Sub-lethal Response (SLR)
Study Plan

Prepared for:

El Dorado Chemical Company
El Dorado, Arkansas

Prepared by:

GBM^{c} & Associates
219 Brown Lane
Bryant, AR 72022

April 19, 2010 rev 2.1

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1.0 INTRODUCTION

El Dorado Chemical Company (EDCC) (**Figure 1**) was issued a modified National Pollutant Discharge Elimination System (NPDES) permit AR0000752 effective on June 1, 2004 for discharge from multiple outfalls, including Outfall 001. As a condition of the permit modification, the facility was required to conduct routine 7-day chronic Whole Effluent Toxicity (WET) on a monthly basis and report the results of the WET tests. In June 2007, the lethality endpoint of the WET testing became a WET limit. Since June 2007, EDCC has completed monthly WET testing and has maintained compliance with the WET permit limit every month with the exception of a single monthly test failure in March 2009. EDCC has not failed the WET testing since March 2009 and currently is in compliance with the WET limit for lethality in 100% effluent.

On or about January 12, 2010, EDCC received a directive from ADEQ requesting EDCC develop and implement a TRE for sub-lethal effects (**Attachment 1**). This demand letter was based on the reported results of the sub-lethal monitoring and report requirements of the existing NPDES permit. Although there is no requirement in the current permit and as an alternative to reopening the existing EDCC NPDES permit, ADEQ is requesting that EDCC undertake actions to address any future consistent and significant sub-lethal for additional monitoring or TRE-related activities associated with sub-lethal results in the WET testing language of Part III, Other Conditions in EDCC's current NPDES permit.

As an alternative, EDCC is proposing a self-directed assessment of the sub-lethal WET test failures should they recur.

2.0 STUDY OBJECTIVE

The Sub-Lethal Response (SLR) Study Plan objectives are to:

1. Evaluate the cause of significant and consistent reductions to water flea neonate production and/or fathead minnow larval growth in whole effluent toxicity (WET) tests in the laboratory 7-day chronic biomonitoring tests on effluent from Outfall 001; and

2. Identify, where possible, and correct the cause of any significant and consistent failures of the sub-lethal endpoints in WET tests completed on effluent from Outfall 001.

The site specific sub-lethal study will combine routine WET testing and analyses of the physical and chemical characteristics of final effluents to determine, to the extent possible and as appropriate, a cause of significant reductions in neonate production of the water flea and/or larval growth of the fathead minnow. In addition, any available historical data will be evaluated during the SLR study period. The findings of the study will be submitted to ADEQ at the conclusion of the SLR study period.

Should the cause of any reduced neonate production and/or the reduced fathead minnow growth be identified as a result of current facility operations and/or the current water management operations, the final report will provide a Compliance Plan defining subsequent actions to increase WET test performance as measured by the routine monitoring requirements.

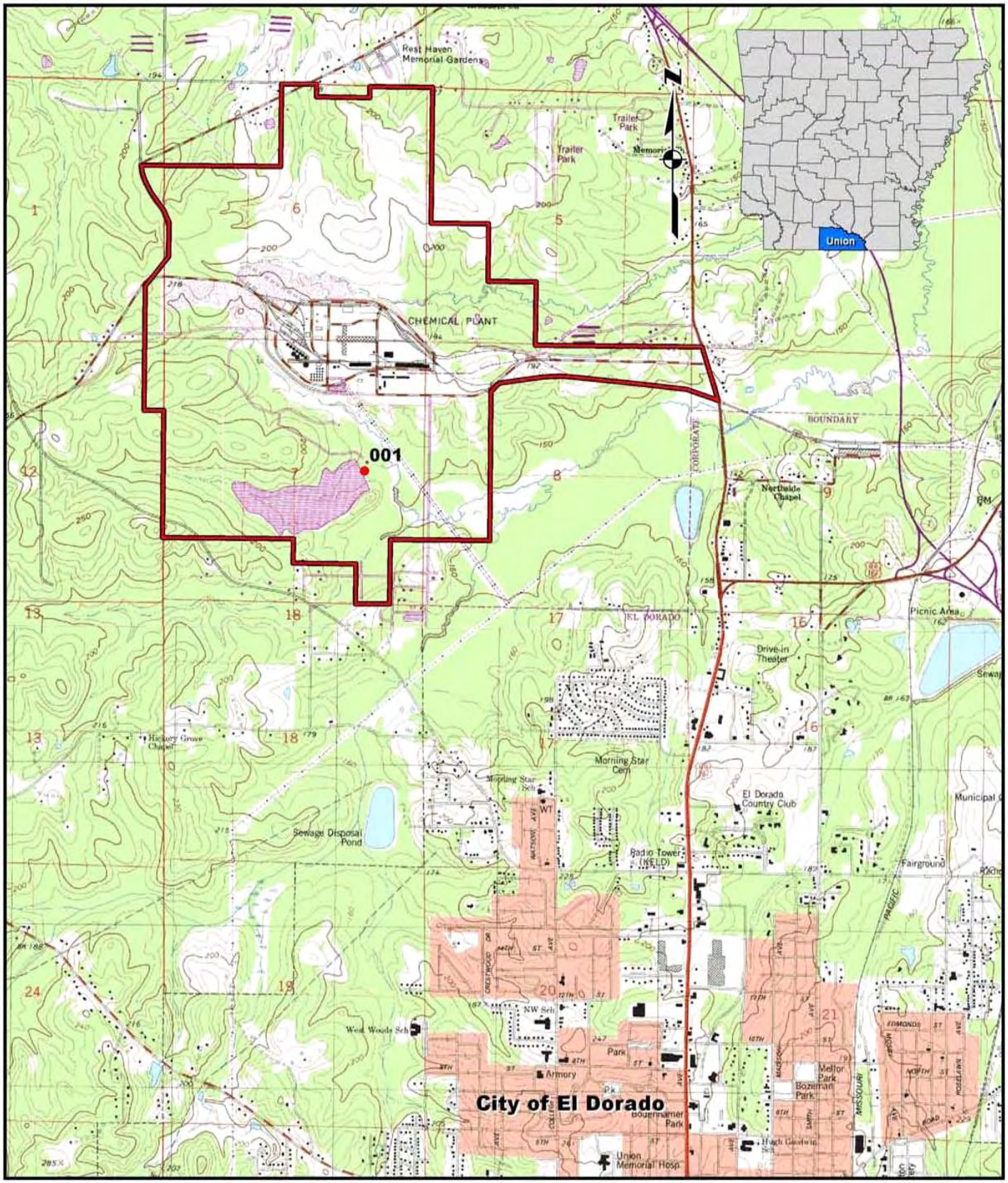


Figure 1. El Dorado Chemical Company facility and Location Outfall 001.

