

US EPA ARCHIVE DOCUMENT

MRID No. 431559-01

**DATA EVALUATION RECORD
FRESHWATER FISH EARLY LIFE-STAGE TEST
GUIDELINE 72-4**

1. **CHEMICAL:** Mepiquate chloride **PC Code No.:** 109101

2. **TEST MATERIAL:** Mepiquat chloride **Purity:** 99%

3. **CITATION:**

Author: R. Munk
Title: Sublethal Toxic Effects on the Rainbow Trout of Mepiquat Chloride in a Flow Through System (28 days)

Study Completion Date: August 27, 1993

Laboratory: BASF Aktiengesellschaft, Ludwigshafen, Germany

Laboratory Report ID: 93/10882

Sponsor: BASF Corporation, Agricultural Products Group, Research Triangle Park, NC

MRID No.: 431559-01

DP Barcode: Not available.

4. **REVIEWED BY:** Rosemary Mora, M.S., Environmental Scientist, KBN Engineering and Applied Sciences, Inc.

Signature: *[Handwritten Signature]* **Date:** 9/20/96

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

Signature: *P. Kosalwat* **Date:** 9/20/96

5. **APPROVED BY:** *Already logged out of PRAT. Do secondary review if data needed in future. KJC 12/21/99*

Signature: **Date:**

6. **CONCLUSIONS:** This study is scientifically sound but does not fulfill the guideline requirements for a fish early life-stage toxicity test. The test organisms were juvenile fish (approximately 7 months old) at test initiation. Therefore, toxic effects on embryos and larvae were not evaluated. Neither growth nor survival were affected by the test material. Based on mean measured concentrations, the NOEC for rainbow trout exposed to mepiquat-chloride was 105.5 ppm, the highest concentration tested.

18.25

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7. ADEQUACY OF THE STUDY:

- A. Classification: Supplemental.
- B. Rationale: The test organisms were juvenile fish (approx. 7 months old) at test initiation.
- C. Repairability: No.

8. MAJOR GUIDELINE DEVIATIONS:

1. The test organisms were juvenile fish (approximately 7 months old) at test initiation, not 2-24 hour old embryos as required.
2. The test design included only one replicate per treatment and control, and only four exposure concentrations; a minimum of 4 replicates per treatment and 5 nominal concentrations are recommended.
3. The dilution factor for the nominal test concentrations ranged from 0.1 to 0.5; a dilution factor of ≥ 0.5 should be used. Nominal concentrations were 1, 10, 50, and 100 ppm.
4. Only samples from three of the test concentrations were analyzed for mepiquat chloride during the test. Concentrations must be monitored at all test levels.
5. The pH of the test solutions (8.1-8.5) was higher than recommended (7.2-7.6).

9. MATERIALS AND METHODS:

A. Biological System:

Guideline Criteria	Reported Information
Species: A freshwater or saltwater fish species.	<i>Oncorhynchus mykiss</i> Walbaum 1792
Source: Commercial fishery, wild, or brood stock.	Forellenhof Fredelsloh, Trout Breeding, Moringen, Germany
Age at beginning of test: Embryos 2 to 24 hours old.	Juveniles approximately 7 months old at test initiation. Weight of the test fish was 3.0 \pm 0.6 g.

Guideline Criteria	Reported Information
<p>Replicates: Minimum of 20 embryos per replicate cup, 4 replicates per concentration.</p> <p>Minimum of 30 fish per treatment for posthatch exposure.</p>	<p>Embryo exposure: No embryo exposure.</p> <p>Larval exposure: 20 fish per replicate, one replicate/treatment.</p>
<p>Posthatch: % of embryos that produce live fry must be $\geq 50\%$ in each control; % hatch in any control embryo cup must be no more than 1.6 times that in another control cup.</p>	<p>No embryo exposure.</p>
<p>Feeding: Fish should be fed at least twice daily. Fish should not be fed for at least 24 hr prior to termination on day 32.</p>	<p>Fish were fed one to two times daily with "Ssniff" trout starter at a rate of approximately 4% of the initial body weight of the fish. Food was withheld about 16 hours prior weight measurement.</p>
<p>Counts: At a minimum, live fish should be counted 11, 18, 25, and 32 days after hatching.</p>	<p>Survival was recorded daily.</p>
<p>Controls: Avg. survival at end of test must be $\geq 80\%$. Survival in any control chamber must not be $< 70\%$.</p>	<p>100%</p>
<p>Controls: Negative control and carrier control (when applicable) are required.</p>	<p>A dilution water control</p>

Comments: In the 1.0-ppm test concentration, only 19 fish were observed at test termination. No explanation for the disappearance was given.

