CASE 406	6.0000	2.0000	28.0000	0.2286
CASE 407	6.0000	2.0000	26.0000	0.1592
CASE 408	6.0000	2.0000	30.0000	0.2552
CASE 409	6.0000	2.0000	31.0000	0.2499
CASE 410	6.0000	2.0000	28.0000	0.2145
CASE 411	6.0000	2.0000	25.0000	0.1754
CASE 412	6.0000	2.0000	27.0000	0.1909

CASE 413	6.0000	2.0000	29.0000	0.2285
CASE 414	6.0000	2.0000	28.0000	0.1631
CASE 415	6.0000	2.0000	29.0000	0.2409
CASE 416	6.0000	2.0000	31.0000	0.2895
CASE 417	6.0000	2.0000	29.0000	0.2038
CASE 418	6.0000	2.0000	29.0000	0.2555
CASE 419	6.0000	2.0000	28.0000	0.2060
CASE 420	6.0000	2.0000	30.0000	0.2397
CASE 421	6.0000	2.0000	31.0000	0.2984
CASE 422	6.0000	2.0000	29.0000	0.1879
CASE 423	6.0000	2.0000	29.0000	0.2303
CASE 424	6.0000	2.0000	27.0000	0.1566
CASE 425	6.0000	2.0000	28.0000	0.2035
CASE 426	6.0000	2.0000	31.0000	0.2875
CASE 427	6.0000	2.0000	27.0000	0.1386
CASE 428	6.0000	2.0000	27.0000	0.1744
CASE 429	6.0000	2.0000	28.0000	0.1988
CASE 430	6.0000	2.0000	25.0000	0.1477
CASE 431	6.0000	2.0000	27.0000	0.1750
CASE 432	6.0000	2.0000	31.0000	0.2647
CASE 433	6.0000	2.0000	29.0000	0.2039
CASE 434	6.0000	2.0000	28.0000	0.2150
CASE 435	6.0000	2.0000	27.0000	0.2081
CASE 436	6.0000	2.0000	26.0000	0.1449
CASE 437	6.0000	2.0000	28.0000	0.2429
CASE 438	6.0000	2.0000	28.0000	0.2136
CASE 439	6.0000	2.0000	28.0000	0.1959
CASE 440	6.0000	2.0000	27.0000	0.1907
CASE 441	6.0000	2.0000	26.0000	0.1540
CASE 442	7.0000	1.0000	28.0000	0.2264
CASE 443	7.0000	1.0000	29.0000	0.2357
CASE 444	7.0000	1.0000	26.0000	0.1620
CASE 445	7.0000	1.0000	27.0000	0.1791
CASE 446	7.0000	1.0000	30.0000	0.2493
CASE 447	7.0000	1.0000	29.0000	0.2032
CASE 448	7.0000	1.0000	30.0000	0.2321
CASE 449	7.0000	1.0000	31.0000	0.2976
CASE 450	7.0000	1.0000	27.0000	0.1649
CASE 451	7.0000	1.0000	27.0000	0.1639
CASE 452	7.0000	1.0000	31.0000	0.2499
CASE 453	7.0000	1.0000	28.0000	0.1471
CASE 454	7.0000	1.0000	26.0000	0.1717
CASE 455	7.0000	1.0000	23.0000	0.0968
CASE 456	7.0000	1.0000	27.0000	0.1535
CASE 457	7.0000	1.0000	29.0000	0.1914
CASE 458	7.0000	1.0000	27.0000	0.1506
CASE 459	7.0000	1.0000	27.0000	0.1847
CASE 460	7.0000	1.0000	26.0000	0.1520
CASE 461	7.0000	1.0000	24.0000	0.1144
CASE 462	7.0000	1.0000	29.0000	0.2056
CASE 463	7.0000	1.0000	30.0000	0.2402
CASE 464	7.0000	1.0000	29.0000	0.2095
CASE 465	7.0000	1.0000	25.0000	0.1289
CASE 466	7.0000	1.0000	30.0000	0.2122
CASE 467	7.0000	1.0000	28.0000	0.2005
CASE 468	7.0000	1.0000	28.0000	0.1921
CASE 469	7.0000	1.0000	31.0000	0.2584
CASE 470	7.0000	1.0000	29.0000	0.2164
CASE 471	7.0000	1.0000	29.0000	0.2178
CASE 472	7.0000	1.0000	29.0000	0.2109
CASE 473	7.0000	1.0000	28.0000	0.2037
CASE 474	7.0000	1.0000	28.0000	0.2228
CASE 475	7.0000	1.0000	28.0000	0.2217
CASE 476	7.0000	2.0000	26.0000	0.1565
CASE 477	7.0000	2.0000	25.0000	0.1648
CASE 478	7.0000	2.0000	27.0000	0.1710
CASE 479	7.0000	2.0000	29.0000	0.2697
CASE 480	7.0000	2.0000	24.0000	0.1166
CASE 481	7.0000	2.0000	24.0000	0.1249

