



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

10-17-94 EEB files
S#38901

OCT 17 1994

OFFICE OF
PREVENTION, PESTICIDES
AND TOXIC SUBSTANCES

MEMORANDUM

Subject: Endothall Technical - Invertebrate Life Cycle Test
Study - D199241

From: *for* Anthony F. Maciorowski, Chief
Ecological Effects Branch
Environmental Fate and Effects Division (7507C) 10/5/94

To: Kathryn Davis, PM Team 52 Reviewer
Special Review and Reregistration Division (7508C)

The following Data Evaluation Record (DER) Conclusions (see attached complete DER) have been provided for the subject study.

Action I.D.: D199241 818815 S#38901
Guideline: 72-4(b) MRID No.: 43007801

CONCLUSIONS: This study is scientifically sound but does not fulfill the guideline requirements for a life-cycle study with freshwater aquatic invertebrates. The NOEC less than 2.2 mg a.i./L for both length and offspring/female.

In the Bean Sheet (D199241) for this action you ask if the subject study with endothall acid (S#038901) would satisfy the requirement for the dipotassium salt of endothall (S# 038904) and/or the N, N- dimethyl alkyl amine salt of endothall (S# 038905). In EEB's March 14, 1991 list B responses placed the requirement for subject study in reserve for both of these chemicals. The reserve status was pending the receipt of lower tier studies, additional use information, and environmental fate data. This information has not come available. Testing on the endothall acid (S# 038901) was not required in the EEB's March 12, 1991 list B response because it did not have any outdoor uses and of course the subject study does not fulfill the guidelines because it did not reach the NOEC level for length or reproduction.

Please contact Dennis J. McLane (305-5096) if you have any further questions.



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DP BARCODE: D199241

REREG CASE # 2245

CASE: 818815
SUBMISSION: S458046

DATA PACKAGE RECORD
BEAN SHEET

DATE: 02/10/94
Page 1 of 1

* * * CASE/SUBMISSION INFORMATION * * *

CASE TYPE: REREGISTRATION ACTION: 627 CORE DATA
CHEMICALS: 038901 Endothall

ID#: 038901-

COMPANY:

PRODUCT MANAGER: 52 KATHRYN DAVIS 703-308-8156 ROOM: CS1 3F3
PM TEAM REVIEWER: KATHRYN DAVIS 703-308-8156 ROOM: CS1 3F3
RECEIVED DATE: 11/15/93 DUE OUT DATE: 02/13/94

* * * DATA PACKAGE INFORMATION * * *

DP BARCODE: 199241 EXPEDITE: N DATE SENT: 02/08/94 DATE RET.: / /

CHEMICAL: 038901 Endothall

DP TYPE: 999 Miscellaneous Data Package

CSF: LABEL:

ASSIGNED TO	DATE IN	DATE OUT	ADMIN DUE DATE: 05/09/94
DIV : EFED	02/14/94	/ /	NEGOT DATE: / /
BRAN: EEB	02/15/94	/ /	PROJ DATE: / /
SECT:	/ /	/ /	
REVR :	/ /	/ /	
CONTR:	/ /	/ /	

* * * DATA REVIEW INSTRUCTIONS * * *

Please review attached study. Does it satisfy for 72-4(b)
Life cycle - invertebrate MRID # 430078-01 for the
dipotassium salt and amine salt as well?

If you have any questions please contact Kathy Davis at
308-8156

* * * DATA PACKAGE EVALUATION * * *

No evaluation is written for this data package

* * * ADDITIONAL DATA PACKAGES FOR THIS SUBMISSION * * *

DP BC	BRANCH/SECTION	DATE OUT	DUE BACK	INS	CSF	LABEL
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DP Barcode : D199241
 PC Code No : 038901
 EEB Out : / /

To: Kathryn Davis
 Product Manager 52
 Special Review and Reregistration Division (7508W)

From: Anthony F. Maciorowski, Chief
 Ecological Effects Branch/EFED (H7507C)

Attached, please find the EEB review of...

Reg./File # : 038901
 Chemical Name : Endothall
 Type Product : herbicide
 Product Name :
 Company Name :
 Purpose : Review invertebrate life cycle study.

