ECOLOGICAL EFFECTS BRANCH
DATA EVALUATION REPORT

1. **Chemical:** Phosmet

2. **Test Material:** Phosmet technical 95.5% ai.

3. **Study Type:** 29 Day Flow through Life Cycle Study with the saltwater mysid, *Mysidopsis bahia*

4. **Study Identification:**
   Study Director: Drotter, Kurt
   Study Laboratory: Wildlife International Ltd, Easton, Md.
   Study Dates: December 21 - January 19, 1993
   Study Identification: Project No. 334A-101B
   Study Sponsor: Gowen Company, Yuma Arizona
   EPA Identification: MRID 42724901

5. **Reviewed by:** Brian Montague, Fisheries Biologist
   Ecological Effects Branch
   Environmental Fate and Effects Division (H507C)

   Brian Montague 5/2/94

6. **Approved by:** Les Touart, PhD, Section Supervisor
   Ecological Effects Branch
   Environmental Fate and Effects Division

   5/9/94

7. **Conclusions:** Phosmet reduced survival of adult mysids at concentration ≥1.3 ug ai/L and reduced survival of second generation young at 0.69 ug ai/L. Therefore the chronic LOEC for mysid is 0.69 ug ai/L and the NOEL is 0.37 ug ai/L. Phosmet has been shown to be very highly toxic to life cycle processes of *Mysidopsis bahia*.

8. **Recommendations:** N/A.

9. **Submission Purpose:** This study was submitted to satisfy Estuarine Invertebrate Lifecycle study requirements for reregistration of Phosmet insecticide on crops which could be located near estuarine environments.

10. **Test Methods and Protocol:** ASTM E 1191-87, Standard Guide for Conducting Life Cycle Toxicity Test with Saltwater mysids was used as a basis for Wildlife International's protocol design.

Dilution Water and Test Solutions Preparations: The water used for holding, acclimation, and testing was natural sea water collected at Indian River Inlet, Delaware, and diluted to the appropriate salinity with well water.

The freshly collected seawater was passed through a sand filter to remove particles greater than approximately 25 m, and pumped into a 37,800-L storage tank. The filtered seawater then was diluted with fresh water from a well on site and aerated with spray nozzles. Prior to delivery to the diluter system, the water was filtered again to remove microorganisms and particulates.

A primary stock solution of the [^{14}C]-phosmet was prepared by diluting the radiolabelled test substance in acetone at a concentration of 0.1505 mg a.i./mL. A primary stock solution of non-labelled phosmet was prepared by dissolving the test substance in acetone at a concentration of 0.5 mg a.i./mL. One working stock then was prepared for each of the five test substance concentrations by combining aliquots of the two primary stocks and diluting with acetone to yield working stocks with nominal concentrations of 0.084, 0.042, 0.021, 0.011, 0.0053 mg a.i./mL. The five stocks were pumped through the diluter and mixed with saltwater to achieve the desired test concentrations. The concentration of the solvent in the solvent control and in all phosmet treatment groups was 0.04 mL/L.

Test Organisms: Mysids used in the test were juveniles less than 24 hours old, and were obtained from cultures maintained by Wildlife International Ltd., Easton, Maryland 21601.

Adult mysids in the cultures were held in water from the same source as used during the test. The adult mysids were held for at least 14 days prior to collection of the juveniles for testing. During the hold period the adults showed no signs of disease or stress. Thirty juveniles mysids were collected from the cultures using wide-bore disposable pipettes and transferred to each of two 25 mL plastic cups. The cups were gently dipped into the test chambers and inverted at the test solution level to release the mysids. 60 mysids were tested

per concentration level. The juvenile mysids were fed live brine shrimp (*Artemia* sp) nauplii three times a day during the test to prevent cannibalism. Brine shrimp nauplii were periodically enriched with a fatty acid supplement.

Test Material and Design: A continuous-flow diluter was used to provide each concentration of the test substance, a negative (saltwater) control, and a solvent control. A syringe pump was used to inject the test substance and solvent control stock solutions into the mixing chambers. The flow of dilution water into the mixing chambers was controlled using rotameters. After mixing, test water was split into replicate test chambers. Except for the plastic syringes used in the syringe pump, all materials that came in contact with the test substance were constructed of nylon, stainless steel, glass, silicone, or Teflon.

Each test chamber received approximately 16 volume additions of test water every 24 hours. The delivery of test substance to test chambers was initiated approximately 3 days prior to the beginning of the test. The general operation of the diluter was checked visually two times per day during the test.

Test compartments used prior to pairing of the mysids were constructed from glass culture dishes approximately 11.5 cm in diameter and 6.5 cm in height. Nylon screen was attached to the sides extending approximately 13 cm above the glass sides. Test compartments used after pairing of the mysids were constructed from glass petri dishes approximately 5.5 cm in diameter and 1.5 cm in height. Nylon screen was attached to the sides extending approximately 10.5 cm above the glass sides. The test compartments were placed in Teflon-lined, 25-L test chambers filled with up to approximately 9 L of water. The minimum volume of water in the test chambers was approximately 6.3 L. The test chambers were indiscriminately positioned in a temperature-controlled water bath to maintain a temperature of 27 $\pm 1^{\circ}$C. The water bath was enclosed in a plexiglass ventilation hood in order to minimize potential cross-contamination between test systems used for other testing procedures.

