

APPENDIX F:

Site Specific Sediment Quality Objective for
Human Health Tier 1 and Tier 2
Assessment for Greater Harbor Waters

Introduction

The Los Angeles Regional Water Quality Control Board (Los Angeles Water Board) adopted the Dominguez Channel and Greater Los Angeles and Long Beach Harbor Waters Toxics Total Maximum Daily Load (TMDL) (2012 DC and Greater Harbor Waters TMDL) in 2011. The 2012 DC and Greater Harbor Waters TMDL required that responsible parties identified in the TMDL, comply with the assigned Waste Load Allocations (WLA) and Load Allocations in the (LA) as identified in the TMDL.

The State of California's *Water Quality Control Plan for Enclosed Bays and Estuaries –Sediment Quality Provisions* (SQPs) addresses the application and implementation of two different Sediment Quality Objectives (SQOs) - SQOs protecting benthic organisms from direct exposure to pollutants in sediment and SQOs protecting human consumers of resident sportfish from contaminants that bioaccumulate from sediment into fish tissue (SWRCB, 2018).

Compliance with certain WLAs and LAs in the 2012 DC and Greater Harbor Waters TMDL to protect benthic organisms in sediment and human health may be demonstrated by several different methods identified in the TMDL. This appendix describes one of the methods for complying with the human health Sediment Quality Objective (SQO) in accordance with the SQPs.

The SQPs include procedures and requirements for conducting human health SQO assessment to evaluate the potential for contaminants in sediment within a site to accumulate in seafood to levels that can cause an unacceptable chemical exposure through human seafood consumption (SWRCB 2018). As described in the SQPs, the human health SQO is assessed via one of three tiers.

- Tier 1 assessment leads to a determination of Unimpacted sediments or, if sediments are not determined to be Unimpacted, to a further assessment under Tier 2. The Tier 1 assessment is a rapid screening evaluation of sediment and fish tissue information to determine if there is sufficient potential for human health impacts and thus a need to complete a Tier 2 or 3 assessment.
- Tier 2 is an evaluation of tissue data and sediment data to assess both chemical exposure to human consumers and to evaluate the link between contaminants in sediment associated with the site and fish. Chemical exposure is evaluated based on comparison to fish contaminant thresholds established by the OEHHA. Evaluation of sediment linkage utilizes a mechanistic food web model to estimate tissue concentrations derived from measured sediment concentrations. Tier 2 may determine if sediments are Unimpacted, Possibly Impacted, Likely Impacted or Clearly Impacted.
- Tier 3 assessment may be performed to address unique situations or evaluate additional factors affecting the assessment not considered in Tier 2. Tier 3 may be performed to improve accuracy and precision of the Tier 2 assessment, evaluate different risk related assumptions, incorporate spatial and temporal factors into the assessment, evaluate specific subareas, contaminant gradients or potential hotspots.

The Ports of Los Angeles and Long Beach, in coordination with the Los Angeles Regional Water Quality Control Board (RWQCB), developed a TMDL-specific compliance framework for the human health SQO to provide guidance for the assessment, evaluation, and documentation required to demonstrate compliance with the Harbor Toxics TMDL. Sediment quality condition of the Greater Harbor Waters is evaluated through the human health SQO assessment process provided in the human health Sediment

Quality Objectives: Compliance Assessment Memorandum (Latitude Environmental and Anchor QEA, 2018), Sediment Quality Objectives for Indirect Effects: Tier 2 Assessment (Anchor QEA, September 2015), and summarized below for the Tier 1 and Tier 2 assessments.

The Tier 3 assessment was conducted in coordination with the Los Angeles Regional Board, Southern California Coastal Water Research Project (SCCWRP), and State Water Resources Control Board (SWRCB) and is described in detail in the Section 3.2 of the 2022 Staff Report and the human health Sediment Quality Objective Tier III Assessment Under Current and Future Conditions Report (Anchor QEA, 2018).