Action Code: 627
 Reviewer: Dennis McLane

Date Due: 5/9/94

EEB Guideline/MRID Summary Table: The review in this package contains an evaluation of the following:

GDLN NO	MRID NO	CAT	GDLN NO	MRID NO	CAT	GDLN NO	MRID NO	CAT
71-1(A)			72-2(A)			72-7(A)		
71-1(B)			72-2(B)			72-7(B)		
71-2(A)			72-3(A)			122-1(A)		
71-2(B)			72-3(B)			122-1(B)		
71-3			72-3(C)			122-2		
71-4(A)			72-3(D)			123-1(A)		
71-4(B)			72-3(E)			123-1(B)		
71-5(A)			72-3(F)			123-2		
71-5(B)			72-4(A)			124-1		
72-1(A)			72-4(B)	43007801	S	124-2		
72-1(B)			72-5			141-1		
72-1(C)			72-6			141-2		
72-1(D)						141-5		

Y=Acceptable (Study satisfied Guideline)/Concur

P=Partial (Study partially fulfilled Guideline but additional information is needed)

S=Supplemental (Study provided useful information but Guideline was not satisfied)

N=Unacceptable (Study was rejected)/Nonconcur

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

1. CHEMICAL: Endothall Technical (acid) Shaughnessey #: 038901
2. TEST MATERIAL: Technical Purity: 91.2 %
3. CITATION:

Author: Arthur E. Putt
Title: Endothall Technical (Acid) - The Chronic Toxicity to *Daphnia magna* Under Flow-Through Conditions
Date: August 13, 1993
Laboratory Report #: 93-11-4525
Any Other Study #: 12442.0692.6148.103
Sponsor: Atochem North America, Inc
Sponsor #: N/A
Laboratory: Springborn Laboratories, Inc.
MRID No.: 43007801

4. REVIEWED BY:

Dennis J/ McLane, Wildlife Biologist
Ecological Effects Branch (7507C)
U.S.E.P.A.

Signature: *Dennis J. McLane*
Date: 9-15-94

5. APPROVED BY:

Les W. Touart
Section Head
Ecological Effects Branch (7507C)
U.S.E.P.A.

Signature: *L. W. Touart*
Date: 9/28/94

6. CONCLUSIONS: This study is scientifically sound but does not fulfill the guideline requirements for a life-cycle study with freshwater aquatic invertebrates. The NOEC₁ less than 2.2 mg a.i./L for both length and offspring/female.

7. MAJOR GUIDELINE DEVIATIONS:

The study did not establish a NOEC or LOEC for daphnids.

8. MATERIALS AND METHODS:

A. Biological System:

Guideline Criteria	Reported Information
Species: <i>Daphnia</i>	<i>Daphnia magna</i>

Guideline Criteria	Reported Information
Source	Springborn's own culture
Food variety - 1) synthetic (trout chow); 2) Alfalfa yeast and algae; 3) Algae <i>Ankistrodesmus falcatus</i> ; <i>Chlamydomonas reinhardtii</i> ; and <i>Selenastrum capricornutum</i>	<i>Ankistrodesmus falcatus</i>
Age at beginning of test: 1) ≤ 24 hours old; 2) Prior to the test, at least 10-12 days old (those that have had at least on brood) should be separated from the culture, put in a separate culture container and maintained for at least 21 days to insure that good health and conditions are present.	1) ≤ 24 hours old 2) Not reported
Renewal: 7 beakers containing 1 parent daphnid each, the offspring, both live and dead, are counted and discarded.	This test was a flow-through not renewal.
Duration: Last day 21 count and measure to nearest 0.01 mm from apex of helmet to the base of the spine. # young, both alive and dead.	Yes
Test Rejection: 1) 30 % die; 2) must ≥ 40 young after 21 days; 3) Production of "resting eggs" or ephippia; 4) Temp. changes over 5°C from 20°C in 48 hrs; 5) DO >50% for 48 hrs; 6) pH changes > one unit in 48 hrs.	1) No 2) Yes 3) Not reported 4) No 5) No 6) No

Guideline Criteria	Reported Information
Data Endpoints: 1) survival of 1 st generation 2) production of young at various times for each treatment 3) Length of 1 st generation at end of test	1) yes 2) Yes 3) Yes