Temperature was recorded continuously in one replicate of the negative control. Temperature was also measured in both replicates of each treatment and control group at the beginning of the test, at weekly intervals thereafter, and at the end of the test using a calibrated, hand-held thermometer.

Measurements of dissolved oxygen and pH were made in alternating replicates of each treatment and control on the day of test initiation, at weekly intervals thereafter, and at test termination. Salinity was measured daily in alternating

replicates of the negative control on days 0, 1, 2, 3, 7, 14, 21, and 29 in the other treatments.

Fluorescent tubes that emit wavelengths similar to natural sunlight were controlled by an automatic timer to provide a photoperiod of 16 hours of light and 8 hours of darkness. The light intensity ranged from approximately 216 to 539 lux at the surface of the water.

Observations of the survival and behavior of each first-generation mysid were made daily throughout the test. The criteria for death included absence of heartbeat, white opaque coloration, lack of movement of appendages, and lack of response to gentle prodding.

After mysids were paired, the number of second-generation mysids was counted and recorded daily until test termination. Second generation mysids were also observed for abnormal development and aberrant behavior. After each observation, second-generation mysids were discarded. If a male in a male/female pair was observed as dead, it was replaced, if possible, with a male from the additional compartment in the same replicate. The length of each surviving first-generation mysid was measured at test termination using a gridded coverslip. The dry weight of each surviving first-generation mysid was also determined.

Duplicate water samples were collected from each test chamber on the day of test initiation, at weekly intervals thereafter, and on the day of test termination to verify the concentrations of the test substance.

In addition to the weekly samples, three confirmatory sets of samples were also collected: On day 15 of the test, liquid scintillation analysis of Day 14 samples indicated that the concentrations had dropped to approximately 50 percent of nominal. It was determined that the delivery lines into the mixing chambers were obstructed. This delivery problem was corrected and samples were collected on Day 15 to document that the test concentrations had returned to nominal levels. On Day 20 of the test, the delivery pump failed and samples were collected to determine worst case concentrations. After the pump failure on Day 20, new pumps were calibrated and the old pump was replaced; samples were collected at approximately 1600 hours.

11. **Reported Test Results:** Duplicate samples were collected from each A and B replicate test chamber on days, 0, 7, 14, 15, 20, 21, 28 and 29. Values for replicate test chambers A and B for all sample periods were averaged to determine mean measured concentrations for the test. Overall mean measured concentrations during the exposure period were 0.16, 0.37,

0.69, 1.3 and 2.6 g a.i./L. The mean measured values were 84, 97, 92, 87, and 97% of nominal test concentrations, respectively.

Results of day 14 analytical measurements were approximately 50 percent of nominal, indicating a reduction in test substance delivery. After the lines were cleared, test concentrations increased to normal levels. The reduction in test substance delivery on day 14 was believed to be of short duration and due to precipitate in the test substance delivery lines.

The duration of stock delivery interruption on Days 20 and 29 was back calculated from stock usage (based on amount remaining in pump). These calculations indicated down times of 7 and 16.3 hours, respectively., The reductions in test substance delivery were intermittent. Consequently, the interruptions were not considered to adversely affect the results of the study. Temperatures were within the range established for the test ($27\pm1^{\circ}C$). Dissolved oxygen concentration remained $\geq$60% of saturation throughout the test period.

Mysid mortality in the negative and solvent control groups prior to pairing was 15% and 38%, respectively, thus survival in the solvent control was significantly reduced in comparison to the negative control. Consequently, all comparisons were made against the solvent control. There were no apparent treatment related effects upon mortality prior to pairing at the 0.16, 0.37, and 0.69 g a.i./L test concentrations. There did appear to be treatment related increases in the 1.3 and 2.6 g a.i./L test concentrations. The reduction in survival was statistically significant only in the 2.6 g a.i. treatment group.

Mortality following pairing (days 15 through 29) averaged 16% and 10% for the negative and solvent controls, respectively. Mean percent mortality values for the 0.16, 0.37, 0.69, 1.3, and 2.6 g a.i./L test concentrations were 43, 27, 28, 64, and 100%, respectively. A statistically significant reduction in survival was found in all treatment groups except the 0.37 g a.i.L treatment group. The mortality in the 0.16 and 0.69 g a.i./L did not exhibit a concentration-response relationship. Consequently, the mortality in the 0.16 and 0.69 g a.i./L treatment groups was not considered by the laboratory to be treatment related.

Clinical observations made during the test included surfacing, lethargy, discoloration, erratic swimming and loss of equilibrium. The majority of these observations were made in the 2.6 g a.i./L treatment group and were considered to be treatment related.