3.0 BACKGROUND

3.1 Historical Summary

ADEQ referenced the historical WET testing completed on Outfall 001 over the period from January 2005 through October 2009 as the basis for the implementation of the sub-lethal TRE on Outfall 001 effluent (Attachment 1). EDCC has completed an additional four (4) monthly WET tests that were not included in the ADEQ request (**Attachment 2**). During that period (January 2005 through February 2010), EDCC had completed 46 WET tests, passing 44 and 42 of the WET tests during 2009 for the lethality endpoint for the water flea and fathead minnow, respectively. Although there have been more sub-lethal endpoints failed than lethality endpoints in the WET tests, EDCC has passed 70 percent of the sub-lethal WET tests during the five-year period, including the last four consecutive WET tests during the period from (November 2009 through February 2010). Therefore, the sub-lethal test failures have not been consistent and, while failing the sub-lethal WET test end-point at the critical dilution of 100% effluent during 2009, the variability in the sub-lethal no observed effect concentration (NOEC) has implicated failures due to procedural considerations and not effluent toxicity.

Outfall 001 discharges water from a 50-acre stabilization basin that is managed to provide final treatment, equalization, storm water control and secondary containment for facility wastewater. In addition to the inflows from the facility, the basin receives storm water from the upstream drainage basin. The sub-lethal record for 2009 was atypical for Outfall 001 when compared to the previous four year period. In comparison, 2009 was the wettest year on record for the state of Arkansas with record rain fall during several months of the year, including the typically drier months of the year.

In addition, given the record for the WET tests results for the fathead minnow (*Pimephales promelas*) as summarized in **Attachment 3**, the SLR Study Plan does not propose to include tasks for evaluating the fathead minnow WET tests in Outfall 001 unless changes in the routine monthly WET testing indicates consistent failures of either test endpoint (lethality and/or growth). However, in order to verify that any proposed modifications will also support the fathead minnow, the final confirmation will include an assessment of the sub-lethal performance of the fathead minnow.

The following sections provide a more detailed accounting of the historical WET testing results for both the water flea and the fathead minnow.

3.2 Water Flea (*Ceriodaphnia dubia*)

As reported in the ADEQ request, there have been 42 7-day chronic WET tests completed using the water flea from January 2005 through October 2009. The WET test record has demonstrated a consistent record of passing the lethality endpoint at the 100% effluent exposure results. There has only been two WET lethality test failure during the 5-year period of record from the January 2005 through October 2009.

In addition, EDCC has completed four additional monthly WET tests (November 2009 through February 2010) that were not included in the period of record (POR) presented in the ADEQ request letter. All four of these tests have also passed the sub-lethal endpoint (**Attachment 4**). Subsequent evaluations of sub-lethal test failures have failed to identify a potential cause-effect relationship of the failures.

3.3 Fathead Minnow (*Pimephales promelas*)

Due to the historical record related to the WET testing of the fathead minnow, the SLR Study Plan will not include assessments of the fathead minnow unless there is a shift in the typical WET test results for Outfall 001. However, should the fathead minnow begin to demonstrate a consistent and definitive failure of WET testing when exposed to Outfall 001 discharge, the application of the SLR Plan will be reevaluated to include the fathead minnow exposure to Outfall 001 as well.

4.0 BIOMONITORING ASSESSMENT

4.1 Objectives

The SLR Plan will be implemented to:

1) Determine the cause of any persistent sub-lethal WET test failures in the discharge from Outfall 001 and propose actions to reduce the sub-lethal WET test failures.

2) Evaluate the effect of pathogens and/or low water hardness on the sub-lethal WET test failures.

3) Evaluate the role that water management plays on the WET test results.

4) Document how any unusual operating conditions or unique events within the facility may impact the WET test results.

5) Characterize effluent to determine if the sporadic sub-lethal failures of WET testing can be attributed to individual contributors.

6) Evaluate WET test results in concert with analytical, rainfall, flow and operation data to determine the role methodology and effluent characteristics may play in any reported significant differences in the sub-lethal endpoints.

7) Implement such additional toxicity reduction/identification evaluation (TR/IE) activities as may be appropriate to address any consistent and significant sub-lethal WET test failures in an effort to determine a source of sub-lethal endpoint test failures.

Additional details of each of the study objectives and actions planned to accomplish each of the objectives are provided below.

4.2 Approach

The following activities will be completed, as required, to accomplish the above study objectives as they relate to repeated sub-lethal WET test failures for either test species at effluent concentrations less than 76% effluent.

4.2.1 Further evaluate the effect of pathogens and/or low water hardness on the sub-lethal WET test failures on Outfall 001 effluent

Efforts to determine the role of biological pathogens and/or low water hardness on the sub-lethal test results have been initiated during the 1st Qtr of 2010 and will continue throughout the study period on a monthly basis. These potential sources of sub-lethal WET test performance will be evaluated by continuing the UV treatment of effluents and/or hardness adjustments when effluents are determined to have low levels of hardness. These manipulations will be completed on effluent samples which will run concurrently with the routine un-manipulated effluents. The results of the side-

by-side WET tests will clarify the role natural pathogens and/or low hardness might play in the sub-lethal WET test results.