Comments: None

B. Physical System:

Guideline Criteria	Reported Information
Test Water: 1) Well or spring provided that the source is not polluted 2) Tested for contaminants 3) Measured pH 7.6 and 8.0. 4) Hardness 160 to 180 mg/L 5) reconstituted water detailed descriptions (ASTM)	1) well water adjusted to meet ASTM hard water criteria plus filtering through Amberlite® resin column and carbon filter. 2) yes 3) 7.9-8.3 4) see above
Test Temperature: 20°C±2°C	20±2°C
Photoperiod: Recommend 16L/8D; Intensity should be 400 to 800 Lux (37 to 74 footcandles) at surface with wide-spectrum fluorescent lamps.	16L/8D; Intensity was not reported. Source was a combination of Marvel® Cool White and Sylvania® Lifeline Natural White fluorescent
Test Vessels: All glass, No. 316 stainless steel, or perfluorocarbon plastics; volume 200 mls. 250 ml (borosilicate glass beakers are typically used). vessels should be covered with glass plates to prevent evaporation.	glass, Nitex® 40-mesh screen, silicone tubing, stoppers and sealant.
Aeration: Dilution water should be aerated to insure DO concentration at or near 100% saturation. Test tanks should not be aerated.	Sufficient DO concentrations were maintained. Test tanks were not aerated.

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Comments: The following are criteria for fish chronic flow-through testing.

ASTM Criteria for a Flow-Through Study	Reported Information
Dosing Apparatus: 1) Intermittent flow proportional diluters or continuous flow serial diluters should be used. 2) Checked twice daily operation of metering system	1) Mount and Brungs (1967) intermittent flow proportional diluter; 2) Yes
Toxicant Mixing: 1) Aeration should not be used for mixing; 2) It must be demonstrated that the test solution is completely mixed before intro. into the test system; 3) Flow splitting accuracy must be within 10%.	1) Not reported 2) Pretest measurements (see Table 2) 3) The 1.9 mg/L level failed to show less than a 10% difference between A & B replicates during Pretest #1 all other measurements met the guidelines.
Retention and Pairing Chambers: Glass with mesh nylon or stainless steel screens	Glass with nylon screens.
Concentrations- Toxicant conc. must be measured in one tank at each toxicant level every week.	- see Table 2
Flow Rate: 1) Flow rates should provide 5 to 10 volume additions per 24 hr; 2) flow rate must maintain DO at or above 60% of saturation and maintain the toxicant level.	1) Flow rate provided approx. 6 volume additions per day. 2) DO maintained at > 60% saturation.

C. Chemical System:

Guideline Criteria	Reported Information
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Concentrations: 1) Minimum of 5 concentrations and a control, all replicated, plus solvent control if appropriate. 2) - food conc. dry weight 5 mg/L for synthetic; algal cells 10^8	1) 5 concentrations and a control 2) -Trout food 5 mg/ml+algal suspension 4×10^7 +Selco® food supplement .6 mg/ml 3 x daily on weekdays 2 x daily on weekends
Other Variables: 1) DO must be measured at each conc. at least once a week; 2) Freshwater parameters in a control & 1 conc. must be analyzed once a week; (pH, alkalinity, hardness, and conductance	1) Once a week 2) Once a week

Comments: No comments.

9. REPORTED RESULTS:

Guideline Criteria	Reported Information
Data Endpoints must include: 1) Survival of first-generation daphnids 2) Production of young 3) Length of first generation daphnids at the end of the test.	1) Yes (see Table 3) 2) Yes (see Table 5) 3) Yes (see Table 7)
Raw data included? (Y/N)	No

A. Effects Data:

Toxicant Conc. (mg/L)		Young per fem.per repro. day				Survival (21 days)				Total Length (mm)				Dry weight (mg)			
Nom.	Meas.	A	B	C	D	A	B	C	D	A	B	C	D	A	B	C	D

