



RMP

REGIONAL MONITORING
PROGRAM FOR WATER QUALITY
IN SAN FRANCISCO BAY

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New San Francisco Bay Contaminants Emerge

Non-targeted analysis shines a light on overlooked contaminants and pathways



San Francisco Bay water sampling sites (left to right, Napa River, San Leandro Bay, and Coyote Creek).

HIGHLIGHTS

In 2016, the RMP launched a novel investigation to detect new or unexpected contaminants in Bay waters, as well as treated sewage (or wastewater) discharged to the Bay. This study used non-targeted analysis, a powerful tool that provides a broad, open-ended view of thousands of synthetic and naturally-derived chemicals simultaneously. We identified hundreds of contaminants, and the results have opened our eyes to urban stormwater runoff as an important pathway for emerging contaminants to enter the Bay.

► **Non-targeted analysis of Bay water and wastewater identified over 400 unique, water-soluble contaminants;**

this analysis does not indicate whether contaminants are at levels of concern for aquatic life

► **Urban stormwater runoff is a major pathway to the Bay for contaminants**

like ethoxylated surfactants, plastic additives, and compounds derived from tires and roadways

► **Treated wastewater is also a major contaminant pathway,**

particularly for pharmaceuticals, personal care and cleaning products, plastic additives, and pesticides

► **Findings informed two new monitoring studies** to

measure levels of ethoxylated surfactants and roadway-related contaminants and evaluate potential risk for the Bay

What are emerging contaminants?

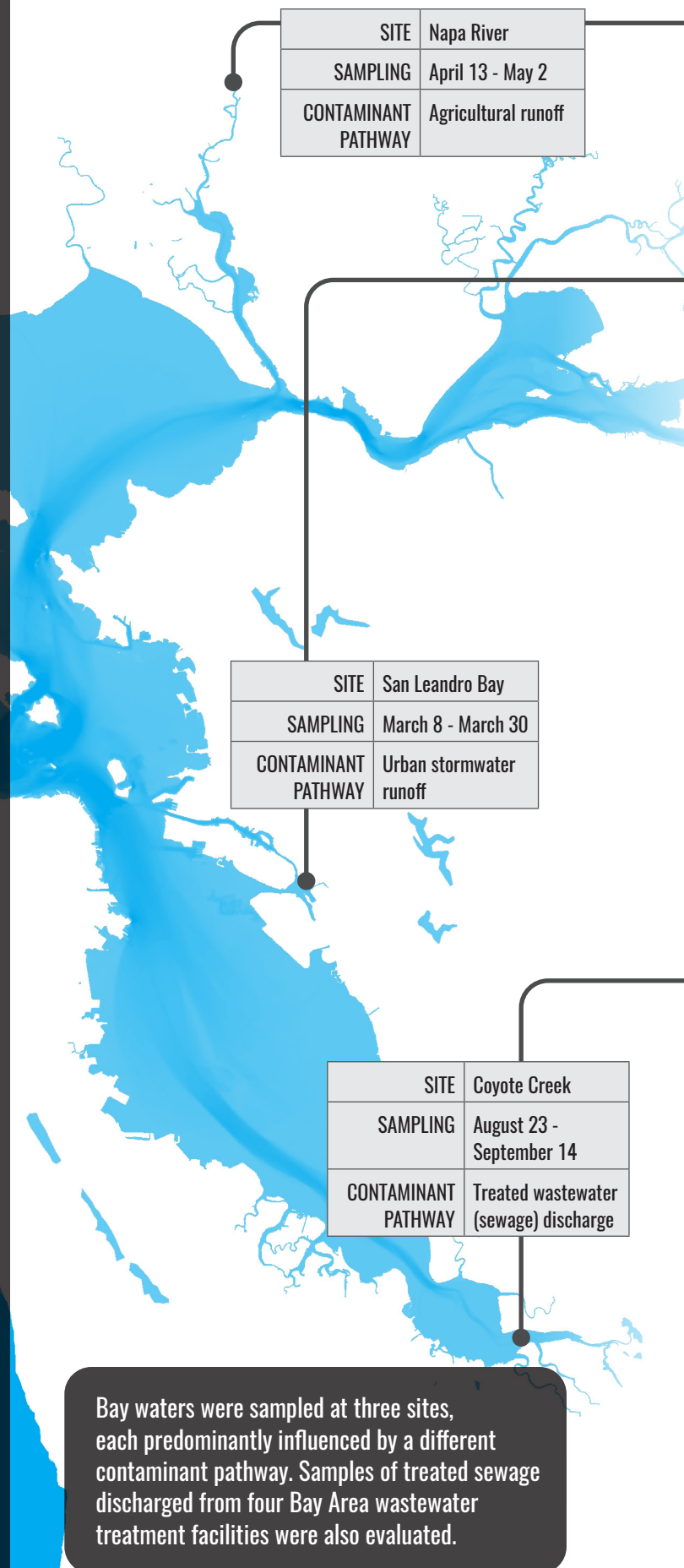
Also called contaminants of emerging concern (CECs), these include any chemical that is not regulated or commonly monitored and that has the potential to enter the environment and harm people or wildlife.

