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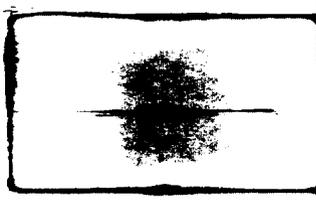
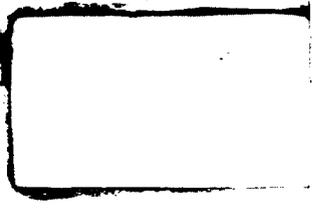
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Title	Substit	CAS Information
Aquatic Toxicity Data Sheet: 48hr <i>Daphnia</i> Magna	1,4-dioxane; heptadecafluoro-1-octanesulfonic acid; linear n-ethyl perfluorooctanesulfonamide; n-ethylperfluorooctanesulfonamidoethyl alcohol; poly(oxy-1,2-ethanediyl), .alpha.-[2- [ethyl]([heptadecafluorooctyl)sulfonyl]amino)ethyl]-.omega.-hydroxy-; poly(oxy-1,2-ethanediyl), .alpha.-[2- [ethyl]([nonafluorobutyl)sulfonyl]amino)ethyl]-.omega.-hydroxy-; poly(oxy-1,2-ethanediyl), .alpha.-[2- [ethyl]([pentafluorohexyl)sulfonyl]amino)ethyl]-.omega.-hydroxy-; poly(oxy-1,2-ethanediyl), .alpha.-[2- [ethyl]([tridecafluorohexyl)sulfonyl]amino)ethyl]-.omega.-hydroxy-; poly(oxy-1,2-ethanediyl), .alpha.-[2- [ethyl]([undecafluoropentyl)sulfonyl]amino)ethyl]-.omega.-hydroxy-; polyethylene glycol; water	1,4-dioxane (123-91-1); heptadecafluoro-1-octanesulfonic acid (1763-23-1); linear n-ethyl perfluorooctanesulfonamide (4151-50-2); n-ethylperfluorooctanesulfonamidoethyl alcohol (1691-99-2); poly(oxy-1,2-ethanediyl), .alpha.-[2-[ethyl]([heptadecafluorooctyl)sulfonyl]amino)ethyl]-.omega.-hydroxy- (29117-08-6); poly(oxy-1,2-ethanediyl), .alpha.-[2-[ethyl]([nonafluorobutyl)sulfonyl]amino)ethyl]-.omega.-hydroxy- (68298-79-3); poly(oxy-1,2-ethanediyl), .alpha.-[2-[ethyl]([pentafluorohexyl)sulfonyl]amino)ethyl]-.omega.-hydroxy- (68298-81-7); poly(oxy-1,2-ethanediyl), .alpha.-[2-[ethyl]([tridecafluorohexyl)sulfonyl]amino)ethyl]-.omega.-hydroxy- (56372-23-7); poly(oxy-1,2-ethanediyl), .alpha.-[2-[ethyl]([undecafluoropentyl)sulfonyl]amino)ethyl]-.omega.-hydroxy- (68298-80-6); polyethylene glycol (25322-68-3); water (7732-18-5)
Multigeneration Daphnid Life Cycle Test	1,4-dioxane; heptadecafluoro-1-octanesulfonic acid; linear n-ethyl perfluorooctanesulfonamide; n-ethylperfluorooctanesulfonamidoethyl alcohol; poly(oxy-1,2-ethanediyl), .alpha.-[2- [ethyl]([heptadecafluorooctyl)sulfonyl]amino)ethyl]-.omega.-hydroxy-; poly(oxy-1,2-ethanediyl), .alpha.-[2- [ethyl]([nonafluorobutyl)sulfonyl]amino)ethyl]-.omega.-hydroxy-; poly(oxy-1,2-ethanediyl), .alpha.-[2- [ethyl]([pentafluorohexyl)sulfonyl]amino)ethyl]-.omega.-hydroxy-; [ethyl]([tridecafluorohexyl)sulfonyl]amino)ethyl]-.omega.-hydroxy-; poly(oxy-1,2-ethanediyl), .alpha.-[2- [ethyl]([undecafluoropentyl)sulfonyl]amino)ethyl]-.omega.-hydroxy-; polyethylene glycol; water	1,4-dioxane (123-91-1); heptadecafluoro-1-octanesulfonic acid (1763-23-1); linear n-ethyl perfluorooctanesulfonamide (4151-50-2); n-ethylperfluorooctanesulfonamidoethyl alcohol (1691-99-2); poly(oxy-1,2-ethanediyl), .alpha.-[2-[ethyl]([heptadecafluorooctyl)sulfonyl]amino)ethyl]-.omega.-hydroxy- (29117-08-6); poly(oxy-1,2-ethanediyl), .alpha.-[2-[ethyl]([nonafluorobutyl)sulfonyl]amino)ethyl]-.omega.-hydroxy- (68298-79-3); poly(oxy-1,2-ethanediyl), .alpha.-[2-[ethyl]([pentafluorohexyl)sulfonyl]amino)ethyl]-.omega.-hydroxy- (68298-81-7); poly(oxy-1,2-ethanediyl), .alpha.-[2-[ethyl]([tridecafluorohexyl)sulfonyl]amino)ethyl]-.omega.-hydroxy- (56372-23-7); poly(oxy-1,2-ethanediyl), .alpha.-[2-[ethyl]([undecafluoropentyl)sulfonyl]amino)ethyl]-.omega.-hydroxy- (68298-80-6); polyethylene glycol (25322-68-3); water (7732-18-5)
Aquatic Invertebrate Testing - Alkyltins LR 8024-1	Alkyltins: dibutyltin laurate and dibutyltin-di(2 ethylhexoate)	Dibutyltin laurate (CAS 77-58-7); Dibutyltin-di(2 ethylhexoate) (CAS 2781-10-4)
Aquatic Invertebrate Testing - Decosheen Material (LR-8052)	Decosheen Ribbon Materials and pigments: Decosheen Blue in Green Ceres Blue ZV; Decosheen Gold Paste Pigment; Decosheen Royal Blue; Solvent Blue	Decosheen Blue in Green; Ceres Blue ZV (CAS 61814-09-3); Decosheen Royal Blue; Solvent Blue; Decosheen Gold Paste Pigment (CAS Number 61814-09-3)
R Scratch Remover (Fathhead Minnow)	55-65% Water; 20-30% Stoddard Solvent; 1-5% Sodium Silicate; 1-5% Potassium Hydroxide; 0.1-3% Nonylphenoxypoly(oxyethylene)ethanol	Water (CAS 7732-18-5); Stoddard Solvent (CAS 8052-41-3); Sodium Silicate (CAS 1344-09-8); Potassium Hydroxide (CAS 1310-58-3); Nonylphenoxypoly(oxyethylene)ethanol (CAS 9016-45-9)
S Scratch Remover (Fathhead Minnow)	60-70% Water; 20-30% Stoddard Solvent; 1-5% Sodium Silicate; 0.1-3% Turgitol NP-33	Water (CAS 7732-18-5); Stoddard Solvent (CAS 8052-41-3); Sodium Silicate (CAS 1344-09-8); Turgitol NP-33 (CAS 9016-45-9)
Octanol Water Partition Coefficient	N-methylperfluorooctane sulfonamidoethanol	CAS 24448-09-7

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Title	Substance	CAS Information
CoCl ₂ .6H ₂ O as Co ²⁺ Toxicity to Microtox Reagent	Cobalt (as Co ²⁺ ion) (CoCl ₂ .6H ₂ O)	CAS 7791-13-1
Activated Sludge Respiration Inhibition Test on CoCl ₂ .6H ₂ O as Co ion	Cobalt (as Co ²⁺ ion) (CoCl ₂ .6H ₂ O)	CAS 7791-13-1
Acute Toxicity of CoCl ₂ .6H ₂ O as Co ion to <i>Daphnia magna</i> under Static Exposure Conditions	Cobalt (as Co ²⁺ ion) (CoCl ₂ .6H ₂ O)	CAS 7791-13-1
Acute Toxicity of CoCl ₂ .6H ₂ O as Co ion to Fathead Minnow under Static Exposure Conditions	Cobalt (as Co ²⁺ ion) (CoCl ₂ .6H ₂ O)	CAS 7791-13-1
Freshwater Algae Growth Inhibition Test	Cobalt (as Co ²⁺ ion) (CoCl ₂ .6H ₂ O)	CAS 7791-13-1
<i>Daphnia magna</i> 21-Day Chronic Reproduction Study	N-ethylperfluorooctane sulfonamidoethanol	CAS 1691-99-2
Plant Growth Effects of []	[]	[]
Final Report (<i>Daphnia</i> and Microtox) Microtox Test Results	Monomethyl ether of hydroquinone 2 Ethylhexyl Acrylate; Isooctyl Acrylate Monomer; 2-Methylbutyl acrylate; Methyl isoamyl acrylate; Isooctyl Acrylate	CAS 150-76-5 2 Ethylhexyl Acrylate (CAS 103-11-7); Isooctyl Acrylate Monomer (CAS 29590-42-9) 2-Methylbutyl acrylate (CAS 44914-03-6); Methyl isoamyl acrylate (CAS 18993-92-1); Isooctyl Acrylate (CAS 29590-42-9)
Phytotoxicity Test Results	[]	[]

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Title	Substance	CAS Information
Plant Toxicity Comparison, Young Seedling Growth	[REDACTED]	[REDACTED]
<i>Ceriodaphnia dubia</i> Survival and Reproduction exposed to Opequon Creek Water Spiked with BETZ 1110 Polymer (November 4, 1987 sample) for seven days under static renewal conditions	BETZ 1110: Non-3M Product - Chemical composition not provided to 3M by manufacturer	MSDS provided by manufacturer states product is "not hazardous" and not "considered to be a carcinogen"
<i>Ceriodaphnia dubia</i> Survival and Reproduction exposed to Opequon Creek Water Spiked with Betz 1138 Polymer (November 4, 1987 sample) for seven days under static renewal conditions	BETZ 1138: Non-3M Product - Chemical composition not provided to 3M by manufacturer	MSDS provided by manufacturer states product is "not hazardous" and not "considered to be a carcinogen"
Toxicity of 1,6 - Hexanediol Diacrylate to <i>Daphnia magna</i>	1,6 Hexanediol diacrylate	CAS 13048-33-4
<i>Daphnia magna</i> Chronic Bioassay Under Static Renewal Conditions	Methyl isoamyl acrylate	CAS 18993-92-1
Estimating the Chronic Toxicity of Nalclear 7177 to <i>Ceriodaphnia</i> Survival and Reproduction Using Short-Term Tests	Nalclear 7177 wastewater treatment acrylamide/acrylate polymer - Chemical composition not provided to 3M by manufacturer	CAS Information not provided to 3M by manufacturer
Acute Toxicity of Isooctyl Acrylate to <i>Daphnia magna</i>	Isooctyl Acrylate Monomer	CAS 29590-42-9
Static Acute Toxicity of [REDACTED] to the <i>Daphnid, Daphnia magna</i>	Tolylthazole	CAS 29385-43-1
Static Acute Toxicity of [REDACTED] to the <i>Alga, Selenastrum capricornutum</i>	Tolylthazole	CAS 29385-43-1
Static Acute Toxicity of [REDACTED] to the <i>Daphnid, Daphnia magna</i>	[REDACTED]	[REDACTED]
Static Acute Toxicity of [REDACTED] to the Fathead Minnow, <i>Pimephales promelas</i>	[REDACTED]	[REDACTED]
Static Acute Toxicity of [REDACTED] to the <i>Daphnid, Daphnia magna</i>	water; propylene-tetrafluoroethylene polymer; tert-butyl alcohol	water (7732-18-5); propylene-tetrafluoroethylene polymer (27029-05-6); tert-butyl alcohol (75-65-0)

