Georgia-Pacific

Georgia-Pacific Crossett LLC
Consumer Products

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April 29, 2024

Mary Barnett
Ecologist Coordinator
Arkansas Energy and Environment
5901 Northshore Drive
North Little Rock, AR 72118-5317

RE: Toxicity Reduction Evaluation Action Plan – Final Report
NPDES Permit AR0001210; AFIN 02-00013

Dear Ms. Barnett:

Please find attached the Final Report (which includes data from the First Quarter of 2024) as required by the Toxicity Reduction Evaluation (TRE) Action Plan for Georgia-Pacific Crossett LLC, NPDES Permit AR0001210 submitted on March 31, 2022.

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

If you have any questions or need additional information, please contact Sarah Ross, our Environmental & Compliance Leader, at (870) 415-6363 or Sarah.Ross@gapac.com .

Sincerely,

Deborah Coduto
Vice-President of Manufacturing

Final TRE Activities Report

A Toxicity Reduction Evaluation (TRE) Action Plan was submitted on March 31, 2022, after confirming persistent sub-lethal effects of Whole Effluent Toxicity (WET) tests for *Ceriodaphnia dubia*, as required by Part II, Condition 15, Paragraph 5 of NPDES permit number AR0001210. As per the plan, the mill began conducting monthly WET testing for *Ceriodaphnia dubia* in an attempt to capture episodes of sub-lethal toxicity after persistent toxicity was confirmed in December of 2021.

There were no episodes of toxicity noted during the first quarter of 2024; therefore, no additional Toxicity Identification Evaluation (TIE) manipulations were conducted this monitoring period. Results of all tests conducted during the TRE period have been summarized in the table below:

	NOEC Value			
	Fathead Minnow		*C. dubia*	
	Lethality	Sub-Lethality	Lethality	Sub-Lethality
January 2022	80%	80%	80%	80%
February 2022	Not tested	Not tested	80%	80%
March 2022 (TIE initiated)	80%	80%	80%	80%
April 2022	Not tested	Not tested	80%	80%
May 2022	80%	80%	80%	80%
June 2022	Not tested	Not tested	80%	<25%
July 2022	80%	80%	80%	<25%
August 2022	Not tested	Not tested	80%	60%
September 2022	Not tested	Not tested	100%	100%
October 2022	80%	80%	80%	80%
November 2022	80%	80%	80%	80%
December 2022	Not tested	Not tested	80%	80%
January 2023	80%	80%	80%	80%
February 2023	Not tested	Not tested	80%	80%
March 2023	80%	80%	80%	80%
April 2023	Not tested	Not tested	80%	80%
May 2023	80%	80%	80%	<25%
June 2023	Not tested	Not tested	80%	80%
July 2023	80%	80%	80%	80%
August 2023	Not tested	Not tested	80%	80%
September 2023	80%	80%	80%	80%
October 2023	Not tested	Not tested	80%	80%
November 2023	80%	80%	80%	80%
December 2023	Not tested	Not tested	80%	80%
January 2024	80%	80%	80%	80%
February 2024	Not tested	Not tested	80%	80%
March 2024	80%	80%	80%	80%

Because there have only been four (4) episodes of sublethal toxicity since beginning the TRE, there have been limited opportunities to conduct TIE manipulations. Toxicity seemed to only be observed during periods of significant algal blooms in the Aeration Stabilization Basin (ASB). Additional algae, cyanobacteria, and associated toxin data was collected for samples collected in July 2022, August 2022 and May 2023 when sublethal toxicity was present. Additional background data was collected for passing tests from June 2023 through December 2023. The results are summarized in the table below.

Sample Date	**WET Test Results**	**Toxins MCs/NODs[1] (ng/mL)**	**Potentially Toxigenic Cyanobacteria[2]**
22-Jul	*C. dubia* NOEC sub-lethal <25%	0.97	*Limnospira, Planktothrix, Microcystis, Anagnostidinema*
22-Aug	*C. dubia* NOEC sub-lethal 60%	0.58	*Limnospira, Planktothrix, Microcystis, Anagnostidinema, Raphidiopsis, Dolichospermum*
23-May	*C. dubia* NOEC sub-lethal <25%	13.4	-
23-Jun	No Toxicity	0.77	*Microcystis, Planktothrix, Limnospira, Pseudoanabaena*
23-Jul	No Toxicity	3.6	*Microcystis* spp, *Limnospira, Pseudoanabaena, Planktothrix, Oscillatoria*
23-Aug	No Toxicity	4.9	*Microcystis* spp, *Limnospira, Planktothrix, Pseudoanabaena*
23-Sep	No Toxicity	1.6	*Microcystis* spp, *Planktothrix, Limnospira, Raphidiopsis*

23-Oct	No Toxicity	ND	*Microcystis* spp, *Limnospira, Planktothrix*
23-Nov	No Toxicity	1.07	*Microcystis, Limnothrix, Planktothrix, Pseudoanabaena*
23-Dec	No Toxicity	2.33	*Limnothrix, Pseudoanabaena, Microcystis* spp, *Limnospira, Pseudoanabaena*

[1]Microcystins/Nodularins; [2]Listed in order of decreasing abundance; ND = Not Detected

A third-party was contracted to review all data associated with these tests and provide feedback on the likelihood that the observed toxicity could be caused by algae, cyanobacteria or associated toxins. An excerpt of the report is quoted below, and the full report has been attached for your review.