A paradigm shift

Most studies of emerging contaminants focus on chemicals we dispose of down the drain, such as pharmaceuticals or personal care and cleaning products. As a result, RMP emerging contaminant monitoring has often focused on treated sewage discharged from wastewater treatment facilities, or sites in the Lower South Bay that are strongly influenced by these discharges.

This study largely confirmed our knowledge of sewage or wastewater contaminants. Signals from pharmaceuticals and pesticides were generally stronger in treated wastewater relative to Bay water. Many of the types of contaminants identified in these wastewater samples via non-targeted analysis, including pharmaceuticals and plastic additives, have already been the subject of RMP studies. Transformation products derived from pharmaceutical “parent” compounds were also observed.

However, this study shines a new light on a previously underappreciated emerging contaminant pathway — stormwater. A number of contaminants were detected in samples from San Leandro Bay, a site strongly influenced by urban stormwater runoff. Contaminants identified include many urban, industrial, and outdoor use chemicals. Based on these findings, a follow-up study to screen Bay Area stormwater for a broad array of emerging contaminants is now underway.



AGRICULTURAL RUNOFF

Pesticides were the dominant compounds detected in the Napa River, which drains a watershed with significant agricultural activity. Compounds associated with stormwater and treated wastewater were generally detected at low levels.

STORMWATER CONTAMINANTS

Ethoxylated surfactants, traditionally thought of as detergents and cleaning ingredients found in wastewater, were instead most prevalent at the stormwater-influenced site. Some of these contaminants, also found in automotive products, asphalt, and many other industrial and consumer products, can break down into endocrine disrupting chemicals. Alkylphenol ethoxylates are a moderate concern for the Bay based on available ecotoxicity data. Other ethoxylated surfactants identified in this study could also be potential concerns.

Roadway contaminants are a newly identified class of stormwater-associated chemicals found in the Bay. For example, samples from the stormwater-influenced site in San Leandro Bay contained compounds used in the production of rubber vehicle tires. Recent studies in Puget Sound showed that tire leachate can be toxic to salmon, leading to increased interest in roadway contaminants derived from tires and vehicles.

A variety of other **industrial chemicals, plastic additives, and pesticides** associated with stormwater were identified, including flame retardants, siloxanes, and chemical catalysts.

WASTEWATER CONTAMINANTS

Pharmaceuticals were commonly detected in both wastewater and the wastewater-influenced Bay site, located near the mouth of Coyote Creek in Lower South Bay. Compounds included antibiotics, antidepressants, antiepileptic drugs, antidepressants, hypertension drugs, anticonvulsants, and cardiac treatment drugs, among others. In some cases, the compounds present in water were transformation products derived from the original medication.

Pesticides were also present at low levels, and included insecticides, fungicides, herbicides, insect repellants, and antimicrobials.

Plastic additives, personal care and cleaning product ingredients, flame retardants, corrosion inhibitors, and other industrial chemicals were also commonly detected.





What is non-targeted analysis?

Scientists usually monitor water for contamination using specific lists of “target” chemicals already identified as problematic. Non-targeted analysis is a cutting-edge technique based on high-resolution mass spectrometry that allows us to take an expansive, open-ended look at thousands of chemicals at a time to determine their presence or absence.

Why do we use non-targeted analysis?

Over 100,000 chemicals are currently registered or approved for commercial use in the US, and this number continues to grow. Non-targeted analysis enables us to identify potentially concerning contaminants that are new or unexpected. The results can inform follow-up targeted monitoring studies to quantify concentrations and determine risks to wildlife, or identify ecotoxicity data gaps. Non-targeted analysis helps regulators and scientists focus resources on new high priority compounds.

How are chemicals identified?

This study focused on water-soluble contaminants, such as detergents and surfactants, plastic additives, pesticides, pharmaceuticals, and their breakdown products. Samples were analyzed using ultra high-performance liquid chromatography coupled to high-resolution mass spectrometry.

The resulting chemical signals were compared to over 22,000 signals for known compounds in mass spectral libraries. Identifications from this matching process are considered “tentative” until verified with standards or targeted analysis. Those that match known compounds at a level over 75% are considered “high confidence” identifications. The compounds described in this fact sheet are among the 400+ compounds in this study that were identified with high confidence.

In the future, as more chemicals are added to libraries of known compounds, the data from this study can be reexamined to determine retroactively whether these additional chemicals were present in Bay samples.

What do results tell us about risks to wildlife?

Non-targeted analysis indicates the presence of contaminants, but not whether they are at toxic levels. The aquatic toxicity of most of the compounds identified is also unknown. Additional targeted monitoring or ecotoxicity studies are needed to evaluate risks posed to aquatic life.

As part of the non-targeted study, 65 compounds were also analyzed using quantitative targeted methods. These compounds, including pharmaceuticals, pesticides, and a corrosion inhibitor, were commonly found in non-targeted analyses elsewhere. The concentrations of these 65 contaminants in Bay waters were below available ecotoxicity thresholds.



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THE REGIONAL MONITORING PROGRAM FOR WATER QUALITY IN SAN FRANCISCO BAY (RMP)

is an independent, long-term monitoring program providing policymakers with the information they need to protect this vital urban ecosystem. The RMP is an innovative collaboration between the San Francisco Estuary Institute, the San Francisco Bay Regional Water Quality Control Board, and regulated dischargers.

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