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Implementation Plan for Zinc in Oyster Tissue in Nueces Bay

Segment 2482

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TEXAS COMMISSION ON ENVIRONMENTAL QUALITY

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Executive Summary

On November 1, 2006, the Texas Commission on Environmental Quality (TCEQ) adopted *One Total Maximum Daily Load for Zinc in Oyster Tissue in Nueces Bay*. The total maximum daily load (TMDL) addresses elevated levels of zinc in oyster tissue in Segment 2482. The U.S. Environmental Protection Agency (USEPA) approved the TMDL on December 15, 2006.

This implementation plan, or I-Plan:

- describes the steps the TCEQ and its stakeholders will take to achieve the pollutant reductions identified in the TMDL report, and
- outlines the schedule for implementation activities.

The ultimate goals of this I-Plan are to:

- ensure that levels of zinc in oyster tissue attenuate to levels below the health assessment comparison value (HAC) of 700 mg/kg that supports the oyster water use in Nueces Bay (Texas Department of State Health Services (DSHS), 2006).
- adopt a criterion for zinc in water that is more appropriate and protective of human health via the pathway of ingestion of oysters. Zinc concentrations in the surface water of Nueces Bay are below the current criterion; however, zinc resulting from legacy sources is found in oyster tissue at levels that could result in adverse health effects from regular or long-term consumption (DSHS, 2006). For this reason, a revised criterion of 29 µg/L for total zinc was calculated to ensure the protection of human health.

The TCEQ conducted an investigation in Nueces Bay to identify sources of zinc and quantify loadings from the surrounding watershed. TMDL program staff also determined that, based on recent water quality data collected with improved methods, zinc levels in water were well below the 29 µg/L criterion. Zinc in sediment originating from historical industrial activities appears to be declining over time as well. As a result, levels of zinc in oyster tissue are expected to diminish with time and eventually fall below the criterion established to support the designated oyster water use.

The evaluation of zinc loadings to Nueces Bay in the TMDL indicated that there are no existing discharges that would result in violation of the proposed revised zinc criterion. For this reason, implementation strategies will address zinc in oyster tissue as a legacy pollutant. The attenuation of the pollutant will be monitored by means of targeted sampling in the impaired area. In addition, the TCEQ also recalculated a more protective criterion for total zinc in water to be protective of human health via ingestion of oysters. This I-Plan recommends that this be included as a site-specific criterion for Nueces Bay in the 2008 water quality standards triennial revision.

Tracking strategies for the success of implementation will primarily rely on the collection of additional data in Nueces Bay. Water quality and sediment data will be collected quarterly as part of the statewide routine monitoring program. Tissue data will be collected annually for a five-year period at several reference sites to detect observable trends. In the absence of additional anthropogenic loadings to Nueces Bay or Corpus Christi Inner Harbor, zinc levels are expected to decline. If this is not the case then the TCEQ will re-evaluate the TMDL and the I-Plan. The TCEQ will report the results of the tracking and evaluation activities in its biennial TMDL program status report and at regional forums.

Introduction

In order to keep Texas' commitment to restore and maintain water quality in impaired rivers, lakes, and bays, the TCEQ recognizes that it must establish I-Plans for each TMDL. The TMDL is a technical analysis that:

- determines the amount of a particular pollutant that a water body can receive and still meet applicable water quality standards, and
- estimates how much the pollutant load must be reduced to comply with water quality standards.

This I-Plan is designed to guide activities that will achieve the water quality goals for Nueces Bay, Segment 2482, as defined in the adopted TMDL. The ultimate goals of the I-Plan are to:

- ensure that levels of zinc in oyster tissue attenuate to levels below the criterion that supports the oyster water use in Nueces Bay.
- adopt a more protective and appropriate criterion for concentrations of zinc in water to be protective of adverse human health effects via ingestion of oysters.

The I-Plan is a flexible tool that governmental and nongovernmental organizations involved in implementation use to guide the management of their programs. The participating organizations may accomplish the activities described in this I-Plan through rule, order, guidance, or other appropriate formal or informal action.

