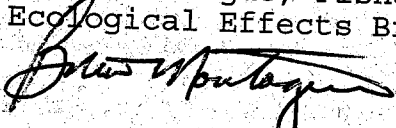


DATA EVALUATION RECORD
AQUATIC INVERTEBRATE LIFE CYCLE TEST
GUIDELINE 72-4(B)

1. **CHEMICAL:** Hydrogen cyanamid PC Code No.: 014002
2. **TEST MATERIAL:** Hydrogen cyanamid solution Purity: 50 %
3. **CITATION**
Authors: Murrell, H and Tom Leak
Title: Chronic Toxicity of Hydrogen Cyanamide to Daphnia magna under Flow Through Conditions
Study Completion Date: November 1995
Laboratory: ABC Laboratories,, Columbia, MO.
Sponsor: SKW Trostberg AG, Trostberg, Germany
Laboratory Report ID: Study #41942
MRID No.: 44076702
DP Barcode: D228813
4. **REVIEWED BY:** Brian Montague, Fisheries Biologist
Ecological Effects Branch

Signature:  Date: 9/26/96
5. **APPROVED BY:** Les Touart, Section Supervisor
Ecological Effects Branch
Environmental Fate and Effects Division

Signature:  Date: 10-4-96
6. **STUDY PARAMETERS**

Scientific Name of Test Organism: Daphnia magna
Age of Test Organism: Full lifecycle test
Definitive Test Duration: 21 days
Study Method: Flow-through
Type of Concentrations: Mean measured
7. **CONCLUSIONS:** Hydrogen Cyanamid 50% ai is shown to be highly toxic to daphnid growth and reproduction of young. The most sensitive endpoint was adult length after 21 days of exposure (LOEC=210 PPB). Numbers of young produced per female per reproduction day was affected at a concentration of 410 PPB.

Results Synopsis
NOEC: 100 ug ai/L LOEC: 210 ug ai/L
LOEC's for specific effects
Young Produced: 410 ug ai/L
Adult Survival: No Effects
Growth (length or weight): 210 ug ai/L (Adult length)
8. **ADEQUACY OF THE STUDY**
A. **Classification:** Core



2026768

DP Barcode: D228813

MRID No.: 44076702

B. Rationale: Study was adequately conducted and results were useable for risk assessment purpose. Agency statistical analysis varied from that of the study laboratory.

C. Repairability: N/A

9. GUIDELINE DEVIATIONS

1. Because 10 females were housed per individual test chamber it was not possible to determine differences in individual numbers of young produced per daphnid-only young produced per replicate chamber was determined.
2. Individual weight for daphnids were not determined, only weight by replicate population was provided.

10 SUBMISSION PURPOSE:

11. MATERIALS AND METHODS

A. Test Organisms/Acclimation

Guideline Criteria	Reported Information
Species	<i>Daphnia magna</i>
Source	ABC Laboratory Cultures
Parental Acclimation Conditions	Temperature: 20°C Photo Intensity: 54-68 footcandles Photoperiod: 16D/8N Feeding: Algae 2.0 ml/day+ trout chow and dry yeast
Parental Acclimation Period	>21 days in culture
Age of Parental Stock	<10-12 days for parental stock. Test organisms were newly hatched and <24 hours old
Feed Regime During Acclimation	- <i>Selenastrum capricornutum</i> or <i>Ankistrodesmus falcatus</i> algae 1.0 x 10 ⁸ mg/ml concentration - Dry yeast and trout chow supplemented this diet
Were Daphnids in good health at acclimation period?	Yes

B. Test System

Guideline Criteria	Reported Information
Test Water Source and Treatment	Aerated hard blended water prepared to 130-160 mg/L as CaCO_3 . Well water was combined with well water demineralized by reverse osmosis
Water Temperature Range	Target: $20 \pm 2^\circ\text{C}$ Range: 20.6 to 21.3°C
pH Range	7.5 to 8.4
Total Hardness	130 - 160 mg/L as CaCO_3
Dissolved Oxygen Range	6.7 to 8.4mg/l equivalent to 79 to 99% saturation
Test Vessels <u>Material, Size, Fill volume:</u>	1 liter glass beakers used as test chambers. Chambers had notched drains
Test Vessel Covers	50 mesh stainless steel screen covered all test chambers
Type of Dilution System (if applicable)	Half liter proportional diluter (Mount and Brungs) with syringe type dispenser. A 7 day pretest flow check was performed.
Flow Rate	5.1 vol/replacements/24 hours Rate: 3.6 ml/minute
Aeration	Dilution water not aerated during definitive study period
Photoperiod	16D/8N at 52-54 footcandle intensity
Solvents and Maximum Concentration	Solvent: None used Test material highly soluble

C. Test Design

Guideline Criteria	Reported Information
Duration	21 day exposure
Nominal Concentrations	0.025, 0.050, 0.100, 0.200, and 0.400 mg ai/L nominal test concentrations used

Guideline Criteria	Reported Information
Number of Test Organisms	10 daphnids per test chamber 4 daphnids per test level
Test Organisms Assignment Methods	Random assignment from 10 daphnid subgroups - computer generated random assignment
Renewal Regime (if applicable)	N/A
Water Parameter Measurements	D.O.: Measured on Days 0, 4, 7, 14 and 21 in 2 chambers/concentration pH: same as above Temperature: same as above and continuously measured in water bath Hardness, Conductivity and Alkalinity: Measured daily in dilution water
Chemical Analysis Regime and Methodology	Test solutions were measured using radio-labeled samples and liquid scintillation methodology. Samples were conducted on days - 5, 0, 4, 7, 11, 12, 13, 14 and 21 of study alternately from 2 chambers/concentration