Toxicant Conc. (mg/L)		Young per fem.per repro. day				Survival (21 days)				Total Length (mm)				Dry weight (mg)			
Ctrl		11.1	10.2	10.6	10.4	90	100	80	100	5.16	5.11	5.2	5.14	1.19	1.36	1.31	1.45
1.9	2.2	10.1	8.6	9.3	8.7	100	100	100	100	5.13	5.06	5.11	4.92	1.4	1.37	1.37	1.28
3.8	5.0	10.6	9.9	10.1	11.0	90	100	100	100	5.24	5.18	5.11	5.3	1.58	1.49	1.44	1.57
7.5	8.9	9.9	8.6	9.5	8.1	100	90	100	100	5.27	5.22	5.24	5.01	1.76	1.61	1.6	1.51
15	17	4.2	6.0	5.8	5.9	90	100	100	100	5.01	4.91	4.99	4.88	1.43	1.4	1.61	1.37
30	35	0.0	0.0	0.0	0.0	0	0	0	0	0	0	0	0	0	0	0	0

B. Statistical Results:

Statistical Methods: Shapiro-Wilks test for normality, Bartlett's test for homogeneity, and William's test for statistical comparison

NOEC: 5.0 mg a.i./L LOEC: 8.9 mg a.i./L

Most sensitive endpoint: Mean Total Weight and Offspring/daphnid

Comments: Table 7. and Figure 5. indicate that the mean dry weight is NOEC is 35 mg a.i./L and the LOEC is 17 mg a.i./L.

10. Reviewer's Statistical Results:

Statistical Method: Toxstat Dunnett's for offspring/female
Toxstat Bonferroni's for total body length

NOEC: <2.2 mg a.i./L LOEC: UNKNOWN

Most sensitive endpoint: Total body length and offspring/female

Of additional interest is that the mean cumulative percent survival decreased from 100% on day 2 to 48% on day 4 at the 35 mg a.i./L. The other treatment levels ranged from 95% to 100% through day 21. This is illustrate in Table 3.

Comments:

The attached Toxstat printout entitled Endothall 21 Day Daphnia - Offspring/Female shows the number offspring per female was most sensitive parameter (Dunnett's) followed by body length. EEB's statistical analysis shows that all treatments except that 5 mg a.i./L offspring/female were different from the control. The total body length (printout entitled 21 Day Daphnia magna Total Length) data shows two levels which were not different from the control at 5.0 mg a.i./L level and 8.9 mg a.i./L level. The Dunn's multiple comparison - Kruskal-Wallis shows that the dry body weight at the 8.9 mg a.i./L level is different from the control, 2.2, and 35 mg a.i./L, whereas, all the other doses were only different from the 35 mg a.i./L level. In addition the effects appear to contradict each other, the weight appears to increase up to 8.9 then decreases while the length decreases from the control to the 2.2 dose and increases to the 5.0 dose and decreases from the 5.0 dose to the 35 mg a.i./L dose. On the other hand, the offspring per female decreases from control to 2.2 dose and increases from 2.2 to 5.0 dose and then decreases through to the last dose (see attached Springborn's Figures 3 - 5). Also, the mean total cumulative offspring per female was 192.75 with a minimum and maximum of 181 and 211, respectively, for the 2.2 mg a.i./L, whereas, the 8.9 mg a.i./L (Springborn's LOEC) was 190 mg a.i./L with a minimum of 171 and maximum of 208. In either case the minimum and maximum values for the control group are not overlapped by either of these two concentrations, further emphasizing the differences from the control. Notice however the offspring/female confidence levels for the 5.0 level are similar to the controls 208 and 231. Based on all these items, it appears the study responses at the 5.0 and/or 8.9 mg a.i./L levels to may be an anomalies, and because the lowest level tested was significantly different from the controls for both offspring/female and length an NOEC can not be determined using this test.

11. ADEQUACY OF THE STUDY:

A. Classification: Supplemental

B. Rationale: The study failed to show a no-observed-effect concentration.

C. Reparability: No

12. COMPLETION OF ONE-LINER FOR STUDY:

One-liner completed

Page _____ is not included in this copy.

Pages 11 through 21 are not included.

The material not included contains the following type of information:

- ☐ Identity of product inert ingredients.
 - ☐ Identity of product impurities.
 - ☐ Description of the product manufacturing process.
 - ☐ Description of quality control procedures.
 - ☐ Identity of the source of product ingredients.
 - ☐ Sales or other commercial/financial information.
 - ☐ A draft product label.
 - ☐ The product confidential statement of formula.
 - ☐ Information about a pending registration action.
 - ☒ FIFRA registration data.
 - ☐ The document is a duplicate of page(s) _____.
 - ☐ The document is not responsive to the request.
-

The information not included is generally considered confidential by product registrants. If you have any questions, please contact the individual who prepared the response to your request.

