

**REPORT FOR CHRONIC TOXICITY TESTING OF  
APPLIED POLYMER SYSTEMS, INC.  
SILT STOP 704F PRODUCT**

**WOODSTOCK, GEORGIA**

**TEST PERIOD: JULY 16-23, 2002**

**Prepared for:**

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

**September 2002**

**REPORT FOR CHRONIC TOXICITY TESTING OF  
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**Prepared for:**

**Applied Polymer Systems, Inc.  
Woodstock, Georgia**

**Prepared by:**

**BioTox Laboratory  
Law Engineering and Environmental Services, Inc.  
Kennesaw, Georgia**

**September 2002**

September 6, 2002

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

Subject: **Applied Polymer Systems, Inc. Chronic Toxicity Testing on 704F Product,  
September 16-23, 2002  
Law Project No. 12000-0-2046.01**

Dear Mr. Iwinski:

Law Engineering and Environmental Services, Inc. (LAW), BioTox Laboratory has completed 7-day chronic toxicity testing on samples of Silt Stop 704F. Toxicity testing was initiated by LAW on July 16, 2002 to determine the IC<sub>25</sub> (the Inhibition Concentration of the sample at which there is a 25% reduction in survival and growth of the fathead minnow, *Pimephales promelas*, when compared to the laboratory control) and the NOEC (the No Observed Effect Concentration, or the highest concentration tested that did not exhibit chronic toxicity). Test samples were prepared by adding 1,680 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 24 hours). This stock test sample was then diluted with laboratory formulated water to the following test concentrations: 26.25 parts per million (ppm), 52.5 ppm, 105 ppm, 210 ppm, 420 ppm, 840 ppm, and 1,680 ppm. Fathead minnows were exposed to the individual test concentrations, which were renewed with a fresh polymer solution daily, for a period of 7-days. After 7-days, the survival and growth endpoints were determined.

Test results indicated no chronic toxicity to fathead minnow survival at any of the 704F polymer sample concentrations as tested. Based on the concentrations analyzed, the statistically determined IC<sub>25</sub> for survival was 97.5 ppm and the NOEC was 1,680 ppm. The actual NOEC could be determined by conducting a chronic toxicity test utilizing a test concentration range greater than 1,680 ppm. Test results did indicate chronic toxicity to fathead minnow growth at the 1,680 ppm 704F polymer sample concentration. Based on the concentrations analyzed, the statistically determined IC<sub>25</sub> for growth was 844 ppm and the NOEC was 840 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).

LAW 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,

LAW ENGINEERING AND ENVIRONMENTAL SERVICES, INC.

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

Margaret E. Tanner  
Environmental Engineer

Attachment: Data Report



## TEST SUMMARY

### **I. Client**

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

Product Tested: Silt Stop 704F

### **II. Laboratory Accreditation**

Laboratory: BioTox Laboratory  
Law Engineering and Environmental Services, Inc.  
3200 Town Point Drive N.W., Suite 100  
Kennesaw, Georgia 30144

Accreditor: State of Florida, Dept. of Health and Rehabilitative Services  
Office of Laboratory Services, Environmental Water

Accreditation ID: Lab ID. E87477, Certificate No. 477-128

Category: Bioassay

Effective: July 1, 2002 through June 30, 2003

### **III. Tests Conducted**

Test: Fathead minnow, *Pimephales promelas*  
7-day Chronic Toxicity Test, Method 1000.0  
EPA/600/4-91/002, Third Edition, July 1994

Test Dates: July 16-23, 2002

Source/Age of Organisms: ARO, ID No. CS844071602 / <24 hrs.

Test Concentrations: Control, 26.25, 52.5, 105, 210, 420, 840, and 1,680 ppm

Dilution/Control Water: Moderately hard synthetic freshwater (reagent grade chemicals and Milli-Q)

Deviation From Test Protocol: Chronic toxicity testing was conducted using seven test concentrations (as opposed to five per the test method) and two test replicates (as opposed to four per the test method). Daily water quality monitoring was performed on the laboratory control and highest polymer test concentration (as opposed to all test concentrations).

#### IV. Results

##### Survival and Growth Data for the Fathead minnow, *Pimephales promelas*, Exposed for 7-days to Applied Polymer Systems, Inc. Silt Stop 704F Product, July 16-23, 2002.

Concentration (ppm)	Survival (%)	Growth (mg)
Laboratory Control <sup>a</sup>	95	0.254
26.25	90	0.234
52.5	90	0.243
105	55	0.163
210	75	0.236
420	60	0.182
840	70	0.200
1,680	50	0.117
<b>IC<sub>25</sub> (ppm) <sup>b</sup></b>	<b>97.5</b>	<b>844</b>
<b>NOEC (ppm) <sup>c</sup></b>	<b>1,680</b>	<b>840</b>

Calculated by: ASP 9/4/02

Checked by: RFP 9/4/02

<sup>a</sup> Laboratory Control – Moderately hard synthetic freshwater.

<sup>b</sup> Inhibition Concentration at which there was a 25% reduction in survival/growth from the Laboratory Control

<sup>c</sup> No Observed Effect Concentration - the highest concentration tested that did not exhibit chronic toxicity

#### V. Summary

Test results indicated no chronic toxicity to fathead minnow survival at any of the 704F polymer sample concentrations as tested. Based on the concentrations analyzed, the statistically determined IC<sub>25</sub> for survival was 97.5 ppm and the NOEC was 1,680 ppm. The actual NOEC could be determined by conducting a chronic toxicity test utilizing a test concentration range greater than 1,680 ppm. Test results did indicate chronic toxicity to fathead minnow growth at the 1,680 ppm 704F polymer sample concentration. Based on the concentrations analyzed, the statistically determined IC<sub>25</sub> for growth was 844 ppm and the NOEC was 840 ppm.

