# ECONOMIC CONSIDERATIONS FOR PROPOSED TOTAL RESIDUAL CHLORINE AND CHLORINE-PRODUCED OXIDANTS POLICY FOR CALIFORNIA

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# Acronyms and Abbreviations

| | |
|---|---|
| BLS | Bureau of Labor Statistics |
| BMP | Best management practice |
| CPO | Chlorine-produced oxidants |
| CWNS | Clean Water Needs Survey |
| cu. yd. | Cubic yard |
| EPA | Environmental Protection Agency |
| gpm | Gallons per minute |
| ITA | Instrument Testing Agency |
| lf | Linear feet |
| mgd | Million gallons per day |
| mg/L | Milligrams per liter |
| NA | Not applicable |
| ND | Nondetect |
| NPDES | National Pollutant Discharge Elimination System |
| NPS Policy | Nonpoint Source Pollution Control Program |
| O&M | Operation and maintenance |
| PCS | Permit compliance system |
| POTW | Publicly owned treatment work |
| ppd | Pounds per day |
| SCADA | Supervisory control and data acquisition |
| SD | Sanitation district |
| SIP | Policy for Implementations of Toxic Standards for Inland Surface Waters, Enclosed Bays, and Estuaries of California |
| sq. ft. | Square feet |
| TRC | Total residual chlorine |
| WPCP | Water pollution control plant |
| WQCP | Water quality control plant |
| WRP | Water reclamation plant |
| WWTP | Wastewater treatment plant |

# Executive Summary

The California State Water Resources Control Board (State Water Board) is proposing a statewide policy for total residual chlorine (TRC) and chlorine-produced oxidants (CPO) applicable to all surface waters, enclosed bays, and estuaries to bring consistency to permitting and enforcement decisions. The proposed policy establishes TRC and CPO objectives for the protection of aquatic life (**Exhibit ES-1**), and implementation procedures for point source dischargers (excluding storm water) including monitoring requirements.

**Exhibit ES-1. Proposed Water Quality Criteria for Chlorine**

| Pollutant (water body type)[1] | 1-hour Average (mg/L) | 4-Day Average (mg/L) |
|---|---|---|
| Total Residual Chlorine (freshwater) | 0.019 | 0.011 |
| Chlorine-Produced Oxidants (saltwater) | 0.013 | 0.0075 |

Source: U.S. EPA (1985).
1. Freshwater is defined as salinity less than 1 ppt 95% of the time. Saltwater is defined as salinity greater than 10 ppt 95% of the time. Waters with salinities between 1 and 10 ppt are estuarine, and the more stringent criteria (i.e., saltwater criteria) apply.

The implementation part of the policy specifies procedures for determining effluent limits, establishing monitoring and reporting requirements, setting compliance schedules, and calculating site-specific criteria. The proposed policy requires continuous monitoring of chlorine residual or dechlorination residuals in all facilities. Back up systems are required when continuous systems are offline for calibration or maintenance. The proposed policy also allows the California Regional Water Quality Control Boards to grant mixing zones where as appropriate. However, this analysis reflects the assumption that the criteria would be applied end-of-pipe.

Based on the experiences of facilities currently meeting the proposed criteria, dechlorination processes can be adjusted to produce the levels of residual chlorine necessary for compliance with the proposed policy. Therefore, the State Water Board estimated that optimizing existing dechlorination processes would enable facilities with dechlorination capabilities to comply with the proposed TRC criteria. For facilities using chlorine but not dechlorinating their effluent, installing dechlorination equipment will enable compliance. The State Water Board also assumed that those facilities not currently monitoring for TRC on a continuous basis would install continuous monitoring with a back up system. For those facilities that currently monitor continuously, but are not required to use a back system during system calibrations or downtime, the State Water Board assumed that they would install a redundant analyzer.

The cost of dechlorination and optimization of the dechlorination process are based on available estimates from the literature and vendor quotes. The State Water Board did not have specific information regarding the operation of treatment processes (e.g., chlorine and sulfur dioxide doses, contact times, and process controls) for most of the facilities. Therefore, facility costs are primarily based on assumptions regarding the operation of existing treatment processes and the potential reductions needed.

The State Water Board evaluated the likely means of compliance and potential costs for 18 case study facilities. Compliance scenarios range from taking no action (e.g., if a facility is currently achieving the proposed criteria) to installing end-of-pipe treatment controls. Available information indicates that only a few of the case study facilities would need to install treatment to comply with projected effluent limits because they currently lack dechlorination capabilities. **Exhibit ES-2** summarizes the likely compliance actions for the case study facilities.

**Exhibit ES-2. Means of Compliance at Case Study Facilities**

| Treatment Controls | | Monitoring | |
|---|---|---|---|
| **Means of Compliance** | **Number of Facilities** | **Means of Compliance** | **Number of Facilities** |
| No Action | 7 | No Action | 3 |
| Process Optimization | 9 | Back Up System | 7 |
| Dechlorination | 2 | Continuous Monitoring with Back Up | 8 |
| **Total** | 18 | **Total** | 18 |

For case study facilities likely to need continuous monitoring equipment only, capital costs may range from $2,000 and $8,000, and operation and maintenance (O&M) costs from $0 to $31,400. For facilities likely to be able to comply through process optimization, capital and O&M costs may range from $6,600 to $139,500, and $0 to $372,000, respectively. Finally, for facilities that may need to add dechlorination, capital costs may range from $29,200 to $799,000, with O&M costs ranging from $23,600 to $131,400.

The case study evaluations and additional data in EPA's permit compliance system (PCS) database provide some indication of the likely magnitude of statewide costs for major facilities. PCS data suggest that about 86% of major municipal and 60% of major industrial facilities may use chlorine (about 142 facilities). PCS contains flow and TRC data (or at least the current effluent limit) for 128 of these facilities (not including the 11 major case study facilities). Evaluating compliance actions based only on the data in PCS, capital costs for major facilities, including the major case study facilities, may be on the order of $8 million, with annual O&M costs totaling $13 million (2004 dollars).

PCS data is not likely indicative of the number of minor facilities that may use chlorine because data for minor facilities are often incomplete. However, the Clean Water Needs Survey (EPA, 2000a) suggests that 90% of municipal facilities may use chlorine. The State Water Board does not have data regarding the number of minor industrial dischargers that use chlorine. However, the case study evaluations and PCS data suggest that power plants, petroleum and oil refineries, correctional institutions, schools and institutions, and ship building and repair facilities may use chlorine.

Although the number of potentially affected minor facilities is uncertain, costs for these facilities are unlikely to exceed $3 million in capital and $3 million in annual O&M. The average cost for the minor case study facilities is on the order of $7,700 in capital and $7,500 in O&M. If 90% of minor municipal facilities incur this cost, along with 25% of minor industrials, total statewide costs (for both major and minor facilities) could increase to approximately $9 million in capital and $14 million in annual O&M. If the percentage of minor industrials incurring this cost is as high as 75%, total statewide costs would be on the order of $11 million in capital, and $16 million in annual O&M.

# 1. Introduction

The California State Water Resources Control Board (State Water Board) is proposing a statewide policy for total residual chlorine (TRC) and chlorine-produced oxidants (CPO) applicable to all surface waters, enclosed bays, and estuaries. This report presents an analysis of potential costs associated with the proposed policy. Specifically, the report provides estimates of potential incremental costs that direct point source dischargers may incur as a result of the proposed policy through changes to their National Pollutant Discharge Elimination System (NPDES) permit limits.

## 1.1 Background

In California, the State Water Board and nine Regional Water Quality Control Boards (Regional Water Boards) have regulatory authority over discharges to waters of the state. Each Regional Water Board has its own basin plan providing narrative or numerical water quality standards and objectives for TRC and CPO. However, there is no statewide policy for regulating these pollutants in NPDES permits.

In 1985, the U.S. Environmental Protection Agency (EPA) published revised water quality criteria for chlorine, and recommended the adoption of these criteria for freshwater and saltwater. The State Water Board is considering adoption of the proposed chlorine policy to provide a consistent statewide approach to implementing EPA's revised chlorine criteria. In the absence of such a policy, the Regional Water Boards will implement the criteria using existing basin plans, applicable state and federal regulations, U.S. EPA guidance for regulating toxic pollutants, and existing Regional Water Board practices. The lack of statewide consistency and potential harm to aquatic life are not the only issues surrounding TRC and CPO criteria. In 1999, California passed the Clean Water Enforcement and Pollution Prevention Act, adding enforcement provisions that limited the ability of Regional Water Boards to interpret violations. A statewide policy would bring consistency to permitting and enforcement decisions.