Endothall 21 Day Daphnia - Offspring/Female
 File: a:offsprin.dat Transform: NO TRANSFORM

SUMMARY STATISTICS ON TRANSFORMED DATA TABLE 1 of 2

GRP	IDENTIFICATION	N	MIN	MAX	MEAN
1	Control	4	215.000	232.000	221.750
2	1.9	4	181.000	211.000	192.750
3	3.8	4	208.000	231.000	218.000
4	7.5	4	171.000	208.000	190.000
5	15	4	88.000	126.000	115.000
6	30	4	0.000	0.000	0.000

Endothall 21 Day Daphnia - Offspring/Female
 File: a:offsprin.dat Transform: NO TRANSFORM

SUMMARY STATISTICS ON TRANSFORMED DATA TABLE 2 of 2

GRP	IDENTIFICATION	VARIANCE	SD	SEM
1	Control	54.917	7.411	3.705
2	1.9	192.250	13.865	6.933
3	3.8	111.333	10.551	5.276
4	7.5	288.667	16.990	8.495
5	15	326.667	18.074	9.037
6	30	0.000	0.000	0.000

Endothall 21 Day Daphnia - Offspring/Female
 File: a:offsprin.dat Transform: NO TRANSFORM

ANOVA TABLE

SOURCE	DF	SS	MS	F
Between	5	146761.000	29352.200	180.845
Within (Error)	18	2921.500	162.306	
Total	23	149682.500		

Critical F value = 2.77 (0.05,5,18)
 Since $F > \text{Critical } F$ REJECT H_0 : All groups equal

Endothall 21 Day Daphnia - Offspring/Female
 File: a:offsprin.dat Transform: NO TRANSFORM

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DUNNETTS TEST - TABLE 1 OF 2

Ho:Control<Treatment

GROUP	IDENTIFICATION	TRANSFORMED MEAN	MEAN CALCULATED IN ORIGINAL UNITS	T STAT	SIG
1	Control	221.750	221.750		
2	1.9 2.2	192.750	192.750	3.219	*
3	3.8 5.1	218.000	218.000	0.416	
4	7.5 8.9	190.000	190.000	3.524	*
5	15 17	115.000	115.000	11.850	*
6	30 35	0.000	0.000	24.616	*

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

Endothall 21 Day Daphnia - Offspring/Female

File: a:offsprin.dat

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	1.9	4	21.710	9.8	29.000
3	3.8	4	21.710	9.8	3.750
4	7.5	4	21.710	9.8	31.750
5	15	4	21.710	9.8	106.750
6	30	4	21.710	9.8	221.750

Endothall 21 Day Daphnia - Offspring/Female

File: a:offsprin.dat

Transform: NO TRANSFORM

ANOVA TABLE

SOURCE	DF	SS	MS	F
Between	5	146761.000	29352.200	180.845
Within (Error)	18	2921.500	162.306	
Total	23	149682.500		

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

Since F > Critical F REJECT Ho:All groups equal

Endothall 21 Day Daphnia - Offspring/Female

File: a:offsprin.dat

Transform: NO TRANSFORM

TUKEY method of multiple comparisons

GROUP

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GROUP	IDENTIFICATION	TRANSFORMED MEAN	ORIGINAL MEAN	0 0 0 0 0 0 6 5 4 2 3 1
6	30	0.000	0.000	\
5	15	115.000	115.000	* \
4	7.5	190.000	190.000	* * \
2	1.9	192.750	192.750	* * . \
3	3.8	218.000	218.000	* * . . \
1	Control	221.750	221.750	* * * * . \

* = significant difference (p=0.05)

Tukey value (6,18) = 4.49

. = no significant difference

s = 162.306

Endothall 21 Day Daphnia - Offspring/Female

File: a:offsprin.dat

Transform: NO TRANSFORM

KRUSKAL-WALLIS ANOVA BY RANKS - TABLE 1 OF 2

GROUP	IDENTIFICATION	TRANSFORMED MEAN	MEAN CALCULATED IN ORIGINAL UNITS	RANK SUM
1	Control	221.750	221.750	84.500
2	1.9	192.750	192.750	53.000
3	3.8	218.000	218.000	77.500
4	7.5	190.000	190.000	49.000
5	15	115.000	115.000	26.000
6	30	0.000	0.000	10.000

Calculated H Value = 20.789

Critical H Value Table = 11.070

Since Calc H > Crit H REJECT Ho: All groups are equal.