12. REPORTED RESULTS

A. General Results

Guideline Criteria	Reported Information
Quality assurance and GLP compliance statements	Both statements are included with the submission
Control Mortality	0%
control Daphnid production least 40 young after 21 days?	120 to 191 young per female average
Ephippia noted	None observed

Guideline Criteria	Reported Information
Data Endpoints(should include) Survival parental daphnids Fecundity Number of young produced per female Growth Effects Dry weight (required) Length (optional) (Each surviving first generation daphnid) Observations of other effects or clinical signs.	Parental survival Days to Hatch Young/chamber/day Adult weight (21 day) Adult length (21 day)
Raw data	No only extrapolations from actual raw data

Effects Data

Toxicant Concentration (ug/L)		Adult No. (%) Dead or Immobile (21 Days)	Young per Female per Repro. Day	Total Length (mm)	Dry Weight (mg)
Nominal	Measured				
Control	--	0 (0%)	10.83	4.74	0.97
25	23	0 (0%)	10.91	4.53	0.88
50	49	1 (2.5%)	11.50	4.63	0.91
100	100	2 (5%)	10.49	4.68	0.97
200	210	0 (0%)	9.64	4.61	0.98
400	410	1 (2.5%)	8.54	4.53	0.92

Toxicity Observations:**B. Study Laboratory's Statistical Results**Most sensitive endpoint:

Endpoint	Method	NOEC	LOEC
Survival	Frequency analysis coupled with Fisher's Exact Test	410 PPB	>410 PPB
Reproduction	Dunnetts	210 PPB	410 PPB

Endpoint	Method	NOEC	LOEC
Weight	ANOVA/Shapiro-Wilks/Dunnetts	No Significance	
Length	ANOVA/Shapiro-Wilks/Dunnetts	210 PPB	410 PPB

13. VERIFICATION OF STATISTICAL RESULTS

Agency analysis of study results produced lower NOEC and LOEC levels for effects to growth. Varying results were seen on weight of daphnids. Williams test detected significance at every test level. However, numbers of daphnids/concentration varied slightly and therefore results using Bonferroni T may be more accurate. All values for treatment concentration mean weights were, however, lower than controls. A clear dose response pattern was not as apparent. Length variation was found to be significant with all three analysis methods using individual daphnid length measurements. It should be mentioned that numbers of young produced per female were also lower than controls in the 210 PPB concentration, however the difference was not statistically significant at $p=0.05$. The reviewer is inclined to view this as a possible biological start point for these reproductive effects.

Most sensitive endpoint:

Endpoint	Method	NOEC	LOEC
Survival	No effects noted		
Reproduction Young/female/ repro day	Dunnetts, Bonferroni T, and Williams Test	210 PPB	410 PPB
Weight	Dunnetts, Bonferroni T Williams Test	210 PPB 210 PPB 23 PPB	410 PPB 410 PPB 23 PPB
Length	Dunnetts, Bonferroni T and Williams Test	100 PPB 100 PPB 100 PPB	210 PPB 210 PPB 210 PPB

14. REVIEWER'S COMMENTS:

The study has been conducted in a scientifically sound manner. Though actual raw data was not included with the report, enough data was included to allow for Agency statistical analysis on reported results. The survival of

DP Barcode: D228813

MRID No.: 44076702

adult daphnids was unaffected at the test dosages used. Days to hatch of brood was unaffected at all test concentrations and was 7 days for all test groups. Numbers of young were affected at 410 ug ai/L mean measured concentrations. A slight but not statistically verifiable decrease in numbers of young produced was seen at 210 ug ai/L. Length of adults was significantly reduced after 21 days exposure to concentrations of 210 ug ai/L or above when compared to control growth. Recovery of the chemical and water quality parameters remained excellent throughout the study. Based on these results the Agency has determined the LOEC for chronic effects to be 210 ug ai/L and the NOEC is 100 ug ai/L. Hydrogen cyanamid is highly toxic to growth and reproductive success of freshwater invertebrates.

This study satisfies freshwater invertebrate chronic testing requirements for Hydrogen Cyanamid products.

DP Barcode: D228813

MRID No.: 44076702

TITLE: Hydrogen Cyanamid-Daphnia-Young/Adult/R-Day
 FILE: HYDCYADM.YAD
 TRANSFORM: NO TRANSFORM NUMBER OF GROUPS: 6

GRP	IDENTIFICATION	REP	VALUE	TRANS VALUE
1	Control	1	12.7700	12.7700
1	Control	2	11.5600	11.5600
1	Control	3	8.0300	8.0300
1	Control	4	10.9700	10.9700
2	23 PPB	1	10.7900	10.7900
2	23 PPB	2	11.6800	11.6800
2	23 PPB	3	10.5800	10.5800
2	23 PPB	4	10.6000	10.6000
3	49 PPB	1	11.0100	11.0100
3	49 PPB	2	10.5100	10.5100
3	49 PPB	3	12.1700	12.1700
3	49 PPB	4	12.2900	12.2900
4	100 PPB	1	10.8100	10.8100
4	100 PPB	2	11.0900	11.0900
4	100 PPB	3	10.6100	10.6100
4	100 PPB	4	9.4300	9.4300
5	210 PPB	1	9.4200	9.4200
5	210 PPB	2	9.9300	9.9300
5	210 PPB	3	9.4100	9.4100
5	210 PPB	4	9.8100	9.8100
6	410 PPB	1	8.6000	8.6000
6	410 PPB	2	8.4800	8.4800
6	410 PPB	3	7.6700	7.6700
6	410 PPB	4	9.4200	9.4200

