

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

STAFF REPORT FOR REGULAR MEETING OF MARCH 20-21, 2008

Prepared on February 20, 2008

ITEM NUMBER: 8

**SUBJECT: Central Coast Long-term Environmental Assessment Network
(CCLEAN) Program Update**

SUMMARY

The Central Coast Long-Term Environmental Assessment Network (CCLEAN) is embarking on its next five years of monitoring with some proposed changes to its program strategy. CCLEAN sampled river and stream mouths for the first five years of its program, to learn more about how pollutant loads from upstream sources compare with those entering the ocean through the major permitted discharges, and how rivers and discharges impact the beneficial uses of Monterey Bay. For most pollutants assessed, the majority of the loading is coming from rivers. This finding, along with comments from an external scientific peer review, has led CCLEAN to propose several program changes. First, river mouth monitoring should be eliminated as a discharger supported program component (though the CCLEAN Steering Committee desires that this program element be maintained through other, more appropriate sources of funding). Second, CCLEAN should add several contaminants of emerging concern to the sampling design. Third, CCLEAN should assess the potential for endocrine disruption in aquatic species associated with effluent discharges. Fourth, program elements should be streamlined, by combining effluent monitoring of Ocean Plan Table B chemicals with CCLEAN high volume water sampling, and by sampling mussels only during the wet season. Other efficiencies may be found in the CCLEAN sediment and benthos sampling approach, following an independent evaluation of the data now underway.

Several details associated with the proposed monitoring need to be clarified. Primary among them is a choice between two approaches to high volume water sampling. One is the solid phase extraction columns used in the past by CCLEAN. The other is the polar organic chemical integrative sampler used by the City of Santa Cruz and Monterey Regional Water Pollution Control Agency (MRWPCA) as a component of their effluent monitoring programs. Another issue that CCLEAN needs to clarify is specifically which Table B contaminants will be included in high volume water sampling. Also, a detailed sampling approach for endocrine disrupting compounds needs to be developed. These details, along with other specific responses to the external peer review, will be provided to Water Board staff for approval in the update to the CCLEAN Quality Assurance Program Plan, due on July 1, 2008.

Staff has incorporated the proposed changes to the CCLEAN program in revisions to Monitoring and Reporting Programs included in the NPDES permits for the four wastewater treatment plant discharges that will be heard in subsequent agenda items at this Board meeting.

DISCUSSION

Background

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 Dynegy (formerly Duke Energy). The program began sampling in 2001, and completed its fifth year of sampling in June 2006.

During the program design phase, a survey of stakeholders indicated that impacts to marine aquatic habitat, endangered species, wildlife habitat 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 was designed to assess loads of contaminants from the four major treatment plant discharges and the four major rivers (San Lorenzo, Pajaro, Salinas and Carmel) and smaller streams entering the Monterey Bay National Marine Sanctuary and to evaluate impacts in nearshore areas.

Since completion of the five-year report, the CCLEAN program has undergone an external peer review by Dr. Brock Bernstein. Dr. Bernstein's recommendations are summarized in this staff report. The CCLEAN five-year report, the external peer review, and other program documents are available online at www.cclean.org. Based on the peer review, the findings from the first five years, and the priorities of the participants, several significant changes are proposed for the upcoming five years of the program.

CCLEAN Five-Year summary

The basic program approach for the first five years of the program was as follows: CCLEAN contractors deployed solid phase extraction columns in effluent discharges and at four major river mouths to obtain 30-day, flow-proportioned samples of POPs during wet-season and dry-season periods. Two sites approximately four to five miles offshore in northern and southern Monterey Bay were also sampled using the same devices over a 30-day period for concentrations of POPs, nutrients and bacteria in ocean water. CCLEAN contractors also collected mussel tissue samples from five sites around the edge of the bay during wet and dry seasons that were analyzed for the same POPs and bacteria. Four background sites and four depositional sites were sampled annually for sediment chemistry and benthic infauna composition along the 80-meter contour in Monterey Bay. Partner agencies (including CCAMP) conducted monthly grab sampling of 14 creek and river mouths (including nitrate, orthophosphate, urea, ammonia, dissolved silica, total suspended solids and bacteria). This sampling design

allowed CCLEAN to estimate relative loading of pollutants from rivers and discharges to Monterey Bay and to track the fate of those pollutants in sediment, water and tissue in nearshore areas. Biological impacts were assessed through sampling of benthic biota and mussels, and through a grant-funded study on sea otter tissue chemistry.

