



# California Regional Water Quality Control Board Central Valley Region

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Delta Vision Blue Ribbon Task Force  
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## RESPONSE TO REQUEST FOR WATER QUALITY INFORMATION

Thank you for the opportunity to provide some additional information about Delta water quality and how the Regional Water Board addresses water quality problems in the Delta. We have been working with your staff for the past several months to discuss water quality issues in the Delta to ensure that the Delta Vision and our work efforts compliment and build upon each other. It is my understanding that you requested information about impaired water body listings in and around the Delta, what TMDLs are being implemented or are under development to address impairments, how the TMDLs are integrated with our other water quality programs and what we know about water quality trends in the Delta.

Water quality in the Delta has been a concern for the Regional Water Board for as long as the Board has existed. Over the years the contaminants and discharge sources have changed and there have been significant improvements in controlling many types of contaminants. For example, there used to be major fish kills throughout the Delta because of low dissolved oxygen and some pesticides used to be present at concentrations that caused toxic conditions in the Delta for several days at a time. These problems have been mostly addressed. Nevertheless, there are a suite of contaminants and source categories that may pose a threat to some Delta beneficial uses. There also is growing concern about an emerging list of contaminant categories (e.g., pharmaceuticals and endocrine disrupting compounds).

Regional Water Board regulatory programs are in place to control discharges of wastes from wastewater treatment facilities, industrial facilities, urban areas, irrigated agricultural lands, dredging operations and other sources of wastewater to the Delta and tributaries. These programs prescribe stringent waste discharge requirements designed to protect beneficial uses of water in the Central Valley Region, including the Delta. We apply the best science available to determine safe levels in the Delta and other waters and then prescribe stringent waste discharge limits on dischargers to ensure that these safe levels are not exceeded. When new scientific information indicates that the safe levels are no longer appropriate (i.e., not protective of beneficial uses), then the Regional Water Board can revise them through a structured process, which is equivalent to adopting regulations. Often, there is significant controversy about the science (e.g., what concentrations are protective).

If a single discharger is responsible for a water quality impairment, the Regional Water Board can address the impairment by taking appropriate regulatory action such as revising the permit or taking enforcement action. However, in many cases, water quality impairments are caused

*California Environmental Protection Agency*

by multiple dischargers and discharge types. In these cases, the Regional Water Board must develop a comprehensive control program that equitably distributes responsibility for addressing water quality impairments among the various contributing sources. This comprehensive water quality control effort addressing multiple dischargers was what was envisioned in Section 303(d) of the Clean Water Act. The Clean Water Act refers to this kind of comprehensive control effort as a TMDL (Total Maximum Daily Load). The Clean Water Act includes requirements for states to develop lists of impaired water bodies and to develop TMDLs or take other appropriate actions to address impairments. The State Water Board has created a TMDL program to implement the provisions of the Clean Water Act. The TMDL program is the primary program responsible for addressing impaired waters where traditional controls on point sources have proven inadequate, by themselves, to address impairments. The program is charged with creating plans for corrective measures, regardless of sources contributing to impairments.

The attached list (Attachment 1) shows the major impaired water body listings (by water body) in the Central Valley Region that were included on the 2006 impaired water body list. The full list includes 342 water body/pollutant combinations. The Regional Water Board has developed and implemented (or in some cases, just started implementing) control programs to address the following impairments that are in the Delta and tributaries to the Delta.

- Selenium in the Grassland Marshes, Salt Slough and the San Joaquin River
- Salinity and boron in the lower San Joaquin River
- Dissolved oxygen in the Stockton Deep Water Ship Channel (Phase 1)
- Bacteria in Stockton area urban creeks
- Diazinon and chlorpyrifos in the San Joaquin River, Delta, Feather River, Sacramento River and Stockton and Sacramento urban creeks
- Mercury in Clear Lake and Cache Creek
- Copper, zinc and cadmium in the Sacramento River
- Nutrients in Clear Lake

Control programs addressing the above impairments are implemented through the Water Boards existing regulatory permitting programs.

