Toxicity Reduction Evaluation (TRE) Plan
El Dorado Chemical Company
NPDES Permit No. AR0000752
Pimephales promelas

August 20, 2018

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TOXICITY REDUCTION EVALUATION PLAN

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1.0 INTRODUCTION

El Dorado Chemical Company (EDCC) was issued a new National Pollutant Discharge Elimination System (NPDES) permit AR0000752 effective October 1, 2017. However, the toxicity requirements at Outfall 007 of this permit were appealed, therefore EDCC is currently operating under the modified AR0000752 permit effective April 1, 2007, for this toxicity requirement. As a condition of the NPDES permit, the facility is required to conduct routine 48-hour acute Whole Effluent Toxicity (WET) on a monthly basis (12 per year) at Outfall 007. The permit requires that the WET tests at Outfall 007 pass 100% critical dilution for both *Daphnia pulex* and *Pimephales promelas*.

Monthly WET tests were performed in 2018 (March, April), both which resulted in failures for lethality in *Pimephales promelas*. Upon realization of the second test failure, EDCC provided ADEQ notification by letter. This TRE Plan has been prepared to address these failures and fulfill WET testing related requirements found in Condition 18, Part III of the EDCC NPDES Permit.

2.0 PURPOSE OF THE TRE PLAN

One requirement of the NPDES permit is to develop and submit an acceptable Toxicity Reduction Evaluation (TRE) Plan upon receiving results that verification testing demonstrates lethal WET test failures in two or more consecutive tests. The TRE is an evaluation intended to determine those actions necessary to achieve compliance with the WET permit requirements in the EDCC NPDES Permit. A TRE is specifically defined as a stepwise process that combines toxicity testing and analyses of the physical and chemical characteristics of an effluent to identify the constituents causing WET test failures and/or determine the treatment methods which will eliminate WET test failures.

The purpose of this TRE plan is to comply with permit conditions specified in NPDES permit by providing information regarding how the TRE for the facility will be conducted. The TRE plan should not be considered comprehensive or encompass all possible activities that could be completed as part of the process. The TRE plan provides an overview of the specific activities anticipated for the TRE, a general sampling plan, a quality assurance plan, project organization, and a schedule for completing the TRE.

3.0 BACKGROUND

The NPDES permit for EDCC (AR0000752) requires the facility to conduct WET testing on a monthly basis at Outfall 007. This requirement began has been on-going since the permit modification effective date of April 1, 2007. The permit requires that WET tests be conducted using fathead minnow (a vertebrate) and the water flea (an invertebrate) as test organisms. The active NPDES permit requires acute WET testing be completed utilizing a critical No Observed Effect Concentration (NOEC) dilution of 100% effluent. Any WET test result with a NOEC less than the applicable critical dilution is considered a WET test failure.

Discharges from Outfall 007 consist of storm water only. Process waters are not discharged from the outfall.

3.1 *Pimephales promelas* (fathead minnow)

EDCC has completed five WET tests (January, February, March, April, June) on the *Pimephales promelas* (fathead minnow) during 2018 as required by the permit. The first two tests (January and February) passed the lethality (survival) for fathead minnow at the 100% critical dilution. However, the following two tests (March and April) failed the lethality for fathead minnow at the 100% critical dilution. A subsequent test completed in June 2018 (Outfall 007 did not have sufficient flow to collect a sample during May 2018) again passed the lethal endpoint. A detailed review of the available WET test reports was conducted in attempt to determine attributes related to the test failures.

3.2 *Daphnia pulex* (Water flea)

Like the fathead minnow, EDCC has completed five WET tests on the *Daphnia pulex* (water flea) during 2018. All tests except April passed successfully with a NOEC of 100%. Based upon these results, there is no need at this time to pursue TRE efforts using the water flea. However, should future WET tests result in routine WET test failures of the water flea, the invertebrate species can be included in the TRE effort.

4.0 TRE APPROACH

4.1 TRE Objective

The objective of the EDCC TRE is to identify the causative agents of the toxicity demonstrated in the failed WET tests and identify and implement corrective actions. Obtaining of this goal will provide compliance with the existing permit conditions governing the monitoring and reporting of the WET tests required by the NPDES permit for the fathead minnow endpoint (lethality). This will be accomplished by conducting a stepwise program of investigation that includes evaluation of the Outfall 007 drainage area and material management practices, toxicity testing, and analyses of physical/chemical effluent characteristics. Sampling and analysis will focus on the lethal endpoint of the fathead minnow, but confirmation testing using the water flea will also be conducted during routine monthly testing to ensure continued compliance with the water flea WET limits.