B. Physical System:

Guideline Criteria	Reported Information
<p>Test Water: 1) May be natural (well or spring) or reconstituted water. 2) Water should be sterilized with UV radiation and screened for contaminants. 3) Hardness of 40-48 mg/L as CaCO₃, pH of 7.2-7.6</p>	<p>1) Drinking water from the city of Frankenthal. 2) The water was activated-carbon filtered, aerated, and screened for contaminants. 3) The dilution water had a hardness of 2.3-2.4 mmol/L (175-182 mg/L as CaCO₃). Test solutions had a pH range of 8.1-8.5.</p>
<p>Test Temperature: Depends upon test species; should not deviate by more than 2°C from appropriate temperature. For fathead minnow, 25°C is recommended.</p>	<p>Temperature monitored daily in each test vessel ranged from 13 to 15°C.</p>
<p>Photoperiod: Recommend 16L/8D.</p>	<p>16 hours of light and 8 hours of darkness.</p>
<p>Dosing Apparatus: Intermittent flow proportional diluters or continuous flow serial diluters should be used. A minimum of 5 toxicant concentrations with a dilution factor at least 0.5 and controls should be used.</p>	<p>Continuous-flow diluter. Only 4 nominal concentrations (1.0, 10, 50, 100 ppm) were used. The dilution factor ranged from 0.1-0.5.</p>

Guideline Criteria	Reported Information
<p>Toxicant Mixing: 1) Mixing chamber is recommended but not required; 2) Aeration should not be used for mixing; 3) It must be demonstrated that the test solution is completely mixed before intro. into the test system; 4) Flow splitting accuracy must be within 10%.</p>	<p>1) A mixing chamber was used for each test concentration and control. 2) Test solutions were continuously aerated. 3) Samples of test solution were collected on Days 0, 7, 14, 21, and 28 from the control and 1.0, 10, 100 ppm test levels and analyzed for levels of toxicant. 4) N/A</p>
<p>Test Vessels: All glass or glass with stainless steel frame.</p>	<p>84-L glass aquaria filled with 60 L of test solution.</p>
<p>Embryo Cups: 120 mL glass jars with bottoms replaced with 40 mesh stainless steel or nylon screen.</p>	<p>No embryo exposure.</p>
<p>Flow Rate: Flow rates to larval cups should provide 90% replacement in 8-12 hours. Flow rate must maintain DO at above 75% of saturation and maintain the toxicant level.</p>	<p>10 L/hour/test aquaria DO levels were $\geq 83\%$ of saturation throughout the test. Chemical concentrations were verified.</p>
<p>Aeration: Dilution water should be aerated to insure DO concentration at or near 100% saturation. Test tanks and embryo cups should not be aerated.</p>	<p>Test tanks were aerated.</p>

Comments: None.

C. Chemical System:

Guideline Criteria	Reported Information
<p>Concentrations: Minimum of 5 concentrations and a control, all replicated, plus solvent control if appropriate.</p> <ul style="list-style-type: none"> - Toxicant conc. must be measured in one tank at each toxicant level every week. - One concentration must adversely affect a life stage and one concentration must not affect any life stage. 	<ul style="list-style-type: none"> - Control and four test concentrations. - Chemical analysis of samples collected at test initiation and weekly thereafter. - Growth and survival of fish were not affected at the concentrations tested.
<p>Other Variables: DO must be measured at each conc. at least once a week.</p>	D.O. and pH were generally measured twice weekly in each treatment and the control.
<p>Solvents: Should not exceed 0.1 mL/L in a flow-through system. Following solvents are acceptable: dimethylformamide, triethylene glycol, methanol, acetone, ethanol.</p>	None.