This I-Plan contains the following components:

1) a description of control actions and management measures[1] that will be implemented to achieve the water quality target.
2) a schedule for implementing activities to achieve TMDL objectives.
3) a follow-up tracking and monitoring plan to determine the effectiveness of the control actions and management measures undertaken.
4) identification of measurable outcomes and other considerations the TCEQ will use to determine whether the I-Plan has been properly executed, water quality standards are being achieved, or the plan needs to be modified.
5) identification of the communication strategies the TCEQ will use to disseminate information to stakeholders and other interested parties.

[1] Control actions refer to point source pollutant reduction strategies, generally TPDES permits. Management measures refer to strategies for reducing nonpoint source pollutants, generally through voluntary best management practices.

This I-Plan and the adopted TMDL also include all of the nine key elements (see Table 1) for watershed-based plans as prescribed in the *FY 2004 Guidelines for the Award of Section 319 Nonpoint Source Grants to States and Territories* (USEPA, 2004). Consequently, projects developed to implement nonpoint source elements of the control actions of this plan that meet the grant program conditions are eligible for funding under the USEPA's Section 319(h) incremental grant program.

Table 1: Nine Key Elements for Watershed Plans

(a)	**Causes/Sources of Impairment** **Targeted Critical Areas**	Historic discharges of zinc to the Corpus Christi Inner Harbor and Nueces Bay Southern portion of Nueces Bay and the Corpus Christi Inner Harbor
(b)	**Management Measures**	Collection of oyster tissue, water, and sediment for the analysis of zinc
(c)	**Estimated Potential Load Reduction (lbs/Year)**	n/a
(d)	**Technical and Financial Assistance for Each Measure**	Federal Grants, state funds, for documenting attenuation
(e)	**Education Component for Each Measure (and Other Education)**	Quarterly project reports available electronically via the project Web page
(f)	**Schedule of Implementation for Each Measure**	2008-2009
(g)	**Interim, Measurable Milestones for Each Measure**	n/a
(h)	**Indicators to Measure Progress**	Attenuation of zinc concentrations in oyster tissues
(i)	**Monitoring Component**	Special study to collect oyster tissue, sediment, and water for zinc analysis
(j)	**Responsible Entity**	TCEQ

This I-Plan is designed to guide activities that will monitor for both the expected reductions of zinc in oyster tissues and to ensure zinc in surface water continues to meet the water quality criterion in Nueces Bay, as defined in the adopted TMDL. The ultimate goal of the I-Plan is to restore the oyster water use of Nueces Bay by reducing the average concentrations of zinc in oyster tissues to levels that meet the health-based oyster tissue criterion recommended by DSHS of 700 mg/kg.

The TCEQ approved the I-Plan on October 24, 2007. The TCEQ has primary responsibility for restoring water quality to achieve designated uses in impaired water bodies.

Summary of the TMDL

In November 2006, the TCEQ adopted *One TMDL for Zinc in Oyster Tissue in Nueces Bay* (Segment 2482). Segment 2482 is a shallow, secondary bay that receives freshwater inflows from the Nueces River (Segments 2101 tidal and 2102 above tidal) and exchanges saline water with Corpus Christi Bay (Segment 2481). The headwaters of the Nueces River originate in central Texas and flow approximately 315 miles before reaching Lake Corpus Christi (Segment 2103) and ultimately Nueces Bay. Principal tributaries

of the Nueces River above Lake Corpus Christi include the Atascosa and Frio Rivers (Figure 1).

Figure 1. Nueces River Basin, including Reservoirs, Tributaries, Rivers, and Adjacent Bays

Nueces Bay (Figure 2) was originally placed on the TCEQ's 303(d) list of impaired waters in 1998 for nonsupport of the oyster waters use in 100 percent of the bay (28.9 square miles). The listing is based on the DSHS's shellfish classification maps, which restrict the growing and harvesting of shellfish from Nueces Bay for direct marketing due to excessive levels of zinc in oyster tissue.