Mysid young were first observed in replicate A of the 1.3 g a.i./L treatment group on day 16. The total number of young produced in the negative control and solvent control groups was 126 and 51, respectively. Total number of young produced in the phosmet treatment groups ranged from 2 in the 2.6 g a.i./L treatment group to 84 in the 0.37 g a.i./L treatment group.

Mean production in the negative and solvent control groups was 0.4506 and 0.2664 young per reproduction day, respectively.

Although the number of young produced per reproduction day were variable, there were no apparent treatment related effects upon mysid production in either the 0.16 or 0.37 g a.i./L treatment groups. Reproduction was significantly reduced in the 0.69 g a.i./L treatment group in comparison to the solvent control. Reproduction was not evaluated in the 1.3 or 2.6 g a.i./L treatment groups because of the magnitude of the effects upon survival.

Growth was determined by measuring the length and dry weight of each surviving first-generation mysid at the termination of the test. When compared with the appropriate control, there were no statistically significant effects upon the lengths or weights of either sex in the 0.69 g a.i./L treatment groups.

12. **Study Author's Conclusions:** "There were no apparent treatment related effects upon the survival, reproduction or growth of Mysidopsis bahia exposed to phosmet at 0.37 g a.i./L. Treatment related reductions upon mysid survival were evident for mysids exposed to phosmet concentrations $\geq$ 1.3 g a.i./L. A treatment related reduction in mysid reproduction was evident for mysids exposed to 0.69 ug a.i./L. Consequently, the lowest observed effect concentration (LOEC), based on mysid reproduction, was 0.69 g a.i./L. The no observed effect concentration (NOEC) for phosmet in this test for 0.37 g a.i./L."

13. **Reviewer's Discussion:** Though not confirmed by the study labs the ASTM guidelines suggest broadstock areas be isolated from test areas. It was not clear whether this is the case at the WLI facility. Observations of a 50% reduction in concentration levels were based on day 14 analytical samples. The precipitate blockage was not visually observed until day 15. Thus, the blockage may have existed for > 12 hours. Based on analysis of stock solution remaining the laboratory estimated that 95% of expected stock solution depletion had occurred. Thus, only a 5% reduction overall appears to have occurred between Day 14 and 15 and this reduction affected all treatment groups equally. The pump failure on day 20 was

calculated to have effected flow for at least 7 hours but on an intermittent basis. It is not completely apparent as to why these precipitates occurred after test solution preparation unless solvent efficiency was in some way reduced during the experimental phase of the study. The other factor that must be considered is whether precipitate blockage occurred more than 1 or 2 days prior to 14 and was not noted in daily observations. The same concerns apply to the pump failure, though this would seem to be a more noticeable breakdown of the system. Day 29 precipitate blockages were late enough in the study to have offered little potential effect on overall outcome of the study. Despite these malfunctions concentration remained close to or over 50% of mean measured concentration during the blockage period. Use of teflon-lined test chambers is not mentioned in ASTM recommendations - however subsequent measurements of test concentrations do not indicate that Phosmet was absorbed to this material in any great mounts. ASTM recommends that seawater be passed through 15 um filters to remove possible mysid larvae predators. WLI employs sand filters which allow larger than recommended particulates or contaminants. It was not clear what size filtration was employed after sand filtration. Though, at first glance solvent controls appear to display solvent effects on adult survival prior to pairing, test groups containing equivalent amounts of acetone display lower mortality levels. Thus, the abnormally high mortality level in the solvent control is apparently due to some other stressor. Mortality of surviving mysids after pairing in the solvent controls does not display a similar trend.

Reproductive rates among the two control were minimally acceptable in three of 4 replicates. Mean averages of young per female were 3.6, 3.16, and 3.56 which is barely above the 3.0 young/female minimum suggested by ASTM. Weekly temperature, pH, and salinity appeared to remained within acceptable ranges through the study period. Dissolved oxygen levels dropped notably on days 14, 20, and 28 when diluter flows were impeded. Day 21 measurements for the treatment groups fell to below 68% of saturation. There is no indication of increased mortality among first generation mysids during the week following this date so it appears that no stress related effects were caused by this DO drop.

Independent statistical analysis of the data presented has confirmed that reproductive impairment occurred at a dosage level of 1.3 ug ai/L. Survival was significantly effected at dosages below 2.7 ug ai/L.

Adequacy of Study:

Category: Core

Rationale: Though some problems were experienced during the study they are not felt to have changed the outcome. The Agency statistical analysis supports the study author's conclusions.

Repairable: N/A.