Comments: None.

10. REPORTED RESULTS:

Guideline Criteria	Reported Information
<p>Data Endpoints must include:</p> <ul style="list-style-type: none"> - Number of embryos hatched; - Time to hatch; - Mortality of embryos, larvae, and juveniles; - Time to swim-up (if appropriate); - Measurement of growth; - Incidence of pathological or histological effects; - Observations of other effects or clinical signs. 	<ul style="list-style-type: none"> - Survival; - Initial and 28-day length; - Initial and 28-day weight; - Toxic symptoms.
<p>Raw data included? (Y/N)</p>	Yes.

Effects Data:

Toxicant Concentration (ppm)		Hatch (%)	Day-28 Survival (%)	Day-28 Length (cm)	Day-28 Weight (g)
Nominal	Measured				
Control	ND	N/A	100	9.25	9.96
1.0	1.1	N/A	100	9.37	10.30
10	10.8	N/A	100	9.30	9.96
50	-*	N/A	100	9.39	10.09
100	105.5	N/A	100	9.28	10.25

* Not measured.

Toxicity Observations: No abnormalities were noted.Statistical Results:

Statistical Method: Dunnetts' test

NOEC: 100 ppm LOEC: >100 ppm MATC: Not determined.

Most sensitive endpoint: None.

Comments: None.**11. REVIEWER'S STATISTICAL RESULTS:**

Statistical Method: ANOVA with Bonferroni's and Dunnett's test.

NOEC: 100 ppm LOEC: >100 ppm MATC: Not determined.

Most sensitive endpoint: None.

Comments: None.

- 12. REVIEWER'S COMMENTS:** This study is scientifically sound but does not fulfill the guideline requirements for a fish early life-stage test. The study was initiated with fish that were approximately 7 months old. Therefore, toxic effects on embryos and larvae were not evaluated. The NOEC for juvenile rainbow trout exposed to mepiquat-chloride was 100 ppm, the highest concentration tested. This study is classified as Supplemental.

OBS	LEVEL	REP	LEN	WT
1	CONTROL	1	8.8	7.6
2	CONTROL	2	9.1	8.4
3	CONTROL	3	9.2	11.1
4	CONTROL	4	9.3	9.1
5	CONTROL	5	9.0	8.5
6	CONTROL	6	10.1	12.4
7	CONTROL	7	7.5	6.1
8	CONTROL	8	8.7	9.3
9	CONTROL	9	9.9	11.0
10	CONTROL	10	10.0	11.5
11	CONTROL	11	9.8	13.3
12	CONTROL	12	10.2	14.3
13	CONTROL	13	7.0	4.4
14	CONTROL	14	9.5	10.4
15	CONTROL	15	9.6	10.1
16	CONTROL	16	9.6	11.7
17	CONTROL	17	9.3	10.1
18	CONTROL	18	9.2	9.0
19	CONTROL	19	8.8	8.3
20	CONTROL	20	10.4	12.5
21	TRT 1	1	9.2	9.1
22	TRT 1	2	9.8	12.8
23	TRT 1	3	9.2	9.5
24	TRT 1	4	10.1	12.7
25	TRT 1	5	9.2	11.6
26	TRT 1	6	9.2	9.9
27	TRT 1	7	9.5	10.9
28	TRT 1	8	9.4	11.9
29	TRT 1	9	9.2	8.4
30	TRT 1	10	9.1	10.0
31	TRT 1	11	9.7	10.0
32	TRT 1	12	9.1	9.5
33	TRT 1	13	9.2	10.1
34	TRT 1	14	9.5	10.6
35	TRT 1	15	9.5	10.6
36	TRT 1	16	8.7	9.0
37	TRT 1	17	8.9	8.9
38	TRT 1	18	9.6	9.6
39	TRT 1	19	9.2	9.7
40	TRT 1	20	9.7	11.4
41	TRT 2	1	9.7	11.6
42	TRT 2	2	9.3	10.0
43	TRT 2	3	9.3	10.5
44	TRT 2	4	9.6	11.0
45	TRT 2	5	9.2	9.3
46	TRT 2	6	9.2	9.6
47	TRT 2	7	9.8	9.0
48	TRT 2	8	10.1	12.1
49	TRT 2	9	10.0	11.9
50	TRT 2	10	8.8	8.5
51	TRT 2	11	8.2	7.9
52	TRT 2	12	9.1	9.4
53	TRT 2	13	8.9	8.9
54	TRT 2	14	9.6	10.6
55	TRT 2	15	9.4	7.5
56	TRT 2	16	8.8	7.8
57	TRT 2	17	9.0	8.8
58	TRT 2	18	10.7	14.9
59	TRT 2	19	8.0	8.6
60	TRT 2	20	9.6	10.7
61	TRT 3	1	8.5	8.2
62	TRT 3	2	8.5	7.7
63	TRT 3	3	9.1	0.8
64	TRT 3	4	9.8	10.7