## 1.2 Scope of the Analysis

This analysis addresses NPDES permitted facilities discharging to water bodies affected by the proposed policy. The types of affected facilities may include industries and publicly owned treatment works (POTWs) discharging wastewater to inland surface waters (i.e., point sources). The sections that follow identify reasonable means of compliance, provide estimates of facility level costs, and discuss potential statewide implications.

## 1.3 Organization of the Report

This report is organized as follows: Section 2 describes the baseline for the analysis, including the current chlorine criteria applicable to each region, and the number of point source dischargers. Section 3 outlines the proposed chlorine criteria and implementation procedures. Section 4 details the method used to estimate potential impacts to affected dischargers, and Section 5 summarizes the results. Appendix A provides detailed case study facility analyses.

Appendix B provides qualitative and quantitative discussions on economic considerations for alternative implementation procedures for the proposed policy.

# 2. Baseline for the Analysis

This section describes the baseline conditions relevant to evaluating the potential incremental costs of the proposed policy. These conditions include water quality criteria currently used to derive NPDES permit limits for point source dischargers, which affects current effluent controls. Baseline conditions also refer to the number and types of facilities that are potentially affected by the proposed rule.

## 2.1 Water Quality Criteria

As stated in Section 1.1, there are nine Regional Water Boards, each with its own basin plan and applicable water quality standards for chlorine. **Exhibit 2-1** summarizes the chlorine criteria for each region and the range of chlorine permit limits for facilities in each region.

**Exhibit 2-1. Baseline Conditions by Regional Water Board**

| Regional Board | Baseline Criteria | Range of Existing Permit Limits (mg/L)[1] |
|---|---|---|
| North Coast (Region 1) | No specific criteria for chlorine, however, a narrative toxicity objective states that all waters shall be maintained free of toxic substances in concentrations that are toxic to, or that produce detrimental physiological responses in human, plant, animal, or aquatic life. | 0.0 – 1.5 |
| San Francisco Bay (Region 2) | Instantaneous maximum effluent limit for all treatment facilities of 0.0 mg/L. In a most permits, the limit is defined as below the detection limit of methods defined in the latest EPA approved edition of "Standard Methods for the Examination of Water and Wastewater." | 0.0 |
| Central Coast (Region 3) | No specific criteria for chlorine, however, a narrative toxicity objective states that all waters shall be maintained free of toxic substances in concentrations that are toxic to, or that produce detrimental physiological responses in human, plant, animal, or aquatic life. | 0.0 – 2.0 |
| Los Angeles (Region 4) | Chlorine should not be present in surface water discharges in concentrations that exceed 0.1 mg/L, and shall not persist in receiving waters at concentrations that impair designated uses. | 0.1 – 0.5 |
| Central Valley (Region 5) | No specific criteria for chlorine, however, a narrative toxicity objective states that all waters shall be maintained free of toxic substances in concentrations that are toxic to, or that produce detrimental physiological responses in human, plant, animal, or aquatic life. | 0.01 – 4.6 |
| Lahotan (Region 6) | TRC shall not exceed either a median value of 0.002 mg/L or a maximum value of 0.003 mg/L (median values should be based on daily measurements taken during any 6-month period). | 0.011 – 0.019 |
| Colorado River (Region 7) | No specific criteria for chlorine, however a narrative toxicity objective states that all waters shall be maintained free of toxic substances in concentrations that are toxic to, or that produce detrimental physiological responses in human, plant, animal, or aquatic life. | 0.01 – 0.02 |
| Santa Ana (Region 8) | Chlorine residual shall not exceed 0.1 mg/L for dischargers to inland surface waters, enclosed bays, and estuaries. | 0.01 – 5.0 |
| San Diego (Region 9) | No specific criteria for chlorine, however, a narrative toxicity objective states that all waters shall be maintained free of toxic substances in concentrations that are toxic to, or that produce detrimental physiological responses in human, plant, animal, or aquatic life. | 0.2 – 650 |

**Exhibit 2-1. Baseline Conditions by Regional Water Board**

| Regional Board | Baseline Criteria | Range of Existing Permit Limits (mg/L)[1] |
|---|---|---|

1. Source: U.S. EPA (2004).
mg/L = milligrams per liter.

Exhibit 2-1 indicates that the chlorine limits for facilities within a region vary. There may also be facilities currently using chlorine that do not have chlorine residual limits.

## 2.2 Point Sources (Excluding Storm Water)

EPA's Permit Compliance System (PCS) database indicates that there are 693 facilities permitted to discharge to inland surface waters, enclosed bays, and estuaries in California (ocean dischargers are not affected by the proposed policy). EPA classifies 75% of these facilities as minor dischargers [facilities discharging less than 1 million gallons per day (mgd) and not likely to discharge toxic pollutants in toxic amounts]. **Exhibit 2-2** provides a summary of these dischargers by region. Note that these facilities do not necessarily represent the universe of potentially affected dischargers. Only those facilities that use chlorine would be affected by the proposed policy. However, PCS does not list treatment processes (e.g., chlorination).

**Exhibit 2-2. Summary of NPDES Dischargers in California**

| Regional Board | Major Facilities | | Minor Facilities | | Total |
|---|---|---|---|---|---|
| | Industrial | Municipal | Industrial | Municipal | |
| 1 | 1 | 10 | 18 | 9 | 38 |
| 2 | 12 | 35 | 40 | 18 | 105 |
| 3 | 2 | 2 | 13 | 4 | 21 |
| 4 | 8 | 19 | 131 | 5 | 163 |
| 5 | 9 | 45 | 148 | 38 | 240 |
| 6 | 0 | 2 | 10 | 1 | 13 |
| 7 | 2 | 8 | 12 | 7 | 29 |
| 8 | 0 | 15 | 30 | 5 | 50 |
| 9 | 2 | 3 | 27 | 2 | 34 |
| Total | 36 | 139 | 429 | 89 | 693 |

## 2.3 Storm Water Discharges

Currently, California does not have a policy addressing the regulation of storm water under the NPDES program. However, the State Water Board has adopted statewide general NPDES permits for storm water discharges from various industrial activities, construction projects, and Caltrans activities. All storm water permits, except for some individual permits for municipal storm water discharges and some industrial discharges, are based on best management practices (BMPs) rather than numeric effluent limitations. In the past, the State Water Board has upheld orders on storm water permit limits that rely on an iterative process using BMPs rather than numeric effluent limits to achieve water quality standards. The State Water Board has concluded in these orders that numeric effluent limits in storm water permits are infeasible.

However, rainwater does not contain chlorine, and runoff to storm drains also is not likely to contain chlorine. Identification of other discharges to storm drains is part of a storm water discharger's maintenance program, and such discharges are only allowed in specified cases that are defined in a storm water permit. There may be occasions in which water that contains chlorine (e.g., from swimming pools, fountains, fire protection systems) enters municipal storm drains. These discharges are only allowed in emergencies (e.g., fires), and storm water permits contain protocols for dealing with these emergency discharges. Any protocols for non-emergency firefighting activities are determined through a Storm Water Management Plan that must be approved by the Regional Water Board prior to implementation. Other instances of non-emergency discharges containing chlorine are not allowed.

Therefore, it is not likely that storm water discharges contain chlorine, and thus would not likely be affected by the proposed policy.

## 2.4 Nonpoint Sources

Nonpoint source discharges (e.g., agricultural) are intermittent, highly variable, and occur under different hydrologic or climatic conditions than continuous discharges from industrial and municipal facilities. Nonpoint sources in California are currently regulated by the State's Policy for Implementation and Enforcement of the Nonpoint Source Pollution Control Program (NPS Policy). This policy provides guidance regarding the prevention and control of nonpoint source pollutant discharges. Similar to storm water, the Regional Water Boards do not usually assign nonpoint sources numeric effluent limits; rather they primarily rely on implementation of management practices to reduce pollution.

Nonpoint source discharges do not usually contain free chlorine. Although, agricultural runoff may contain chlorine-containing pesticides, the chlorine originating from these pesticides generally undergoes dechlorination anaerobically. Because anaerobic conditions are not conducive to the formation of TRC or CPO compounds, it is unlikely that measurable chlorine concentrations would be present in nonpoint source discharges. Therefore, it is unlikely that nonpoint sources would be affected by the proposed policy.