The Regional Water Board is currently working on developing control programs for the following impairments on the 2006 list.

- Mercury in the Delta
- Salinity in the San Joaquin River upstream from the Delta
- Multiple pesticides in the Delta and tributaries to the Sacramento River and San Joaquin River
- Dissolved oxygen in the Stockton Deep Water Ship Channel (Phase 2)
- Organochlorine pesticides in multiple water bodies throughout the region

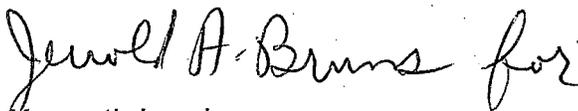
The Regional Water Board has limited resources to develop and implement TMDLs and has generally focused them on high priority water bodies, with most resources being spent in and around the Delta or on water quality problems that are relevant to the Delta. Note that no impairments due to ammonia appear on the list of impaired waterbodies. That is because we have no evidence to suggest that Central Valley waterways exceed safe levels of ammonia (i.e., US EPA water quality criteria) for protecting aquatic life. Recently, concern has been

raised that the US EPA criteria may not be protective of some Delta species. The Regional Water Board funded studies to determine whether ammonia could be impacting Delta species. Attachment 2 summarizes the status of these studies.

The State and Regional Water Boards recognize the importance of water quality issues in the Delta and have recently adopted a strategic workplan for addressing Delta concerns. The intent of the workplan is to focus on work efforts needed to augment the existing regulatory control programs. The strategic workplan includes elements that stress the importance of continuing to work on TMDLs. In addition, the workplan highlights the need for more studies on the potential impacts of ammonia on Delta species, development of a comprehensive Delta monitoring and assessment program, characterizing discharges from Delta islands, coordinating with the Department of Pesticide Regulation and the county agricultural commissioners on pesticide issues, and evaluating the need for additional permit requirements to address impacts from power plant diversions and discharges.

In addition to the activities identified in the strategic workplan, the Regional Water Board is engaged in several other Delta-related efforts. We have entered into contracts with researchers to assess the potential impacts of certain pesticides on Delta waterways and to compile and assess all readily available contaminants and toxicity data. Regional Water Board staff chair the Interagency Ecological Program's Contaminants Work Team, which is responsible for guiding the investigations of the relative importance of contaminants in the decline of pelagic organisms in the Delta. We also are providing technical assistance to the Bay Delta Conservation Plan Other Stressors Workgroup as they develop strategies to address toxics. It is our hope that all of our efforts to protect beneficial uses of water in the Delta are closely integrated with the goals and objectives of the Delta Vision Strategy.

If you have any questions about any of the information we have provided, or would like additional information on other water quality issues in the Delta, please contact me at (916) 464-4726 or Karen Larsen at (916) 464-4646.



Kenneth Landau  
Assistant Executive Officer

Enclosure(s) - 2

cc: Delta Vision Blue Ribbon Task Force Members  
John Kirlin, Delta Vision Executive Director  
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Sam Harader, CALFED Water Quality Program Manager

Central Valley Water Board  
Major Water Bodies Listed as Impaired (2006 303(d) List)

Count of WATER BODY NAME	POLLUTANT CATEGORY	POLLUTANT
WATER BODY NAME	Metals/Metalloids	Mercury
American River, Lower (Nimbus Dam to confluence with Sacram	Toxicity	Unknown Toxicity
American River, South Fork (below Slab Creek Reservoir to Fols	Metals/Metalloids	Mercury Mollinate/Ordram
	Toxicity	Unknown Toxicity Group A Pesticides
	Toxicity	Unknown Toxicity
Delta Waterways (export area)	Metals/Metalloids	Mercury
	Miscellaneous	Exotic Species
	Pesticides	Chlorpyrifos DDT Diazinon
	Toxicity	Group A Pesticides
	Toxicity	Unknown Toxicity Group A Pesticides
Delta Waterways (northwestern portion)	Metals/Metalloids	Mercury
	Miscellaneous	Exotic Species
	Pesticides	Chlorpyrifos DDT Diazinon
	Salinity	Group A Pesticides
	Toxicity	Electrical Conductivity
	Toxicity	Unknown Toxicity
Delta Waterways (southern portion)	Metals/Metalloids	Mercury
	Miscellaneous	Exotic Species
	Pesticides	Chlorpyrifos DDT Diazinon
	Salinity	Group A Pesticides
	Toxicity	Electrical Conductivity
	Toxicity	Unknown Toxicity
Delta Waterways (Stockton Ship Channel)	Metals/Metalloids	Mercury
	Miscellaneous	Exotic Species