Hydrogen Cyanamid-Daphnia-Young/Adult/R-Day
 File: HYDCYADM.YAD Transform: NO TRANSFORM
 SUMMARY STATISTICS ON TRANSFORMED DATA TABLE 1 of 2

GRP	IDENTIFICATION	N	MIN	MAX	MEAN
1	Control	4	8.030	12.770	10.833
2	23 PPB	4	10.580	11.680	10.913
3	49 PPB	4	10.510	12.290	11.495
4	100 PPB	4	9.430	11.090	10.485
5	210 PPB	4	9.410	9.930	9.643
6	410 PPB	4	7.670	9.420	8.543

Hydrogen Cyanamid-Daphnia-Young/Adult/R-Day
 File: HYDCYADM.YAD Transform: NO TRANSFORM
 SUMMARY STATISTICS ON TRANSFORMED DATA TABLE 2 of 2

GRP	IDENTIFICATION	VARIANCE	SD	SEM
1	Control	4.052	2.013	1.006
2	23 PPB	0.271	0.520	0.260
3	49 PPB	0.764	0.874	0.437
4	100 PPB	0.533	0.730	0.365
5	210 PPB	0.071	0.267	0.134
6	410 PPB	0.513	0.716	0.358

Hydrogen Cyanamid-Daphnia-Young/Adult/R-Day
 File: HYDCYADM.YAD Transform: NO TRANSFORM
 ANOVA TABLE

SOURCE	DF	SS	MS	F
Between	5	22.560	4.512	4.364
Within (Error)	18	18.614	1.034	
Total	23	41.175		

Critical F value = 2.77 (0.05,5,18)
 Since F > Critical F REJECT Ho: All groups equal

DP Barcode: D228813

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Hydrogen Cyanamid-Daphnia-Young/Adult/R-Day

File: HYDCYADM.YAD

Transform: NO TRANSFORM

DUNNETTS TEST

TABLE 1 OF 2

Ho:Control<Treatment

GROUP	IDENTIFICATION	TRANSFORMED MEAN	MEAN CALCULATED IN ORIGINAL UNITS	T STAT	SIG
1	Control	10.833	10.833		
2	23 PPB	10.913	10.913	-0.111	
3	49 PPB	11.495	11.495	-0.921	
4	100 PPB	10.485	10.485	0.483	
5	210 PPB	9.643	9.643	1.655	
6	410 PPB	8.543	8.543	3.185	*

Dunnett table value = 2.41 (1 Tailed Value, P=0.05, df=18,5)

Hydrogen Cyanamid-Daphnia-Young/Adult/R-Day

File: HYDCYADM.YAD

Transform: NO TRANSFORM

DUNNETTS TEST

TABLE 2 OF 2

Ho:Control<Treatment

GROUP	IDENTIFICATION	NUM OF REPS	Minimum Sig Diff (IN ORIG. UNITS)	% of CONTROL	DIFFERENCE FROM CONTROL
1	Control	4			
2	23 PPB	4	1.733	16.0	-0.080
3	49 PPB	4	1.733	16.0	-0.662
4	100 PPB	4	1.733	16.0	0.348
5	210 PPB	4	1.733	16.0	1.190
6	410 PPB	4	1.733	16.0	2.290

Hydrogen Cyanamid-Daphnia-Young/Adult/R-Day

File: HYDCYADM.YAD

Transform: NO TRANSFORM

ANOVA TABLE

SOURCE	DF	SS	MS	F
Between	5	22.560	4.512	4.364
Within (Error)	18	18.614	1.034	
Total	23	41.175		

Critical F value = 2.77 (0.05,5,18)

Since F > Critical F REJECT Ho:All groups equal

Hydrogen Cyanamid-Daphnia-Young/Adult/R-Day

File: HYDCYADM.YAD

Transform: NO TRANSFORM

BONFERRONI T-TEST

TABLE 1 OF 2

Ho:Control<Treatment

GROUP	IDENTIFICATION	TRANSFORMED MEAN	MEAN CALCULATED IN ORIGINAL UNITS	T STAT	SIG
1	Control	10.833	10.833		
2	23 PPB	10.913	10.913	-0.111	
3	49 PPB	11.495	11.495	-0.921	
4	100 PPB	10.485	10.485	0.483	
5	210 PPB	9.643	9.643	1.655	
6	410 PPB	8.543	8.543	3.185	*

Bonferroni T table value = 2.55 (1 Tailed Value, P=0.05, df=18,5)

Hydrogen Cyanamid-Daphnia-Young/Adult/R-Day

File: HYDCYADM.YAD

Transform: NO TRANSFORM

BONFERRONI T-TEST

TABLE 2 OF 2

Ho:Control<Treatment

GROUP	IDENTIFICATION	NUM OF REPS	Minimum Sig Diff (IN ORIG. UNITS)	% of CONTROL	DIFFERENCE FROM CONTROL
1	Control	4			
2	23 PPB	4	1.836	16.9	-0.080
3	49 PPB	4	1.836	16.9	-0.662
4	100 PPB	4	1.836	16.9	0.348
5	210 PPB	4	1.836	16.9	1.190
6	410 PPB	4	1.836	16.9	2.290

Hydrogen Cyanamid-Daphnia-Young/Adult/R-Day

DP Barcode: D228813

MRID No.: 44076702

File: HYDCYADM.YAD Transform: NO TRANSFORM
WILLIAMS TEST (Isotonic regression model) TABLE 1 OF 2