4.2.2 Evaluate the role flow contributes to the sub-lethal water flea WET testing results

During the three year study period, flow data and daily rainfall data at the facility will be documented. This information will be utilized to develop a water balance estimate of the relative proportional volumes of influent streams making up the Outfall 001 effluent during WET testing; and provide relative strengths of those constituents originating from each source.

Additional analytical chemistry and WET test may be completed on any or all of the influent waste streams as may be necessary to determine if any individual source stream contributes to any future WET test failure. The specific analytical chemistry and WET testing will be determined based on conditions during the specific study period. Additional testing/investigations will be directed at specific issues. The specifics of the approach will be determined by the specific conditions that may lead to any future consistent WET test failure.

4.2.3 Document unusual operating conditions or unique events within the facility

Facility operational information and operating data will be documented with specific attention to unusual operating conditions or events that occurred during the time frame of WET testing. These operational conditions will be evaluated to determine if a specific activity may have contributed to unanticipated results in the WET testing through Outfall 001. Since this is a manufacturing facility, there are conditions that are not controllable or preventable. There are policies in place such as the SWPPP and the SPCC to limit and correct deficiencies once identified. These policies and procedures will be evaluated as they may relate to the WET test results. Modifications to the policies and procedures will be developed as required to address WET test failures to the extent that those modifications improve WET compliance.

4.2.4 Routine chronic biomonitoring

As required by the NPDES permit, monthly 7-day chronic biomonitoring will continue through the study period. The critical dilution is 100% effluent. The results of WET tests will be evaluated for adherence to analytical chemistry, test acceptance criteria, and reference toxicity results evaluating the condition of the organism cultures.

4.2.5 Evaluate WET toxicity test results in concert with analytical, rainfall, flow and operation data

The results of the WET testing will be evaluated in association with the information developed in the tasks above. The objective of the assessment is to determine the existing conditions that result in sub-lethal WET test failure (if it occurs) and those conditions that promote tests success. In the absence of any identified cause effect relationship. This data will be utilized to document conditions just prior to and during the WET testing periods. The specific analyses have not yet been determined and will be dependent on information developed during the implementation of the SLR Study Plan.

4.2.6 Evaluate the potential cause of the significant and persistent sub-lethal WET test failures in Outfall 001 discharge

Due to the historically inconsistent results demonstrating sporadic and variability in level of significance with the sub-lethal test failures, one or more sub-lethal toxicity identification evaluations (TIE) will be designed and implemented on effluent from Outfall 001 should consecutive sub-lethal effects be demonstrated in effluent concentrations less than 76% Outfall 001 effluent.

Initially, TIE actions will be directed at the water flea only. However, should the routine fathead minnow WET test exhibit consistent and significant WET tests failures, TIE manipulations will be implemented in an effort to identify the cause of the fathead minnow WET test failures. This approach is proposed based on the standard TRE language now being utilized in ADEQ NPDES permits as provided below in the excerpt from standard NPDES language defining the application of Whole Effluent Toxicity Limits.

TOXICITY REDUCTION EVALUATIONS (TREs)

TREs for lethal and sub-lethal effects are performed in a very similar manner. EPA Region 6 is currently addressing TREs as follows: a sub-lethal TRE (TRE_{SL}) is triggered based on three sub-lethal test failures while a lethal effects (TRE_L) is triggered based on only two failures for lethality. In addition, EPA Region 6 will consider the magnitude of toxicity and use flexibility when considering a (TRE_{SL}) where there are no effects at effluent dilutions of less than 76% effluent.

4.2.7 Implement such additional QA/QC activities as may be appropriate to determine if an identified source of sub-lethal endpoint test results can be eliminated

Depending on the results of the routine analytical monitoring and WET testing, additional analytical parameters and WET testing may be completed to include but not limited to duplicate sampling and/or split samples to multiple labs. Any additional effort will be designed to answer specific questions generated by the information developed during the initial 24-month period of the routine monitoring.

4.2.8 WET Test Scheduling

At least two (2) WET tests will be conducted within each year which includes rainfall contribution to the effluent and best efforts to schedule WET tests such that the effluent includes rainfall contributions during two WET test events each year. It is the intent of the SLR Plan to accomplish this characterization within the required monthly WET monitoring and may or may not be accomplished in conjunction with other storm water assessments. The specific application of WET test scheduling is to characterize the range of discharge conditions typical of the facility operations.

5.0 SCHEDULE

The SLR Study will be implemented over a 28-month period. Any additional activities to implement controls are outside the scope of this Study Plan. Due to the sporadic nature and the variability demonstrated in the historical water flea sub-lethal test failures when exposed to Outfall 001 effluent, and the nature of the discharge (from a large 50-acre equalization basin with native biotic communities), the following table represents a best estimate of the schedule required to implement the SLR Study. However, the schedule may be modified (compressed or

expanded) as required by developments within the proposed study schedule. The SLR Study is expected to take 28 months to implement. During this period, status reports will be submitted every six months to the Water Quality Planning Branch to the attention of Ms. Mary Barnett.

As indicated in the introduction (Section 1), the SLR Study was to be submitted by April 1, 2010 and therefore serves as the date of initiation for the 28-month study period. Based on the 28-month schedule the final report is due to ADEQ no later than August 31, 2012.

Table1. Proposed schedule for the implementation of the Sub-lethal Response (SLR) Study, EDCC El Dorado, AR. NPDES Permit No. AR0000752.