There are a number of findings associated with the first five years of the CCLEAN program. Included here is the summary of findings from the CCLEAN Five-Year Report:

Beneficial uses in Monterey Bay are impaired due to POPs. Evidence for this impairment comes from data on contaminants in water, mussel tissue and sediments. For example, marine waters 5–6 miles offshore have frequently exceeded human health objectives in the California Ocean Plan for PCBs and occasionally for dieldrin and PAHs. Moreover, mussels at several sites along the northern shore of Monterey Bay, especially at The Hook, have often exceeded the California Office of Environmental Health Hazard human health alert level for dieldrin and have exceeded the 95th percentile for contaminant concentrations measured by State Mussel Watch in over 200 samples of resident California mussels for dieldrin, endosulphans and chlordanes. PCB 56, PBDE 28 and some chlordanes also were found to be significant risk factors for sea otters dying from various infectious diseases. Sediment samples have consistently exceeded the National Oceanic and Atmospheric Administration concentration of DDT above which toxicity occurs in 10% of samples. Unmeasured contaminants associated with sediment particles from rivers may be negatively impacting benthic organisms, as suggested by negative statistical associations between suspended sediment loads from rivers and numerous benthic species.

There is substantial evidence that runoff from the land is the largest source of POPs that are impairing beneficial uses in Monterey Bay, rather than discharges of municipal wastewater. Cumulative loads of various POPs from rivers over a four-year period were 2.4 to 394 times greater than from wastewater. There also were significant statistical associations between concentrations of some pesticides in mussels and local rainfall, but not between mussels and flows of rivers or wastewater, and higher POP loads from rivers and concentrations in mussels occurred in wet-season samples, both of which suggest that storm runoff from the land, including urban landscapes, could be an important source of these contaminants. Moreover, analysis of long-term data for mussels indicates that concentrations of these POPs have not declined since their use was banned 20–30 years ago.

While runoff from land, including rivers, is the largest source of most of the troublesome POPs measured by CCLEAN during the first five years of the program, there are other emerging contaminants of concern, such as PBDEs, personal care products and hormones that we have not measured. Some of these emerging contaminants of concern have been shown to come predominantly from wastewater. For example, PBDEs are flame retardants used in foam furniture and electronic equipment. They are chemically very similar to PCBs and accumulate to high concentrations in fatty tissues of organisms near the top of the food web, such as humans and sea otters. CCLEAN began

measuring PBDEs in 2006-2007 and preliminary data indicate that concentrations of PBDEs in wastewater are 1–2 orders of magnitude greater than in the rivers and loads from wastewater may exceed those from rivers.

*In addition to the impairments to beneficial uses caused by POPs, there also are impairments to beneficial uses in Monterey Bay caused by nutrients and bacteria. While we do not have load estimates for bacteria from wastewater for comparison with rivers, most nutrient loads were greater from rivers than from wastewater. Impairments to streams, rivers and marine waters from bacteria and nutrients were directly related to exceedences of water-contact recreation and municipal water supply water quality criteria, respectively. Although direct links between impairments of marine waters and nutrients from point and non-point sources have not been clearly demonstrated in Monterey Bay, there is considerable evidence that urea enhances the growth of certain harmful dinoflagellates and the toxicity of *Pseudonitzschia* spp., the diatoms that produce domoic acid, which is the cause of amnesic shellfish poisoning and an important health concern for sea otters.*

The CCLEAN five-year report includes several recommendations for the next five years of the program:

1. A more complete picture of contaminant sources and loads should be developed for the Monterey Bay area.

This recommendation includes sampling of non-riverine runoff along with effluent and river discharges, and also measuring emerging contaminants of concern, such as Polybrominated Diphenyl Ether (PBDEs), pyrethroids, perfluorinated compounds, personal care products and hormones. The recommendation suggests that these parameters should be considered for measurement over at least a five-year period to evaluate sources, loads and potential trends.

2. The program should be streamlined.

This recommendation includes reducing mussel sampling to the wet season only, which has proven to be the “index” period, when worst-case concentrations of contaminants in mussels can be measured. The National Status and Trends program also samples in winter for long-term measurements of POPs in mussels along the California coast, so this recommendation maintains consistency between CCLEAN and this federal sampling program.

This recommendation also proposes program streamlining through reduction in analytical costs, achieved by combining effluent monitoring requirements for Table B pollutants with CCLEAN load monitoring activities.