OBS	LEVEL	REP	LEN	WT
65	TRT 3	5	8.6	8.0
66	TRT 3	6	10.0	12.2
67	TRT 3	7	9.4	9.5
68	TRT 3	8	9.4	10.2
69	TRT 3	9	9.2	9.7
70	TRT 3	10	10.3	11.4
71	TRT 3	11	10.5	12.8
72	TRT 3	12	10.0	9.9
73	TRT 3	13	8.9	9.4
74	TRT 3	14	9.0	8.3
75	TRT 3	15	9.5	11.5
76	TRT 3	16	9.8	12.7
77	TRT 3	17	10.0	13.1
78	TRT 3	18	9.4	9.5
79	TRT 3	19	9.1	8.9
80	TRT 3	20	8.8	9.2
81	TRT 4	1	6.8	5.8
82	TRT 4	2	8.6	9.5
83	TRT 4	3	9.4	10.8
84	TRT 4	4	9.5	10.4
85	TRT 4	5	8.7	8.6
86	TRT 4	6	9.7	10.7
87	TRT 4	7	9.6	10.7
88	TRT 4	8	8.3	7.0
89	TRT 4	9	8.4	7.6
90	TRT 4	10	9.4	10.8
91	TRT 4	11	10.8	14.6
92	TRT 4	12	10.0	12.2
93	TRT 4	13	9.4	11.5
94	TRT 4	14	9.8	11.2
95	TRT 4	15	8.7	9.2
96	TRT 4	16	8.9	8.4
97	TRT 4	17	9.6	9.4
98	TRT 4	18	9.9	10.9
99	TRT 4	19	9.7	10.8
100	TRT 4	20	10.3	14.9

Mepiquat-chloride: Effects to the Growth of Fathead Minnows
 01:39 Tuesday, September 3, 1996

LEVEL		TRT 1		TRT 2		TRT 3	
CONTROL	MEAN	CONTROL	MEAN	CONTROL	MEAN	CONTROL	MEAN
LEN	9.25	9.37	9.30	9.30	9.39	9.39	9.39
WT	9.96	10.30	9.96	9.96	10.09	10.09	10.09

(CONTINUED)
 Mepiquat-chloride: Effects to the Growth of Fathead Minnows
 01:39 Tuesday, September 3, 1996

LEVEL		TRT 4	
CONTROL	MEAN	CONTROL	MEAN
LEN	9.28	9.28	9.28

Mepiquat-chloride: Effects to the Growth of Fathead Minnows
01:39 Tuesday, September 3, 1996

LEVEL=CONTROL

Variable	N	Mean	Std Dev	CV
REP	20	10.500	5.916	56.344
LEN	20	9.250	0.842	9.103
WT	20	9.955	2.419	24.503

LEVEL=TRT 1

Variable	N	Mean	Std Dev	CV
REP	20	10.500	5.916	56.344
LEN	19	9.368	0.343	3.664
WT	19	10.300	1.270	12.328

LEVEL=TRT 2

Variable	N	Mean	Std Dev	CV
REP	20	10.500	5.916	56.344
LEN	20	9.300	0.634	6.818
WT	20	9.960	1.780	17.870

