

**REPORT FOR ACUTE TOXICITY TESTING OF  
APPLIED POLYMER SYSTEMS, INC.  
SUPER SHOCK LOG**

**WOODSTOCK, GEORGIA**

**TEST PERIOD: December 10-12, 2004**

**Prepared for:**

**APPLIED POLYMER SYSTEMS, INC.  
Woodstock, Georgia**

**January 2005**

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**Prepared for:**

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**Prepared by:**

**BioTox Laboratory  
Mactec Engineering and Consulting, Inc.  
Kennesaw, Georgia**

**January 2005**

January 6, 2005

Mr. Steven R. Iwinski  
Applied Polymer Systems, Inc.  
519 Industrial Way  
Woodstock, GA 30189

Subject: **Applied Polymer Systems, Inc. Acute Toxicity Testing on Super Shock Log Product,**  
**December 10-12, 2004**  
**MACTEC Project No. 12000-0-2046.01**

Dear Mr. Iwinski:

Mactec Engineering and Consulting, Inc. (MACTEC), BioTox Laboratory has completed 48-hour acute toxicity testing on a sample of Super Shock Log received on December 6, 2004. Toxicity testing was initiated by MACTEC on December 10, 2004 to determine the LC<sub>50</sub> (the Lethality Concentration of the sample at which 50% of the test organisms die) and the NOAEC (the No Observed Acute Effect Concentration, or the highest concentration tested that did not exhibit acute toxicity). In the toxicity test, the sample was prepared by adding 6,720 milligrams (mg) of polymer to 1.0 liter (L) of laboratory formulated water and allowed to mix on a stir plate until fully dissolved (approximately 1 hour). The solution, that included both a flocculant and supernate, was then diluted with laboratory formulated water to the following test concentrations: 420 parts per million (ppm), 840 ppm, 1,680 ppm, 3,360 ppm, and 6,720 ppm.

Test results indicated acute mortality to the water flea (*Ceriodaphnia dubia*) in the polymer sample at the 3,360 and 6,720 ppm test concentration. The statistically determined LC<sub>50</sub> was 2,254 ppm and the NOAEC was 1,680 ppm.

Results are summarized in the accompanying report. Detailed testing documentation, including chemical and physical measurements (Appendix A), fathead minnow documentation (Appendix B), and polymer sample test data/reference toxicant data (Appendix C).

MACTEC appreciates the opportunity to provide these testing services to you and Applied Polymer Systems, and we look forward to serving your future needs. If there are any questions, please do not hesitate to contact Mr. Andrew S. Peiken at (770) 421-7027.

Sincerely,

MACTEC ENGINEERING AND CONSULTING, INC.

Andrew S. Peiken, C.E.  
BioTox Laboratory Manager

Margaret E. Tanner  
Senior Environmental Engineer

Attachment: Data Report

## TEST SUMMARY

### **I. Client**

Client: Applied Polymer Systems, Inc.  
519 Industrial Way  
Woodstock, GA 30189

Product Tested: Super Shock Log (MACTEC ID. 04-0282-01)

### **II. Laboratory Accreditation**

Laboratory: BioTox Laboratory  
Mactec Engineering and Consulting, Inc.  
3200 Town Point Drive N.W., Suite 100  
Kennesaw, Georgia 30144

Accreditor: State of Florida, Department. of Health  
Bureau of Laboratories

Accreditation ID: Lab ID. E87477

Category: Non-Potable Water – Whole Effluent Toxicity

Effective: July 1, 2004 through June 30, 2005

### **III. Tests Conducted**

Test: Water Flea, *Ceriodaphnia dubia*  
48-hr. Acute Static Toxicity Test  
EPA-821-R-02-012, Fifth Edition, October 2002

Test Dates (Times): December 10 (1100) – 12 (1500), 2004

Source, Age of Organisms: In-house Cultures, CERB0112604 / <24 hrs

Test Concentrations: Control, 420, 840, 1,680, 3,360, and 6,720 ppm

Dilution/Control Water: Diluted Mineral Water (20% Perrier)

Deviation From Test Protocol: None

**IV. Results****Survival Data for Water Flea, *Ceriodaphnia dubia*, Exposed for 48-hr to Applied Polymer Systems, Inc., Super Shock Log Product, December 10-12, 2004.**