Phosmet Mortality After Pairing Mysids-Generation 1
File: phosgen2.mo Transform: NO TRANSFORM

SUMMARY STATISTICS ON TRANSFORMED DATA TABLE 1 of 2

GRP	IDENTIFICATION	N	MIN	MAX	MEAN
1	Solvent Control	2	1.000	2.000	1.500
2	Dilute Control	2	1.000	6.000	3.500
3	0.16 PPB	2	6.000	10.000	8.000
4	0.37 PPB	2	3.000	9.000	6.000
5	0.69 PPB	2	5.000	8.000	6.500
6	1.3 PPB	2	12.000	39.000	25.500

Phosmet Mortality After Pairing Mysids-Generation 1
File: phosgen2.mo Transform: NO TRANSFORM

SUMMARY STATISTICS ON TRANSFORMED DATA TABLE 2 of 2

GRP	IDENTIFICATION	VARIANCE	SD	SEM
1	Solvent Control	0.500	0.707	0.500
2	Dilute Control	12.500	3.536	2.500
3	0.16 PPB	8.000	2.828	2.000
4	0.37 PPB	18.000	4.243	3.000
5	0.69 PPB	4.500	2.121	1.500
6	1.3 PPB	364.500	19.092	13.500

Phosmet Mortality After Pairing Mysids-Generation 1
File: phosgen2.mo Transform: NO TRANSFORM

ANOVA TABLE

SOURCE	DF	SS	MS	F
Between	5	747.000	149.400	2.197
Within (Error)	6	408.000	68.000	
Total	11	1155.000		

Critical F value = 4.39 (0.05,5,6)
Since F < Critical F FAIL TO REJECT Ho:All groups equal

Phosmet Mortality After Pairing Mysids-Generation 1
File: phosgen2.mo 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	Solvent Control	1.500	1.500		
2	Dilute Control	3.500	3.500	-0.243	
3	0.16 PPB	8.000	8.000	-0.788	
4	0.37 PPB	6.000	6.000	-0.546	
5	0.69 PPB	6.500	6.500	-0.606	
6	1.3 PPB	25.500	25.500	-2.910	

Dunnett table value = 2.83 (1 Tailed Value, P=0.05, df=6,5)

Phosmet Mortality After Pairing Mysids-Generation 1
File: phosgen2.mo 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	Solvent Control	2			
2	Dilute Control	2	23.337	1555.8	-2.000
3	0.16 PPB	2	23.337	1555.8	-6.500
4	0.37 PPB	2	23.337	1555.8	-4.500
5	0.69 PPB	2	23.337	1555.8	-5.000
6	1.3 PPB	2	23.337	1555.8	-24.000

Phosmet Mortality After Pairing Mysids-Generation 1
File: phosgen2.mo Transform: NO TRANSFORM

ANOVA TABLE

SOURCE	DF	SS	MS	F
Between	5	747.000	149.400	2.197
Within (Error)	6	408.000	68.000	
Total	11	1155.000		

Critical F value = 4.39 (0.05,5,6)
Since F < Critical F FAIL TO REJECT Ho:All groups equal

Phosmet Mortality After Pairing Mysids-Generation 1
File: phosgen2.mo Transform: NO TRANSFORM

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

		TRANSFORMED	MEAN CALCULATED IN

GROUP	IDENTIFICATION	MEAN	ORIGINAL UNITS	T STAT	SIG
1	Solvent Control	1.500	1.500		
2	Dilute Control	3.500	3.500	-0.243	
3	0.16 PPB	8.000	8.000	-0.788	
4	0.37 PPB	6.000	6.000	-0.546	
5	0.69 PPB	6.500	6.500	-0.606	
6	1.3 PPB	25.500	25.500	-2.910	

Bonferroni T table value = 3.14 (1 Tailed Value, P=0.05, df=6,5)

Phosmet Mortality After Pairing Mysids-Generation 1
File: phosgen2.mo 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	Solvent Control	2			
2	Dilute Control	2	25.918	1727.9	-2.000
3	0.16 PPB	2	25.918	1727.9	-6.500
4	0.37 PPB	2	25.918	1727.9	-4.500
5	0.69 PPB	2	25.918	1727.9	-5.000
6	1.3 PPB	2	25.918	1727.9	-24.000

Phosmet Mortality After Pairing Mysids-Generation 1
File: phosgen2.mo Transform: NO TRANSFORM

WILLIAMS TEST (Isotonic regression model) TABLE 1 OF 2

GROUP	IDENTIFICATION	N	ORIGINAL MEAN	TRANSFORMED MEAN	ISOTONIZED MEAN
1	Solvent Control	2	1.500	1.500	1.500
2	Dilute Control	2	3.500	3.500	3.500
3	0.16 PPB	2	8.000	8.000	6.833
4	0.37 PPB	2	6.000	6.000	6.833
5	0.69 PPB	2	6.500	6.500	6.833
6	1.3 PPB	2	25.500	25.500	25.500

Phosmet Mortality After Pairing Mysids-Generation 1
File: phosgen2.mo 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
Solvent Control	1.500				
Dilute Control	3.500	0.243		1.94	k= 1, v= 6
0.16 PPB	6.833	0.647		2.06	k= 2, v= 6

0.37 PPB	6.833	0.647		2.10	k= 3, v= 6
0.69 PPB	6.833	0.647		2.12	k= 4, v= 6
1.3 PPB	25.500	2.910	*	2.13	k= 5, v= 6

s = 8.246

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

Phosmet Mean Mysid Young Produced/female
File: phosmys.ypf Transform: NO TRANSFORM