4.2 TRE Approach and Specific Activities

The basic approach to achieve the TRE objective previously stated is outlined in the following sections. Sound scientific judgment will be employed at each step of the process. Therefore, based on the results of the data collected and analyzed, each specific activity may not be conducted in the order presented in this plan, nor will each activity necessarily be conducted if determined to be unnecessary to reach the TRE objective.

Based on the limited WET history at Outfall 007, considering recent changes/reduction of the overall Outfall 007 drainage area, it is possible that effluent toxicity as demonstrated by WET test failures will not be present during the TRE or may only be intermittent. Detailed toxicity identification evaluation efforts will not be completed until routine WET tests exhibit a WET test failure at the 100% critical dilution. EDCC will coordinate with a toxicity testing laboratory capable of developing procedures and completing specific toxicity identification evaluation testing.

4.2.1 Toxicity Identification Evaluation (TIE) and Characterization

It is EDCC's current belief that the fathead minnow toxicity observed during the months of March and April is associated with ammonia.

Given the recent historical WET test results (as summarized in Section 3 above), TIE manipulations associated with the identification and characterization portion of the TRE will be focused on the fathead minnow. As described in the Phase I TIE manual, the initial characterization will consist of multiple manipulations and will generally follow procedures described in EPA's Phase I Characterization Procedures (EPA/600/6-91/003). Phase II and Phase III Characterization and Confirmation Procedures from EPA/600/R-92/080 and EPA/600/R-92/081 will be generally followed as warranted depending on results of the Phase I characterization step.

Examples of possible TIE manipulations include:

1) Degradation tests, designed to determine how toxicity changes (degrades) over time;
2) pH adjustment and graduated pH tests, used to determine the effect of pH adjustment on toxicity;
3) Filtration tests, to develop an association between toxicity and filterable materials;
4) Aeration/pH adjustment tests, to determine if toxicity is caused by oxidizable or volatile substances (including those that can be made to oxidize or become volatile through change in pH;
5) Solid phase extraction/pH adjustment tests, these manipulations are used to determine toxicity that can be attributed to non-polar-organic compounds (or those that can be made non-polar through pH changes);
6) Zeolite media filtration test, to determine if toxicity is caused by ammonia;
7) Oxidant reduction tests, to determine if toxicity can be attributable to oxidants; and
8) EDTA chelation test, for evaluation of potential heavy metal toxicity.

4.2.2 Assembly of Pertinent Facility Information

Information associated with the EDCC facility will be obtained and reviewed to assess the potential for facility materials or operations to cause or contribute to toxicity. As the TRE advances, the information obtained in this step will be relied on for more in-depth analyses. Informational categories include:

1) Facility configuration and process information: The general facility configuration, operational scenario's that could potentially be contributing sources to the Outfall 007 discharge, the 007 storm water conveyance, and inspection records will be obtained and reviewed to establish facility baseline

and anticipated operating configuration and to assess whether operations could contribute to, or be used to mitigate effluent toxicity.

2) Facility chemical usage: MSDS sheets on chemicals used in the facility will be assembled and reviewed. Chemical use records will be examined and evaluated for the potential of getting into the Outfall 007 drainage basin.
3) Facility sampling data: Monitoring information including NPDES outfall monitoring, facility process sampling and/or other storm water data collected by the facility will be reviewed as needed to evaluate the potential to assist in the TRE process. Facility WET tests results and associated analytical data will be further reviewed.
4) Housekeeping and best management practices: Facility housekeeping pollution prevention records will be examined to evaluate their potential for effect on effluent toxicity. Similar to facility operating procedures, housekeeping, and best management practices will be reviewed to evaluate the opportunity for effluent toxicity mitigation.

4.2.3 Source Identification

Depending on the results of the facility data review, and in consideration of the results of the TIE and characterization process, the next step in the TRE process will likely be an evaluation of the storm water drainage area for potential surface runoff sources entering the Outfall 007 system. As previously noted, the Outfall 007 drainage area has been reduced in recent years and currently the only contributing source to the 007 discharge is storm water. However, shallow groundwater does occur in the area of EDCC. Groundwater, as well as other sources, considered allowable non-storm water discharges according to the Arkansas General Industrial Storm Water Permit, will be investigated for its presence and evaluated as a potential contributing source to Outfall 007.