Peer Review Findings

Dr. Brock Bernstein has been involved in monitoring design work for the State of California, the Southern California Coastal Water Research Program, and others for a number of years. Dr. Bernstein reviewed the CCLEAN Five-year report, the Quality Assurance plan and data management methods, and interviewed all CCLEAN participants in the course of his peer review. He commended the program's several accomplishments, in particular in producing information about contaminant loading from various sources and about the impacts of these contaminants on key beneficial uses. One of his primary comments was that several of the core objectives had been met and others need to be revisited in light of what was learned over the course of the five year period. He recommended a comprehensive reevaluation of program questions and objectives to refocus efforts for the future. Some of his suggestions are being addressed through proposed program revisions, but others will require more detailed discussion and program revisions over the course of the next several years.

Dr. Bernstein recommended several areas for improvement:

- Standardizing data acquisition and management
- Linking Data Quality Objectives to core questions and related data analysis
- Expanding the suite of data analysis methods
- Improving the efficiency of the monitoring design
- Defining a reporting strategy that more effectively communicates results to key audiences
- Expanding relationships with other monitoring and research programs and institutions

Staff has several comments on the above areas:

Data Acquisition and Management – This item included recommendations for standardized data delivery and transfer formats, a strategic approach for achieving Surface Water Ambient Monitoring Program (SWAMP) compliance, and better use of tools to improve routine data loading, error checking, data summaries and other products. CCAMP monitoring has replaced the CCLEAN creek sampling efforts by local agencies; this has greatly simplified data acquisition issues for CCLEAN. CCLEAN is also adopting a data delivery approach that will utilize CCAMP web-based data delivery tables, now being standardized for use by SWAMP for grants data delivery. Some CCLEAN data elements have already been delivered to CCAMP in this format as a result of activities of the Monterey Bay National Marine Sanctuary's Data Synthesis, Assessment and Monitoring project (SAM). CCLEAN needs to commit to routine deliveries of data to CCAMP using this new format. Consequently, it may want to consider a database approach that facilitates this delivery format. Ultimately, the CCAMP format will be linked to web viewers and other tools, so this will address a number of the above concerns. CCLEAN will include a schedule of data reporting in the revisions to the Quality Assurance Program Plan.

Data Quality Objectives – The CCLEAN Quality Assurance Program Plan identifies Method Quality Objectives for accuracy and precision of analytical methods but does not link these to the Program objectives or study questions of interest. An analytical

measurement may be able to be made with a known level of precision, but the precision of loading estimates is not quantified. For example, the program should be able to express how much change it could detect in loading of a given pollutant from a given discharge, if change were occurring. Analytical questions and statistical methods should be revisited, and data products should be more explicitly defined. This issue should be addressed in the revisions to the Quality Assurance Program Plan.

Expanding the Suite of Data Analysis Methods – Dr. Bernstein recommended that with additional years of data, the program should utilize new approaches for analyzing the data, including trend analysis, improved graphical approaches, use of multivariate statistics and other more sophisticated analytical approaches.

Monitoring Design Efficiency – The primary efficiency proposed for the revised program is to utilize sampling via flow integrated sampling devices as a means to address effluent monitoring requirements of Ocean Plan Table B chemicals. Another relates to reduced frequency of mussel tissue monitoring, to that used by the National Status and Trends program. A third possible efficiency, related to sediment monitoring frequency, is currently being evaluated by external reviewers.

Reporting Strategy – Dr. Bernstein suggested that CCLEAN develop a reporting strategy for communicating results, both to meet the needs of its participants and other program customers. He suggested more concise annual reports, with a more comprehensive synthesis report on a less frequent basis. He also suggested that the format be organized around answering key questions, with a known degree of confidence. He provided many other specific suggestions. Staff expects revisions to the CCLEAN reporting strategy to be described in the updated Quality Assurance Program Plan.

Expanding Relationships – CCLEAN has invited participation in its Steering Committee meetings from stormwater agencies in the area, particularly those in Areas of Special Biological Significance. The CCLEAN Program Director and some CCLEAN members have participated in dialogues with State Board staff and local agencies about pending requirements for ASBS monitoring. CCLEAN has been proposed as a possible coordinating mechanism for this new monitoring effort. CCLEAN also has the potential to expand its membership to other wastewater treatment plant operators south of the Monterey Bay area.

