Algal Blooms and Oil Pollution: BP Cherry Point Case Study

Fiona Cooper
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Abstract

For this research project, I studied the potential effects of BP Cherry Point refinery waste on the abundance of cyanobacteria algal blooms, which produce microcystin toxins. While the findings themselves are inconclusive, I was able to analyze said findings to positively correlate the environment of the BP refinery with ideal conditions for cyanobacteria blooms, using variables such as pH, nitrate concentration, and proximity to Cherry Point to deduct my reasoning.

Introduction

"Cyanobacteria, in general, prefer relatively high ammonium (NH_4^+) concentration for their growth, in line with their relatively high tolerance to ammonia (NH_3) in comparison to most of the microalgae classes [38]." (Haberle et. al., 2020)

Due to its high nitrogen content, oil refinery pollution can be a large source of nutrients for cyanobacteria and other toxic algae blooms that prefer highly nitrogenated environments.
According to the Environmental Protection Agency's Toxic Release Index (TRI) report on the BP Cherry Point Refinery, over 300,000 pounds of nitrates and ammonia are released yearly into the air and Puget Sound's waters (EPA, 2023). Cyanobacteria fix nitrogen by using nitrogenase in their vegetative cells to split the nitrogen from the nitrous oxide, and the hydrogens from the ammonia, utilizing these chemicals to make nutrients (Marino *et. al.,* 2009) These nitrogen-fixation abilities could be harnessed as a tool of bioremediation, as nitric oxide gas from oil refineries can be directly oxidized into an aqueous solution inside the Cyanobacteria's cytoplasm (Chen *et. al.*, 2019).

There have been notable cases of cyanobacteria in high nitrogen environments causing indefinite public closures to bodies of water in recent years. One such case is with Lake Terrell, which lies 4.9 miles from the Cherry Point refinery. In 2019, Lake Terrell exceeded the state recreation guideline for microcystin toxins, which are commonly produced by cyanobacteria algae.
According to the Department of Ecology, Lake Terrell has confirmed contamination above cleanup levels. The contaminant type is "Non-Halogenated Organics - Petroleum Products-Unspecified" (DOE, 2025). While both nitrates and ammonia produced by oil and petroleum refineries are non-halogenated, only nitrates can have organic properties.

Methods

I gleaned my online research from various governmental and educational entities. I compiled information of interest into a separate Google Docs document to aid in formulating a conclusion using the evidence provided by these websites. Professor Shannon Call assisted me with this by sending links via Canvas for me to broaden my scope of findings.

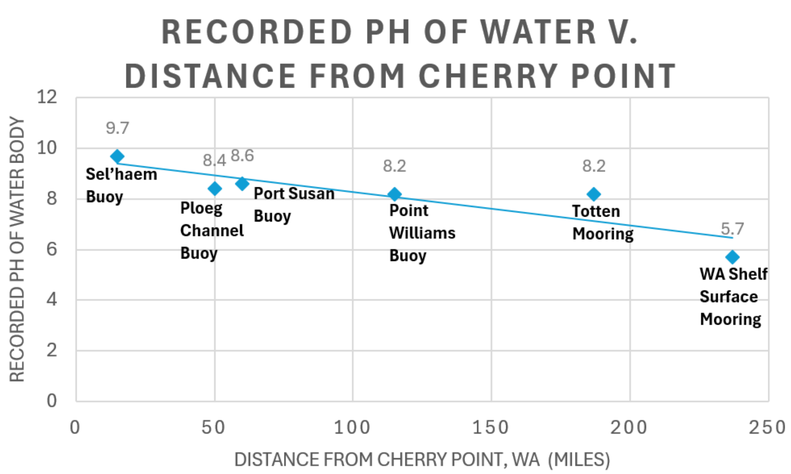

Figure 1. *A graph comparing pH data from buoys registered under the NANOOS Visualization System (NVS) Data Explorer feature. The data was collected as of June 10th, 2025. Note the decreasing trend in aquatic pH values correlated to increasing distance from the BP Cherry Point refinery.*

