Attachment L

Artificial Matrix WET Tests

LION OIL COMPANY
El Dorado Refinery
1000 McHenry
P.O. Box 7005
El Dorado, Arkansas 71731-7005
(870) 862-8111

October 22, 2012

VIA U.S. AND ELECTRONIC MAIL

Sarah Clem
Branch Manager
Arkansas Department of Environmental Quality
Water Division
5301 Northshore Drive
North Little Rock, AR 72118-5317
clem@adeq.state.ar.us

Re: Lion Oil Company (Lion Oil) Third Party Rulemaking
Results of WET Tests on Dissolved Minerals Criteria Proposed for Adoption

Dear Ms. Clem:

As you know, on August 31, 2012 Lion Oil submitted three documents for your review that concern the proposal to revise the dissolved minerals (chloride, sulfate, and total dissolved solids (TDS)) criteria for Loutre Creek and Bayou de Loutre.[1] In support of these revised criteria, I enclose the results of recent whole effluent toxicity (WET) tests that show the criteria proposed for Loutre Creek passed the 7-day chronic WET tests, both lethal and sub-lethal endpoints. In addition to the information already submitted to the Department, these tests provide further evidence that the proposed criteria for Loutre Creek do not result in either lethal or sub-lethal effects. The criteria proposed for Bayou de Loutre are more stringent (lower in concentration) than those proposed for Loutre Creek so the Bayou de Loutre criteria also do not have such effects.

[1] These documents are the Loutre Creek—Section 2.303 Use Attainability Analysis (criteria for Loutre Creek), the Bayou de Loutre—Section 2.306 Site Specific Water Quality Study (criteria for Bayou de Loutre), and the Loutre Creek & Bayou de Loutre—Section 2.309 Water Quality Standards Variance (criteria for both waterbodies).

The WET tests were performed between September 6 and September 14, 2012. These tests were performed on the water flea (*Ceriodaphnia dubia*) because the U.S. Environmental Protection Agency (EPA) previously raised a concern that WET tests performed on the water flea indicated lethal and sub-lethal effects at the criteria concentrations adopted by Arkansas in 2007. *See* attached EPA August 31, 2011 letter. The dissolved minerals criteria now proposed for adoption are more stringent than the criteria adopted in 2007 and the enclosed WET tests further evidence that the new criteria will not result in lethal or sub-lethal effects in the receiving streams and will maintain the designated uses of Loutre Creek and Bayou de Loutre.

As shown on the enclosed statistical reports, four sets of WET tests were performed to evaluate the potential effects of the new criteria. Because it is difficult for the laboratory to develop a precise mixture of dissolved minerals, the levels of dissolved minerals differ for each test.[2] Tests 01 and 04 most closely reflect the new criteria proposed and demonstrate there are no lethal or sub-lethal effects on the water flea, even at concentrations of sulfates and TDS higher than the criteria proposed. Although Tests 02 and 03 indicated reduced reproduction in the higher exposures of the WET tests, both of these tests (Test 02 and 03) had concentrations of sulfate and TDS that substantially exceeded the criteria proposed.

Lion Oil will update the relevant sections of the documents submitted to you on August 31, 2012 to include the results of these WET tests and the conclusions in this letter. Please feel free to contact me directly if you have any questions regarding these results.

Sincerely,

William R. Hammock

William (Chuck) R. Hammock
Environmental Manager

w/ enclosed laboratory report and August 31, 2011 letter from EPA

cc: Matt Hubner, EPA w/ enclosure
Vince Blubaugh, GBMc & Associates w/o enclosure
Roland McDaniel, GBMc & Associates w/o enclosure
Steve Higgs, Perkins Coie LLP w/ enclosure
Chuck Nestrud, Chisenhall, Nestrud & Julian P.A. w/ enclosure

[2] The laboratory mixtures to mimic the proposed in-stream dissolved minerals concentrations were also developed to reflect in-stream concentrations of anions and cations typical of Loutre Creek (i.e., nitrate, potassium, sodium, magnesium, and calcium).

October 3, 2012

Chronic WET Testing

Synthetic Matrices

Prepared for:

Mr. Roland McDaniel

Principal/ Senior Scientist

GBMc and Associates

RE: Lion Oil

Synthetic Matrix #1 Modified 2: Lab number 1208360-01

Ceriodaphnia dubia

Prepared by:

Arkansas Analytical, Inc.

11701 I-30, Bldg 1, Suite 115

Little Rock, AR 72209

Arkansas Analytical Inc.

Table of Contents

Overview

The purpose of this report is to provide results of chronic biomonitoring (WET) tests for Lion Oil Corporation as requested by GBMc and Associates. The tests were performed utilizing synthetic mixtures of salts in a dilution series with moderately hard water. The species tested were *ceriodaphnia dubia* . Tests were conducted utilizing standard testing protocol as defined in Test 1002.0(*Ceriodaphnia dubia*, Survival and Reproduction Test). A standard dilution series of 0%, 6.25%, 12.5%, 25%, 50%, and 100% were analyzed.

Tabulated below find a summary of the Test Matrices, the target and actual concentrations of the analytes of interest, and the test results.

Synthetic Matrix #1 Modified 2: 1208360-01		
Parameter	Target Concentration(mg/L)	Analyzed Concentration(mg/L)
Chlorides	227	214
Sulfates	775	737
TDS	1562	1500
Nitrate	-	7.15
Potassium	9.73	10.9
Sodium	--	462
Magnesium	4.13	3.63
Calcium	27.4	23.4
Results Synthetic Matrix #1		
Species	NOEC/LOEC Survival	NOEC/LOEC Reproduction/Growth
Ceriodaphnia dubia	100%/ NA	100%/NA

Synthetic Mixture Preparation

A variety of salts were selected to prepare solutions containing the desired analytes at target concentrations. The target analytes were chloride, sulfate, and TDS. All salts were dried to remove the moisture content prior to weighing, except in the case of hydrated salts. Concentrates were prepared which were diluted to working volume each day of the test. The same concentrate was utilized for the entire test. Salts of sodium, calcium, potassium, and magnesium were used.

On the following pages are detailed bench sheets from each sample tested. Included are the data sheets followed by the statistical analysis. Also included are the water chemistry analyses from each day of testing. The detail of the salts used to prepare the synthetic mixtures and the lab analysis of the solutions is provided in the appendix.

Dilution Water

The dilution water used in the toxicity tests was moderately hard synthetic. It was prepared using Elga Maxima ultra pure water according to EPA specifications. Each batch was analyzed for pH, hardness, total alkalinity, and conductivity
Dilution Series

Five dilutions in addition to a control (0% effluent) were used in the toxicity tests. The dilutions, which were made with synthetic water, were 6.25%, 12.5%, 25%, 50%, and 100%.

Test Methods

EPA Method 1002.0, Cladoceran, *Ceriodaphnia dubia,* Survival and Reproduction Test, was also used. Neonates are exposed in a static renewal system until at least 60% of the control organisms have produced a third brood. Results are based on the survival and reproduction of the organisms. One neonate was placed in each often replicate chambers using a randomizing template. Test chambers were 30 ml plastic cups filled with 15 ml of test solution. The test temperature was 25 degrees Centigrade

Test Organisms
The organisms used in Test 1002.0 were < 24 hour old *Ceriodaphnia dubia* neonates, (all born within the same eight hours), obtained from an in-house culture. An organism history is provided in the Appendix.

Quality Assurance

Test Acceptability

Synthetic #1 Modified 2 , Lion Oil, 1208360-01

TEST ACCEPTANCE CRITERIA for *Ceriodaphnia dubia*

Control Criteria	Results	Pass	Fail
Greater than or equal to 80% survival	100%	X	
Average of 15 or more young per surviving female	20.6	X	
At least 60% of surviving females should have produced 3 broods	100%	X	
The percent coefficient of variation between replicates must be 40% or less for the young of surviving females	16.5	X	

Reference Toxicant

The reference toxicant used was Potassium Chloride prepared in-house. The tests were performed using moderately hard synthetic as dilution water. The results of the reference toxicant were

Ceriodaphnia dubia(8-12-12)		Range of acceptability	
	Mg/L	Mg/L	
NOEC Survival	500	125-500	Pass
LOEC Survival	1000	250-1000	Pass
NOEC Reproduction	125	125-500	Pass
LOEC Reproduction	250	250-1000	Pass

Synthetic #1 Modified 2 , Lion Oil, 1208360-01

Ceriodaphnia dubia

Bench Sheets

Statistical Analysis

Chemistry Bench Sheets

Syn #1 . 1208360-01

Surv. 100%
Repro 100%

Cerodaphnia dubia

SURVIVAL AND REPRODUCTION TEST

Analyst: RH

Discharger:

Lab Number/s

Location:

Test Start - Date/ Time: 9-6-12 1430

Date Sample Collected:

Test Stop - Date/Time:

Conc 1

%	Day	A	B	C	D	E	F	G	H	I	J	No. of Young	No. of Adult	Young/ Adult	Analyst
	1	0	0	0	0	0	0	0	0	0	0	0	10	0	
	2	0	0	0	0	0	0	0	0	0	0	0	10	0	
	3	1	0	5	2	2	2	0	2	0	1	15	10	1.5	
	4	7	6	3	5	6	2	1	2	7	2	41	10	4.1	
	5	2	4	1	7	1	5	8	9	0	3	40	10	4.0	
	6	5	7	11	3	5	7	14	4	9	6	71	10	7.1	
	7	56	3	1	1	2	10	2	6	5	4	39	10	3.9	
	8														
	Total	20	20	21	18	16	26	25	23	21	16	266		X=20.6	

CV=16.5

Conc 2

%	Day	A	B	C	D	E	F	G	H	I	J	No. of Young	No. of Adult	Young/ Adult	Analyst
	1	0	0	0	0	0	0	0	0	0	0	0	10	0	
	2	0	0	0	0	0	0	0	0	0	0	0	10	0	
	3	5	2	0	0	1	1	0	0	3	4	16	10	1.6	
	4	4	6	1	5	1	6	5	6	5	2	41	10	4.1	
	5	2	3	5	3	6	8	7	1	2	6	43	10	4.3	
	6	2	9	8	4	6	3	3	5	9	6	55	10	5.5	
	7	7	11	11	7	2	10	7	4	10	0	69	10	6.9	
	8														
	Total	20	31	25	19	16	28	22	16	29	18	224			

Conc 3

%	Day	A	B	C	D	E	F	G	H	I	J	No. of Young	No. of Adult	Young/ Adult	Analyst
	1	0	0	0	0	0	0	0	0	0	0	0	10	0	
	2	0	0	0	0	0	0	0	0	0	0	0	10	0	
	3	3	5	3	4	0	2	1	0	0	5	23	10	2.3	
	4	6	3	1	1	5	1	5	6	4	1	33	10	3.3	
	5	7	8	6	5	2	3	0	1	8	6	46	10	4.6	
	6	2	10	12	15	6	4	2	11	4	15	81	10	8.1	
	7	11	2	0	3	4	5	4	15	9	2	55	10	5.5	
	8														
	Total	29	28	22	28	17	15	12	33	25	29	238			

X= DEAD; Y= MALE

Conc 4

%	Day	A	B	C	D	E	F	G	H	I	J	No. of Young	No. of Adult	Young/ Adult	Analyst
	1	0	0	0	0	0	0	0	0	0	0	0	10	0	
	2	0	0	0	0	0	0	0	0	0	0	0	10	0	
	3	1	0	2	2	4	6	0	4	0	0	19	10	1.9	
	4	6	8	0	5	1	1	7	6	2	7	43	10	4.3	
	5	3	1	7	1	5	7	1	0	4	2	31	10	3.1	
	6	10	5	12	13	12	3	5	13	3	2	78	10	7.8	
	7	8	2	18	4	0	3	6	13	5	2	54	10	5.4	
	8														
	Total	28	16	32	25	22	20	19	36	14	13	225			

Conc 5

%	Day	A	B	C	D	E	F	G	H	I	J	No. of Young	No. of Adult	Young/ Adult	Analyst
	1	0	0	0	0	0	0	0	0	0	0	0	10	0	
	2	0	0	0	0	0	0	0	0	0	0	0	10	0	
	3	2	2	1	0	0	0	2	0	3	2	12	10	1.2	
	4	1	7	2	1	4	8	3	6	1	2	35	10	3.5	
	5	9	2	1	6	7	0	6	7	6	8	52	10	5.2	
	6	6	5	8	4	11	8	0	4	1	2	49	10	4.9	
	7	1	5	3	4	2	1	2	9	6	0	33	10	3.3	
	8														
	Total	19	21	15	15	24	17	13	26	17	14	181			

Conc 6

%	Day	A	B	C	D	E	F	G	H	I	J	No. of Young	No. of Adult	Young/ Adult	Analyst
	1	0	0	0	0	0	0	0	0	0	0	0	10	0	
	2	0	0	0	0	0	0	0	0	0	0	0	10	0	
	3	2	2	5	3	0	4	3	1	0	0	20	10	2.0	
	4	1	0	2	6	7	6	4	2	0	6	28	10	2.8	
	5	7	5	6	0	3	7	3	8	X0	1	40	9	4.4	
	6	3	8	4	6	4	7	7	10	–	7	56	9	6.2	
	7	5	3	2	6	0	6	8	13		4	47	9	5.2	
	8														
	Total	18	18	19	21	14	24	25	34	X0	18	191			

X = 21.2
CV = 27.6

Revision 1
11/30/10

1208360-01

AA # K1208002, C. DUBIA CHRONIC, REPRODUCION, 9-6-12
File: Z:/toxstat/monte\CD. Transform: NO TRANSFORMATION

Shapiro - Wilk's test for normality

******** Shapiro - Wilk's Test is aborted ********

This test can not be performed because total number of replicates
is greater than 50.

Total number of replicates = 60

AA # K1208002, C. DUBIA CHRONIC, REPRODUCION, 9-6-12
File: Z:/toxstat/monte\CD. Transform: NO TRANSFORMATION

Bartlett's test for homogeneity of variance
Calculated B1 statistic = 9.85

Table Chi-square value = 15.09 (alpha = 0.01, df = 5)
Table Chi-square value = 11.07 (alpha = 0.05, df = 5)

Data PASS B1 homogeneity test at 0.01 level. Continue analysis.

1208360-01

FISHER'S EXACT TEST

IDENTIFICATION	NUMBER OF ALIVE	NUMBER OF DEAD	TOTAL ANIMALS
CONTROL	10	0	10
6.25	10	0	10
TOTAL	20	0	20

CRITICAL FISHER'S VALUE (10,10,10) (p=0.05) IS 6. b VALUE IS 10.
Since b is greater than 6 there is no significant difference between CONTROL and TREATMENT at the 0.05 level.

FISHER'S EXACT TEST

IDENTIFICATION	NUMBER OF ALIVE	NUMBER OF DEAD	TOTAL ANIMALS
CONTROL	10	0	10
12.5	10	0	10
TOTAL	20	0	20

CRITICAL FISHER'S VALUE (10,10,10) (p=0.05) IS 6. b VALUE IS 10.
Since b is greater than 6 there is no significant difference between CONTROL and TREATMENT at the 0.05 level.

FISHER'S EXACT TEST

IDENTIFICATION	NUMBER OF ALIVE	NUMBER OF DEAD	TOTAL ANIMALS
CONTROL	10	0	10
25	10	0	10

1208360-01

TOTAL	20	0	20

CRITICAL FISHER'S VALUE (10,10,10) (p=0.05) IS 6. b VALUE IS 10.
Since b is greater than 6 there is no significant difference between CONTROL and TREATMENT at the 0.05 level.

FISHER'S EXACT TEST

IDENTIFICATION	NUMBER OF ALIVE	NUMBER OF DEAD	TOTAL ANIMALS
CONTROL	10	0	10
50	10	0	10
TOTAL	20	0	20

CRITICAL FISHER'S VALUE (10,10,10) (p=0.05) IS 6. b VALUE IS 10.
Since b is greater than 6 there is no significant difference between CONTROL and TREATMENT at the 0.05 level.

FISHER'S EXACT TEST

IDENTIFICATION	NUMBER OF ALIVE	NUMBER OF DEAD	TOTAL ANIMALS
CONTROL	10	0	10
100	9	1	10
TOTAL	19	1	20

CRITICAL FISHER'S VALUE (10,10,10) (p=0.05) IS 6. b VALUE IS 9.
Since b is greater than 6 there is no significant difference between CONTROL and TREATMENT at the 0.05 level.

SUMMARY OF FISHER'S EXACT TESTS

	NUMBER	NUMBER	SIG

1208360-8

GROUP	IDENTIFICATION	EXPOSED	DEAD	(P=.05)
	CONTROL	10	0	
1	6.25	10	0	
2	12.5	10	0	
3	25	10	0	
4	50	10	0	
5	100	10	1	

TITLE: AA # K1208002, C. DUBIA CHRONIC, REPRODUCION, 9-6-12
FILE: Z:/toxstat/monte\CD.
TRANSFORM: NO TRANSFORMATION NUMBER OF GROUPS: 6

GRP	IDENTIFICATION	REP	VALUE	TRANS VALUE
1	CONTROL	1	20.0000	20.0000
1	CONTROL	2	20.0000	20.0000
1	CONTROL	3	21.0000	21.0000
1	CONTROL	4	18.0000	18.0000
1	CONTROL	5	16.0000	16.0000
1	CONTROL	6	26.0000	26.0000
1	CONTROL	7	25.0000	25.0000
1	CONTROL	8	23.0000	23.0000
1	CONTROL	9	21.0000	21.0000
1	CONTROL	10	16.0000	16.0000
2	6.25 % EFFLUENT	1	20.0000	20.0000
2	6.25 % EFFLUENT	2	31.0000	31.0000
2	6.25 % EFFLUENT	3	25.0000	25.0000
2	6.25 % EFFLUENT	4	19.0000	19.0000
2	6.25 % EFFLUENT	5	16.0000	16.0000
2	6.25 % EFFLUENT	6	28.0000	28.0000
2	6.25 % EFFLUENT	7	22.0000	22.0000
2	6.25 % EFFLUENT	8	16.0000	16.0000
2	6.25 % EFFLUENT	9	29.0000	29.0000
2	6.25 % EFFLUENT	10	18.0000	18.0000
3	12.5 % EFFLUENT	1	29.0000	29.0000
3	12.5 % EFFLUENT	2	28.0000	28.0000
3	12.5 % EFFLUENT	3	22.0000	22.0000
3	12.5 % EFFLUENT	4	28.0000	28.0000
3	12.5 % EFFLUENT	5	17.0000	17.0000
3	12.5 % EFFLUENT	6	15.0000	15.0000
3	12.5 % EFFLUENT	7	12.0000	12.0000
3	12.5 % EFFLUENT	8	33.0000	33.0000
3	12.5 % EFFLUENT	9	25.0000	25.0000
3	12.5 % EFFLUENT	10	29.0000	29.0000
4	25 % EFFLUENT	1	28.0000	28.0000
4	25 % EFFLUENT	2	16.0000	16.0000
4	25 % EFFLUENT	3	32.0000	32.0000
4	25 % EFFLUENT	4	25.0000	25.0000
4	25 % EFFLUENT	5	22.0000	22.0000
4	25 % EFFLUENT	6	20.0000	20.0000
4	25 % EFFLUENT	7	19.0000	19.0000
4	25 % EFFLUENT	8	36.0000	36.0000

L208360-01

4	25 % EFFLUENT	9	14.0000	14.0000
4	25 % EFFLUENT	10	13.0000	13.0000
5	50 % EFFLUENT	1	19.0000	19.0000
5	50 % EFFLUENT	2	21.0000	21.0000
5	50 % EFFLUENT	3	15.0000	15.0000
5	50 % EFFLUENT	4	15.0000	15.0000
5	50 % EFFLUENT	5	24.0000	24.0000
5	50 % EFFLUENT	6	17.0000	17.0000
5	50 % EFFLUENT	7	13.0000	13.0000
5	50 % EFFLUENT	8	26.0000	26.0000
5	50 % EFFLUENT	9	17.0000	17.0000
5	50 % EFFLUENT	10	14.0000	14.0000
6	100 % EFFLUENT	1	18.0000	18.0000
6	100 % EFFLUENT	2	18.0000	18.0000
6	100 % EFFLUENT	3	19.0000	19.0000
6	100 % EFFLUENT	4	21.0000	21.0000
6	100 % EFFLUENT	5	14.0000	14.0000
6	100 % EFFLUENT	6	24.0000	24.0000
6	100 % EFFLUENT	7	25.0000	25.0000
6	100 % EFFLUENT	8	34.0000	34.0000
6	100 % EFFLUENT	9	0.0000	0.0000
6	100 % EFFLUENT	10	18.0000	18.0000

AA # K1208002, C. DUBIA CHRONIC, REPRODUCION, 9-6-12
File: Z:/toxstat/monte\CD. Transform: NO TRANSFORMATION

ANOVA TABLE

SOURCE	DF	SS	MS	F
Between	5	241.883	48.377	1.186
Within (Error)	54	2202.700	40.791	
Total	59	2444.583		

Critical F value = 2.45 (0.05,5,40)
Since F < Critical F FAIL TO REJECT Ho: All equal

AA # K1208002, C. DUBIA CHRONIC, REPRODUCION, 9-6-12
File: Z:/toxstat/monte\CD. Transform: NO TRANSFORMATION

DUNNETT'S TEST - TABLE 1 OF 2 Ho:Control<Treatment

GROUP	IDENTIFICATION	TRANSFORMED MEAN	MEAN CALCULATED IN ORIGINAL UNITS	T STAT	SIG
1	CONTROL	20.600	20.600		
2	6.25 % EFFLUENT	22.400	22.400	-0.630	
3	12.5 % EFFLUENT	23.800	23.800	-1.120	
4	25 % EFFLUENT	22.500	22.500	-0.665	
5	50 % EFFLUENT	18.100	18.100	0.875	
6	100 % EFFLUENT	19.100	19.100	0.525	

1208360-01

Dunnett table value = 2.31 (1 Tailed Value, P=0.05, df=40,5)

AA # K1208002, C. DUBIA CHRONIC, REPRODUCION, 9-6-12
File: Z:/toxstat/monte\CD. Transform: NO TRANSFORMATION

DUNNETT'S TEST - TABLE 2 OF 2 Ho:Control<Treatment

GROUP	IDENTIFICATION	NUM OF REPS	Minimum Sig Diff (IN ORIG. UNITS)	% of CONTROL	DIFFERENCE FROM CONTROL
1	CONTROL	10			
2	6.25 % EFFLUENT	10	6.598	32.0	-1.800
3	12.5 % EFFLUENT	10	6.598	32.0	-3.200
4	25 % EFFLUENT	10	6.598	32.0	-1.900
5	50 % EFFLUENT	10	6.598	32.0	2.500
6	100 % EFFLUENT	10	6.598	32.0	1.500

AA # K1208002, C. DUBIA CHRONIC, REPRODUCION, 9-6-12
File: Z:/toxstat/monte\CD. Transform: NO TRANSFORMATION