Tasks	Description	Duration in Months	Dates	
			From	To
Task 1	Study Plan submitted to ADEQ	3	April 2010	May 2010
Task 2	Pathogen & hardness Evaluations	24	May 2010	May 2012
Task 3	Flow monitoring	24	May 2010	May 2012
Task 4	Monitoring of facility conditions	28	May 2010	August 2012
Task 5	Routine chronic toxicity testing	28	March 2010	August 2012
Task 6	Routine assessment of WET results	28	May 2010	August 2012
Task 7	Chronic TIE manipulations, as needed	24	August 2010	August 2012
Task 8	Implementation of additional monitoring	16	May 2011	August 2012
Task 9	Evaluation of monitoring data	24	August 2010	August 2012
Task 10	Status reports	Semi-annual	November 2010 & 2011 and May 2011 & 2012	
Task 11	Final Report (to ADEQ)	1	September 2012	

ATTACHMENT 1

ADEQ Sub-Lethal TRE Request

ADEQ

A R K A N S A S
Department of Environmental Quality

Certified Mail No.: 7009 0960 0000 7899 0831

January 12, 2010

David Sartain
El Dorado Chemical Company
P.O. Box 231
El Dorado, AR 71731-0231

RE: Request to begin Toxicity Reduction Evaluation (TRE).
NPDES Permit No. AR0000752
AFIN: 70-00040
Outfall 001

Dear Mr. Sartain:

During a review of the whole effluent toxicity (WET) testing data for the past five years, it was noted that there have been numerous failures reported for sub-lethality for *P. promelas* (growth) and *C. dubia* (reproduction). It is necessary at this time for EDCC to take the appropriate actions to address *P. promelas* and *C. dubia* toxicity at outfall 001. Therefore, the Department requires that EDCC begin a Toxicity Reduction Evaluation (TRE) for *P. promelas* and *C. dubia* sub-lethality.

Reg 2.508 states "Toxic substances shall not be present in receiving waters, after mixing, in such quantities as to be toxic to human, animal, plant or aquatic life or to interfere with the normal propagation, growth and survival of the indigenous aquatic biota."

Below is a summary of the reported WET test failures for NPDES Permit No. AR0000752

Number of tests performed during previous 5 years by species:
***Pimephales promelas* (Fathead minnow): 42**
***Ceriodaphnia dubia* (water flea):42**

Failed test dates during previous 5 years by species:

***Pimephales promelas* (Fathead minnow):**	Lethal	Sub-lethal
	01-05	01-05
	02-05	02-05
	03-05	03-05
	03-09	04-05
		05-05
		06-05
		03-06
		09-06

01-07
10-07
11-07
10-08
03-09

***Ceriodaphnia dubia* (water flea):**	Lethal	Sub-lethal
	12-08	01-05
	02-09	03-05
		05-05
		09-05
		04-06
		12-08
		02-09
		04-09
		06-09
		07-09
		09-09
		10-09

Enclosed are the Departments standard requirements for permittee's conducting a TRE. including guidelines. schedules, and reporting requirements.

If you have any questions, please contact myself or Sarah Clem.

Sincerely,

Mary Barnett
Ecologist
501-682-0666
barnett@adeq.state.ar.us

TOXICITY REDUCTION EVALUATION (TRE)

a. Within ninety (90) days of confirming lethality in the retests, the permittee shall submit a Toxicity Reduction Evaluation (TRE) Action Plan and Schedule for conducting a TRE. The TRE Action Plan shall specify the approach and methodology to be used in performing the TRE. A Toxicity Reduction Evaluation is an investigation intended to determine those actions necessary to achieve compliance with water quality-based effluent limits by reducing an effluent's toxicity to an acceptable level. A TRE is defined as a step-wise process which combines toxicity testing and analyses of the physical and chemical characteristics of a toxic effluent to identify the constituents causing effluent toxicity and/or treatment methods which will reduce the effluent toxicity. The TRE Action Plan shall lead to the successful elimination of effluent toxicity at the critical dilution and include the following:

i. Specific Activities. The plan shall detail the specific approach the permittee intends to utilize in conducting the TRE. The approach may include toxicity characterizations, identifications and confirmation activities, source evaluation, treatability studies, or alternative approaches. When the permittee conducts Toxicity Characterization Procedures the permittee shall perform multiple characterizations and follow the procedures specified in the documents "Methods for Aquatic Toxicity Identification Evaluations: Phase I Toxicity Characterization Procedures" (EPA-600/6-91/003) and "Toxicity Identification Evaluation: Characterization of Chronically Toxic Effluents, Phase I" (EPA-600/6-91/005F), or alternate procedures. When the permittee conducts Toxicity Identification Evaluations and Confirmations, the permittee shall perform multiple identifications and follow the methods specified in the documents "Methods for Aquatic Toxicity Identification Evaluations, Phase II Toxicity Identification Procedures for Samples Exhibiting Acute and Chronic Toxicity" (EPA/600/R-92/080) and "Methods for Aquatic Toxicity Identification Evaluations, Phase III Toxicity Confirmation Procedures for Samples Exhibiting Acute and Chronic Toxicity" (EPA/600/R-92/081), as appropriate.

The documents referenced above may be obtained through the National Technical Information Service (NTIS) by phone at (800) 553-6847, or by writing:

U.S. Department of Commerce
National Technical Information Service
5285 Port Royal Road
Springfield, VA 22161

ii. Sampling Plan (e.g., locations, methods, holding times, chain of custody, preservation, etc.). The effluent sample volume collected for all tests shall be adequate to perform the toxicity test, toxicity characterization,

identification and confirmation procedures, and conduct chemical specific analyses when a probable toxicant has been identified;

Where the permittee has identified or suspects specific pollutant(s) and/or source(s) of effluent toxicity, the permittee shall conduct, concurrent with toxicity testing, chemical specific analyses for the identified and/or suspected pollutant(s) and/or source(s) of effluent toxicity. Where lethality was demonstrated within 48 hours of test initiation, each composite sample shall be analyzed independently. Otherwise the permittee may substitute a composite sample, comprised of equal portions of the individual composite samples, for the chemical specific analysis;

iii. Quality Assurance Plan (e.g., QA/QC implementation, corrective actions, etc.); and

iv. Project Organization (e.g., project staff, project manager, consulting services, etc.).