Elevated levels of zinc in Nueces Bay are the result of historical discharges related to nearby metallurgical processing facilities. From 1942 to 1985, the American Smelting and Refining Company (ASARCO) operated a zinc smelting facility in the Nueces Bay area and discharged effluent along the southwestern shoreline of Nueces Bay and to the Corpus Christi Inner Harbor (CCIH). Several billion tons of zinc ore were processed during that time and that activity is believed to be the cause of the zinc that remains today (Barrera et al., 1995; Armstrong and Ward, 1998).

The TMDL analysis identified point and nonpoint sources of zinc that could have caused elevated levels in oyster tissue. Land surface runoff and atmospheric deposition were identified as nonpoint source inputs to Nueces Bay. Permitted municipal and industrial discharges to the segment were identified as the point sources to the system. The TMDL also identified sediments as a significant reservoir of zinc.

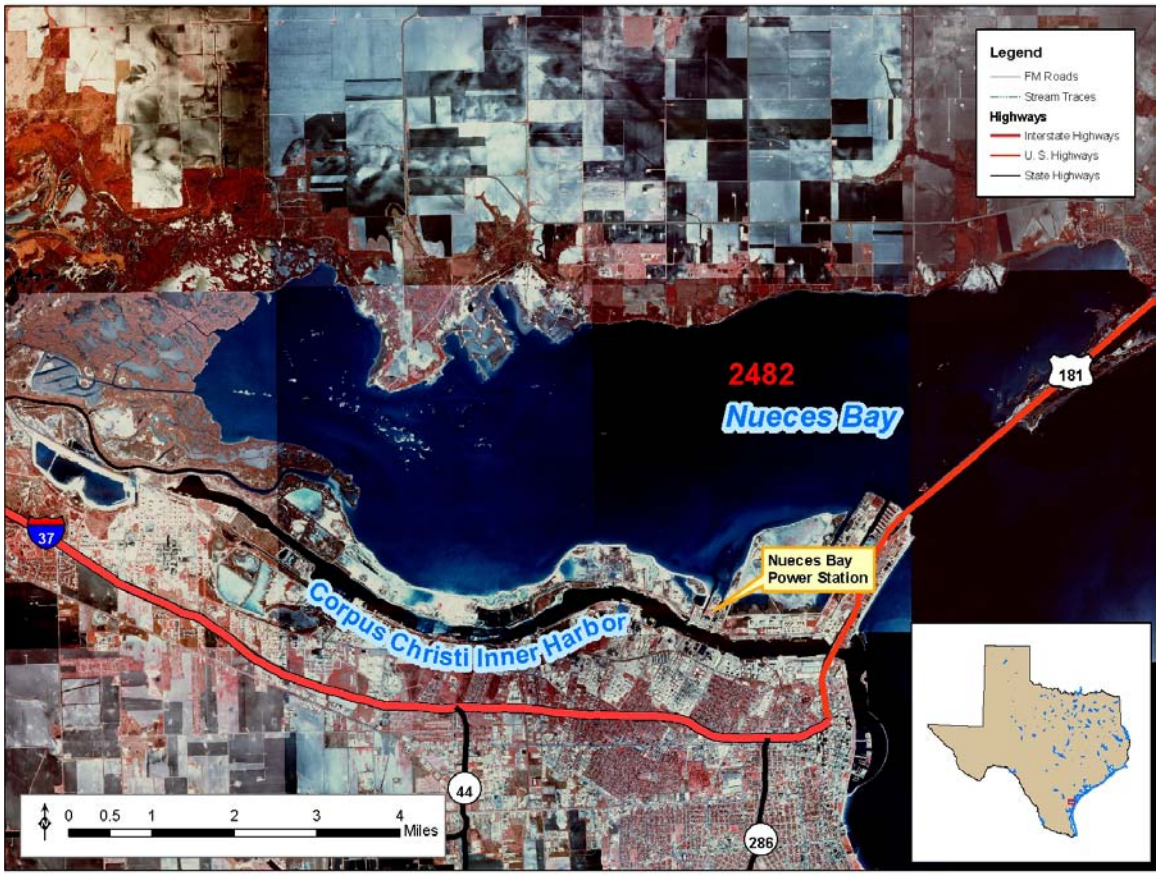

Figure 2. Nueces Bay

The TMDL analysis quantified the loadings from the all of the sources to the surface water of Nueces Bay. The total loadings to surface water predicted by the analysis represent concentrations below those specified in the water quality standards. This result is lower than expected levels of total zinc in the water, due primarily to improved analytical methods for zinc. The current levels of total zinc measured with the improved methods (19.4 µg\L) are below the recalculated criterion (29 µg\L) proposed in the TMDL.