STEEL'S MANY-ONE RANK TEST - Ho:Control<Treatment

GROUP	IDENTIFICATION	TRANSFORMED MEAN	RANK SUM	CRIT. VALUE	df	SIG
1	CONTROL	20.600				
2	6.25 % EFFLUENT	22.400	112.00	75.00	10.00	
3	12.5 % EFFLUENT	23.800	122.50	75.00	10.00	
4	25 % EFFLUENT	22.500	108.50	75.00	10.00	
5	50 % EFFLUENT	18.100	85.50	75.00	10.00	
6	100 % EFFLUENT	19.100	98.00	75.00	10.00	

Critical values use k = 5, are 1 tailed, and alpha = 0.05

1208360-01

CHEMICAL DATA SHEET FOR CHRONIC TOXICITY TESTING									Cerodaphnia Dubia
Lab # / Sample ID		Syn #1			Test Start (Date/Time)		9-6-12 1430		
Client:					Test End (Date/Time)		9-14-12 1200		
		Day of Test							
		1	2	3	4	5	6	7	notes/remarks
Control	MHS551			9-8	9-9				
D.O. (mg/L)	INITIAL	8.4	8.7	8.9	8.7	9.5	8.9	8.7	
	FINAL	8.0	8.1	8.5	8.3	8.5	8.3	8.5	
pH (s.u.)	INITIAL	7.9	7.8	8.3	8.0	8.0	7.9	7.9	
	FINAL	7.5	8.0	7.9	8.1	7.6	8.0	7.7	
temp (C)	INITIAL	23	22	22.0	20.7	21	21	22	
	FINAL	25	25	25	25	25	25	25	
ALKALINITY (mg/L)									
HARDNESS (mg/L)									
CONDUCTIVITY (umhos/cm)									
CHLORINE (mg/L)									
CONC:									
D.O. (mg/L)	INITIAL	8.6	8.7	8.7	8.6	9.0	8.8	8.7	
	FINAL	8.1	8.2	8.4	8.3	8.5	8.5	8.4	
pH (s.u)	INITIAL	7.8	8.0	8.0	7.9	7.8	7.9	7.6	
	FINAL	7.7	8.0	7.9	7.8	7.9	7.9	7.6	
temp (C)	INITIAL	22	22	21.4	20.2	21	22	21	
	FINAL	25	25	25	25	25	25	25	
CONC:									
D.O. (mg/L)	INITIAL	8.7	8.9	8.5	8.6	8.9	9.0	8.7	
	FINAL	8.0	8.2	8.4	8.3	8.5	8.5	8.4	
pH (mg/L)	INITIAL	7.9	8.0	8.1	7.9	7.8	7.7	7.7	
	FINAL	7.7	7.9	7.9	7.8	8.0	7.2	7.6	
temp (C)	INITIAL	22	22	21.4	20.3	21	21	21	
	FINAL	25	25	25	25	25	25	25	
CONC:									
D.O. (mg/L)	INITIAL	8.7	8.9	9.4	8.8	8.7	9.0	8.7	
	FINAL	8.1	8.1	8.5	8.4	8.5	8.5	8.3	
pH (s.u.)	INITIAL	7.5	7.9	8.1	7.9	7.9	7.6	7.7	
	FINAL	7.6	7.8	7.8	7.8	7.7	8.0	7.7	
temp (C)	INITIAL	22	21	21.4	20.4	21	21	22	
	FINAL	25	25	25	25	25	25	25	
CONC:									
D.O. (mg/L)	INITIAL	8.7	8.7	8.4	8.8	8.8	9.0	8.8	
	FINAL	8.1	8.1	8.4	8.3	8.6	8.5	8.4	
pH (s.u.)	INITIAL	7.8	8.0	8.0	7.9	7.8	7.4	7.8	
	FINAL	7.6	7.7	7.8	7.8	7.7	7.6	7.6	
temp (C)	INITIAL	23	22	21.4	20.5	20	21	22	
	FINAL	25	25	25	25	25	25	25	
CONC:									
D.O. (mg/L)	INITIAL	8.8	8.6	8.6	8.8	9.0	8.7	8.8	
	FINAL	8.1	8.1	8.5	8.4	8.6	8.5	8.5	
pH (s.u.)	INITIAL	7.5	7.7	5.6	5.1	6.6	7.5	7.6	
	FINAL	7.3	7.6	7.6	7.8	7.5	7.8	7.5	
temp (C)	INITIAL	22	22	21.4	20.7	21	22	22	
	FINAL	25	25	25	25	25	25	25	
CONC:	**100%**								
ALKALINITY (mg/L)		4							
HARDNESS (mg/L)		64							
CONDUCTIVITY (umhos/cm)		237							
CHLORINE (mg/L)		<0.05							

MHS

6.25

12.5

25

50

100

Revision 1
11/30/10

Appendix

Synthetic Salt Preparation

Lab Results of Synthetic Mixtures

Organism History

Control Charts for Reference Toxicants

Chain of Custody

Lion Oil		synthetic									
		matrix #1	1208360-01								
											atomic
		target									weight
Chloride		227								Chloride	35
Sulfate		775								Sulfate	96
Sodium										Sodium	23
Potassium		9.73								Potassium	39
Calcium		27.4								Calcium	40
Magnesium		4.13								Magnesium	24.3
Carbonate(CO3)									Carbonate(CO3)		60
Nitrate(No3)		8.71							Nitrate(No3)		62
										H2O	18
TDS		1562									
		mg of salt	mg	mg	mg	mg	mg	mg	mg	mg	mg
compound	g/mole	per liter	Na	CL	K	SO4	Ca	Mg	CO3	NO3	TDS
Sodium Chloride(NaCl)	58.0	290	115	175	0	0	0	0	0	0	290
Sodium Sulfate(Na2SO4)	142.0	1115	361.1971831	0	0	753.803	0	0	0	0	1115
Sodium Carbonate(Na2CO3)	106.0	0	0	0	0	0	0	0	0	0	0
Potassium Chloride(KCl)	75.0	10	0	4.72973	5.270	0	0	0	0	0	10
Potassium Sulfate(K2SO4)	174.0	10	0	0	4.4827586	5.51724	0	0	0	0	10
Potassium Carbonate(K2CO3)	138.0	0	0	0	0	0	0	0	0	0	0
Magnesium Chloride(MgCl2)	94.3	0	0	0	0	0	0	0	0	0	0
Magnesium Sulfate(MgSO4)	120.3	21.5	0	0	0	17.1571	0	4.18204	0	0	21.33915
Calcium Chloride dihyrate (CaCl2)	146.0	101	0	48.42466	0	0	27.67123	0	0	0	76.09589
we have these chemicals		Sum:	476.1971831	228.1544	9.7530289	776.477	27.67123	4.18204	0	0	1522.435
		existing							0	0	
		Target		227	9.73	775	27.4	4.13			1562
ratio to sodium		existing	1		#DIV/0!		#DIV/0!	#DIV/0!			
theoretical			1		0.0204811		0.058109	0.00878			

			atomic									
			weight									
	Chloride		35									
	Sulfate		96									
	Sodium		23									
	Potassium		39									
	Calcium		40									
	Magnesium		24.3									
	Carbonate(CO3)		60									
	Nitrate(No3)		62									
	water		18									
					synthetic 1	1208360-01						
											mls to add	mls Elga to
		cation	anion						ppm	target	in 3 Liters	make 3 L
	58	0.396552	0.603448		Sodium Chloride(NaCl)			5g/L	5000	290	174	
	142	0.323944	0.676056		Sodium Sulfate(Na2SO4)			5g/L	15000	1115	223	
	106	0.433962	0.566038									
	74	0.527027	0.472973		Potassium Chloride(KCl)			5g/L	5000	10	6	
	174	0.448276	0.551724		Potassium Sulfate(K2SO4)			5g/L	5000	10	6	
	138	0.565217	0.434783									
	94.3	0.257688	0.742312		Magnesium Chloride(MgCl2)							
	120.3	0.194514	0.798005		Magnesium Sulfate(MgSO4)			5g/L	5000	21.5	12.9	
	146	0.273973	0.479452		Calcium Chloride dihyrate (CaCl2)			5g/L	5000	101	60.6	
										totals mls	482.5	2517.5

Arkansas Analytical Inc.

11701 I-30 Bldg 1, Ste 115 - Little Rock, AR 72209
501-455-3233 Fax 501-455-6118

17 September 2012

Norma James
Arkansas Analytical, Inc.
11701 I-30, Bldg 1, Suite 115
Little Rock, AR 72209

RE: Lion Oil

SDG Number: 1208360

Enclosed are the results of analyses for samples received by the laboratory on 31-Aug-12 15:00. If you have any questions concerning this report, please feel free to contact me.

Sample Receipt Information:

Custody Seals	
Containers Correct	
COC/Labels Agree	
Preservation Confirmed	
Received On Ice	
Temperature on Receipt	5.0°C

Sincerely,

Norma James
President

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17 September 2012

Norma James
Arkansas Analytical, Inc.
11701 I-30, Bldg 1, Suite 115
Little Rock, AR 72209
Project: Lion Oil

Date Received: 31-Aug-12 15:00

CASE NARRATIVE

Sample Delivery Group - 1208360

Qualified analytical and/or quality control results are discussed below:

Anions Analysis:

Holding Time Excursion (E2): The Nitrate results for sample 1208360-01 thru 1208360-03 were qualified as "estimated" (E2) as they were analyzed outside of holding time.

Total Metals Analysis:

Matrix Spike/Matrix Spike Duplicate (MS/MSD) Failure: Magnesium, Potassium, and Sodium failed to recover within laboratory acceptance criteria in the MS/MSD sample due to the high concentration of these analytes in the parent sample. The recoveries were qualified by "MBA", which means "Masked by Analyte", in the quality control section of the final report. These analytes were qualified as "estimated" (E20) in the parent sample, 1208360-01 (Synthetic #1-Mod 2).

This report must be reproduced in its entirety.

17 September 2012

Norma James
Arkansas Analytical, Inc.
11701 I-30, Bldg 1, Suite 115
Little Rock, AR 72209
Project: Lion Oil

Date Received: 31-Aug-12 15:00

ANALYTICAL RESULTS

Lab Number: 1208360-01
Sample Name: DRAFT: Synthetic #1 Modified 2
Date/Time Collected: 8/31/12 0:00
Sample Matrix: Water

DRAFT: Anions	Units	Result	Qualifier(s)	Date/Time Analyzed	Batch	Method
Chloride	mg/L	**214**		9/4/12 11:43	A209016	300.0/9056A
Nitrate (Calc.)	mg/L	**7.15**		9/5/12 9:14	A209030	300.0/9056A
Sulfate as SO4	mg/L	**737**		9/4/12 11:43	A209016	300.0/9056A
Nitrate as N	mg/L	**1.62**	E2	9/4/12 10:35	A209016	300.0/9056A

DRAFT: Dissolved Metals	Units	Result	Qualifier(s)	Date/Time Analyzed	Batch	Method
Calcium	mg/L	**23.4**		9/4/12 12:02	A209006	200.7
Magnesium	mg/L	**3.63**	E20	9/4/12 12:02	A209006	200.7
Potassium	mg/L	**10.9**	E20	9/4/12 12:02	A209006	200.7
Sodium	mg/L	**462**	E20	9/4/12 12:02	A209006	200.7

DRAFT: Wet Chemistry	Units	Result	Qualifier(s)	Date/Time Analyzed	Batch	Method
TDS	mg/L	**1500**		8/31/12 14:25	A208391	2540C

ANALYTICAL RESULTS

Lab Number: 1208360-02
Sample Name: DRAFT: Synthetic #2 Modified 2
Date/Time Collected: 8/31/12 0:00
Sample Matrix: Water

DRAFT: Anions	Units	Result	Qualifier(s)	Date/Time Analyzed	Batch	Method
Chloride	mg/L	**158**		9/4/12 12:05	A209016	300.0/9056A
Nitrate (Calc.)	mg/L	**7.00**		9/5/12 9:14	A209030	300.0/9056A
Sulfate as SO4	mg/L	**767**		9/4/12 12:05	A209016	300.0/9056A
Nitrate as N	mg/L	**1.58**	E2	9/4/12 10:58	A209016	300.0/9056A

DRAFT: Dissolved Metals	Units	Result	Qualifier(s)	Date/Time Analyzed	Batch	Method
Calcium	mg/L	**22.4**		9/4/12 12:13	A209006	200.7
Magnesium	mg/L	**5.63**		9/4/12 12:13	A209006	200.7
Potassium	mg/L	**12.5**		9/4/12 12:13	A209006	200.7
Sodium	mg/L	**531**		9/4/12 12:13	A209006	200.7

DRAFT: Wet Chemistry	Units	Result	Qualifier(s)	Date/Time Analyzed	Batch	Method
TDS	mg/L	**1700**		8/31/12 14:25	A208391	2540C

This report must be reproduced in its entirety.

17 September 2012

Norma James
Arkansas Analytical, Inc.
11701 I-30, Bldg 1, Suite 115
Little Rock, AR 72209
Project: Lion Oil

Date Received: 31-Aug-12 15:00

ANALYTICAL RESULTS

Lab Number: 1208360-05
Sample Name: DRAFT: Synthetic #4 9/12/12 Tweaked
Date/Time Collected: 9/12/12 11:30
Sample Matrix: Water

DRAFT: Anions	Units	Result	Qualifier(s)	Date/Time Analyzed	Batch	Method
Chloride	mg/L	**235**		9/13/12 12:13	A209175	300.0/9056A
Sulfate as SO4	mg/L	**467**		9/13/12 12:58	A209175	300.0/9056A
Nitrate as N	mg/L	**1.56**		9/13/12 11:51	A209175	300.0/9056A
DRAFT: Dissolved Metals	**Units**	**Result**	**Qualifier(s)**	**Date/Time Analyzed**	**Batch**	**Method**
Calcium	mg/L	**105**		9/12/12 19:42	A209164	200.7
Magnesium	mg/L	**3.49**		9/12/12 19:42	A209164	200.7
Potassium	mg/L	**9.04**		9/12/12 19:42	A209164	200.7
Sodium	mg/L	**262**	E20	9/12/12 19:42	A209164	200.7
DRAFT: Wet Chemistry	**Units**	**Result**	**Qualifier(s)**	**Date/Time Analyzed**	**Batch**	**Method**
TDS	mg/L	**1200**		9/12/12 16:54	A209166	2540C

This report must be reproduced in its entirety.

17 September 2012

Norma James
Arkansas Analytical, Inc.
11701 I-30, Bldg 1, Suite 115
Little Rock, AR 72209
Project: Lion Oil

Date Received: 31-Aug-12 15:00

QUALITY CONTROL RESULTS

DRAFT: Wet Chemistry -- Batch: A208391 (Water)

Prepared: 30-Aug-12 15:30 By: AP -- Analyzed: 30-Aug-12 15:30 By: AP

Analyte	BLK	LCS / LCSD	MS / MSD	Dup	RPD	Qualifiers
TDS	<1.0 mg/L	98.0% / 101%	NA / NA		3.02%	

DRAFT: Dissolved Metals -- Batch: A209006 (Water)

Prepared: 04-Sep-12 10:10 By: TC -- Analyzed: 04-Sep-12 13:52 By: TC

Analyte	BLK	LCS / LCSD	MS / MSD	Dup	RPD	Qualifiers
Calcium	<0.100 mg/L	113% / NA	92.8% / 125%		2.54%	
Magnesium	<0.100 mg/L	90.5% / NA	MBA / MBA		1.03%	MBA
Potassium	<0.100 mg/L	88.9% / NA	107% / MBA		2.79%	MBA
Sodium	<1.00 mg/L	98.0% / NA	MBA / MBA		10.1%	MBA

DRAFT: Anions -- Batch: A209016 (Water)

Prepared: 04-Sep-12 10:00 By: MG -- Analyzed: 04-Sep-12 16:41 By: Melis

Analyte	BLK	LCS / LCSD	MS / MSD	Dup	RPD	Qualifiers
Chloride	<0.500 mg/L	104% / NA	94.4% / 94.0%		0.154%	
Nitrate as N	<0.500 mg/L	104% / NA	104% / 104%		0.337%	
Sulfate as SO4	<0.500 mg/L	94.6% / NA	106% / 105%		0.368%	

DRAFT: Anions -- Batch: A209045 (Water)

Prepared: 05-Sep-12 15:41 By: MG -- Analyzed: 05-Sep-12 18:26 By: Melis

Analyte	BLK	LCS / LCSD	MS / MSD	Dup	RPD	Qualifiers
Chloride	<0.500 mg/L	99.3% / NA	99.1% / 100%		0.367%	
Nitrate as N	<0.500 mg/L	106% / NA	110% / 106%		2.54%	
Sulfate as SO4	<0.500 mg/L	104% / NA	97.1% / 94.0%		1.02%	

DRAFT: Dissolved Metals -- Batch: A209072 (Water)

Prepared: 06-Sep-12 13:20 By: TC -- Analyzed: 06-Sep-12 15:41 By: TC

Analyte	BLK	LCS / LCSD	MS / MSD	Dup	RPD	Qualifiers
Calcium	<0.100 mg/L	91.3% / NA	101% / 77.9%		1.68%	
Magnesium	<0.100 mg/L	100% / NA	95.7% / 88.1%		2.51%	
Potassium	<0.100 mg/L	90.2% / NA	113% / 99.1%		1.95%	
Sodium	<1.00 mg/L	95.2% / NA	93.9% / 102%		0.0291%	

DRAFT: Wet Chemistry -- Batch: A209085 (Water)

Prepared: 06-Sep-12 18:15 By: AP -- Analyzed: 06-Sep-12 18:15 By: AP

Analyte	BLK	LCS / LCSD	MS / MSD	Dup	RPD	Qualifiers
TDS	<1.0 mg/L	102% / 97.0%	NA / NA		4.53%	

This report must be reproduced in its entirety.

17 September 2012

Norma James
Arkansas Analytical, Inc.
11701 I-30, Bldg 1, Suite 115
Little Rock, AR 72209
Project: Lion Oil

Date Received: 31-Aug-12 15:00

QUALITY CONTROL RESULTS

DRAFT: Dissolved Metals -- Batch: A209164 (Water)

Prepared: 12-Sep-12 16:45 By: TC -- Analyzed: 12-Sep-12 19:50 By: TC

Analyte	BLK	LCS / LCSD	MS / MSD	Dup	RPD	Qualifiers
Calcium	<0.100 mg/L	102% / NA	92.8% / 120%		2.34%	
Magnesium	<0.100 mg/L	96.2% / NA	90.1% / 90.2%		0.0344%	
Potassium	<0.100 mg/L	93.3% / NA	104% / 105%		0.938%	
Sodium	<1.00 mg/L	91.6% / NA	MBA / MBA		0.622%	MBA

DRAFT: Wet Chemistry -- Batch: A209166 (Water)

Prepared: 12-Sep-12 13:20 By: AP -- Analyzed: 12-Sep-12 13:20 By: AP

Analyte	BLK	LCS / LCSD	MS / MSD	Dup	RPD	Qualifiers
TDS	<1.0 mg/L	101% / 99.0%	NA / NA		2.00%	

DRAFT: Anions -- Batch: A209175 (Water)

Prepared: 13-Sep-12 11:50 By: MG -- Analyzed: 13-Sep-12 15:20 By: MG

Analyte	BLK	LCS / LCSD	MS / MSD	Dup	RPD	Qualifiers
Chloride	<0.500 mg/L	98.0% / NA	98.0% / 99.2%		0.632%	
Nitrate as N	<0.500 mg/L	91.2% / NA	93.0% / 93.7%		0.303%	
Sulfate as SO4	<0.500 mg/L	101% / NA	93.3% / 93.7%		0.188%	

QUALIFIER(S)

*E2: Estimated Result; Analyzed Outside of Holding Time
*E20: Estimated Result Due to Matrix Spike and/or Matrix Spike Duplicate Failure; This sample was used as the "parent sample" in MS/MSD prep.
*MBA: Masked By Analyte

All Analysis performed according to EPA approved methodology when available:
SW 846, Revised December, 1996; EPA 600/4-79-020, Revised March, 1983; Standard Methods, 20th Edition.
Instrument calibration and quality control samples performed at or above frequency specified in analytical method.

Reviewed by: _____
Norma James
President

This report must be reproduced in its entirety.

Arkansas Analytical Inc.

11701 Interstate 30, Bldg. 1, Ste. 115
Little Rock, AR 72209
PHONE: 501-455-3233
FAX: 501-455-6118

CHAIN OF CUSTODY RECORD

CLIENT INFORMATION

ACK Analytical

Project Description

Reporting Information

Telephone:

Fax:

Email:

Turnaround Time

24 Hour
48 Hour
72 Hour
Routine (5 Day)

Preservative Code:

Bottle Type:

Preservation Codes:

1. Cool, 4 Degrees Centigrade
2. Sulfuric Acid (H_2SO_4), pH < 2
3. Nitric Acid (HNO_3), pH < 2
4. Thiosulfate for Dechlorination
5. Hydrochloric Acid(HCl)
6. Sodium Hydroxide (NaOH), pH > 12

Lessie Redican
Sampler(s) Signature

Lessie Redican
Sampler(s) Printed

Field Number	SAMPLE COLLECTION Date/s	Time/s	Grab	Comp	Number of Bottles	Sample Matrix	SAMPLE IDENTIFICATION/ DESCRIPTION	TEST PARAMETERS: Cl, NO_3, SO_4	TDS	K Na Mg Ca	Bottle Type Code (G = Glass; P = Plastic; V = Septum; A = Amber)	Arkansas Analytical Work Order Number: 1208360
1	8-31-12					W	Syn 1 modified 2	✓	✓	✓		-01
2	8-31-12					W	Syn 2 modified 2	✓	✓	✓		-02
3	8-31-12					W	LC4 modified 2	✓	✓	✓		-03
	9-6-12						Lion Oil Synthetic 4	✓	✓	✓		-04

1. Relinquished by: (Signature)	Date/Time	2. Received by: (Signature)
Lessie Redican	8-31-12 15:00	
3. Relinquished by: (Signature)	Date/Time	4. Received by lab: (Signature)
		Lessie Redican

SAMPLE CONDITION UPON RECEIPT IN LAB

1. CUSTODY SEALS:	NA	___Yes ___No
2. CONTAINERS CORRECT:		___Yes ___No
3. COC/LABELS AGREE:		___Yes ___No
4. PRESERVATION CONFIRMED:		___Yes ___No
5. RECEIVED ON ICE:		___Yes ___No
6. TEMPERATURE ON RECEIPT:		

FOR COMPLETION BY LAB ONLY

REMARKS / SAMPLE COMMENTS

P.O. Number -

prepared by Lab 8-31-12

LP

Revision 1
12/1/10

1300 Blue Spruce Drive, Suite C
Fort Collins, Colorado 80524

Toll Free: 800/331-5916
Tel:970/484-5091 Fax:970/484-2514

ORGANISM HISTORY

DATE: 6/22/09

SPECIES: *Ceriodaphnia dubia*

AGE: Variable

LIFE STAGE: Adult

HATCH DATE: Variable

BEGAN FEEDING: Immediately

FOOD: YTC, *Selenastrum* sp.