Master Index to Studies Submitted Under TSCA 8(e) by 3M Company on October 26, 2004
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Title	Substance	CAS Information
Isooctyl acrylate: Fish, Acute Toxicity Test	Isooctyl Acrylate Monomer	CAS 29590-42-9
Isooctyl Acrylate: <i>Daphnia</i> sp. Acute Immobilization Test	Isooctyl Acrylate Monomer	CAS 29590-42-9
Isooctyl Acrylate: Alga, Growth Inhibition Test	Isooctyl Acrylate Monomer	CAS 29590-42-9
Isooctyl Acrylate: <i>Daphnia</i> sp. Reproduction Test	Isooctyl Acrylate Monomer	CAS 29590-42-9
Acute Toxicity of [] to the mysid, <i>Mysidopsis bahia</i>	[]	[]
Final Report (Microtox)	[]	[]
Determination of the Partition Coefficient (N-Octanol/Water) of T-5896 by High Performance Liquid Chromatography (HPLC)	N-methyl perfluorooctane sulfonamido ethanol; N-methyl perfluorooctane sulfonamideethyl acrylate	N-methyl perfluorooctane sulfonamido ethanol (CAS 25268-77-3); N-methyl perfluorooctane sulfonamideethyl acrylate (CAS 24448-09-7)
OECD Activated Sludge Respiration Inhibition Test Results	N-Dodecyltrimethylammonium chloride	CAS = 112-00-5
Final Report (Fish Acute Toxicity)	Miralaine CB (30% Cocamidopropyl betaine = Amides, coco, N-(3-dimethylamino)propyl), alkylation products with chloroacetic acid, sodium salts, 70% Water and Inerts); Miralaine COB (30% Coco/Oleamidopropyl Betaine = 1-Propanaminium, 3-amino-N-(carboxymethyl)-N,N-dimethyl-, N-coco acyl derivs., inner salt)	Cocamidopropyl betaine (CAS 70851-07-9); Coco/Oleamidopropyl Betaine (CAS 61789-40-0)
A Flow-Through Life-Cycle Toxicity Test With the Saltwater Mysid (<i>Mysidopsis bahia</i>)	Perfluorooctane sulfonate	CAS 1763-23-1
Lithium: Alga, Acute toxicity Tests	Lithium Chloride	CAS 7447-41-8
An Early Life-Stage Toxicity Test With the Fathead Minnow (<i>Pimephales promelas</i>)	Perfluorooctane sulfonate	CAS 1763-23-1
Lithium: Fish, Acute toxicity Tests	Lithium Chloride	CAS 7447-41-8
Lithium: <i>Daphnia</i> , Acute toxicity Tests	Lithium Chloride	CAS 7447-41-8
Summary of Toxicity Testing on OSCI and OSF	Octane sulfonyl chloride and Octane sulfonyl fluoride	Octane sulfonyl fluoride (CAS 7795-95-1), Octane sulfonyl chloride (CAS 4063-63-5)
Toxicity to Microtox Test	Lauryl dimethylamine oxide	CAS 1643-20-5

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Title	Substance	CAS Information
Ecotoxicological Testing of CoCl ₂ .6H ₂ O as Co ²⁺ ion (Seed Germination and Root Elongation)	Cobalt (as Co ²⁺ ion) (CoCl ₂ .6H ₂ O)	CAS 7791-13-1

ASCI Corporation
Environmental Testing Laboratory
Submitted to 3M - 3/00
ASCI-ETL Study ID# 5010-068

**Lithium: Fish, Acute Toxicity Test
for 3M Lab Request #W2906
OECD Guideline 203
Study Completed December 14, 1999**

Prepared by

**ASCI Corporation
Environmental Testing Laboratory
4444 Airpark Boulevard
Duluth, Minnesota 55811**

Submitted to

**3M Environmental Technology and Safety Services
935 Bush Avenue
Building 2-3E-09
St. Paul, MN 55144**

Submitted February 2000

**Sponsor: 3M
Sponsor Study ID# W2906**

REPORT APPROVAL

Name (signed):  Date: 3/27/00

Name (typed): Joseph Dierkes

Title: Operations Manager

Name (signed):  Date: 3/27/00

Name (typed): Alan Mozol

Title: Quality Assurance Manager

TABLE OF CONTENTS

GENERAL INFORMATION	1
INTRODUCTION	2
STUDY SUMMARY	2
TEST METHODS	3
Test Substance	3
Test Organism	3
Dilution Water	4
Exposure Chambers	4
Range-Finding Test Performance	4
Definitive Test Performance	4
Physical Test Conditions	5
Biological Observations	5
Determination of Water Chemistry Parameters	5
Chemical Analyses	6
Statistical Analyses	6
RESULTS AND DISCUSSION	6
Results of Biological Observations	6
Chemical Analytical Results	7
Routine Water Chemistry Results	7
Test Acceptability	8

Table of Contents (Cont.)

CONCLUSIONS 8
REFERENCES 9

TABLE 1. Lithium: List of Test Conditions for 96-Hour Fathead Minnow Acute Toxicity Test

TABLE 2. Lithium: NaCl Reference Test Information

TABLE 3. Lithium: Acute Toxicity of Lithium Ion to Juvenile Fathead Minnows (*Pimephales promelas*)

TABLE 4. Lithium: Measured Initial and Final Test Lithium Ion Concentrations (mg/L) for Fathead Minnow 96-Hour Acute Toxicity Test

TABLE 5. Lithium: pH, Dissolved Oxygen Concentration, and Conductivity of Test Solutions from Fathead Minnow Acute Toxicity Test

TABLE 6. Lithium: Test Acceptability Criteria

TABLE 7. Lithium: Statistical Endpoints for Fathead Minnow 96-Hour Acute Toxicity Test

APPENDIX A -- TEST SUBSTANCE INFORMATION

APPENDIX B -- CHEMICAL ANALYSES OF POST-CARBON WATER

APPENDIX C -- DEFINITIVE TEST DATA

APPENDIX D -- REFERENCE TEST CONTROL CHART

APPENDIX E -- STATISTICAL CALCULATIONS

APPENDIX F -- ANALYTICAL RESULTS

GENERAL INFORMATION

Study Title:	Lithium: Fish, Acute Toxicity for 3M Lab Request #W2906.
Data Standard:	OECD Guideline 203.
Sponsor:	3M Environmental Technology and Safety Services, Building 2-3E-09, 935 Bush Avenue, St. Paul, MN 55106; Tel No. (651) 778-7065.
Sponsor's Representative:	Rochelle Robideau, 3M Environmental Technology and Safety Services, Building 2-3E-09, 935 Bush Avenue, St. Paul, MN 55106; Tel No. (651) 778-7065.
Sponsor's Lab Request #:	W2906.
Testing Facility:	ASCI Corporation's Environmental Testing Laboratory, 4444 Airpark Boulevard, Duluth, MN 55811; Tel. No. (218) 722-4040.
Principal Investigator:	Joe Dierkes.
Project Director:	Joe Dierkes.
Testing Facility Director:	Donald Mount.
Definitive Test Dates:	September 3-7, 1999.
Retention of Raw Data and Final Report:	Ten years from the date study is completed.
Location of Raw Data and Final Report:	ASCI Corporation's Environmental Testing Laboratory, 4444 Airpark Boulevard, Duluth, MN 55811; Tel. No. (218) 722-4040.

INTRODUCTION

At the request of 3M Environmental Technology and Safety Services (3M), ASCI Corporation's Environmental Testing Laboratory (ASCI-ETL) conducted a *Pimephales promelas* (fathead minnow) acute toxicity test. The fathead minnows were exposed to the lithium ion for 96 hours and observed for survival. Subsequently, the cumulative numbers of dead organisms in the control and test exposures were compared to quantify the test substance effect. The objective of the study was to determine, if possible, the 24-hour, 48-hour, 72-hour, and 96-hour 10% and 50% median lethal concentrations (LC_{10s} and LC_{50s}), and 96-hour no observed effect concentration (NOEC) and lowest observed effect concentration (LOEC) of lithium ion for fathead minnow. The study was performed following Office of Economic Cooperation Development (OECD) guidelines. The specific method followed was OECD 203, "Fish, Acute Toxicity Test."

The following report summarizes results of the static 96-hour acute toxicity test performed with lithium ion.

STUDY SUMMARY

The test produced a normal and interpretable concentration response to juvenile fathead minnows during the 96-hour acute toxicity test. Control organism survival was acceptable and routine water chemistries obtained from the test were all within physiological acceptable ranges. Nominal lithium ion concentrations were within 8% of 96-hour mean measured concentrations. The table below summarizes the 96-hour statistical endpoints generated from the test.

Endpoint	Based on Mean Measured 96-Hour Conc. (mg/L)
96-Hour LC ₁₀	4.6 (4.4-4.8)
96-Hour LC ₅₀	6.6 (5.8-7.4)
96-Hour NOEC	4.4 (Not Applicable)
96-Hour LOEC	7.5 (Not Applicable)

TEST METHODS

Range-finding and definitive acute lethality tests were conducted under standard static acute test conditions. The range-finding test was conducted to determine the appropriate test concentration range for the definitive test. Test conditions for the definitive test are listed in Table 1. Test conditions for the NaCl reference toxicity test performed concurrently with the study were similar to the lithium ion definitive test. Pertinent additional information from the reference test is contained in Table 2.

The estimated 96-hour LC_{50} based on range-finding test results was approximately 5 mg/L; therefore, the definitive test was conducted with a dilution water control and five treatment exposures, each with two replicates.

Test Substance

The lithium ion was obtained from lithium chloride (LiCl). The LiCl was purchased from Sigma Chemical company, Lot#77H00771. The material safety data sheets (MSDS) for the test substance are included in Appendix A.

Test Organism

Test organisms were juvenile fathead minnows obtained from ASCI-ETL's in-house culture. Original brood stocks for the culture were obtained from Aquatic Biosystems, Inc., Fort Collins, Colorado. The test organisms did not appear diseased or stressed at test initiation. At the time of the definitive test initiation, the fish were 19 days old. At test termination, the control fish had a mean length of 1.5 ± 0.1 cm and a mean weight of 22 ± 6 mg.

Dilution Water

Dilution water was dechlorinated City of Duluth tap water (post-carbon (PC)). The tap water was dechlorinated via treatment through two 1.5-cubic foot activated carbon beds. The carbon beds are renewed approximately once per month. The water was vigorously aerated for at least 24 hours before using in the tests. The dechlorinated tap water is analyzed twice per year for elemental contaminants, organochlorine pesticides, and PCBs. The most recent chemical analysis results are included in Appendix B.

Exposure Chambers

Exposure chambers were 3.8-L wide-mouth non-borosilicate glass jars. Each chamber contained 2.5 L of dilution water or test solution. During the test, exposure chambers were kept covered except during biological observations or sampling for chemistry determinations.

Range-Finding Test Performance

The range-finding test was performed using nominal test substance concentrations. The test was performed with two test concentration replicates in a static system. Each test chamber received five fish via impartial distribution. The range-finding test duration was 96 hours. At each 24-hour test interval, the organisms were observed for lethality.

Definitive Test Performance

The lithium ion test concentrations were prepared by direct addition of LiCl to 5.0 L of dilution water. The nominal 12 mg/L lithium ion concentration solution (highest concentration tested) was prepared by addition of 367 mg of LiCl to the dilution water. The amount of LiCl added to the dilution water accounted for the amount of lithium ion in the LiCl reagent. Based on the formula weights, the LiCl reagent contained 16.37% lithium ion. The 7.2 mg/L, 4.3 mg/L, 2.6 mg/L, and 1.6 mg/L lithium ion

nominal concentrations were respectively obtained by diluting 222 mg, 130 mg, 79 mg, and 49 mg masses of LiCl to dilution water. These solutions were then split equally and distributed to each of the two test replicates. Similarly, 2.5 L of dilution (control) water was distributed to the two control replicates. Each chamber contained 2.5 L of test solution or control water.

Organisms were impartially introduced into each test replicate and monitoring chamber until each contained 10 fish. The definitive study contained a total of 10 test chambers and two control chambers.

Physical Test Conditions

The test organisms were not fed during the 96-hour test. During the test, water temperature was maintained at $21 \pm 1^\circ \text{C}$. Daily photoperiod was maintained using cool-white fluorescent lamps for 16-hour light and 8-hour dark periods.

Biological Observations

Test organisms were observed daily for test substance effect. The numbers of fish displaying both lethal and sub-lethal adverse effects were counted and documented. At test termination, the control fish were harvested, and wet weights and total lengths were determined.

Determination of Water Chemistry Parameters

Intermediate routine water chemistry measurements were obtained from test chamber aliquots. The 0-hour test solutions and dilution water chemistry measurements were taken prior to solution distribution to test replicates. Zero-hour chemistries consisted of pH, temperature, dissolved oxygen concentration, and specific conductivity. Total hardness and alkalinity were also measured for the control and high concentration solutions. Solution aliquots were used for daily measurements of pH, dissolved oxygen, temperature, and conductivity. Test solution pH, temperature, dissolved oxygen, and conductivity were

measured directly from the test replicates at test termination after biological observations were completed and samples for test substance quantitation were collected.

