

San Francisco Estuary Institute

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MEMORANDUM

Date: March 10, 2008

To: Regional Monitoring Program Technical Review Committee

From: Susan Klosterhaus, Don Yee, Meg Sedlak, and Mike Connor,
San Francisco Estuary Institute (SFEI)

Subject: Dioxin Data Needs

Background

Dioxins and furans (commonly referred to as only ‘dioxin’) were added to the 303(d) list of impaired water bodies for San Francisco Bay in 1998 on the basis of elevated concentrations in fish. Regional Monitoring Program (RMP) studies of contaminants in Bay sport fish conducted every three years since 1994, with the most recent in 2006, have found that dioxin concentrations have remained relatively unchanged over this time period and in some species, continue to exceed an Office of Environmental Health Hazard Assessment (OEHHA) screening value for human consumption of fish by a factor of five. Our understanding of the sources and pathways by which dioxins are introduced into the Bay is quite 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.

The CEP Conceptual Model/Impairment Assessment report prepared by SFEI in 2005 summarized loading estimates of dioxin into the Bay, though considerable uncertainty was associated with these estimates due to the dearth of information available. The highest loading by a factor of five was associated with local stormwater runoff; however this loading estimate was based on two studies characterizing three single storm events in which the dioxin toxic equivalents (TEQ) concentrations varied by two orders of magnitude. The next highest loading of dioxin to the Bay was from direct atmospheric deposition to surface waters, followed by municipal effluent and runoff from the Central Valley watershed.

SFEI convened a meeting in February 2008 to discuss the Bay dioxin data collected to date and the potential regulatory issues in managing dioxin in wastewater effluents and the Bay as a whole. Representatives from the San Francisco Regional Water Quality Control Board, EPA Region 9, and outside consultants were in agreement that a better

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understanding of the current inventories, sources, and loadings is required to best manage future inputs of dioxin to the Bay. Because the dioxin congeners responsible for the majority of the fish impairment are typically not the congeners dominant in abiotic matrices, additional data are needed to discern the relative influences of dioxin sources and environmental processes on accumulation in fish and other wildlife. Development of a one box model for dioxin, similar to those recently developed for PCBs, PBDEs, and other organic pollutants, was highly recommended and would be helpful for TMDL development. The dioxin data currently available are not sufficient to support impending management decisions for dioxins in the Bay.

The only RMP funds currently allocated for the collection of additional dioxin data are for the analysis of dioxin in cormorant eggs collected in 2009 as part of Status and Trends monitoring. These results will complement the existing cormorant egg dioxin data from the 2002 and 2004 collections, providing information on long-term trends of dioxin in an apex predator. However, to refine our understanding of the potential sources and fate of dioxin, we also recommend that the RMP consider analyzing stormwater runoff from local watersheds, surface water, sport fish and/or sediment surface grabs and cores for the typical suite of dioxin and furan congeners that are responsible for dioxin-like toxicity. Mechanisms for these sample collections are already in place through other RMP studies and will facilitate collection of samples for dioxin analysis. The rationale for each matrix and a proposed sampling design is presented below.

Approach

Fish

The RMP analyzes sport fish every three years, with the next sampling event occurring in 2009. It is recommended that fish samples at various locations (particularly for species with small home ranges) and high lipid content be analyzed for dioxin. This information can be used along with sediment data to assess potential spatial differences and reductions in concentrations over time.

Sediment – Surface Samples and Cores

As part of the RMP Annual Status and Trends cruise, surface samples (0-5cm) are collected at 40 random sites and 7 historic locations. It is recommended that all of these sites be sampled in 2008 to characterize dioxin distributions in the Bay. Although NOAA-EMAP previously characterized dioxins in SF Bay surface sediments, their analytical methods were only sufficient to quantify the higher chlorinated congeners. Extraction of larger samples would provide quantitative results for the higher TEQ congeners in more samples.

Additionally, the RMP recently collected sediment cores for analysis of PCBs to support one box model and TMDL development. It is recommended that sections from these cores be analyzed for dioxins to characterize historical loadings, which can be compared to surface sediments to determine if loadings to the Bay have changed over time. This

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information would be used to assess spatial variation in sediment concentrations, compare sediment congener profiles to those in water and accumulated in fish, and determine whether recent loadings are different from deeply bedded sediment. Concentrations in deeper sediments are also needed for estimating the mass of the dioxin reservoir in the Bay.

Stormwater

In 2009, a small tributary in the Bay Area watershed will be selected to help characterize contaminant loads from urban streams to the Bay. Six priority watersheds have been identified and selection of the watershed will be conducted in concert with the Sources, Pathways and Loadings workgroup in 2008. In 2010 and 2011, the San Joaquin/Sacramento Rivers and the Guadalupe River will also be sampled for organics and mercury. It is recommended that a subset of samples from each of these studies be analyzed for dioxin using a high volume sampling system, which is required to obtain detection of the less chlorinated congeners in water which often dominate the TEQ concentrations in fish. Though loadings from local tributaries and the Central Valley are the dominant source of other particle-bound contaminants (e.g. PCBs and PBDEs) to the Bay, dioxin loadings from these sources have not been adequately quantified and are essential for development of a dioxin model and TMDL for the Bay.

Surface water

As part of the annual RMP summer Status and Trends cruise, it is recommended that water samples for dioxin analysis be collected at a select number of stations using a high volume sampling system. This information would be used to assess spatial variation in water concentrations, compare water congener profiles to those in sediment and accumulated in fish, and determine whether concentrations and congeners in recent loadings are different from those in bedded sediment. Concentrations in surface waters are also needed for estimating the mass of the dioxin reservoir in the Bay water column.

Matrix	No. of Samples	Cost per Sample	Total	Comment
Fish	20	\$700	\$14,000	Conduct in 2009 as part of RMP triennial sport fish monitoring.
Sediment – surface	47	\$700	\$32,900	Collect in 2008 as part of the RMP S&T sediment cruise
Sediment - cores	50	\$700	\$35,000	Core samples were collected in 2006. Analyze 4-5 sections from 11 Bay cores
Stormwater	35	\$700	\$24,500	In 2009, 15 small tributary samples. In 2010, 10 Mallard Island samples In 2011, 10 Guadalupe River samples.
Surface water	10	\$700	\$7000	Collect in 2008 as part of the annual RMP S&T water cruise.