Concentration (ppm)	Survival (%) at 48-hours
Laboratory Control <sup>a</sup>	100
420	90
840	90
1,680	85
3,360	25
6,720	5
LC <sub>50</sub> <sup>b</sup>	<b>2,254 ppm</b>
NOAEC <sup>c</sup>	<b>1,680 ppm</b>

Calculated by: ASP 1/5/05

Checked by: SEC 1/5/05

<sup>a</sup> Laboratory Control – Diluted Mineral Water<sup>b</sup> Lethal Concentration at which 50% mortality occurs.<sup>c</sup> No Observable Acute Effect Concentration.**V. Summary**

Test results indicated acute mortality to the water flea (*Ceriodaphnia dubia*) in the polymer sample at the 3,360 and 6,720 ppm test concentration. The statistically determined LC<sub>50</sub> was 2,254 ppm and the NOAEC was 1,680 ppm.

**VI. Quality Assurance***Ceriodaphnia dubia*, NaCl Reference Toxicant, RT143ACD, 11/30/04Survival: 48-hr LC<sub>50</sub> = 2,639 mg/L NaCl (**PASS**)48-hr LC<sub>50</sub> Range of Acceptability = 1,920 to 3,120 mg/L NaCl

## GLOSSARY AND ABBREVIATIONS

Acute	Involving a stimulus severe enough to rapidly induce a response; in toxicity tests, a response observed in 96 hours or less typically is considered acute.
Chronic	Involving a stimulus that lingers or continues for a relatively long period of time, often one-tenth of the life span or more. A chronic effect can be lethality, growth, reduced reproduction, etc.
Chronic Value	A numeric value representing the geometric mean of the numeric values of concentrations analyzed as the NOEC (No Observed Effect Concentration) and the LOEC (Lowest Observed Effect Concentration) by chronic toxicity testing. The chronic value is an estimate of the toxicant concentration that will be the actual no effect concentration based on the chronic effect tested.
Critical Value	Minimum numeric value for a toxicity test endpoint (i.e., survival, growth, or reproduction) below which a given test result will be statistically significantly different from the control value.
DMW	Diluted Mineral Water
EC	Effective concentration, a point estimate of the toxicant concentration that would cause an adverse response such as death, immobilization, or serious incapacitation.
Ft-c	Foot candles - a measure of <u>light</u> intensity
Graphical Method	Log concentration versus percent mortality method. Toxicity test data are plotted on 2-cycle semi-log graph paper. The logarithmic axis (y axis) is used for percent effluent concentration, and the linear axis (x axis) is used for percent mortality. The graph provides a reasonably accurate estimate of the LC <sub>50</sub> , but does not provide a confidence interval.
IC	Inhibition Concentration, a point estimate of the toxicant concentration that would cause a given percent reduction in a biological measurement such as fecundity or growth.
LC	Lethal Concentration, identical to EC when the observed response is death.
LC <sub>50</sub>	The toxicant concentration that is lethal to 50 percent of exposed organisms at a specific time of observation.
LCL	Lower 95% Confidence Limit
LOEC	Lowest-Observed-Effect-Concentration, the lowest concentration of toxicant to which organisms are exposed that causes adverse effects.
LWC	Lab Water Control, moderately hard synthetic freshwater prepared from MILLIPORE MILLI-Q <sup>R</sup> water and reagent grade chemicals.

NOEC	No-Observed-Effect-Concentration, the highest concentration of toxicant to which organisms are exposed that causes no observable adverse effects.
Probit Analysis	Probit Analysis consists of a group of statistical methods used to analyze data from concentration-response experiments, and provides an estimate of the LC <sub>50</sub> and the precision of this estimate. In Probit Analysis, the percentages of affected organisms are converted to Probits (probability units), and the effluent concentrations are converted to logarithms. The relationship between the Probits and the logarithmic values of the concentrations is approximately linear. A Probit regression line drawn through the data points is used to estimate the LC <sub>50</sub> and its precision estimate. To use Probit Analysis, at least two partial mortalities must be obtained in the toxicity test.
UCL	Upper 95% Confidence Limit
μE/m <sup>2</sup> /s	Micro-ergs per square meter per second - a measure of <u>light</u> intensity