Chemical Analysis

The low, mid, and high nominal lithium ion concentrations were analyzed at test initiation (0 hours) with solutions from one test substance replicate. The samples were collected in pre-cleaned Nalgene® bottles, acidified with HNO₃ to pH <2.0 and chilled before shipment to 3M's analytical laboratory for analysis. Lithium ion concentrations were determined using United States Environmental Protection Agency (USEPA) Method 200.7. Lithium ion concentrations were determined at the 48-hour intermediate test interval for solutions bracketing the 48-hour effect concentration. At test termination (96 hours), lithium ion concentrations were determined for solutions in four of the five test concentrations bracketing the effect concentration and the control chambers.

Statistical Analyses

Acute LC₅₀s were calculated via the Trimmed Spearman-Kärber method. Ten percent lethal concentrations (LC₁₀s) were calculated using the USEPA Inhibition Concentration (ICp) approach. The NOEC and LOEC were determined via the TOXSTAT software package, Version 3.5.

RESULTS AND DISCUSSION

Results of Biological Observations

The survival/mortality observations from the toxicity test are in Table 3. Complete (100%) survival was observed in all solutions at the 24-hour test interval. By the 48-hour test interval, 12 of 20 fish exposed to the 12 mg/L nominal test concentration had died. The surviving fish in the 12 mg/L exposures were observed to be swimming abnormally. All lesser concentrations supported complete survival and normal behavior. By the 72-hour test interval, complete lethality was observed for fish

exposed to the 12 mg/L solution, and five fish exposed to the 7.2 mg/L solutions had died (75% survival). The surviving fish in the 7.2 mg/L solutions were observed to be resting on the bottom of the exposure chamber. At test termination six of twenty fish survived the 7.2 mg/L exposure, and one fish was observed dead in the 4.3 mg/L nominal concentration solution. No mortalities occurred in the 2.6 mg/L, 1.6 mg/L, or control exposures. Additionally, all fish in the control, 1.6 mg/L, 2.6 mg/L, and 4.3 mg/L lithium ion solutions were swimming normally.

Chemical Analytical Results

Lithium ion measured concentrations are in Table 4. Initial (0-Hour) mean measured lithium ion concentrations for the low (1.6 mg/L), mid (4.3 mg/L), and high (12 mg/L) test solutions were 1.7 mg/L, 4.3 mg/L, and 12 mg/L, respectively. Forty-eight hour measured lithium concentrations from replicate A of the 7.2 mg/L and 12 mg/L concentrations were 7.2 mg/L and 12 mg/L, respectively. Control exposure lithium ion concentrations were measured at test termination and were below detection (<0.1 mg/L). The 96-hour final mean measured lithium ion concentrations were 1.7 mg/L (1.6 mg/L nominal), 4.4 mg/L (4.3 mg/L nominal), 7.5 mg/L (7.2 mg/L nominal), and 13 mg/L (12 mg/L nominal). Each of nominal lithium ion concentrations were within 8% of the respective mean measured concentrations.

Routine Water Chemistry Results

Tables 5 contains the test solution routine water chemistry values. Test solution pH values ranged from 7.72 to 8.14. No substantial pH differences were observed between the control and lithium exposures. Dissolved oxygen concentrations at test initiation ranged from 8.6 mg/L to 8.8 mg/L. Dissolved oxygen concentrations at test termination ranged from 7.6 mg/L to 7.8 mg/L. The lowest dissolved oxygen concentration measured during the test was 83% of saturation at 21°C.

Specific conductivity values for the test ranged from 131 to 315 μ mhos/cm. At test initiation, total hardness values for the control and high test concentration solutions were 40 mg/L and 46 mg/L as

CaCO₃, respectively. At test initiation, alkalinity of the control water and high test concentration solutions was 48 mg/L and 50 mg/L as CaCO₃, respectively. Temperatures were maintained at 21.0°C ± 1°C and ranged from 20.5°C to 20.7°C during the test.

Since no mortalities or sub-lethal adverse effects were observed in the control solutions and the test produced an interpretable concentration response, it appears suitable water quality was maintained during the toxicity exposure.

Test Acceptability

Table 6 summarizes the test acceptability results. The toxicity exposure met acceptability criteria for test duration, minimum control organism survival, and minimum dissolved oxygen concentration.

CONCLUSIONS

The test produced a normal and interpretable concentration response to juvenile fathead minnows during the 96-hour static acute toxicity test. Zero-percent mortality occurred in the control exposures. Nominal lithium ion concentrations were within 8% of 96-hour mean measured concentrations. Additionally, 0-hour measured test concentrations were within 10% of the 96-hour measured values indicating that test concentrations were maintained throughout the test duration. Statistical endpoints for each test interval are presented in Table 7.

Based on 96-hour measured concentrations, the 96-hour NOEC and LOEC was 4.4 mg/L and 7.5 mg/L, respectively. The 96-hour LC₁₀ was 4.6 mg/L (95% confidence interval 4.4-4.8 mg/L), and the 96-hour LC₅₀ was 6.6 mg/L (95% confidence interval 5.8-7.4 mg/L).

REFERENCES

Organization for Economic Cooperation and Development (OECD). 1993 OECD Guidelines for Testing of Chemicals. OECD Publication Information Center, Washington, DC.

Hamilton, M.A., R.C. Russo, and R.V. Thurston. 1977. Trimmed Spearman-Kärber Method for Estimating Median Lethal Concentrations in Toxicity Bioassays. Environ. Sci. Technol. 11(7): 714-719; Correction 12(4):417. 1978.

West Inc. and University of Wyoming. Toxstat Software Package. Version 3.5. Laramie, Wyoming.

USEPA. 1993. A Linear Interpolation Method for Sublethal Toxicity: The Inhibition Concentration (ICp) Approach. Version 2.0. Environmental Research Laboratory, Duluth, Minnesota.

TABLE 1. Lithium: List of Test Conditions for 96-Hour Fathead Minnow Acute Toxicity Test

Test Organism	Species: Fathead Minnow (<i>Pimephales promelas</i>). Age: Juvenile (19 days old, all hatched within a 24-hour window). Stock Source: Aquatic Biosystems, Inc., Fort Collins, Colorado. Test Organism Source: ASCI-ETL in-house culture. Collection Method: Culture. Holding Feeding Frequency: One to three times per day. Toxicity Test Method: OECD Guideline 203.
Test Substance Definitive Test Dates:	9/3-7/99.
Vehicles or Additives:	None.
Dilution Water:	Dechlorinated City of Duluth, MN, tap water (post carbon (PC) water). The most recent chemical analysis is in Appendix B.
Test Temperature:	21.0 ± 1°C.
Lighting:	Cool-white fluorescent 50-100 ft-candles, 16 hours light, 8 hours darkness daily.
Test Chamber:	3.8-L clear-glass, wide-mouthed jars.
Test Solution Volume:	2.5 L.
Nominal Test Concentrations:	0 mg/L, 1.6 mg/L, 2.6 mg/L, 4.3 mg/L, 7.2 mg/L, 12 mg/L.
Replicates per Concentration:	Two test replicates plus one monitoring chamber.
Organisms per Replicate:	Ten.
Test Substance Introduction:	Solutions prepared via mass addition accompanied by gentle mechanical stirring.
Solution Renewal:	None.

TABLE 2. Lithium: NaCl Reference Test Information

Reference Substance:	NaCl; VWR, Reagent-Grade, Lot #127038-118832.
Reference Substance Test Dates:	9/3-7/99.
Reference Substance 96-Hour LC ₅₀ :	11.31 g/L; 95% Confidence Interval Not Calculable.

TABLE 3. Lithium: Acute Toxicity of Lithium Ion to Juvenile Fathead Minnows (*Pimephales promelas*)

Nominal Test Substance Concentration (mg/L)	Cumulative Number of Dead Organisms and Percent Mortality			
	24 H	48 H	72 H	96 H
0 (Control)	0 (0) ^{ab}	0 (0)	0 (0)	0 (0)
1.6	0 (0)	0 (0)	0 (0)	0 (0)
2.6	0 (0)	0 (0)	0 (0)	0 (0)
4.3	0 (0)	0 (0)	0 (0)	1 (5)
7.2	0 (0)	0 (0)	5 (20)	14 (70)
12	0 (0)	12 (60)	20 (100)	20 (100)

^a Percentages are in Parenthesis

^b Percentage Mortality Based on the Mean of Two Replicates

TABLE 4. Lithium: Measured Initial and Final Test Substance Concentrations (mg/L) for Fathead Minnow 96-Hour Acute Toxicity Test

Test Substance Nominal Conc. (mg/L)	Test Replicate	0 H	48 H	96 H
0 (Control)	A	NM ^a	NM	<0.1
	B	NM	NM	<0.1
	mean	--	--	
1.6	A	1.6	NM	1.6
	B	1.7	NM	1.8
	mean	1.7	--	1.7
2.6	A	NM	NM	NM
	B	NM	NM	NM
	mean	--	--	--
4.3	A	4.3	NM	4.4
	B	4.2	NM	4.3
	mean	4.3	--	4.4
7.2	A	NM	7.2	7.7
	B	NM	NM	7.3
	mean	--	--	7.5
12	A	12	12	12
	B	12	NM	13
	mean	12	--	13

Note: Method Detection Limit = 0.1 mg/L.

^a NM = Not Measured

TABLE 5. Lithium: pH, Dissolved Oxygen Concentration, and Conductivity of Test Solutions from Fathead Minnow 96-Hour Acute Toxicity Test

Test Substance Nominal Conc. (mg/L)	pH (S.U.)				Dissolved Oxygen (mg/L)				Specific Cond. (µmhos/cm)					
	0-H	24-H	48-H	96-H	0-H	24-H	48-H	72-H	96-H	0-H	24-H	48-H	72-H	96-H
0 (Control)	8.0	7.8	8.0	8.1 ^a	8.7	8.1	8.1	8.0	7.8 ^a	134	132	133	140	132 ^a
1.6	7.9	7.8	8.0	8.0 ^a	8.7	8.2	7.9	8.0	7.8 ^a	157	159	158	156	157 ^a
2.6	7.9	7.8	7.9	8.0 ^a	8.6	8.2	7.9	7.9	7.7 ^a	172	174	174	174	172 ^a
4.3	7.9	7.8	7.9	8.0 ^a	8.8	8.0	7.9	7.8	7.8 ^a	197	200	199	200	197 ^a
7.2	7.8	7.8	7.9	7.9 ^a	8.6	8.1	7.8	7.6	7.6 ^a	241	243	244	243	241 ^a
12	7.8	7.7	7.8	-- ^b	8.8	8.2	7.6	7.4	-- ^b	312	314	315	315	-- ^b

^a Mean Value of Replicates

^b Complete Organism Mortality Observed at Previous Test Interval

TABLE 6. Lithium: Test Acceptability Criteria

Criterion	Results
Test duration must be 96 hours.	Test duration was 96 hours.
Dissolved oxygen concentration at test termination must be maintained at a minimum of 60% of the air saturation value at test temperature.	The lowest dissolved oxygen concentration measured at test termination was 83% of the saturation value at 21°C.
Less than 10% of the control organisms die or appear to be stressed or diseased during the 96-hour test period.	0% of the control organisms died or appeared diseased during the 96-hour test period.