Endothall 21 Day Daphnia - Offspring/Female

File: a:offsprin.dat

Transform: NO TRANSFORM

DUNN'S MULTIPLE COMPARISON - KRUSKAL-WALLIS - TABLE 2 OF 2

GROUP	IDENTIFICATION	TRANSFORMED MEAN	ORIGINAL MEAN	GROUP 0 0 0 0 0 0 6 5 4 2 3 1
6	30	0.000	0.000	\
5	15	115.000	115.000	. \
4	7.5	190.000	190.000	. . \
2	1.9	192.750	192.750	. . . \
3	3.8	218.000	218.000	* . . . \
1	Control	221.750	221.750	* \

* = significant difference (p=0.05)

Table q value (0.05,6) = 2.936

. = no significant difference

SE = 4.985

21 Day Daphnia magna Total Length
File: c:\chem\endothal\daph21.dat

Transform: NO TRANSFORM

ANOVA TABLE

SOURCE	DF	SS	MS	F
Between	5	863.655	172.731	6397.444
Within (Error)	225	5.980	0.027	
Total	230	869.635		

Critical F value = 2.29 (0.05,5,120)
Since $F > \text{Critical } F$ REJECT H_0 : All groups equal

21 Day Daphnia magna Total Length
File: c:\chem\endothal\daph21.dat

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	5.149	5.149		
2	1.9	5.054	5.054	2.513	*
3	3.8	5.207	5.207	-1.512	
4	7.5	5.182	5.182	-0.881	
5	15	4.942	4.942	5.432	*
6	30	0.000	0.000	136.390	*

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

21 Day Daphnia magna Total Length
File: c:\chem\endothal\daph21.dat

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	36			
2	1.9	40	0.089	1.7	0.095
3	3.8	37	0.091	1.8	-0.058
4	7.5	39	0.090	1.7	-0.033
5	15	39	0.090	1.7	0.206
6	30	40	0.089	1.7	5.149

21 Day Daphnia magna Total Length
File: c:\chem\endothal\daph21.dat

Transform: NO TRANSFORM

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WILLIAMS TEST (Isotonic regression model)

TABLE 1 OF 2

GROUP	IDENTIFICATION	N	ORIGINAL MEAN	TRANSFORMED MEAN	ISOTONIZED MEAN
1	Control	36	5.149	5.149	5.149
2	1.9	40	5.054	5.054	5.146
3	3.8	37	5.207	5.207	5.146
4	7.5	39	5.182	5.182	5.146
5	15	39	4.942	4.942	4.942
6	30	40	0.000	0.000	0.000

21 Day Daphnia magna Total Length
File: c:\chem\endothal\daph21.dat

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	5.149				
1.9	5.146	0.078		1.66	k= 1, v=225
3.8	5.146	0.077		1.73	k= 2, v=225
7.5	5.146	0.078		1.75	k= 3, v=225
15	4.942	5.475	*	1.77	k= 4, v=225
30	0.000	137.463	*	1.77	k= 5, v=225