CASE	482	7.0000	2.0000	18.0000	0.0683
CASE	483	7.0000	2.0000	27.0000	0.2071
CASE	484	7.0000	2.0000	26.0000	0.1392
CASE	485	7.0000	2.0000	26.0000	0.1542
CASE	486	7.0000	2.0000	26.0000	0.2013
CASE	487	7.0000	2.0000	25.0000	0.1541
CASE	488	7.0000	2.0000	26.0000	0.1718
CASE	489	7.0000	2.0000	27.0000	0.1739
CASE	490	7.0000	2.0000	27.0000	0.1767
CASE	491	7.0000	2.0000	26.0000	0.1424
CASE	492	7.0000	2.0000	27.0000	0.1807
CASE	493	7.0000	2.0000	27.0000	0.1845
CASE	494	7.0000	2.0000	27.0000	0.1767
CASE	495	7.0000	2.0000	26.0000	0.1590
CASE	496	7.0000	2.0000	29.0000	0.2645
CASE	497	7.0000	2.0000	28.0000	0.1628
CASE	498	7.0000	2.0000	30.0000	0.2539
CASE	499	7.0000	2.0000	27.0000	0.1426
CASE	500	7.0000	2.0000	29.0000	0.2354
CASE	501	7.0000	2.0000	25.0000	0.1420
CASE	502	7.0000	2.0000	24.0000	0.1274
CASE	503	7.0000	2.0000	27.0000	0.1887
CASE	504	7.0000	2.0000	24.0000	0.1331
CASE	505	7.0000	2.0000	28.0000	0.1965
CASE	506	7.0000	2.0000	31.0000	0.2829
CASE	507	7.0000	2.0000	27.0000	0.1832
CASE	508	7.0000	2.0000	25.0000	0.1650
CASE	509	7.0000	2.0000	30.0000	0.2779
CASE	510	7.0000	2.0000	27.0000	0.2059
CASE	511	7.0000	2.0000	28.0000	0.2231

basis." In the reviewer's opinion, the chronic toxicity of DDVP is a reregistration data requirement. It is possible that the effects on growth are the result of DDVP-induced toxicity. Naled hazard assessment should incorporate DDVP chronic toxicity data once it becomes available.

Several of the measured concentrations at test initiation were more than 30% greater than the time-weighted average concentration for the replicate. Measured concentrations throughout the remainder of the test were lower than measured concentrations at test initiation and fairly consistent.

The concentration of acetone in the test solutions was not the same for all test levels. The acetone concentration was 0.018 ml/l in the highest test concentration and decreased by approximately 50% with each lower test concentration. Since the concentration of acetone in the four lowest test concentrations was more like that of the dilution water control (≤ 0.009 ml/l), the statistical difference between the three highest concentrations and the dilution water control for length will be considered biologically significant by the reviewer. This conclusion leads to a conservative NOEC and LOEC of >2.9 <6.3 ppb naled (measured concentrations or > 3.4 and 6.9 μg Naled equivalents/l, respectively).

This study is scientifically sound and meets the guideline requirements for an early life-stage toxic test using fathead minnows. Under the conditions of the test, the MATC was >2.9 <6.3 ppb naled (measured concentrations) or >3.4 and <6.9 μg Naled equivalents/l (mean measured concentrations). The geometric mean MATC was 4.3 μg Naled equivalents/l.

D. Adequacy of the Study:

- (1) Classification: Core.
- (2) Special Note: The toxicity of DDVP, a primary degradate of Naled which was present all test solutions by test termination, is unknown and may have affected the test results. This naled chronic study can only be partially used for hazard assessment purposes because lab and field exposures will include DDVP, in addition to the parent compound, Naled.

15. COMPLETION OF ONE-LINER FOR STUDY: Yes, 02-10-93.

REFERENCES: ASTM. 1992. Standard guide for conducting early life-stage toxicity tests with fishes. E 1241-92.