TABLE 7. Lithium: Statistical Endpoints for Fathead Minnow 96-Hour Acute Toxicity Test

Endpoint ^a	Value (mg/L)	95% Confidence Intervals (mg/L)
24-Hour LC ₁₀	> 13	Not Calculable
24-Hour LC ₅₀	> 13	Not Calculable
48-Hour LC ₁₀	8.4	8.2-8.9
48-Hour LC ₅₀	11.9	Not Calculable
72-Hour LC ₁₀	5.6	5.2-7.5
72-Hour LC ₅₀	8.6	7.8-9.6
96-Hour LC ₁₀	4.6	4.4-4.8
96-Hour LC ₅₀	6.6	5.8-7.4
96-Hour NOEC	4.4	Not Applicable
96-Hour LOEC	7.5	Not Applicable

^a Endpoint Values Determined Using Mean 96-Hour Measured Lithium Concentrations

ASci Corporation
Environmental Testing Laboratory
Submitted to 3M - 3/00
ASci-ETL Study ID# 5010-068

APPENDIX A

TEST SUBSTANCE INFORMATION

Sponsor: 3M
Sponsor Study ID# W2906



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ATTN: SAFETY DIRECTOR

EMERGENCY PHONE 1-314-771-5765

ASCI
1365 BEVERLY RD
MC LEAN VA 22101-3632

DATE 11/04/97
CUST#: 6-091-03672
PO#: 750100149

M A T E R I A L S A F E T Y D A T A S H E E T PAGE 1

SECTION 1. - - - - - CHEMICAL IDENTIFICATION - - - - -

CATALOG #: L4408
NAME: LITHIUM CHLORIDE ANHYDROUS SIGMAULTRA

SECTION 2. - - - - - COMPOSITION/INFORMATION ON INGREDIENTS - - - - -

CAS #: 7447-41-8
MF: CLLI
EC NO: 231-212-3

SYNONYMS
CHLORKU LITU (POLISH) * CHLORURE DE LITHIUM (FRENCH) *

SECTION 3. - - - - - HAZARDS IDENTIFICATION - - - - -

LABEL PRECAUTIONARY STATEMENTS

TOXIC
MAY CAUSE HARM TO THE UNBORN CHILD.
MAY CAUSE HARM TO BREASTFED BABIES.
POSSIBLE RISK OF IMPAIRED FERTILITY.
HARMFUL IF SWALLOWED.
IRRITATING TO EYES AND RESPIRATORY SYSTEM.
CAUSES SEVERE SKIN IRRITATION.
TARGET ORGAN(S):
CENTRAL NERVOUS SYSTEM
KIDNEYS
AVOID EXPOSURE - OBTAIN SPECIAL INSTRUCTIONS BEFORE USE.
IN CASE OF ACCIDENT OR IF YOU FEEL UNWELL, SEEK MEDICAL ADVICE
IMMEDIATELY (SHOW THE LABEL WHERE POSSIBLE).
WEAR SUITABLE PROTECTIVE CLOTHING, GLOVES AND EYE/FACE
PROTECTION.
DO NOT BREATHE DUST.

SECTION 4. - - - - - FIRST-AID MEASURES - - - - -

IN CASE OF CONTACT, IMMEDIATELY FLUSH EYES OR SKIN WITH COPIOUS
AMOUNTS OF WATER FOR AT LEAST 15 MINUTES WHILE REMOVING CONTAMINATED
CLOTHING AND SHOES.
ASSURE ADEQUATE FLUSHING OF THE EYES BY SEPARATING THE EYELIDS
WITH FINGERS.
IF INHALED, REMOVE TO FRESH AIR. IF NOT BREATHING GIVE ARTIFICIAL
RESPIRATION. IF BREATHING IS DIFFICULT, GIVE OXYGEN.
IF SWALLOWED, WASH OUT MOUTH WITH WATER PROVIDED PERSON IS CONSCIOUS.
CALL A PHYSICIAN.
WASH CONTAMINATED CLOTHING BEFORE REUSE.

SECTION 5. - - - - - FIRE FIGHTING MEASURES - - - - -

EXTINGUISHING MEDIA

CONTINUED ON NEXT PAGE

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M A T E R I A L S A F E T Y D A T A S H E E T P A G E 2

CATALOG #: L4408
NAME: LITHIUM CHLORIDE ANHYDROUS SIGMAULTRA

WATER SPRAY.
CARBON DIOXIDE, DRY CHEMICAL POWDER OR APPROPRIATE FOAM.

SPECIAL FIREFIGHTING PROCEDURES
WEAR SELF-CONTAINED BREATHING APPARATUS AND PROTECTIVE CLOTHING TO
PREVENT CONTACT WITH SKIN AND EYES.

UNUSUAL FIRE AND EXPLOSIONS HAZARDS
EMITS TOXIC FUMES UNDER FIRE CONDITIONS.

SECTION 6. - - - - - ACCIDENTAL RELEASE MEASURES- - - - -

EVACUATE AREA.
WEAR SELF-CONTAINED BREATHING APPARATUS, RUBBER BOOTS AND HEAVY
RUBBER GLOVES.
SWEEP UP, PLACE IN A BAG AND HOLD FOR WASTE DISPOSAL.
AVOID RAISING DUST.
VENTILATE AREA AND WASH SPILL SITE AFTER MATERIAL PICKUP IS COMPLETE.

SECTION 7. - - - - - HANDLING AND STORAGE- - - - -

REFER TO SECTION 8.

SECTION 8. - - - - - EXPOSURE CONTROLS/PERSONAL PROTECTION- - - - -

WEAR APPROPRIATE NIOSH/MSHA-APPROVED RESPIRATOR, CHEMICAL-RESISTANT
GLOVES, SAFETY GOGGLES, OTHER PROTECTIVE CLOTHING.
SAFETY SHOWER AND EYE BATH.
USE ONLY IN A CHEMICAL FUME HOOD.
DO NOT BREATHE DUST.
DO NOT GET IN EYES, ON SKIN, ON CLOTHING.
AVOID PROLONGED OR REPEATED EXPOSURE.
WASH THOROUGHLY AFTER HANDLING.
KEEP TIGHTLY CLOSED.
STORE IN A COOL DRY PLACE.

SECTION 9. - - - - - PHYSICAL AND CHEMICAL PROPERTIES - - - - -

APPEARANCE AND ODOR
SOLID.

SECTION 10. - - - - - STABILITY AND REACTIVITY - - - - -

STABILITY
STABLE.

INCOMPATIBILITIES
STRONG OXIDIZING AGENTS
STRONG ACIDS
PROTECT FROM MOISTURE.

HAZARDOUS COMBUSTION OR DECOMPOSITION PRODUCTS

CONTINUED ON NEXT PAGE



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M A T E R I A L S A F E T Y D A T A S H E E T PAGE 3

CATALOG #: L4408
NAME: LITHIUM CHLORIDE ANHYDROUS SIGMAULTRA

TOXIC FUMES OF:
HYDROGEN CHLORIDE GAS
LITHIUM OXIDES

HAZARDOUS POLYMERIZATION
WILL NOT OCCUR.

SECTION 11. - - - - - TOXICOLOGICAL INFORMATION. - - - - -

ACUTE EFFECTS

HARMFUL IF SWALLOWED, INHALED, OR ABSORBED THROUGH SKIN.
CAUSES SEVERE SKIN IRRITATION.
MATERIAL IS IRRITATING TO MUCOUS MEMBRANES AND UPPER
RESPIRATORY TRACT.
SYMPTOMS OF EXPOSURE MAY INCLUDE BURNING SENSATION, COUGHING,
WHEEZING, LARYNGITIS, SHORTNESS OF BREATH, HEADACHE, NAUSEA AND
VOMITING.

CHRONIC EFFECTS

MAY CAUSE CONGENITAL MALFORMATION IN THE FETUS.
MAY CAUSE REPRODUCTIVE DISORDERS.
CYANOSIS AND T-WAVE INVERSION HAVE OCCURRED IN THE BREAST-FED INFANTS
OF WOMEN RECEIVING LITHIUM CARBONATE THERAPY.
TARGET ORGAN(S):
CENTRAL NERVOUS SYSTEM
KIDNEYS
CARDIOVASCULAR SYSTEM
THYROID
TO THE BEST OF OUR KNOWLEDGE, THE CHEMICAL, PHYSICAL, AND
TOXICOLOGICAL PROPERTIES HAVE NOT BEEN THOROUGHLY INVESTIGATED.

ADDITIONAL INFORMATION

LARGE DOSES OF LITHIUM ION HAVE CAUSED DIZZINESS AND PROSTRATION, AND
CAN CAUSE KIDNEY DAMAGE IF SODIUM INTAKE IS LIMITED. DEHYDRATION,
WEIGHT LOSS, DERMATOLOGICAL EFFECTS AND THYROID DISTURBANCES HAVE BEEN
REPORTED. CENTRAL NERVOUS SYSTEM EFFECTS THAT INCLUDE SLURRED SPEECH,
BLURRED VISION, SENSORY LOSS, ATAXIA AND CONVULSIONS MAY OCCUR.
DIARRHEA, VOMITING AND NEUROMUSCULAR EFFECTS SUCH AS TREMOR, CLONUS
AND HYPERACTIVE REFLEXES MAY OCCUR AS A RESULT OF REPEATED EXPOSURE TO
LITHIUM ION.
CYANOSIS AND T-WAVE INVERSION HAVE OCCURRED IN THE BREAST-FED INFANTS
OF WOMEN RECEIVING LITHIUM CARBONATE THERAPY.

RTECS #: OJ5950000
LITHIUM CHLORIDE

IRRITATION DATA

SKN-RBT 500 MG/24H SEV
EYE-RBT 100 MG/24H MOD

28ZPAK -,7,1972
28ZPAK -,7,1972

TOXICITY DATA

ORL-HMN LDLO:200 MG/KG/3D

JAMAAP 139,688,1949

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M A T E R I A L S A F E T Y D A T A S H E E T PAGE 4

CATALOG #: L4408
 NAME: LITHIUM CHLORIDE ANHYDROUS SIGMAULTRA

ORL-RAT LD50:526 MG/KG	APTOA6 47,351,1980
IPR-RAT LD50:514 MG/KG	PETKP# 22DEC1977
SCU-RAT LD50:499 MG/KG	PETKP# 22DEC1977
ICE-RAT LD50:4800 UG/KG	PJPPAA 26,399,1974
ORL-MUS LD50:1165 MG/KG	RPTOAN 33,266,1970
IPR-MUS LD50:600 MG/KG	JTBIDS 6,87,1981
SCU-MUS LD50:738 MG/KG	APTOA6 43,51,1978
IVN-MUS LD50:363 MG/KG	OYYAA2 7,413,1973
ICE-MUS LD50:14040 UG/KG	NYKZAU 69,75,1973
IPR-CAT LD50:492 MG/KG	RPTOAN 42,9,1979
ORL-RBT LD50:800 MG/KG	FATOAO 39,53,1976
ORL-OAL LD50:422 MG/KG	AECTCV 12,355,1983
ORL-BWD LD50:422 MG/KG	AECTCV 12,355,1983

TARGET ORGAN DATA

- BRAIN AND COVERINGS (RECORDINGS FROM SPECIFIC AREAS OF CNS)
 - SENSE ORGANS AND SPECIAL SENSES (PTOSIS)
 - BEHAVIORAL (ALTERED SLEEP TIME)
 - BEHAVIORAL (SOMNOLENCE)
 - BEHAVIORAL (TREMOR)
 - BEHAVIORAL (FOOD INTAKE)
 - BEHAVIORAL (MUSCLE WEAKNESS)
 - BEHAVIORAL (MUSCLE CONTRACTION OR SPASTICITY)
 - BEHAVIORAL (ANTIPSYCHOTIC)
 - GASTROINTESTINAL (CHANGES IN STRUCTURE OR FUNCTION OF SALIVARY GLANDS)
 - GASTROINTESTINAL (NAUSEA OR VOMITING)
 - ENDOCRINE (CHANGE IN LH)
 - ENDOCRINE (ANDROGENIC)
 - BLOOD (LYMPHOMA INCLUDING HODGKIN'S DISEASE)
 - MUSCULO-SKELETAL (OTHER CHANGES)
 - PATERNAL EFFECTS (SPERMATOGENESIS)
 - PATERNAL EFFECTS (OTHER EFFECTS ON MALE)
 - EFFECTS ON FERTILITY (POST-IMPLANTATION MORTALITY)
 - EFFECTS ON FERTILITY (LITTER SIZE)
 - EFFECTS ON FERTILITY (ABORTION)
 - EFFECTS ON EMBRYO OR FETUS (FETAL DEATH)
 - EFFECTS ON EMBRYO OR FETUS (OTHER EFFECTS TO EMBRYO OR FETUS)
 - SPECIFIC DEVELOPMENTAL ABNORMALITIES (EYE, EAR)
 - SPECIFIC DEVELOPMENTAL ABNORMALITIES (CRANIOFACIAL)
 - EFFECTS ON NEWBORN (OTHER NEONATAL MEASURES OR EFFECTS)
 - EFFECTS ON NEWBORN (GROWTH STATISTICS)
 - EFFECTS ON NEWBORN (BIOCHEMICAL AND METABOLIC)
 - EFFECTS ON NEWBORN (PHYSICAL)
 - NUTRITIONAL AND GROSS METABOLIC (BODY TEMPERATURE DECREASE)
 - TUMORIGENIC (NEOPLASTIC BY RTECS CRITERIA)
- ONLY SELECTED REGISTRY OF TOXIC EFFECTS OF CHEMICAL SUBSTANCES (RTECS) DATA IS PRESENTED HERE. SEE ACTUAL ENTRY IN RTECS FOR COMPLETE INFORMATION.