GROUP	IDENTIFICATION	N	ORIGINAL MEAN	TRANSFORMED MEAN	ISOTONIZED MEAN
1	Control	4	10.833	10.833	11.080
2	23 PPB	4	10.913	10.913	11.080
3	49 PPB	4	11.495	11.495	11.080
4	100 PPB	4	10.485	10.485	10.485
5	210 PPB	4	9.643	9.643	9.643
6	410 PPB	4	8.543	8.543	8.543

Hydrogen Cyanamid-Daphnia-Young/Adult/R-Day
File: HYDCYADM.YAD Transform: NO TRANSFORM
WILLIAMS TEST (Isotonic regression model) TABLE 2 OF 2

IDENTIFICATION	ISOTONIZED MEAN	CALC. WILLIAMS	SIG P= .05	TABLE WILLIAMS	DEGREES OF FREEDOM
Control	11.080				
23 PPB	11.080	0.344		1.73	k= 1, v=18
49 PPB	11.080	0.344		1.82	k= 2, v=18
100 PPB	10.485	0.483		1.85	k= 3, v=18
210 PPB	9.643	1.655		1.86	k= 4, v=18
410 PPB	8.543	3.185	*	1.87	k= 5, v=18

s = 1.017

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

DP Barcode: D228813

MRID No.: 44076702

TITLE: Hydrogen Cyanamid Daphnia 21 Day Mean WtFILE: HYDCYADM.Mwt
TRANSFORM: NO TRANSFORM

NUMBER OF GROUPS: 6

GRP	IDENTIFICATION	REP	VALUE	TRANS VALUE
1	Controls	1	4.6500	4.6500
1	Controls	2	4.8050	4.8050
1	Controls	3	4.7350	4.7350
1	Controls	4	4.7450	4.7450
2	23 PPB	1	4.4250	4.4250
2	23 PPB	2	4.4700	4.4700
2	23 PPB	3	4.6550	4.6550
2	23 PPB	4	4.5850	4.5850
3	49 PPB	1	4.7170	4.7170
3	49 PPB	2	4.7350	4.7350
3	49 PPB	3	4.5300	4.5300
3	49 PPB	4	4.5400	4.5400
4	100 PPB	1	4.7110	4.7110
4	100 PPB	2	4.6830	4.6830
4	100 PPB	3	4.6650	4.6650
4	100 PPB	4	4.6650	4.6650
5	210 PPB	1	4.6750	4.6750
5	210 PPB	2	4.6400	4.6400
5	210 PPB	3	4.5750	4.5750
5	210 PPB	4	4.5500	4.5500
6	410 PPB	1	4.5150	4.5150
6	410 PPB	2	4.5150	4.5150
6	410 PPB	3	4.4750	4.4750
6	410 PPB	4	4.6110	4.6110

Hydrogen Cyanamid Daphnia 21 Day Mean Wt

File: HYDCYADM.Mwt Transform: NO TRANSFORM

SUMMARY STATISTICS ON TRANSFORMED DATA TABLE 1 of 2

GRP	IDENTIFICATION	N	MIN	MAX	MEAN
1	Controls	4	4.650	4.805	4.734
2	23 PPB	4	4.425	4.655	4.534
3	49 PPB	4	4.530	4.735	4.630
4	100 PPB	4	4.665	4.711	4.681
5	210 PPB	4	4.550	4.675	4.610
6	410 PPB	4	4.475	4.611	4.529

Hydrogen Cyanamid Daphnia 21 Day Mean Wt

File: HYDCYADM.Mwt Transform: NO TRANSFORM

SUMMARY STATISTICS ON TRANSFORMED DATA TABLE 2 of 2

GRP	IDENTIFICATION	VARIANCE	SD	SEM
1	Controls	0.004	0.064	0.032
2	23 PPB	0.011	0.105	0.053
3	49 PPB	0.012	0.111	0.055
4	100 PPB	0.000	0.022	0.011
5	210 PPB	0.003	0.058	0.029
6	410 PPB	0.003	0.058	0.029

Hydrogen Cyanamid Daphnia 21 Day Mean Wt

File: HYDCYADM.Mwt Transform: NO TRANSFORM

ANOVA TABLE

SOURCE	DF	SS	MS	F
Between	5	0.130	0.026	4.333
Within (Error)	18	0.104	0.006	
Total	23	0.234		

Critical F value = 2.77 (0.05,5,18)

Since F > Critical F REJECT Ho: All groups equal

Hydrogen Cyanamid Daphnia 21 Day Mean Wt

File: HYDCYADM.Mwt Transform: NO TRANSFORM

DUNNETTS TEST

TABLE 1 OF 2

Ho: Control < Treatment

GROUP	IDENTIFICATION	TRANSFORMED MEAN	MEAN CALCULATED IN ORIGINAL UNITS	T STAT	SIG
1	Controls	4.734	4.734		
2	23 PPB	4.534	4.534	3.651	*
3	49 PPB	4.630	4.630	1.885	
4	100 PPB	4.681	4.681	0.963	

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5	210 PPB	4.610	4.610	2.259
6	410 PPB	4.529	4.529	3.738 *

Dunnnett table value = 2.41 (1 Tailed Value, P=0.05, df=18,5)