# 3. Description of Proposed Policy

State Water Board is proposing statewide policy for TRC and CPO to promote consistency throughout the state on regulation procedures, and improve clarity on the basis for enforcement of violations. The policy establishes TRC and CPO objectives for the protection of aquatic life beneficial uses, and implementation procedures including monitoring requirements.

## 3.1 Water Quality Criteria

The State Water Board is proposing to adopt EPA-recommended TRC and CPO criteria for the protection of aquatic life in freshwater and saltwater (**Exhibit 3-1**).

**Exhibit 3-1. Proposed Water Quality Criteria for Chlorine**

| Pollutant (water body type)[1] | 1-hour Average (mg/L) | 4-Day Average (mg/L) |
|---|---|---|
| Total Residual Chlorine (freshwater) | 0.019 | 0.011 |
| Chlorine-Produced Oxidants (saltwater) | 0.013 | 0.0075 |

Source: U.S. EPA (1985).
1. Freshwater is defines as having a salinity less than 1 ppt 95% of the time. Saltwater is defines as having a salinity of greater than 10 ppt 95% of the time. Waters with salinities between 1 and 10 ppt are estuarine, and the more stringent criteria (i.e., saltwater criteria) apply.

For intermittent discharges (i.e., discharges lasting less than 2 hours in any 24-hour period), the State Water Board is proposing instantaneous maximum criteria, calculated using the following equations:

Freshwater: $C = 1070/T^{0.740}$
Saltwater: $C = 63.1/T^{0.43}$

where,
T = Sum of intermittent discharge times (in minutes) during a 24-hour period, not to exceed 120 minutes.

Chlorine in freshwater will usually be found as free chlorine or combined chlorine. Both are toxic to aquatic organisms, thus, the term total residual chlorine is used to refer to the sum of free chlorine and combined chlorine in freshwater. Saltwater contains bromide, and the addition of chlorine will also produce hypobromous acid (HOBr), hypobromous ion ($OBr^-$), and bromamines (U.S. EPA, 1985). The term chlorine-produced oxidants refers to the sum of these oxidative products in saltwater. The formation of these oxidants is directly dependent on the amount of chlorine available to react in saltwater. Both TRC and CPO are intended to refer to the sum of free and combined chlorine and bromine in water measured using analytical methods for determining total residual chlorine (U.S. EPA, 1985). Note that these criteria would only be applicable to inland surface waters, enclosed bays, and estuaries classified as freshwater, saltwater, or estuarine. These criteria are not applicable to ocean waters.

## 3.2 Implementation Procedures

The policy also specifies procedures for determining effluent limits, establishing monitoring and reporting requirements, setting compliance schedules, and calculating site-specific criteria. The proposed policy allows Regional Water Boards to grant mixing zones where they deem appropriate. These implementation procedures do not apply to storm water and nonpoint source discharges.

The proposed policy specifies that compliance schedules may be warranted if compliance with a new or more restrictive effluent limit is not immediately feasible. However, such schedules shall be as short as practicable and in no case exceed five years from the date the permit is issued, reissued, or modified to include the new or more stringent effluent limits or other policy requirements. In addition, the permit must contain interim limits to be met during that time.

The proposed policy requires continuous monitoring at all facilities except where to the Regional Water Board has determined that such monitoring is does not appropriately characterize the discharge. The State Water Board defines continuous monitoring as one or more data points every minute. Back up systems are required when continuous systems are offline for calibration or maintenance, and may include monitoring for dechlorination residual, redundant analyzer, stoichiometry method, or grab samples taken at least once every 15 minutes at end of pipe and the downstream receiving water. When calculating one-hour and 4-day average concentrations, the policy allows nondetect and zero values to be considered zero. However, the proposed policy states that any concentration above the criterion would be considered a violation.

The proposed policy also allows a Regional Water Board to develop a site-specific objective for TRC and CPO whenever it determines, based on its best professional judgment, that the objectives in the proposed policy are inappropriate for a particular water body. Site-specific objectives must be developed in compliance with state and federal laws and regulations.

# 4. Method

This section describes the method for determining the reasonable means of compliance and estimating potential costs associated with the proposed policy.

## 4.1 Case Studies

To estimate the potential costs associated with the proposed policy, the State Water Board evaluated the reasonable means of compliance for potentially affected point source dischargers in the state using a sample of facilities.[1] **Exhibit 4-1** provides a summary of these facilities. However, the State Water Board only evaluated those facilities that currently use chlorine in their treatment processes, and thus, could be impacted by the proposed policy. As discussed in Sections 2.3 and 2.4, storm water and nonpoint source discharges are not likely to contain chlorine, and thus would not likely incur costs associated with meeting the proposed objectives.

**Exhibit 4-1. Summary of Case Study Facilities**

| NPDES | Facility Name | Region | Facility Type | Category | Flow (mgd) | Currently Using Chlorine |
|---|---|---|---|---|---|---|
| CA0022713 | Arcata WWTP | 1 | Major | Municipal | 5 | Yes |
| CA0023043 | Forestville County SD | 1 | Minor | Municipal | 0.13 | Yes |
| CA0006688 | Iron Gate Salmon Hatchery | 1 | Minor | Industrial | 31.9 | No |
| CA0037966 | Calistoga WWTP | 2 | Minor | Municipal | 0.8 | Yes |
| CA0005649 | PG&E - Hunters Point | 2 | Minor[1] | Industrial | 412 | Yes |
| CA0037842 | San Jose/Santa Clara WPCP | 2 | Major | Municipal | 167 | Yes |
| CA0037621 | Sunnyvale WPCP | 2 | Major | Municipal | 29.5 | Yes |
| CA0005550 | Valero Refinery | 2 | Major | Industrial | 2.5 | No |
| CA0047902 | San Juan Bautista WWTP | 3 | Minor | Municipal | 0.27 | No |
| CA0058688 | Honeywell Inc. | 4 | Minor | Industrial | 0.03 | Yes |
| CA0001309 | SSFL - Boeing Company | 4 | Major | Industrial | 1.5 | Yes |
| CA0056227 | Tillman WRP | 4 | Major | Municipal | 80 | Yes |
| CA0063185 | Tosco Refining Company | 4 | Major | Industrial | 11.2 | No |
| CA0078930 | City of Biggs WWTP | 5 | Minor | Municipal | 0.37 | Yes |
| CA0104493 | Coachella Sanitary District | 7 | Major | Municipal | 2.4 | Yes |
| CA0004391 | Collins Pine Company | 5 | Major | Industrial | 3 | Yes |
| CA0081621 | Donner Summit WWTP | 5 | Minor | Municipal | 0.52 | Yes |
| CA0079219 | Merced WWTF | 5 | Major | Municipal | 10 | Yes |
| CA0077682 | Sacramento Regional WWTP | 5 | Major | Municipal | 181 | Yes |

[1] To gain efficiencies with respect to collecting data and information, the State Water Board used the same sample of facilities it used in analysis of costs associated with the Policy for Implementation of Toxics Standards for Inland Surface Waters, Enclosed Bays, and Estuaries of California. EPA originally selected the sample for analysis of the California Toxics Rule. The State Water Board replaced one minor facility for which the permit has been rescinded with a new, randomly chosen minor facility.

**Exhibit 4-1. Summary of Case Study Facilities**

| NPDES | Facility Name | Region | Facility Type | Category | Flow (mgd) | Currently Using Chlorine |
|---|---|---|---|---|---|---|
| CA0080357 | Sierra Pacific – Quincy Division | 5 | Minor | Industrial | NA | No |
| CA8000304 | Colton/San Bernardino RIX | 8 | Major | Municipal | 45 | No |
| CA0106283 | Disneyland Resort | 8 | Minor | Industrial | NA | Yes |
| CA0105350 | Riverside Regional WQCP | 8 | Major | Municipal | 40 | Yes |
| CA0001368 | Duke Energy, South Bay Plant | 9 | Major | Industrial | 602.2 | Yes |
| CA0107867 | U.S. Navy Public Works | 9 | Minor | Industrial | NA | No |

WWTP = Wastewater Treatment Plant
SD = Sanitation District
WQCP = Water Quality Control Plant
WRP = Water Reclamation Plant
WPCP = Water Pollution Control Plant
1. This facility discharges mostly once-through cooling water. Therefore, EPA classified it as a minor facility despite its flow.