## **REFERENCES**

- Gulley, D.D., and WEST, Inc. 1996. TOXSTAT version 3.5. Fish Physiology and Toxicology Laboratory. Department of Zoology and Physiology. University of Wyoming. Laramie, Wyoming.
- U.S. Environmental Protection Agency. 1979. Methods for Chemical Analysis of Water And Wastes. Environmental Monitoring Laboratory, U.S. Environmental Protection Agency, Cincinnati, OH. EPA 600/4-79-020.
- U.S. Environmental Protection Agency. 2002. Methods for Measuring the Acute Toxicity of Effluents to Freshwater and Marine Organisms. Fifth Edition. Office of Water (4303T), U.S. Environmental Protection Agency, Washington, DC. EPA-821-R-02-012.

**Summary of Effluent Toxicity Test Conditions for the water flea (*Ceriodaphnia dubia*) Acute Survival Test (EPA 821-R-02-012)**

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1. Test type:	48-hr Static Acute
2. Temperature (°C):	24.0-25.5°C
3. Light quality:	Cool White Fluorescent
4. Light intensity:	10-20 uE/m <sup>2</sup> /s (50-100 ft-c)
5. Photoperiod:	16-hr light, 8-hr dark
6. Test chamber size:	250 ml
7. Test solution volume:	100 ml/replicate
8. Age of neonates:	< 24 hours
9. No. neonates per test chamber:	5
10. No. replicate chambers per concentration:	4
11. No. neonates per concentration:	20
12. Feeding regime:	Fed YCT/selenastrum 2 hours prior to test start
13. Aeration:	None
14. Dilution water:	Moderately hard synthetic freshwater (reagent grade chemicals and Milli-Q)
15. Effluent concentrations (ppm):	Control, 420, 840, 1,680, 3,360, and 6,720
16. Dilution factor:	0.5
17. Test duration	48-hr
18. Effect measured:	Mortality - no movement on gentle prodding
19. Test acceptability:	90% or greater survival in controls
20. Sample handling:	Whole polymer samples held at room temperature.
21. Sample volume required:	1 L
22. Chemical parameters:	pH, DO, total residual chlorine, total alkalinity, total hardness, conductivity, temperature

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**Initial Chemical Characterization of Applied Polymer Systems, Inc. Super Shock Log Product and Control Water Used in Acute Toxicity Tests, December 10-12, 2004.**

<b>Constituent</b>	<b>Super Shock Log (6,720 ppm)</b>	<b>DMW<sup>a</sup></b>
Dissolved Oxygen (mg/L)	6.20	6.74
pH	6.34	7.62
Total Alkalinity as CaCO <sub>3</sub> (mg/L)	796	63.5
Total Hardness as CaCO <sub>3</sub> (mg/L)	3,652	73.0
Conductivity @ 25°C (µmhos/cm)	3,490	205
Total Residual Chlorine <sup>c</sup> (mg/L)	<0.01	<0.01
Total Ammonia-nitrogen <sup>c</sup> (mg/L)	1.0	<0.01

Determined according to EPA 600/4-79-020, 1979.

Entered by: ASP 1/5/05  
Checked by: SEC 1/5/05

<sup>a</sup> Control = Diluted Mineral Water (20% Perrier and Milli-Q)

<sup>b</sup> Control = Moderately hard synthetic freshwater (reagent grade chemicals and Milli-Q)

<sup>c</sup> Determined by Hach Colorimetric Test Kit in conjunction with spectrophotometer

## **APPENDICES**

## **APPENDIX A**

### **Chemical and Physical Data**

## **APPENDIX B**

### **Test Organism Documents**

Mactec Engineering and Consulting, Inc.  
BioTox Laboratory

*Ceriodaphnia dubia* Culture Source Document

<b>Brood Board ID No.</b>	<b>Brood Board Start Date</b>	<b>Source</b>	<b>Age of Neonates at Test Start</b>	<b>Water Type/Temp. (°C)</b>	<b>Food Type</b>
CERB01112604	11/26/04	In-house Cultures	< 24 hrs	DMW (25.0)	YCT/selenastrum

**APPENDIX C**

**Test Data Sheets**

**Water Flea  
Reference Toxicant Data Sheet**

**Water Flea  
Polymer Test**