Hydrogen Cyanamid Daphnia 21 Day Mean Wt

File: HYDCYADM.Mwt Transform: NO TRANSFORM

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

GROUP	IDENTIFICATION	NUM OF REPS	Minimum Sig Diff (IN ORIG. UNITS)	% of CONTROL	DIFFERENCE FROM CONTROL
1	Controls	4			
2	23 PPB	4	0.132	2.8	0.200
3	49 PPB	4	0.132	2.8	0.103
4	100 PPB	4	0.132	2.8	0.053
5	210 PPB	4	0.132	2.8	0.124
6	410 PPB	4	0.132	2.8	0.205

Hydrogen Cyanamid Daphnia 21 Day Mean Wt

File: HYDCYADM.Mwt Transform: NO TRANSFORM

ANOVA TABLE

SOURCE	DF	SS	MS	F
Between	5	0.130	0.026	4.333
Within (Error)	18	0.104	0.006	
Total	23	0.234		

Critical F value = 2.77 (0.05,5,18)

Since F > Critical F REJECT Ho:All groups equal

Hydrogen Cyanamid Daphnia 21 Day Mean Wt

File: HYDCYADM.Mwt Transform: NO TRANSFORM

BONFERRONI T-TEST - TABLE 1 OF 2 Ho:Control<Treatment

GROUP	IDENTIFICATION	TRANSFORMED MEAN	MEAN CALCULATED IN ORIGINAL UNITS	T STAT	SIG
1	Controls	4.734	4.734		
2	23 PPB	4.534	4.534	3.651	*
3	49 PPB	4.630	4.630	1.885	
4	100 PPB	4.681	4.681	0.963	
5	210 PPB	4.610	4.610	2.259	
6	410 PPB	4.529	4.529	3.738	*

Bonferroni T table value = 2.55 (1 Tailed Value, P=0.05, df=18,5)

Hydrogen Cyanamid Daphnia 21 Day Mean Wt

File: HYDCYADM.Mwt Transform: NO TRANSFORM

BONFERRONI T-TEST - TABLE 2 OF 2 Ho:Control<Treatment

GROUP	IDENTIFICATION	NUM OF REPS	Minimum Sig Diff (IN ORIG. UNITS)	% of CONTROL	DIFFERENCE FROM CONTROL
1	Controls	4			
2	23 PPB	4	0.140	3.0	0.200
3	49 PPB	4	0.140	3.0	0.103
4	100 PPB	4	0.140	3.0	0.053
5	210 PPB	4	0.140	3.0	0.124
6	410 PPB	4	0.140	3.0	0.205

Hydrogen Cyanamid Daphnia 21 Day Mean Wt

File: HYDCYADM.Mwt Transform: NO TRANSFORM

WILLIAMS TEST (Isotonic regression model) TABLE 1 OF 2

GROUP IDENTIFICATION	N	MEAN	ORIGINAL MEAN	TRANSFORMED MEAN	ISOTONIZED
1 Controls	4	4.734	4.734	4.734	
2 23 PPB	4	4.534	4.534	4.615	
3 49 PPB	4	4.630	4.630	4.615	
4 100 PPB	4	4.681	4.681	4.615	
5 210 PPB	4	4.610	4.610	4.610	
6 410 PPB	4	4.529	4.529	4.529	

DP Barcode: D228813

MRID No.: 44076702

Hydrogen Cyanamid Daphnia 21 Day Mean Wt
File: HYDCYADM.Mwt Transform: NO TRANSFORM
WILLIAMS TEST (Isotonic regression model)

TABLE 2 OF 2

IDENTIFICATION	ISOTONIZED MEAN	CALC. MEAN	SIG WILLIAMS	TABLE P=.05	DEGREES OF WILLIAMS FREEDOM	Controls
23 PPB	4.615	2.213	*	1.73	k= 1, v=18	
49 PPB	4.615	2.213	*	1.82	k= 2, v=18	
100 PPB	4.615	2.213	*	1.85	k= 3, v=18	
210 PPB	4.610	2.308	*	1.86	k= 4, v=18	
410 PPB	4.529	3.819	*	1.87	k= 5, v=18	

s = 0.076

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

DP Barcode: D228813

MRID No.: 44076702

TITLE: Daphnid Length in Micrometer Units 20=1 mmFILE: hydcyadm.len
TRANSFORM: NO TRANSFORM

