

**STATE OF CALIFORNIA
REGIONAL WATER QUALITY CONTROL BOARD
CENTRAL COAST REGION**

**STAFF REPORT FOR REGULAR MEETING OF SEPTEMBER 7-8, 2006
Prepared July 26, 2006**

ITEM NUMBER: 19

SUBJECT: Status and summary of findings by the Central Coast Long-term Environmental Assessment Network (CCLEAN) in Monterey Bay

KEY INFORMATION

Location: Monterey Bay
Discharge Type: Major ocean NPDES dischargers
This Action: Status Report

SUMMARY

The Central Coast Long-Term Environmental Assessment Network (CCLEAN) has recently completed its fifth year of monitoring in the Monterey Bay area. This interagency regionalized monitoring program assesses loads and fates of contaminants leaving rivers and effluent discharges and entering the Monterey Bay National Marine Sanctuary.

Results from thirty-day flow proportioned sampling of river and effluent discharges indicate that the total loading of persistent organic pollutants from river discharges is significantly higher in almost all cases than from effluent discharges. Loading of nitrate and pathogen indicators is also far higher from rivers and streams, but effluent discharges are the largest sources of ammonia and ortho-phosphate.

DDT and other organic pollutants are found in highest concentrations near the "apex" of the bay, where the Salinas and Pajaro Rivers discharge, and river loads are much higher in the wet season than in the dry season. Concentrations of persistent organic pollutants in mussels also exhibit strong seasonal patterns and high wet-season persistent organic

pollutants (POP) concentrations in mussels at locations distant from major rivers suggests there may be other important sources of these pollutants to Monterey Bay. Mussels at one site in northern Monterey Bay exceed numerous human health alert levels for pesticides. Sites four to five miles offshore in Monterey Bay exceeded Ocean Plan Table B criteria for PCBs and Dieldrin and equaled the criterion for DDTs in March 2004. Analysis of mussels sampled since the 1970s at several sites in Monterey Bay that are distant from major agricultural sources show that concentrations of legacy pesticides have not declined significantly over approximately 30 years. Concentrations of pesticides in sediments at several sites in Monterey Bay also have not changed; data suggest that some benthic organisms may be negatively affected by suspended sediments discharged from the Pajaro and Salinas rivers and by the concentrations of pollutants in the sediments.

Data findings confirm that loadings of pollutants, primarily from major rivers, contribute to exceedances of water quality criteria in ocean waters. In some locations, pollutants and pathogen indicators also exceed guideline values for

mussel tissue collected along the shoreline and may pose a risk to human health with respect to consumption of bivalves during certain times of the year. Pollutants also appear to be associated with changes in benthic invertebrate assemblages in some nearshore areas.

Because findings point to large nonpoint source contributions for several of the key parameters, member agencies are considering possible ways to expand CCLEAN to include other local agencies and organizations. The five-year summary report, which is to be completed by January 2007, will include a scientific peer review and recommendations for future program modifications.

DISCUSSION

The Central Coast Long-Term Environmental Assessment Network (CCLEAN) is a unique monitoring partnership between ocean dischargers in the Monterey Bay area, working in collaboration with the Central Coast Water Board's Central Coast Ambient Monitoring Program (CCAMP). Participants include the City of Santa Cruz, City of Watsonville, Carmel Area Wastewater District, Monterey Regional Water Pollution Control Agency, and LS LLC (formerly Duke Energy).

During the program design phase, a survey of stakeholders indicated that impacts to marine aquatic habitat, endangered species, and water body contact recreation were of primary concern, so the program was designed to assess impacts to these beneficial uses. This resulted in a program focus on persistent organic pollutants (POPs), nutrients, and pathogen indicators. The program is designed to assess loads of contaminants from the four major treatment plant discharges and the four major rivers (San Lorenzo, Pajaro, Salinas and Carmel) entering the Monterey Bay National Marine Sanctuary and to evaluate impacts in nearshore areas.

CCLEAN contractors deploy solid phase extraction columns deployed in effluent discharges and river mouths to obtain 30-day, flow-proportioned samples of POPs during wet-season and dry-season periods. CCLEAN contractors also collect mussel tissue samples from five sites around the edge of the bay during wet and dry seasons that are analyzed for POPs and bacteria. Four background sites and four depositional sites are sampled annually for sediment chemistry and benthic infauna composition along the 80-meter contour in Monterey Bay. Two sites approximately four to five miles offshore in northern and southern Monterey Bay are sampled over a 30-day period for concentrations of POPs, nutrients and bacteria. Partner agencies (including CCAMP) conduct monthly grab sampling of 14 creek and river mouths (and includes nitrate, orthophosphate, urea, ammonia, dissolved silica, total suspended solids and bacteria).