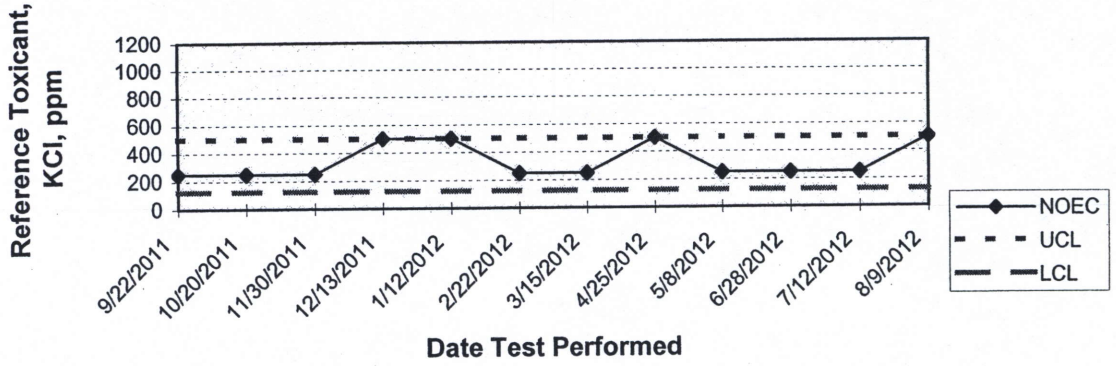
Water Chemistry Record:	Current	Range
TEMPERATURE:	25°C	20-25°C
SALINITY/CONDUCTIVITY:	--	--
TOTAL HARDNESS (as $CaCO_3$):	142 mg/l	86-124 mg/l
TOTAL ALKALINITY (as $CaCO_3$):	100 mg/l	65-130 mg/l
pH:	7.92	7.56-8.35

Comments:

Facility Supervisor

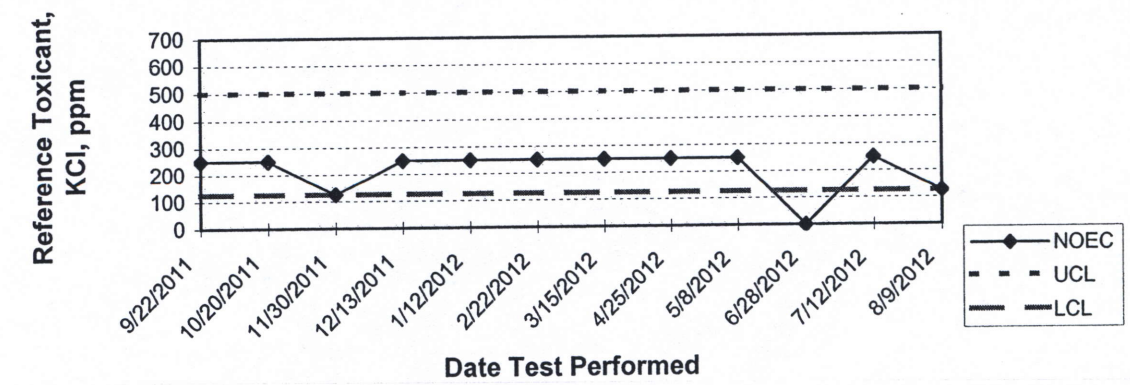
ARKANSAS ANALYTICAL, INC.

CERIODAPHNIA DUBIA SURVIVAL
QUALITY ASSURANCE



ARKANSAS ANALYTICAL, INC.

CERIODAPHNIA DUBIA REPRODUCTION
QUALITY ASSURANCE



October 3, 2012

Chronic WET Testing

Synthetic Matrices

Prepared for:

Mr. Roland McDaniel

Principal/ Senior Scientist

GBMc and Associates

RE: Lion Oil

Synthetic Matrix #1 Modified 2: Lab number 1208360-02

Ceriodaphnia dubia

Prepared by:

Arkansas Analytical, Inc.

11701 I-30, Bldg 1, Suite 115

Little Rock, AR 72209

Arkansas Analytical Inc.

Table of Contents

Overview

The purpose of this report is to provide results of chronic biomonitoring (WET) tests for Lion Oil Corporation as requested by GBMc and Associates. The tests were performed utilizing synthetic mixtures of salts in a dilution series with moderately hard water. The species tested were *ceriodaphnia dubia* . Tests were conducted utilizing standard testing protocol as defined in Test 1002.0(*Ceriodaphnia dubia*, Survival and Reproduction Test). A standard dilution series of 0%, 6.25%, 12.5%, 25%, 50%, and 100% were analyzed.

Tabulated below find a summary of the Test Matrices, the target and actual concentrations of the analytes of interest, and the test results.

Synthetic Matrix #1 Modified 2: 1208360-02		
Parameter	Target Concentration(mg/L)	Analyzed Concentration(mg/L)
Chlorides	190	158
Sulfates	864	767
TDS	1862	1700
Nitrate	--	7.00
Potassium	9.73	125
Sodium	--	531
Magnesium	4.13	5.63
Calcium	27.4	22.4
Species	NOEC/LOEC Survival	NOEC/LOEC Reproduction/Growth
Ceriodaphnia dubia	100%/ NA	50%/ 100%

Synthetic Mixture Preparation

A variety of salts were selected to prepare solutions containing the desired analytes at target concentrations. The target analytes were chloride, sulfate, and TDS. All salts were dried to remove the moisture content prior to weighing, except in the case of hydrated salts. Concentrates were prepared which were diluted to working volume each day of the test. The same concentrate was utilized for the entire test. Salts of sodium, calcium, potassium, and magnesium were used.

On the following pages are detailed bench sheets from each sample tested. Included are the data sheets followed by the statistical analysis. Also included are the water chemistry analyses from each day of testing. The detail of the salts used to prepare the synthetic mixtures and the lab analysis of the solutions is provided in the appendix.

Dilution Water

The dilution water used in the toxicity tests was moderately hard synthetic. It was prepared using Elga Maxima ultra pure water according to EPA specifications. Each batch was analyzed for pH, hardness, total alkalinity, and conductivity
Dilution Series

Five dilutions in addition to a control (0% effluent) were used in the toxicity tests. The dilutions, which were made with synthetic water, were 6.25%, 12.5%, 25%, 50%, and 100%.

Test Methods

EPA Method 1002.0, Cladoceran, *Ceriodaphnia dubia,* Survival and Reproduction Test, was also used. Neonates are exposed in a static renewal system until at least 60% of the control organisms have produced a third brood. Results are based on the survival and reproduction of the organisms. One neonate was placed in each often replicate chambers using a randomizing template. Test chambers were 30 ml plastic cups filled with 15 ml of test solution. The test temperature was 25 degrees Centigrade

Test Organisms
The organisms used in Test 1002.0 were < 24 hour old *Ceriodaphnia dubia* neonates, (all born within the same eight hours), obtained from an in-house culture. An organism history is provided in the Appendix.

Quality Assurance

Test Acceptability

Synthetic #1 Modified 2 , Lion Oil, 1208360-02

TEST ACCEPTANCE CRITERIA for *Ceriodaphnia dubia*

Control Criteria	**Results**	**Pass**	**Fail**
Greater than or equal to 80% survival	100%	X	
Average of 15 or more young per surviving female	20.6	X	
At least 60% of surviving females should have produced 3 broods	100%	X	
The percent coefficient of variation between replicates must be 40% or less for the young of surviving females	16.5	X	

Reference Toxicant

The reference toxicant used was Potassium Chloride prepared in-house. The tests were performed using moderately hard synthetic as dilution water. The results of the reference toxicant were

Ceriodaphnia dubia(8-12-12)		Range of acceptability	
	Mg/L	Mg/L	
NOEC Survival	500	125-500	Pass
LOEC Survival	1000	250-1000	Pass
NOEC Reproduction	125	125-500	Pass
LOEC Reproduction	250	250-1000	Pass

Synthetic #1 Modified 2 , Lion Oil, 1208360-02

Ceriodaphnia dubia

Bench Sheets

Statistical Analysis

Chemistry Bench Sheets

Syn #2

Surv. 100%
Repro 50%

1208360-02

Cerodaphnia dubia

SURVIVAL AND REPRODUCTION TEST

Discharger:
Location:
Date Sample Collected:
Lab Number/s

Analyst: RH
Test Start - Date/ Time: 9-6-12 1430
Test Stop - Date/Time: 9/13/12

Conc 1 — % MHS

Day	A	B	C	D	E	F	G	H	I	J	No. of Young	No. of Adult	Young/ Adult	Analyst
1	0	0	0	0	0	0	0	0	0	0	0	10	0	
2	0	0	0	0	0	0	0	0	0	0	0	10	0	
3	0	0	4	2	1	2	3	2	0	2	16	10	1.6	
4	8	4	3	3	4	5	0	4	5	2	38	10	3.8	
5	1	7	6	7	1	4	5	4	3	4	44	10	4.4	
6	10	11	7	10	6	4	8	3	6	4	69	10	6.9	
7	1	1	4	1	6	10	2	5	8	3	41	10	4.1	
8														
Total	20	23	24	23	18	25	18	18	22	15	206			

~~X̄=16.5~~ ~~CV=25%~~ X̄=20.6 CV=15%

Conc 2 — % 6.25%

Day	A	B	C	D	E	F	G	H	I	J	No. of Young	No. of Adult	Young/ Adult	Analyst
1	0	0	0	0	0	0	0	0	0	0	0	10	0	
2	0	0	0	0	0	0	0	0	0	0	0	10	0	
3	0	0	3	2	3	4	1	2	0	1	16	10	1.6	
4	7	5	2	5	3	5	0	4	5	2	38	10	3.8	
5	1	2	6	5	5	6	5	1	3	4	38	10	3.8	
6	13	6	10	11	7	0	5	3	2	7	64	10	6.4	
7	12	8	4	0	3	3	3	6	4	5	48	10	4.8	
8														
Total	33	21	25	23	21	18	14	16	19	19	204			

Conc 3 — % 12.5

Day	A	B	C	D	E	F	G	H	I	J	No. of Young	No. of Adult	Young/ Adult	Analyst
1	0	0	0	0	0	0	0	0	0	0	0	10	0	
2	0	0	0	0	0	0	0	0	0	0	0	10	0	
3	5	4	3	0	1	3	0	1	3	0	20	10	2.0	
4	3	5	5	8	5	1	3	5	0	2	37	10	3.7	
5	4	6	3	2	1	7	2	5	5	6	41	10	4.1	
6	0	3	4	5	6	16	8	2	4	5	53	10	5.3	
7	1	9	2	5	7	1	6	7	5	2	45	10	4.5	
8														
Total	13	27	17	20	20	28	19	20	17	15	196			

X= DEAD; Y= MALE

Conc 4 — % 25

Day	A	B	C	D	E	F	G	H	I	J	No. of Young	No. of Adult	Young/ Adult	Analyst
1	0	0	0	0	0	0	0	0	0	0	0	10	0	
2	0	0	0	0	0	0	0	0	0	0	0	10	0	
3	0	2	2	1	2	0	2	1	3	1	14	10	1.4	
4	5	1	4	3	2	4	5	4	5	6	39	10	3.9	
5	2	3	6	9	5	5	3	2	0	4	39	10	3.9	
6	7	5	8	2	4	3	5	3	14	8	59	10	5.9	
7	8	3	0	1	3	2	9	5	13	11	55	10	5.5	
8														
Total	22	14	20	16	16	14	24	15	35	30	206			

Conc 5 — % 50

Day	A	B	C	D	E	F	G	H	I	J	No. of Young	No. of Adult	Young/ Adult	Analyst
1	0	0	0	0	0	0	0	0	0	0	0	10	0	
2	0	0	0	0	0	0	0	0	0	0	0	10	0	
3	1	2	0	2	4	3	0	1	8	5	26	10	2.6	
4	6	5	3	7	0	5	3	1	0	5	35	10	3.5	
5	2	3	2	1	3	2	4	5	7	4	33	10	3.3	
6	9	2	8	2	7	2	5	6	4	0	46	10	4.5	
7	15	7	7	3	2	4	8	2	1	1	50	10	5.0	
8														
Total	33	19	20	15	16	16	20	15	20	15	189			

Conc 6 — % 100

Day	A	B	C	D	E	F	G	H	I	J	No. of Young	No. of Adult	Young/ Adult	Analyst
1	0	0	0	0	0	0	0	0	0	0	0	10	0	
2	0	0	0	0	0	0	0	0	0	0	0	10	0	
3	4	1	0	0	2	1	0	0	1	0	9	10	0.9	
4	1	2	3	2	1	0	2	2	6	4	23	10	2.3	
5	7	8	4	5	X0	5	6	4	3	5	47	9	5.2	
6	2	3	5	5	–	4	3	3	4	3	34	9	3.8	
7	8	2	4	5		5	3	5	4	4	36	9	4.4	
8														
Total	22	16	16	17	X3	15	14	14	20	16	~~137~~ 153			

X̄=16.7
CV=16.2

Revision 1
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1208360-02

AA # Synthetic #2, C. DUBIA CHRONIC, REPRODUCION, 9-6-1
File: Z:\TOXSTAT\MONTE\CD. Transform: NO TRANSFORMATION

Shapiro - Wilk's test for normality

******** Shapiro - Wilk's Test is aborted ********

This test can not be performed because total number of replicates
is greater than 50.

Total number of replicates = 60

AA # Synthetic #2, C. DUBIA CHRONIC, REPRODUCION, 9-6-1
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Bartlett's test for homogeneity of variance
Calculated B1 statistic = 5.39

Table Chi-square value = 15.09 (alpha = 0.01, df = 5)
Table Chi-square value = 11.07 (alpha = 0.05, df = 5)

Data PASS B1 homogeneity test at 0.01 level. Continue analysis.

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FISHER'S EXACT TEST

IDENTIFICATION	NUMBER OF ALIVE	NUMBER OF DEAD	NUMBER OF TOTAL ANIMALS
CONTROL	10	0	10
6.25	10	0	10
TOTAL	20	0	20

CRITICAL FISHER'S VALUE (10,10,10) (p=0.05) IS 6. b VALUE IS 10.
Since b is greater than 6 there is no significant difference between CONTROL and TREATMENT at the 0.05 level.

FISHER'S EXACT TEST

IDENTIFICATION	NUMBER OF ALIVE	NUMBER OF DEAD	NUMBER OF TOTAL ANIMALS
CONTROL	10	0	10
12.5	10	0	10
TOTAL	20	0	20

CRITICAL FISHER'S VALUE (10,10,10) (p=0.05) IS 6. b VALUE IS 10.
Since b is greater than 6 there is no significant difference between CONTROL and TREATMENT at the 0.05 level.

FISHER'S EXACT TEST

IDENTIFICATION	NUMBER OF ALIVE	NUMBER OF DEAD	NUMBER OF TOTAL ANIMALS
CONTROL	10	0	10
25	10	0	10

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TOTAL	20	0	20

CRITICAL FISHER'S VALUE (10,10,10) (p=0.05) IS 6. b VALUE IS 10.
Since b is greater than 6 there is no significant difference
between CONTROL and TREATMENT at the 0.05 level.

FISHER'S EXACT TEST

	NUMBER OF		
IDENTIFICATION	ALIVE	DEAD	TOTAL ANIMALS
CONTROL	10	0	10
50	10	0	10
TOTAL	20	0	20

CRITICAL FISHER'S VALUE (10,10,10) (p=0.05) IS 6. b VALUE IS 10.
Since b is greater than 6 there is no significant difference
between CONTROL and TREATMENT at the 0.05 level.

FISHER'S EXACT TEST

	NUMBER OF		
IDENTIFICATION	ALIVE	DEAD	TOTAL ANIMALS
CONTROL	10	0	10
100	9	1	10
TOTAL	19	1	20

CRITICAL FISHER'S VALUE (10,10,10) (p=0.05) IS 6. b VALUE IS 9.
Since b is greater than 6 there is no significant difference
between CONTROL and TREATMENT at the 0.05 level.

SUMMARY OF FISHER'S EXACT TESTS

	NUMBER	NUMBER	SIG

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GROUP	IDENTIFICATION	EXPOSED	DEAD	(P=.05)
	CONTROL	10	0	
1	6.25	10	0	
2	12.5	10	0	
3	25	10	0	
4	50	10	0	
5	100	10	1	

TITLE: AA # Synthetic #2, C. DUBIA CHRONIC, REPRODUCION, 9-6-1
FILE: Z:\TOXSTAT\MONTE\CD.
TRANSFORM: NO TRANSFORMATION NUMBER OF GROUPS: 6

GRP	IDENTIFICATION	REP	VALUE	TRANS VALUE
1	CONTROL	1	20.0000	20.0000
1	CONTROL	2	23.0000	23.0000
1	CONTROL	3	24.0000	24.0000
1	CONTROL	4	23.0000	23.0000
1	CONTROL	5	18.0000	18.0000
1	CONTROL	6	25.0000	25.0000
1	CONTROL	7	18.0000	18.0000
1	CONTROL	8	18.0000	18.0000
1	CONTROL	9	22.0000	22.0000
1	CONTROL	10	15.0000	15.0000
2	6.25 % EFFLUENT	1	33.0000	33.0000
2	6.25 % EFFLUENT	2	21.0000	21.0000
2	6.25 % EFFLUENT	3	25.0000	25.0000
2	6.25 % EFFLUENT	4	23.0000	23.0000
2	6.25 % EFFLUENT	5	21.0000	21.0000
2	6.25 % EFFLUENT	6	18.0000	18.0000
2	6.25 % EFFLUENT	7	14.0000	14.0000
2	6.25 % EFFLUENT	8	16.0000	16.0000
2	6.25 % EFFLUENT	9	14.0000	14.0000
2	6.25 % EFFLUENT	10	19.0000	19.0000
3	12.5 % EFFLUENT	1	13.0000	13.0000
3	12.5 % EFFLUENT	2	27.0000	27.0000
3	12.5 % EFFLUENT	3	17.0000	17.0000
3	12.5 % EFFLUENT	4	20.0000	20.0000
3	12.5 % EFFLUENT	5	20.0000	20.0000
3	12.5 % EFFLUENT	6	28.0000	28.0000
3	12.5 % EFFLUENT	7	19.0000	19.0000
3	12.5 % EFFLUENT	8	20.0000	20.0000
3	12.5 % EFFLUENT	9	17.0000	17.0000
3	12.5 % EFFLUENT	10	15.0000	15.0000
4	25 % EFFLUENT	1	22.0000	22.0000
4	25 % EFFLUENT	2	14.0000	14.0000
4	25 % EFFLUENT	3	20.0000	20.0000
4	25 % EFFLUENT	4	16.0000	16.0000
4	25 % EFFLUENT	5	16.0000	16.0000
4	25 % EFFLUENT	6	14.0000	14.0000
4	25 % EFFLUENT	7	24.0000	24.0000
4	25 % EFFLUENT	8	15.0000	15.0000

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4	25 % EFFLUENT	9	35.0000	35.0000
4	25 % EFFLUENT	10	30.0000	30.0000
5	50 % EFFLUENT	1	33.0000	33.0000
5	50 % EFFLUENT	2	19.0000	19.0000
5	50 % EFFLUENT	3	20.0000	20.0000
5	50 % EFFLUENT	4	15.0000	15.0000
5	50 % EFFLUENT	5	16.0000	16.0000
5	50 % EFFLUENT	6	16.0000	16.0000
5	50 % EFFLUENT	7	20.0000	20.0000
5	50 % EFFLUENT	8	15.0000	15.0000
5	50 % EFFLUENT	9	20.0000	20.0000
5	50 % EFFLUENT	10	15.0000	15.0000
6	100 % EFFLUENT	1	22.0000	22.0000
6	100 % EFFLUENT	2	16.0000	16.0000
6	100 % EFFLUENT	3	16.0000	16.0000
6	100 % EFFLUENT	4	17.0000	17.0000
6	100 % EFFLUENT	5	3.0000	3.0000
6	100 % EFFLUENT	6	15.0000	15.0000
6	100 % EFFLUENT	7	14.0000	14.0000
6	100 % EFFLUENT	8	14.0000	14.0000
6	100 % EFFLUENT	9	20.0000	20.0000
6	100 % EFFLUENT	10	16.0000	16.0000

AA # Synthetic #2, C. DUBIA CHRONIC, REPRODUCION, 9-6-1
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ANOVA TABLE

SOURCE	DF	SS	MS	F
Between	5	208.133	41.627	1.442
Within (Error)	54	1558.600	28.863	
Total	59	1766.733		

Critical F value = 2.45 (0.05,5,40)
Since F < Critical F FAIL TO REJECT Ho: All equal

AA # Synthetic #2, C. DUBIA CHRONIC, REPRODUCION, 9-6-1
File: Z:\TOXSTAT\MONTE\CD. Transform: NO TRANSFORMATION

DUNNETT'S TEST - TABLE 1 OF 2 Ho:Control<Treatment

GROUP	IDENTIFICATION	TRANSFORMED MEAN	MEAN CALCULATED IN ORIGINAL UNITS	T STAT	SIG
1	CONTROL	20.600	20.600		
2	6.25 % EFFLUENT	20.400	20.400	0.083	
3	12.5 % EFFLUENT	19.600	19.600	0.416	
4	25 % EFFLUENT	20.600	20.600	0.000	
5	50 % EFFLUENT	18.900	18.900	0.708	
6	100 % EFFLUENT	15.300	15.300	2.206	

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Dunnett table value = 2.31 (1 Tailed Value, P=0.05, df=40,5)

AA # Synthetic #2, C. DUBIA CHRONIC, REPRODUCION, 9-6-1
File: Z:\TOXSTAT\MONTE\CD. Transform: NO TRANSFORMATION

DUNNETT'S TEST - TABLE 2 OF 2 Ho:Control<Treatment

GROUP	IDENTIFICATION	NUM OF REPS	Minimum Sig Diff (IN ORIG. UNITS)	% of CONTROL	DIFFERENCE FROM CONTROL
1	CONTROL	10			
2	6.25 % EFFLUENT	10	5.550	26.9	0.200
3	12.5 % EFFLUENT	10	5.550	26.9	1.000
4	25 % EFFLUENT	10	5.550	26.9	0.000
5	50 % EFFLUENT	10	5.550	26.9	1.700
6	100 % EFFLUENT	10	5.550	26.9	5.300

AA # Synthetic #2, C. DUBIA CHRONIC, REPRODUCION, 9-6-1
File: Z:\TOXSTAT\MONTE\CD. Transform: NO TRANSFORMATION

STEEL'S MANY-ONE RANK TEST - Ho:Control<Treatment

GROUP	IDENTIFICATION	TRANSFORMED MEAN	RANK SUM	CRIT. VALUE	df	SIG
1	CONTROL	20.600				
2	6.25 % EFFLUENT	20.400	99.00	75.00	10.00	
3	12.5 % EFFLUENT	19.600	95.00	75.00	10.00	
4	25 % EFFLUENT	20.600	96.00	75.00	10.00	
5	50 % EFFLUENT	18.900	86.00	75.00	10.00	
6	100 % EFFLUENT	15.300	69.50	75.00	10.00	*