SUMMARY STATISTICS ON TRANSFORMED DATA TABLE 1 of 2

GRP	IDENTIFICATION	N	MIN	MAX	MEAN
1	Solvent Control	2	3.160	3.560	3.360
2	Dilute Control	2	3.600	9.000	6.300
3	0.16 PPB	2	1.770	4.000	2.885
4	0.37 PPB	2	4.100	5.370	4.735
5	0.69 PPB	2	0.880	1.880	1.380
6	1.3 PPB	2	0.666	2.620	1.643
7	2.6 PPB	2	0.000	0.660	0.330

Phosmet Mean Mysid Young Produced/female
File: phosmys.ypf Transform: NO TRANSFORM

SUMMARY STATISTICS ON TRANSFORMED DATA TABLE 2 of 2

GRP	IDENTIFICATION	VARIANCE	SD	SEM
1	Solvent Control	0.080	0.283	0.200
2	Dilute Control	14.580	3.818	2.700
3	0.16 PPB	2.486	1.577	1.115
4	0.37 PPB	0.806	0.898	0.635
5	0.69 PPB	0.500	0.707	0.500
6	1.3 PPB	1.909	1.382	0.977
7	2.6 PPB	0.218	0.467	0.330

Phosmet Mean Mysid Young Produced/female
File: phosmys.ypf Transform: NO TRANSFORM

ANOVA TABLE

SOURCE	DF	SS	MS	F
Between	6	51.237	8.540	2.905
Within (Error)	7	20.580	2.940	
Total	13	71.817		

Critical F value = 3.87 (0.05,6,7)
Since F < Critical F FAIL TO REJECT Ho:All groups equal

Phosmet Mean Mysid Young Produced/female

File: phosmys.ypf 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	Solvent Control	3.360	3.360		
2	Dilute Control	6.300	6.300	-1.715	
3	0.16 PPB	2.885	2.885	0.277	
4	0.37 PPB	4.735	4.735	-0.802	
5	0.69 PPB	1.380	1.380	1.155	
6	1.3 PPB	1.643	1.643	1.001	
7	2.6 PPB	0.330	0.330	1.767	

Dunnett table value = 2.82 (1 Tailed Value, P=0.05, df=7,6)

Phosmet Mean Mysid Young Produced/female
File: phosmys.ypf 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	Solvent Control	2			
2	Dilute Control	2	4.835	143.9	-2.940
3	0.16 PPB	2	4.835	143.9	0.475
4	0.37 PPB	2	4.835	143.9	-1.375
5	0.69 PPB	2	4.835	143.9	1.980
6	1.3 PPB	2	4.835	143.9	1.717
7	2.6 PPB	2	4.835	143.9	3.030

Phosmet Mean Mysid Young Produced/female
File: phosmys.ypf Transform: NO TRANSFORM

ANOVA TABLE

SOURCE	DF	SS	MS	F
Between	6	51.237	8.540	2.905
Within (Error)	7	20.580	2.940	
Total	13	71.817		

Critical F value = 3.87 (0.05,6,7)
Since F < Critical F FAIL TO REJECT Ho:All groups equal

Phosmet Mean Mysid Young Produced/female
File: phosmys.ypf 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	Solvent Control	3.360	3.360		
2	Dilute Control	6.300	6.300	-1.715	
3	0.16 PPB	2.885	2.885	0.277	
4	0.37 PPB	4.735	4.735	-0.802	
5	0.69 PPB	1.380	1.380	1.155	
6	1.3 PPB	1.643	1.643	1.001	
7	2.6 PPB	0.330	0.330	1.767	

Bonferroni T table value = 3.13 (1 Tailed Value, P=0.05, df=7,6)

Phosmet Mean Mysid Young Produced/female
File: phosmys.ypf 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	Solvent Control	2			
2	Dilute Control	2	5.363	159.6	-2.940
3	0.16 PPB	2	5.363	159.6	0.475
4	0.37 PPB	2	5.363	159.6	-1.375
5	0.69 PPB	2	5.363	159.6	1.980
6	1.3 PPB	2	5.363	159.6	1.717
7	2.6 PPB	2	5.363	159.6	3.030

Phosmet Mean Mysid Young Produced/female
File: phosmys.ypf Transform: NO TRANSFORM

WILLIAMS TEST (Isotonic regression model) TABLE 1 OF 2

GROUP	IDENTIFICATION	N	ORIGINAL MEAN	TRANSFORMED MEAN	ISOTONIZED MEAN
1	Solvent Control	2	3.360	3.360	4.830
2	Dilute Control	2	6.300	6.300	4.830
3	0.16 PPB	2	2.885	2.885	3.810
4	0.37 PPB	2	4.735	4.735	3.810
5	0.69 PPB	2	1.380	1.380	1.512
6	1.3 PPB	2	1.643	1.643	1.512
7	2.6 PPB	2	0.330	0.330	0.330