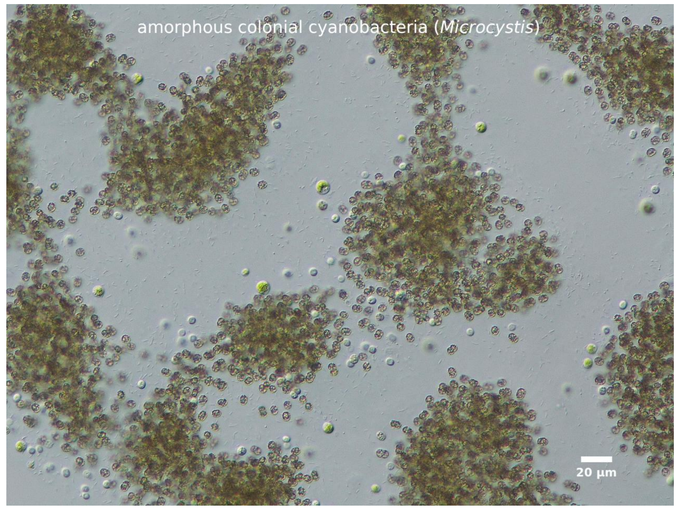

Figure 2. *Colony of cyanobacteria of the Microcystis genus. Microcystis produce microcystin, a potent hepatotoxin that can cause gastrointestinal cancers and fatal liver damage.*

Discussion

While performing my research, I graphed a striking set of observations from the NVS Data Explorer feature agreeing with my hypothesis that the nitrogen content of water bodies in Northwest Washington would be inversely proportional to their distance from the BP Cherry Point refinery. As demonstrated in Figure 1, The closest measurable data point to Cherry Point was 15 miles away at the Sel'haem buoy on Bellingham Bay, measuring a basic water pH of 9.7. The furthest data point I collected was 237 miles from Cherry Point, at the WA Shelf Surface Mooring on the Washington Continental Shelf, measuring an acidic pH of 5.7.

Nitrogen is a strong Lewis base, tending to donate electrons to H_2O and form a basic solution consisting of hydroxide and a weak acid, which can reverse to form the original reactants. High concentrations of nitrates and ammonia in the water will significantly raise the pH and form this highly reversible basic solution. I can infer that the higher pH values closer to the BP Cherry Point refinery are due to the high nitrogen content in the water from nitrate and ammonia pollutants, which could have played a significant role in the closure of Lake Terrell and recent uptick in microcystin toxins in the Puget Sound.

I find this data alarming, especially with relation to the impacts on Coast Salish cultural practices in the affected bodies of water. For example, the Lummi Nation previously won a case in 2016 against the conversion of sacred Xwe'chi'eXen land into dumping grounds for a potential coal terminal. In 2023, BP finalized a buyout of 450 hectares of Xwe'chi'eXen land, claiming to not have current plans for the land. This claim feels dishonest, since government-led entities such as fracking companies have broken treaties with Indigenous peoples before. In the video *Not For Any Price* by the Northwest Treaty Tribes YouTube channel, significant violations of the Treaty of Point Elliott occurred as the state government underwent construction of the Gateway Pacific Terminal without a permit from the Lummi Tribal Nation. Earthjustice author and senior attorney Jan Hasselmann had this to say regarding the state's political position towards fracking companies:

"You can't just trust [politicians] to do the right thing…they will always assure us that there'll be no pollution, there will be no environmental harm…these promises remain hollow." (Hasselmann, 2017)

With the previous statement in mind, I could not find definitive research on any correlation of microcystin prevalence and the activity in BP Cherry Point. With BP's monopoly on the worldwide oil and petroleum industry, it would not be surprising if such data were obfuscated or expunged from conventional search engines as to not harm the company's image.

Future research on this project should include field research, through taking samples of water in Cherry Point and recording their nitrogen content and the algal growth. Time constraints this quarter made this unfeasible for me, so I will hand this project off to future students who share this passion and have the means to embark on further discovery.

Acknowledgements

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