Critical values use k = 5, are 1 tailed, and alpha = 0.05

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CHEMICAL DATA SHEET FOR CHRONIC TOXICITY TESTING									Cerodaphnia Dubia
Lab # / Sample ID		Syn #2			Test Start (Date/Time)		9-6-12 1430		
Client:					Test End (Date/Time)		9-14-12 1015		
		Day of Test							
		1	2	3	4	5	6	7	notes/remarks
Control	MHS551			9-8	9-9				
D.O. (mg/L)	INITIAL	8.4	8.7	8.9	8.7	9.5	8.9	8.7	
	FINAL	8.0	8.5	8.6	8.5	8.4	8.4	8.3	
pH (s.u.)	INITIAL	7.9	7.8	8.3	8.0	8.0	7.9	7.9	
	FINAL	7.7	7.9	7.9	8.2	8.0	8.0	7.5	
temp (C)	INITIAL	23	22	22.0	20.7	21	21	22	
	FINAL	25	25	25	25	25	25	25	
ALKALINITY (mg/L)									
HARDNESS (mg/L)									
CONDUCTIVITY (umhos/cm)									
CHLORINE (mg/L)									
CONC:									
D.O. (mg/L)	INITIAL	8.6	8.5	9.1	8.5	8.8	8.9	8.7	
	FINAL	8.2	8.2	8.5	8.4	8.5	8.4	8.3	
pH (s.u)	INITIAL	7.4	7.9	7.9	7.7	7.6	8.1	7.9	
	FINAL	7.6	8.0	7.6	7.4	7.9	7.9	8.2	
temp (C)	INITIAL	22	22	21.5	21.0	21	22	21	
	FINAL	25	25	25	25	25	25	25	
CONC:									
D.O. (mg/L)	INITIAL	8.8	8.6	9.0	8.8	9.0	8.9	8.8	
	FINAL	8.0	8.2	8.6	8.4	8.4	8.5	8.4	
pH (mg/L)	INITIAL	7.4	8.2	8.2	7.9	8.0	8.0	8.1	
	FINAL	7.6	8.2	7.9	7.9	7.5	7.9	8.2	
temp (C)	INITIAL	22	21	21.4	20.8	21	22	21	
	FINAL	25	25	25	25	25	25	25	
CONC:									
D.O. (mg/L)	INITIAL	8.8	8.6	9.0	8.9	8.9	8.8	8.8	
	FINAL	8.0	8.2	8.5	8.6	8.4	8.4	8.4	
pH (s.u.)	INITIAL	8.0	8.0	8.2	8.0	8.2	8.0	8.0	
	FINAL	7.9	8.2	8.0	7.9	8.1	7.7	8.0	
temp (C)	INITIAL	22	22	21.3	20.8	21	22	21	
	FINAL	25	25	25	25	25	25	25	
CONC:									
D.O. (mg/L)	INITIAL	8.7	8.5	8.9	8.9	8.9	8.6	8.7	
	FINAL	8.2	8.1	8.6	8.4	8.4	8.5	8.4	
pH (s.u.)	INITIAL	7.8	8.2	8.3	8.1	8.2	8.2	8.1	
	FINAL	7.6	8.4	8.2	7.7	8.0	7.4	8.1	
temp (C)	INITIAL	22	21	21.3	20.8	21	22	21	
	FINAL	25	25	25	25	25	25	25	
CONC:									
D.O. (mg/L)	INITIAL	8.7	8.7	8.9	9.0	8.9	8.7	8.6	
	FINAL	8.3	8.1	8.6	8.4	8.5	8.4	8.5	
pH (s.u.)	INITIAL	7.9	8.2	8.5	8.3	8.1	8.2	8.1	
	FINAL	8.1	8.6	8.3	8.2	8.0	8.3	8.2	
temp (C)	INITIAL	22	22	21.4	20.9	21	22	21	
	FINAL	25	25	25	25	25	25	25	
CONC:	**100%**								
ALKALINITY (mg/L)		156							
HARDNESS (mg/L)		64							
CONDUCTIVITY (umhos/cm)		2.68							
CHLORINE (mg/L)		<0.05							

MHS

6.25

12.5

25

50

100

Revision 1
11/30/10

Appendix

Synthetic Salt Preparation

Lab Results of Synthetic Mixtures

Organism History

Control Charts for Reference Toxicants

Chain of Custody

Lion Oil		synthetic									
		matrix #2	1208360-02								
											atomic
		target									weight
Chloride		190								Chloride	35
Sulfate		864								Sulfate	96
Sodium										Sodium	23
Potassium		9.73								Potassium	39
Calcium		27.4								Calcium	40
Magnesium		4.13								Magnesium	24.3
Carbonate(CO3)										Carbonate(CO3)	60
Nitrate(No3)		8.71								Nitrate(No3)	62
										H2O	18
TDS		1862									
		mg of salt	mg	mg	mg	mg	mg	mg	mg	mg	mg
compound	g/mole	per liter	Na	CL	K	SO4	Ca	Mg	CO3	NO3	TDS
Sodium Chloride(NaCl)	58.0	228	90.4137931	137.5862	0	0	0	0	0	0	228
Sodium Sulfate(Na2SO4)	142.0	1245	403.3098592	0	0	841.69	0	0	0	0	1245
Sodium Carbonate(Na2CO3)	106.0	0	0	0	0	0	0	0	0	0	0
Potassium Chloride(KCl)	75.0	10	0	4.72973	5.270	0	0	0	0	0	10
Potassium Sulfate(K2SO4)	174.0	10	0	0	4.4827586	5.51724	0	0	0	0	10
Potassium Carbonate(K2CO3)	138.0	0	0	0	0	0	0	0	0	0	0
Magnesium Chloride(MgCl2)	94.3	0	0	0	0	0	0	0	0	0	0
Magnesium Sulfate(MgSO4)	120.3	21.5	0	0	0	17.1571	0	4.18204	0	0	21.33915
Calcium Chloride dihyrate (CaCl2)	146.0	101	0	48.42466	0	0	27.67123	0	0	0	76.09589
sodium Bicarbonate NaHCO3	84.0	275	75.29761905						196.43		271.7262
we have these chemicals		Sum:	569.0212713	190.7406	9.7530289	864.364	27.67123	4.18204	196.43	0	1862.161
		existing							0	0	
		Target		190	9.73	864	27.4	4.13			1862
ratio to sodium		existing	1		#DIV/0!		#DIV/0!	#DIV/0!			
theoretical			1		0.01714		0.04863	0.00735			
1208360-02			531	158	12.5	767	22.4	5.63		1.58	1700
										(6.997)	

	Chloride												
	Sulfate												
	Sodium												
	Potassium												
	Calcium												
	Magnesium												
	Carbonate(CO3)												
	Nitrate(No3)												
	water												
		Synthetic 2		1208360-02									
												mls to add	mls Elga to
		cation	anion						ppm	target	in 3 Liters	make 3 L
	58	0.396552	0.603448		Sodium Chloride(NaCl)		5g/L		5000	228	136.8	
	142	0.323944	0.676056		Sodium Sulfate(Na2SO4)		5g/L		15000	1245	249	
	106	0.433962	0.566038		Sodium Carbonate(Na2CO3)					0	0	
	74	0.527027	0.472973		Potassium Chloride(KCl)		5g/L		5000	10	6	
	174	0.448276	0.551724		Potassium Sulfate(K2SO4)		5g/L		5000	10	6	
	138	0.565217	0.434783							0	0	
	94.3	0.257688	0.742312		Magnesium Chloride(MgCl2)				5000	0	0	
	120.3	0.194514	0.798005		Magnesium Sulfate(MgSO4)		5g/L		5000	21.5	12.9	
	146	0.273973	0.479452		Calcium Chloride dihyrate (CaCl2)		5g/L		5000	101	60.6	
	84	0.27381	0.714286		sodium Bicarbonate NaHCO3		5g/L		5000	275	165	
										totals	636.3	2363.7
							Ca 10000ppm from Metals Std				0.6 lemls	

Arkansas Analytical Inc.

11701 I-30 Bldg 1, Ste 115 - Little Rock, AR 72209
501-455-3233 Fax 501-455-6118

17 September 2012

Norma James
Arkansas Analytical, Inc.
11701 I-30, Bldg 1, Suite 115
Little Rock, AR 72209

RE: Lion Oil

SDG Number: 1208360

Enclosed are the results of analyses for samples received by the laboratory on 31-Aug-12 15:00. If you have any questions concerning this report, please feel free to contact me.

Sample Receipt Information:

Custody Seals	
Containers Correct	
COC/Labels Agree	
Preservation Confirmed	
Received On Ice	
Temperature on Receipt	5.0°C

Sincerely,

Norma James
President

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17 September 2012

Norma James
Arkansas Analytical, Inc.
11701 I-30, Bldg 1, Suite 115
Little Rock, AR 72209
Project: Lion Oil

Date Received: 31-Aug-12 15:00

CASE NARRATIVE

Sample Delivery Group - 1208360

Qualified analytical and/or quality control results are discussed below:

Anions Analysis:

Holding Time Excursion (E2): The Nitrate results for sample 1208360-01 thru 1208360-03 were qualified as "estimated" (E2) as they were analyzed outside of holding time.

Total Metals Analysis:

Matrix Spike/Matrix Spike Duplicate (MS/MSD) Failure: Magnesium, Potassium, and Sodium failed to recover within laboratory acceptance criteria in the MS/MSD sample due to the high concentration of these analytes in the parent sample. The recoveries were qualified by "MBA", which means "Masked by Analyte", in the quality control section of the final report. These analytes were qualified as "estimated" (E20) in the parent sample, 1208360-01 (Synthetic #1-Mod 2).

This report must be reproduced in its entirety.

17 September 2012

Norma James
Arkansas Analytical, Inc.
11701 I-30, Bldg 1, Suite 115
Little Rock, AR 72209
Project: Lion Oil

Date Received: 31-Aug-12 15:00

ANALYTICAL RESULTS

Lab Number: 1208360-01
Sample Name: DRAFT: Synthetic #1 Modified 2
Date/Time Collected: 8/31/12 0:00
Sample Matrix: Water

DRAFT: Anions	Units	Result	Qualifier(s)	Date/Time Analyzed	Batch	Method
Chloride	mg/L	**214**		9/4/12 11:43	A209016	300.0/9056A
Nitrate (Calc.)	mg/L	**7.15**		9/5/12 9:14	A209030	300.0/9056A
Sulfate as SO4	mg/L	**737**		9/4/12 11:43	A209016	300.0/9056A
Nitrate as N	mg/L	**1.62**	E2	9/4/12 10:35	A209016	300.0/9056A

DRAFT: Dissolved Metals	Units	Result	Qualifier(s)	Date/Time Analyzed	Batch	Method
Calcium	mg/L	**23.4**		9/4/12 12:02	A209006	200.7
Magnesium	mg/L	**3.63**	E20	9/4/12 12:02	A209006	200.7
Potassium	mg/L	**10.9**	E20	9/4/12 12:02	A209006	200.7
Sodium	mg/L	**462**	E20	9/4/12 12:02	A209006	200.7

DRAFT: Wet Chemistry	Units	Result	Qualifier(s)	Date/Time Analyzed	Batch	Method
TDS	mg/L	**1500**		8/31/12 14:25	A208391	2540C

ANALYTICAL RESULTS

Lab Number: 1208360-02
Sample Name: DRAFT: Synthetic #2 Modified 2
Date/Time Collected: 8/31/12 0:00
Sample Matrix: Water

DRAFT: Anions	Units	Result	Qualifier(s)	Date/Time Analyzed	Batch	Method
Chloride	mg/L	**158**		9/4/12 12:05	A209016	300.0/9056A
Nitrate (Calc.)	mg/L	**7.00**		9/5/12 9:14	A209030	300.0/9056A
Sulfate as SO4	mg/L	**767**		9/4/12 12:05	A209016	300.0/9056A
Nitrate as N	mg/L	**1.58**	E2	9/4/12 10:58	A209016	300.0/9056A

DRAFT: Dissolved Metals	Units	Result	Qualifier(s)	Date/Time Analyzed	Batch	Method
Calcium	mg/L	**22.4**		9/4/12 12:13	A209006	200.7
Magnesium	mg/L	**5.63**		9/4/12 12:13	A209006	200.7
Potassium	mg/L	**12.5**		9/4/12 12:13	A209006	200.7
Sodium	mg/L	**531**		9/4/12 12:13	A209006	200.7

DRAFT: Wet Chemistry	Units	Result	Qualifier(s)	Date/Time Analyzed	Batch	Method
TDS	mg/L	**1700**		8/31/12 14:25	A208391	2540C

This report must be reproduced in its entirety.

17 September 2012

Norma James
Arkansas Analytical, Inc.
11701 I-30, Bldg 1, Suite 115
Little Rock, AR 72209
Project: Lion Oil

Date Received: 31-Aug-12 15:00

ANALYTICAL RESULTS

Lab Number:	**1208360-05**
Sample Name:	**DRAFT: Synthetic #4 9/12/12 Tweaked**
Date/Time Collected:	**9/12/12 11:30**
Sample Matrix:	**Water**

DRAFT: Anions	Units	Result	Qualifier(s)	Date/Time Analyzed	Batch	Method
Chloride	mg/L	**235**		9/13/12 12:13	A209175	300.0/9056A
Sulfate as SO4	mg/L	**467**		9/13/12 12:58	A209175	300.0/9056A
Nitrate as N	mg/L	**1.56**		9/13/12 11:51	A209175	300.0/9056A
DRAFT: Dissolved Metals	**Units**	**Result**	**Qualifier(s)**	**Date/Time Analyzed**	**Batch**	**Method**
Calcium	mg/L	**105**		9/12/12 19:42	A209164	200.7
Magnesium	mg/L	**3.49**		9/12/12 19:42	A209164	200.7
Potassium	mg/L	**9.04**		9/12/12 19:42	A209164	200.7
Sodium	mg/L	**262**	E20	9/12/12 19:42	A209164	200.7
DRAFT: Wet Chemistry	**Units**	**Result**	**Qualifier(s)**	**Date/Time Analyzed**	**Batch**	**Method**
TDS	mg/L	**1200**		9/12/12 16:54	A209166	2540C

This report must be reproduced in its entirety.

17 September 2012

Norma James
Arkansas Analytical, Inc.
11701 I-30, Bldg 1, Suite 115
Little Rock, AR 72209
Project: Lion Oil

Date Received: 31-Aug-12 15:00

QUALITY CONTROL RESULTS

DRAFT: Wet Chemistry -- Batch: A208391 (Water)
Prepared: 30-Aug-12 15:30 By: AP -- Analyzed: 30-Aug-12 15:30 By: AP

Analyte	BLK	LCS / LCSD	MS / MSD	Dup	RPD	Qualifiers
TDS	<1.0 mg/L	98.0% / 101%	NA / NA		3.02%	

DRAFT: Dissolved Metals -- Batch: A209006 (Water)
Prepared: 04-Sep-12 10:10 By: TC -- Analyzed: 04-Sep-12 13:52 By: TC

Analyte	BLK	LCS / LCSD	MS / MSD	Dup	RPD	Qualifiers
Calcium	<0.100 mg/L	113% / NA	92.8% / 125%		2.54%	
Magnesium	<0.100 mg/L	90.5% / NA	MBA / MBA		1.03%	MBA
Potassium	<0.100 mg/L	88.9% / NA	107% / MBA		2.79%	MBA
Sodium	<1.00 mg/L	98.0% / NA	MBA / MBA		10.1%	MBA

DRAFT: Anions -- Batch: A209016 (Water)
Prepared: 04-Sep-12 10:00 By: MG -- Analyzed: 04-Sep-12 16:41 By: Melis

Analyte	BLK	LCS / LCSD	MS / MSD	Dup	RPD	Qualifiers
Chloride	<0.500 mg/L	104% / NA	94.4% / 94.0%		0.154%	
Nitrate as N	<0.500 mg/L	104% / NA	104% / 104%		0.337%	
Sulfate as SO4	<0.500 mg/L	94.6% / NA	106% / 105%		0.368%	

DRAFT: Anions -- Batch: A209045 (Water)
Prepared: 05-Sep-12 15:41 By: MG -- Analyzed: 05-Sep-12 18:26 By: Melis

Analyte	BLK	LCS / LCSD	MS / MSD	Dup	RPD	Qualifiers
Chloride	<0.500 mg/L	99.3% / NA	99.1% / 100%		0.367%	
Nitrate as N	<0.500 mg/L	106% / NA	110% / 106%		2.54%	
Sulfate as SO4	<0.500 mg/L	104% / NA	97.1% / 94.0%		1.02%	

DRAFT: Dissolved Metals -- Batch: A209072 (Water)
Prepared: 06-Sep-12 13:20 By: TC -- Analyzed: 06-Sep-12 15:41 By: TC

Analyte	BLK	LCS / LCSD	MS / MSD	Dup	RPD	Qualifiers
Calcium	<0.100 mg/L	91.3% / NA	101% / 77.9%		1.68%	
Magnesium	<0.100 mg/L	100% / NA	95.7% / 88.1%		2.51%	
Potassium	<0.100 mg/L	90.2% / NA	113% / 99.1%		1.95%	
Sodium	<1.00 mg/L	95.2% / NA	93.9% / 102%		0.0291%	

DRAFT: Wet Chemistry -- Batch: A209085 (Water)
Prepared: 06-Sep-12 18:15 By: AP -- Analyzed: 06-Sep-12 18:15 By: AP

Analyte	BLK	LCS / LCSD	MS / MSD	Dup	RPD	Qualifiers
TDS	<1.0 mg/L	102% / 97.0%	NA / NA		4.53%	

This report must be reproduced in its entirety.

17 September 2012

Norma James
Arkansas Analytical, Inc.
11701 I-30, Bldg 1, Suite 115
Little Rock, AR 72209
Project: Lion Oil

Date Received: 31-Aug-12 15:00

QUALITY CONTROL RESULTS

DRAFT: Dissolved Metals -- Batch: A209164 (Water)
Prepared: 12-Sep-12 16:45 By: TC -- Analyzed: 12-Sep-12 19:50 By: TC

Analyte	BLK	LCS / LCSD	MS / MSD	Dup	RPD	Qualifiers
Calcium	<0.100 mg/L	102% / NA	92.8% / 120%		2.34%	
Magnesium	<0.100 mg/L	96.2% / NA	90.1% / 90.2%		0.0344%	
Potassium	<0.100 mg/L	93.3% / NA	104% / 105%		0.938%	
Sodium	<1.00 mg/L	91.6% / NA	MBA / MBA		0.622%	MBA

DRAFT: Wet Chemistry -- Batch: A209166 (Water)
Prepared: 12-Sep-12 13:20 By: AP -- Analyzed: 12-Sep-12 13:20 By: AP

Analyte	BLK	LCS / LCSD	MS / MSD	Dup	RPD	Qualifiers
TDS	<1.0 mg/L	101% / 99.0%	NA / NA		2.00%	

DRAFT: Anions -- Batch: A209175 (Water)
Prepared: 13-Sep-12 11:50 By: MG -- Analyzed: 13-Sep-12 15:20 By: MG

Analyte	BLK	LCS / LCSD	MS / MSD	Dup	RPD	Qualifiers
Chloride	<0.500 mg/L	98.0% / NA	98.0% / 99.2%		0.632%	
Nitrate as N	<0.500 mg/L	91.2% / NA	93.0% / 93.7%		0.303%	
Sulfate as SO4	<0.500 mg/L	101% / NA	93.3% / 93.7%		0.188%	

QUALIFIER(S)

*E2: Estimated Result; Analyzed Outside of Holding Time
*E20: Estimated Result Due to Matrix Spike and/or Matrix Spike Duplicate Failure; This sample was used as the "parent sample" in MS/MSD prep.
*MBA: Masked By Analyte

All Analysis performed according to EPA approved methodology when available:
SW 846, Revised December, 1996; EPA 600/4-79-020, Revised March, 1983; Standard Methods, 20th Edition.
Instrument calibration and quality control samples performed at or above frequency specified in analytical method.

Reviewed by: _____
Norma James
President

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Arkansas Analytical Inc.
11701 Interstate 30, Bldg. 1, Ste. 115
Little Rock, AR 72209
PHONE: 501-455-3233
FAX: 501-455-6118

CHAIN OF CUSTODY RECORD

CLIENT INFORMATION	Project Description	Turnaround Time
ArK Analytical		24 Hour
		48 Hour
	Reporting Information	72 Hour
	Telephone:	Routine (5 Day)
	Fax:	Preservative Code:
	Email:	Bottle Type:

Preservation Codes:
1. Cool, 4 Degrees Centigrade
2. Sulfuric Acid (H_2SO_4), pH < 2
3. Nitric Acid (HNO_3), pH < 2
4. Thiosulfate for Dechlorination
5. Hydrochloric Acid(HCl)
6. Sodium Hydroxide (NaOH), pH > 12

Sampler(s) Signature: Lessie Redican
Sampler(s) Printed: Lessie Redican

Field Number	SAMPLE COLLECTION Date/s	Time/s	Grab	Comp	Number of Bottles	Sample Matrix	SAMPLE IDENTIFICATION/ DESCRIPTION	TEST PARAMETERS: Cl, NO_3, SO_4	TDS	K Na mg Ca	Bottle Type Code (G = Glass; P = Plastic; V = Septum; A = Amber)	Arkansas Analytical Work Order Number: 1208360
1	8-31-12					W	Syn 1 modified 2	✓	✓	✓		-01
2	8-31-12					W	Syn 2 modified 2	✓	✓	✓		-02
3	8-31-12					W	LC4 modified 2	✓	✓	✓		-03
	9-6-12						Lion Oil Synthetic 4	✓	✓	✓		-04

1. Relinquished by: (Signature)	Date/Time	2. Received by: (Signature)
Lessie Redican	8-31-12 15:00	
3. Relinquished by: (Signature)	Date/Time	4. Received by lab: (Signature)
		Lessie Redican

SAMPLE CONDITION UPON RECEIPT IN LAB

1. CUSTODY SEALS:	NA	___Yes ___No
2. CONTAINERS CORRECT:		___Yes ___No
3. COC/LABELS AGREE:		___Yes ___No
4. PRESERVATION CONFIRMED:		___Yes ___No
5. RECEIVED ON ICE:		___Yes ___No
6. TEMPERATURE ON RECEIPT:		

FOR COMPLETION BY LAB ONLY

REMARKS / SAMPLE COMMENTS

P.O. Number -

prepared by Lab 8-31-12

LP

Revision 1
12/1/10

1300 Blue Spruce Drive, Suite C
Fort Collins, Colorado 80524

Toll Free: 800/331-5916
Tel:970/484-5091 Fax:970/484-2514

ORGANISM HISTORY

DATE: 6/22/09

SPECIES: *Ceriodaphnia dubia*

AGE: Variable

LIFE STAGE: Adult

HATCH DATE: Variable

BEGAN FEEDING: Immediately

FOOD: YTC, *Selenastrum* sp.