## 4.2 Determining Necessary Controls

Revised effluent limits for residual chlorine would be expressed as 1-hour and 4-day average, and compliance should be determined based on continuous monitoring data (i.e., one data point taken every minute). However, there are no continuous monitoring data available for any of the case study facilities; only daily values from self monitoring reports or average and maximum monthly values from EPA's PCS database are available. Thus, this analysis is based on the data available.

For facilities for which only monthly effluent data are available, a conservative (i.e., erring on the side of higher costs) evaluation of compliance is based on comparison of the maximum effluent concentration to the 4-day average limit. For facilities for which daily data are available, compliance can be determined by comparing the maximum calculated 4-day average concentration to the 4-day average limit, and the maximum daily value to the 1-hour average limit. For saltwater discharges, compliance can be evaluated by assuming that TRC concentrations in the effluent translate directly to CPO concentrations (i.e., TRC concentration equals CPO concentration). Many facilities may report nondetected values as zero in their discharge monitoring reports. Thus, the State Water Board assumed that any TRC value reported as a zero is nondetect. In calculating the potential reductions in residual chlorine concentrations necessary for compliance with the proposed policy, the State Water Board only considered detected effluent values (the average, maximum, and minimum effluent concentrations do not include nondetects).

Those facilities exceeding the proposed criteria may need controls for compliance. In addition, all facilities using chlorine could incur additional monitoring costs if they are not continuously monitoring for chlorine or do not have a back up monitoring system for times when the continuous monitoring system is offline. Facilities exceeding current permit limits will incur costs to come into compliance with these requirements. However, these baseline costs are not attributable to the policy.

### 4.2.1 Treatment Options

There are primarily two ways to reduce chlorine residual in wastewater prior to discharge: dechlorination by adding sulfur dioxide or sulfite salts, and carbon adsorption (U.S. EPA, 2000b). Carbon adsorption is expensive compared to dechlorination with sulfur dioxide because pretreatment may be necessary to remove competing organic contaminants. Another option for controlling the residual chlorine levels in effluent is switching to another form of disinfection other than chlorine, such as UV light or ozone. This option may be more economically feasible for new facilities rather than facilities with existing chlorination systems because it may be less expensive to upgrade or optimize current processes than to retrofit new processes in an existing facility. However, existing facilities may be making such a switch for other reasons (e.g., safety concerns, compliance with more stringent limits on disinfection byproducts or bacteria).

For facilities already using chlorine to disinfect their wastewater, dechlorination with sulfur dioxide or sulfite salts is most likely the cost-effective option for reducing chlorine residual levels. When dissolved in water, chlorine hydrolyzes to form hypochlorous acid (HOCl) and hypochlorite ions ($OCl^-$), known as free chlorine. Free chlorine can then react with ammonia present in the wastewater to form chloramines, or combined chlorine. Total residual chlorine is the combination of free chlorine and combined chlorine. When sulfur dioxide or sulfite salts are dissolved in water they form sulfur compounds in the $^+4$ oxidation state. These compounds react rapidly (contact time on the order of minutes) with residual chlorine as shown below (U.S. EPA, 2000b):

$$SO_3^{-2} + HOCl \rightarrow SO_4^{-2} + Cl^- + H^+$$

$$SO_3^{-2} + NH_2Cl + H_2O \rightarrow SO_4^{-2} + Cl^- + NH_4^+$$

The stoichiometric weight ratio of sulfur dioxide to chlorine is 0.9:1; in practice, a 1:1 ratio is often used.

However, to achieve near zero effluent levels of chlorine residual, careful process control is necessary. Overdosing sulfur dioxide can lead to reduced dissolved oxygen levels and a corresponding increase in biochemical oxygen demand and decrease in pH levels (Metcalf and Eddy, 2003). Not adding enough sulfur dioxide could result in chlorine residual levels that exceed the proposed criteria.

Although reliable process control options are limited, there are several options that are capable of producing very low chlorine residual levels. One method involves the use of the amperometric monitoring (direct reading analyzer), which measures the total residual chlorine concentration after dechlorination. The main problem with this technique is that at low concentrations the accuracy of the monitor decreases. Therefore, operators may use a “zero-shifted” or “biased” analyzer instead. This technique uses a residual chlorine analyzer and a known concentration of chlorine is added to the effluent sample to be analyzed. The “zero” point is shifted by the amount of the known, added concentration. The residual chlorine or sulfur dioxide dose can then be inferred from the result of the sample analysis, and adjustments to doses can be made accordingly (U.S. EPA, 2000b).

Another viable option involves the use of "feed-forward" process controls. These controls measure chlorine residual levels after disinfection and prior to the addition of sulfur dioxide. A mass flow signal is sent to the sulfonator from the analyzer and the sulfur dioxide delivery rate is automatically calculated and adjusted to the ratio required. This technique can also be combined with biased instrumentation to effectively achieve low residual levels (U.S. EPA, 2000b).

### 4.2.2 Facilities Achieving Proposed Criteria

To assess the feasibility of the proposed policy, the State Water Board identified facilities in California currently meeting the proposed TRC criteria. **Exhibit 4-2** summarizes the effluent data for each facility from EPA's PCS database.

**Exhibit 4-2. Facilities Currently in Compliance with Proposed TRC Criteria {tc "Exhibit 4-2. Facilities Currently in Compliance with EPA's 1986 Bacteria Criteria " \f D }**

| NPDES No. | Facility Name | Flow (mgd) | Effluent Data (mg/L)[a] | |
|---|---|---|---|---|
| | | | Average | Maximum |
| CA0077950 | Woodland Water Pollution Control Plant | 6 | 0.0[b] | 0.0[b] |
| CA0077704 | Anderson Water Pollution Control Plant | 2 | 0.01[c] | 0.01[c] |

Source: U.S. EPA (2004).
a. Represents the last three years of effluent data.
b. All values reported as zero, or nondetect.
c. Only one detected observation.

The Woodland Water Pollution Control Plant (WPCP) also dechlorinates their effluent and achieves low levels of chlorine residual. The facility uses feed-forward process controls to treat about 6 mgd of wastewater with sulfur dioxide prior to discharge. The sulfur dioxide dose necessary is based on readouts from flow and chlorine residual concentrations just after disinfection. The facility adds a buffer of sulfur dioxide to ensure that all of the chlorine is reacted (usually about 100-200 lbs/day excess). The system is controlled by the facility's supervisory control and data acquisition (SCADA) system (Hierholzer, 2004). SCADA systems comprise software that enables plant operators to control and monitor their process hardware (e.g., chemical feeders, remote pump station and valves) easily and efficiently from one location. To maintain the dechlorination system, residual analyzers are cleaned 2-3 times per week, and are calibrated weekly, and the equipment is checked daily to make certain that everything is operating properly and efficiently (Hierholzer, 2004).

The Anderson Water Pollution Control Plant operates a feed-forward chlorination/dechlorination system for compliance with a 1-hour average limit of 0.02 mg/L and a 4-day average limit of 0.01 mg/L. For compliance with previous TRC limits that were less stringent, the facility had been using downstream residual concentrations for feeding sulfur dioxide. However, to meet the new, more stringent TRC permit limits, they would have to overdose their sulfur dioxide because the downstream residual concentrations were not consistent. To avoid having to overdose, the facility installed an upstream sampling infuser just downstream of the chlorine feed point, and a controller to better control the chlorine dose for disinfection. This feed-forward system ensures a more constant upstream chlorine residual in the chlorine contact chamber. Both the chlorine and sulfur dioxide feeds are flow paced. There is an alarm for the upstream chlorine residual concentration to alert operators of potential spikes or malfunctions. All of the necessary modifications were made by plant personnel. Currently, the sulfur dioxide feed is set to 0.5 mg/L above the necessary sulfur dioxide set point (based on the upstream TRC concentration) to ensure there is adequate dechlorination at all times. The analyzers are checked and calibrated daily by plant personnel (Berry, 2004).

### 4.2.3 Reasonable Means of Compliance

The experiences above suggest that dechlorination processes can be adjusted to produce the levels of residual chlorine necessary for compliance with the proposed policy. Therefore, the State Water Board estimated that optimization of existing dechlorination processes would enable facilities with dechlorination capabilities to comply with the proposed TRC criteria. Process optimization usually involves process analysis and process modifications. Process analysis is an investigation of the performance-limiting factors of the treatment process and is a key factor in achieving optimum treatment efficiency. Performance-limiting factors for dechlorination may include operator training, response to changes in wastewater quality, maintenance activities, automation, and process control testing. The cost of process analysis includes the cost of additional or continuous monitoring throughout the treatment process, and a treatment performance evaluation.