"Of note in this data review was the abundance of the filamentous cyanobacterium *Planktothrix* sp. at the times sub-lethal toxicity (impaired reproduction) to *Ceriodaphnia dubia* was detected in WET tests. It is hypothesized that the occurrence of *Planktothrix*, a microcystin producer (Pancrace et al. 2017), could have contributed to the observed toxicity. While MCs/NODs were detected at times when no toxicity was observed in WET tests, the potency and susceptibility to microcystin variants can differ, and thus toxicity may not be directly related to microcystin concentration. Additionally, it is plausible that the filamentous nature of *Planktothrix* could inhibit the filter feeding ability of *C. dubia* in WET tests, resulting stress to the test organism."

While the cause could not be determined conclusively, there is reason to believe that the source of toxicity may be related to naturally occurring processes. No significant sources of toxicity have been identified from current mill process areas. Surfactant analysis of the effluent samples did not identify anything of concern. In October of 2019 the mill permanently shut down the pulpmill, chemical recovery area and bleach board business. The current flow rate through the treatment system is less than 25% of the pre-shutdown flowrate resulting in a retention time of approximately one month. Since the shutdown, influent loading to the treatment system has been significantly reduced. The increased retention time allows enhanced treatment of biodegradable components of the effluent stream; however, the improved water quality has also resulted in algal blooms.

The mill will continue to monitor and report as required but no feasible options have been found for algae reduction in our aeration stabilization basin (ASB) at this time.

COPPERHEAD
ENVIRONMENTAL CONSULTING

MEMORANDUM

Date: April 23, 2024

To: Diane Rosseter, Rachel Johnson, Sarah Ross

From: Matt Huddleston, Ph.D.

Subject: Georgia-Pacific Crossett Mill Outfall 001 Data Review

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Algae, cyanobacteria, and associated toxin data from Georgia-Pacific's Crossett Mill Outfall 001 were evaluated in combination with Whole Effluent Toxicity (WET) test results from the same period, 2022-2023. Results are summarized in the table below.

Sample Date	WET Test Results	Toxins MCs/NODs[1] (ng/mL)	Potentially Toxigenic Cyanobacteria[2]
22-Jul	*C. dubia* NOEC sub-lethal <25%	0.97	*Limnospira, Planktothrix, Microcystis, Anagnostidinema*
22-Aug	*C. dubia* NOEC sub-lethal 60%	0.58	*Limnospira, Planktothrix, Microcystis, Anagnostidinema, Raphidiopsis, Dolichospermum*
23-May	*C. dubia* NOEC sub-lethal <25%	13.4	-
23-Jun	No Toxicity	0.77	*Microcystis, Planktothrix, Limnospira, Pseudoanabaena*

23-Jul	No Toxicity	3.6	*Microcystis* spp, *Limnospira, Pseudoanabaena, Planktothrix, Oscillatoria*
23-Aug	No Toxicity	4.9	*Microcystis* spp, *Limnospira, Planktothrix, Pseudoanabaena*
23-Sep	No Toxicity	1.6	*Microcystis* spp, *Planktothrix, Limnospira, Raphidiopsis*
23-Oct	No Toxicity	ND	*Microcystis* spp, *Limnospira, Planktothrix*
23-Nov	No Toxicity	1.07	*Microcystis, Limnothrix, Planktothrix, Pseudoanabaena*
23-Dec	No Toxicity	2.33	*Limnothrix, Pseudoanabaena, Microcystis* spp, *Limnospira, Pseudoanabaena*

[1]Microcystins/Nodularins; [2]Listed in order of decreasing abundance; ND = Not Detected

With exception of one event, microcystin/nodularin toxins were detected in Outfall 001 samples. These secondary metabolite compounds are naturally produced by several cyanobacteria genera, including those listed in the table above, and occur in multiple chemical variants. Thus, their toxic potency can vary by form, and their production by cyanobacteria can vary depending on environmental conditions.

Microcystins are known to produce toxic effects in animals, plants, and humans (Melaram et al. 2022), including aquatic invertebrates (Ferrão-Filho and Kozlowsky-Suzuki 2011). Of note in this data review was the abundance of the filamentous cyanobacterium *Planktothrix* sp. at the times sub-lethal toxicity (impaired reproduction) to *Ceriodaphnia dubia* was detected in WET tests. It is hypothesized that the occurrence of *Planktothrix*, a microcystin producer (Pancrace et al. 2017), could have contributed to the observed toxicity. While MCs/NODs were detected at times when no toxicity was observed in WET tests, the potency and susceptibility to microcystin variants can differ, and thus toxicity may not be directly related to microcystin concentration. Additionally, it is plausible that the filamentous nature of *Planktothrix* could inhibit the filter feeding ability of C.

dubia in WET tests, resulting stress to the test organism. *Planktothrix* abundance was less at times no toxicity was observed.

There are numerous possibilities as to the observed WET test toxicity in 2022-2023, including several toxin-producing cyanobacteria and environmental conditions at the time. The abundance of *Planktothrix* contributing toxicity and potential feeding inhibition in the *C. dubia* test organism is one possibility.

References Cited

Ferrão-Filho, A. and B. Kozlowsky-Suzuki. 2011. Cyanotoxins: bioaccumulation and effects on aquatic animals. *Marine Drugs* 9, 2729-2772; doi:10.3390/md9122729.

Melaram, R., A. R. Newton, and J Chafin. 2022. Microcystin contamination and toxicity: implications for agriculture and public health. *Toxins* 14, 350; dii.org/10.3390/toxins14050350.

Pancrace, C., M. Barny, R. Ueoka, A. Calteau, T. Scalvenzi1, J. Pédron, V. Barbe, J. Piel, J. Humbert, and M. Gugger. 2017. Insights into the *Planktothrix* genus: genomic and metabolic comparison of benthic and planktic strains. *Scientific Reports* 7, 41181; doi: 10.1038/srep41181.