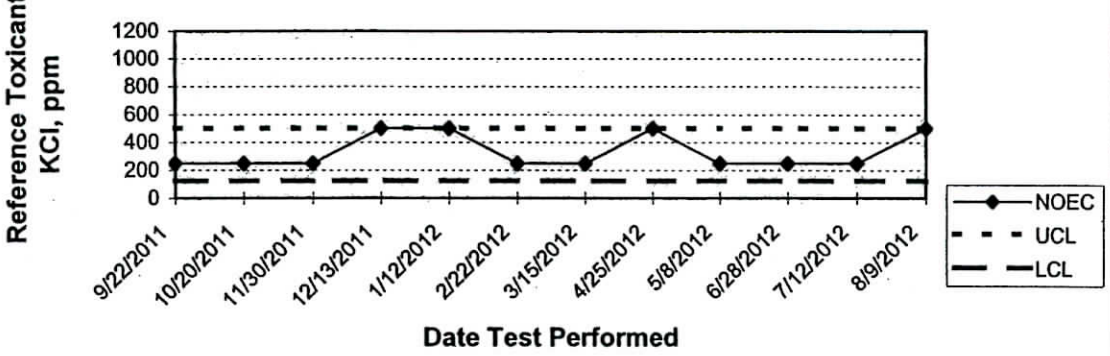
Water Chemistry Record:	Current	Range
TEMPERATURE:	25°C	20-25°C
SALINITY/CONDUCTIVITY:	--	--
TOTAL HARDNESS (as $CaCO_3$):	142 mg/l	86-124 mg/l
TOTAL ALKALINITY (as $CaCO_3$):	100 mg/l	65-130 mg/l
pH:	7.92	7.56-8.35

Comments:

Facility Supervisor

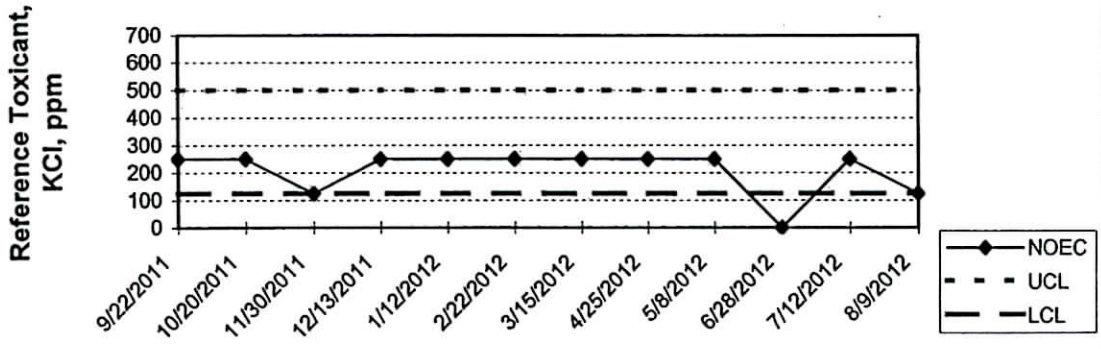
ARKANSAS ANALYTICAL, INC.

CERIODAPHNIA DUBIA SURVIVAL
QUALITY ASSURANCE



ARKANSAS ANALYTICAL, INC.

CERIODAPHNIA DUBIA REPRODUCTION
QUALITY ASSURANCE



October 3, 2012

Chronic WET Testing

Synthetic Matrices

Prepared for:

Mr. Roland McDaniel

Principal/ Senior Scientist

GBMc and Associates

RE: Lion Oil

Synthetic Matrix #LC-4 Modified 2: Lab number 1208360-03

Ceriodaphnia dubia

Prepared by:

Arkansas Analytical, Inc.

11701 I-30, Bldg 1, Suite 115

Little Rock, AR 72209

Arkansas Analytical Inc.

Table of Contents

Overview

The purpose of this report is to provide results of chronic biomonitoring (WET) tests for Lion Oil Corporation as requested by GBMc and Associates. The tests were performed utilizing synthetic mixtures of salts in a dilution series with moderately hard water. The species tested were *ceriodaphnia dubia* . Tests were conducted utilizing standard testing protocol as defined in Test 1002.0(*Ceriodaphnia dubia*, Survival and Reproduction Test). A standard dilution series of 0%, 6.25%, 12.5%, 25%, 50%, and 100% were analyzed.

Tabulated below find a summary of the Test Matrices, the target and actual concentrations of the analytes of interest, and the test results.

Synthetic Matrix #LC-4 Modified 2: 1208360-03		
Parameter	Target Concentration(mg/L)	Analyzed Concentration(mg/L)
Chlorides	191	162
Sulfates	1010	854
TDS	1900	1700
Nitrate	--	6.94
Potassium	9.73	1.09
Sodium	559	565
Magnesium	4.13	3.63
Calcium	27.4	24.3
Species	NOEC/LOEC Survival	NOEC/LOEC Reproduction/Growth
Ceriodaphnia dubia	100%/ NA	25%/50%

Synthetic Mixture Preparation

A variety of salts were selected to prepare solutions containing the desired analytes at target concentrations. The target analytes were chloride, sulfate, and TDS. All salts were dried to remove the moisture content prior to weighing, except in the case of hydrated salts. Concentrates were prepared which were diluted to working volume each day of the test. The same concentrate was utilized for the entire test. Salts of sodium, calcium, potassium, and magnesium were used.

On the following pages are detailed bench sheets from each sample tested. Included are the data sheets followed by the statistical analysis. Also included are the water chemistry analyses from each day of testing. The detail of the salts used to prepare the synthetic mixtures and the lab analysis of the solutions is provided in the appendix.

Dilution Water

The dilution water used in the toxicity tests was moderately hard synthetic. It was prepared using Elga Maxima ultra pure water according to EPA specifications. Each batch was analyzed for pH, hardness, total alkalinity, and conductivity
Dilution Series

Five dilutions in addition to a control (0% effluent) were used in the toxicity tests. The dilutions, which were made with synthetic water, were 6.25%, 12.5%, 25%, 50%, and 100%.

Test Methods

EPA Method 1002.0, Cladoceran, *Ceriodaphnia dubia,* Survival and Reproduction Test, was also used. Neonates are exposed in a static renewal system until at least 60% of the control organisms have produced a third brood. Results are based on the survival and reproduction of the organisms. One neonate was placed in each often replicate chambers using a randomizing template. Test chambers were 30 ml plastic cups filled with 15 ml of test solution. The test temperature was 25 degrees Centigrade

Test Organisms
The organisms used in Test 1002.0 were < 24 hour old *Ceriodaphnia dubia* neonates, (all born within the same eight hours), obtained from an in-house culture. An organism history is provided in the Appendix.

Quality Assurance

Test Acceptability

Synthetic Matrix LC-4 Modified 2 , Lion Oil, 1208360-03

TEST ACCEPTANCE CRITERIA for *Ceriodaphnia dubia*

Control Criteria	Results	Pass	Fail
Greater than or equal to 80% survival	100%	X	
Average of 15 or more young per surviving female	20.6	X	
At least 60% of surviving females should have produced 3 broods	100%	X	
The percent coefficient of variation between replicates must be 40% or less for the young of surviving females	16.5	X	

Reference Toxicant

The reference toxicant used was Potassium Chloride prepared in-house. The tests were performed using moderately hard synthetic as dilution water. The results of the reference toxicant were

Ceriodaphnia dubia(8-12-12)		Range of acceptability	
	Mg/L	Mg/L	
NOEC Survival	500	125-500	Pass
LOEC Survival	1000	250-1000	Pass
NOEC Reproduction	125	125-500	Pass
LOEC Reproduction	250	250-1000	Pass

Synthetic Matrix LC-4 Modified 2 , Lion Oil, 1208360-03

Ceriodaphnia dubia

Bench Sheets

Statistical Analysis

Chemistry Bench Sheets

LC-4

1208360-03

surv. 100
Repro. X .25

Cerodaphnia dubia — SURVIVAL AND REPRODUCTION TEST

RH

Discharger:
Location:
Date Sample Collected:
Lab Number/s
Analyst:
Test Start - Date/ Time: 7-6-12 1430
Test Stop - Date/Time:

MHS

Conc 1

%	Day	A	B	C	D	E	F	G	H	I	J	No. of Young	No. of Adult	Young/ Adult	Analyst
	1	0	0	0	0	0	0	0	0	0	0	0	10	0	
	2	0	0	0	0	0	0	0	0	0	0	0	10	0	
	3	5	3	2	0	1	1	0	2	6	3	23	10	2.3	
	4	1	8	2	3	2	7	6	6	2	1	38	10	3.8	
	5	7	1	5	5	4	1	0	1	7	8	39	10	3.9	
	6	0	9	6	4	1	12	9	13	0	3	57	10	5.7	
	7	9	8	10	3	6	6	9	7	10	8	76	10	7.6	
	8														
	Total	22	29	25	15	14	27	24	29	25	23	233			

X=23.3
CV=22.3

6.25

Conc 2

%	Day	A	B	C	D	E	F	G	H	I	J	No. of Young	No. of Adult	Young/ Adult	Analyst
	1	0	0	0	0	0	0	0	0	0	0	0	10	0	
	2	0	0	0	0	0	0	0	0	0	0	0	10	0	
	3	3	1	0	1	2	5	1	2	0	4	19	10	1.9	
	4	3	0	2	3	2	0	6	8	3	2	29	10	2.9	
	5	2	5	7	2	7	2	0	1	7	9	42	10	4.2	
	6	6	2	0	9	1	6	10	11	1	2	48	10	4.8	
	7	2	3	5	6	4	2	1	2	10	8	43	10	4.3	
	8														
	Total	16	11	14	21	16	15	18	24	21	25	181			

12.5

Conc 3

%	Day	A	B	C	D	E	F	G	H	I	J	No. of Young	No. of Adult	Young/ Adult	Analyst
	1	0	0	0	0	0	0	0	0	0	0	0			
	2	0	0	0	0	0	0	0	0	0	0	0			
	3	0	1	0	1	2	0	4	5	3	2	18			
	4	5	3	1	2	2	4	1	0	1	6	25			
	5	1	3	6	8	5	2	4	8	7	1	45			
	6	6	1	4	3	3	3	1	6	8	3	38			
	7	2	4	5	6	2	2	8	0	2	7	38			
	8														
	Total	14	12	16	20	14	11	18	19	21	19	164			

X= DEAD; Y= MALE

25

Conc 4

%	Day	A	B	C	D	E	F	G	H	I	J	No. of Young	No. of Adult	Young/ Adult	Analyst
	1	0	0	0	0	0	0	0	0	0	0	0	10	0	
	2	0	0	0	0	0	0	0	0	0	0	0	10	0	
	3	2	2	0	3	0	4	0	2	0	3	16	10	1.6	
	4	8	0	2	4	2	0	7	6	8	7	44	10	4.4	
	5	0	7	6	7	4	8	0	1	1	8	42	10	4.2	
	6	13	2	1	6	3	5	13	0	9	0	52	10	5.2	
	7	14	7	5	0	12	5	7	6	6	4	60	10	6.0	
	8														
	Total	37	18	14	20	21	22	27	15	18	22	214			

50

Conc 5

%	Day	A	B	C	D	E	F	G	H	I	J	No. of Young	No. of Adult	Young/ Adult	Analyst
	1	0	0	0	0	0	0	0	0	0	0	0	10	0	
	2	0	0	0	0	0	0	0	0	0	0	0	10	0	
	3	0	3	1	2	0	3	4	3	2	6	24	10	2.4	
	4	2	2	2	4	2	3	8	1	0	1	25	10	2.5	
	5	5	8	4	2	2	4	0	9	7	8	49	10	4.9	
	6	3	3	4	5	8	2	9	9	6	6	55	10	5.5	
	7	3	0	4	2	4	4	0	0	1	2	20	10	2.0	
	8														
	Total	13	16	15	15	16	16	21	22	16	23	173			

100

Conc 6

%	Day	A	B	C	D	E	F	G	H	I	J	No. of Young	No. of Adult	Young/ Adult	Analyst
	1	0	0	0	0	0	0	0	0	0	0	0	10	0	
	2	0	0	0	0	0	0	0	0	0	0	0	10	0	
	3	3	1	4	5	1	2	0	2	0	1	19	10	1.9	
	4	3	5	1	2	4	1	X	2	7	1	29	9	3.2	
	5	9	2	2	7	1	5	—	9	0	2	37	9	4.1	
	6	0	3	2	4	4	4	—	5	9	6	35	9	3.9	
	7	2	5	3	0	2	4		8	6	5	35	9	3.9	
	8														
	Total	17	16	12	18	12	16	X	26	20	18	155			

X=17.2
CV=24.6

Revision 1
11/30/10

1208360-03

AA # Synthetic LC-4, C. DUBIA CHRONIC, REPRODUCION, 9-
File: Z:\TOXSTAT\MONTE\CD. Transform: NO TRANSFORMATION

Shapiro - Wilk's test for normality

******** Shapiro - Wilk's Test is aborted ********

This test can not be performed because total number of replicates
is greater than 50.

Total number of replicates = 60

AA # Synthetic LC-4, C. DUBIA CHRONIC, REPRODUCION, 9-
File: Z:\TOXSTAT\MONTE\CD. Transform: NO TRANSFORMATION

Bartlett's test for homogeneity of variance
Calculated B1 statistic = 7.01

Table Chi-square value = 15.09 (alpha = 0.01, df = 5)
Table Chi-square value = 11.07 (alpha = 0.05, df = 5)

Data PASS B1 homogeneity test at 0.01 level. Continue analysis.

1208360-03

FISHER'S EXACT TEST

IDENTIFICATION	NUMBER OF ALIVE	NUMBER OF DEAD	NUMBER OF TOTAL ANIMALS
CONTROL	10	0	10
6.25	10	0	10
TOTAL	20	0	20

CRITICAL FISHER'S VALUE (10,10,10) (p=0.05) IS 6. b VALUE IS 10.
Since b is greater than 6 there is no significant difference between CONTROL and TREATMENT at the 0.05 level.

FISHER'S EXACT TEST

IDENTIFICATION	NUMBER OF ALIVE	NUMBER OF DEAD	NUMBER OF TOTAL ANIMALS
CONTROL	10	0	10
12.5	10	0	10
TOTAL	20	0	20

CRITICAL FISHER'S VALUE (10,10,10) (p=0.05) IS 6. b VALUE IS 10.
Since b is greater than 6 there is no significant difference between CONTROL and TREATMENT at the 0.05 level.

FISHER'S EXACT TEST

IDENTIFICATION	NUMBER OF ALIVE	NUMBER OF DEAD	NUMBER OF TOTAL ANIMALS
CONTROL	10	0	10
25	10	0	10

1208360-03

TOTAL	20	0	20

CRITICAL FISHER'S VALUE (10,10,10) (p=0.05) IS 6. b VALUE IS 10.
Since b is greater than 6 there is no significant difference
between CONTROL and TREATMENT at the 0.05 level.

FISHER'S EXACT TEST

	NUMBER OF		
IDENTIFICATION	ALIVE	DEAD	TOTAL ANIMALS
CONTROL	10	0	10
50	10	0	10
TOTAL	20	0	20

CRITICAL FISHER'S VALUE (10,10,10) (p=0.05) IS 6. b VALUE IS 10.
Since b is greater than 6 there is no significant difference
between CONTROL and TREATMENT at the 0.05 level.

FISHER'S EXACT TEST

	NUMBER OF		
IDENTIFICATION	ALIVE	DEAD	TOTAL ANIMALS
CONTROL	10	0	10
100	9	1	10
TOTAL	19	1	20

CRITICAL FISHER'S VALUE (10,10,10) (p=0.05) IS 6. b VALUE IS 9.
Since b is greater than 6 there is no significant difference
between CONTROL and TREATMENT at the 0.05 level.

SUMMARY OF FISHER'S EXACT TESTS

	NUMBER	NUMBER	SIG

1208360-03

GROUP	IDENTIFICATION	EXPOSED	DEAD	(P=.05)
	CONTROL	10	0	
1	6.25	10	0	
2	12.5	10	0	
3	25	10	0	
4	50	10	0	
5	100	10	1	

TITLE: AA # Synthetic LC-4, C. DUBIA CHRONIC, REPRODUCION, 9-
FILE: Z:\TOXSTAT\MONTE\CD.
TRANSFORM: NO TRANSFORMATION NUMBER OF GROUPS: 6

GRP	IDENTIFICATION	REP	VALUE	TRANS VALUE
1	CONTROL	1	22.0000	22.0000
1	CONTROL	2	29.0000	29.0000
1	CONTROL	3	25.0000	25.0000
1	CONTROL	4	15.0000	15.0000
1	CONTROL	5	14.0000	14.0000
1	CONTROL	6	27.0000	27.0000
1	CONTROL	7	24.0000	24.0000
1	CONTROL	8	29.0000	29.0000
1	CONTROL	9	25.0000	25.0000
1	CONTROL	10	23.0000	23.0000
2	6.25 % EFFLUENT	1	16.0000	16.0000
2	6.25 % EFFLUENT	2	11.0000	11.0000
2	6.25 % EFFLUENT	3	14.0000	14.0000
2	6.25 % EFFLUENT	4	21.0000	21.0000
2	6.25 % EFFLUENT	5	16.0000	16.0000
2	6.25 % EFFLUENT	6	15.0000	15.0000
2	6.25 % EFFLUENT	7	18.0000	18.0000
2	6.25 % EFFLUENT	8	24.0000	24.0000
2	6.25 % EFFLUENT	9	21.0000	21.0000
2	6.25 % EFFLUENT	10	25.0000	25.0000
3	12.5 % EFFLUENT	1	14.0000	14.0000
3	12.5 % EFFLUENT	2	12.0000	12.0000
3	12.5 % EFFLUENT	3	16.0000	16.0000
3	12.5 % EFFLUENT	4	20.0000	20.0000
3	12.5 % EFFLUENT	5	14.0000	14.0000
3	12.5 % EFFLUENT	6	11.0000	11.0000
3	12.5 % EFFLUENT	7	18.0000	18.0000
3	12.5 % EFFLUENT	8	19.0000	19.0000
3	12.5 % EFFLUENT	9	21.0000	21.0000
3	12.5 % EFFLUENT	10	19.0000	19.0000
4	25 % EFFLUENT	1	37.0000	37.0000
4	25 % EFFLUENT	2	18.0000	18.0000
4	25 % EFFLUENT	3	14.0000	14.0000
4	25 % EFFLUENT	4	20.0000	20.0000
4	25 % EFFLUENT	5	21.0000	21.0000
4	25 % EFFLUENT	6	22.0000	22.0000
4	25 % EFFLUENT	7	23.0000	23.0000
4	25 % EFFLUENT	8	15.0000	15.0000

1208360-03

4	25 % EFFLUENT	9	18.0000	18.0000
4	25 % EFFLUENT	10	22.0000	22.0000
5	50 % EFFLUENT	1	13.0000	13.0000
5	50 % EFFLUENT	2	16.0000	16.0000
5	50 % EFFLUENT	3	15.0000	15.0000
5	50 % EFFLUENT	4	15.0000	15.0000
5	50 % EFFLUENT	5	16.0000	16.0000
5	50 % EFFLUENT	6	16.0000	16.0000
5	50 % EFFLUENT	7	21.0000	21.0000
5	50 % EFFLUENT	8	22.0000	22.0000
5	50 % EFFLUENT	9	16.0000	16.0000
5	50 % EFFLUENT	10	23.0000	23.0000
6	100 % EFFLUENT	1	17.0000	17.0000
6	100 % EFFLUENT	2	16.0000	16.0000
6	100 % EFFLUENT	3	12.0000	12.0000
6	100 % EFFLUENT	4	18.0000	18.0000
6	100 % EFFLUENT	5	12.0000	12.0000
6	100 % EFFLUENT	6	16.0000	16.0000
6	100 % EFFLUENT	7	0.0000	0.0000
6	100 % EFFLUENT	8	26.0000	26.0000
6	100 % EFFLUENT	9	20.0000	20.0000
6	100 % EFFLUENT	10	18.0000	18.0000

AA # Synthetic LC-4, C. DUBIA CHRONIC, REPRODUCION, 9-
File: Z:\TOXSTAT\MONTE\CD. Transform: NO TRANSFORMATION

ANOVA TABLE

SOURCE	DF	SS	MS	F
Between	5	442.400	88.480	3.369
Within (Error)	54	1418.000	26.259	
Total	59	1860.400		

Critical F value = 2.45 (0.05,5,40)
Since F > Critical F REJECT Ho: All equal

AA # Synthetic LC-4, C. DUBIA CHRONIC, REPRODUCION, 9-
File: Z:\TOXSTAT\MONTE\CD. Transform: NO TRANSFORMATION

DUNNETT'S TEST - TABLE 1 OF 2 Ho:Control<Treatment

GROUP	IDENTIFICATION	TRANSFORMED MEAN	MEAN CALCULATED IN ORIGINAL UNITS	T STAT	SIG
1	CONTROL	23.300	23.300		
2	6.25 % EFFLUENT	18.100	18.100	2.269	
3	12.5 % EFFLUENT	16.400	16.400	3.011	*
4	25 % EFFLUENT	21.000	21.000	1.004	
5	50 % EFFLUENT	17.300	17.300	2.618	*
6	100 % EFFLUENT	15.500	15.500	3.404	*

1208360-03

Dunnett table value = 2.31 (1 Tailed Value, P=0.05, df=40,5)

AA # Synthetic LC-4, C. DUBIA CHRONIC, REPRODUCION, 9-
File: Z:\TOXSTAT\MONTE\CD. Transform: NO TRANSFORMATION

DUNNETT'S TEST - TABLE 2 OF 2 Ho:Control<Treatment

GROUP	IDENTIFICATION	NUM OF REPS	Minimum Sig Diff (IN ORIG. UNITS)	% of CONTROL	DIFFERENCE FROM CONTROL
1	CONTROL	10			
2	6.25 % EFFLUENT	10	5.294	22.7	5.200
3	12.5 % EFFLUENT	10	5.294	22.7	6.900
4	25 % EFFLUENT	10	5.294	22.7	2.300
5	50 % EFFLUENT	10	5.294	22.7	6.000
6	100 % EFFLUENT	10	5.294	22.7	7.800

AA # Synthetic LC-4, C. DUBIA CHRONIC, REPRODUCION, 9-
File: Z:\TOXSTAT\MONTE\CD. Transform: NO TRANSFORMATION

STEEL'S MANY-ONE RANK TEST - Ho:Control<Treatment

GROUP	IDENTIFICATION	TRANSFORMED MEAN	RANK SUM	CRIT. VALUE	df	SIG
1	CONTROL	23.300				
2	6.25 % EFFLUENT	18.100	77.50	75.00	10.00	
3	12.5 % EFFLUENT	16.400	68.00	75.00	10.00	*
4	25 % EFFLUENT	21.000	83.50	75.00	10.00	
5	50 % EFFLUENT	17.300	74.00	75.00	10.00	*
6	100 % EFFLUENT	15.500	74.00	75.00	10.00	*