b. The permittee shall initiate the TRE Action Plan within thirty (30) days of plan and schedule submittal. The permittee shall assume all risks for failure to achieve the required toxicity reduction.

c. The permittee shall submit a quarterly TRE Activities Report, with the Discharge Monitoring Report in the months of January, April, July and October, containing information on toxicity reduction evaluation activities including:

i. any data and/or substantiating documentation which identifies the pollutant(s) and/or source(s) of effluent toxicity;

ii. any studies/evaluations and results on the treatability of the facility's effluent toxicity; and

iii. any data which identifies effluent toxicity control mechanisms that will reduce effluent toxicity to the level necessary to meet no significant lethality at the critical dilution.

d. The permittee shall submit a Final Report on Toxicity Reduction Evaluation Activities no later than twenty-eight (28) months from confirming lethality in the retests, which provides information pertaining to the specific control mechanism selected that will, when implemented, result in reduction of effluent toxicity to no significant lethality at the critical dilution. The report will also provide a specific corrective action schedule for implementing the selected control mechanism.

Quarterly testing during the TRE is a minimum monitoring requirement. EPA recommends that permittees required to perform a TRE not rely on quarterly testing alone to ensure success in the TRE, and that additional screening tests be performed to capture

toxic samples for identification of toxicants. Failure to identify the specific chemical compound causing toxicity test failure will normally result in a permit limit for whole effluent toxicity limits per federal regulations at 40 CFR 122.44(d)(1)(v).

ATTACHMENT 2

EDCC Response to ADEQ Request

4500 NORTH WEST AVE. • P. O. BOX 231 • EL DORADO, AR 71731 • (870) 863-1400

EL DORADO

CHEMICAL COMPANY

January 26, 2010

Ms. Mary Barnett
Ecologist, Water Division
ADEQ
5301 Northshore Drive
North Little Rock, AR 72118

Re: Sub-lethal TRE El Dorado Chemical Company
NPDES No. AR0000752, AFIN: 70-00040

Dear Ms Barnett:

This letter is in response to your letter dated January 12, 2010 requesting El Dorado Chemical Company (EDCC) initiate a Toxicity Reduction Evaluation (TRE) on effluent from Outfall 001. As specified in your letter, the TRE is to target the sub-lethal effects for both *Pimephales promelas* (fathead minnow) and *Ceriodaphnia dubia* (water flea).

Based on our understanding of the request, we offer the following comments:

First, our existing NPDES permit does have a WET permit limit for lethality, with which EDCC is in compliance, but does not have the language requiring the implementation of a TRE for either lethality or sub-lethal effects for Outfall 001.

Second, the listing of lethal and sub-lethal WET test failures referenced in the January 12th letter date back to January,2005. However, the historical test results are no longer characteristic of the discharge. Since the beginning of 2005, EDCC has completed numerous actions to reduce concentrations of permitted constituents resulting in significant reductions in permitted discharge parameters thus allowing compliance with EDCC's current permit.

These efforts have also resulted in the reduction of WET test failures in both species, particularly with the fathead minnow. Since March 2005, there has been only one WET test failure (1 failure in 18 quarters of monitoring) of the lethality endpoint. In addition, the incidence of sub-lethal failures has been reduced to only one per year for 2008 and 2009. Clearly, the recent history (last 2 year period of record) does not support the need to implement a sub-lethal TRE even if EDCC's NPDES permit required one. According to typical NPDES language, a TRE is typically triggered only after consecutive WET test failures are demonstrated at the critical dilution. That requirement has not been triggered with the fathead minnow WET test results.

Based on EDCC records, during the most recent 2 year period of record, 2008 - 2009, EDCC has passed all but two 7-day chronic WET tests on the water flea. Subsequent WET tests have passed the lethality endpoint at the 100% critical dilution.

Although the sub-lethal endpoint (i.e. reproduction) failed several tests during the 2009 period, there is evidence that at least some of the test failures were due to natural pathogens (e.g. bacteria) that exist in the wastewater treatment holding pond and were transferred to the test organisms resulting in the sub-lethal test failure.

Although the current NPDES permit does not contain TRE language for Outfall 001, EDCC recognizes the need to determine the cause for the sub-lethal test failures. Therefore, EDCC will voluntarily initiate a self directed investigation to identify and, to the extent possible, correct the cause of the sub-lethal WET test failures as they may occur in future WET tests at dilutions of 75% effluent or below.

Within the next 60 day period, EDCC will develop and submit to ADEQ an approach to evaluate significant sub-lethal WET test failures (LOEC 75% or less), to identify the cause for any sub-lethal test failure (if possible), and develop a corrective action to address significant and consistent sub-lethal effects as indicated by the test results.

EDCC does not agree that there is a regulatory requirement to implement a sub-lethal TRE, Therefore, EDCC respectfully requests clarification of the regulatory basis and the historical WET test performance that would trigger this requirement.

Unless ADEQ stipulates otherwise, EDCC will initiate the development of the study plan within the next 14 days and proceed with the self directed investigation as set forth therein. EDCC welcomes the opportunity to meet with you and water division management to discuss this matter in greater detail. Please do not hesitate to contact me at (870) 863-1414 or Roland McDaniel at (501) 847-7077 should you have any questions or need additional information.

Regards,
El Dorado Chemical Company

Greg Withrow

Greg Withrow
General Manager

cc Steve Drown, Water Division Chief, ADEQ
Teresa Marks, Director, ADEQ
David Sartain, EDCC
John Carver, LSB
Chuck Nestrud, Chisenhall, Nestrud & Julian
Roland McDaniel, GBM^{c} & Associates.