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 Major Water Bodies Listed as Impaired (2006 303(d) List)

Delta Waterways (Stockton Ship Channel)	Nutrients	Organic Enrichment/Low Dissolved Oxygen
	Other Organics	Dioxin Furan Compounds PCBs (Polychlorinated biphenyls)
	Pathogens	Pathogens
	Pesticides	Chlorpyrifos DDT Diazinon Group A Pesticides
	Toxicity	Unknown Toxicity
Delta Waterways (western portion)	Metals/Metalloids	Mercury
	Miscellaneous	Exotic Species
	Pesticides	Chlorpyrifos DDT Diazinon Group A Pesticides
	Salinity	Electrical Conductivity
	Toxicity	Unknown Toxicity
Feather River, Lower (Lake Oroville Dam to Confluence with Sa)	Metals/Metalloids	Mercury
	Pesticides	Chlorpyrifos Diazinon Group A Pesticides
	Toxicity	Unknown Toxicity
Feather River, North Fork (below Lake Almanor)	Metals/Metalloids	Mercury
	Miscellaneous	Temperature, water
Merced River, Lower (McSwain Reservoir to San Joaquin River)	Metals/Metalloids	Mercury
	Pesticides	Chlorpyrifos Diazinon Group A Pesticides
Middle River	Nutrients	Low Dissolved Oxygen
	Metals/Metalloids	Copper Zinc
Mokelumne River, Lower	Metals/Metalloids	Boron Selenium
	Pesticides	Pesticides
Mud Slough	Salinity	Electrical Conductivity
	Toxicity	Unknown Toxicity
Old River (San Joaquin River to Delta-Mendota Canal)	Nutrients	Low Dissolved Oxygen

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 Major Water Bodies Listed as Impaired (2006 303(d) List)

Sacramento River (Keswick Dam to Cottonwood Creek)	Metals/Metalloids	Cadmium Copper Zinc
	Toxicity	Unknown Toxicity
Sacramento River (Cottonwood Creek to Red Bluff)	Toxicity	Unknown Toxicity
Sacramento River (Red Bluff to Knights Landing)	Metals/Metalloids	Mercury
	Toxicity	Unknown Toxicity
Sacramento River (Knights Landing to the Delta)	Metals/Metalloids	Mercury Diazinon
	Salinity	Group A Pesticides
	Toxicity	Electrical Conductivity
		Unknown Toxicity
San Joaquin River (Bear Creek to Mud Slough)	Metals/Metalloids	Boron Mercury
	Pesticides	Chlorpyrifos

## Concerns about Ammonia Concentrations in Delta Waters

A June 2<sup>nd</sup> article in the Sacramento Bee highlighted some recent findings by Dr. Richard Dugdale, a researcher at San Francisco State University, which suggested that ammonia levels in the Delta and Sacramento River may pose a threat to Delta species by interrupting the food chain. The Regional Water Board and others agree that it is essential to initiate actions to follow-up on these preliminary results. Following is some background information and a brief description of the follow-up activities underway on this particular issue and some related issues.