The program began sampling in 2001, and completed its fifth year of sampling in June 2006. CCLEAN annual reports and other program documents are available online at www.cclean.org. The fifth year of sampling has just been completed and data from that year are being compiled with past information for the five-year program summary report, due in January 2007.

Loading from Wastewater Treatment Plant Discharges and Rivers

Effluent discharge sampling indicates that concentrations of POPs from treatment plants were low, generally in parts per trillion or less, with polynuclear aromatic hydrocarbons generally present in the highest concentrations (up to 156.7 ng/L). Other contaminants, including chlordane, hexachlorocyclohexanes (HCHs), DDTs, Dacthal, and PCBs, were detected at concentrations that were generally lower than 1 ng/L, although HCHs were often between 1-2 ng/L in wastewater. Annual loads of POPs from all four wastewater discharges were proportional to

concentration, with PAHs ranging between 1.5-2.0 kg per year. Total annual wastewater loads of HCHs ranged from 39-62 g, with other POPs ranging from 10 g (DDTs) to 44 g (chlordane).

River mouth monitoring showed much higher overall concentrations and loads of most POPs, with PAHs having the highest concentrations and combined annual loads (up to 129.5 ng/L and 83.7 kg, respectively). DDTs usually had the second highest concentrations in rivers, up to 83.5 ng/L in the Salinas River. Annual combined loads of DDTs from rivers ranged from 0.5-11.8 kg. It is estimated that approximately 99% of the DDTs that enter Monterey Bay are discharged by the the Pajaro and Salinas rivers combined. The agricultural herbicide Dacthal was found in concentrations in the Pajaro and Salinas rivers at levels that were 23 to 500 times greater than in either of the other rivers or any of the wastewater discharges, with combined annual loads from rivers ranging from 0.5-17.8 kg. Highest concentrations and loads of POPs in rivers usually occurred in the wet season.

The collaborative sampling effort in streams and rivers generates monthly grab sample data from 14 of the largest watersheds entering Monterey Bay. "Loadings" have been estimated for the six sites that also have USGS flow gauges. The five-year report will include modeled flow estimates for all creek discharges. It should be noted that loading estimates from monthly sampling have a large margin of error, because sampling is relatively infrequent and storm events are not well represented in the data. Loading estimates from grab sample data are likely conservative because significant loading can occur during major storm events.

Highest loads of nutrients were documented in the wet season, from December through March. Nitrate-N loads leaving rivers ranged as high as 334,900 kg/yr from the Salinas River. In contrast,

nitrate-N loads from effluent discharges ranged from 5,114 kg/yr to 149,095 kg/yr. River loads of orthophosphate ranged from 489 kg/yr to 71,731 kg/yr, and ammonia ranged from 41 to 7,462 kg/yr. Orthophosphate loads from wastewater discharges ranged from 6,276 to 289,355 kg/yr, and ammonia ranged from 5,847 to 415,614 kg/yr. For most parameters, discharges from the six rivers and streams with flow data contribute significantly larger loads to the Bay than wastewater treatment plant discharges. However, loads of ammonia and orthophosphate from treatment plants were substantially higher than from these rivers and streams. Highest average concentrations of nitrate-N, orthophosphate, ammonia and urea were found in Tembladero Slough, tributary to Moss Landing Harbor. Average nitrate-N concentration in this system was 22.4 mg/L. This system has been severely impaired by agricultural activities in the area.

Of the fourteen rivers sampled, the San Lorenzo and Salinas rivers generally had the highest annual loads of total coliform bacteria, and the San Lorenzo River generally had the highest loads of *E. coli* and enterococcus. Highest loads of bacteria occurred in the wet season, from December through March.

Pollutant Fate Monitoring in Mussels and Nearshore Areas

Levels of DDTs found in marine sediments along the 80-m depth contour consistently exceeded the National Oceanic and Atmospheric Administration (NOAA) Effects Range Low guideline value. This guideline value was developed from a compendium of toxicity studies and represents the 10th percentile of all study results where a chemical level has been associated with a toxic effect. Analysis of historical data indicates that only one of the eight nearshore sites has showed a significant decline in DDT concentrations from levels documented in 1970. Statistical analysis of benthic infauna samples showed a significant relationship

between densities of several species and POP concentrations. Additional years of data will substantiate this finding.