LEVEL=TRT 3

Variable	N	Mean	Std Dev	CV
REP	20	10.500	5.916	56.344
LEN	20	9.390	0.593	6.314
WT	20	10.085	1.683	16.693

LEVEL=TRT 4

Variable	N	Mean	Std Dev	CV
REP	20	10.500	5.916	56.344
LEN	20	9.273	0.869	9.366
WT	20	10.250	2.230	21.757

Mepiquat-chloride: Effects to the Growth of Fathead Minnows
1. ANALYSIS OF LENGTH

01:39 Tuesday, September 3, 1996

General Linear Models Procedure
Class Level Information

Class	Levels	Values
LEVEL	5	CONTROL TRT 1 TRT 2 TRT 3 TRT 4

Number of observations in data set = 100

NOTE: Due to missing values, only 99 observations can be used in this analysis.

Mepiquat-chloride: Effects to the Growth of Fathead Minnows

1. ANALYSIS OF LENGTH

01:39 Tuesday, September 3, 1996

General Linear Models Procedure
Type I Estimable Functions for: LEVEL

Effect Coefficients

INTERCEPT	0
LEVEL	
CONTROL	L2
TRT 1	L3
TRT 2	L4
TRT 3	L5
TRT 4	-L2-L3-L4-L5

Mepiquat-chloride: Effects to the Growth of Fathead Minnows

1. ANALYSIS OF LENGTH

01:39 Tuesday, September 3, 1996

General Linear Models Procedure

Dependent Variable: LEN	Sum of Squares	Mean Square	F Value	Pr > F
Source	OF			
Model	4	0.2875888	0.0718972	0.15 0.9613
Error	94	44.2465526	0.4707080	
Corrected Total	98	44.5341414		

Source	DF	Type I SS	Mean Square	F Value	Pr > F
LEVEL	4	0.2875888	0.0718972	0.15	0.9613

Mepiquat-chloride: Effects to the Growth of Fathead Minnows

1. ANALYSIS OF LENGTH

01:39 Tuesday, September 3, 1996

General Linear Models Procedure
Least Squares Means

LEVEL	LEN	Pr > T	LSMEAN(I)=LSMEAN(J)
CONTROL	9.25000000	1	0.5913
TRT 1	9.3682105	2	0.8182
TRT 2	9.30000000	3	0.7563
TRT 3	9.39000000	4	0.5203
TRT 4	9.27500000	5	0.9085

NOTE: To ensure overall protection level, only probabilities associated with pre-planned comparisons should be used.

Mepiquat-chloride: Effects to the Growth of Fathead Minnows
1. ANALYSIS OF LENGTH

01:39 Tuesday, September 3, 1996

General Linear Models Procedure

Tukey's Studentized Range (HS0) Test for variable: LEN

NOTE: This test controls the type I experimentwise error rate.

Alpha= 0.05 Confidence= 0.95 df= 94 MSE= 0.470708
Critical Value of Studentized Range= 3.934

Comparisons significant at the 0.05 level are indicated by ****.

LEVEL Comparison	Simultaneous Lower Confidence Limit	Difference Between Means	Simultaneous Upper Confidence Limit
TRT 3 - TRT 1	-0.5928	0.0216	0.6329
TRT 3 - TRT 2	-0.5135	0.0900	0.6935
TRT 3 - TRT 4	-0.4885	0.1150	0.7185
TRT 3 - CONTROL	-0.4635	0.1400	0.7435
TRT 1 - TRT 3	-0.6329	-0.0216	0.5898
TRT 1 - TRT 2	-0.5429	0.0684	0.6798
TRT 1 - TRT 4	-0.5179	0.0934	0.7048
TRT 1 - CONTROL	-0.4929	0.1184	0.7298
TRT 2 - TRT 3	-0.6935	-0.0900	0.5135
TRT 2 - TRT 1	-0.6798	-0.0684	0.5429
TRT 2 - TRT 4	-0.5785	0.0250	0.6285
TRT 2 - CONTROL	-0.5535	0.0500	0.6535
TRT 4 - TRT 3	-0.7185	-0.1150	0.4885
TRT 4 - TRT 1	-0.7048	-0.0934	0.5179
TRT 4 - TRT 2	-0.6285	-0.0250	0.5785
TRT 4 - CONTROL	-0.5785	0.0250	0.6285
CONTROL - TRT 3	-0.7435	-0.1400	0.4635
CONTROL - TRT 1	-0.7298	-0.1184	0.4929
CONTROL - TRT 2	-0.6535	-0.0500	0.5535
CONTROL - TRT 4	-0.6285	-0.0250	0.5785