The source identification step is designed to identify the specific source of toxicity to the final effluent. As warranted, this step may involve a more thorough review of the documents and information obtained as described in Section 4.2.2 or may include sampling, toxicity testing and analyses of smaller sub-drainage basins contributing to the Outfall 007 discharge. Source identification efforts can typically consist of the following steps, as described in EPA's Generalized Industrial TRE Methods (EPA6002-88/070):

1) Setting initial source search from the evaluation of previously collected data;

2) Collection of samples from upstream drainage areas (influent);
3) Development of chemical-specific analyses for tracking sources;
4) Evaluation of treatment effects on identified toxicants;
5) Use of a bench scale model to simulate degradation;
6) Track toxicity to sources; and
7) Characterization of toxicity in the suspect source.

4.2.4 Management/Treatment Considerations and Housekeeping Optimization

The next phase of the TRE includes an evaluation of the management/treatment considerations and housekeeping optimization within the Outfall 007 drainage basin. Facility operations and customary practices related to the housekeeping optimization will be examined in conjunction with performance data obtained as described in Section 4.2.1 to assess the opportunity for management/treatment considerations and operational adjustments to mitigate final effluent toxicity. Opportunities to correct final effluent toxicity will be carefully examined in light of the potential sources determined as described in 4.2.3. The information developed from an evaluation of contributing sources and housekeeping optimization is particularly useful when designing and implementing toxicity corrective actions whether the action is source reduction or potential storm water treatment alternatives. Facility-specific management practices, where warranted, will be written where it appears that the opportunity for operational adjustments may successfully meet the TRE objective.

There is no active treatment system in place for Outfall 007 as it contains only storm water runoff. Due to the nature of the discharge, treatment options considered during the TRE may include BMPs typically utilized for storm water runoff. As identified in EPA's Generalized Industrial TRE Methods (EPA6002-88/070) these may include:

- General facility cleanliness/tidiness;
- Facility spill prevention and control;
- Materials handling operations, including loading stations, on-site transport, piing and valve assemblies;
- Waste handling and disposal; and
- Run-on/off control.

An important component of the overall assessment of sources and potential housekeeping optimization involves a thorough understanding of the raw products, material handling, and chemicals used at the facility. Materials / raw products exposed to storm water that reach Outfall 007 are of particular importance.

Management/treatment considerations and housekeeping optimization will be conducted in association with the review of the source identification within the drainage basin.

4.2.5 Toxicity Reduction Method Evaluation

The selection process for choosing the toxicity reduction method or combination of methods that achieve the TRE project objective will consider a number of important factors including:

1) The probability of long-term effluent toxicity reduction,
2) Cost,
3) Fit with long-term facility goals,
4) Implementation and operational ease or complexity, and
5) Adaptability to changing regulations.

Potential solutions will be compared on a cost-benefit basis considering these factors, and perhaps others as necessary. The solution that best fits the facility's needs and will meet the TRE objective will be selected for implementation.

4.2.6 Post Implementation Confirmation

EDCC will develop a post-implementation monitoring schedule sufficient to confirm final effluent toxicity reduction as specified in the TRE Plan objective.

5.0 SAMPLING PLAN

5.1 General Statement and Methods

A sampling plan for conducting a TRE should be specific enough that there is confidence that the samples will be collected, handled, preserved and transported correctly so that there will be a high degree of confidence on decisions made on the basis of those samples; yet the plan must be general enough to be modified as conditions warrant during the TRE.

For of all routine samples: the collection, preservation, containers, holding times and analyses will follow EPA methods at 40 CFR Part 136, as amended. Toxicity testing completed for the TIE shall follow typical quality assurance guidelines as outlined in *Methods for Measuring the Acute Toxicity of Effluents and Receiving Waters*

Using Freshwater and Marine Organisms (EPA, 1993). If metals toxicity is suspected, Clean Techniques Sampling following EPA Method 1669 will be conducted for samples subjected to metals analyses.