Phosmet Mean Mysid Young Produced/female
File: phosmys.ypf 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
Solvent Control	4.830				
Dilute Control	4.830	0.857		1.89	k= 1, v= 7
0.16 PPB	3.810	0.262		2.00	k= 2, v= 7
0.37 PPB	3.810	0.262		2.04	k= 3, v= 7
0.69 PPB	1.512	1.078		2.06	k= 4, v= 7
1.3 PPB	1.512	1.078		2.07	k= 5, v= 7
2.6 PPB	0.330	1.767		2.08	k= 6, v= 7

s = 1.715

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

Phosmet Female Terminal Length in mm
File: phosmys.fwt Transform: NO TRANSFORM

SUMMARY STATISTICS ON TRANSFORMED DATA TABLE 1 of 2

GRP	IDENTIFICATION	N	MIN	MAX	MEAN
1	Solvent Control	2	6.800	7.200	7.000
2	Dilute Control	2	7.560	7.830	7.695
3	0.16	2	7.080	7.080	7.080
4	0.37	2	7.000	7.280	7.140
5	0.69	2	6.720	6.730	6.725
6	1.3	2	6.650	7.090	6.870

Phosmet Female Terminal Length in mm
File: phosmys.fwt Transform: NO TRANSFORM

SUMMARY STATISTICS ON TRANSFORMED DATA TABLE 2 of 2

GRP	IDENTIFICATION	VARIANCE	SD	SEM
1	Solvent Control	0.080	0.283	0.200
2	Dilute Control	0.036	0.191	0.135
3	0.16	0.000	0.000	0.000
4	0.37	0.039	0.198	0.140
5	0.69	0.000	0.007	0.005
6	1.3	0.097	0.311	0.220

Phosmet Female Terminal Length in mm
File: phosmys.fwt Transform: NO TRANSFORM

ANOVA TABLE

SOURCE	DF	SS	MS	F
Between	5	1.116	0.223	5.310
Within (Error)	6	0.253	0.042	
Total	11	1.369		

Critical F value = 4.39 (0.05,5,6)
Since F > Critical F REJECT Ho:All groups equal

Phosmet Female Terminal Length in mm
File: phosmys.fwt 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	Solvent Control	7.000	7.000		
2	Dilute Control	7.695	7.695	-3.391	
3	0.16	7.080	7.080	-0.390	
4	0.37	7.140	7.140	-0.683	
5	0.69	6.725	6.725	1.342	
6	1.3	6.870	6.870	0.634	

Dunnett table value = 2.83 (1 Tailed Value, P=0.05, df=6,5)

Phosmet Female Terminal Length in mm
File: phosmys.fwt 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	Solvent Control	2			
2	Dilute Control	2	0.580	8.3	-0.695
3	0.16	2	0.580	8.3	-0.080
4	0.37	2	0.580	8.3	-0.140
5	0.69	2	0.580	8.3	0.275
6	1.3	2	0.580	8.3	0.130

Phosmet Female Terminal Length in mm
File: phosmys.fwt Transform: NO TRANSFORM

ANOVA TABLE

SOURCE	DF	SS	MS	F
Between	5	1.116	0.223	5.310
Within (Error)	6	0.253	0.042	
Total	11	1.369		

Critical F value = 4.39 (0.05,5,6)
Since F > Critical F REJECT Ho:All groups equal

Phosmet Female Terminal Length in mm
File: phosmys.fwt Transform: NO TRANSFORM

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

TRANSFORMED MEAN CALCULATED IN

GROUP	IDENTIFICATION	MEAN	ORIGINAL UNITS	T STAT	SIG
1	Solvent Control	7.000	7.000		
2	Dilute Control	7.695	7.695	-3.391	
3	0.16	7.080	7.080	-0.390	
4	0.37	7.140	7.140	-0.683	
5	0.69	6.725	6.725	1.342	
6	1.3	6.870	6.870	0.634	

Bonferroni T table value = 3.14 (1 Tailed Value, P=0.05, df=6,5)

Phosmet Female Terminal Length in mm
File: phosmys.fwt 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	Solvent Control	2			
2	Dilute Control	2	0.644	9.2	-0.695
3	0.16	2	0.644	9.2	-0.080
4	0.37	2	0.644	9.2	-0.140
5	0.69	2	0.644	9.2	0.275
6	1.3	2	0.644	9.2	0.130

Phosmet Female Terminal Length in mm
File: phosmys.fwt Transform: NO TRANSFORM

WILLIAMS TEST (Isotonic regression model) TABLE 1 OF 2

GROUP	IDENTIFICATION	N	ORIGINAL MEAN	TRANSFORMED MEAN	ISOTONIZED MEAN
1	Solvent Control	2	7.000	7.000	7.348
2	Dilute Control	2	7.695	7.695	7.348
3	0.16	2	7.080	7.080	7.110
4	0.37	2	7.140	7.140	7.110
5	0.69	2	6.725	6.725	6.798
6	1.3	2	6.870	6.870	6.798

Phosmet Female Terminal Length in mm
File: phosmys.fwt 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
Solvent Control	7.348				
Dilute Control	7.348	1.694		1.94	k= 1, v= 6
0.16	7.110	0.536		2.06	k= 2, v= 6