Proposed Changes to the Monitoring Program

CCLEAN Steering Committee members have met a number of times since the completion of the peer review to discuss program objectives and the future of the CCLEAN Program. They have proposed a number of changes to CCLEAN for the upcoming five years:

- Eliminate river mouth sampling using solid-phase extraction columns
- Transfer creek mouth grab sampling to CCAMP
- Reduce frequency of mussel monitoring to once per year during the wet season
- Maintain effluent monitoring using high volume sampling devices
- Add PBDE and perfluorinated compounds (PFCs) to the suite of chemicals monitored in effluent, mussels, and sediment
- Evaluate and implement biological assessment methodologies for evaluating endocrine disruption in suitable test species (bioassays were chosen in lieu of

sampling for individual compounds given the large number of POP and personal care and pharmaceutical product related compounds exhibiting potential endocrine disruption)

Dischargers agree that stream and river monitoring has been a very worthwhile endeavor, particularly because the data clearly show very large contributions of the overall load of most pollutants measured coming from these sources, rather than from the permitted discharges. They also agree this type of monitoring should continue, to provide context for the loads coming from point source discharges. However, dischargers also agree that they should not be responsible for continuing to pay for river and stream monitoring. Ideally, they want to see other non-point source dischargers maintain these program components, preferably by participating directly in CCLEAN. These program elements have been eliminated from the proposed Monitoring and Reporting Programs associated with wastewater NPDES permits, but are still maintained in the current Program objectives, in identifying "sources of contaminants to the ocean."

The monthly stream mouth monitoring for nutrients, pathogen indicators, and other parameters will essentially be maintained through the Central Coast Ambient Monitoring Program's Coastal Confluences monitoring. CCAMP already samples most of the CCLEAN stream and river sites for monthly grab samples and flow, and so have added additional CCLEAN parameters (urea and silicate) to the existing CCAMP analyte list to continue this program element. The primary CCLEAN program component that will have an uncertain future, assuming the Board adopts the monitoring program as proposed, is the sampling of the four major river mouths for persistent organic pollutants, using solid phase extraction columns and 30-day flow-proportioned samples. At this time, the Cities of Watsonville and Santa Cruz intend to continue their river mouth monitoring stations outside of CCLEAN requirements, because of the large potential influence of their respective urban areas on the Pajaro and San Lorenzo rivers, and their desire to understand and manage these issues. However, the Carmel River and Salinas River stations will need funding through other sources if they are to continue.

CCLEAN participants have proposed to investigate other contaminants not currently addressed by the program, including Ocean Plan Table B pollutants, as appropriate. They propose to use high volume sampling devices to provide a much more precise measure of 30-day averages of these pollutants in effluent, and thus address effluent monitoring requirements as well as CCLEAN goals. Participants also propose to include program components for monitoring the most probable emerging contaminants of potential concern. One chemical they have already added to the suite of contaminants being monitored is Polybrominated Diphenyl Ether (PBDE). This contaminant is used in fire retardants, and has recently been shown to be present at surprisingly high levels in sea otter tissue collected along the Central Coast. The other chemical group of interest is perfluorinated compounds (PFCs). PFCs are used for example, in stain resistant products (like Scotchgard) and in Teflon products. Both PFCs and PBDEs have been found in sea otter tissue and have been tentatively associated with higher risk of pathogenic disease. PFCs are more water soluble than PBDEs, and thus will be monitored using a more conventional grab sampling approach.

The first five years of CCLEAN sediment data is currently being evaluated by outside experts to determine whether a reduction in sampling frequency can still result in adequate statistical capability to detect status and trends. Any recommendations for streamlining will be incorporated into revisions to the Quality Assurance Program Plan.

CONCLUSION

CCLEAN will address any revisions to sampling methods in the update to the Quality Assurance Program Plan, due to staff on July 1, 2008, with new sampling to be adopted into the program at that time. Other program revisions made in response to Dr. Bernstein's peer review will also be addressed in that document and implemented accordingly.

CCLEAN participants will revisit program objectives as recommended in the peer review over the next year and will report back to the Board with any revisions in December, 2008. CCLEAN has also been involved in discussions with local agencies and organizations and the State Board about a regionalized approach to monitoring in Areas of Special Biological Significance. Should CCLEAN become the monitoring entity to organize a regionalized monitoring approach for storm water agencies, program objectives and the Quality Assurance Program Plan may be further revised to reflect this.

Staff is working to increase monitoring in the Central Coast in a variety of ways. We are working on expanding the CCAMP endowment through requests to other potential funding sources, particularly those associated with ocean resources. We have begun a dialogue with the Ocean Protection Council and the Resources Legacy Fund Foundation about monitoring needs and deficiencies in the Central Coast, and have suggested that the greater monitoring community will benefit by finding ways to help fund the river monitoring sites. Additionally, we would like to see monitoring of other larger discharges in more southerly parts of the Region using high volume sampling technologies, including point sources and larger river systems. We will be exploring whether CCLEAN technology has applicability in these areas.

RECOMMENDATION

This item is presented for Board discussion and input. Staff has incorporated the proposed changes to the CCLEAN program in revisions to Monitoring and Reporting Programs for the four wastewater treatment plant discharges that will be heard in subsequent agenda items at this Board meeting.