ATTACHMENT 3

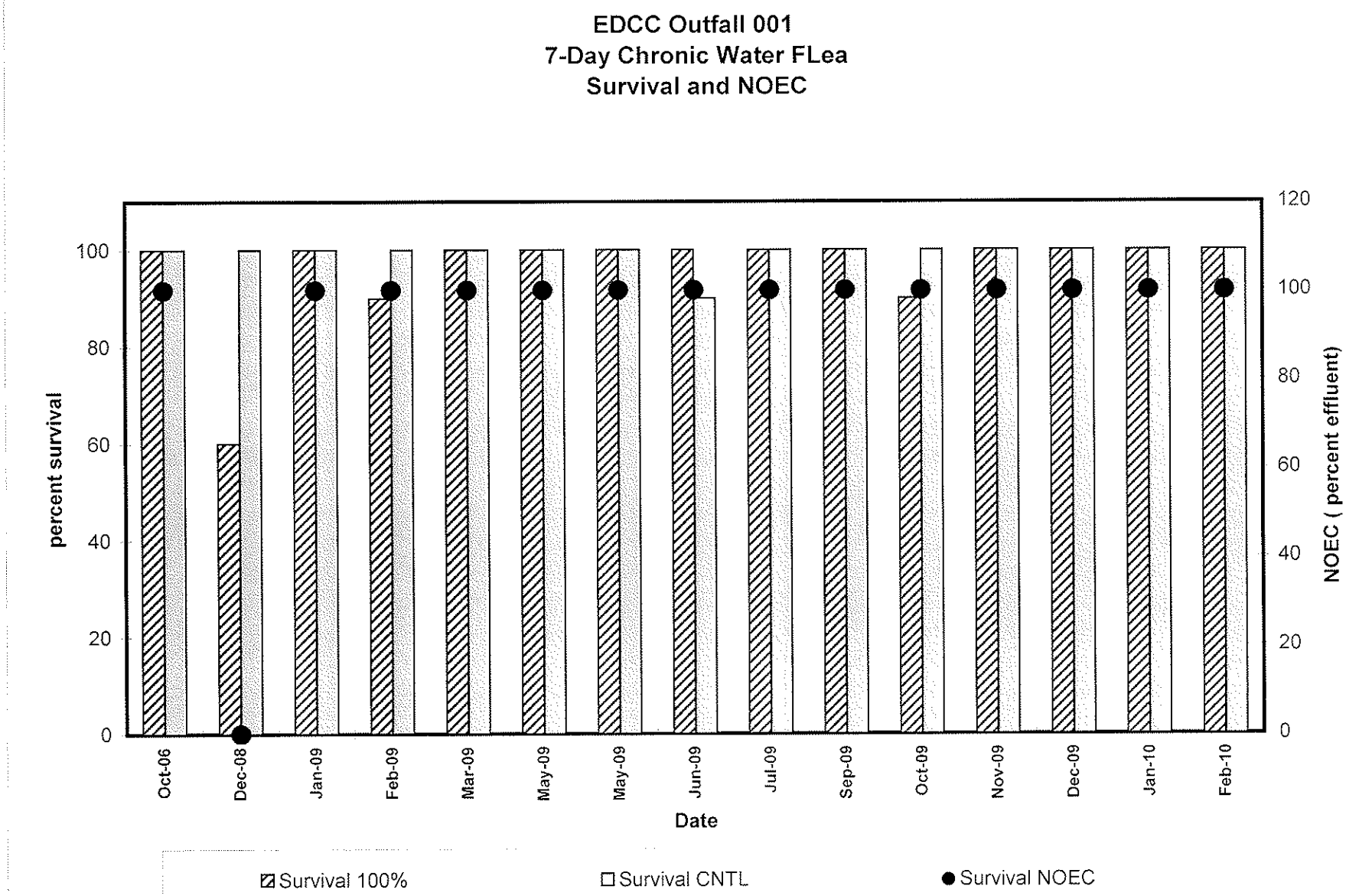
Outfall 001 Chronic Summary Table
WET NOEC For Fathead Minnow and Water Flea

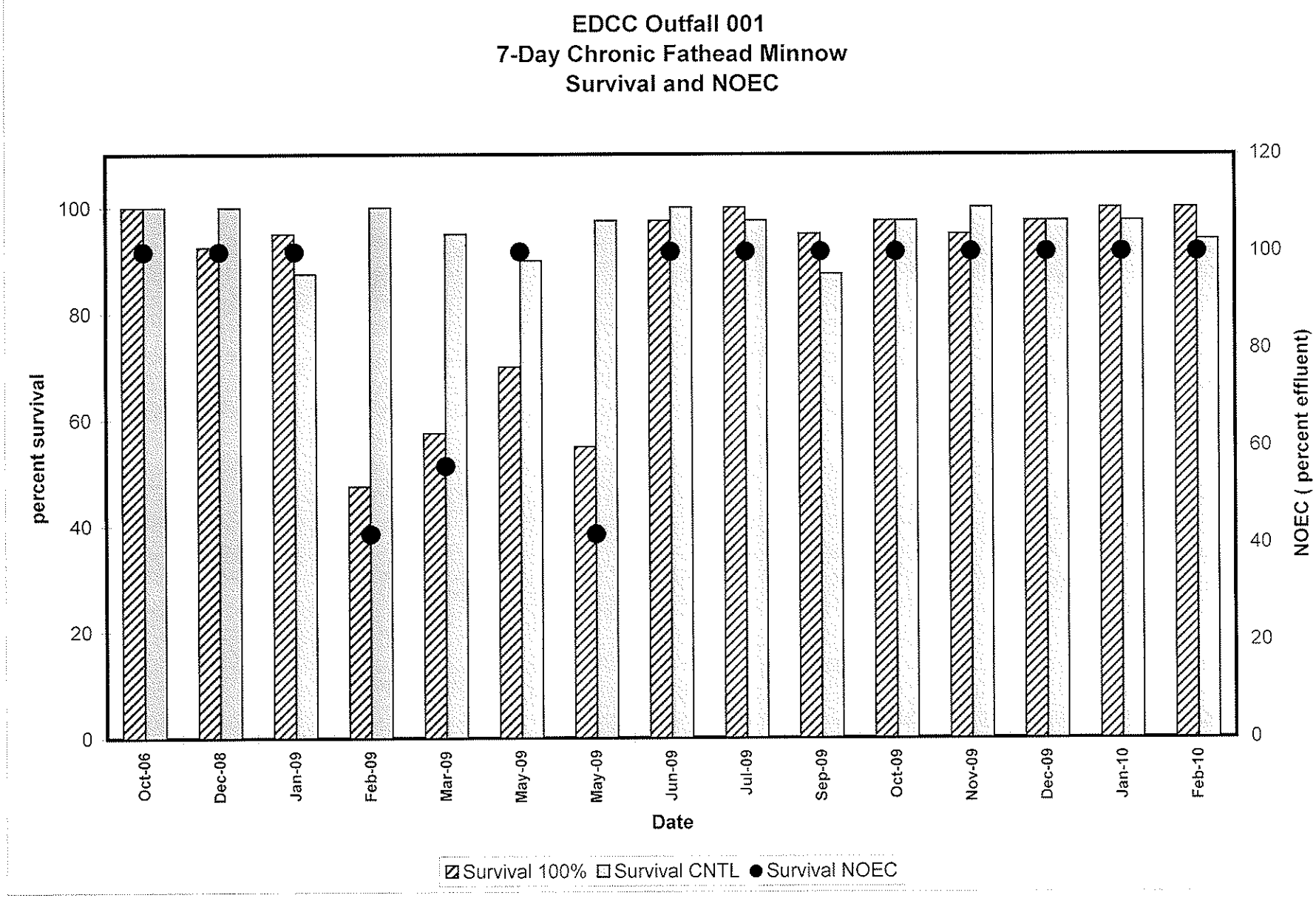
Outfall 001 Toxicity Summary (7-day chronic toxicity test).