Tier 1 Assessment

The Tier 1 assessment was conducted at four assessment areas defined by the RWQCB within the compliance monitoring program: Consolidated Slip, Los Angeles Outer Harbor, Long Beach Outer Harbor, and Eastern San Pedro Bay. Sediment data used in the assessment were collected in 2013 and 2014 (Anchor QEA, 2015) (SCCWRP, 2016), and fish tissue were collected in 2014 (Anchor QEA, 2015) (Amec Foster Wheeler, 2016). Data used in the assessment included 40 polychlorinated biphenyl (PCB) congeners, total of the six derivatives of DDT (2,4'-DDD, 2,4'-DDE, 2,4'-DDT, 4,4'-DDD, 4,4'-DDE, and 4,4'-DDT), five components of total chlordane (chlordane, alpha-; chlordane, gamma-; nonachlor, cis-; nonachlor, trans-; and oxychlordane), and dieldrin. A separate assessment is conducted for each contaminant group (PCBs, DDTs, chlordanes, or dieldrin). Fish tissue concentrations were compared to SQO Tier 1 screening thresholds (Table 1). If the average tissue concentration of all measured species exceeded the screening threshold, there is the potential for unacceptable chemical exposure and a Tier 2 evaluation is required. If the tissue concentration is equal to or less than the tissue screening threshold, the chemical exposure is acceptable, and the site is assessed as Unimpacted.

Table 1 Tier I Tissue Screening Thresholds (maximum of ATL3)

Parameter	Total DDTs (ng/g ww)	Total PCBs (ng/g ww)	Total Chlordanes (ng/g ww)	Dieldrin (ng/g ww)
Tier 1 Threshold¹	>520	>21	>190	>15

¹ Advisory Tissue Level based on three servings per week

The 95% upper confidence limit (UCL) for sediment concentrations in each area were compared to sediment screening thresholds. Screening thresholds are calculated from a biota-sediment accumulation factor (BSAF). The technical guidance document provides BSAF lookup tables for each dietary guild of fish (Table 3.2 in (SCCWRP, 2017a)). The calculated sediment values are compared to the 95% UCL for each contaminant. If the 95% UCL value is higher than the BSAF calculated threshold value, there is the potential for unacceptable chemical exposure and a Tier II evaluation is required. If the 95% UCL value is equal to or less than the BSAF screening threshold, the chemical exposure is acceptable, and the site is assessed as Unimpacted.

Tier 1 Assessment Findings

The Tier I assessment for each of the four areas is summarized in Table 2.

Table 2 Overall Assessment for Tier 1 for Each Area Evaluated

Assessment Area	DDT	PCBs	Chlordane	Dieldrin
LA Outer Harbor	Unimpacted	Tier 2 Assessment Required	Unimpacted	Unimpacted
LB Outer Harbor	Unimpacted	Tier 2 Assessment Required	Unimpacted	Unimpacted
Consolidated Slip	Tier 2 Assessment Required	Tier 2 Assessment Required	Unimpacted	Unimpacted
Eastern San Pedro Bay	Unimpacted	Tier 2 Assessment Required	Unimpacted	Unimpacted

Tier 2 Assessment

The Tier 2 assessment was applied to the four assessment units within the Greater Harbor Area that were sampled as part of the RWQCB-approved compliance monitoring program (Anchor QEA, 2014a). The Tier 2 assessment reported here was conducted in 2015 using available data collected between 2010 and 2014 within the Ports' database.

A bioaccumulation model based on (Gobas, F.A. and J.A. Arnot, 2010) has been incorporated into a Microsoft Excel-based model called the Decision Support Tool (DST) for Tier 2 assessments (SCCWRP, 2017b). This DST was used to evaluate the indirect effects of sediment contamination in four areas where sediment and fish tissue data were available: Consolidated Slip, Eastern San Pedro Bay, Outer Los Angeles Harbor, and Outer Long Beach Harbor. Because the Tier 1 assessment concluded Unimpacted sediment quality condition for dieldrin and total chlordane in all assessment areas, those analytes were dropped from Tier II assessment. DST inputs included PCB congener and DDT in sediment and fish tissue quality data, site-specific parameter (area size and maximum length of the site), and the following abiotic factors: dissolved oxygen (DO), temperature, salinity, dissolved organic carbon (DOC), particulate organic carbon (POC), and total suspended solid (TSS) concentration. Information concerning the specific development and function of modeling steps within the DST is available in the user's guide (SCCWRP, 2017a).

Consumption risk results and sediment linkage results were categorized in accordance with the SQP Plan Tier II effects assessment (SWRCB, 2018). Chemical exposure is assessed by comparing average tissue contaminant concentration to thresholds. The tissue thresholds are based on serving of one, two and three 8-ounce servings over the course of a week. Tissue thresholds are presented in Table 3. Tissue categories and outcomes are presented in Table 4.