SECTION 12. - - - - - ECOLOGICAL INFORMATION - - - - -

DATA NOT YET AVAILABLE.

CONTINUED ON NEXT PAGE



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M A T E R I A L S A F E T Y D A T A S H E E T PAGE 5

CATALOG #: L4408
NAME: LITHIUM CHLORIDE ANHYDROUS SIGMAULTRA

SECTION 13. ----- DISPOSAL CONSIDERATIONS -----

CONTACT A LICENSED PROFESSIONAL WASTE DISPOSAL SERVICE TO DISPOSE OF THIS MATERIAL. OBSERVE ALL FEDERAL, STATE AND LOCAL ENVIRONMENTAL REGULATIONS.

SECTION 14. ----- TRANSPORT INFORMATION -----

CONTACT SIGMA CHEMICAL COMPANY FOR TRANSPORTATION INFORMATION.

SECTION 15. ----- REGULATORY INFORMATION -----

EUROPEAN INFORMATION

- TOXIC
- R 61 MAY CAUSE HARM TO THE UNBORN CHILD.
- R 64 MAY CAUSE HARM TO BREASTFED BABIES.
- R 62 POSSIBLE RISK OF IMPAIRED FERTILITY.
- R 22 HARMFUL IF SWALLOWED.
- R 36/37 IRRITATING TO EYES AND RESPIRATORY SYSTEM.
- S 53 AVOID EXPOSURE - OBTAIN SPECIAL INSTRUCTIONS BEFORE USE.
- S 45 IN CASE OF ACCIDENT OR IF YOU FEEL UNWELL, SEEK MEDICAL ADVICE IMMEDIATELY (SHOW THE LABEL WHERE POSSIBLE).
- S 36/37/39 WEAR SUITABLE PROTECTIVE CLOTHING, GLOVES AND EYE/FACE PROTECTION.
- S 22 DO NOT BREATHE DUST.

REVIEWS, STANDARDS, AND REGULATIONS

OEL=MAK
NOHS 1974: HZD 84472; NIS 26; TNF 1089; NOS 25; TNE 5881
NOES 1983: HZD 84472; NIS 36; TNF 2291; NOS 36; TNE 34091; TFE 15304
EPA GENETOX PROGRAM 1988, NEGATIVE: CELL TRANSFORM.-SA7/SHE; B SUBTILIS REC ASSAY
EPA TSCA SECTION 8(B) CHEMICAL INVENTORY

SECTION 16. ----- OTHER INFORMATION -----

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M A T E R I A L S A F E T Y D A T A S H E E T P A G E 6

CATALOG #: L4408
NAME: LITHIUM CHLORIDE ANHYDROUS SIGMAULTRA

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ASci Corporation
Environmental Testing Laboratory
Submitted to 3M - 3/00
ASci-ETL Study ID# 5010-068

APPENDIX B

CHEMICAL ANALYSES OF POST-CARBON WATER

Sponsor: 3M
Sponsor Study ID# W2906

NORTHERN LAKE SERVICE, INC.
 Analytical Laboratory and Environmental Services
 400 North Lake Avenue - Crandon, WI 54520
 Tel:(715)478-2777 Fax:(715)478-3060

WIS. LAB CERT. NO. 721026460

ANALYTICAL REPORT

PAGE: 2 NLS PROJECT# 49291
 NLS CUST# 01472

Client: ASCI-Duluth Environmental Testing Div.
 Attn: Allan Mozol
 4444 Air Park Blvd.
 Duluth, MN 55811

Project Description: Laboratory Water & Food Analysis
 Project Title: 98

Sample ID: Post Carbon NLS#: 207621
 Ref. Line 3 of COC 38362 Description: Post Carbon
 Collected: 07/28/99 Received: 07/27/99 Reported: 08/31/99

Parameter	Result	Units	LOD	LOQ	Method	Analyzed Lab
Aluminum, tot. as Al by ICP	0.027	mg/L	0.0074	0.026	EPA 200.7	08/11/99 721026460
Arsenic, tot. as As by furnace AAS	ND	ug/L	1.5	5.4	EPA 206.2	08/20/99 721026460
Cadmium, tot. as Cd by furnace AAS	ND	ug/L	0.13	0.47	EPA 213.2	08/08/99 721026460
Calcium, tot. as Ca by ICP	14	mg/L	0.30	0.30	EPA 200.7	08/11/99 721026460
Chromium, tot. as Cr by furnace AAS	ND	ug/L	0.18	0.64	EPA 218.2	08/10/99 721026460
Copper, tot. as Cu by ICP	ND	ug/L	0.47	1.7	EPA 200.7	08/11/99 721026460
Cyanide, tot. (distilled) as CN	ND	mg/L	0.0032	0.011	EPA 335.4	08/02/99 721026460
Fluoride, as F (unfiltered)	1.1	mg/L	0.010	0.033	EPA 340.1	08/09/99 721026460
Iron, tot. as Fe by ICP	< 0.0027 >	mg/L	0.0010	0.0035	EPA 200.7	08/11/99 721026460
Lead, tot. as Pb by furnace AAS	ND	ug/L	0.46	1.6	EPA 239.2	08/06/99 721026460
Magnesium, tot. as Mg by ICP	2.8	mg/L	0.30	0.30	EPA 200.7	08/11/99 721026460
Mercury, tot. as Hg	ND	ug/L	0.050	0.050	EPA 245.7M	08/04/99 721026460
Nickel, tot. as Ni by ICP	ND	ug/L	0.66	2.3	EPA 200.7	08/11/99 721026460
Potassium, tot. as K	0.49	mg/L	0.11	0.40	EPA 200.7	08/12/99 721026460
Selenium, tot. as Se by furnace AAS	ND	ug/L	1.3	4.6	EPA 270.2	08/10/99 721026460
Silver, tot. as Ag by furnace AAS	ND	ug/L	0.22	0.79	SM 3113B	08/05/99 721026460
Sodium, tot. as Na (TSS)	8.8	mg/L	0.020	0.020	EPA 200.7	08/11/99 721026460
Solids, tot. susp.	ND	mg/L	1.0		EPA 160.2	07/28/99 721026460
Total organic carbon (TOC)	ND	mg/L	1.3		EPA 415.1	08/11/99 737053130
Zinc, tot. as Zn by ICP	ND	ug/L	12	12	EPA 200.7	08/11/99 721026460
Organochlorine Pesticides (water) by EPA 8081	see attached				SW846 8081	08/12/99 721026460
PCBs (water) by EPA 8082	see attached				SW846 8082	08/12/99 721026460
Pesticides by EPA 8141	see attached				SW846 8141	08/07/99 999462640
Organics Extraction for Chlorinated Pest/PCBs	yes				SW846 3500	08/02/99 721026460
Extraction for Nitrogen/Phosphorus Pesticides	yes				SW846 3500	08/02/99 999462640

✓ # 9/10/99

ANALYTICAL RESULTS: Nitrogen/Phosphorous Pesticides by Method 8270

Customer: ASCI-Duluth Environmental Testing Div.
 Project Description: Laboratory Water & Food Analysis Project Title: 98
 Northern Lake Service Project Number: 49291

Page: 1

Analyte Name	207620 ug/L	Millipore H2O	DILUTION FACTOR	LOD ug/L	LOQ ug/L
Atrazine	ND		1	0.029	0.029
Alachlor	ND		1	0.035	0.035
Butylate	ND		1	0.50	0.50
Cyanazine	ND		1	0.060	0.060
EPTC	ND		1	0.046	0.046
Malathion	ND		1	0.075	0.075
Metolachlor	ND		1	0.032	0.032
Metribuzin	ND		1	0.049	0.049
Pendimethalin	ND		1	0.030	0.030
Simazine	ND		1	0.057	0.057
Trifluralin	ND		1	0.075	0.075
Phorate	ND		1	0.038	0.038
Diazinon	ND		1	0.50	0.50
Carbofuran	ND		1	0.50	0.50
Methyl Parathion	ND		1	0.11	0.11
Ethyl Parathion	ND		1	0.10	0.10
Chlorpyrifos	ND		1	0.028	0.028

Analyte Name	207621 ug/L	Post Carbon	DILUTION FACTOR	LOD ug/L	LOQ ug/L
Atrazine	ND		1	0.029	0.029
Alachlor	ND		1	0.035	0.035
Butylate	ND		1	0.50	0.50
Cyanazine	ND		1	0.060	0.060
EPTC	ND		1	0.046	0.046
Malathion	ND		1	0.075	0.075
Metolachlor	ND		1	0.032	0.032
Metribuzin	ND		1	0.049	0.049
Pendimethalin	ND		1	0.030	0.030
Simazine	ND		1	0.057	0.057
Trifluralin	ND		1	0.075	0.075
Phorate	ND		1	0.038	0.038
Diazinon	ND		1	0.50	0.50
Carbofuran	ND		1	0.50	0.50
Methyl Parathion	ND		1	0.11	0.11
Ethyl Parathion	ND		1	0.10	0.10
Chlorpyrifos	ND		1	0.028	0.028

✓ 9/10/99

ANALYTICAL RESULTS: Pesticides by Method 8081 and PCBs by Method 8082
 Page: 2

Customer: ASCI-Duluth Environmental Testing Div.
 Project Description: Laboratory Water & Food Analysis Project Title: 98
 Northern Lake Service Project Number: 49291

Analyte Name	207621 Post Carbon ug/L	DILUTION FACTOR	LOD ug/L	LOQ ug/L
Aldrin	ND	1	0.0097	0.033
Alpha-BHC	ND	1	0.011	0.037
Beta-BHC	ND	1	0.012	0.043
Delta-BHC	ND	1	0.011	0.037
Gamma-BHC	ND	1	0.0094	0.032
Chlordane	ND	1	0.027	0.10
4,4'-DDD	ND	1	0.0098	0.038
4,4'-DDE	ND	1	0.0094	0.032
4,4'-DDT	ND	1	0.015	0.053
Dieldrin	ND	1	0.011	0.036
Endosulfan I	ND	1	0.011	0.037
Endosulfan II	ND	1	0.011	0.039
Endosulfan Sulfate	ND	1	0.015	0.051
Endrin	ND	1	0.013	0.039
Endrin Aldehyde	ND	1	0.013	0.044
Heptachlor	ND	1	0.011	0.039
Heptachlor Epoxide	ND	1	0.0099	0.034
Methoxychlor	ND	1	0.0097	0.033
PCB-1016	ND	1	0.033	0.11
PCB-1221	ND	1	0.32	1.1
PCB-1232	ND	1	0.032	0.11
PCB-1242	ND	1	0.030	0.10
PCB-1248	ND	1	0.028	0.095
PCB-1254	ND	1	0.021	0.069
PCB-1260	ND	1	0.032	0.11
Toxaphene	ND	1	0.23	0.80
Surrogate Recovery on DBC = 105 %				

✓ AT 9/10/99

ASci Corporation
Environmental Testing Laboratory
Submitted to 3M - 3/00
ASci-ETL Study ID# 5010-068

APPENDIX C

DEFINITIVE TEST DATA

Sponsor: 3M
Sponsor Study ID# W2906

10/7

ASCI Corporation

TEST Lithium "FHM Acute"

