The Transport of Contaminants to San Francisco Bay by Stormwater

by Lester McKee and Jay Davis

In 1998 the Regional Monitoring Program (RMP) adopted an objective that established a new direction for the Program: to describe general sources and loading of contamination to the Estuary. Stormwater runoff is considered to be a potentially significant pathway for the entry of many contaminants that are currently of great concern, such as PCBs, PAHs, registered pesticides (e.g., diazinon and chlorpyrifos), mercury, copper, and nickel. At present, contaminant inputs from stormwater are relatively poorly characterized.

The San Francisco Estuary Institute (SFEI) has prepared a report (currently in review) estimating the quantity of contaminants entering coastal waters in the San Francisco Bay region from local stormwater runoff. Due to improvements in municipal wastewater treatment, the masses of some contaminants transported to the Bay from urban and rural landscapes via rivers and drains are now greater than from sewage treatment plants. With these ideas in mind, it seems likely that achieving high water quality in San Francisco Bay may require the treatment of stormwater, or the reduction of these contaminants at their source in the landscape.

The analysis was conducted using a simplified model for calculating local stormwater contaminant loads. The study didn’t take into account well known complex nonlinear processes such as the transfer of rainfall to runoff, of contaminant mobilization during storms, and contaminant fate and transport during stormwater runoff. In spite of simplifications, this desktop study successfully identified data gaps and brought to
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get a group of local stormwater experts to develop recommendations for future evaluation of stormwater emissions in the San Francisco Bay region.

A number of high priority contaminants have not been quantified using existing local data (e.g., mercury, selenium, PCBs, PAHs, DDT, chlordane, dieldrin, diazinon, and dioxin). In some cases the data that exist are unreliable, and in other cases no data exist at all. This lack of reliable data for some key contaminants is a critical information gap.

The recommendations from the study reflected limitations in the current estimation methods, and the data quantity and quality for key contaminants. The report recommended the need for improving communication to the public and stormwater managers. There are some key questions that are not yet answered because of a previous lack of funding and coordinated effort. The following tasks were identified during consultation with local stormwater managers and agencies.

1. **Characterize Watersheds.** At a given scale, how many discrete watershed boundaries are there in the Bay Area? How do storm drains influence the definition of such watershed boundaries? What are the key land uses within these boundaries and where are the sources of key contaminants? What is the condition of the banks of the streams and riparian and in-stream habitats in these watersheds?

2. **Develop Conceptual Models.** What are the key processes, sources, flows, and processes of a given contaminant in the landscape, and how do these interact with the people and biology of the bay? Conceptual models must be developed that include key sources, flows, and processes of each individual contaminant. These would improve communication to the public and to stormwater managers, help to prioritize data collection, and are necessary prior to the development of data collection and evaluation strategies.

3. **Develop evaluation strategies.** Is the source of a particular contaminant historical or contemporary, is it from a point source or is it diffuse in nature, and how is it dominantly transported? Some contaminants are predominantly associated with sewage disposal or industrial effluents, have a broad spatial distribution, or have natural sources. Some are predominantly transported associated with sediment particles or organic material, and others are in dissolved form. In some cases, land use based models that describe load or delivery processes may be appropriate. For others, PCBs for example, land use based models are inappropriate due to very localized sources. The evaluation strategies will be policy-driven.

Further information: Jay Davis or Lester McKee at the San Francisco Estuary Institute (www.sfei.org). Further information: Jay Davis or Lester McKee at the San Francisco Estuary Institute (www.sfei.org).

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that toxicity data exists for only 10% of the chemicals in use.

The USGS and the EPA are currently in the early stages of investigating unknown or “emerging contaminants” in the waterways of America. What are they discovering so far? A potpourri of synthetic organic compounds downstream from sewage treatment plants—caffeine, animal feed additives, fragrances, sunscreen lotions, hormones, antibiotics and other pharmaceuticals.

Though these emerging contaminants have been detected at very minute levels, the concern arises that a slow but continuous accumulation of such a diverse mix may cause problems whose consequences we’re unable to predict.

“Effects on aquatic organisms are particularly worrisome because effects could accumulate so slowly that major change goes undetected until the cumulative level of these effects finally cascades to irreversible change,” writes EPA researcher Chris Daughton in a special report on these new pollutants.

According to Daughton and other scientists, “priority pollutants” first identified and regulated thirty years ago, “are only one piece of the larger risk puzzle.”

In an attempt to fill in some of the unknown pieces of this puzzle, the Regional Monitoring Program will begin, in December of this year, to identify unknown organic contaminants monitored in SF Bay. The study is expected to generate a final report 18 months later.

“It doesn’t make much sense to continue to focus our monitoring efforts on chlorinated hydrocarbons banned 30 years ago,” says Hoenicke. “We need to identify compounds that may pose environmental risks in the future. Nobody in the San Francisco Bay Area has systematically related the peaks on the chromatograms with adverse environmental effects. This needs to be done.”

What happens when these unknown contaminants are identified and matched up with environmental effects studies? Among the obvious benefits of identification and quantification, is the possibility for a more proactive model for identifying pollutants and anticipating potential problem contaminants.

For Further Reading:

San Francisco Bay Seafood Consumption Study
The Regional Monitoring Program for Trace Substances (RMP) sponsored the San Francisco Bay Seafood Consumption Study, contracting with the California Department of Health Services and Impact Assessment, Inc. The RMP participants—74 public and private entities that discharge treated wastewater, cooling water, dispose of dredged material, and manage stormwater discharges—recognized that seafood consumption data for the San Francisco Bay Area were insufficient and decided to contribute funding to this study effort.

What are the goals of this study?
• To gather data in order to assess exposures of the fishing population of San Francisco Bay to chemical contaminants from consumption of Bay-caught fish and shellfish
• To identify people who may be highly exposed to chemicals from consuming Bay fish
• To gather information needed to develop educational messages

When will the study results be ready?
Angler interviews at selected fishing sites through out the Bay have been completed. A preliminary draft is currently being revised and is expected to be ready for public distribution by autumn of 2000.

For more information, please contact Rainer Hoenicke via e-mail at rainer@sfei.org

Air Monitoring for Dioxins in the SF Bay Area
Thanks in part to the RMP Air Deposition Pilot Study and the visibility it has received nationwide, EPA Region 9, the Bay Area Air Quality Management District, and the California Air Resources Board are collaborating in using $100,000 of Persistent Bioaccumulative Toxics Initiative (PBTI) to support ambient air monitoring to measure average air dioxin concentrations in the Bay Area.

This air monitoring effort is part of a multimedia dioxins reduction and outreach strategy for the Bay Area. Key components of the strategy include multimedia monitoring, including fish tissue and sediment sampling and emissions research.

In 1994, the California Office of Health Hazard Assessment issued a public health advisory due to the presence of pollutants, including dioxins, in SF Bay fish. As a result, the Bay has been listed under the Federal Water Pollution Control Act as failing to meet water quality standards for dioxins.

Such listing requires EPA and the California Water Quality Control Board to establish a total maximum daily pollutant load (TMDL) to maintain water quality. This will be one of the first multimedia TMDLs to address a full suite of dioxins and dioxin-like compounds.

The effort represents a model for engaging state and local governments and the public on the emerging dioxin issue and augments the RMP’s air monitoring of trace metals, PAHs and PCBs. Dioxin data collection is scheduled to begin in April 2001 and will result in a final report in late 2002. For more information, contact Catherine Brown and Carol Bohnenkamp in the EPA Air Division at 415-744-1298.

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