Mepiquat-chloride: Effects to the Growth of Fathead Minnows
1. ANALYSIS OF LENGTH

01:39 Tuesday, September 3, 1996

General Linear Models Procedure

Dunnnett's One-tailed T tests for variable: LEN

NOTE: This tests controls the type I experimentwise error for comparisons of all treatments against a control.

Alpha= 0.05 Confidence= 0.95 df= 94 MSE= 0.470708
Critical Value of Dunnnett's T= 2.191

Comparisons significant at the 0.05 level are indicated by ****.

LEVEL	Simultaneous Lower Confidence	Difference Between	Simultaneous Upper Confidence
TRT 1	-0.6329	0.0216	0.6329
TRT 2	-0.5429	0.0684	0.6798
TRT 3	-0.4929	0.1184	0.7298
CONTROL	-0.4635	0.1400	0.7435

Comparison Limit Means

TRT 3 - CONTROL	-0.3353	0.1400	0.6153
TRT 1 - CONTROL	-0.3631	0.1184	0.5999
TRT 2 - CONTROL	-0.4253	0.0500	0.5253
TRT 4 - CONTROL	-0.4503	0.0250	0.5003

Mepiquat-chloride: Effects to the Growth of Fathead Minnows

1. ANALYSIS OF LENGTH

01:39 Tuesday, September 3, 1996

General Linear Models Procedure

Bonferroni (Dunn) T tests for variable: LEN

NOTE: This test controls the type I experimentwise error rate but generally has a higher type II error rate than Tukey's for all pairwise comparisons.

Alpha= 0.05 Confidence= 0.95 df= 94 MSE= 0.470708
Critical Value of T= 2.87480

Comparisons significant at the 0.05 level are indicated by ****.

LEVEL Comparison	Simultaneous Lower Confidence Limit	Difference Between Means	Simultaneous Upper Confidence Limit
TRT 3 - TRT 1	-0.6103	0.0216	0.6534
TRT 3 - TRT 2	-0.5337	0.0900	0.7137
TRT 3 - TRT 4	-0.5087	0.1150	0.7387
TRT 3 - CONTROL	-0.4837	0.1400	0.7637
TRT 1 - TRT 3	-0.6534	-0.0216	0.6103
TRT 1 - TRT 2	-0.5634	0.0684	0.7003
TRT 1 - TRT 4	-0.5384	0.0934	0.7253
TRT 1 - CONTROL	-0.5134	0.1184	0.7503
TRT 2 - TRT 3	-0.7137	-0.0900	0.5337
TRT 2 - TRT 1	-0.7003	-0.0684	0.5634
TRT 2 - TRT 4	-0.5987	0.0250	0.6487
TRT 2 - CONTROL	-0.5737	0.0500	0.6737
TRT 4 - TRT 3	-0.7387	-0.1150	0.5087
TRT 4 - TRT 1	-0.7253	-0.0934	0.5384
TRT 4 - TRT 2	-0.6487	-0.0250	0.5987
TRT 4 - CONTROL	-0.5987	0.0250	0.6487
CONTROL - TRT 3	-0.7637	-0.1400	0.4837
CONTROL - TRT 1	-0.7503	-0.1184	0.5134
CONTROL - TRT 2	-0.6737	-0.0500	0.5737
CONTROL - TRT 4	-0.6487	-0.0250	0.5987

Mepiquat-chloride: Effects to the Growth of Fathead Minnows

2. ANALYSIS OF WEIGHT

01:39 Tuesday, September 3, 1996

General Linear Models Procedure

Class Level Information

Class	Levels	Values
LEVEL	5	CONTROL TRT 1 TRT 2 TRT 3 TRT 4

Number of observations in data set = 100

NOTE: Due to missing values, only 99 observations can be used in this analysis.