During the testing period, it was noted that the dissolved oxygen in the 1,680 ppm test concentration fell below 3.0 mg/L. Desirable dissolved oxygen levels range between 3.00 and 9.00 mg/L. The drop in dissolved oxygen noted at the higher test concentrations would be expected to result in chronic toxicity, however we cannot conclude that the low dissolved oxygen level alone resulted in the observed toxicity.

#### VI. Quality Assurance

*Pimephales promelas*, NaCl Reference Toxicant No. 134, 7/30/02

Survival: 7-day IC<sub>25</sub> = 1,900 mg/L NaCl (**PASS**)

7-day IC<sub>25</sub> Range of Acceptability = 1,140 to 5,300 mg/L NaCl

Growth: 7-day IC<sub>25</sub> = 1,690 mg/L NaCl (**PASS**)

7-day IC<sub>25</sub> Range of Acceptability = 1,540 to 3,420 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.
RWC	Receiving Water Control
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. 1999. Errata for Effluent and Receiving Water Toxicity Testing Manuals: Acute Toxicity of Effluents and Receiving Waters to Freshwater and Marine Organisms; Short-Term Methods for Estimating the Chronic Toxicity of Effluent and Receiving Waters to Freshwater Organisms; and Short-Term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to Marine and Estuarine Organisms. U.S. Environmental Protection Agency, Office of Research and Development, Duluth, MN. EPA/600/R-98/182.
- Weber, C.I., W.H. Peltier, T.J. Norberg-King, W.B. Horning, II, F.A. Kessler, J.R. Menkedick, T.W. Neihsel, P.A. Lewis, D.J. Klemm, Q.H. Pickering, E.L. Robinson, J.M. Lazorchak, L.J. Wymer, and R.W. Freyberg. 1994. Short-Term Methods For Estimating The Chronic Toxicity Of Effluents And Receiving Waters To Freshwater Organisms, Third Edition. Environmental Monitoring Systems Laboratory, U.S. Environmental Protection Agency, Cincinnati, Ohio. EPA/600/4-91/002.

**Summary of Effluent Toxicity Test Conditions for the Fathead minnow (*Pimephales promelas*)  
Chronic Survival Test (EPA 600/4-91/002)**

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1. Test type:	Method 1000.0, 7-day Chronic Static Renewal
2. Temperature (°C):	25.0-26.5°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:	400 mL
7. Test solution volume:	250 mL/replicate
8. Age of fathead minnow:	< 24 hours
9. No. fish per test chamber:	10
10. No. replicate chambers per concentration:	2
11. No. fish per concentration:	20
12. Feeding regime:	Fed <i>Artemia</i> twice daily
13. Aeration:	None during testing. The 1,680 ppm stock solution was gently aerated immediately after the 24-hour mixing period.
14. Dilution water:	Moderately hard synthetic freshwater (reagent grade chemicals and Milli-Q)
15. Effluent concentrations (ppm):	Control, 26.25, 52.5, 105, 210, 420, 840, and 1,680
16. Dilution factor:	0.5
17. Test duration:	7-days
18. Effect measured:	Survival/mortality - no movement on gentle prodding Growth – mg dry weight
19. Test acceptability:	80% or greater survival in controls
20. Sample handling:	Whole polymer samples held at room temperature.
21. Sample volume required:	2 L of 1,680 ppm / day
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. Silt Stop 704F Product and Control Water Used in Chronic Toxicity Tests, July 16-23, 2002.**

<b>Parameter</b>	<b>704F (1,680 ppm)</b>	<b>Laboratory Control<sup>a</sup></b>
Dissolved Oxygen (mg/L)	6.66	7.72
pH	7.61	6.64
Total Alkalinity as CaCO <sub>3</sub> (mg/L)	400	65.0
Total Hardness as CaCO <sub>3</sub> (mg/L)	1,048	84.0
Conductivity @ 25°C (µmhos/cm)	1,652	290
Total Residual Chlorine <sup>b</sup> (mg/L)	<0.01	<0.01
Total Ammonia-nitrogen <sup>b</sup> (mg/L)	3.68 <sup>c</sup>	<0.01

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

Entered by: ASP 9/4/02  
Checked by: RFP 9/4/02

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

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

<sup>c</sup> A flocculant (interference) was noted upon addition of Nessler Reagent to the sample. Results should be interpreted with caution.



## **APPENDICES**

## **APPENDIX A**

### **Chemical and Physical Data**

**APPENDIX B**

**Fathead minnow Documents**

LAW Engineering and Environmental Services, Inc.  
BioTox Laboratory

*Pimephales promelas* Culture Source Document

Larvae ID No.	Hatch Date	Source	Age of Larvae at Test Start	Water Type/Temp. (°C)	Food Type
CS844071602	7/16/02	ARO, Inc.	<24 hrs	LWC/25.0	<i>Artemia</i>

## **APPENDIX C**

### **Test Data Sheets**

**Fathead minnow  
Polymer Test**

**Fathead minnow**  
**Reference Toxicant Data Sheets**