0.37	7.110	0.536	2.10	k= 3, v= 6
0.69	6.798	0.987	2.12	k= 4, v= 6
1.3	6.798	0.987	2.13	k= 5, v= 6

s = 0.205

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

Phosmet Mysid Mean Terminal Length Males
File: phosmys.mwt Transform: NO TRANSFORM

SUMMARY STATISTICS ON TRANSFORMED DATA TABLE 1 of 2

GRP	IDENTIFICATION	N	MIN	MAX	MEAN
1	Solvent Control	2	6.890	7.080	6.985
2	Dilute Control	2	7.670	8.040	7.855
3	0.16	2	6.880	7.410	7.145
4	0.37	2	6.970	7.420	7.195
5	0.69	2	6.700	7.000	6.850
6	1.3	2	6.650	6.800	6.725

Phosmet Mysid Mean Terminal Length Males
File: phosmys.mwt Transform: NO TRANSFORM

SUMMARY STATISTICS ON TRANSFORMED DATA TABLE 2 of 2

GRP	IDENTIFICATION	VARIANCE	SD	SEM
1	Solvent Control	0.018	0.134	0.095
2	Dilute Control	0.068	0.262	0.185
3	0.16	0.140	0.375	0.265
4	0.37	0.101	0.318	0.225
5	0.69	0.045	0.212	0.150
6	1.3	0.011	0.106	0.075

Phosmet Mysid Mean Terminal Length Males
File: phosmys.mwt Transform: NO TRANSFORM

ANOVA TABLE

SOURCE	DF	SS	MS	F
Between	5	1.587	0.317	4.953
Within (Error)	6	0.384	0.064	
Total	11	1.971		

Critical F value = 4.39 (0.05,5,6)
Since F > Critical F REJECT Ho:All groups equal

Phosmet Mysid Mean Terminal Length Males
File: phosmys.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	Solvent Control	6.985	6.985		
2	Dilute Control	7.855	7.855	-3.439	
3	0.16	7.145	7.145	-0.632	
4	0.37	7.195	7.195	-0.830	
5	0.69	6.850	6.850	0.534	
6	1.3	6.725	6.725	1.028	

Dunnett table value = 2.83 (1 Tailed Value, P=0.05, df=6,5)

Phosmet Mysid Mean Terminal Length Males
File: phosmys.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	Solvent Control	2			
2	Dilute Control	2	0.716	10.2	-0.870
3	0.16	2	0.716	10.2	-0.160
4	0.37	2	0.716	10.2	-0.210
5	0.69	2	0.716	10.2	0.135
6	1.3	2	0.716	10.2	0.260

Phosmet Mysid Mean Terminal Length Males
File: phosmys.mwt Transform: NO TRANSFORM

ANOVA TABLE

SOURCE	DF	SS	MS	F
Between	5	1.587	0.317	4.953
Within (Error)	6	0.384	0.064	
Total	11	1.971		

Critical F value = 4.39 (0.05,5,6)
Since F > Critical F REJECT Ho:All groups equal

Phosmet Mysid Mean Terminal Length Males
File: phosmys.mwt Transform: NO TRANSFORM

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

TRANSFORMED MEAN CALCULATED IN

GROUP	IDENTIFICATION	MEAN	ORIGINAL UNITS	T STAT	SIG
1	Solvent Control	6.985	6.985		
2	Dilute Control	7.855	7.855	-3.439	
3	0.16	7.145	7.145	-0.632	
4	0.37	7.195	7.195	-0.830	
5	0.69	6.850	6.850	0.534	
6	1.3	6.725	6.725	1.028	

Bonferroni T table value = 3.14 (1 Tailed Value, P=0.05, df=6,5)

Phosmet Mysid Mean Terminal Length Males
File: phosmys.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	Solvent Control	2			
2	Dilute Control	2	0.795	11.4	-0.870
3	0.16	2	0.795	11.4	-0.160
4	0.37	2	0.795	11.4	-0.210
5	0.69	2	0.795	11.4	0.135
6	1.3	2	0.795	11.4	0.260

Phosmet Mysid Mean Terminal Length Males
File: phosmys.mwt Transform: NO TRANSFORM

WILLIAMS TEST (Isotonic regression model) TABLE 1 OF 2

GROUP	IDENTIFICATION	N	ORIGINAL MEAN	TRANSFORMED MEAN	ISOTONIZED MEAN
1	Solvent Control	2	6.985	6.985	7.420
2	Dilute Control	2	7.855	7.855	7.420
3	0.16	2	7.145	7.145	7.170
4	0.37	2	7.195	7.195	7.170
5	0.69	2	6.850	6.850	6.850
6	1.3	2	6.725	6.725	6.725

Phosmet Mysid Mean Terminal Length Males
File: phosmys.mwt 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
Solvent Control	7.420				
Dilute Control	7.420	1.718		1.94	k= 1, v= 6
0.16	7.170	0.731		2.06	k= 2, v= 6