Process modifications include activities short of adding new treatment technology units (conventional or unconventional) to the treatment train. For dechlorination, process modifications could include adjusting the sulfur dioxide dose, upgrading monitoring equipment (e.g., continuous analyzers), equalizing flow, training operators, and installing automation equipment including necessary hardware and software. Several months of adjustments may be needed to achieve a desired level of process optimization (e.g., synchronizing sulfur dioxide dose with chlorine dose at varied levels of flow).

For those case study facilities not currently operating dechlorination, the State Water Board assumed that installing dechlorination equipment would enable compliance with the proposed criteria. These facilities may also chose to switch to chemicals other than chlorine for disinfection and anti-fouling purposes; however, because detailed information regarding the effectiveness and feasibility of such a switch is not available, the State Water Board did not estimate the costs for this option.

Although facilities may have other options, the State Water Board also assumed that those facilities not currently monitoring for TRC on a continuous basis would install continuous monitoring and a redundant continuous residual analyzer. For those facilities that currently monitor continuously, but are not required to use a back-up system during system calibrations or downtime, the State Water Board assumed that they would install a redundant analyzer.

**Exhibit 4-3** summarizes the potential compliance scenarios that may be necessary depending on current treatment performance and existing controls.

**Exhibit 4-3. Summary of Potential Compliance Scenarios**

<table>
<tr><th colspan="2">Monitoring Requirements</th><th colspan="3">Proposed Criteria</th></tr>
<tr><th>Existing System</th><th>Means of Compliance</th><th>TRC Levels[1]</th><th>Existing Controls</th><th>Means of Compliance</th></tr>
<tr><td>Continuous Monitoring with Back Up</td><td>None</td><td>Below Criteria</td><td>Any</td><td>None</td></tr>
<tr><td rowspan="2">Continuous Monitoring Only</td><td rowspan="2">Back Up System</td><td rowspan="4">Above Criteria</td><td>Process Optimization[2]</td><td>Minor Process Optimization</td></tr>
<tr><td rowspan="2">Dechlorination</td><td rowspan="2">Process Optimization</td></tr>
<tr><td rowspan="2">No Continuous Monitoring</td><td rowspan="2">Continuous Monitoring with Back Up</td></tr>
<tr><td>No Dechlorination</td><td>Dechlorination</td></tr>
</table>

1. Baseline for compliance scenario assumed to be the current permit limit for facilities not currently meeting their existing limit.
2. E.g., for compliance with current limit.

## 4.3 Estimating the Cost of Controls

The estimated costs for dechlorination and optimization of the dechlorination process at the sample facilities reflect available estimates from the literature and vendor quotes. The State Water Board did not have specific information regarding the operation of treatment processes (e.g., chlorine and sulfur dioxide doses, contact times, and process controls) for most of the facilities. Therefore, facility costs are primarily based on assumptions regarding the operation of existing treatment processes and the potential reductions needed.

### 4.3.1 Process Optimization

For most of the facilities, the State Water Board does not have specific information regarding the treatment processes, such as chlorine concentration prior to dechlorination, process controls (e.g., feed-forward automated controls, continuous monitoring, and SCADA systems) currently in use, type of dechlorination chemical being used, dechlorination chemical dose, contact time, mixing conditions, or maintenance procedures. Therefore, the State Water Board assumed that, on average, facilities with TRC levels above the proposed criteria do not have sufficient process controls, and that sulfur dioxide is used as the dechlorination chemical.

A two-week analysis of facility treatment processes should enable identification of necessary modifications (chlorination and dechlorination processes are relatively simple and well-known processes). Therefore, the process analysis costs include the cost of labor associated with two weeks of full time monitoring the wastewater at different stages throughout the treatment plant (e.g., before and after dechlorination), and determining the process modifications necessary. The estimated costs reflect the midpoint labor rate ($80 per hour, including benefits and overhead) for an environmental engineer provided in comments by the Sacramento Regional Count Sanitation District (SRCSD) (SRCSD, 2006). These assumptions result in a process analysis cost of approximately $6,400 (80 hours × $80/hour).

In practice, the process modifications necessary for compliance would be determined by the process analysis study. For the case study facilities, the State Water Board assumed that modifications to the dechlorination process would include adding feed-forward process controls consisting of two continuous chlorine residual analyzers: one just after chlorination to measure the amount of sulfur dioxide necessary, and one after dechlorination prior to discharge (if not already present) to determine if the appropriate amount of sulfur dioxide was added and if the criteria are being met. The second analyzer (located just prior to discharging) would also fulfill the continuous monitoring requirement of the proposed policy. Each analyzer would cost approximately $2,000 (Chemical Injection, 2004; Foxcroft, 2004; Hach Company, 2004). Finally, the State Water Board also included a redundant analyzer as the back up system for when the analyzer used to measure compliance is offline for calibration. Back ups may include monitoring for dechlorination residual, redundant analyzer, stoichiometry method, or grab samples taken at least once every 15 minutes.

Facilities will also have to maintain the new analyzers used to control the sulfur dioxide dose through calibrations and maintenance practices, including replenishing chemical reagents, cleaning the chlorine probes, and checking that the sample flow through the analyzer is maintained at a sufficient level. Instrument Testing Association (ITA) indicates that the majority of facilities it surveyed calibrate their analyzers less than once per week and performed daily maintenance tasks such as cleaning and manually checking (ITA, 1999). Calibration involves taking a grab sample that is representative of the process stream and performing a laboratory amperometric titration in close proximity to the chlorine analyzer. ITA (1999) also reports that about 70% of the facilities surveyed perform less than one hour of labor per maintenance period (e.g., per day, per week).

Potential maintenance costs include additional labor and materials. Assuming weekly calibrations and daily maintenance checks, an additional 4.5 labor hours may be needed per week for each analyzer [1 hour per calibration per unit and 0.5 hr per daily check/cleaning per analyzer, or 234 hours per year ($4.5 \times 52$)]. Labor costs may be approximately $65 per hour (including benefits and overhead, based on the midpoint of the range for a wastewater treatment plant operator provided in comments by SRCSD) (SRCSD, 2006). Material costs range from $100 to $500 per year per analyzer (ITA, 1999).[2] Thus, minor facilities may incur approximately $100 per year per analyzer for materials, and major facilities may incur approximately $500 per year per analyzer. Maintenance costs (labor and materials) for the redundant analyzer would likely be insignificant because the redundant system would only be used while the main analyzer is offline, or for about 52 hours per year (1 hour per week per year for calibrations).

As another component of modifying their chlorination process, facilities may have to increase their sulfur dioxide dose to ensure that all of the residual chlorine is reacted. Sulfur dioxide is usually sold in 150-lb and 1-ton cylinders. Facilities using less than 8,000 pounds per year of sulfur dioxide would likely use 150-lb cylinders, and facilities using over that amount would likely use 1-ton cylinders. The additional amount of sulfur dioxide needed in pounds per year is calculated by multiplying the current chlorine residual concentration plus 1 mg/L to allow for excess sulfur dioxide (assuming all TRC will need to be reacted with sulfur dioxide), by the average flow in mgd, number of days in a year (365), and a conversion factor (8.34 to convert from mg/L to lbs/million gallons).

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[2] Costs represent costs associated with chemical cleaning solutions, spare parts, and replacement sensors/probes (not escalated from original estimates).

Facilities may need storage space for the additional sulfur dioxide cylinders. A large cylinder could be stored in an area of 150 square feet, and a small cylinder in an area of 50 square feet. The State Water Board calculated the number of cylinders that would need to be stored in a given time period (e.g., per week, per month, or per quarter), and multiplied the additional number of cylinders by the area of the cylinder. Note that the average TRC concentration represents the average of the detected values for each facility (and zeros are considered nondetect). Thus, because the additional amount of sulfur dioxide and storage space is calculated based on the average of the detected TRC values, costs may be overstated.

**Exhibit 4-4** summarizes the estimated costs for process modifications, and the source of the cost estimates. In estimating compliance costs for the sample facilities, the State Water Board also added indirect costs as a percent of capital costs to account for process engineering and contingency (30%) and sales taxes (7%). However, the State Water Board did not add these indirect costs to capital expenditures for continuous monitoring, back up monitoring systems, or the process analysis study.