		Ceriodaphnia dubia (Water Flea)							Pimephales promelas (Fathead Minnow)						Maximum concentrations					Min.	
		Lethality			Sub-lethal																
Report Date	Sample Date	Survival CNTL	Survival 100%	Survival NOEC	young produced CNTL	young produced in 100%	Repro. NOEC	LC50	Survival CNTL	Survival 100%	Survival NOEC	Growth CNTL	Growth 100%	Growth NOEC	LC50	Hardness	Alkalinity	Conductivity	pH	D.O.	NOTES
10/1/2006	9/18-22/2006	100	100	100	24.3	31.2	100	1.25	100	100	100	0.673	0.57	0	7.71	68	112	533	8.3	7	effluent. Growth reduced in fathead minnow when compaired to control but still 0.565 grams. But significant to < 32 % effluent exposure.
12/1/2008	12/15-19/2008	100	60	0	18.4	0	0	1.17	100	92.5	100	0.885	0.78	100	0.949	48	85	445	8.5	4.3	PASSED Fathead minnow endpoints, including the growth ,but all effluent concentrations failed lethality endpoint to Ceriodaphnia dubia. Note the DO very low.
1/30/2009	1/19-23/2009	100	100	100	19.2	7.8	0	1.62	87.5	95	100	0.6	0.72	100	6.27	40	76	450	8.2	7.6	PASSED 3 of 4 endpoints. Failed reproduction on C. dubia for critical dilution
2/28/2009	2/16-20/2009	100	90	100	16.1	18.8	100	1.41	100	47.5	42	0.78	0.46	0	7.16	44	72	455	8.8	7.9	PASSED water Flea endpoints NOEC =100%. Failed fathead minonow lethally in 100%
3/31/2009	3/16-20/2009	100	100	100	19.3	18.9	100	1.62	95	57.5	56	0.835	0.75	56	5.92	10	20	132.4	7.8	7.7	PASSED water Flea endpoints NOEC =100%. Failed fathead minonow lethally in 100%
5/1/2009	4/27-5/1/2009	100	100	100	28.4	14.4	0	1.62	90	70	100	0.615	0.48	100	6	48	92	439	8.7	5.3	PASSED 3 of 4 endpoints. Non-lethal test failure were noted for the water flea.
5/30/2009	5/11-15/2009	100	100	100	20.9	7.2	0	1.41	97.5	55	42	0.783	0.62	42	6.95	40	76	440	8.5	5	*UV treated 100% effluent recieved 81% survival and 0.687 growth, Non-lethal effects on C. dubia for all effluent concentrations, Failed lethality endpoint to P. promelas in the critical dilutions
6/30/2009	6/22-26/2009	90	100	100	22.7	6.6	0	1.54	100	97.5	100	0.983	0.82	100	2.45	40	88	414	8.2	7	PASSED 3 of 4 endpoints. Non-lethal test failure were noted for the water flea. UV treatment of 100% fathead minnow inplicated fungal infections however VU not ocmpleted on Water flea exposure.
7/31/2009	7/20-24/2009	100	100	100	27.1	8.8	0	1.41	97.5	100	100	0.88	0.85	100	6.56	36	112	395	9.8	7.4	PASSED 3 of 4 endpoints. Non-lethal test failure were noted for the water flea. UV treatment of 100% fathead minnow inplicated fungal infections however VU not ocmpleted on Water flea exposure.
9/30/2009	9/21-25/2009	100	100	100	21.2	14.4	32	1.41	87.5	95	100	0.733	0.67	100	6.37	64	80	478	8	4	were noted for the water flea. UV treatment of 100% fathead minnow inplicated fungal infections however VU not ocmpleted on Water flea exposure.
10/30/2009	10/19-23/2009	100	90	100	17.8	11.6	42	1.62	97.5	97.5	100	0.973	0.9	100	6.31	40	44	405	7.7	7.6	PASSED 3 of 4 endpoints. Non-lethal test failure were noted for the water flea.
11/30/2009	11/16-20/2009	100	100	100	19.1	18.1	100	1.54	100	95	100	0.908	0.73	0	7.38	32	48	362	7.9	7.6	PASSED 3 of 4 endpoints. Non-lethal test failure were noted for the P.promelas
12/30/2009	12/14-18/2009	100	100	100	20.6	21.8	100	1.5	97.5	97.5	100	0.858	0.93	100	1.169	32	48	354	7.9	5.2	PASSED ALL 4 endpoints
1/31/2010	1/19/26/2010	100	100	100	19.7	23.3	100		97.5	100	100	1.106	1.07	100		28	44	366	7.9	7.5	PASSED ALL 4 endpoints
2/28/2010	2/14-20/2010	100	100	100	20	22.7	100		94	100	100	0.958	1	100							PASSED ALL 4 endpoints (report not finalized, results verbal)