Mepiquat-chloride: Effects to the Growth of Fathead Minnows
2. ANALYSIS OF WEIGHT

01:39 Tuesday, September 3, 1996

General Linear Models Procedure

Type I Estimable Functions for: LEVEL

Effect Coefficients

INTERCEPT	0
LEVEL	
CONTROL	L2
TRT 1	L3
TRT 2	L4
TRT 3	L5
TRT 4	-L2-L3-L4-L5

Mepiquat-chloride: Effects to the Growth of Fathead Minnows
2. ANALYSIS OF WEIGHT

01:39 Tuesday, September 3, 1996

General Linear Models Procedure

Dependent Variable: WT

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	4	2.0205354	0.5051338	0.14	0.9686
Error	94	348.7530000	3.7101383		
Corrected Total	98	350.7735354			
R-Square					WT Mean
0.005760			1.9262		10.108

Source	DF	Type I SS	Mean Square	F Value	Pr > F
LEVEL	4	2.0205354	0.5051338	0.14	0.9686

Mepiquat-chloride: Effects to the Growth of Fathead Minnows
2. ANALYSIS OF WEIGHT

01:39 Tuesday, September 3, 1996

General Linear Models Procedure

Least Squares Means

LEVEL	WT LSMEAN	Pr > T	T	MSMEAN(I)=LSMEAN(J)	4	5
CONTROL	9.9550000	1	0.5774	0.9935	0.8315	0.6293
TRT 1	10.3000000	2	0.5774	0.7283	0.9356	
TRT 2	9.9600000	3	0.9935	0.5829	0.6351	
TRT 3	10.0850000	4	0.8315	0.7283	0.8378	
TRT 4	10.2500000	5	0.6293	0.9356	0.6351	0.7871

NOTE: To ensure overall protection level, only probabilities associated with pre-planned comparisons should be used.

Mepiquat-chloride: Effects to the Growth of Fathead Minnows
2. ANALYSIS OF WEIGHT

01:39 Tuesday, September 3, 1996

General Linear Models Procedure

Tukey's Studentized Range (HSD) Test for variable: WT

NOTE: This test controls the type I experimentwise error rate.

Alpha= 0.05 Confidence= 0.95 df= 94 MSE= 3.710138
Critical Value of Studentized Range= 3.934

Comparisons significant at the 0.05 level are indicated by ****.

LEVEL Comparison	Simultaneous Confidence Limit		Difference Between Means	Simultaneous Upper Confidence Limit	
	Lower Limit	Upper Limit		Lower Limit	Upper Limit
TRT 1 - TRT 4	-1.6664	0.0500	0.0500	1.7664	1.7664
TRT 1 - TRT 3	-1.5014	0.2150	0.2150	1.9314	1.9314
TRT 1 - TRT 2	-1.3764	0.3400	0.3400	2.0564	2.0564
TRT 1 - CONTROL	-1.5714	0.3450	0.3450	2.0614	2.0614
TRT 4 - TRT 1	-1.7664	-0.0500	-0.0500	1.6664	1.6664
TRT 4 - TRT 3	-1.5292	0.1650	0.1650	1.8592	1.8592
TRT 4 - TRT 2	-1.4042	0.2900	0.2900	1.9842	1.9842
TRT 4 - CONTROL	-1.5992	0.2950	0.2950	1.9892	1.9892
TRT 3 - TRT 1	-1.9314	-0.2150	-0.2150	1.5014	1.5014
TRT 3 - TRT 4	-1.8592	-0.1650	-0.1650	1.5292	1.5292
TRT 3 - TRT 2	-1.6992	0.1250	0.1250	1.8192	1.8192
TRT 3 - CONTROL	-1.5642	0.1300	0.1300	1.8242	1.8242
TRT 2 - TRT 1	-2.0564	-0.3400	-0.3400	1.3764	1.3764
TRT 2 - TRT 4	-1.9842	-0.2900	-0.2900	1.4042	1.4042
TRT 2 - TRT 3	-1.8192	-0.1250	-0.1250	1.5692	1.5692
TRT 2 - CONTROL	-1.6892	0.0050	0.0050	1.6992	1.6992
CONTROL - TRT 1	-2.0614	-0.3450	-0.3450	1.3714	1.3714
CONTROL - TRT 4	-1.9892	-0.2950	-0.2950	1.3992	1.3992
CONTROL - TRT 3	-1.8242	-0.1300	-0.1300	1.5642	1.5642
CONTROL - TRT 2	-1.6992	-0.0050	-0.0050	1.6892	1.6892