**Exhibit 4-4. Process Modification Cost Components {tc "Exhibit 4-3. Process Modification Cost Components " \f D }**

| Modification | Total Capital ($2004) | O&M ($2004) | Source |
|---|---|---|---|
| Process Controls (residual analyzer) | $2,000 per analyzer | Labor to calibrate, check, and clean analyzers: $65/hour<br>Maintenance materials: $100 - $500 per year per analyzer | Chemical Injection (2004); Foxcroft (2004); Hach Company (2004); SRCSD (2006); ITA (1999) |
| Increase dose | Storage space: $/sq. ft. = Area^-0.110548×$132.16 | Sulfur dioxide:<br>$1,250/1-ton cylinder<br>$480/150-lb cylinder | AACE (2002); Airgas (2004); Praxair (2004); JCI Jones Chemical (2004); TDS Chemical (2004) |

sq. ft. = square foot

The State Water Board assumed that facilities not currently in compliance with current permit limits will achieve compliance through process optimization or dechlorination. Once in compliance with current permit limits, these facilities may need additional reductions if their current limit is less stringent than the proposed criteria. To achieve the additional reductions, the State Water Board assumed that minor process optimization, consisting of increasing sulfur dioxide dose, would be implemented.

### 4.3.2 Dechlorination

The principle elements of a sulfur dioxide dechlorination system include sulfur dioxide containers, scales, sulfur dioxide feeders, solution injectors, diffuser, mixing chamber, and interconnecting piping (Metcalf and Eddy, 2003). Residual chlorine analyzers are also necessary for precise process control.

The State Water Board calculated the amount of sulfur dioxide a facility would need based on current chlorine residual concentrations assuming a 1 to 1 dose ratio and allowing for an additional 1 mg/L excess of sulfur dioxide. Therefore, the amount of sulfur dioxide needed in pounds per year is the TRC concentration in mg/L plus 1 mg/L, multiplied by the average flow in mgd, number of days in a year (365), and a conversion factor (8.34 to convert from mg/L to lbs/million gallons). The cylinder size and storage space required are calculated as described in Section 4.3.2.

Chemical feeders are necessary to transport the sulfur dioxide from the cylinder to the injection point. The feeders are sized based on the amount of sulfur dioxide needed per day (e.g., 100, 200, or 500 gallons per day). If more than 500 gallons per day are necessary, then an additional feed system is needed. The sulfur dioxide is injected into a side stream for mixing. The side stream is then pumped (using a booster pump) to the inlet of the mixing chamber where it recombines with the effluent. The State Water Board assumed facilities would use a vacuum regulator to control the amount of sulfur dioxide injected into the effluent. Manufactures indicate that the useful life of chemical feed systems is about 20 years (Chemical Injection Technologies, 2004; Chlorinators Inc., 2004). The State Water Board assumed that energy costs of the feed system would be negligible.

For control of the dechlorination process, the State Water Board included the capital and O&M costs of feed-forward continuous residual analyzers as described in Section 4.3.1.

The State Water Board assumed that a contact basin would be needed to provide adequate contact time for the residual chlorine to react with the sulfur dioxide. The reaction time between sulfur dioxide and chlorine is almost instantaneous (Metcalf and Eddy, 2003). Therefore, the State Water Board assumed that a three-minute contact time would be sufficient.

To estimate contact basin costs, the State Water Board assumed a length to width ratio for the contact basin of 4, a depth of 13 feet, and a freeboard of 3 feet. Then, the State Water Board used the following equation to calculate the basin volume necessary:

$$Volume = CT * Q_{avg}$$

where,
CT = contact time (3 min)
$Q_{avg}$ = average flow ($ft^3$/min).

Using the dimensions of the basin (e.g., width to length ratio of 4 feet and depth of 13 feet), the State Water Board calculated the concrete volume need for the basin, assuming a wall thickness of 1 foot.

**Exhibit 4-5** summarizes the unit costs for installation of a dechlorination system. In estimating costs for the case study facilities, the State Water Board added indirect costs as a percent of capital costs, as described in Section 4.3.1. However, the State Water Board did not add these indirect costs to capital expenditures for continuous monitoring.

**Exhibit 4-5. Dechlorination Cost Components[1]{tc "Exhibit 4-3. Process Modification Cost Components " \f D }**

| Component | Total Capital ($2004) | O&M ($2004) | Source |
|---|---|---|---|
| Sulfur Dioxide | 150-lb Scale: $800<br>1-ton Scale = $2,300<br>Storage space: $/sq. ft. = Area^-0.110548×$132.16 | Sulfur dioxide:<br>$1,250/1-ton cylinder<br>$480/150-lb cylinder | Global Treat Inc. (2004); AACE (2002); Airgas (2004); Praxair (2004); JCI Jones Chemical (2004); TDS Chemical (2004) |
| Feed System[2] | 100 ppd: $5,600<br>200 ppd: $6,100<br>500 ppd: $7,100 | NA | Chemical Injection (2004); Chlorinators Inc (2004) |
| Side Stream Piping | 0.5”: $11/lf<br>1.0”: $13/lf<br>8.0”: $53/lf | NA | RS Means (1998) |
| Booster Pumps | 10 gpm: $1,700<br>750 gpm: $5,800 | NA | GE Osmonics (2003); Aquatic Eco-Systems (2004); American-Marsh Pumps (2002); Tencarva Machinery (2003) |
| Process Controls (residual analyzer) | $2,000 per analyzer | Labor to calibrate, check, and clean analyzers: $65/hour<br>Maintenance materials: $100 - $500 per year per analyzer | Chemical Injection (2004); Foxcroft (2004); Hach Company (2004); SRCSD (2006); ITA (1999) |
| Contact Basin | Contact basin: $350/cu. yd. of concrete | NA | RS Mean (1998) |

sq. ft. = square foot
ppd = pounds per day
lf = linear foot
gpm = gallons per minute
cu. yd. = cubic yard
1. Costs escalated to 2004 dollars, using the Engineering News Record Construction Cost index, from 2002 dollars for sulfur dioxide scales and storage space, from 2002 and 2003 dollars for pump costs, and from 1998 dollars for the side stream piping and contact basin.
2. Includes the cost of sulfonator, injector, controller, and vacuum regulator.

### 4.3.3 Monitoring

The State Water Board estimated continuous monitoring costs assuming that one chlorine residual analyzer would be necessary per outfall prior to discharge. Continuous chlorine residual analyzers are about $2,000 each (Chemical Injection, 2004; Foxcroft, 2004; Hach Company, 2004). The State Water Board assumed that facilities would have to maintain the new analyzer through calibrations and maintenance practices. These practices and costs are described Section 4.3.1.

The proposed policy also requires back up monitoring during calibration and maintenance checks. The requirements and costs for back monitoring are described in Section 4.3.1.

# 5. Results

This section describes the results of the case study analyses, available information related to potential statewide costs, and the limitations and uncertainties associated with the analysis.

## 5.1 Reasonable Means of Compliance

As described in Section 4.2, the State Water Board determined the treatment controls that facilities would likely implement to comply with the proposed policy based on the magnitude and occurrence of exceedances. Potential means of compliance range from taking no action (e.g., if a facility is currently achieving the proposed criteria) to installing end-of-pipe treatment controls. The State Water Board then estimated the costs associated with implementing these treatment controls.

In identifying reasonable means of compliance, the State Water Board first evaluated lower-cost options, and only considered higher cost options after determining that lower-cost options would not result in compliance with the proposed policy. The State Water Board found optimizing current treatment processes to be the lowest cost option, and a reasonable means of compliance for facilities with dechlorination capabilities. For facilities that do not currently employ dechlorination, the State Water Board determined that implementing end-of-pipe treatment (e.g., dechlorination) would be the likely means of compliance. In addition, all facilities not currently operating continuous monitoring equipment would need to purchase and install such systems, as well as back up systems.

Some of the case study facilities are not likely to need to take any action to comply with the proposed policy because their effluent levels are already below the proposed criteria, and they are already monitoring continuously. Most of the facilities would likely need to implement process optimization or a combination of process optimization and increased monitoring. The State Water Board projected that only a few of the case study facilities would need to install treatment to comply with projected effluent limits because they currently lack dechlorination capabilities. The State Water Board estimated that these facilities would install dechlorination equipment, rather than switch to another disinfectant for compliance with the proposed policy.