0.37	7.170	0.731	2.10	k= 3, v= 6
0.69	6.850	0.533	2.12	k= 4, v= 6
1.3	6.725	1.027	2.13	k= 5, v= 6

s = 0.253

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

Phosmet Mysid Terminal Dry Weights
File: phosmysf.wt Transform: NO TRANSFORM

SUMMARY STATISTICS ON TRANSFORMED DATA TABLE 1 of 2

GRP	IDENTIFICATION	N	MIN	MAX	MEAN
1	Solvent Control	12	0.540	0.910	0.671
2	Dilute Control	18	0.760	1.570	1.085
3	0.16	10	0.650	1.470	0.933
4	0.37	14	0.590	1.070	0.803
5	0.69	14	0.510	0.820	0.659
6	1.3	7	0.570	0.800	0.669

Phosmet Mysid Terminal Dry Weights
File: phosmysf.wt Transform: NO TRANSFORM

SUMMARY STATISTICS ON TRANSFORMED DATA TABLE 2 of 2

GRP	IDENTIFICATION	VARIANCE	SD	SEM
1	Solvent Control	0.011	0.104	0.030
2	Dilute Control	0.040	0.199	0.047
3	0.16	0.060	0.245	0.078
4	0.37	0.018	0.135	0.036
5	0.69	0.006	0.078	0.021
6	1.3	0.005	0.073	0.028

Phosmet Mysid Terminal Dry Weights
File: phosmysf.wt Transform: NO TRANSFORM

ANOVA TABLE

SOURCE	DF	SS	MS	F
Between	5	2.181	0.436	18.167
Within (Error)	69	1.682	0.024	
Total	74	3.863		

Critical F value = 2.37 (0.05,5,60)
Since F > Critical F REJECT Ho:All groups equal

Phosmet Mysid Terminal Dry Weights

File: phosmysf.wt Transform: NO TRANSFORM

DUNNETTS TEST

****** WARNING ******

This data set has unequal replicates. The Bonferroni T-test should be used instead of the Dunnetts test.

Phosmet Mysid Terminal Dry Weights
File: phosmysf.wt 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	Solvent Control	0.671	0.671		
2	Dilute Control	1.085	1.085	-7.174	
3	0.16	0.933	0.933	-3.952	
4	0.37	0.803	0.803	-2.166	
5	0.69	0.659	0.659	0.189	
6	1.3	0.669	0.669	0.031	

Dunnett table value = 2.28 (1 Tailed Value, P=0.05, df=60,5)

Phosmet Mysid Terminal Dry Weights
File: phosmysf.wt 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	Solvent Control	12			
2	Dilute Control	18	0.132	19.6	-0.414
3	0.16	10	0.151	22.5	-0.262
4	0.37	14	0.139	20.7	-0.132
5	0.69	14	0.139	20.7	0.012
6	1.3	7	0.168	25.0	0.002

Phosmet Mysid Terminal Dry Weights
File: phosmysf.wt Transform: NO TRANSFORM

ANOVA TABLE

SOURCE	DF	SS	MS	F
Between	5	2.181	0.436	18.167

Within (Error)	69	1.682	0.024
Total	74	3.863	

Critical F value = 2.37 (0.05,5,60)
Since F > Critical F REJECT Ho:All groups equal

Phosmet Mysid Terminal Dry Weights
File: phosmysf.wt 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	Solvent Control	0.671	0.671		
2	Dilute Control	1.085	1.085	-7.174	
3	0.16	0.933	0.933	-3.952	
4	0.37	0.803	0.803	-2.166	
5	0.69	0.659	0.659	0.189	
6	1.3	0.669	0.669	0.031	

Bonferroni T table value = 2.39 (1 Tailed Value, P=0.05, df=60,5)

Phosmet Mysid Terminal Dry Weights
File: phosmysf.wt 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	Solvent Control	12			
2	Dilute Control	18	0.138	20.6	-0.414
3	0.16	10	0.159	23.6	-0.262
4	0.37	14	0.146	21.7	-0.132
5	0.69	14	0.146	21.7	0.012
6	1.3	7	0.176	26.3	0.002

Phosmet Mysid Terminal Dry Weights
File: phosmysf.wt Transform: NO TRANSFORM

WILLIAMS TEST (Isotonic regression model) TABLE 1 OF 2

GROUP	IDENTIFICATION	N	ORIGINAL MEAN	TRANSFORMED MEAN	ISOTONIZED MEAN
1	Solvent Control	12	0.671	0.671	0.923
2	Dilute Control	18	1.085	1.085	0.923
3	0.16	10	0.933	0.933	0.923
4	0.37	14	0.803	0.803	0.803

5	0.69	14	0.659	0.659	0.662
6	1.3	7	0.669	0.669	0.662

Phosmet Mysid Terminal Dry Weights
File: phosmysf.wt 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
Solvent Control	0.923				
Dilute Control	0.923	4.330	*	1.67	k= 1, v=69
0.16	0.923	3.769	*	1.75	k= 2, v=69
0.37	0.803	2.150	*	1.77	k= 3, v=69
0.69	0.662	0.138		1.78	k= 4, v=69
1.3	0.662	0.114		1.79	k= 5, v=69

s = 0.156
Note: df used for table values are approximate when v > 20.