Distribution of DDT and Dacthal concentrations in sediment and mussels were consistent with highest loads occurring in the wet season and originating near the apex of the Bay (where the Salinas and Pajaro rivers enter).

In general, POP levels in mussels were higher in wet-season samples. POPs in mussels from some sites exceeded several screening values. For example, mussel samples collected from The Hook (east of Santa Cruz near 41st Street) exceeded at least one screening value for PAHs, chlordane, PCBs, dieldrin, endosulfan and DDTs. In particular, dieldrin concentrations in mussels from The Hook and Laguna Creek often exceeded most applicable screening levels (Attachment 1, Figure 1. The meaning and implication of screening levels are explained in the figures). Long-term trends in concentrations of pesticides in mussels at Monterey Bay sites distant from large agricultural sources have not changed since the 1970s. For example, DDTs and dieldrin exhibited slight downward or upward trends at these locations (Attachment 1, Figure 2) but the changes are not significant.

Highest pathogen indicator levels in mussels occurred in the wet season, with Laguna Creek, Fanshell Overlook on the 17 Mile Drive and Carmel River Beach exceeding Food and Drug Administration guidelines for fecal coliform in shellfish.

CCLEAN contractors collected 30-day composite water samples during the wet season and the dry season at two sites four to five miles from shore in northern and southern Monterey Bay. Concentrations of some POPs in wet season samples from these offshore sites (March 2004) approached or exceeded Ocean Plan Table B water quality objectives (Attachment 1, Figure 3). These

results suggest that wet season flows from rivers are affecting water quality in Monterey Bay.

Related CCLEAN grant projects

CCLEAN has been awarded nearly \$2,000,000 in funds under the California's consolidated grant programs. These funds are being used to 1) analyze POP concentrations in sea otters to help determine the relationship between POPs and sea otter health and mortality, 2) determine the sources and loads of fecal pathogens to marine waters in Region 3 and 3) test the efficacy of wetlands for reducing loads of fecal pathogens. The results of these grant-funded projects will provide support for regulatory and management decision-making to reduce effects of river and stream discharges on nearshore waters.

Peer Review and Planning for the Next Five Years

A nationally recognized expert in monitoring program design and evaluation will be retained by CCLEAN to provide an outside review of the CCLEAN program over the next several months. This review will include an assessment of objectives, (including checks of internal and external consistency and relevance) and an assessment of technical design (including the ability to address objectives, and technical soundness and efficiency). We also plan to request a review of data QA/QC processes by State Surface Water Ambient Monitoring Program personnel. This review process will be used to refine the program and may result in recommendations for additions or deletion of program elements.

CCLEAN participants plan to examine over the next several months whether other questions should be addressed as part of the upcoming five-year program. For example, some participants have expressed interest in monitoring for emerging contaminants using semi-permeable membrane devices or the

currently used solid phase extraction column technology. Any program changes will be included in recommendations in the five-year report.

As the findings of the CCLEAN program indicate that major sources of POPs to Monterey Bay are from rivers, streams and probably other non-point discharges, program participants have begun a dialogue with other agencies and organizations to explore their interest in joining CCLEAN. In particular, those entities discharging to Areas of Special Biological Significance may find a regional monitoring approach to be relevant and cost-effective. These entities include Pebble Beach Company, the cities of Carmel and Pacific Grove, part of the city of Monterey, State Parks and Hopkins Marine Lab. We recognize that bringing new participants into the CCLEAN program is a process that will require significant planning and negotiation, both with these agencies and the Regional Board. Other potential collaborators include storm discharge management agencies, volunteer monitoring programs, and the Cooperative Monitoring Program for Agriculture.

RECOMMENDATIONS

This item is for information and discussion only. Staff will return to the Board with recommendations for program adjustments following evaluation of the CCLEAN external peer review and five-year program report in 2007. CCLEAN participants will be discussing opportunities for collaboration with other agencies over the next several months and findings associated with these discussions will also be included in the report to the Board at that time.

ATTACHMENT

Attachment 1. CCLEAN Selected Results for 2001 - 2005