s = 0.163

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

```

*****
* User name:  HWNNIK (13)           Queue:  DCOPP1/PRINTQ_1012_BAY
* File name:  _____           Server  PRINT_SERVER_1
* Directory:  _____
* Description: Quattro Pro
*              September 14, 94      9:29am
*****
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*      H  H W  W  III  N  N N  N  III  K  K
*      H  H W  W  I   NN  N NN  N  I   K  K
*      H  H W  W  I   N N N N N N  I   K  K
*      HHHHH W W W  I   N N N N N N  I   KK
*      H  H W W W  I   N N N N N N  I   K  K
*      H  H WW WW  I   N  NN N  NN  I   K  K
*      H  H W  W  III  N  N N  N  III  K  K
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Endothall 21 Day Daphnia dry body weight

File: c:\chem\endothal\dapwt.dat

Transform: NO TRANSFORM

SUMMARY STATISTICS ON TRANSFORMED DATA TABLE 1 of 2

GRP	IDENTIFICATION	N	MIN	MAX	MEAN
1	control	36	0.900	1.650	1.336
2	1.9	40	0.860	1.740	1.357
3	3.8	37	1.110	1.800	1.519
4	7.5	39	1.160	1.970	1.618
5	15	39	1.020	1.830	1.455
6	30	40	0.000	0.000	0.000

Endothall 21 Day Daphnia dry body weight

File: c:\chem\endothal\dapwt.dat

Transform: NO TRANSFORM

SUMMARY STATISTICS ON TRANSFORMED DATA TABLE 2 of 2

GRP	IDENTIFICATION	VARIANCE	SD	SEM
1	control	0.046	0.216	0.036
2	1.9	0.048	0.220	0.035
3	3.8	0.032	0.180	0.030
4	7.5	0.040	0.200	0.032
5	15	0.038	0.196	0.031
6	30	0.000	0.000	0.000

Endothall 21 Day Daphnia dry body weight

File: c:\chem\endothal\dapwt.dat

Transform: NO TRANSFORM

ANOVA TABLE

SOURCE	DF	SS	MS	F
Between	5	72.377	14.475	425.735
Within (Error)	225	7.649	0.034	
Total	230	80.026		

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

Since $F > \text{Critical } F$ REJECT H_0 : All groups equal

Endothall 21 Day Daphnia dry body weight

File: c:\chem\endothal\dapwt.dat

Transform: NO TRANSFORM

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BONFERRONI T-TEST

- TABLE 1 OF 2

Ho:Control<Treatment

GROUP	IDENTIFICATION	TRANSFORMED MEAN	MEAN CALCULATED IN ORIGINAL UNITS	T STAT	SIG
1	control	1.336	1.336		
2	1.9	1.357	1.357	-0.512	
3	3.8	1.519	1.519	-4.260	
4	7.5	1.618	1.618	-6.632	
5	15	1.455	1.455	-2.803	
6	30	0.000	0.000	31.528	*

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

Endothall 21 Day Daphnia dry body weight

File: c:\chem\endothal\dapwt.dat

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	36			
2	1.9	40	0.100	7.5	-0.022
3	3.8	37	0.102	7.6	-0.184
4	7.5	39	0.100	7.5	-0.283
5	15	39	0.100	7.5	-0.119
6	30	40	0.100	7.5	1.336

Endothall 21 Day Daphnia dry body weight

