

Quarterly Progress Report

September 2024

Project Title

**Sediment Mercury Concentrations in the Closed Area of Lavaca Bay and the Risk to
Wildlife from Mercury Remobilization During Dredging**

Contract # 041

Submitted to

Matagorda Bay Mitigation Trust

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Project Summary

The Closed Area of Lavaca Bay is a mercury (Hg) Superfund site that is undergoing long-term environmental monitoring. The proposed Matagorda ship channel expansion project will dredge in the Closed Area and could remobilize Hg stored in sediment back into the bay. This study will investigate how sediment Hg concentrations vary with depth throughout the proposed dredging area and undertake lab-based toxicity and bioaccumulation experiments to determine whether the Hg-rich sediment is toxic to benthic organisms. Agencies can use the data to make informed decisions about how to dredge and dispose of the Hg-rich sediment to minimize its environmental impact.

Project Goals and Objectives

The goal of this project is to investigate sediment Hg concentrations in the Closed Area of Lavaca Bay (with a focus on the area that will be dredged) and determine whether sediment Hg concentrations are high enough to pose a threat to the health of benthic organisms if Hg is remobilized during the proposed dredging activities. This study can be broken down into six objectives:

Objective 1: Investigate how THg concentrations change with sediment depth to determine 1) at what depth the greatest THg concentrations are found; 2) how thick the Hg layer is; and 3) how THg concentrations vary spatially throughout the Closed Area.

Objective 2: Map the bay floor and investigate the relationship between sediment THg concentrations and sediment characteristics (grain size and organic matter content).

Objective 3: Use radioisotopes (^{210}Pb and ^{137}Cs) to create sediment age-depth profiles and determine sedimentation rates.

Objective 4: Speciate THg in the surface and Hg layer sediment to determine the MeHg concentration and percent MeHg and determine the bacterial composition of the sediment.

Objective 5: Calculate how much Hg could potentially be released into Lavaca Bay from the proposed dredging activities.

Objective 6: Determine whether sediment Hg concentrations are high enough to cause toxicity to benthic organisms (polychaete worms, amphipods, bivalves, gastropods) using laboratory-based toxicity tests and bioaccumulation experiments.

Project Update

Objective 1

All sediment cores for this project have been collected. 32 cores were collected in June 2023 and 28 cores were collected in May 2024 (Fig. 1). All the cores have been sectioned into 1 cm or 2 cm depth intervals and each depth interval has been subsampled for different analyses.



Figure 1. 2023 and 2024 sediment core collection locations. The yellow pins show the location of each core.

For each year, the following has been completed:

2023

- Number of cores subsampled for the different analyses = 32
- Number of cores that have been freeze dried = 22
- Number of cores that have had the Hg concentration measured in each depth interval = 22

2024

- Number of cores subsampled for the different analyses = 28
- Number of cores that have been freeze dried = 11
- Number of cores that have had the Hg concentration measured in each depth interval = 9

Objective 2

- The CHIRP profiling of the Superfund site was completed in June 2024. A field test was run near Harbor Bridge in the Corpus Christi ship channel to determine the proper configuration of the sub-bottom profiling system for data collection prior to data collection in Lavaca Bay. This was to confirm that the GNSS receiver and the sub-bottom profiling system could successfully interface and incorporate navigation data. Along and across the axis of greater Lavaca Bay, Cox Bay, and Keller Bay, we collected seven long profiles to demonstrate the regional sub-bottom characteristics of the bay floor. Eight profiles were then collected in the Superfund site (five in the ship channel, two between Alcoa and Dredge Island, and one next to Witco marsh). Access to seismic interpretation software has been secured and data analysis is about to begin.
- For grain size analysis, Co-PI Prothro's group are preparing samples for grain size analysis. Four cores have been processed so far.
- For organic matter content analysis, PI Dutton has set up the muffle furnace and determined the loss on ignition method that will be used to complete the analysis. Analysis has started on the low Hg sediment samples.

Objective 3

- Four cores (1, 5, 6, 16) have been selected to start the ^{210}Pb and ^{137}Cs analysis to age the sediment. These cores were selected based on their Hg concentration depth profile and collection location. To age the sediment, cores need to be collected from areas that are minimally disturbed so that chronology is maintained.

Objective 4

- The sediment bacterial composition is being investigated in 10 cores collected in 2023. For each core, depending on the thickness of the Hg layer, between five and 11 different depths are being investigated. In total, there are 68 samples being analyzed. To date, DNA has been extracted from all the samples.

Presentations

PI Dutton gave a public presentation in Port Lavaca on August 22nd titled "Mercury concentrations in sediment and biota in the Alcoa (Point Comfort) Superfund site". This meeting was hosted by the San Antonio Bay Estuarine Waterkeeper. It was attended by ~200 people (federal and state agencies, city council, industry, environmental groups, community members), livestreamed (~1000 views to date), and translated into Spanish and Vietnamese.

Goals for the Next Quarter

- Continue to dry and measure the Hg concentrations in the sediment cores (Objective 1)
- Interpret the CHIRP profiles (Objective 2)
- Continue the grain size analysis and organic matter content analysis (Objective 2)
- Start the ^{210}Pb and ^{137}Cs analysis (Objective 3)
- Complete the bacterial composition analysis (Objective 4)
- Speciate the Hg in the sediment to determine the percent that is methylmercury (MeHg) (Objective 4)