As a result, the TMDL identifies excess capacity for zinc loading. Levels of zinc in oyster tissue, however, remain above the criterion established to protect the oyster water use. The criterion to protect the oyster water use is established by the DSHS and is a health assessment comparison level (HAC) of zinc in oyster tissue of 700 mg/kg that is protective of human health for the pathway of ingestion of oysters. The TMDL describes an

implementation strategy in which zinc levels in oyster tissue are expected to decline if levels of zinc in the water column remain at or below existing levels.

The final TMDL analysis for zinc loadings to Nueces Bay resulted in the following equation:

TMDL = ΣLA +ΣWLA + AFG, where
LA=Load allocation
WLA=Waste load allocation
AFG=Allowance for future growth

TMDL = 26.6 kg/d + 32.6 kg/d + 6.7 kg/d
TMDL = 65.9 kg/d

Implementation Strategy

The implementation strategy describes the actions that the TCEQ and its stakeholders will undertake to achieve water quality standards. The strategy specifies actions to meet the load allocations assigned to all point sources and nonpoint sources identified in the TMDL report. Action strategies may be selected from a menu of possible measures based on an evaluation of feasibility, costs, support, timing, and other factors. Activities may be implemented in phases based on the TCEQ's assessment of progress.

Measure 1. Document Natural Attenuation

Since the TMDL does not require a reduction in total loads of zinc to surface waters, control of sources will not be necessary. Attenuation of zinc in tissues will be tracked through data collection from oysters at several locations in the bay. In addition, collection of water samples will be necessary to ensure that levels of zinc in water do not become elevated and result in additional increases in oyster tissue. Maintenance of zinc levels in water at or near current levels will provide a level of assurance that zinc in oyster tissue will be reduced over time through attenuation.

Efforts to assess levels of zinc in Nueces Bay will be coordinated through existing programs at the TCEQ. Existing contractors will provide support for tissue monitoring activities at several sites in the bay. Routine quarterly data collection by the TCEQ of water samples in the Corpus Christi Inner Harbor and Nueces Bay will provide additional assurances that concentrations are decreasing.

Point source discharges to Nueces Bay will also be monitored to ensure that additional zinc loadings will not affect the attenuation of zinc in oyster tissues. The Nueces Bay Power Station (NBPS) represents the largest proportion of the total load to Nueces Bay as identified in the TMDL, not because it is a source of zinc but because it moves a large volume of cooling water from the Inner Harbor to Nueces Bay. In recent decades, zinc levels in the Inner Harbor have been lower than in Nueces Bay, but the Inner Harbor could still release a large volume of water into Nueces Bay. This facility has been closed for several years, but in the event that the NBPS is reopened and begins to pump water from the Inner Harbor to Nueces Bay, additional reporting limits for zinc through amendments of existing TPDES permit will be necessary.

Measure 2. Adjust the Water Quality Criteria

The development of the TMDL also led to the derivation of a water quality criterion better suited to protect human health. Further assessment and calculation determined that the zinc criteria included in the 2008 water quality standards should be revised to one specific for Nueces Bay. The water quality criteria included in the standards provide values for acute (92.7 µg/L) and chronic (84.7 µg/L) levels of dissolved zinc in water. The TMDL recalculated a criterion of 29 µg/L for total zinc in water, which should result in tissue levels protective of the oyster water use. The use of total versus dissolved zinc is thought to be more protective since the suspended portion in water is also considered. This could ultimately result in a criterion *specific to Nueces Bay* which is more stringent than that included in the current water quality standards.