**Exhibit 5-1** summarizes the likely compliance actions for the case study facilities. Detailed facility-level analyses are presented in Appendix A.

**Exhibit 5-1. Means of Compliance at Case Study Facilities**

| Treatment Controls | | Monitoring | |
|---|---|---|---|
| **Means of Compliance** | **Number of Facilities** | **Means of Compliance** | **Number of Facilities** |
| No Action | 7 | No Action | 1 |
| Process Optimization | 9 | Back Up System | 7 |
| Dechlorination | 2 | Continuous Monitoring with Back Up | 10 |
| **Total** | 18 | **Total** | 18 |

## 5.2 Case Study Costs

**Exhibit 5-2** summarizes the estimated incremental costs and baseline conditions (e.g., existing permit limit) for each of the case study facilities. As shown in the exhibit, current TRC concentrations, existing effluent limits, and facility flow drive potential control costs.

**Exhibit 5-2. Summary of Estimated Incremental Compliance Costs for Case Study Facilities**

| Facility Name | Type | Flow[a] (mgd) | Effluent TRC (mg/L) | | Existing Limit (mg/L)[b] | Means of Compliance | Total Capital | Annual O&M |
|---|---|---|---|---|---|---|---|---|
| | | | Max. | Avg. | | | | |
| Sacramento WWTP | Major | 184 | 0.014 | 0.005 | 0.011[c] | Optimization | $139,500 | $372,000 |
| Coachella SD | Major | 1.6 | 0.01 | 0.003 | 0.01[c] | Back up | $2,000 | $0 |
| Biggs WWTP | Minor | 0.44 | 1.9 | 0.98 | 0.01[d] | Back up | $2,000 | $0 |
| Calistoga WWTP | Minor | 1.1 | ND | ND | 0.0 | Back up | $4,000 | $0 |
| Donner Summit WWTP | Minor | 0.27 | ND | ND | 0.01[e] | Back up | $2,000 | $0 |
| San Jose/Santa Clara WWTP | Major | 115 | ND | ND | 0.0 | Monitoring; Back up | $2,000 - $4,000 | $0 - $15,700 |
| SSFL - Boeing Co. | Major | 12 | ND | ND | 0.1 | Monitoring; Back up | $8,000 | $31,400 |
| PG&E - Hunters Point | Minor | 108 | ND | ND | 0.0 | Monitoring; Back up | $8,000 | $30,600 |
| Disneyland Resort | Minor | NA | 0.08 | 0.04-0.07 | 0.1 | Optimization | $15,500 | $8,900 |
| Honeywell Inc. | Minor | 0.03 | 0.5 | NA | 0.1 | Optimization | $10,600 | $700 |
| Arcata WWTP | Major | 2.6 | 4.5 | 3.2 | None | Optimization; Back up | $10,400 | $0 |
| Riverside Reg. WQCP | Major | 33 | 2.0 | 0.69 | 0.1 | Optimization; Back up | $43,300 | $70,000 |
| Tillman WRP | Major | 47 | 1.7 | 0.74 | 0.1 | Optimization; Back up | $55,400 | $98,800 |
| Merced WWTF | Major | 8.4 | 1.6 | 0.03 | 0.1[c] | Optimization; Monitoring; Back up | $32,800 | $33,200 |
| Sunnyvale WPCP | Major | 15 | 1.5 | 0.76 | 0.0 | Optimization; Monitoring; Back up | $30,700 - $32,800 | $28,800 - $44,500 |
| Forestville County SD | Minor | 0.13 | 1.4 | 0.15 | 0.1 | Optimization; Monitoring; Back up | $16,800 | $20,000 |
| Collins Pine Company | Major | 0.42[f] | 0.60 | 0.12 | None | Dechlorination; Monitoring; Back up | $29,200 | $36,200 |
| Duke Energy | Major | 601 | 0.07 | 0.05 | 0.085 | Dechlorination; Monitoring; Back up | $799,000[g] | $131,400 |

**Exhibit 5-2. Summary of Estimated Incremental Compliance Costs for Case Study Facilities**

| Facility Name | Type | Flow[a] (mgd) | Effluent TRC (mg/L) | | Existing Limit (mg/L)[b] | Means of Compliance | Total Capital | Annual O&M |
|---|---|---|---|---|---|---|---|---|
| | | | Max. | Avg. | | | | |

WWTP = Wastewater Treatment Plant
SD = Sanitation District
WQCP = Water Quality Control Plant
WRP = Water Reclamation Plant
WPCP = Water Pollution Control Plant
ND = nondetect
NA = not applicable
a. Represents average (not design) flow calculated from all flow data for the last three years in EPA's PCS database or data provided by the Regional Water Boards.
b. Represents a maximum limit unless otherwise noted.
c. Represents a monthly average limit.
d. Represents a 4-day average limit.
e. Represents a weekly average limit.
f. Represents the flow that needs treatment. The facility can discharge up to 3 mgd, however, only the cooling tower blowdown water would need to be dechlorinated.
g. Annualized capital cost at 6% over 20 years would be $69,600.

## 5.3 Statewide Impacts

Since the case study facilities are part of a sample EPA originally selected for evaluation of the California Toxics Rule, the State Water Board did not extrapolate the average cost results to obtain statewide impacts of the proposed chlorine policy. However, the evaluations can be used to provide some indication of the likely magnitude of statewide costs.

### 5.3.1 Major Facilities

Data in EPA's PCS indicates that over 86% of the 139 major municipal facilities, and over 61% of the 36 major industrial facilities in California have data, limits, or monitoring requirements for chlorine. EPA's Clean Water Needs Survey (CWNS) also indicates that over 90% of all municipal facilities use chlorine, although it does not contain data for industrial facilities (U.S. EPA, 2000a). Note, however, that this survey was conducted over five years ago, and may not reflect changes in facility treatment processes.[3] Nonetheless, if the PCS data are indicative of the number of facilities using chlorine (e.g., approximately 86% of major municipal facilities and 60% of major industrial facilities), there could be about 142 major facilities (139 x 86% + 36 x 60%) affected by the proposed policy. Based on evaluation of case study facilities, means of compliance may range from no action to adding dechlorination.

A rough estimate of the means of compliance for these facilities can be developed based on flow and TRC data (or at least the current effluent limit).[4] PCS contains this information for 128 facilities (109 municipals and 19 industrials), not including the 11 major case study facilities.

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[3] For example, a number of facilities are eliminating the use of chlorine due to safety concerns or compliance with more stringent effluent limits on disinfection byproducts.
[4] The State Water Board had site-specific information from facility permits regarding current treatment processes, and more comprehensive data sets, for the case study facilities.

Therefore, sufficient data are available for almost all of the major facilities that may be affected (see Appendix C for summary of PCS data).

Using only data in PCS for these 128 facilities, the State Water Board first assessed compliance with current limits by comparing the average of the maximum monthly TRC concentrations to the lowest effluent limit (if more than one exist), or the average monthly concentration if there are no maximum data. Given that all of the major municipal case study facilities employ dechlorination, the State Water Board assumed that the universe of potentially affected major municipal facilities also currently dechlorinate. Thus, the State Water Board assumed that any facilities not in compliance with their current limits would have to optimize their dechlorination process for compliance with current limits (or dechlorinate, if not currently doing so). However, these costs are not attributable to the proposed policy. Once in compliance with current permit limits, the State Water Board assumed that minor process optimization would be needed if the proposed criteria are more stringent than the facility's current limit.

If there are no effluent data in PCS, the State Water Board assumed the facility is discharging at its lowest permit limit (e.g., average monthly limit). For those facilities for which current effluent limits are at or below the proposed criteria, the State Water Board assumed that no treatment controls would be necessary. The State Water Board also assumed that facilities with average TRC concentrations below the proposed 4-day average criteria would also not need treatment.

For municipal facilities in compliance with current permit limits, but not in compliance with potential limits based on the proposed criteria, the State Water Board assumed that optimizing the dechlorination process would be necessary. For industrial facilities in this category, the State Water Board used the case study analyses to estimate whether the facility currently dechlorinates, assuming that facilities in similar industrial categories have similar treatment controls in place. Of the 19 facilities, 9 may need treatment to comply with the proposed policy. The State Water Board assumed that six of these facilities would need to install dechlorination (three power generation plants similar to Duke Energy, and three refineries that may be discharging cooling water); the remaining three facilities may already dechlorinate, and thus would need to optimize this process.

