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August 22, 2013

Mary Barnett, Ecologist
Water Division
Arkansas Department of Environmental Quality
5301 Northshore Drive
North Little Rock, AR 72118-5317

Reference: Georgia-Pacific LLC
Crossett Paper Operations
NPDES Permit # **AR0001210**
Final Sub-lethal TRE Report

Dear Ms. Barnett:

Georgia-Pacific LLC (GP) originally submitted a Toxicity Reduction Evaluation (TRE) Action Plan on July 12, 2011, after sub-lethal effects were demonstrated in three consecutive sub-lethal Whole Effluent Toxicity (WET) tests for *Ceriodaphnia dubia (C. dubia)*. This report is the Final Report on TRE activities, as required by Part II, Condition 15, Paragraph 5 of NPDES Permit #AR0001210.

During the TRE process (August 2011 through August 2013), the testing frequency was accelerated to monthly for *C. dubia* as set forth in the approved TRE plan.[1] During this period the fathead minnow passed both the lethality and sub-lethal endpoints in all routine WET tests. In addition the During this period, *C. dubia* consistently passed the lethality endpoint in the critical dilution (80%), but as set forth in more detail below, sporadic sub-lethal effects were observed (i.e., *C. dubia* reproduction test).

During the 11 month period immediately following confirmation of sub-lethal effects, which included tests in May 2011 and July 2011 through March 2012, only the December 5, 2011 test demonstrated sub-lethal toxicity. Thus, only one TRE investigation could be undertaken in this time period, which made up a significant portion of the 28 month investigation period allowed by

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[1] During this time period, the fathead minnow passed both the lethality and sub-lethal endpoints in all routine WET tests. Therefore, there TRE Action Plan did not cover fathead minnows and testing frequency for fathead minnows has remained bimonthly, in accordance with NPDES Permit # AR0001210.

the permit. A series of treatment manipulations were performed on the remaining sample collected in conjunction with the December 5, 2011 test, which are outlined in Table 1 below. It was noted that toxicity was significantly reduced by the ferric chloride treatments during the investigation process.

TABLE 1.
Percent Effect to C. dubia Reproduction for Untreated and Treated Effluent
December 2011

Water/Test Date	Average Neonates per Female	Percent Inhibition
River Water 12/6/11	28.1	NA
80% 001 Effluent	18.2	35[2]
River Water 12/16/11	25.3	NA
80% 001 Effluent[3]	17.5	31[2]
80% GAC[4] treated 001	20.8	18[2]
80% EDTA[5] treated 001	15.5	39[2]
80% pH reduction treated 001	10.1	60[2]
80% Ferric/Floc treated 001	23.2	8
80% Ferric/Foam Fractionated treated 001	23.7	6

Sub-lethal results during monthly testing in 2012 were more sporadic. During the 2012 calendar year, the effluent demonstrated sub-lethal toxicity below permit levels in six of twelve months tested (April, May, June, August, November and December), but never more than three consecutive months. Two of three *C. dubia* retesting events (April and August 2012) demonstrated either a reduction in baseline toxicity by aging or toxicity reduction by ferric chloride. The December 2012 test appears inconsistent with the other sub-lethal failures because effluent samples may have had abnormally high ammonia levels, and we believe this is the reason for the sub-lethal toxicity noted for the December 2012 testing event.

After reviewing the toxicity data generated as part of the TRE, it appears that toxicity may have a cyclic pattern associated with the season generally from December through May. However, we have not been able to make a definitive determination because the TIE results have been inconsistent and inconclusive in determining an exact cause. It is possible that the sub-lethal effects that were observed are due to a combination of factors. Very limited data has been collected which indicates that Quaternary Ammonium surfactants have increased. Analysis of the testing data indicates that increased total suspended solids (TSS) and/or increased biochemical oxygen demand (BOD) levels in the treated effluent tend to occur during the same general period as increased sub-lethal effects, from December through May, although a correlation has not been established.

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[2] Impaired compared to river water control.
[3] 12/16/11 effluent sample used is a composite of the same samples used for the 12/6/11 test.
[4] GAC = Granular activated carbon.
[5] EDTA = Ethylene diamine tetraacetic acid

Control Mechanisms and Schedule of Implementation

In response to the TRE findings, GP plans to implement the following control measures:

1. The facility will continue to collect surfactant data on all WET samples collected for the next several months to further evaluate if there may be a potential correlation.

2. Since a general increase in BOD and/or TSS levels in the season of December through May may coincide with sub-lethality, GP will evaluate ways to further optimize treatment during this time period to improve BOD and TSS removal efficiencies.

3. The facility has passed 3 consecutive sub-lethal tests since the last failure in May 2013. Due to the seasonality of the sub-lethal effects, we plan to suspend monthly sub-lethal testing now and resume from November 2013 through June 2014. In the interim period, we will conduct WET tests for *C. dubia* bimonthly as required by the permit. Should the time period of November through June demonstrate no further sub-lethal effects, we would consider the measures taken as sufficient and would revert to our normal WET testing schedule.

4. In addition to the control mechanisms described above, we note that the facility has recently stopped burning Tire Derived fuel (TDF) in the power boilers and a significant decrease in effluent zinc concentrations has occurred. Certain metal concentrations can of course have an effect on sub-lethal toxicity for *C. dubia*. We will continue to monitor zinc concentrations in accordance with the permit monitoring requirements and evaluate those results in relation to *C. dubia* WET results.

We will contact you once you have had a chance to review this report to discuss these actions. If you have any questions or need additional information prior to this, please feel free to contact me at (870) 567-8144 or by email at james.cutbirth@gapac.com.

Sincerely,

James W. Cutbirth

James W. Cutbirth
Environmental Services Superintendent