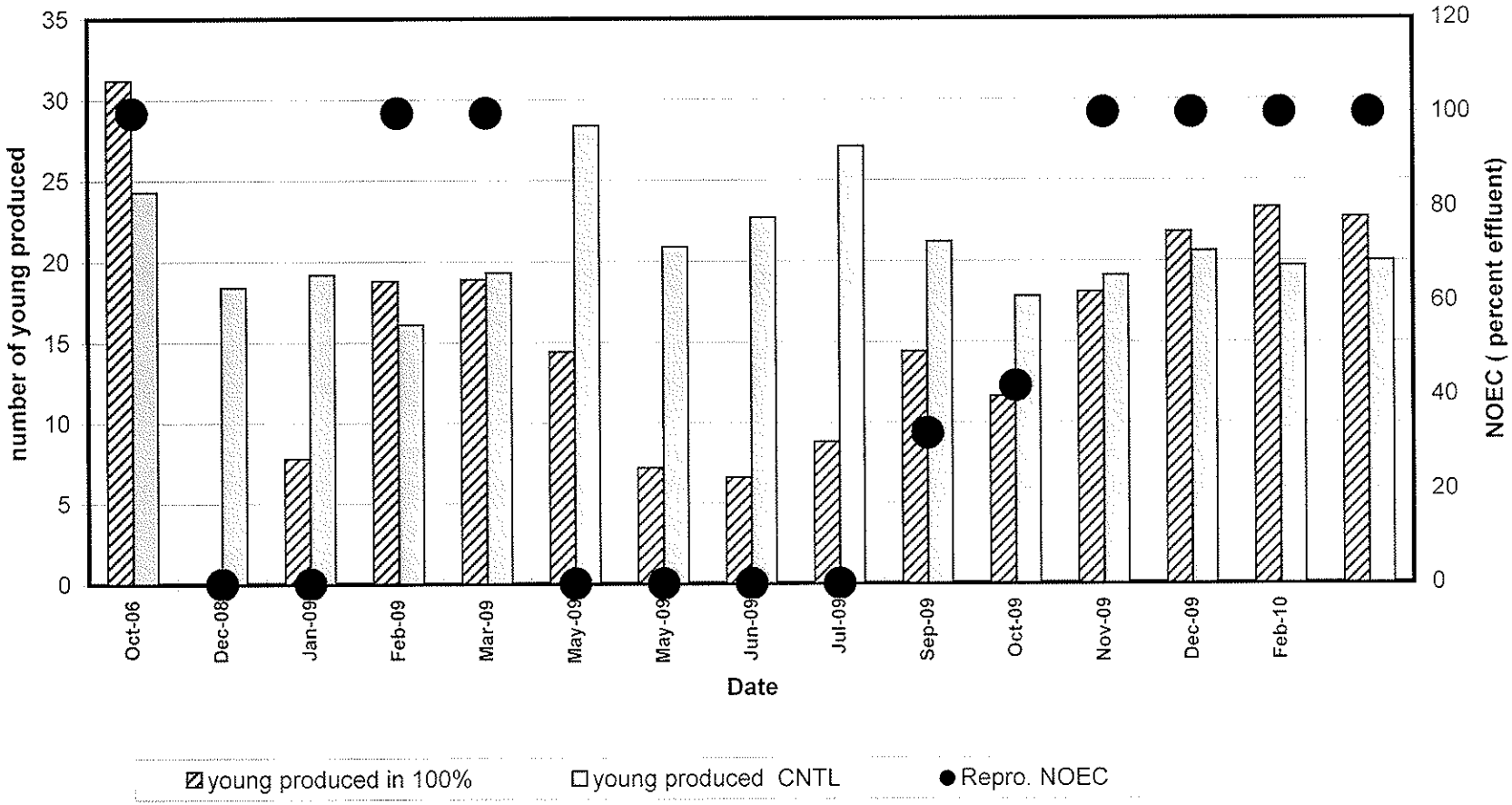
ATTACHMENT 4

Figures of WET NOEC for Fathead Minnow and Water Flea


EDCC Outfall 001
7-Day Chronic Water FLea
Survival and NOEC
percent survival
NOEC (percent effluent)
0
20
40
60
80
100
120
Oct-06
Dec-08
Jan-09
Feb-09
Mar-09
May-09
May-09
Jun-09
Jul-09
Sep-09
Oct-09
Nov-09
Dec-09
Jan-10
Feb-10
Date
Survival 100%
Survival CNTL
Survival NOEC


EDCC Outfall 001
7-Day Chronic Fathead Minnow
Survival and NOEC
percent survival
NOEC (percent effluent)
0
20
40
60
80
100
120
Oct-06
Dec-08
Jan-09
Feb-09
Mar-09
May-09
May-09
Jun-09
Jul-09
Sep-09
Oct-09
Nov-09
Dec-09
Jan-10
Feb-10
Date
Survival 100%
Survival CNTL
Survival NOEC

EDCC Outfall 001
7-Day Chronic Water Flea
Production and NOEC



EDCC Outfall 001
7-Day Chronic Fathead Minnow
Growth and NOEC