### Algal Production

Primary production rates and standing chlorophyll levels in the Sacramento-San Joaquin Delta Estuary are among the lowest of all the major estuaries in the world and continue to decline. The reason(s) are unclear but decreasing primary production is cited as a possible cause of the decline of important Delta fish species, such as Delta smelt. Recent work by Drs. Dugdale and Wilkerson, San Francisco State University Romberg Tiburon Center, has shown that elevated ammonium concentrations reduce diatom (a type of algae that is important in the Bay and Delta) production rates in water samples collected from San Francisco and Suisun Bays by inhibiting nitrate uptake. It is not known whether the same effect is manifested in the Delta.

Also, it is not known whether the ammonium concentrations in the River inhibit freshwater diatom production and are a cause of low algal primary production in the freshwater portions of the Delta. The Regional Water Board contracted with Dr. Dugdale to conduct experiments with diatoms collected from the lower Sacramento River to determine whether ambient in-stream ammonium concentrations reduce growth rates. Staff will be evaluating existing information to determine the need for studies to determine fate and transport of ammonium down the Sacramento River and across the Delta to determine what factors contribute to ammonium concentrations in Suisun Bay.

Once the results of the follow-up screening studies are complete, further work will be needed to determine the relative importance of ammonium on the Delta food web.

### Delta Smelt Survival

In most water years, larval Delta smelt are caught in the spring about 30 miles below the City of Sacramento at the confluence of the Sacramento River and Sacramento Deepwater Ship Channel. Recent data from bioassay tests with ambient Sacramento River water has led to the hypothesis that larval Delta smelt may be sensitive to ammonia.

The Regional Water Board has contracted with researchers at the University of California, Davis to conduct bioassays with larval Delta smelt to determine their

sensitivity to ammonia in the lower Sacramento River and to identify whether other toxicants might be present. These studies were initiated in May 2008. Further study will be needed to determine if any additional actions should be taken to control ammonia discharges to protect Delta smelt.

#### Stimulation of Nuisance Algal Blooms

Recent research conducted by the Department of Water Resources (DWR) suggests that nuisance algal blooms that have been occurring in the Delta in recent years might be linked to elevated levels of ammonia in Delta waters. The nuisance blooms are characterized by surface scums and the release of toxins into the water. Regional Water Board staff is coordinating with DWR on follow-up studies.

#### Wastewater Treatment Plant Discharges

A recent review of ammonia concentrations in the Delta has shown that ammonia levels in the Sacramento River at Greene Landing are about an order of magnitude higher than concentrations reducing diatom growth in half in San Francisco Bay. And, as was discussed above, there are concerns about potential toxic impacts to Delta smelt and stimulation of nuisance algal blooms.

As was mentioned in the article, the Sacramento Regional County Sanitation District (SRCSD) discharge is the largest single source of ammonia in the Delta. Other sources include other smaller wastewater treatment plants and agricultural discharges. The Regional Water Board's current wastewater discharge permit requirements for ammonia are based on US EPA guidance on aquatic toxicity that is designed to protect the most sensitive aquatic species. When writing a permit, Regional Water Board staff evaluates effluent concentrations, concentrations of ammonia already in the river and available dilution. Limitations in permits are, therefore, site specific. SRCSD's permit allows for discharge of relatively high concentrations of ammonia because the river is large and provides considerable dilution. SRCSD has constructed large storage basins to hold wastewater when there is not sufficient dilution in the river. The City of Stockton, on the other hand, has very stringent effluent ammonia limits because little dilution is available. Several years ago the Regional Water Board required Stockton to upgrade their wastewater treatment facility to add treatment processes to remove ammonia.

It is important to recognize that current Delta ammonia concentrations are far lower than concentrations that US EPA guidance indicates would be toxic. The current studies and follow-up studies may provide information that would lead to the need for stricter requirements on all sources of ammonia to the Delta.

Be assured that the Water Quality Control Board is committed to protecting the waters of our state. In this effort we are engaged with the scientific community to study and document impacts to water quality. When new scientific information is developed we incorporate this information into our permits.

