

2011 Dioxins Studies: In-Bay surface waters, tributary loadings, and archived surface sediments

Estimated Cost: \$163,850-170,400 (\$80,000-\$87,000 from the 2011 Special Study pool)
 Oversight Group: Dioxin Strategy Team, TRC
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Background

San Francisco Bay was placed on the State of California’s 303(d) list of impaired waterways in 1998 as a result of elevated concentrations of chlorinated dioxins and furans (commonly referred to as only ‘dioxin’) in fish. RMP studies of contaminants in Bay sport fish conducted every three years since 1994 have found that dioxin concentrations have remained relatively unchanged over this time period and in some species, continue to exceed screening values for human consumption. Our understanding of dioxin in the Bay is extremely limited however and improving this is a necessary first step in the process to reduce concentrations in Bay fish and resultant health risks to fish-eating humans and wildlife.

Strategy Update

A dioxin strategy was developed in 2008 to ensure that the RMP is providing information that is of highest value and most urgently needed by managers for development of a dioxin TMDL (see attached Table). An update on the status of the strategy elements is listed below:

Sample Design Element	Status
Quality assurance project plan (QAPP)	Completed in 2009
2009 Sport fish	Data expected in June 2010; QA review to be completed by Aug/Sept 2010
2008 surface sediment	Freezer storage; pending 2009 sediment data review
2009 surface sediment	Data review completed June 2010
2009 in-bay surface water	Data review completed June 2010
2010 tributary waters (Zone 4 Line A, Guadalupe River, Mallard Island)	Most data received in June 2010; QA review to be completed by Aug/Sept 2010
Sediment cores	Funding received in 2010; material to be shipped to lab in Summer 2010
Atmospheric deposition modeling	To be completed by end of 2010
2009 tributary waters	Samples not collected due to lack of completed QAPP
One-box model	Data not yet received; moved to 2013/2014

Strategy Questions for Dioxin

The following priority questions were developed for obtaining information on dioxin in the Bay at the 2008 Dioxin Strategy meeting:

1. Are the beneficial uses of San Francisco Bay impaired by dioxins?
2. What is the spatial pattern of dioxin impairment?
3. What is the dioxin reservoir in Bay sediments and water?
4. Have dioxin loadings/concentrations changed over time?
5. What is the relative contribution of each loading pathway as a source of dioxin impairment in the Bay?
6. What future impairment is predicted for dioxins in the Bay?

Study Objectives

Following the RMP Dioxin Strategy, the analysis of dioxins in Bay ambient surface waters, tributary waters, and 2008 or 2010 surface sediment are proposed studies for 2011. Input from the Dioxin Strategy Workgroup is still needed, however, to determine if these design elements are the preferred next steps. QA review of all data collected thus far is not expected to be completed until August/September 2010.

In-Bay Surface Water

Dioxin will be analyzed in 22 ambient surface water samples collected as part of S&T monitoring in the summer of 2011. Dioxin analysis will coincide with the analysis of PCBs since they can be extracted together. Dioxin concentrations in ambient surface water are expected to be very low relative to watershed/stormwater runoff and thus high volume water samples (100 L) are required to obtain detection of the less chlorinated congeners which often dominate the TEQ concentrations in fish.

Surface water dioxin data will be used to assess spatial variation of dioxin contamination in the Bay (Question 2) and to estimate the total dioxin reservoir in the water column (Question 3). Data will be used in foodweb modeling and development of a one-box model (Question 6).

Tributary Loadings

According to the Dioxin Strategy, samples from two additional urban tributaries are needed. In addition to continued sampling at Zone 4 Line A and the Guadalupe River, sampling is proposed to occur at two more urban creeks, Walnut Creek and possibly Castro Valley Creek, in water year 2011. Samples for dioxin analysis may be collected from these urban-influenced creeks; the final sampling plan for urban tributaries is expected to be determined mid-June 2010.