DATE 9/3/99

TECHNICIAN(S) J, we

ENVIRONMENTAL SAMPLE
 TEST INFORMATION

Date:	9/3/99	
Effluent/Ambient:	LiCl	Analyst: <u>S. D. Sankos</u>
Template Number:	NA	
Test Dates:	9/3-7/99	Part carbon
Dilution Water:	Dechlorinated City of Duluth Tap Water (PC)	
Test Site:	ASCI H ₂ O bath II	
Test Chamber:	3.8 Liter Glass	
Food:	NONE	
Temperature:	21°C ± 1	
Test Organism/Age:	Fathead minnow / 19 days old	
Culture Medium:	Dechlorinated City of Duluth Tap Water	
Comments:	Lithium obtained from Lithium Chloride, Sigma Chemical Co. Lot 77H00771	
	Test concentrations of 12 mg/L, 7.2 mg/L, 4.3 mg/L, 2.6 mg/L, and 1.6 mg/L as Lithium.	
	6.941 g/L	
	Lithium Chloride $FW = 42.367$, Li $FW = 6.941$, Cl $FW = 35.453$	
	$\% \text{ Li in LiCl} = (6.941 / 42.367) (100) = 16.37\%$	
	6.941 g/L	16.37% Actual (mg)
12 mg/L :	$(SL)(12 \text{ mg/L as Li})(0.1637)^{-1}$	368 mg 367
7.2 mg/L :	$(SL)(7.2 \text{ mg/L as Li})(0.1637)^{-1}$	221 mg 222
4.3 mg/L :	$(SL)(4.3 \text{ mg/L as Li})(0.1637)^{-1}$	132 mg 130
2.6 mg/L :	$(SL)(2.6 \text{ mg/L as Li})(0.1637)^{-1}$	80 mg 79
1.6 mg/L :	$(SL)(1.6 \text{ mg/L as Li})(0.1637)^{-1}$	49 mg 49
	0.1637 for all g/L me 9/2/99	
	Fish hatch date 8/15/99	
	LiCl is white crystalline material which is hygroscopic	

ACUTE TOXICITY TEST FORM

ASci Study ID#: <u>5010-068</u>		Sponsor: <u>ZIM</u>		Test Substance: <u>Lithium</u>			
Test Organism: <u>FHM</u>		Age: <u>19 day</u>		Dilution Water: <u>PC</u>			
Study Director: <u>[Signature]</u>		In-Life Phase Test Hour: 0 6 12		Analyst's Initials: <u>WAK</u>			
Today's Date: <u>9/14/99</u>		<u>[Signature]</u> 48 72 96		Time: <u>1050</u>			

Conc. (mg/L)	Exposure ID# & Rep	# Alive / # Affected	Obs	DO (mg/L)	pH	Temp. (°C)	Cond. (µmhos/cm)	Alkalinity (as mg CaCO ₃ /L)	Hardness (as mg CaCO ₃ /L)
0	A	10/0		<u>8.1</u>	<u>7.78</u>	<u>20.4</u>	<u>132</u>		
↓	B	10/0	<u>Look good</u>						
1.6	A	10/0	<u>↓</u>	<u>8.2</u>	<u>7.76</u>	<u>20.7</u>	<u>159</u>		
↓	B	<u>10/0</u> <u>ADAMANT</u>	<u>Look good</u>						
2.6	A	10/0	<u>↓</u>	<u>8.2</u>	<u>7.76</u>	<u>20.7</u>	<u>174</u>		
↓	B	10/0	<u>Look good</u>						
4.3	A	10/0	<u>Look good</u>	<u>8.0</u>	<u>7.75</u>	<u>20.7</u>	<u>200</u>		
↓	B	10/0	<u>↓</u>						
7.2	A	10/0	<u>Look good</u>	<u>8.1</u>	<u>7.75</u>	<u>20.7</u>	<u>243</u>		
↓	B	10/0	<u>↓</u>						
12	A	10/0	<u>Look good</u>	<u>8.2</u>	<u>7.72</u>	<u>20.7</u>	<u>314</u>		
↓	B	10/0	<u>↓</u>						

Parameter	Comments:	Mean ± SD
Minimum DO as % satn'	<u>90?</u>	
Test Organisms Length (mm)		
Test Organisms Weight (g)		

Note: Obs = Observation codes for test organisms and test solutions are on the reverse side of this page.

(OVER)

ACUTE TOXICITY TEST FORM

ASCI Study ID#: <u>5010-068</u>	Sponsor: <u>3M</u>	Test Substance: <u>Lithium</u>
Test Organism: <u>FHM</u>	Age: <u>19 day</u>	Dilution Water: <u>PC</u>
Study Director: <u>A</u>	In-Life Phase Test Hour: 0 6 12	Analyst's Initials: <u>HKC</u>
Today's Date: <u>9/5/99</u>	24 <u>Q</u> 72 96	Time: <u>1300</u>

Conc. (mg/L)	Exposure ID# & Rep	# Alive / # Affected	Obs	DO (mg/L)	pH	Temp. (°C)	Cond. (µmhos/cm)	Alkalinity (as mg CaCO ₃ /L)	Hardness (as mg CaCO ₃ /L)
0	A	10/0							
↓	B	10/0	Like good	8.1	7.98	20.6	133		
1.6	A	10/0							
↓	B	10/0		7.9	7.95	20.6	158		
2.6	A	10/0							
↓	B	10/0		7.9	7.92	20.6	174		
4.3	A	10/0							
↓	B	10/0		7.9	7.90	20.5	199		
7.2	A	10/0							
↓	B	10/0	✓	7.8	7.87	20.6	244		
12	A	2/8	Observed						
↓	B	4/4	swimming not below	7.6	7.83	20.6	315		

Parameter	Comments: <u>9/5/99</u> <u>Fish all alive in cages 12A + 12B are swimming on their sides. slow movement. 9/5/99.</u>	Mean ± SD
Minimum DO as % satn'		<u>85%</u>
Test Organisms Length (mm)		
Test Organisms Weight (g)		

Note: Obs = Observation codes for test organisms and test solutions are on the reverse side of this page.

(OVER)

ACUTE TOXICITY TEST FORM

ASCI Study ID#: <u>5010-068</u>		Sponsor: <u>3M</u>		Test Substance: <u>Lithium</u>			
Test Organism: <u>FHM</u>		Age: <u>19 day</u>		Dilution Water: <u>PC</u>			
Study Director: <u>[Signature]</u>		In-Life Phase Test Hour: 0 6 12		Analyst's Initials: <u>KA</u>			
Today's Date: <u>9/6/89</u>		24 48 <u>96</u>		Time: <u>1315</u>			

Conc. (mg/L)	Exposure ID# & Rep	# Alive / # Affected	Obs	DO (mg/L)	pH	Temp. (°C)	Cond. (µmhos/cm)	Alkalinity (as mg CaCO ₃ /L)	Hardness (as mg CaCO ₃ /L)
0 ↓	A B	10/0 10/0	lunch good	8.0	7.98	20.6	140		
1.6 ↓	A B	10/0 10/0		8.0	7.93	20.6	156		
2.6 ↓	A B	10/0 10/0		7.9	7.88	20.6	174		
4.3 ↓	A B	10/0 10/0		7.8	7.85	20.6	200		
7.2 ↓	A B	6/4 9/1	Fish lying on bottom (unresponsive) skin	7.6	7.83	20.6	243		
12 ↓	A B	0/10 0/10	DEAD ↓	7.4	7.80	20.6	315		

Parameter	Comments:	Mean ± SD
Minimum DO as % satn'	<u>83%</u>	
Test Organisms Length (mm)		
Test Organisms Weight (g)		

Note: Obs = Observation codes for test organisms and test solutions are on the reverse side of this page.

(OVER)

ACUTE TOXICITY TEST FORM

ASCI Study ID#: <u>5010-068</u>	Sponsor: <u>3M</u>	Test Substance: <u>Lithium</u>
Test Organism: <u>FHM</u>	Age: <u>19 day</u>	Dilution Water: <u>PC</u>
Study Director: <u>[Signature]</u>	In-Life Phase Test Hour: 0 6 12	Analyst's Initials: <u>[Signature]</u>
Today's Date: <u>9/7/99</u>	24 48 72 <u>96</u>	Time: <u>1100</u>

Conc. (mg/L)	Exposure ID/Rep	# Alive/ # Affected	Obs	DO (mg/L)	pH	Temp. (°C)	Cond. (µmhos/cm)	Alkalinity (as mg CaCO ₃ /L)	Hardness (as mg CaCO ₃ /L)
0	A	10/0	look	7.8	8.14	20.5	131		
↓	B	10/0	Good	7.7	8.09	20.5	133		
1.6	A	10/0	look	7.8	8.04	20.5	156		
↓	B	10/0	Good	7.8	8.02	20.5	157		
2.6	A	10/0	look	7.7	7.99	20.5	172		
↓	B	10/0	Good	7.7	7.98	20.5	172		
4.3	A	9/1	look	7.8	7.95	20.5	195		
↓	B	10/0	Good	7.7	7.94	20.5	198		
7.2	A	3/7	live fish erratic swimming	7.6	7.90	20.5	239		
↓	B	3/7		7.6	7.89	20.5	242		
12	A	0/10	ALL DEAD						
↓	B	0/10	DEAD						

Parameter	Comments:																	Mean ± SD			
Minimum DO as % satn'	851.																				
Test Organisms Length (mm)	16	16	16	17	12	15	15	14	16	12	16	14	16	15	16	13	16	16	14	15	15.0 ± 1.4
Test Organisms Weight (g) mg	23.3	24.0	27.5	30.6	14.7	26.1	19.0	18.5	28.9	13.2	26.8	16.6	25.5	13.8	13.8	12.2	29.0	25.3	13.8	17.6	21.5 ± 5.9

Note: Obs = Observation codes for test organisms and test solutions are on the reverse side of this page.

(OVER)

1 of 5

ASci Corporation

TEST Lithium Range finders

DATE 6/23/99

TECHNICIAN J. DIEMER

ASCI Corporation
 TEST INFORMATION & RESULTS

Date: 6/23/99
 Effluent/Ambient: LiCl Range finders
 Template Number: NA
 Test Dates: 6/23-27/99
 Dilution Water: dechlorinated City of Duluth Tap H₂O (PC)
 Test Site: ASCI
 Test Chamber: 102 plastic, 250 ml glass
 Food: NONE
 Temperature: 20° ~~SPIRE~~ 21°C
 Test Organism/Age: D. magna 124h, FHM 12 day (6/16/99) match
 Comments:
 Lithium Chloride (LiCl) fw = 42.367
 Li fw = ~~6.941~~ 6.941 g/mole
 Cl fw = 35.453

$$\% \text{ Li in LiCl} = \left(\frac{6.941}{42.367} \right) (100) = 16.37\%$$

$$(2000 \text{ ml}) (5 \text{ mg/L Li}) (0.1637)^{-1} =$$

$$? = (2 \text{ L}) (5 \text{ mg/L}) (0.1637)^{-1} = 61.27 \text{ mg}$$
 ✓ # 6/23/99
 Lithium Chloride:
 Sigma Chem Co. Received 11/8/97
 Lot 77H0071
 99%

16.37%
 6.941 g/mole
 16.37%
 1 mg/L conc. obtained
 by diluting 120 ml of
 5 mg/L soln to
 600 ml. (f)
 0.1 mg/L soln. obtained
 by diluting 12 ml of
 5 mg/L soln to 600 ml
 (f)

TOXICITY TEST RENEWAL FORM

3 of 5

TEST DAY	0 (Test Initiation)	1	2	3	4	5	6	7
DATE	<i>6/25/99</i>	<i>6/26/99</i>	<i>6/25/99</i>	<i>6/26/99</i>	<i>6/27/99</i>			
TIME OF RENEWAL/READING (Circle One)	<i>1200</i>	<i>1200</i>	<i>1130</i>	<i>1115</i>				
TIME OF FEEDING	<i>NA</i>	<i>-</i>	<i>-</i>	<i>NA</i>				
DILUTION WATER BATCH #	<i>PC H2O</i>	<i>-</i>	<i>-</i>	<i>NA</i>				
INITIALS	<i>JK</i>	<i>JK</i>	<i>JK</i>	<i>JK</i>				

Test observed on
 6/27/99 by Hollie K. Herman -
 Ms. K. Herman is unable to
 complete this data sheet.
 However she did initial
 and date the survival
 values on the appropriate
 page. *JK*
 2/8/00

ASci Corporation
Environmental Testing Laboratory
Submitted to 3M - 3/00
ASci-ETL Study ID# 5010-068