NUMBER OF GROUPS: 6

GRP	IDENTIFICATION	REP	VALUE	TRANS VALUE
1	Controls	1	90.0000	90.0000
1	Controls	2	91.0000	91.0000
1	Controls	3	93.0000	93.0000
1	Controls	4	95.0000	95.0000
1	Controls	5	91.0000	91.0000
1	Controls	6	95.0000	95.0000
1	Controls	7	96.0000	96.0000
1	Controls	8	97.0000	97.0000
1	Controls	9	92.0000	92.0000
1	Controls	10	90.0000	90.0000
1	Controls	11	90.0000	90.0000
1	Controls	12	97.0000	97.0000
1	Controls	13	97.0000	97.0000
1	Controls	14	99.0000	99.0000
1	Controls	15	94.0000	94.0000
1	Controls	16	95.0000	95.0000
1	Controls	17	94.0000	94.0000
1	Controls	18	91.0000	91.0000
1	Controls	19	95.0000	95.0000
1	Controls	20	94.0000	94.0000
1	Controls	21	95.0000	95.0000
1	Controls	22	98.0000	98.0000
1	Controls	23	99.0000	99.0000
1	Controls	24	96.0000	96.0000
1	Controls	25	91.0000	91.0000
1	Controls	26	94.0000	94.0000
1	Controls	27	94.0000	94.0000
1	Controls	28	91.0000	91.0000
1	Controls	29	95.0000	95.0000
1	Controls	30	94.0000	94.0000
1	Controls	31	93.0000	93.0000
1	Controls	32	95.0000	95.0000
1	Controls	33	94.0000	94.0000
1	Controls	34	95.0000	95.0000
1	Controls	35	96.0000	96.0000
1	Controls	36	97.0000	97.0000
1	Controls	37	97.0000	97.0000
1	Controls	38	95.0000	95.0000
1	Controls	39	95.0000	95.0000
1	Controls	40	94.0000	94.0000
2	49 PPB	1	96.0000	96.0000
2	49 PPB	2	91.0000	91.0000
2	49 PPB	3	91.0000	91.0000
2	49 PPB	4	93.0000	93.0000
2	49 PPB	5	94.0000	94.0000
2	49 PPB	6	95.0000	95.0000
2	49 PPB	7	95.0000	95.0000
2	49 PPB	8	96.0000	96.0000
2	49 PPB	9	98.0000	98.0000
2	49 PPB	10	93.0000	93.0000
2	49 PPB	11	92.0000	92.0000
2	49 PPB	12	93.0000	93.0000
2	49 PPB	13	90.0000	90.0000
2	49 PPB	14	87.0000	87.0000
2	49 PPB	15	88.0000	88.0000
2	49 PPB	16	92.0000	92.0000
2	49 PPB	17	90.0000	90.0000
2	49 PPB	18	91.0000	91.0000
2	49 PPB	19	90.0000	90.0000
2	49 PPB	20	93.0000	93.0000
2	49 PPB	21	92.0000	92.0000
2	49 PPB	22	93.0000	93.0000
2	49 PPB	23	93.0000	93.0000
2	49 PPB	24	90.0000	90.0000
2	49 PPB	25	87.0000	87.0000
2	49 PPB	26	92.0000	92.0000
2	49 PPB	27	90.0000	90.0000
2	49 PPB	28	91.0000	91.0000
2	49 PPB	29	90.0000	90.0000
2	49 PPB	30	88.0000	88.0000
2	49 PPB	31	91.0000	91.0000
2	49 PPB	32	92.0000	92.0000
2	49 PPB	33	90.0000	90.0000
2	49 PPB	34	92.0000	92.0000
2	49 PPB	35	91.0000	91.0000
2	49 PPB	36	90.0000	90.0000

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2	49 PPB	37	92.0000	92.0000
2	49 PPB	38	92.0000	92.0000
2	49 PPB	39	90.0000	90.0000
3	100 PPB	1	98.0000	98.0000
3	100 PPB	2	92.0000	92.0000
3	100 PPB	3	95.0000	95.0000
3	100 PPB	4	90.0000	90.0000
3	100 PPB	5	99.0000	99.0000
3	100 PPB	6	92.0000	92.0000
3	100 PPB	7	93.0000	93.0000
3	100 PPB	8	97.0000	97.0000
3	100 PPB	9	92.0000	92.0000
3	100 PPB	10	96.0000	96.0000
3	100 PPB	11	92.0000	92.0000
3	100 PPB	12	96.0000	96.0000
3	100 PPB	13	94.0000	94.0000
3	100 PPB	14	92.0000	92.0000
3	100 PPB	15	95.0000	95.0000
3	100 PPB	16	92.0000	92.0000
3	100 PPB	17	94.0000	94.0000
3	100 PPB	18	92.0000	92.0000
3	100 PPB	19	91.0000	91.0000
3	100 PPB	20	93.0000	93.0000
3	100 PPB	21	90.0000	90.0000
3	100 PPB	22	95.0000	95.0000
3	100 PPB	23	95.0000	95.0000
3	100 PPB	24	98.0000	98.0000
3	100 PPB	25	91.0000	91.0000
3	100 PPB	26	92.0000	92.0000
3	100 PPB	27	93.0000	93.0000
3	100 PPB	28	95.0000	95.0000
3	100 PPB	29	94.0000	94.0000
3	100 PPB	30	93.0000	93.0000
3	100 PPB	31	94.0000	94.0000
3	100 PPB	32	95.0000	95.0000
3	100 PPB	33	94.0000	94.0000
3	100 PPB	34	95.0000	95.0000
3	100 PPB	35	95.0000	95.0000
3	100 PPB	36	92.0000	92.0000
3	100 PPB	37	85.0000	85.0000
3	100 PPB	38	96.0000	96.0000
4	210 PPB	1	95.0000	95.0000
4	210 PPB	2	93.0000	93.0000
4	210 PPB	3	93.0000	93.0000
4	210 PPB	4	97.0000	97.0000
4	210 PPB	5	92.0000	92.0000
4	210 PPB	6	94.0000	94.0000
4	210 PPB	7	91.0000	91.0000
4	210 PPB	8	92.0000	92.0000
4	210 PPB	9	93.0000	93.0000
4	210 PPB	10	95.0000	95.0000
4	210 PPB	11	92.0000	92.0000
4	210 PPB	12	96.0000	96.0000
4	210 PPB	13	95.0000	95.0000
4	210 PPB	14	93.0000	93.0000
4	210 PPB	15	93.0000	93.0000
4	210 PPB	16	92.0000	92.0000
4	210 PPB	17	91.0000	91.0000
4	210 PPB	18	94.0000	94.0000
4	210 PPB	19	90.0000	90.0000
4	210 PPB	20	92.0000	92.0000
4	210 PPB	21	95.0000	95.0000
4	210 PPB	22	93.0000	93.0000
4	210 PPB	23	91.0000	91.0000
4	210 PPB	24	94.0000	94.0000
4	210 PPB	25	91.0000	91.0000
4	210 PPB	26	88.0000	88.0000
4	210 PPB	27	90.0000	90.0000
4	210 PPB	28	93.0000	93.0000
4	210 PPB	29	90.0000	90.0000
4	210 PPB	30	90.0000	90.0000
4	210 PPB	31	95.0000	95.0000
4	210 PPB	32	91.0000	91.0000
4	210 PPB	33	0.9000	0.9000
4	210 PPB	34	94.0000	94.0000
4	210 PPB	35	92.0000	92.0000
4	210 PPB	36	96.0000	96.0000
4	210 PPB	37	92.0000	92.0000
4	210 PPB	38	81.0000	81.0000
4	210 PPB	39	90.0000	90.0000
4	210 PPB	40	89.0000	89.0000
5	410 PPB	1	91.0000	91.0000
5	410 PPB	2	88.0000	88.0000