Whole water samples will be collected for dioxin analysis alongside those for other pollutants of concern during the rising and peak stages of wet season storm events. Although 32 samples per wet season are planned for other pollutants in SPLWG studies, where possible, 16 samples (4 samples during 4 storm events per year) will be collected for dioxin analysis in these studies to provide a cost-effective estimate of dioxin loads. Based on method detection limits, it is anticipated that collection of 4-8 L water samples will allow detection of most dioxin congeners.

Dioxin concentrations in water samples from these studies will be used to refine the loading estimates provided in the CEP Conceptual Model/Impairment Assessment report by providing additional data on loadings from the Central Valley watershed (Mallard Island), small tributaries that receive urban runoff (e.g. Hayward Zone 4 Line A), and a small tributary that receives runoff from both urban and agricultural sources (Guadalupe River; Question 5). Loading estimates from these pathways will be used in development of a one-box model (Question 6) and in the dioxin TMDL to determine the focus of management actions.

Surface Sediments

Surface sediment samples collected in the summer of 2008 (n=47) were scheduled for analysis according to the Dioxin Strategy; however the analysis was put on hold pending completion of the QAPP and review of the 2009 sediment data. Review of the 2009 samples was recently completed and the majority of congeners were detected frequently in these samples. Though the 2008 samples are ready for analysis, there is some concern that it may be preferable to analyze the sediment samples collected in January 2010 (n=27) instead, to provide wet season data that would complement the 2009 samples (n=47), which were collected in the summer/dry season. The Dioxin Strategy includes analysis of sediment from two collection years during this time period; however, input from the Dioxin Strategy Workgroup is needed to determine which samples will be analyzed.

Budget

	Estimated Costs
2011 In-Bay surface waters (n=22, plus QA samples)	
-- Analytical (\$800/sample)	\$20,000
-- Data mgt, analysis, minimal reporting	\$7,000
Total	\$27,000
2011 Tributary loading studies (2 urban tributaries)	
-- Analytical (\$890/4L or \$1050/8L sample)	\$30,000-35,700
-- Data mgt, analysis, minimal reporting	\$9,400
-- Field work (~\$3,000-5,000 per trib)	\$6,000-10,000
-- Shipping (~\$75 per 4L bottle)	\$2,550-5,100
Total	\$53,650-60,200
2008 Surface sediments (n=47, collected in summer/dry season)	
-- Analytical (\$861/20g sample + CRM)	\$41,300
-- Data mgt, analysis, minimal reporting	\$10,200
Total	\$51,500
2010 Surface sediments (n=27, collected in winter/wet season)	
-- Analytical (\$861/20g sample + CRM)	\$24,100
-- Data mgt, analysis, minimal reporting	\$7,600
Total	\$31,700
Total for all elements	\$163,850-170,400

- Analytical costs include anticipated 5% cost increase
- \$4,000 per element added for reporting/analysis

FIVE YEAR PLAN FOR RMP DIOXIN WORK

Sample Design Element	Questions Addressed	2008	2009	2010	2011	2012	Total by Element
Sport fish	1,2,4,6		\$22,000			\$22,000	\$44,000
Bird eggs	2,4,					\$10,000	\$10,000
Surface sediment	2,3 6	\$57,000	\$57,000			\$57,000	\$171,000
In-Bay surface water	3,6		\$20,000		\$20,000		\$40,000
Sediment cores	3,4,6	\$57,000					\$57,000
Trib. loadings, Delta outflow	5,6		\$34,000 (Small Trib)	\$34,000 (Small Trib) \$34,000 (Delta outflow)	\$34,000 (Small Trib) \$34,000 (Guadalupe)		\$170,000
Atmospheric deposition	5,6		\$25,000				\$25,000
One-box model	6				\$20,000		\$20,000
Foodweb model	6					\$20,000	\$20,000
QA/QC – development of QAPP			\$13,500				\$20,000
Total by Year		\$114,000	\$171,500	\$68,000	\$108,000	\$109,000	\$577,000

Costs include data management, analysis, and reporting (30% of total)