APPENDIX D

REFERENCE TEST CONTROL CHART

Sponsor: 3M
Sponsor Study ID# W2906

**Reference Toxicity Control Chart for
96-Hour Acute Tests with Juvenile Fathead Minnows**

Test Date	NaCl 96-Hour LC ₅₀ (g/L)	Running Mean (g/L)	Standard Deviation	Lower Limit	Upper Limit
December 1996	6.7	--	--	--	--
January 1997	5.5	6.1	0.8	4.5	7.7
February 1997	6.9	6.4	0.8	4.8	8.0
February 1997	6.1	6.3	0.6	5.1	7.5
March 1997	6.1	6.3	0.6	5.1	7.5
March 1997	8.0	6.6	0.9	4.8	8.4
March 1997	11.3	7.2	2.0	3.2	11.2
April 1997	10.2	7.6	2.1	3.4	11.8
June 1997	8.8	7.7	2.0	3.7	11.7
July 1997	11.3	8.1	2.2	3.7	12.5
August 1997	11.3	8.4	2.3	3.8	13.0
November 1997	11.3	8.6	2.3	4.0	13.2
November 1997	11.3	8.8	2.4	4.0	13.6
December 1997	11.3	9.0	2.4	4.2	13.8
December 1997	8.0	8.9	2.3	4.3	13.5
January 1998	10.2	9.0	2.2	4.6	13.4
February 1998	9.9	9.1	2.2	4.7	13.5
September 1998	11.3	9.2	2.2	4.8	13.6
November 1998	9.9	9.2	2.1	5.0	13.4
December 1998	9.2	9.2	2.1	5.0	13.4
December 1998	9.9	9.3	2.0	5.3	13.3
January 1999	5.7	9.1	2.1	4.9	13.3
February 1999	11.3	9.2	2.1	5.0	13.3
August 1999	11.3	9.3	2.1	5.1	13.5
September 1999	11.3	9.4	2.1	5.2	13.6
November 1999	9.5	9.4	2.1	5.2	13.6
December 1999	8.6	9.3	2.0	5.3	13.4

*** Inhibition Concentration Percentage Estimate ***

Toxicant/Effluent: LITHIUM ION
 Test Start Date: 9/3/99 Test Ending Date: 9/7/99
 Test Species: FATHEAD MINNOW
 Test Duration: HOURS, 48
 DATA FILE:

Conc. ID	Number Replicates	Concentration MG/L	Response Means	Std. Dev.	Pooled Response Means
1	2	0.000	10.000	0.000	10.000
2	2	1.700	10.000	0.000	10.000
3	2	2.600	10.000	0.000	10.000
4	2	4.400	10.000	0.000	10.000
5	2	7.500	10.000	0.000	10.000
6	2	13.000	4.000	2.828	4.000

The Linear Interpolation Estimate: 8.4167 Entered P Value: 10

Number of Resamplings: 80 80 Resamples Generated
 The Bootstrap Estimates Mean: 8.5083 Standard Deviation: 0.2719
 Original Confidence Limits: Lower: 8.1875 Upper: 8.8750
 Expanded Confidence Limits: Lower: 7.5000 Upper: 10.2500
 Resampling time in Seconds: 0.00 Random Seed: -415225628
 Press Any Key to Continue

*** Inhibition Concentration Percentage Estimate ***

Toxicant/Effluent: LITHIUM ION
 Test Start Date: 9/3/99 Test Ending Date: 9/7/99
 Test Species: FATHEAD MINNOW
 Test Duration: HOURS, 72
 DATA FILE:

Conc. ID	Number Replicates	Concentration MG/L	Response Means	Std. Dev.	Pooled Response Means
1	2	0.000	10.000	0.000	10.000
2	2	1.700	10.000	0.000	10.000
3	2	2.600	10.000	0.000	10.000
4	2	4.400	10.000	0.000	10.000
5	2	7.500	7.500	2.121	7.500
6	2	13.000	0.000	0.000	0.000

The Linear Interpolation Estimate: 5.6400 Entered P Value: 10

Number of Resamplings: 80 80 Resamples Generated
 The Bootstrap Estimates Mean: 6.0817 Standard Deviation: 0.9530
 Original Confidence Limits: Lower: 5.1750 Upper: 7.5000
 Expanded Confidence Limits: Lower: 3.7800 Upper: 13.0800
 Resampling time in Seconds: 0.06 Random Seed: 721617188
 Press Any Key to Continue

*** Inhibition Concentration Percentage Estimate ***

Toxicant/Effluent: LITHIUM ION

Test Start Date: 9/3/99 Test Ending Date: 9/7/99

Test Species: FATHEAD MINNOW

Test Duration: HOURS, 96

DATA FILE:

Conc. ID	Number Replicates	Concentration MG/L	Response Means	Std. Dev.	Pooled Response Means
1	2	0.000	10.000	0.000	10.000
2	2	1.700	10.000	0.000	10.000
3	2	2.600	10.000	0.000	10.000
4	2	4.400	9.500	0.707	9.500
5	2	7.500	3.000	0.000	3.000
6	2	13.000	0.000	0.000	0.000

The Linear Interpolation Estimate: 4.6385 Entered P Value: 10

Number of Resamplings: 80 80 Resamples Generated
The Bootstrap Estimates Mean: 4.6189 Standard Deviation: 0.1580
Original Confidence Limits: Lower: 4.4000 Upper: 4.8429
Expanded Confidence Limits: Lower: 3.6846 Upper: 5.4560
Resampling time in Seconds: 0.05 Random Seed: 2048006500
Press Any Key to Continue

ENTER THE NUMBER OF MORTALITIES AT EACH CONCENTRATION:

0 0 0 0 12

WOULD YOU LIKE THE AUTOMATIC TRIM CALCULATION (Y/N)? Y

DATE: 9/3/99

TEST NUMBER: 1

DURATION: 48 HOURS

CHEMICAL: LITHIUM
NOW

SPECIES: FATHEAD MIN

RAW DATA:

CONCENTRATION (MG/L)	1.70	2.60	4.40	7.50	13.00
NUMBER EXPOSED:	20	20	20	20	20
MORTALITIES:	0	0	0	0	12
SPEARMAN-KARBER TRIM:		40.00%			

SPEARMAN-KARBER ESTIMATES: LC50: 11.86
95% CONFIDENCE LIMITS
ARE NOT RELIABLE.

WOULD YOU LIKE TO HAVE A COPY SENT TO THE PRINTER (Y/N)?

ENTER DURATION OF TEST: 72

ENTER THE NUMBER OF MORTALITIES AT EACH CONCENTRATION:

0 0 0 5 20

DATE: 9/3/99

TEST NUMBER: 1

DURATION: 72 HOURS

CHEMICAL: LITHIUM
NOW

SPECIES: FATHEAD MIN

RAW DATA:

CONCENTRATION (MG/L)	1.70	2.60	4.40	7.50	13.00
NUMBER EXPOSED:	20	20	20	20	20
MORTALITIES:	0	0	0	5	20
SPEARMAN-KARBER TRIM:		.00%			

SPEARMAN-KARBER ESTIMATES: LC50: 8.62
95% LOWER CONFIDENCE: 7.76
95% UPPER CONFIDENCE: 9.58

WOULD YOU LIKE TO HAVE A COPY SENT TO THE PRINTER (Y/N)?

ENTER THE NUMBER OF MORTALITIES AT EACH CONCENTRATION:

0 0 1 14 20

WOULD YOU LIKE THE AUTOMATIC TRIM CALCULATION (Y/N)? Y

DATE: 9/3/99

TEST NUMBER: 1

DURATION: 96 HOURS

CHEMICAL: LITHIUM
NOW

SPECIES: FATHEAD MIN

RAW DATA:

CONCENTRATION (MG/L)	1.70	2.60	4.40	7.50	13.00
NUMBER EXPOSED:	20	20	20	20	20
MORTALITIES:	0	0	1	14	20
SPEARMAN-KARBER TRIM:		.00%			

SPEARMAN-KARBER ESTIMATES:	LC50:	6.58
	95% LOWER CONFIDENCE:	5.82
	95% UPPER CONFIDENCE:	7.44

WOULD YOU LIKE TO HAVE A COPY SENT TO THE PRINTER (Y/N)?

Summary of Fisher's Exact Tests

GROUP	IDENTIFICATION	NUMBER EXPOSED	NUMBER DEAD	SIG 0.05
	CONTROL	20	0	
1	1.7 MG/L	20	0	
2	2.6 MG/L LITHIUM	20	0	
3	4.4 MG/L LITHIUM	20	1	
4	7.5 MG/L LITHIUM	20	14	*
5	13 MG/L LITHIUM	20	20	*

Press any key to continue...

ASci Corporation
Environmental Testing Laboratory
Submitted to 3M - 3/00
ASci-ETL Study ID# 5010-068

APPENDIX F

ANALYTICAL RESULTS

Sponsor: 3M
Sponsor Study ID# W2906

11/19/1999

ENVIRONMENTAL LABO

Post-it® Fax Note	7671	Date	# of pages
To	S.D.	From	
Co./Dept.	ASC	Co.	
Phone #	218-727-4040	Phone #	
Fax #	218-727-7542	Fax #	

LAB REQUEST NO. W2906
 REQUESTOR NAME: RR ROBIDEAU
 DEPARTMENT:
 PROJECT NO: 0535

DATE RECEIVED: 10/20/1999
 DESC: LITHIUM ANALYSIS ON AQUATIC TOX SAMPLES

PHONE NO: 651-778-6048
 3M FAX NO: 651-778-6176

Concentrations were based on Li ion.

Samples prepared and analyzed using EPA method 200.7.

SAMPLE	DATE	CODE	DESCRIPTION	RESULT	MDL or (95% C.I.)
1	09/22/99	Sludge-0HR	1000mg/L		
		LI	LITHIUM	500 MG/L	5
		200-7-PREP	PREP BY EPA METHOD 200.7	COMPLETE	
2	09/09/99	Microtox	2000mg/L		
		LI	LITHIUM	2000 MG/L	20
		200-7-PREP	PREP BY EPA METHOD 200.7	COMPLETE	
3	09/21/99	DM-Initial	0.4mg/L		
		LI	LITHIUM	0.46 MG/L	0.01
		200-7-PREP	PREP BY EPA METHOD 200.7	COMPLETE	
4	09/21/99	DM-Initial	1.11mg/L		
		LI	LITHIUM	1.3 MG/L	0.01
		200-7-PREP	PREP BY EPA METHOD 200.7	COMPLETE	
5	09/21/99	DM-Initial	5.14mg/L		
		LI	LITHIUM	5.6 MG/L	0.05
		200-7-PREP	PREP BY EPA METHOD 200.7	COMPLETE	
6	09/23/99	DM-48HR	Control A		
		LI	LITHIUM	<0.01 MG/L	0.01
		200-7-PREP	PREP BY EPA METHOD 200.7	COMPLETE	
7	09/23/99	DM-48HR	1.85mg/L A		
		LI	LITHIUM	2.2 MG/L	0.01
		200-7-PREP	PREP BY EPA METHOD 200.7	COMPLETE	
8	09/23/99	DM-48HR	3.09mg/L A		
		LI	LITHIUM	3.2 MG/L	0.05

11/19/1999

ENVIRONMENTAL LABORATORY STATUS REPORT

LAB REQUEST NO. W2906

CONTINUED

SAMPLE	DATE	CODE	DESCRIPTION	RESULT	MDL or (95% C.I.)
8	09/23/99	DM-48HR	3.09mg/L A		
	200-7-PREP	PREP BY EPA METHOD	200.7	COMPLETE	
9	09/23/99	DM-48HR	3.09mg/L B		
	LI	LITHIUM		3.2 MG/L	0.05
	200-7-PREP	PREP BY EPA METHOD	200.7	COMPLETE	
10	09/23/99	DM-48HR	5.14mg/L A		
	LI	LITHIUM		5.4 MG/L	0.05
	200-7-PREP	PREP BY EPA METHOD	200.7	COMPLETE	
11	09/23/99	DM-48HR	5.14mg/L C		
	LI	LITHIUM		5.5 MG/L	0.01
	200-7-PREP	PREP BY EPA METHOD	200.7	COMPLETE	
12	09/03/99	FHM-Initial	1.6mg/L A		
	LI	LITHIUM		1.6 MG/L	0.01
	200-7-PREP	PREP BY EPA METHOD	200.7	COMPLETE	
13	09/03/99	FHM-Initial	1.6mg/L B		
	LI	LITHIUM		1.7 MG/L	0.01
	200-7-PREP	PREP BY EPA METHOD	200.7	COMPLETE	
14	09/03/99	FHM-Initial	4.3mg/L A		
	LI	LITHIUM		4.3 MG/L	0.05
	200-7-PREP	PREP BY EPA METHOD	200.7	COMPLETE	
15	09/03/99	FHM-Initial	4.3mg/l B		
	LI	LITHIUM		4.2 MG/L	0.05
	200-7-PREP	PREP BY EPA METHOD	200.7	COMPLETE	
16	09/03/99	FHM-Initial	12mg/L A		
	LI	LITHIUM		12 MG/L	0.1
	200-7-PREP	PREP BY EPA METHOD	200.7	COMPLETE	
17	09/03/99	FHM-Initial	12mg/L B		
	LI	LITHIUM		12 MG/L	0.1