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5	410 PPB	3	88.0000	88.0000
5	410 PPB	4	90.0000	90.0000
5	410 PPB	5	93.0000	93.0000
5	410 PPB	6	90.0000	90.0000
5	410 PPB	7	92.0000	92.0000
5	410 PPB	8	92.0000	92.0000
5	410 PPB	9	90.0000	90.0000
5	410 PPB	10	89.0000	89.0000
5	410 PPB	11	93.0000	93.0000
5	410 PPB	12	92.0000	92.0000
5	410 PPB	13	88.0000	88.0000
5	410 PPB	14	88.0000	88.0000
5	410 PPB	15	90.0000	90.0000
5	410 PPB	16	91.0000	91.0000
5	410 PPB	17	86.0000	86.0000
5	410 PPB	18	93.0000	93.0000
5	410 PPB	19	89.0000	89.0000
5	410 PPB	20	93.0000	93.0000
5	410 PPB	21	90.0000	90.0000
5	410 PPB	22	90.0000	90.0000
5	410 PPB	23	93.0000	93.0000
5	410 PPB	24	86.0000	86.0000
5	410 PPB	25	91.0000	91.0000
5	410 PPB	26	90.0000	90.0000
5	410 PPB	27	92.0000	92.0000
5	410 PPB	28	79.0000	79.0000
5	410 PPB	29	91.0000	91.0000
5	410 PPB	30	93.0000	93.0000
5	410 PPB	31	92.0000	92.0000
5	410 PPB	32	91.0000	91.0000
5	410 PPB	33	91.0000	91.0000
5	410 PPB	34	93.0000	93.0000
5	410 PPB	35	93.0000	93.0000
5	410 PPB	36	91.0000	91.0000
5	410 PPB	37	92.0000	92.0000
5	410 PPB	38	94.0000	94.0000
5	410 PPB	39	93.0000	93.0000
6	23 PPB	1	87.0000	87.0000
6	23 PPB	2	85.0000	85.0000
6	23 PPB	3	87.0000	87.0000
6	23 PPB	4	91.0000	91.0000
6	23 PPB	5	89.0000	89.0000
6	23 PPB	6	89.0000	89.0000
6	23 PPB	7	88.0000	88.0000
6	23 PPB	8	88.0000	88.0000
6	23 PPB	9	89.0000	89.0000
6	23 PPB	10	92.0000	92.0000
6	23 PPB	11	89.0000	89.0000
6	23 PPB	12	90.0000	90.0000
6	23 PPB	13	87.0000	87.0000
6	23 PPB	14	94.0000	94.0000
6	23 PPB	15	91.0000	91.0000
6	23 PPB	16	87.0000	87.0000
6	23 PPB	17	93.0000	93.0000
6	23 PPB	18	86.0000	86.0000
6	23 PPB	19	89.0000	89.0000
6	23 PPB	20	88.0000	88.0000
6	23 PPB	21	93.0000	93.0000
6	23 PPB	22	92.0000	92.0000
6	23 PPB	23	87.0000	87.0000
6	23 PPB	24	95.0000	95.0000
6	23 PPB	25	95.0000	95.0000
6	23 PPB	26	93.0000	93.0000
6	23 PPB	27	96.0000	96.0000
6	23 PPB	28	90.0000	90.0000
6	23 PPB	29	96.0000	96.0000
6	23 PPB	30	94.0000	94.0000
6	23 PPB	31	90.0000	90.0000
6	23 PPB	32	90.0000	90.0000
6	23 PPB	33	95.0000	95.0000
6	23 PPB	34	95.0000	95.0000
6	23 PPB	35	96.0000	96.0000
6	23 PPB	36	90.0000	90.0000
6	23 PPB	37	90.0000	90.0000
6	23 PPB	38	92.0000	92.0000
6	23 PPB	39	91.0000	91.0000
6	23 PPB	40	88.0000	88.0000

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Daphnid Length in Micrometer Units 20=1 mm

File: hydcyadm.len Transform: NO TRANSFORM

SUMMARY STATISTICS ON TRANSFORMED DATA TABLE 1 of 2

GRP	IDENTIFICATION	N	MIN	MAX	MEAN
1	Controls	40	90.000	99.000	94.350
2	49 PPB	39	87.000	98.000	91.641
3	100 PPB	38	85.000	99.000	93.605
4	210 PPB	40	0.900	97.000	89.972
5	410 PPB	39	79.000	94.000	90.538
6	23 PPB	40	85.000	96.000	90.675