File: c:\chem\endothal\dapwt.dat

Transform: NO TRANSFORM

KRUSKAL-WALLIS ANOVA BY RANKS - TABLE 1 OF 2

GROUP	IDENTIFICATION	TRANSFORMED MEAN	MEAN CALCULATED IN ORIGINAL UNITS	RANK SUM
1	control	1.336	1.336	3883.000
2	1.9	1.357	1.357	4472.500
3	3.8	1.519	1.519	5608.000
4	7.5	1.618	1.618	6794.000
5	15	1.455	1.455	5218.500
6	30	0.000	0.000	820.000

Calculated H Value = -5736.008

Critical H Value Table = 11.070

Since Calc H < Crit H FAIL TO REJECT Ho:All groups are equal.

Endothall 21 Day Daphnia dry body weight

File: c:\chem\endothal\dapwt.dat

Transform: NO TRANSFORM

DUNNS MULTIPLE COMPARISON - KRUSKAL-WALLIS - TABLE 2 OF 2

GROUP	IDENTIFICATION	TRANSFORMED MEAN	ORIGINAL MEAN	GROUP					
				0	0	0	0	0	0
				6	1	2	5	3	4
6	30	0.000	0.000	\					
1	control	1.336	1.336	*	\				
2	1.9	1.357	1.357	*	.	\			
5	15	1.455	1.455	*	.	.	\		
3	3.8	1.519	1.519	*	.	.	.	\	
4	7.5	1.618	1.618	*	*	*	.	.	\

* = significant difference (p=0.05)
Table q value (0.05,6) = 2.936

. = no significant difference
Unequal reps - multiple SE values

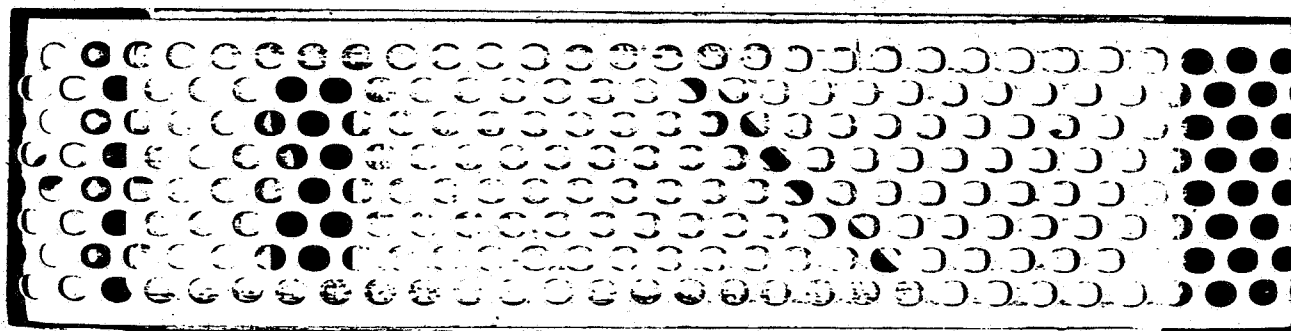
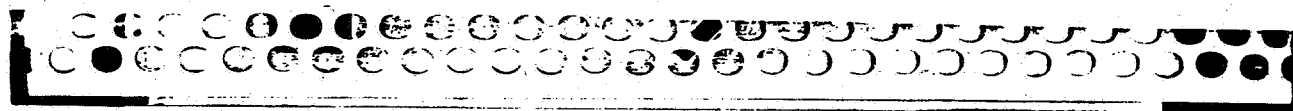


Figure 1
21 Day Daphnia Study
Percent Difference Between Measured Concentrations of Endothall

Nominal Conc.	Pretest #1	Pretest #2	Day 0	Day 7	Day 14	Day 21	Means
30	31	33	37	32	37	35	34.17
	31	33	34	33	39	32	33.67
	0.00%	0.00%	8.11%	-3.13%	-5.41%	8.57%	1.46%
15	NA	NA	17	16	18	17	11.33
	NA	NA	17	16	18	16	11.17
			0.00%	0.00%	0.00%	5.88%	1.47%
7.5	8.9	9.2	9.4	8.2	9.7	8.3	8.95
	8.9	9.7	9.7	8.3	9.7	8.2	9.08
	0.00%	-5.43%	-3.19%	-1.22%	0.00%	1.20%	-1.49%
3.8	NA	NA	5.2	4.7	5.7	4.1	3.28
	NA	NA	5.3	4.8	5.7	4.5	3.38
			-1.92%	-2.13%	0.00%	-9.76%	-3.05%
1.9	**						
	4.1	2.8	2.5	2.1	2.3	1.9	2.62
	2.7	2.9	2.5	1.9	2.3	1.9	2.37
	34.15%	-3.57%	0.00%	9.52%	0.00%	0.00%	9.55%

* The number of times the 10% difference was exceeded for a given conce
 ** The difference between the two replicates exceeds the 10% allowed by t

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Figure 2

Daphnia magna Reproduction Test Summary

Conc. mg/L	REP.	Offspring / Female	Offspring / Female /Day @ Day 21
Control	A	232	11.05
	B	215	10.24
	C	222	10.57
	D	218	10.38
Average		221.75	10.56
1.9	A	211	10.05
	B	181	8.62
	C	196	9.33
	D	183	8.71
Average		192.75	9.18
3.8	A	222	10.57
	B	208	9.90
	C	211	10.05
	D	231	11.00
Average		216.67	10.32
7.5	A	208	9.90
	B	181	8.62
	C	200	9.52
	D	171	8.14
Average		190	9.05
15	A	88	4.19
	B	126	6.00
	C	122	5.81
	D	124	5.90
Average		115	5.48
30	A	0	0.00
	B	0	0.00
	C	0	0.00
	D	0	0.00
Average		0	0.00