Mepiquat-chloride: Effects to the Growth of Fathead Minnows
2. ANALYSIS OF WEIGHT

01:39 Tuesday, September 3, 1996

General Linear Models Procedure

Dunnnett's One-tailed T tests for variable: WT

NOTE: This tests controls the type I experimentwise error for comparisons of all treatments against a control.

Alpha= 0.05 Confidence= 0.95 df= 94 MSE= 3.710138
Critical Value of Dunnnett's t= 2.191

Comparisons significant at the 0.05 level are indicated by ****.

LEVEL Comparison	Simultaneous Lower Confidence Limit		Difference Between Means	Simultaneous Upper Confidence Limit	
	Lower Limit	Upper Limit		Lower Limit	Upper Limit
TRT 1 - CONTROL	-1.0068	0.3450	0.3450	1.6968	
TRT 4 - CONTROL	-1.0593	0.2950	0.2950	1.6293	
TRT 3 - CONTROL	-1.2043	0.1500	0.1500	1.4643	
TRT 2 - CONTROL	-1.3293	0.0050	0.0050	1.5393	

Mepiquat-chloride: Effects to the Growth of Fathead Minnows
 2. ANALYSIS OF WEIGHT

01:39 Tuesday, September 3, 1996

General Linear Models Procedure

Bonferroni (Dunn) T tests for variable: WT

NOTE: This test controls the type I experimentwise error rate but generally has a higher type II error rate than Tukey's for all pairwise comparisons.

Alpha= 0.05 Confidence= 0.95 df= 94 MSE= 3.710138
 Critical Value of T= 2.87480

Comparisons significant at the 0.05 level are indicated by ****.

LEVEL Comparison	Simultaneous Lower Confidence Limit		Difference Between Means	Simultaneous Upper Confidence Limit	
	Lower Limit	Upper Limit		Lower Limit	Upper Limit
TRT 1 - TRT 4	-1.7240	0.0500	0.0500	1.8240	
TRT 1 - TRT 3	-1.5590	0.2150	0.2150	1.8890	
TRT 1 - TRT 2	-1.4340	0.3400	0.3400	2.1140	
TRT 1 - CONTROL	-1.4290	0.3450	0.3450	2.1190	
TRT 4 - TRT 1	-1.8240	-0.0500	-0.0500	1.7240	
TRT 4 - TRT 3	-1.5861	0.1650	0.1650	1.9161	
TRT 4 - TRT 2	-1.4611	0.2900	0.2900	2.0411	
TRT 4 - CONTROL	-1.4561	0.2950	0.2950	2.0461	
TRT 3 - TRT 1	-1.9890	-0.2150	-0.2150	1.5590	
TRT 3 - TRT 4	-1.9161	-0.1650	-0.1650	1.5861	
TRT 3 - TRT 2	-1.6261	0.1250	0.1250	1.8761	
TRT 3 - CONTROL	-1.6211	0.1300	0.1300	1.8811	
TRT 2 - TRT 1	-2.1140	-0.3400	-0.3400	1.4240	
TRT 2 - TRT 4	-2.0411	-0.2900	-0.2900	1.4611	
TRT 2 - TRT 3	-1.8761	-0.1250	-0.1250	1.6261	
TRT 2 - CONTROL	-1.7461	0.0050	0.0050	1.7561	
CONTROL - TRT 1	-2.1190	-0.3450	-0.3450	1.4290	
CONTROL - TRT 4	-2.0461	-0.2950	-0.2950	1.4561	
CONTROL - TRT 3	-1.8811	-0.1300	-0.1300	1.6211	
CONTROL - TRT 2	-1.7561	-0.0050	-0.0050	1.7461	