5.2 Basic Sampling Plan

TIE efforts will only be undertaken when routine WET testing demonstrates the presence of effluent toxicity. During the TRE period, sampling efforts for routine monthly WET tests will also include collection of additional sample to conduct TIE and/or additional chemical analyses if toxicity is exhibited (i.e. 48-hour lethality). Samples will be collected at Outfall 007 in the location used for NPDES permit requirement purposes. Samples for TIE analysis shall be collected in sufficient volume and in the containers required by the laboratory for completion of the Phase I characterization. Additionally, samples will be collected concurrently for analysis of NPDES permit required parameters. If needed, samples for metals will be collected using clean techniques by personnel wearing latex gloves in a manner designed to prevent sample contamination (e.g. modified clean sampling based on Method 1669). Volumes to be collected will be calculated on a case by case basis in advance of the sampling event to ensure sufficient water is collected for all foreseeable TIE/TRE purposes. When there is a question regarding sample volume, additional sample volume will be collected.

In addition to samples collected for analyses, *in-situ* measurements of physiochemical parameters will also be conducted during select sampling events. Multiple measurements will be obtained during the course of the collection of composite samples where feasible. The parameters of dissolved oxygen, pH, conductivity, and temperature will be measured.

5.3 TIE Confirmation Sampling

Should the Phase I toxicity characterization identify a potential source of toxicity, the testing must be repeated using another set of effluent samples from a new sampling event. A minimum of two series of Phase I TIEs should be conducted to verify similar potential source of toxicity. If the Phase I TIEs do not return similar results, then additional sampling events will be required for Phase I toxicity characterization. All methods and procedures described in Section 5.2, Basic Sampling Plan, will be followed for TIE confirmation sampling.

5.4 Watershed Sampling

Following the initial Phase I TIE test's identification of the potential source of toxicity (i.e. pollutant) and follow-up pollutant confirmation TIE sampling event, an evaluation of the storm water drainage area will be completed in an effort to delineate all surface runoff sources entering the Outfall 007 system (detailed in Section 4.2.3). Once a delineation of runoff sources has been completed, source water sampling/analysis will take place to investigate the presence of the potential causing toxicity.

6.0 QUALITY ASSURANCE PLAN

Trained personnel will be conducting the sampling, toxicity testing, and data analysis during the study. The laboratory conducting all analytical testing and toxicity testing will be an ADEQ certified laboratory or hold a national certification (NELAP or equivalent) with experience in the respective areas. Records will be kept for all samples collected, flows, tests completed, and data analyzed. Field check sheets will be completed for days requiring multiple samples and multiple sampling locations to ensure that all necessary samples are collected. Notes will be made of any unusual observations occurring during each sample run such as water color, odors, and noticeable facility process changes. All record sheets, calibration logs, field notes, and other study documentation will be reviewed for completeness and accuracy by the Project Manager.

All samples collected will be placed in the appropriate clean containers supplied by the laboratory. Each sample container will be labeled with the sample I.D., date, time, and initials of the collector(s). Samples will be placed in ice chests for delivery to the laboratory. Chain of Custody (COC) forms that include information on each sample delivered to the laboratory for analysis will be completed. Each COC form will be signed by each person handling the samples from collection in the field to receipt in the laboratory. The COC form will include all required information and will be checked for completeness prior to submission of samples to the laboratory.

Field duplicate samples and field blanks for metals and organics will be collected at a minimum frequency of 10% of the samples collected for the entire study. Additionally, a minimum of one duplicate sample and one field blank sample will be collected during each sampling event.

Duplicate samples consist of a second sample taken immediately following the test sample from the same location to be used to measure variability in the test media and the repeatability of the sampling techniques. Duplicate samples shall vary by no

more than 30% relative percent difference (RPD) or the sample results will be considered suspect. In the event, an RPD exceeds 30% the Project Manager will investigate the incident to determine the cause of the exceedance and what action, if any, is necessary.

Field blanks will consist of a sample of ultra pure laboratory water poured into the appropriate sample container in the field to simulate all possible contaminant exposures. If a field blank is found to be contaminated, an analysis will be conducted to determine the potential impact of the contamination on the results of the associated batch of samples. The Project Manager will determine the appropriate course of action from the results of the analysis.