Table 3 Tier 2 Tissue Contaminant Thresholds

Parameter	FCG ¹ (ng/g ww)	ATL3 ² (ng/g ww)	ATL2 ³ (ng/g ww)	ATL1 ⁴ (ng/g ww)
Total Chlordanes	5.6	190	280	560
Total DDTs	21	520	1,000	2100
Dieldrin	0.46	15	23	46
Total PCBs	3.6	21	42	120

1. FCG - Fish Contaminant Goal based on one 8-ounce serving per week
2. ATL3 - Tissue Advisory Level based on consumption of three 8-ounce servings per week
3. ATL2 - Tissue Advisory Level based on two 8-ounce servings per week
4. ATL1 - Tissue Advisory Level based on one 8-ounce serving per week

Table 4 Tier 2 Chemical Exposure Categories

Tissue Contaminant Concentration	Threshold	Outcome
Average	< FCG	1. Very Low
Average	< ATL3	2. Low
Average	< ATL2	3. Moderate
Average	< ATL1	4. High
Average	> ATL1	5. Very High

A site linkage factor is calculated by comparing tissue concentrations estimated from site sediments to the observed tissue contaminant concentration for the same species used in the chemical exposure evaluation. Site linkage determination is performed separately for each contaminant class. A Monte Carlo simulation is used to generate a cumulative distribution of the site linkage factor. Percentiles are then compared to thresholds presented in Table 5 to categorize the site linkage for the site. Detail description of site linkage determination and calculation of bioaccumulation factor (BSAF) as described in the SQPs.

The results of the simulations are compiled to calculate a cumulative probability distribution of sediment linkage. The portion of the distribution less than the sediment linkage threshold is used to determine the site linkage category.

Table 5 Site Linkage Categories for Tier 2 Evaluation

Cumulative % of sediment linkage distribution above threshold	Linkage threshold	Outcome
0-25%	0.5	1. Very Low
26-50%	0.5	2. Low
51-75%	0.5	3. Moderate
76-100%	0.5	4. High

Site assessment category is determined using the decision matrix presented in Table 6. Site sediments categorized as Unimpacted or Likely Unimpacted meet the sediment quality condition that is protective of the beneficial uses for the specific contaminants evaluated. Sediments categorized as Possibly Impacted, Likely Impacted, or Clearly Impacted do not meet the sediment quality condition protective of beneficial uses. Each chemical contaminant group is analyzed separately to determine if it meets the SQO.

Table 6 Site Assessment Matrix

Site Sediment Linkage/Chemical Exposure	Very Low Chemical Exposure	Low Chemical Exposure	Moderate Chemical Exposure	High Chemical Exposure	Very High Chemical Exposure
Very Low Site Sediment Linkage	Unimpacted	Unimpacted	Likely Unimpacted	Likely Unimpacted	Likely Unimpacted
Low Site Sediment Linkage	Unimpacted	Unimpacted	Likely Unimpacted	Possibly Impacted	Likely Impacted
Moderate Site Sediment Linkage	Unimpacted	Likely Unimpacted	Likely Impacted	Likely Impacted	Clearly Impacted
High Site Sediment Linkage	Unimpacted	Likely Unimpacted	Likely Impacted	Clearly Impacted	Clearly Impacted

Tier 2 Assessment Findings

The Tier 2 assessment results are shown in Table 7 for each area (Outer Los Angeles Harbor, Outer Long Beach Harbor, and Eastern San Pedro Bay). Tier 2 assessment was not conducted on Consolidated Slip because the size of the site is less than 1 square kilometer. Model input and output summaries for each assessment area are provided in Attachment C. These results were based on the individual lines of evidence that included consumption risk and sediment linkage for each assessment area. The final

assessment category for DDT was either an Unimpacted or Likely Unimpacted for all areas. The final assessment category for PCBs was Clearly Impacted for all areas.

Table 7 Overall Assessment for Tier 2 for Each Area Evaluated

Assessment Area	DDT	PCBs
LA Outer Harbor	Likely Impacted	Likely Impacted
LB Outer Harbor	Likely Impacted	Clearly Impacted
Eastern San Pedro Bay	Likely Impacted	Clearly Impacted

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SWRCB. (2018). *Amendments to the Water Quality Control Plan for Enclosed Bays and Estuaries of California - Sediment Quality Provisions.*