# Study to Evaluate Potential Effects of Ammonia on Delta Smelt

Status Update – 30 July 2008

A previous web posting<sup>1</sup> summarized background information about issues related to ammonia in the Sacramento-San Joaquin Delta estuary. As indicated in that posting, the Regional Water Board contracted with researchers at the University of California, Davis Aquatic Toxicology Laboratory to initiate studies to evaluate the potential effects of ammonia on delta smelt. The study was designed to answer two questions:

1. Is delta smelt survival negatively impacted by ambient ammonia concentrations in the Sacramento River with increasing concentrations causing increased mortality?
2. Is delta smelt survival negatively impacted by one or more contaminants present in the Sacramento Regional Wastewater Treatment Plant (SRWTP) effluent that are positively correlated with ammonia?

The study plan identified two sets of experiments to be conducted with the first set beginning in June 2008. To date, researchers have conducted two tests: one to determine the 4-day delta smelt ammonia LC50 in laboratory water (i.e., establish the concentration of ammonia that would cause 50% of the test fish to die) and the first set of ambient tests using the SRWTP effluent as a source of ammonia. In the LC50 test the concentration of total ammonia at which no effect could be detected was 5 mg/L, the lowest concentration that produced an effect was 9 mg/L, and the LC50 was calculated at 12 mg/L. These results suggest that delta smelt are about as sensitive to ammonia as some of the more sensitive species (e.g., salmon and trout) and therefore, that the USEPA acute ammonia criteria used by the Regional Board in NPDES permitting would be protective of delta smelt. Average ammonia concentrations in the Sacramento River also are lower than the chronic effect levels for fish species reported in the USEPA dataset.

The ambient set of tests were conducted in Sacramento River water collected upstream of the SRWTP discharge at concentrations of ammonia that encompassed average concentrations in the River once the effluent is fully mixed downstream. To evaluate whether any other toxicants could be present in the SRWTP effluent that effect delta smelt (question #2), the tests were conducted using laboratory ammonium chloride (ranging from 0.25 to 4.0 mg/L) and SRWTP effluent (ranging from 0.25 to 2.0 mg/L) as a source of ammonia. No effect was observed at any of the ammonia concentrations. These results are consistent with the laboratory LC50 study and indicate that the SRWTP effluent is not acutely toxic to Delta smelt at concentrations four times greater than the average currently observed in the Sacramento River, and five times greater than the average effluent concentration now present in the Sacramento River.

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<sup>1</sup>The referenced document is available for download at:  
[http://www.waterboards.ca.gov/centralvalley/water\\_issues/delta\\_water\\_quality/ammonia\\_issues/ammonia\\_issues\\_11jun08.pdf](http://www.waterboards.ca.gov/centralvalley/water_issues/delta_water_quality/ammonia_issues/ammonia_issues_11jun08.pdf)

After reviewing the initial results, Regional Water Board staff, in consultation with UC Davis researchers, SRWTP, and the review team<sup>2</sup>, planned modifications to the study design to further evaluate question #2. - The new objective is to quantify the potential interactions between effluent and ammonia toxicity to delta smelt (i.e., does the effluent add to, decrease, or have no effect on toxicity). The second set of tests will include some of the same concentrations of ammonia that were tested previously to verify the results of the first set of tests. In addition, higher concentrations, closer to the level that produced effects in the LC50 study, will be tested to evaluate question #2 and to assess the potential for effluent and ammonia interactions. It should be noted that these concentrations are well above levels that occur in the Sacramento River downstream of the SRWTP discharge. This second set of tests will be conducted in July 2008.

It is important to note that these studies only assess the acute (i.e., short-term, lethal) effects of ammonia on delta smelt immediately downstream of the SRWTP discharge location in the Sacramento River. Questions remain about the potential for chronic (i.e., long-term, sub-lethal) impacts from ammonia as well as the impacts in sensitive delta smelt spawning areas downstream of the SRWTP discharge. Future studies may need to be designed to answer these questions.

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<sup>2</sup> The Interagency Ecological Program Contaminants Work Team served as the technical review panel for these studies.