The laboratory will validate analytical data by use of blanks, laboratory controls, spikes, and spike duplicates. Laboratory blanks measure the amount of each respective analyte contributed from the analytical procedure. A laboratory blank is considered out of control for a specific analyte if the value exceeds the higher of either the minimum detection limit (MDL) or five percent of the measured concentration in the sample. A laboratory control measures the ability of the laboratory to recover an analyte from a blank matrix. The laboratory spike sample is used to evaluate the laboratory's ability to recover an analyte in the sample matrix. The QC exceedance criteria for laboratory controls and spikes is based on upper and lower control limits derived from the laboratory's method specialized limits. The laboratory spike duplicate is used to evaluate the laboratory's precision (ability to attain similar analytical results from duplicate samples). An RPD is calculated for the spike and spike duplicate. The RPD is compared to method specialized limits to determine QC exceedance. Any significant excursion from one of the QC parameters will result in a repeat of the analysis in question following an investigation by the laboratory as to the cause of the QC excursion and a report of the corrective actions taken.

Toxicity testing shall include minimum control survival of 80% and an acceptable level of organism performance in reference toxicity testing. It should be emphasized that toxicity tests with control survival of 70 to 80% may still contain valuable data that may be used towards characterization of effluent toxicity, but such data must be used with caution. Additional requirements specific to TIEs (EPA, 1991) include the addition of a baseline toxicity test to ensure toxicity exists in the original sample and method controls in which laboratory dilution water is treated identical to the test treatment and run parallel to the test treatment to ensure that the test treatment itself is not causing toxicity.

7.0 PROJECT ORGANIZATION

The following personnel and roles are currently contemplated for the EDCC TRE:

Project Sponsors	Delmar R. Reppond; General Manager El Dorado Chemical Company Responsible for overall project completion and coordination with ADEQ.
Project Management	David Sartain, Environmental Coordinator Les Morgan, Environmental Technician El Dorado Chemical Company Responsible for implementation of TRE Plan, routine facility operations, routine WET testing sampling and NPDES compliance. Will provide support for TRE specific sampling and analyses as may be required.
Consulting Services:	Kyle Hathcote, Project Manager Jonathan Brown, Senior Scientist GBM^{c} & Associates Provide technical support to EDCC personnel; including but not limited to, sampling strategies, data evaluation, and interpretation, specialized sampling techniques.
Routine Sample Collection:	EDCC Environmental Technicians Responsible for collection of final treated and upstream wastewater samples to be utilized in all TIE efforts in accordance with QA/QC provisions of the sampling protocols.
Laboratory services:	Bio-Analytical Laboratories and/or American Interplex Corporation Laboratories (routine WET testing), and American Interplex Laboratories and/or Great Lakes Environmental Center (GLEC) of Columbus, Ohio (specialized TI/RE manipulations) and TRE Phase II and TRE Phase III manipulations, as required.

8.0 PROJECT SCHEDULE

The effective NPDES permit for the facility specifies that a final report on toxicity reduction activities shall be submitted no later than 28 months from the date of lethality confirmation. According to ADEQ records, the confirmation of WET test failure occurred on April 9, 2018, therefore the 28-month TRE schedule concludes in August 2020. The quarterly reporting schedule established by the approved TRE Plan will begin as specified by ADEQ upon TRE Plan approval. During the course of the TRE, individual activities may overlap or may be completed sequentially as dictated by the initial stages of the TRE activities. The quarterly reports, to be submitted throughout the TRE project, will to be submitted quarterly with Discharge Monitoring Reports in the months of January, April, July, and October. For the EDCC TRE project, the initial activities report will be submitted in October 2018. The anticipated schedule for the TRE is shown in Table 1, however specific TIE activities will be initiated only after confirmed current toxicity, and the TRE Plan has been approved by ADEQ.

Table 1. TRE Plan Schedule

Activity	Date	
	Start	**Complete**
Submit TRE Action Plan	--	July 2018
Receive plan approval from ADEQ	--	August 2018
Assemble facility information	July 2018	August 2018
Baseline toxicity and analytical testing	August 2018	March 2020
Toxicity identification and characterization*		
Initial TIE (actual date depends on WET test failures)	August 2018	March 2020
Confirmation TIE	August 2018	March 2020
Source identification*	August 2018	March 2020
Treatment considerations and chemical optimization	August 2018	March 2020
Evaluation of toxicity reduction methods	March 2020	July 2020
Post implementation confirmation	March 2020	July 2020
Submit activity reports quarterly (Jan/Apr/July/Oct)	October 2018	Quarterly Jan/Apr/July/Oct (2018 -2020)
Submit final TRE report	--	August 17, 2020

*= Activity to be initiated after confirmation of toxic effluent as confirmed by WET test failure. Additional sample volume will be collected during routine WET sampling for subsequent TIE analysis if toxicity is confirmed.