11/19/1999

ENVIRONMENTAL LABORATORY STATUS REPORT

3

LAB REQUEST NO. W2906

CONTINUED

SAMPLE	DATE	CODE	DESCRIPTION	RESULT	MDL or (95% C.I.)
17	09/03/99	FHM-Initial	12mg/L B		
	200-7-PREP	PREP BY EPA METHOD 200.7		COMPLETE	
18	09/05/99	FHM-48HR	7.2mg/L A		
	LI	LITHIUM		7.2 MG/L	0.05
	200-7-PREP	PREP BY EPA METHOD 200.7		COMPLETE	
19	09/05/99	FHM-48HR	12mg/L A		
	LI	LITHIUM		12 MG/L	0.1
	200-7-PREP	PREP BY EPA METHOD 200.7		COMPLETE	
20	09/07/99	FHM-96HR	Control A		
	LI	LITHIUM		<0.01 MG/L	0.01
	200-7-PREP	PREP BY EPA METHOD 200.7		COMPLETE	
21	09/07/99	FHM-96HR	Control B		
	LI	LITHIUM		<0.01 MG/L	0.01
	200-7-PREP	PREP BY EPA METHOD 200.7		COMPLETE	
22	09/07/99	FHM-96HR	1.6mg/L A		
	LI	LITHIUM		1.6 MG/L	0.01
	200-7-PREP	PREP BY EPA METHOD 200.7		COMPLETE	
23	09/07/99	FHM-96HR	1.6mg/L B		
	LI	LITHIUM		1.8 MG/L	0.01
	200-7-PREP	PREP BY EPA METHOD 200.7		COMPLETE	
24	09/07/99	FHM-96HR	4.3mg/L A		
	LI	LITHIUM		4.4 MG/L	0.05
	200-7-PREP	PREP BY EPA METHOD 200.7		COMPLETE	
25	09/07/99	FHM-96HR	4.3mg/L B		
	LI	LITHIUM		4.3 MG/L	0.05
	200-7-PREP	PREP BY EPA METHOD 200.7		COMPLETE	
26	09/07/99	FHM-96HR	7.2mg/L A		
	LI	LITHIUM		7.7 MG/L	0.1

11/19/1999

ENVIRONMENTAL LABORATORY STATUS REPORT

4

LAB REQUEST NO. W2906

CONTINUED

SAMPLE	DATE	CODE	DESCRIPTION	RESULT	MDL or (95% C.I.)
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26	09/07/99	FHM-96HR	7.2mg/L A		
	200-7-PREP	PREP BY EPA METHOD	200.7	COMPLETE	
27	09/07/99	FHM-96HR	7.2mg/L B		
	LI	LITHIUM		7.3 MG/L	0.1
	200-7-PREP	PREP BY EPA METHOD	200.7	COMPLETE	
28	09/07/99	FHM-96HR	12mg/L A		
	LI	LITHIUM		12 MG/L	0.1
	200-7-PREP	PREP BY EPA METHOD	200.7	COMPLETE	
29	09/07/99	FHM-96HR	12mg/L B		
	LI	LITHIUM		13 MG/L	0.1
	200-7-PREP	PREP BY EPA METHOD	200.7	COMPLETE	
30	09/16/99	ALG Initial	WEDTA Contrl		
	LI	LITHIUM		<0.01 MG/L	0.01
	200-7-PREP	PREP BY EPA METHOD	200.7	COMPLETE	
31	09/06/99	ALG Initial	WEDTA2.3mg/L		
	LI	LITHIUM		2.5 MG/L	0.01
	200-7-PREP	PREP BY EPA METHOD	200.7	COMPLETE	
32	09/06/99	ALG Initial	WEDTA3.9mg/L		
	LI	LITHIUM		4.0 MG/L	0.01
	200-7-PREP	PREP BY EPA METHOD	200.7	COMPLETE	
33	09/06/99	ALG Initial	WEDTA6.5mg/L		
	LI	LITHIUM		6.4 MG/L	0.01
	200-7-PREP	PREP BY EPA METHOD	200.7	COMPLETE	
34	09/06/99	ALG Initial	WEDTA 11mg/L		
	LI	LITHIUM		11 MG/L	0.01
	200-7-PREP	PREP BY EPA METHOD	200.7	COMPLETE	
35	09/06/99	ALG Initial	WEDTA 18mg/L		
	LI	LITHIUM		19 MG/L	0.01

11/19/1999

ENVIRONMENTAL LABORATORY STATUS REPORT

5

LAB REQUEST NO. W2906

CONTINUED

SAMPLE	DATE	CODE	DESCRIPTION	RESULT	MDL or (95% C.I.)
35	09/06/99	ALG Initial	WEDTA 18mg/L		
	200-7-PREP	PREP BY EPA METHOD	200.7	COMPLETE	

36	09/06/99	ALG Initial	WEDTA 30mg/L		
	LI	LITHIUM		29 MG/L	0.01
	200-7-PREP	PREP BY EPA METHOD 200.7		COMPLETE	
37	09/06/99	ALG Initial	WEDTA 50mg/L		
	LI	LITHIUM		52 MG/L	0.01
	200-7-PREP	PREP BY EPA METHOD 200.7		COMPLETE	
38	09/06/99	ALG Initial	WEDTA 83mg/L		
	LI	LITHIUM		86 MG/L	0.01
	200-7-PREP	PREP BY EPA METHOD 200.7		COMPLETE	
39	09/06/99	ALG-Initial	W/O Control		
	LI	LITHIUM		<0.01 MG/L	0.01
	200-7-PREP	PREP BY EPA METHOD 200.7		COMPLETE	
40	09/06/99	ALG Initial	W/O 2.3mg/L		
	LI	LITHIUM		2.6 MG/L	0.01
	200-7-PREP	PREP BY EPA METHOD 200.7		COMPLETE	
41	09/06/99	ALG Initial	W/O 3.9mg/L		
	LI	LITHIUM		4.0 MG/L	0.01
	200-7-PREP	PREP BY EPA METHOD 200.7		COMPLETE	
42	09/06/99	ALG Initial	W/O 6.5mg/L		
	LI	LITHIUM		6.6 MG/L	0.01
	200-7-PREP	PREP BY EPA METHOD 200.7		COMPLETE	
43	09/06/99	ALG Initial	W/O 11mg/L		
	LI	LITHIUM		12 MG/L	0.01
	200-7-PREP	PREP BY EPA METHOD 200.7		COMPLETE	
44	09/06/99	ALG Initial	W/O 18mg/L		
	LI	LITHIUM		19 MG/L	0.01

11/19/1999

ENVIRONMENTAL LABORATORY STATUS REPORT

6

LAB REQUEST NO. W2906

CONTINUED

SAMPLE	DATE	CODE	DESCRIPTION	RESULT	MDL or (95% C.I.)
44	09/06/99	ALG Initial	W/O 18mg/L		
		200-7-PREP	PREP BY EPA METHOD 200.7	COMPLETE	
45	09/06/99	ALG Initial	W/O 30mg/L		

	LI	LITHIUM	32 MG/L	0.01
	200-7-PREP	PREP BY EPA METHOD 200.7	COMPLETE	
46	09/06/99	ALG Initial W/O 50mg/L		
	LI	LITHIUM	52 MG/L	0.01
	200-7-PREP	PREP BY EPA METHOD 200.7	COMPLETE	
47	09/10/99	ALG 96HR WEDTA Contrl		
	LI	LITHIUM	<0.01 MG/L	0.01
	200-7-PREP	PREP BY EPA METHOD 200.7	COMPLETE	
48	09/10/99	ALG 96HR WEDTA2.3mg/L		
	LI	LITHIUM	2.6 MG/L	0.01
	200-7-PREP	PREP BY EPA METHOD 200.7	COMPLETE	
49	09/10/99	Alg-96HR WEDTA3.9mg/L		
	LI	LITHIUM	3.8 MG/L	0.01
	200-7-PREP	PREP BY EPA METHOD 200.7	COMPLETE	
50	09/10/99	ALG-96HR WEDTA6.5mg/L		
	LI	LITHIUM	6.4 MG/L	0.01
	200-7-PREP	PREP BY EPA METHOD 200.7	COMPLETE	
51	09/10/99	ALG 96HR WEDTA 11mg/L		
	LI	LITHIUM	11 MG/L	0.01
	200-7-PREP	PREP BY EPA METHOD 200.7	COMPLETE	
52	09/10/99	ALG 96HR WEDTA 18mg/L		
	LI	LITHIUM	19 MG/L	0.01
	200-7-PREP	PREP BY EPA METHOD 200.7	COMPLETE	
53	09/10/99	ALG 96HR WEDTA 30mg/L		
	LI	LITHIUM	30 MG/L	0.01

11/19/1999

ENVIRONMENTAL LABORATORY STATUS REPORT

7

LAB REQUEST NO. W2906

CONTINUED

SAMPLE	DATE	CODE	DESCRIPTION	RESULT	MDL or (95% C.I.)
53	09/10/99	ALG 96HR	WEDTA 30mg/L		
		200-7-PREP	PREP BY EPA METHOD 200.7	COMPLETE	
54	09/10/99	ALG 96HR	WEDTA 50mg/L		
		LI	LITHIUM	50 MG/L	0.01
		200-7-PREP	PREP BY EPA METHOD 200.7	COMPLETE	

55	09/10/99	ALG 96HR	WEDTA 83mg/L		
	LI	LITHIUM		84 MG/L	0.01
	200-7-PREP	PREP BY EPA METHOD 200.7		COMPLETE	
56	09/10/99	ALG 96HR	W/O Control		
	LI	LITHIUM		<0.01 MG/L	0.01
	200-7-PREP	PREP BY EPA METHOD 200.7		COMPLETE	
57	09/10/99	ALG 96HR	W/O 2.3mg/L		
	LI	LITHIUM		2.6 MG/L	0.01
	200-7-PREP	PREP BY EPA METHOD 200.7		COMPLETE	
58	09/10/99	ALG 96HR	W/O 3.9mg/L		
	LI	LITHIUM		4.0 MG/L	0.01
	200-7-PREP	PREP BY EPA METHOD 200.7		COMPLETE	
59	09/10/99	ALG 96HR	W/O 6.5mg/L		
	LI	LITHIUM		6.5 MG/L	0.01
	200-7-PREP	PREP BY EPA METHOD 200.7		COMPLETE	
60	09/10/99	ALG 96HR	W/O 11mg/L		
	LI	LITHIUM		12 MG/L	0.01
	200-7-PREP	PREP BY EPA METHOD 200.7		COMPLETE	
61	09/10/99	ALG 96HR	W/O 18mg/L		
	LI	LITHIUM		19 MG/L	0.01
	200-7-PREP	PREP BY EPA METHOD 200.7		COMPLETE	
62	09/10/99	ALG 96HR	W/O 30mg/L		
	LI	LITHIUM		31 MG/L	0.01

11/19/1999

ENVIRONMENTAL LABORATORY STATUS REPORT

8

LAB REQUEST NO. W2906

CONTINUED

SAMPLE	DATE	CODE	DESCRIPTION	RESULT	MDL or (95% C.I.)
62	09/10/99	ALG 96HR	W/O 30mg/L		
	200-7-PREP	PREP BY EPA METHOD 200.7		COMPLETE	
63	09/10/99	ALG 96HR	W/O 50mg/L		
	LI	LITHIUM		49 MG/L	0.01
	200-7-PREP	PREP BY EPA METHOD 200.7		COMPLETE	
64	11/04/99	new 10000	sludge		
	LI	LITHIUM		1000 MG/L	0.01

200-7-PREP PREP BY EPA METHOD 200.7 COMPLETE