The adjustments to the water quality criteria will be fully reviewed and facilitated through the triennial revisions to the water quality standards. This process updates the TCEQ rules (Title 30 TAC §307.1-10) to incorporate changes due to the availability of new information on site-specific conditions or new methods by which criteria are derived. The revisions and subsequent approval process are coordinated by the Water Quality Standards Team at the TCEQ. The approved updates to the standards are included in the State's Water Quality Management Plan and implemented through several programs at the TCEQ. The rules were last updated in 2000 and the next revisions were initiated in 2007. If through the triennial revisions process different criteria are established, this implementation goal would likewise be adjusted.

Implementation Tracking

This I-Plan includes provisions to track the progress of the plan using both implementation and water quality indicators. These terms are further defined as:

- **Programmatic Indicators** – A measure of administrative actions undertaken to effect an improvement in water quality.
- **Water Quality Indicators** – A measure of water quality conditions for comparison to pre-existing conditions, constituent loadings, and water quality standards.

Implementation tracking provides information that can be used to determine if progress is being made toward meeting goals. Tracking also allows stakeholders to evaluate actions taken, identify those that may not be working, and make any changes that may be necessary to get the plan back on target. The TMDL program will be responsible for tracking attenuation of zinc in oyster tissues through the biennial status report.

Programmatic Indicators

The TMDL Program will initiate a project to collect additional information, specifically zinc in water, sediment, and oyster tissue data, to evaluate the attenuation of zinc in oyster tissue levels throughout Nueces Bay. Water samples will be collected and analyzed for total and dissolved zinc and Total Suspended Solids (TSS). Sediment samples will be collected and analyzed for zinc, total organic carbon, and grain size. Oysters will be sampled and analyzed for zinc at each of the stations (oysters would only be collected in the

bay). These activities are expected to be funded through existing federal grants that support water-quality enhancement projects.

The TMDL program will also participate in the upcoming process for revising the water quality standards and will provide input specific to the revisions of zinc criteria.

Water Quality Indicators

The evaluation of the success of the implementation activities will be evident in reductions of zinc levels in oyster tissue. Assessment of the oyster tissue, sediment, and water data should provide insight to trends in zinc levels over time. In addition, the evaluation of zinc concentrations in the water will ensure that there is a low potential for additional increases of zinc levels in oyster tissue.

Review Strategy

Stakeholders in I-Plans periodically assess the results of the planned activities, along with other sources of information, to evaluate the adequacy of the I-Plan and adapt to changing circumstances. Stakeholders evaluate several factors, such as the pace of implementation, the effectiveness of best management practices, reductions in pollutant loads, and progress toward meeting water quality standards. The TCEQ will document these evaluations and its rationale for maintaining or revising elements of the I-Plan, and will present them as part of the state's normal reporting processes (see "Communication Strategy" section).

The data collected through implementation tracking will be evaluated to assess attenuation of zinc in oyster tissues. Review of this data will provide insight towards the rate at which levels of zinc are decreasing and the effect of lower concentrations in the water column. If attenuation does not result in acceptable levels of zinc in oyster tissue, the plan will be revised to evaluate and address other potential sources identified in the TMDL.

Communication Strategy

Communication is necessary to ensure that stakeholders understand the I-Plan and its progress in restoring water quality conditions. The TCEQ will disseminate the information derived from tracking I-Plan activities to interested parties, including watershed stakeholders, state leadership, government agencies, nongovernmental organizations, and individuals. For instance, the CBBEP convenes regularly scheduled Bay council meetings where the TCEQ could effectively update watershed stakeholders.

Results and progress will be documented in the TMDL Program's biennial status report. This report will summarize all actions taken to address the impairment and will report trends observed in the water quality data collected to track the progress of implementation. Work plans include a commitment to provide appropriate information to the TCEQ to update these progress assessments. Regionally, the progress of this implementation plan will be reported in the annual reports prepared by the Nueces River Authority under provisions of the Texas Clean Rivers Program.

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