Daphnid Length in Micrometer Units 20=1 mm

File: hydcyadm.len Transform: NO TRANSFORM

SUMMARY STATISTICS ON TRANSFORMED DATA TABLE 2 of 2

GRP	IDENTIFICATION	VARIANCE	SD	SEM
1	Controls	5.823	2.413	0.382
2	49 PPB	5.657	2.378	0.381
3	100 PPB	6.786	2.605	0.423
4	210 PPB	216.174	14.703	2.325
5	410 PPB	7.571	2.752	0.441
6	23 PPB	9.507	3.083	0.488

Daphnid Length in Micrometer Units 20=1 mm

File: hydcyadm.len Transform: NO TRANSFORM

ANOVA TABLE

SOURCE	DF	SS	MS	F
Between	5	631.174	126.235	2.968
Within (Error)	230	9782.400	42.532	
Total	235	10413.574		

Critical F value = 2.29 (0.05,5,120)

Since F > Critical F REJECT Ho: All groups equal

Daphnid Length in Micrometer Units 20=1 mm

File: hydcyadm.len Transform: NO TRANSFORM

DUNNETTS TEST

***** WARNING *****

This data set has unequal replicates. The Bonferroni T-test should be used instead of the Dunnett's test.

Daphnid Length in Micrometer Units 20=1 mm

File: hydcyadm.len Transform: NO TRANSFORM

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

GROUP	IDENTIFICATION	TRANSFORMED MEAN	MEAN CALCULATED IN ORIGINAL UNITS	T STAT	SIG
1	Controls	94.350	94.350		
2	49 PPB	91.641	91.641	1.846	
3	100 PPB	93.605	93.605	0.504	
4	210 PPB	89.972	89.972	3.002	*
5	410 PPB	90.538	90.538	2.597	*
6	23 PPB	90.675	90.675	2.520	*

Dunnett table value = 2.23 (1 Tailed Value, P=0.05, df=230,5)

Daphnid Length in Micrometer Units 20=1 mm

File: hydcyadm.len Transform: NO TRANSFORM

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

GROUP	IDENTIFICATION	NUM OF REPS	Minimum Sig Diff (IN ORIG. UNITS)	% of CONTROL	DIFFERENCE FROM CONTROL
1	Controls	40			
2	49 PPB	39	3.273	3.5	2.709
3	100 PPB	38	3.294	3.5	0.745
4	210 PPB	40	3.252	3.4	4.378
5	410 PPB	39	3.273	3.5	3.812
6	23 PPB	40	3.252	3.4	3.675

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Daphnid Length in Micrometer Units 20=1 mm
 File: hydscyadm.len Transform: NO TRANSFORM
 ANOVA TABLE

SOURCE	DF	SS	MS	F
Between	5	631.174	126.235	2.968
Within (Error)	230	9782.400	42.532	
Total	235	10413.574		

Critical F value = 2.29 (0.05,5,120)
 Since F > Critical F REJECT Ho: All groups equal

Daphnid Length in Micrometer Units 20=1 mm
 File: hydscyadm.len Transform: NO TRANSFORM

BONFERRONI T-TEST		TABLE 1 OF 2		Ho: Control < Treatment	
GROUP	IDENTIFICATION	TRANSFORMED MEAN	MEAN CALCULATED IN ORIGINAL UNITS	T STAT	SIG
1	Controls	94.350	94.350		
2	49 PPB	91.641	91.641	1.846	
3	100 PPB	93.605	93.605	0.504	
4	210 PPB	89.972	89.972	3.002 *	
5	410 PPB	90.538	90.538	2.597 *	
6	23 PPB	90.675	90.675	2.520 *	

Bonferroni T table value = 2.36 (1 Tailed Value, P=0.05, df=120,5)

Daphnid Length in Micrometer Units 20=1 mm
 File: hydscyadm.len Transform: NO TRANSFORM
 BONFERRONI T-TEST TABLE 2 OF 2

GROUP	IDENTIFICATION	NUM OF REPS	Minimum Sig Diff (IN ORIG. UNITS)	% of CONTROL	DIFFERENCE FROM CONTROL
1	Controls	40			
2	49 PPB	39	3.461	3.7	2.709
3	100 PPB	38	3.484	3.7	0.745
4	210 PPB	40	3.439	3.6	4.378
5	410 PPB	39	3.461	3.7	3.812
6	23 PPB	40	3.439	3.6	3.675

Daphnid Length in Micrometer Units 20=1 mm
 File: hydscyadm.len Transform: NO TRANSFORM
 WILLIAMS TEST (Isotonic regression model) TABLE 1 OF 2

GROUP	IDENTIFICATION	N	ORIGINAL MEAN	TRANSFORMED MEAN	ISOTONIZED MEAN
1	Controls	40	94.350	94.350	94.350
2	49 PPB	39	91.641	91.641	92.610
3	100 PPB	38	93.605	93.605	92.610
4	210 PPB	40	89.972	89.972	90.394
5	410 PPB	39	90.538	90.538	90.394
6	23 PPB	40	90.675	90.675	90.394

File: hydscyadm.len Transform: NO TRANSFORM
 WILLIAMS TEST (Isotonic regression model) TABLE 2 OF 2

IDENTIFICATION	ISOTONIZED MEAN	CALC. WILLIAMS	SIG P=.05	TABLE WILLIAMS	DEGREES OF FREEDOM
Controls	94.350				
49 PPB	92.610	1.185	1.66	k= 1, v=230	
100 PPB	92.610	1.178	1.73	k= 2, v=230	
210 PPB	90.394	2.713	1.75	k= 3, v=230	
410 PPB	90.394	2.695	1.77	k= 4, v=230	
23 PPB	90.394	2.713	1.77	k= 5, v=230	

s = 6.522

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

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