Critical values use k = 5, are 1 tailed, and alpha = 0.05

1208360-03

CHEMICAL DATA SHEET FOR CHRONIC TOXICITY TESTING									Cerodaphnia Dubia
Lab # / Sample ID		LC 4			Test Start (Date/Time)		9-6-12	1430	
Client:					Test End (Date/Time)		9-14-12	1100	
		Day of Test							
		1	2	3	4	5	6	7	notes/remarks
Control	MHS551			9-8	9-9				
D.O. (mg/L)	INITIAL	8.4	8.7	8.9	8.7	9.5	8.9	8.7	
	FINAL	8.2	8.3	8.4	8.4	8.5	8.4	8.0	
pH (s.u.)	INITIAL	7.9	7.8	8.3	8.0	8.0	7.9	7.9	
	FINAL	7.6	8.0	8.1	8.0	8.1	8.0	7.6	
temp (C)	INITIAL	23	22	22	20.7	21	21	22	
	FINAL	25	25	25	25	25	25	25	
ALKALINITY (mg/L)									
HARDNESS (mg/L)									
CONDUCTIVITY (umhos/cm)									
CHLORINE (mg/L)									
CONC:									
D.O. (mg/L)	INITIAL	8.6	8.7	8.4	8.6	9.0	8.9	8.8	
	FINAL	8.2	8.2	8.4	8.4	8.4	8.4	8.1	
pH (s.u)	INITIAL	8.0	8.0	8.0	7.8	7.9	7.8	7.8	
	FINAL	7.2	8.0	8.1	8.0	8.1	7.3	7.9	
temp (C)	INITIAL	23	22	21.6	21.1	21	22	21	
	FINAL	25	25	25	25	25	25	25	
CONC:									
D.O. (mg/L)	INITIAL	8.7	8.6	8.6	8.6	9.2	8.8	8.7	
	FINAL	8.2	8.1	8.4	8.3	8.4	8.4	8.0	
pH (mg/L)	INITIAL	8.1	8.1	8.0	7.8	7.9	7.6	7.9	
	FINAL	7.5	8.0	8.0	7.9	8.0	8.0	7.9	
temp (C)	INITIAL	23	22	21.3	20.9	21	22	21	
	FINAL	25	25	25	25	25	25	25	
CONC:									
D.O. (mg/L)	INITIAL	8.9	8.6	8.7	8.6	9.1	8.8	8.9	
	FINAL	8.4	8.1	8.6	8.3	8.4	8.4	8.2	
pH (s.u.)	INITIAL	8.1	7.9	8.1	7.84	7.9	7.8	8.0	
	FINAL	7.8	8.0	7.9	7.9	8.0	8.0	7.6	
temp (C)	INITIAL	22	22	21.3	20.9	21	21	21	
	FINAL	25	25	25	25	25	25	25	
CONC:									
D.O. (mg/L)	INITIAL	8.6	8.7	8.5	8.6	9.3	8.6	8.7	
	FINAL	8.3	8.1	8.4	8.4	8.5	8.4	8.1	
pH (s.u.)	INITIAL	8.0	7.8	8.0	7.9	8.0	7.9	7.9	
	FINAL	7.8	8.1	7.9	8.0	8.0	7.9	7.8	
temp (C)	INITIAL	23	22	21.4	20.9	21	22	21	
	FINAL	25	25	25	25	25	25	25	
CONC:									
D.O. (mg/L)	INITIAL	8.6	8.6	8.5	8.7	9.5	8.7	8.8	
	FINAL	8.3	8.1	8.4	8.2	8.4	8.4	8.0	
pH (s.u.)	INITIAL	8.1	8.1	8.1	8.0	7.7	7.8	7.8	
	FINAL	7.9	8.1	8.0	7.9	7.8	8.0	7.7	
temp (C)	INITIAL	23	22	21.4	21.0	21	22	21	
	FINAL	25	25	25	25	25	25	25	
CONC:	**100%**								
ALKALINITY (mg/L)		60							
HARDNESS (mg/L)		78							
CONDUCTIVITY (umhos/cm)		1.74							
CHLORINE (mg/L)		<0.05							

MHS

6.25

12.5

25

50

100

Revision 1
11/30/10

Appendix

Synthetic Salt Preparation

Lab Results of Synthetic Mixtures

Organism History

Control Charts for Reference Toxicants

Chain of Custody

Lion Oil		synthetic									
		LC4	1208360-03								
											atomic
		target									weight
Chloride		191								Chloride	35
Sulfate		1010								Sulfate	96
Sodium		559								Sodium	23
Potassium		9.73								Potassium	39
Calcium		27.4								Calcium	40
Magnesium		4.13								Magnesium	24.3
Carbonate(CO3)										Carbonate(CO3)	60
Nitrate(No3)		8.71								Nitrate(No3)	62
										H2O	18
TDS		1900									
		mg of salt	mg	mg	mg	mg	mg	mg	mg	mg	mg
compound	g/mole	per liter	Na	CL	K	SO4	Ca	Mg	CO3	NO3	TDS
Sodium Chloride(NaCl)	58.0	228	90.4137931	137.5862	0	0	0	0	0	0	228
Sodium Sulfate(Na2SO4)	142.0	1400	453.5211268	0	0	946.479	0	0	0	0	1400
Sodium Carbonate(Na2CO3)	106.0	0	0	0	0	0	0	0	0	0	0
Potassium Chloride(KCl)	75.0	10	0	4.72973	5.270	0	0	0	0	0	10
Potassium Sulfate(K2SO4)	174.0	10	0	0	4.4827586	5.51724	0	0	0	0	10
Potassium Carbonate(K2CO3)	138.0	0	0	0	0	0	0	0	0	0	0
Magnesium Chloride(MgCl2)	94.3	0	0	0	0	0	0	0	0	0	0
Magnesium Sulfate(MgSO4)	120.3	21.5	0	0	0	17.1571	0	4.18204	0	0	21.33915
Calcium Chloride dihyrate (CaCl2)	146.0	101	0	48.42466	0	0	27.67123	0	0	0	76.09589
sodium Bicarbonate NaHCO3	84.0	105	28.75						75		103.75
we have these chemicals		Sum:	572.6849199	190.7406	9.7530289	969.153	27.67123	4.18204	75	0	1849.185
		existing							0	0	
		Target	559	191	9.73	1010	27.4	4.13			1900
ratio to sodium		existing	1		#DIV/0!		#DIV/0!	#DIV/0!			
theoretical			1		0.0170304		0.048318	0.0073			
1208360-03											

	Chloride											
	Sulfate											
	Sodium											
	Potassium											
	Calcium											
	Magnesium											
	Carbonate(CO3)											
	Nitrate(No3)											
	water											
			LC4	1208360-03								
											mls to add	mls LC4 to
		cation	anion	solubility					ppm	target	in 3 Liters	make 3 L
	58	0.396552	0.603448	35.9	Sodium Chloride(NaCl)			5g/L	5000	228	136.8	
	142	0.323944	0.676056	19.5	Sodium Sulfate(Na2SO4)			5g/L	15000	1400	280	
	106	0.433962	0.566038	0.00019	Sodium Carbonate(Na2CO3)			5g/L	5000	0	0	
	74	0.527027	0.472973	34.2	Potassium Chloride(KCl)			5g/L	5000	10	6	
	174	0.448276	0.551724	11.1	Potassium Sulfate(K2SO4)			5g/L	5000	10	6	
	138	0.565217	0.434783	111	Potassium Carbonate(K2CO3)			5g/L	5000	0	0	
	94.3	0.257688	0.742312		Magnesium Chloride(MgCl2)			5g/L	5000	0	0	
	120.3	0.194514	0.798005	33.7	Magnesium Sulfate(MgSO4)			5g/L	5000	21.5	12.9	
	146	0.273973	0.479452	74.5	Calcium Chloride dihyrate (CaCl2)			5g/L	5000	101	60.6	
	84	0.27381	0.714286	100	sodium Bicarbonate NaHCO3			5g/L	5000	105	63	
										totals	565.3	2434.7
						Ca. 10000ppm in HNO_3 metals std.					D.I. to mL	

Arkansas Analytical Inc.

11701 I-30 Bldg 1, Ste 115 - Little Rock, AR 72209
501-455-3233 Fax 501-455-6118

17 September 2012

Norma James
Arkansas Analytical, Inc.
11701 I-30, Bldg 1, Suite 115
Little Rock, AR 72209

RE: Lion Oil

SDG Number: 1208360

Enclosed are the results of analyses for samples received by the laboratory on 31-Aug-12 15:00. If you have any questions concerning this report, please feel free to contact me.

Sample Receipt Information:

Custody Seals	
Containers Correct	
COC/Labels Agree	
Preservation Confirmed	
Received On Ice	
Temperature on Receipt	5.0°C

Sincerely,

Norma James
President

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17 September 2012

Norma James
Arkansas Analytical, Inc.
11701 I-30, Bldg 1, Suite 115
Little Rock, AR 72209
Project: Lion Oil

Date Received: 31-Aug-12 15:00

CASE NARRATIVE

Sample Delivery Group - 1208360

Qualified analytical and/or quality control results are discussed below:

Anions Analysis:

Holding Time Excursion (E2): The Nitrate results for sample 1208360-01 thru 1208360-03 were qualified as "estimated" (E2) as they were analyzed outside of holding time.

Total Metals Analysis:

Matrix Spike/Matrix Spike Duplicate (MS/MSD) Failure: Magnesium, Potassium, and Sodium failed to recover within laboratory acceptance criteria in the MS/MSD sample due to the high concentration of these analytes in the parent sample. The recoveries were qualified by "MBA", which means "Masked by Analyte", in the quality control section of the final report. These analytes were qualified as "estimated" (E20) in the parent sample, 1208360-01 (Synthetic #1-Mod 2).

This report must be reproduced in its entirety.

17 September 2012

Norma James
Arkansas Analytical, Inc.
11701 I-30, Bldg 1, Suite 115
Little Rock, AR 72209
Project: Lion Oil

Date Received: 31-Aug-12 15:00

ANALYTICAL RESULTS

Lab Number: 1208360-01
Sample Name: DRAFT: Synthetic #1 Modified 2
Date/Time Collected: 8/31/12 0:00
Sample Matrix: Water

DRAFT: Anions	Units	Result	Qualifier(s)	Date/Time Analyzed	Batch	Method
Chloride	mg/L	**214**		9/4/12 11:43	A209016	300.0/9056A
Nitrate (Calc.)	mg/L	**7.15**		9/5/12 9:14	A209030	300.0/9056A
Sulfate as SO4	mg/L	**737**		9/4/12 11:43	A209016	300.0/9056A
Nitrate as N	mg/L	**1.62**	E2	9/4/12 10:35	A209016	300.0/9056A
DRAFT: Dissolved Metals	**Units**	**Result**	**Qualifier(s)**	**Date/Time Analyzed**	**Batch**	**Method**
Calcium	mg/L	**23.4**		9/4/12 12:02	A209006	200.7
Magnesium	mg/L	**3.63**	E20	9/4/12 12:02	A209006	200.7
Potassium	mg/L	**10.9**	E20	9/4/12 12:02	A209006	200.7
Sodium	mg/L	**462**	E20	9/4/12 12:02	A209006	200.7
DRAFT: Wet Chemistry	**Units**	**Result**	**Qualifier(s)**	**Date/Time Analyzed**	**Batch**	**Method**
TDS	mg/L	**1500**		8/31/12 14:25	A208391	2540C

ANALYTICAL RESULTS

Lab Number: 1208360-02
Sample Name: DRAFT: Synthetic #2 Modified 2
Date/Time Collected: 8/31/12 0:00
Sample Matrix: Water

DRAFT: Anions	Units	Result	Qualifier(s)	Date/Time Analyzed	Batch	Method
Chloride	mg/L	**158**		9/4/12 12:05	A209016	300.0/9056A
Nitrate (Calc.)	mg/L	**7.00**		9/5/12 9:14	A209030	300.0/9056A
Sulfate as SO4	mg/L	**767**		9/4/12 12:05	A209016	300.0/9056A
Nitrate as N	mg/L	**1.58**	E2	9/4/12 10:58	A209016	300.0/9056A
DRAFT: Dissolved Metals	**Units**	**Result**	**Qualifier(s)**	**Date/Time Analyzed**	**Batch**	**Method**
Calcium	mg/L	**22.4**		9/4/12 12:13	A209006	200.7
Magnesium	mg/L	**5.63**		9/4/12 12:13	A209006	200.7
Potassium	mg/L	**12.5**		9/4/12 12:13	A209006	200.7
Sodium	mg/L	**531**		9/4/12 12:13	A209006	200.7
DRAFT: Wet Chemistry	**Units**	**Result**	**Qualifier(s)**	**Date/Time Analyzed**	**Batch**	**Method**
TDS	mg/L	**1700**		8/31/12 14:25	A208391	2540C

This report must be reproduced in its entirety.

17 September 2012

Norma James
Arkansas Analytical, Inc.
11701 I-30, Bldg 1, Suite 115
Little Rock, AR 72209
Project: Lion Oil

Date Received: 31-Aug-12 15:00

ANALYTICAL RESULTS

Lab Number:	**1208360-05**
Sample Name:	**DRAFT: Synthetic #4 9/12/12 Tweaked**
Date/Time Collected:	**9/12/12 11:30**
Sample Matrix:	**Water**

DRAFT: Anions	Units	Result	Qualifier(s)	Date/Time Analyzed	Batch	Method
Chloride	mg/L	**235**		9/13/12 12:13	A209175	300.0/9056A
Sulfate as SO4	mg/L	**467**		9/13/12 12:58	A209175	300.0/9056A
Nitrate as N	mg/L	**1.56**		9/13/12 11:51	A209175	300.0/9056A
DRAFT: Dissolved Metals	**Units**	**Result**	**Qualifier(s)**	**Date/Time Analyzed**	**Batch**	**Method**
Calcium	mg/L	**105**		9/12/12 19:42	A209164	200.7
Magnesium	mg/L	**3.49**		9/12/12 19:42	A209164	200.7
Potassium	mg/L	**9.04**		9/12/12 19:42	A209164	200.7
Sodium	mg/L	**262**	E20	9/12/12 19:42	A209164	200.7
DRAFT: Wet Chemistry	**Units**	**Result**	**Qualifier(s)**	**Date/Time Analyzed**	**Batch**	**Method**
TDS	mg/L	**1200**		9/12/12 16:54	A209166	2540C

This report must be reproduced in its entirety.

17 September 2012

Norma James
Arkansas Analytical, Inc.
11701 I-30, Bldg 1, Suite 115
Little Rock, AR 72209
Project: Lion Oil

Date Received: 31-Aug-12 15:00

QUALITY CONTROL RESULTS

DRAFT: Wet Chemistry -- Batch: A208391 (Water)
Prepared: 30-Aug-12 15:30 By: AP -- Analyzed: 30-Aug-12 15:30 By: AP

Analyte	BLK	LCS / LCSD	MS / MSD	Dup	RPD	Qualifiers
TDS	<1.0 mg/L	98.0% / 101%	NA / NA		3.02%	

DRAFT: Dissolved Metals -- Batch: A209006 (Water)
Prepared: 04-Sep-12 10:10 By: TC -- Analyzed: 04-Sep-12 13:52 By: TC

Analyte	BLK	LCS / LCSD	MS / MSD	Dup	RPD	Qualifiers
Calcium	<0.100 mg/L	113% / NA	92.8% / 125%		2.54%	
Magnesium	<0.100 mg/L	90.5% / NA	MBA / MBA		1.03%	MBA
Potassium	<0.100 mg/L	88.9% / NA	107% / MBA		2.79%	MBA
Sodium	<1.00 mg/L	98.0% / NA	MBA / MBA		10.1%	MBA

DRAFT: Anions -- Batch: A209016 (Water)
Prepared: 04-Sep-12 10:00 By: MG -- Analyzed: 04-Sep-12 16:41 By: Melis

Analyte	BLK	LCS / LCSD	MS / MSD	Dup	RPD	Qualifiers
Chloride	<0.500 mg/L	104% / NA	94.4% / 94.0%		0.154%	
Nitrate as N	<0.500 mg/L	104% / NA	104% / 104%		0.337%	
Sulfate as SO4	<0.500 mg/L	94.6% / NA	106% / 105%		0.368%	

DRAFT: Anions -- Batch: A209045 (Water)
Prepared: 05-Sep-12 15:41 By: MG -- Analyzed: 05-Sep-12 18:26 By: Melis

Analyte	BLK	LCS / LCSD	MS / MSD	Dup	RPD	Qualifiers
Chloride	<0.500 mg/L	99.3% / NA	99.1% / 100%		0.367%	
Nitrate as N	<0.500 mg/L	106% / NA	110% / 106%		2.54%	
Sulfate as SO4	<0.500 mg/L	104% / NA	97.1% / 94.0%		1.02%	

DRAFT: Dissolved Metals -- Batch: A209072 (Water)
Prepared: 06-Sep-12 13:20 By: TC -- Analyzed: 06-Sep-12 15:41 By: TC

Analyte	BLK	LCS / LCSD	MS / MSD	Dup	RPD	Qualifiers
Calcium	<0.100 mg/L	91.3% / NA	101% / 77.9%		1.68%	
Magnesium	<0.100 mg/L	100% / NA	95.7% / 88.1%		2.51%	
Potassium	<0.100 mg/L	90.2% / NA	113% / 99.1%		1.95%	
Sodium	<1.00 mg/L	95.2% / NA	93.9% / 102%		0.0291%	

DRAFT: Wet Chemistry -- Batch: A209085 (Water)
Prepared: 06-Sep-12 18:15 By: AP -- Analyzed: 06-Sep-12 18:15 By: AP

Analyte	BLK	LCS / LCSD	MS / MSD	Dup	RPD	Qualifiers
TDS	<1.0 mg/L	102% / 97.0%	NA / NA		4.53%	

This report must be reproduced in its entirety.

17 September 2012

Norma James
Arkansas Analytical, Inc.
11701 I-30, Bldg 1, Suite 115
Little Rock, AR 72209
Project: Lion Oil

Date Received: 31-Aug-12 15:00

QUALITY CONTROL RESULTS

DRAFT: Dissolved Metals -- Batch: A209164 (Water)
Prepared: 12-Sep-12 16:45 By: TC -- Analyzed: 12-Sep-12 19:50 By: TC

Analyte	BLK	LCS / LCSD	MS / MSD	Dup	RPD	Qualifiers
Calcium	<0.100 mg/L	102% / NA	92.8% / 120%		2.34%	
Magnesium	<0.100 mg/L	96.2% / NA	90.1% / 90.2%		0.0344%	
Potassium	<0.100 mg/L	93.3% / NA	104% / 105%		0.938%	
Sodium	<1.00 mg/L	91.6% / NA	MBA / MBA		0.622%	MBA

DRAFT: Wet Chemistry -- Batch: A209166 (Water)
Prepared: 12-Sep-12 13:20 By: AP -- Analyzed: 12-Sep-12 13:20 By: AP

Analyte	BLK	LCS / LCSD	MS / MSD	Dup	RPD	Qualifiers
TDS	<1.0 mg/L	101% / 99.0%	NA / NA		2.00%	

DRAFT: Anions -- Batch: A209175 (Water)
Prepared: 13-Sep-12 11:50 By: MG -- Analyzed: 13-Sep-12 15:20 By: MG

Analyte	BLK	LCS / LCSD	MS / MSD	Dup	RPD	Qualifiers
Chloride	<0.500 mg/L	98.0% / NA	98.0% / 99.2%		0.632%	
Nitrate as N	<0.500 mg/L	91.2% / NA	93.0% / 93.7%		0.303%	
Sulfate as SO4	<0.500 mg/L	101% / NA	93.3% / 93.7%		0.188%	

QUALIFIER(S)

*E2: Estimated Result; Analyzed Outside of Holding Time
*E20: Estimated Result Due to Matrix Spike and/or Matrix Spike Duplicate Failure; This sample was used as the "parent sample" in MS/MSD prep.
*MBA: Masked By Analyte

All Analysis performed according to EPA approved methodology when available:
SW 846, Revised December, 1996; EPA 600/4-79-020, Revised March, 1983; Standard Methods, 20th Edition.
Instrument calibration and quality control samples performed at or above frequency specified in analytical method.

Reviewed by: _____
Norma James
President

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Arkansas Analytical Inc.

11701 Interstate 30, Bldg. 1, Ste. 115
Little Rock, AR 72209
PHONE: 501-455-3233
FAX: 501-455-6118

CHAIN OF CUSTODY RECORD

CLIENT INFORMATION	Project Description	Turnaround Time	Preservation Codes:
ArK Analytical		24 Hour	1. Cool, 4 Degrees Centigrade; 4. Thiosulfate for Dechlorination
		48 Hour	2. Sulfuric Acid (H_2SO_4), pH < 2; 5. Hydrochloric Acid(HCl)
	Reporting Information	72 Hour	3. Nitric Acid (HNO_3), pH < 2; 6. Sodium Hydroxide (NaOH), pH > 12
	Telephone:	Routine (5 Day)	
	Fax:	Preservative Code:	
	Email:	Bottle Type:	

Lessie Redican — Sampler(s) Signature

Lessie Redican — Sampler(s) Printed

Field Number	SAMPLE COLLECTION Date/s	Time/s	Grab	Comp	Number of Bottles	Sample Matrix	SAMPLE IDENTIFICATION/ DESCRIPTION	Cl, NO_3, SO_4	TDS	K Na mg Ca	TEST PARAMETERS	Bottle Type Code: G = Glass; P = Plastic; V = Septum; A = Amber	Arkansas Analytical Work Order Number: 1208360
1	8-31-12					W	Syn 1 modified 2	✓	✓	✓			-01
2	8-31-12					W	Syn 2 modified 2	✓	✓	✓			-02
3	8-31-12					W	LC4 modified 2	✓	✓	✓			-03
	9-6-12						Lion Oil Synthetic 4	✓	✓	✓			-04

1. Relinquished by: (Signature)	Date/Time	2. Received by: (Signature)	SAMPLE CONDITION UPON RECEIPT IN LAB	REMARKS / SAMPLE COMMENTS
Lessie Redican	8-31-12 15:00		1. CUSTODY SEALS: NA ___Yes ___No	P.O. Number -
			2. CONTAINERS CORRECT: ___Yes ___No	Prepared by Lab 8-31-12
			3. COC/LABELS AGREE: ___Yes ___No	
3. Relinquished by: (Signature)	Date/Time	4. Received by lab: (Signature)	4. PRESERVATION CONFIRMED: ___Yes ___No	LP
		Lessie Redican	5. RECEIVED ON ICE: ___Yes ___No	
			6. TEMPERATURE ON RECEIPT:	
			FOR COMPLETION BY LAB ONLY	

Revision 1
12/1/10

1300 Blue Spruce Drive, Suite C
Fort Collins, Colorado 80524

Toll Free: 800/331-5916
Tel:970/484-5091 Fax:970/484-2514

ORGANISM HISTORY

DATE: 6/22/09

SPECIES: *Ceriodaphnia dubia*

AGE: Variable

LIFE STAGE: Adult

HATCH DATE: Variable

BEGAN FEEDING: Immediately

FOOD: YTC, *Selenastrum* sp.

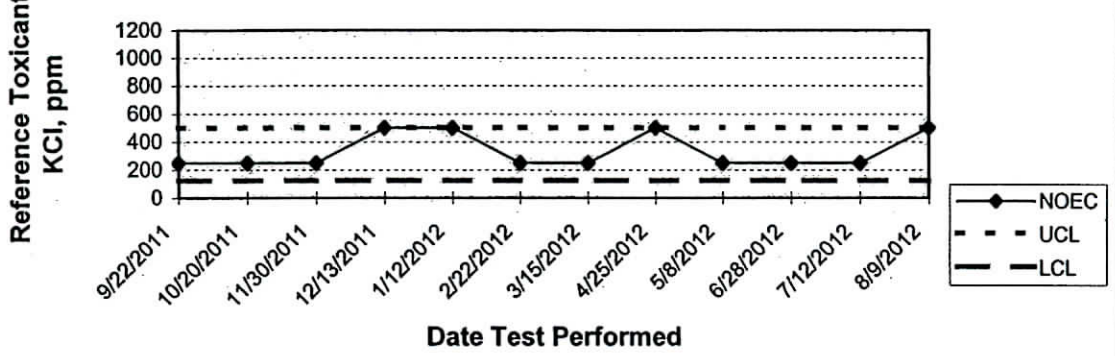
Water Chemistry Record:	Current	Range
TEMPERATURE:	25°C	20-25°C
SALINITY/CONDUCTIVITY:	–	–
TOTAL HARDNESS (as $CaCO_3$):	142 mg/l	86-124 mg/l
TOTAL ALKALINITY (as $CaCO_3$):	100 mg/l	65-130 mg/l
pH:	7.92	7.56-8.35

Comments:

Facility Supervisor

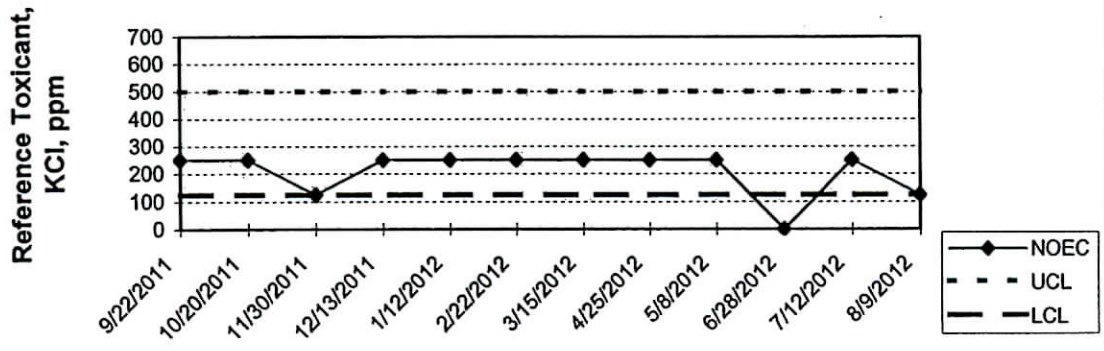
ARKANSAS ANALYTICAL, INC.

CERIODAPHNIA DUBIA SURVIVAL
QUALITY ASSURANCE



ARKANSAS ANALYTICAL, INC.

CERIODAPHNIA DUBIA REPRODUCTION
QUALITY ASSURANCE



October 3, 2012

Chronic WET Testing

Synthetic Matrices

Prepared for:

Mr. Roland McDaniel

Principal/ Senior Scientist

GBMc and Associates

RE: Lion Oil

Synthetic Matrix # 4: Lab number 1208360-04

Ceriodaphnia dubia

Prepared by:

Arkansas Analytical, Inc.

11701 I-30, Bldg 1, Suite 115

Little Rock, AR 72209

Arkansas Analytical Inc.

Table of Contents

Overview

The purpose of this report is to provide results of chronic biomonitoring (WET) tests for Lion Oil Corporation as requested by GBMc and Associates. The tests were performed utilizing synthetic mixtures of salts in a dilution series with moderately hard water. The species tested were *ceriodaphnia dubia* . Tests were conducted utilizing standard testing protocol as defined in Test 1002.0(*Ceriodaphnia dubia*, Survival and Reproduction Test). A standard dilution series of 0%, 6.25%, 12.5%, 25%, 50%, and 100% were analyzed.

Tabulated below find a summary of the Test Matrices, the target and actual concentrations of the analytes of interest, and the test results.

Synthetic Matrix # 4: Lab number 1208360-04		
Parameter	Target Concentration(mg/L)	Analyzed Concentration(mg/L)
Chlorides	241	264
Sulfates	645	727
TDS	1354	1600
Nitrate	--	6.94
Potassium	9.73	12.4
Sodium	--	521
Magnesium	4.13	4.23
Calcium	27.4	25.2
Species	NOEC/LOEC Survival	NOEC/LOEC Reproduction/Growth
Ceriodaphnia dubia	100%/ NA	100%/ NA

Synthetic Mixture Preparation

A variety of salts were selected to prepare solutions containing the desired analytes at target concentrations. The target analytes were chloride, sulfate, and TDS. All salts were dried to remove the moisture content prior to weighing, except in the case of hydrated salts. Concentrates were prepared which were diluted to working volume each day of the test. The same concentrate was utilized for the entire test. Salts of sodium, calcium, potassium, and magnesium were used.

On the following pages are detailed bench sheets from each sample tested. Included are the data sheets followed by the statistical analysis. Also included are the water chemistry analyses from each day of testing. The detail of the salts used to prepare the synthetic mixtures and the lab analysis of the solutions is provided in the appendix.

Dilution Water

The dilution water used in the toxicity tests was moderately hard synthetic. It was prepared using Elga Maxima ultra pure water according to EPA specifications. Each batch was analyzed for pH, hardness, total alkalinity, and conductivity
Dilution Series

Five dilutions in addition to a control (0% effluent) were used in the toxicity tests. The dilutions, which were made with synthetic water, were 6.25%, 12.5%, 25%, 50%, and 100%.

Test Methods

EPA Method 1002.0, Cladoceran, *Ceriodaphnia dubia,* Survival and Reproduction Test, was also used. Neonates are exposed in a static renewal system until at least 60% of the control organisms have produced a third brood. Results are based on the survival and reproduction of the organisms. One neonate was placed in each often replicate chambers using a randomizing template. Test chambers were 30 ml plastic cups filled with 15 ml of test solution. The test temperature was 25 degrees Centigrade

Test Organisms
The organisms used in Test 1002.0 were < 24 hour old *Ceriodaphnia dubia* neonates, (all born within the same eight hours), obtained from an in-house culture. An organism history is provided in the Appendix.

Quality Assurance

Test Acceptability

Synthetic Matrix # 4: Lab number 1208360-04

TEST ACCEPTANCE CRITERIA for *Ceriodaphnia dubia*

Control Criteria	Results	Pass	Fail
Greater than or equal to 80% survival	100%	X	
Average of 15 or more young per surviving female	20.6	X	
At least 60% of surviving females should have produced 3 broods	100%	X	
The percent coefficient of variation between replicates must be 40% or less for the young of surviving females	16.5	X	

Reference Toxicant

The reference toxicant used was Potassium Chloride prepared in-house. The tests were performed using moderately hard synthetic as dilution water. The results of the reference toxicant were

Ceriodaphnia dubia(8-12-12)		Range of acceptability	
	Mg/L	Mg/L	
NOEC Survival	500	125-500	Pass
LOEC Survival	1000	250-1000	Pass
NOEC Reproduction	125	125-500	Pass
LOEC Reproduction	250	250-1000	Pass

Synthetic Matrix # 4: Lab number 1208360-04

Ceriodaphnia dubia

Bench Sheets

Statistical Analysis

Chemistry Bench Sheets

Syn #4

12083600-04

RH

Cerodaphnia dubia — **SURVIVAL AND REPRODUCTION TEST**

Discharger:
Location:
Date Sample Collected:
Lab Number/s

Analyst:
Test Start - Date/ Time: 9-6-12 1430
Test Stop - Date/Time:

Conc 1 (%: 0)

Day	A	B	C	D	E	F	G	H	I	J	No. of Young	No. of Adult	Young/ Adult	Analyst
1	0	0	0	0	0	0	0	0	0	0	0	10	0	
2	0	0	0	0	0	0	0	0	0	0	0	10	0	
3	1	0	3	2	2	0	1	0	3	3	15	10	1.5	
4	5	6	2	7	3	3	3	3	1	1	39	10	3.9	
5	3	3	6	6	4	3	2	4	7	5	37	10	3.7	
6	2	6	2	11	4	2	4	2	0	6	39	10	3.9	
7	6	4	4	0	2	1	4	3	5	6	35	10	3.5	
8														
Total	17	19	17	20	15	14	14	12	16	21	165			

X = 16.5
CV = 17.4

Conc 2 (%: 6.25)

Day	A	B	C	D	E	F	G	H	I	J	No. of Young	No. of Adult	Young/ Adult	Analyst
1	0	0	0	0	0	0	0	0	0	0	0	10	0	
2	0	0	0	0	0	0	0	0	0	0	0	10	0	
3	0	2	2	1	0	2	0	1	2	3	13	10	1.3	
4	7	4	1	3	3	4	3	2	0	1	28	10	2.8	
5	3	2	9	6	4	5	1	4	5	4	43	10	4.3	
6	4	6	4	7	4	3	8	5	3	0	44	10	4.4	
7	10	7	0	2	3	5	3	2	4	8	44	10	4.4	
8														
Total	24	21	16	19	14	19	15	14	14	16	172			

Conc 3 (%: 12.5)

Day	A	B	C	D	E	F	G	H	I	J	No. of Young	No. of Adult	Young/ Adult	Analyst
1	0	0	0	0	0	0	0	0	0	0	0	10	0	
2	0	0	0	0	0	0	0	0	0	0	0	10	0	
3	5	4	4	3	0	6	0	0	1	2	25	10	2.5	
4	1	2	0	2	6	2	4	3	2	0	22	10	2.2	
5	4	5	7	4	2	0	2	3	3	7	37	10	3.7	
6	10	1	0	3	2	4	3	5	4	11	39	10	3.9	
7	3	6	7	4	3	7	1	2	3	1	37	10	3.7	
8														
Total	19	18	18	16	13	19	10	13	13	21	160			

X= DEAD; Y= MALE

Conc 4 (%: 25)

Day	A	B	C	D	E	F	G	H	I	J	No. of Young	No. of Adult	Young/ Adult	Analyst
1	0	0	0	0	0	0	0	0	0	0	0	10	0	
2	0	0	0	0	0	0	0	0	0	0	0	10	0	
3	1	1	0	2	6	3	1	0	2	2	18	10	1.8	
4	5	2	3	1	0	3	1	7	1	2	26	10	2.6	
5	6	5	4	8	5	0	4	3	3	1	39	10	3.9	
6	4	1	6	2	10	8	3	8	4	5	51	10	5.1	
7	3	4	2	5	2	0	3	2	6	6	33	10	3.3	
8														
Total	19	13	15	18	23	14	12	20	16	17	167			

Conc 5 (%: 50)

Day	A	B	C	D	E	F	G	H	I	J	No. of Young	No. of Adult	Young/ Adult	Analyst
1	0	0	0	0	0	0	0	0	0	0	0	10	0	
2	0	0	0	0	0	0	0	0	0	0	0	10	0	
3	0	2	0	2	3	5	2	0	1	0	15	10	1.5	
4	5	6	5	2	4	1	5	1	2	3	34	10	3.4	
5	3	2	0	1	8	6	0	4	3	4	31	10	3.1	
6	4	2	5	6	5	1	7	6	2	4	42	10	4.2	
7	3	5	6	3	0	5	0	6	7	3	38	10	3.8	
8														
Total	15	17	16	14	20	18	14	17	15	14	158			

Conc 6 (%: 100)

Day	A	B	C	D	E	F	G	H	I	J	No. of Young	No. of Adult	Young/ Adult	Analyst
1	0	0	0	0	0	0	0	0	0	0	0	10	0	
2	0	0	0	0	0	0	0	0	0	0	0	10	0	
3	0	1	0	3	5	1	0	0	1	0	11	10	1.1	
4	7	4	6	1	0	2	5	4	3	5	37	10	3.7	
5	2	2	1	3	3	6	4	3	2	2	28	10	2.8	
6	2	3	3	7	2	2	0	4	4	4	36	10	3.6	
7	7	8	2	2	3	8	7	3	5	9	54	10	5.4	
8														
Total	18	18	17	16	13	19	16	14	15	20	166			

X = 16.6
CV = 13.4

Revision 1
11/30/10

1208360-04

AA # Synthetic #4, C. DUBIA CHRONIC, REPRODUCION, 9-6-1
File: Z:\TOXSTAT\MONTE\CD. Transform: NO TRANSFORMATION

Shapiro - Wilk's test for normality

******** Shapiro - Wilk's Test is aborted ********

This test can not be performed because total number of replicates
is greater than 50.

Total number of replicates = 60

AA # Synthetic #4, C. DUBIA CHRONIC, REPRODUCION, 9-6-1
File: Z:\TOXSTAT\MONTE\CD. Transform: NO TRANSFORMATION

Bartlett's test for homogeneity of variance
Calculated B1 statistic = 4.71

Table Chi-square value = 15.09 (alpha = 0.01, df = 5)
Table Chi-square value = 11.07 (alpha = 0.05, df = 5)

Data PASS B1 homogeneity test at 0.01 level. Continue analysis.

1208360-04

FISHER'S EXACT TEST

IDENTIFICATION	NUMBER OF ALIVE	NUMBER OF DEAD	NUMBER OF TOTAL ANIMALS
CONTROL	10	0	10
6.25	10	0	10
TOTAL	20	0	20

CRITICAL FISHER'S VALUE (10,10,10) (p=0.05) IS 6. b VALUE IS 10.
Since b is greater than 6 there is no significant difference between CONTROL and TREATMENT at the 0.05 level.

FISHER'S EXACT TEST

IDENTIFICATION	NUMBER OF ALIVE	NUMBER OF DEAD	NUMBER OF TOTAL ANIMALS
CONTROL	10	0	10
12.5	10	0	10
TOTAL	20	0	20

CRITICAL FISHER'S VALUE (10,10,10) (p=0.05) IS 6. b VALUE IS 10.
Since b is greater than 6 there is no significant difference between CONTROL and TREATMENT at the 0.05 level.

FISHER'S EXACT TEST

IDENTIFICATION	NUMBER OF ALIVE	NUMBER OF DEAD	NUMBER OF TOTAL ANIMALS
CONTROL	10	0	10
25	10	0	10

1208360-04

TOTAL	20	0	20

CRITICAL FISHER'S VALUE (10,10,10) (p=0.05) IS 6. b VALUE IS 10.
Since b is greater than 6 there is no significant difference between CONTROL and TREATMENT at the 0.05 level.

FISHER'S EXACT TEST

IDENTIFICATION	NUMBER OF ALIVE	NUMBER OF DEAD	TOTAL ANIMALS
CONTROL	10	0	10
50	10	0	10
TOTAL	20	0	20

CRITICAL FISHER'S VALUE (10,10,10) (p=0.05) IS 6. b VALUE IS 10.
Since b is greater than 6 there is no significant difference between CONTROL and TREATMENT at the 0.05 level.

FISHER'S EXACT TEST

IDENTIFICATION	NUMBER OF ALIVE	NUMBER OF DEAD	TOTAL ANIMALS
CONTROL	10	0	10
100	10	0	10
TOTAL	20	0	20

CRITICAL FISHER'S VALUE (10,10,10) (p=0.05) IS 6. b VALUE IS 10.
Since b is greater than 6 there is no significant difference between CONTROL and TREATMENT at the 0.05 level.

SUMMARY OF FISHER'S EXACT TESTS

	NUMBER	NUMBER	SIG

1208360-04

GROUP	IDENTIFICATION	EXPOSED	DEAD	(P=.05)
	CONTROL	10	0	
1	6.25	10	0	
2	12.5	10	0	
3	25	10	0	
4	50	10	0	
5	100	10	0	

TITLE: AA # Synthetic #4, C. DUBIA CHRONIC, REPRODUCION, 9-6-1
FILE: Z:\TOXSTAT\MONTE\CD.
TRANSFORM: NO TRANSFORMATION NUMBER OF GROUPS: 6

GRP	IDENTIFICATION	REP	VALUE	TRANS VALUE
1	CONTROL	1	17.0000	17.0000
1	CONTROL	2	19.0000	19.0000
1	CONTROL	3	17.0000	17.0000
1	CONTROL	4	20.0000	20.0000
1	CONTROL	5	15.0000	15.0000
1	CONTROL	6	14.0000	14.0000
1	CONTROL	7	14.0000	14.0000
1	CONTROL	8	12.0000	12.0000
1	CONTROL	9	16.0000	16.0000
1	CONTROL	10	21.0000	21.0000
2	6.25 % EFFLUENT	1	24.0000	24.0000
2	6.25 % EFFLUENT	2	21.0000	21.0000
2	6.25 % EFFLUENT	3	16.0000	16.0000
2	6.25 % EFFLUENT	4	19.0000	19.0000
2	6.25 % EFFLUENT	5	14.0000	14.0000
2	6.25 % EFFLUENT	6	19.0000	19.0000
2	6.25 % EFFLUENT	7	15.0000	15.0000
2	6.25 % EFFLUENT	8	14.0000	14.0000
2	6.25 % EFFLUENT	9	14.0000	14.0000
2	6.25 % EFFLUENT	10	16.0000	16.0000
3	12.5 % EFFLUENT	1	19.0000	19.0000
3	12.5 % EFFLUENT	2	18.0000	18.0000
3	12.5 % EFFLUENT	3	18.0000	18.0000
3	12.5 % EFFLUENT	4	16.0000	16.0000
3	12.5 % EFFLUENT	5	13.0000	13.0000
3	12.5 % EFFLUENT	6	19.0000	19.0000
3	12.5 % EFFLUENT	7	10.0000	10.0000
3	12.5 % EFFLUENT	8	13.0000	13.0000
3	12.5 % EFFLUENT	9	13.0000	13.0000
3	12.5 % EFFLUENT	10	21.0000	21.0000
4	25 % EFFLUENT	1	19.0000	19.0000
4	25 % EFFLUENT	2	13.0000	13.0000
4	25 % EFFLUENT	3	15.0000	15.0000
4	25 % EFFLUENT	4	18.0000	18.0000
4	25 % EFFLUENT	5	23.0000	23.0000
4	25 % EFFLUENT	6	14.0000	14.0000
4	25 % EFFLUENT	7	12.0000	12.0000
4	25 % EFFLUENT	8	20.0000	20.0000

1208360-04

4	25 % EFFLUENT	9	16.0000	16.0000
4	25 % EFFLUENT	10	17.0000	17.0000
5	50 % EFFLUENT	1	15.0000	15.0000
5	50 % EFFLUENT	2	17.0000	17.0000
5	50 % EFFLUENT	3	16.0000	16.0000
5	50 % EFFLUENT	4	14.0000	14.0000
5	50 % EFFLUENT	5	20.0000	20.0000
5	50 % EFFLUENT	6	18.0000	18.0000
5	50 % EFFLUENT	7	14.0000	14.0000
5	50 % EFFLUENT	8	17.0000	17.0000
5	50 % EFFLUENT	9	15.0000	15.0000
5	50 % EFFLUENT	10	14.0000	14.0000
6	100 % EFFLUENT	1	18.0000	18.0000
6	100 % EFFLUENT	2	18.0000	18.0000
6	100 % EFFLUENT	3	17.0000	17.0000
6	100 % EFFLUENT	4	16.0000	16.0000
6	100 % EFFLUENT	5	13.0000	13.0000
6	100 % EFFLUENT	6	19.0000	19.0000
6	100 % EFFLUENT	7	16.0000	16.0000
6	100 % EFFLUENT	8	14.0000	14.0000
6	100 % EFFLUENT	9	15.0000	15.0000
6	100 % EFFLUENT	10	20.0000	20.0000

AA # Synthetic #4, C. DUBIA CHRONIC, REPRODUCION, 9-6-1
File: Z:\TOXSTAT\MONTE\CD. Transform: NO TRANSFORMATION

ANOVA TABLE

SOURCE	DF	SS	MS	F
Between	5	10.400	2.080	0.235
Within (Error)	54	478.600	8.863	
Total	59	489.000		

Critical F value = 2.45 (0.05,5,40)
Since F < Critical F FAIL TO REJECT Ho: All equal

AA # Synthetic #4, C. DUBIA CHRONIC, REPRODUCION, 9-6-1
File: Z:\TOXSTAT\MONTE\CD. Transform: NO TRANSFORMATION

DUNNETT'S TEST - TABLE 1 OF 2 Ho:Control<Treatment

GROUP	IDENTIFICATION	TRANSFORMED MEAN	MEAN CALCULATED IN ORIGINAL UNITS	T STAT	SIG
1	CONTROL	16.500	16.500		
2	6.25 % EFFLUENT	17.200	17.200	-0.526	
3	12.5 % EFFLUENT	16.000	16.000	0.376	
4	25 % EFFLUENT	16.700	16.700	-0.150	
5	50 % EFFLUENT	16.000	16.000	0.376	
6	100 % EFFLUENT	16.600	16.600	-0.075	

1208360-04

Dunnett table value = 2.31 (1 Tailed Value, P=0.05, df=40,5)

AA # Synthetic #4, C. DUBIA CHRONIC, REPRODUCION, 9-6-1
File: Z:\TOXSTAT\MONTE\CD. Transform: NO TRANSFORMATION

DUNNETT'S TEST - TABLE 2 OF 2 Ho:Control<Treatment

GROUP	IDENTIFICATION	NUM OF REPS	Minimum Sig Diff (IN ORIG. UNITS)	% of CONTROL	DIFFERENCE FROM CONTROL
1	CONTROL	10			
2	6.25 % EFFLUENT	10	3.076	18.6	-0.700
3	12.5 % EFFLUENT	10	3.076	18.6	0.500
4	25 % EFFLUENT	10	3.076	18.6	-0.200
5	50 % EFFLUENT	10	3.076	18.6	0.500
6	100 % EFFLUENT	10	3.076	18.6	-0.100

AA # Synthetic #4, C. DUBIA CHRONIC, REPRODUCION, 9-6-1
File: Z:\TOXSTAT\MONTE\CD. Transform: NO TRANSFORMATION

STEEL'S MANY-ONE RANK TEST - Ho:Control<Treatment

GROUP	IDENTIFICATION	TRANSFORMED MEAN	RANK SUM	CRIT. VALUE	df	SIG
1	CONTROL	16.500				
2	6.25 % EFFLUENT	17.200	108.00	75.00	10.00	
3	12.5 % EFFLUENT	16.000	101.00	75.00	10.00	
4	25 % EFFLUENT	16.700	105.50	75.00	10.00	
5	50 % EFFLUENT	16.000	100.00	75.00	10.00	
6	100 % EFFLUENT	16.600	106.50	75.00	10.00	

Critical values use k = 5, are 1 tailed, and alpha = 0.05

1208360-04

CHEMICAL DATA SHEET FOR CHRONIC TOXICITY TESTING									Cerodaphnia Dubia
Lab # / Sample ID		Sym #4			Test Start (Date/Time)		9-6-12		1430
Client:					Test End (Date/Time)		9-14-12		0930
		Day of Test							
		1	2	3	4	5	6	7	notes/remarks
Control	MHS551			9-4	9-9				
D.O. (mg/L)	INITIAL	8.4	8.7	8.9	8.7	9.5	8.9	8.7	
	FINAL	7.9	8.3	8.4	8.3	8.4	8.3	8.4	
pH (s.u.)	INITIAL	7.9	7.8	8.3	8.0	8.0	7.9	7.9	
	FINAL	7.6	8.1	8.0	7.7	7.8	7.9	7.9	
temp (C)	INITIAL	23	22	22	20.7	21	21	22	
	FINAL	25	25	25	25	25	25	25	
ALKALINITY (mg/L)									
HARDNESS (mg/L)									
CONDUCTIVITY (umhos/cm)									
CHLORINE (mg/L)									
CONC:									
D.O. (mg/L)	INITIAL	8.6	8.7	8.3	8.6	8.7	8.8	8.6	
	FINAL	8.0	7.9	8.4	8.3	8.5	8.3	8.3	
pH (s.u)	INITIAL	7.9	7.8	7.8	7.7	7.1	7.8	7.9	
	FINAL	7.3	7.5	8.0	7.9	7.6	7.9	7.7	
temp (C)	INITIAL	22	21	21.5	21.9	21	22	21	
	FINAL	25	25	25	25	25	25	25	
CONC:									
D.O. (mg/L)	INITIAL	8.7	8.6	8.5	9.4	9.2	8.8	8.8	
	FINAL	8.0	8.1	8.4	8.3	8.4	8.3	8.3	
pH (mg/L)	INITIAL	7.9	7.8	8.0	7.8	7.3	7.8	8.1	
	FINAL	7.7	8.1	7.9	7.9	7.9	8.0	7.8	
temp (C)	INITIAL	22	21	21.4	20.7	20	22	21	
	FINAL	25	25	25	25	25	25	25	
CONC:									
D.O. (mg/L)	INITIAL	8.6	8.6	8.6	9.4	8.7	8.8	9.0	
	FINAL	8.0	8.1	8.4	8.3	8.3	8.3	8.3	
pH (s.u.)	INITIAL	7.9	7.8	8.0	7.8	7.2	7.9	8.0	
	FINAL	7.0	8.1	7.8	8.0	7.4	7.8	8.0	
temp (C)	INITIAL	23	21	21.3	20.5	20	22	21	
	FINAL	25	25	25	25	25	25	25	
CONC:									
D.O. (mg/L)	INITIAL	8.4	8.7	8.6	9.3	8.8	8.7	8.6	
	FINAL	8.0	8.1	8.4	8.3	8.4	8.3	8.3	
pH (s.u.)	INITIAL	7.9	7.7	7.8	7.7	7.1	7.8	7.8	
	FINAL	7.7	8.0	7.9	7.8	7.7	7.8	7.9	
temp (C)	INITIAL	23	21	21.3	20.6	21	22	21	
	FINAL	25	25	25	25	25	25	25	
CONC:									
D.O. (mg/L)	INITIAL	8.4	8.5	8.7	9.4	8.7	8.7	8.8	
	FINAL	8.0	8.1	8.5	8.3	8.4	8.4	8.4	
pH (s.u.)	INITIAL	7.8	7.8	5.4	5.2	6.6	7.8	7.7	
	FINAL	7.3	7.6	7.7	7.7	7.4	7.8	7.7	
temp (C)	INITIAL	22	22	21.3	20.7	21	22	21	
	FINAL	25	25	25	25	25	25	25	
CONC:	**100%**								
ALKALINITY (mg/L)		4							
HARDNESS (mg/L)		70							
CONDUCTIVITY (umhos/cm)		2.15							
CHLORINE (mg/L)		<0.05							

MHS

6.25

12.5

25

50

100

Revision 1
11/30/10

Appendix

Synthetic Salt Preparation

Lab Results of Synthetic Mixtures

Organism History

Control Charts for Reference Toxicants

Chain of Custody

			atomic
			weight
Chloride			35
Sulfate			96
Sodium			23
Potassium			39
Calcium			40
Magnesium			24.3
Carbonate(CO3)			60
Nitrate(No3)			62
water			18

synthetic 4 9/6/12 1208360-04

	cation	anion			ppm	target	mls to add in 3 Liters	mls Elga to make 3 L
58	0.396552	0.603448	Sodium Chloride(NaCl)	5g/L	5000	310	186	
142	0.323944	0.676056	Sodium Sulfate(Na2SO4)	15g/L	15000	920	184	
106	0.433962	0.566038						
74	0.527027	0.472973	Potassium Chloride(KCl)	5g/L	5000	10	6	
174	0.448276	0.551724	Potassium Sulfate(K2SO4)	5g/L	5000	10	6	
138	0.565217	0.434783						
94.3	0.257688	0.742312	Magnesium Chloride(MgCl2)					
120.3	0.194514	0.798005	Magnesium Sulfate(MgSO4)	5g/L	5000	21.5	12.9	
146	0.273973	0.479452	Calcium Chloride dihyrate (CaCl2)	5g/L	5000	101	60.6	
						totals mls	455.5	2544.5
			Ca from Metal standard		10000	2.2	0.66	

Lion Oil		synthetic									
		matrix #1	1208360-04								
											atomic
		target									weight
Chloride		227								Chloride	35
Sulfate		775								Sulfate	96
Sodium										Sodium	23
Potassium		9.73								Potassium	39
Calcium		27.4								Calcium	40
Magnesium		4.13								Magnesium	24.3
Carbonate(CO3)										Carbonate(CO3)	60
Nitrate(No3)		8.71								Nitrate(No3)	62
										H2O	18
TDS		1562									
		mg of salt	mg	mg	mg	mg	mg	mg	mg	mg	mg
compound	g/mole	per liter	Na	CL	K	SO4	Ca	Mg	CO3	NO3	TDS
Sodium Chloride(NaCl)	58.0	310	122.9310345	187.069	0	0	0	0	0	0	310
Sodium Sulfate(Na2SO4)	142.0	920	298.028169	0	0	621.972	0	0	0	0	920
Sodium Carbonate(Na2CO3)	106.0	0	0	0	0	0	0	0	0	0	0
Potassium Chloride(KCl)	75.0	10	0	4.72973	5.270	0	0	0	0	0	10
Potassium Sulfate(K2SO4)	174.0	10	0	0	4.4827586	5.51724	0	0	0	0	10
Potassium Carbonate(K2CO3)	138.0	0	0	0	0	0	0	0	0	0	0
Magnesium Chloride(MgCl2)	94.3	0	0	0	0	0	0	0	0	0	0
Magnesium Sulfate(MgSO4)	120.3	21.5	0	0	0	17.1571	0	4.18204	0	0	21.33915
Calcium Chloride dihyrate (CaCl2)	146.0	101	0	48.42466	0	0	27.67123	0	0	0	76.09589
we have these chemicals		Sum:	420.9592035	240.2234	9.7530289	644.646	27.67123	4.18204	0	0	1347.435
		existing							0	0	
		Target		241	9.73	645	27.4	4.13			1354
ratio to sodium		existing	1		#DIV/0!		#DIV/0!	#DIV/0!			
theoretical			1		0.0231686		0.065734	0.00993			

Arkansas Analytical Inc.

11701 I-30 Bldg 1, Ste 115 - Little Rock, AR 72209
501-455-3233 Fax 501-455-6118

17 September 2012

Norma James
Arkansas Analytical, Inc.
11701 I-30, Bldg 1, Suite 115
Little Rock, AR 72209

RE: Lion Oil

SDG Number: 1208360

Enclosed are the results of analyses for samples received by the laboratory on 31-Aug-12 15:00. If you have any questions concerning this report, please feel free to contact me.

Sample Receipt Information:

Custody Seals	
Containers Correct	
COC/Labels Agree	
Preservation Confirmed	
Received On Ice	
Temperature on Receipt	5.0°C

Sincerely,

Norma James
President

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17 September 2012

Norma James
Arkansas Analytical, Inc.
11701 I-30, Bldg 1, Suite 115
Little Rock, AR 72209
Project: Lion Oil

Date Received: 31-Aug-12 15:00

CASE NARRATIVE

Sample Delivery Group - 1208360

Qualified analytical and/or quality control results are discussed below:

Anions Analysis:

Holding Time Excursion (E2): The Nitrate results for sample 1208360-01 thru 1208360-03 were qualified as "estimated" (E2) as they were analyzed outside of holding time.

Total Metals Analysis:

Matrix Spike/Matrix Spike Duplicate (MS/MSD) Failure: Magnesium, Potassium, and Sodium failed to recover within laboratory acceptance criteria in the MS/MSD sample due to the high concentration of these analytes in the parent sample. The recoveries were qualified by "MBA", which means "Masked by Analyte", in the quality control section of the final report. These analytes were qualified as "estimated" (E20) in the parent sample, 1208360-01 (Synthetic #1-Mod 2).

This report must be reproduced in its entirety.

17 September 2012

Norma James
Arkansas Analytical, Inc.
11701 I-30, Bldg 1, Suite 115
Little Rock, AR 72209
Project: Lion Oil

Date Received: 31-Aug-12 15:00

ANALYTICAL RESULTS

Lab Number: 1208360-01
Sample Name: DRAFT: Synthetic #1 Modified 2
Date/Time Collected: 8/31/12 0:00
Sample Matrix: Water

DRAFT: Anions	Units	Result	Qualifier(s)	Date/Time Analyzed	Batch	Method
Chloride	mg/L	**214**		9/4/12 11:43	A209016	300.0/9056A
Nitrate (Calc.)	mg/L	**7.15**		9/5/12 9:14	A209030	300.0/9056A
Sulfate as SO4	mg/L	**737**		9/4/12 11:43	A209016	300.0/9056A
Nitrate as N	mg/L	**1.62**	E2	9/4/12 10:35	A209016	300.0/9056A
DRAFT: Dissolved Metals	**Units**	**Result**	**Qualifier(s)**	**Date/Time Analyzed**	**Batch**	**Method**
Calcium	mg/L	**23.4**		9/4/12 12:02	A209006	200.7
Magnesium	mg/L	**3.63**	E20	9/4/12 12:02	A209006	200.7
Potassium	mg/L	**10.9**	E20	9/4/12 12:02	A209006	200.7
Sodium	mg/L	**462**	E20	9/4/12 12:02	A209006	200.7
DRAFT: Wet Chemistry	**Units**	**Result**	**Qualifier(s)**	**Date/Time Analyzed**	**Batch**	**Method**
TDS	mg/L	**1500**		8/31/12 14:25	A208391	2540C

ANALYTICAL RESULTS

Lab Number: 1208360-02
Sample Name: DRAFT: Synthetic #2 Modified 2
Date/Time Collected: 8/31/12 0:00
Sample Matrix: Water

DRAFT: Anions	Units	Result	Qualifier(s)	Date/Time Analyzed	Batch	Method
Chloride	mg/L	**158**		9/4/12 12:05	A209016	300.0/9056A
Nitrate (Calc.)	mg/L	**7.00**		9/5/12 9:14	A209030	300.0/9056A
Sulfate as SO4	mg/L	**767**		9/4/12 12:05	A209016	300.0/9056A
Nitrate as N	mg/L	**1.58**	E2	9/4/12 10:58	A209016	300.0/9056A
DRAFT: Dissolved Metals	**Units**	**Result**	**Qualifier(s)**	**Date/Time Analyzed**	**Batch**	**Method**
Calcium	mg/L	**22.4**		9/4/12 12:13	A209006	200.7
Magnesium	mg/L	**5.63**		9/4/12 12:13	A209006	200.7
Potassium	mg/L	**12.5**		9/4/12 12:13	A209006	200.7
Sodium	mg/L	**531**		9/4/12 12:13	A209006	200.7
DRAFT: Wet Chemistry	**Units**	**Result**	**Qualifier(s)**	**Date/Time Analyzed**	**Batch**	**Method**
TDS	mg/L	**1700**		8/31/12 14:25	A208391	2540C

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17 September 2012

Norma James
Arkansas Analytical, Inc.
11701 I-30, Bldg 1, Suite 115
Little Rock, AR 72209
Project: Lion Oil

Date Received: 31-Aug-12 15:00

ANALYTICAL RESULTS

Lab Number:	**1208360-05**
Sample Name:	**DRAFT: Synthetic #4 9/12/12 Tweaked**
Date/Time Collected:	**9/12/12 11:30**
Sample Matrix:	**Water**

DRAFT: Anions	Units	Result	Qualifier(s)	Date/Time Analyzed	Batch	Method
Chloride	mg/L	**235**		9/13/12 12:13	A209175	300.0/9056A
Sulfate as SO4	mg/L	**467**		9/13/12 12:58	A209175	300.0/9056A
Nitrate as N	mg/L	**1.56**		9/13/12 11:51	A209175	300.0/9056A
DRAFT: Dissolved Metals	**Units**	**Result**	**Qualifier(s)**	**Date/Time Analyzed**	**Batch**	**Method**
Calcium	mg/L	**105**		9/12/12 19:42	A209164	200.7
Magnesium	mg/L	**3.49**		9/12/12 19:42	A209164	200.7
Potassium	mg/L	**9.04**		9/12/12 19:42	A209164	200.7
Sodium	mg/L	**262**	E20	9/12/12 19:42	A209164	200.7
DRAFT: Wet Chemistry	**Units**	**Result**	**Qualifier(s)**	**Date/Time Analyzed**	**Batch**	**Method**
TDS	mg/L	**1200**		9/12/12 16:54	A209166	2540C

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17 September 2012

Norma James
Arkansas Analytical, Inc.
11701 I-30, Bldg 1, Suite 115
Little Rock, AR 72209
Project: Lion Oil

Date Received: 31-Aug-12 15:00

QUALITY CONTROL RESULTS

DRAFT: Wet Chemistry -- Batch: A208391 (Water)
Prepared: 30-Aug-12 15:30 By: AP -- Analyzed: 30-Aug-12 15:30 By: AP

Analyte	BLK	LCS / LCSD	MS / MSD	Dup	RPD	Qualifiers
TDS	<1.0 mg/L	98.0% / 101%	NA / NA		3.02%	

DRAFT: Dissolved Metals -- Batch: A209006 (Water)
Prepared: 04-Sep-12 10:10 By: TC -- Analyzed: 04-Sep-12 13:52 By: TC

Analyte	BLK	LCS / LCSD	MS / MSD	Dup	RPD	Qualifiers
Calcium	<0.100 mg/L	113% / NA	92.8% / 125%		2.54%	
Magnesium	<0.100 mg/L	90.5% / NA	MBA / MBA		1.03%	MBA
Potassium	<0.100 mg/L	88.9% / NA	107% / MBA		2.79%	MBA
Sodium	<1.00 mg/L	98.0% / NA	MBA / MBA		10.1%	MBA

DRAFT: Anions -- Batch: A209016 (Water)
Prepared: 04-Sep-12 10:00 By: MG -- Analyzed: 04-Sep-12 16:41 By: Melis

Analyte	BLK	LCS / LCSD	MS / MSD	Dup	RPD	Qualifiers
Chloride	<0.500 mg/L	104% / NA	94.4% / 94.0%		0.154%	
Nitrate as N	<0.500 mg/L	104% / NA	104% / 104%		0.337%	
Sulfate as SO4	<0.500 mg/L	94.6% / NA	106% / 105%		0.368%	

DRAFT: Anions -- Batch: A209045 (Water)
Prepared: 05-Sep-12 15:41 By: MG -- Analyzed: 05-Sep-12 18:26 By: Melis

Analyte	BLK	LCS / LCSD	MS / MSD	Dup	RPD	Qualifiers
Chloride	<0.500 mg/L	99.3% / NA	99.1% / 100%		0.367%	
Nitrate as N	<0.500 mg/L	106% / NA	110% / 106%		2.54%	
Sulfate as SO4	<0.500 mg/L	104% / NA	97.1% / 94.0%		1.02%	

DRAFT: Dissolved Metals -- Batch: A209072 (Water)
Prepared: 06-Sep-12 13:20 By: TC -- Analyzed: 06-Sep-12 15:41 By: TC

Analyte	BLK	LCS / LCSD	MS / MSD	Dup	RPD	Qualifiers
Calcium	<0.100 mg/L	91.3% / NA	101% / 77.9%		1.68%	
Magnesium	<0.100 mg/L	100% / NA	95.7% / 88.1%		2.51%	
Potassium	<0.100 mg/L	90.2% / NA	113% / 99.1%		1.95%	
Sodium	<1.00 mg/L	95.2% / NA	93.9% / 102%		0.0291%	

DRAFT: Wet Chemistry -- Batch: A209085 (Water)
Prepared: 06-Sep-12 18:15 By: AP -- Analyzed: 06-Sep-12 18:15 By: AP

Analyte	BLK	LCS / LCSD	MS / MSD	Dup	RPD	Qualifiers
TDS	<1.0 mg/L	102% / 97.0%	NA / NA		4.53%	

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17 September 2012

Norma James
Arkansas Analytical, Inc.
11701 I-30, Bldg 1, Suite 115
Little Rock, AR 72209
Project: Lion Oil

Date Received: 31-Aug-12 15:00

QUALITY CONTROL RESULTS

DRAFT: Dissolved Metals -- Batch: A209164 (Water)
Prepared: 12-Sep-12 16:45 By: TC -- Analyzed: 12-Sep-12 19:50 By: TC

Analyte	BLK	LCS / LCSD	MS / MSD	Dup	RPD	Qualifiers
Calcium	<0.100 mg/L	102% / NA	92.8% / 120%		2.34%	
Magnesium	<0.100 mg/L	96.2% / NA	90.1% / 90.2%		0.0344%	
Potassium	<0.100 mg/L	93.3% / NA	104% / 105%		0.938%	
Sodium	<1.00 mg/L	91.6% / NA	MBA / MBA		0.622%	MBA

DRAFT: Wet Chemistry -- Batch: A209166 (Water)
Prepared: 12-Sep-12 13:20 By: AP -- Analyzed: 12-Sep-12 13:20 By: AP

Analyte	BLK	LCS / LCSD	MS / MSD	Dup	RPD	Qualifiers
TDS	<1.0 mg/L	101% / 99.0%	NA / NA		2.00%	

DRAFT: Anions -- Batch: A209175 (Water)
Prepared: 13-Sep-12 11:50 By: MG -- Analyzed: 13-Sep-12 15:20 By: MG

Analyte	BLK	LCS / LCSD	MS / MSD	Dup	RPD	Qualifiers
Chloride	<0.500 mg/L	98.0% / NA	98.0% / 99.2%		0.632%	
Nitrate as N	<0.500 mg/L	91.2% / NA	93.0% / 93.7%		0.303%	
Sulfate as SO4	<0.500 mg/L	101% / NA	93.3% / 93.7%		0.188%	

QUALIFIER(S)

*E2: Estimated Result; Analyzed Outside of Holding Time
*E20: Estimated Result Due to Matrix Spike and/or Matrix Spike Duplicate Failure; This sample was used as the "parent sample" in MS/MSD prep.
*MBA: Masked By Analyte

All Analysis performed according to EPA approved methodology when available:
SW 846, Revised December, 1996; EPA 600/4-79-020, Revised March, 1983; Standard Methods, 20th Edition.
Instrument calibration and quality control samples performed at or above frequency specified in analytical method.

Reviewed by: _____
Norma James
President

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Arkansas Analytical Inc.

11701 Interstate 30, Bldg. 1, Ste. 115
Little Rock, AR 72209
PHONE: 501-455-3233
FAX: 501-455-6118

CHAIN OF CUSTODY RECORD

CLIENT INFORMATION	Project Description	Turnaround Time	Preservation Codes:
ArK Analytical		24 Hour	1. Cool, 4 Degrees Centigrade; 4. Thiosulfate for Dechlorination
		48 Hour	2. Sulfuric Acid (H_2SO_4), pH < 2; 5. Hydrochloric Acid(HCl)
	Reporting Information	72 Hour	3. Nitric Acid (HNO_3), pH < 2; 6. Sodium Hydroxide (NaOH), pH > 12
	Telephone:	Routine (5 Day)	
	Fax:	Preservative Code:	
	Email:	Bottle Type:	

Sampler(s) Signature: Lessie Redican

Sampler(s) Printed: Lessie Redican

Field Number	SAMPLE COLLECTION Date/s	Time/s	Grab	Comp	Number of Bottles	Sample Matrix	SAMPLE IDENTIFICATION/ DESCRIPTION	Cl, NO_3, SO_4	TDS	K Na Mg Ca	TEST PARAMETERS	Bottle Type Code: G = Glass, P = Plastic; V = Septum; A = Amber	Arkansas Analytical Work Order Number: 1208360
1	8-31-12					W	Syn 1 modified 2	✓	✓	✓			-01
2	8-31-12					W	Syn 2 modified 2	✓	✓	✓			-02
3	8-31-12					W	LC4 modified 2	✓	✓	✓			-03
	9-6-12						Lion Oil Synthetic 4	✓	✓	✓			-04

1. Relinquished by: (Signature)	Date/Time	2. Received by: (Signature)	SAMPLE CONDITION UPON RECEIPT IN LAB	REMARKS / SAMPLE COMMENTS
Lessie Redican	8-31-12 15:00		1. CUSTODY SEALS: NA ___Yes ___No	P.O. Number -
			2. CONTAINERS CORRECT: ___Yes ___No	prepared by Lab 8-31-12
			3. COC/LABELS AGREE: ___Yes ___No	
3. Relinquished by: (Signature)	Date/Time	4. Received by lab: (Signature)	4. PRESERVATION CONFIRMED: ___Yes ___No	
		Lessie Redican	5. RECEIVED ON ICE: ___Yes ___No	
			6. TEMPERATURE ON RECEIPT:	
			FOR COMPLETION BY LAB ONLY	

Revision 1
12/1/10

1300 Blue Spruce Drive, Suite C
Fort Collins, Colorado 80524

Toll Free: 800/331-5916
Tel:970/484-5091 Fax:970/484-2514

ORGANISM HISTORY

DATE: 6/22/09

SPECIES: *Ceriodaphnia dubia*

AGE: Variable

LIFE STAGE: Adult

HATCH DATE: Variable

BEGAN FEEDING: Immediately

FOOD: YTC, *Selenastrum* sp.

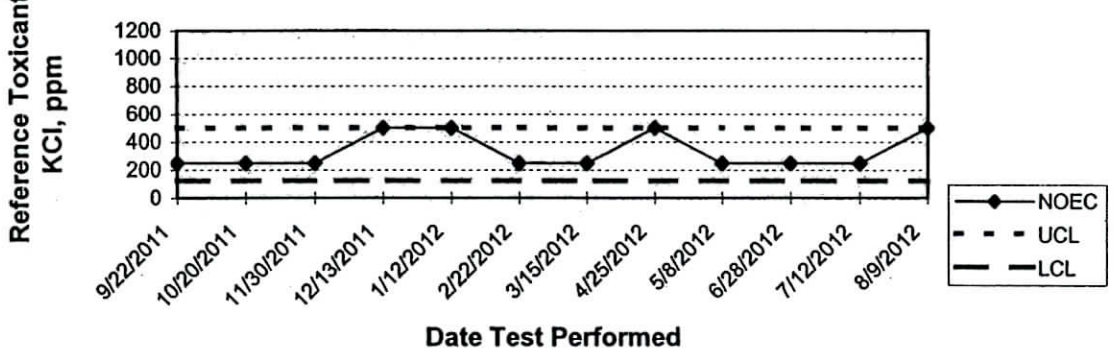
Water Chemistry Record:	Current	Range
TEMPERATURE:	25°C	20-25°C
SALINITY/CONDUCTIVITY:	--	--
TOTAL HARDNESS (as $CaCO_3$):	142 mg/l	86-124 mg/l
TOTAL ALKALINITY (as $CaCO_3$):	100 mg/l	65-130 mg/l
pH:	7.92	7.56-8.35

Comments:

Facility Supervisor

ARKANSAS ANALYTICAL, INC.

CERIODAPHNIA DUBIA SURVIVAL
QUALITY ASSURANCE



ARKANSAS ANALYTICAL, INC.

CERIODAPHNIA DUBIA REPRODUCTION
QUALITY ASSURANCE