Because monitoring practices are not reported in PCS, the State Water Board assumed that all major facilities would need continuous monitoring, and a back up monitoring system, for one outfall. Based on the treatment and monitoring costs described in Section 4, capital costs for major facilities, including the major case study facilities, may be on the order of $8 million, with annual O&M costs totaling $13 million. Note that the dechlorination costs for 4 power generation facilities account for over 60% of the total capital cost, and approximately 50% of annual O&M costs. If the three power generation facilities not included in the case study evaluations already have dechlorination, statewide costs may be overestimated.

### 5.3.2 Minor Facilities

PCS does not contain data or limits for many minor facilities, and thus may not provide useful information on the number of minor facilities using chlorine. The CWNS (U.S. EPA, 2000a) suggests that 90% of municipal facilities, including minors, use chlorine. This estimate implies that up to 80 minor municipal facilities (90% of 89) could be affected by the proposed policy. The State Water Board does not have data regarding the number of minor industrial dischargers that use chlorine. However, the case study evaluations and PCS data suggest that power plants, petroleum and oil refineries, correctional institutions, schools and institutions, and ship building and repair facilities may use chlorine.

Although the number of potentially affected minor facilities is uncertain, compliance costs for these facilities are unlikely to exceed $3 million in capital and $3 million in annual O&M. The average cost for the minor case study facilities is on the order of $7,700 in capital and $7,500 in O&M. If 90% of minor municipal facilities incur this cost, along with 25% of minor industrials, total statewide costs (for both major and minor facilities) could increase to approximately $9 million in capital and $14 million in O&M. If the percentage of minor industrials incurring this cost is as high as 75%, total statewide costs would be on the order of $11 million in capital, and $16 million in O&M.

## 5.3 Limitations of the Analysis

The estimates of economic impacts are subject to a number of uncertainties regarding how facilities would respond to potential revised permit conditions, the total number of facilities that may be affected, and factors affecting costs. These uncertainties are described in **Exhibit 5-3**.

**Exhibit 5-3. Limitations of the Analysis {tc "Exhibit 5-2. Limitations of the Analysis " \f D }**

| Limitation/Assumption | Potential Impact on Costs | Comment |
|---|---|---|
| The State Water Board does not have specific information on dechlorination processes (e.g., sulfur dioxide dose, contact time, process controls used) at the case study facilities. Therefore, the State Water Board used “one size fits all” cost estimates for process optimization (e.g., $3,600 for analysis, increased dose based on current average TRC concentration, and addition of process controls). | + | Facilities may not have to implement all of the modifications indicated, or they may be able to adjust other system parameters (e.g., reduce chlorine dose). |
| The State Water Board does not have specific information on current monitoring practices (e.g., continuous monitoring, back up systems) for the case study facilities. Therefore, the State Water Board assumed that continuous monitoring with a back up system would be needed, unless facility or permit data indicated otherwise. | + | Facilities may already have continuous monitoring and back up systems. |

**Exhibit 5-3. Limitations of the Analysis {tc "Exhibit 5-2. Limitations of the Analysis " \f D }**

| Limitation/Assumption | Potential Impact on Costs | Comment |
|---|---|---|
| In estimating statewide costs for major facilities, the State Water Board used the design flow reported in PCS. | + | Sulfur dioxide costs are calculated based on average flow and TRC concentration. Therefore, these costs may be overstated because facilities often discharge below their design capacity. |
| In estimating potential statewide costs, the State Water Board did not include point source discharges with general permits. | - | There may be general permitted dischargers that use chlorine. |
| In estimating potential statewide costs for major facilities, the State Water Board compared the maximum of maximum monthly (or average monthly) TRC values to the proposed 4-day average TRC criteria to determine compliance with the proposed policy. | ? | It is not possible to predict whether continuous monitoring data (i.e., one data point per minute) would indicate that a facility is more or less likely to incur costs for compliance with revised effluent limits. |
| In estimating potential statewide costs for major facilities, the State Water Board assumed facilities without effluent data are discharging at their current permit limits. | ? | Facilities may actually be discharging at levels below or above current limits. |
| In estimating potential statewide costs for major facilities the State Water Board assumed that all the information from EPA's PCS database and CWNS is representative of the number of facilities actually using chlorine. | ? | More or fewer major facilities may use chlorine. |

Key: + = Costs are potentially overstated
- = Costs are potentially understated
? = Impact of costs is unknown.

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# Appendix A.  Facility Analyses

This appendix provides the analyses for the case study facilities.  The State Water Board determined the need for treatment controls based on total residual chlorine effluent concentrations for each case study facility.  Data are from EPA's Permit Compliance System (PCS) database, except where otherwise noted.  The State Water Board based estimated costs for each sample facility on average flow.  For data from PCS, the average flow is calculated as the average of average monthly values.  For data provided by California Regional Water Boards, the average flow is calculated as the average of all available values.

## Arcata Wastewater Treatment Plant

### Facility Description

The City of Arcata Wastewater Treatment Plant (NPDES permit number CA0022713) is located in Arcata, California. This major discharger has a design capacity of 5 mgd and treats domestic waste from the City of Arcata, the unincorporated community of Glendale, and several minor dischargers. The facility discharges secondary treated wastewater to Humboldt Bay through Outfall 001, and to the Arcata Marsh Wildlife Sanctuary (AMWS) through Outfall 002. The 30-acre AMWS provides final polishing for a portion of the wastewater. This water flows by gravity through the AMWS and eventually back to the chlorine contact basin.

### Treatment Processes

The facility's 2004 NPDES permit indicates that the current treatment processes consist of mechanical bar screens, grit removal, clarifiers, anaerobic digesters, oxidation ponds, treatment marshes, chlorination, and dechlorination. Sludge is treated in drying beds and by composting. Note that a new series of constructed wetlands should be completed by 2005. The new constructed wetlands will receive a portion of the flow from Outfall 001.

### Summary of Effluent Data and Limits

**Exhibit A-1** summarizes daily effluent monitoring data from continuous monitoring for TRC from July 2001 to July 2004 provided by the North Coast Regional Water Board.

**Exhibit A-1. TRC Effluent Data Summary, Arcata WWTP[1]**

| Outfall | Number of Observations | | | | Summary of Detected Values (mg/L) | | | Current Limit (mg/L) |
|---|---|---|---|---|---|---|---|---|
| | Total | Detect | Nondetect[2] | LDL (mg/L) | Maximum | Mean | Minimum | |
| 001 | 1,126 | 5 | 1,121 | Not specified | 4.50 | 3.24 | 0.50 | None |

LDL = lowest detection level (of nondetects).
TRC = total residual chlorine.
1. Represents daily TRC data from July 2001 to July 2004 provided by the North Coast Regional Water Board.
2. Zero values counted as nondetects.

### Controls Needed

Exhibit A-1 indicates that the facility exceeded the proposed saltwater chlorine residual criteria 5 times from July 2001 to July 2004. The facility monitoring reports indicate that each of the exceedances was due to a malfunction in the sulfur dioxide feeder, and that none of the exceedances lasted for longer than 45 minutes. Since the cause of exceedance has already been identified, only minor process modifications would be necessary for compliance with the proposed policy. The State Water Board estimated that a redundant sulfur dioxide feeder would ensure that malfunctions would not lead to violations. The State Water Board also assumed that this facility would incur costs for a redundant analyzer because, although the facility currently monitors for TRC continuously, there is no current requirement for a back up system. **Exhibit A-2** summarizes these costs.

**Exhibit A-2. Summary of Estimated Compliance Costs, Arcata WWTP ($2004)[1]{tc "Exhibit 4-3. Process Modification Cost Components " \f D }**

| Component | Total Capital Costs | O&M Costs |
|---|---|---|
| Process Modifications:<br>-Redundant $SO_2$ feeder | $8,400 | $0 |
| Back up monitoring system | $2,000 | $0 |
| Total | $10,400 | $0 |

Sources: Chemical Injection Technologies (2004); Chlorinators Inc. (2004); Foxcroft (2004); Hach Company (2004).

# Forestville County Sanitation District

## Facility Description

The Forestville County Sanitation District (NPDES permit number CA0023043) is located in Forestville, California. The minor facility has a design capacity of 0.13 mgd and treats wastewater from Forestville and the Mirabel Heights Zone of Benefit. The facility may also receive disinfected, secondary effluent from the Graton Sanitary Zone WWTF when there is adequate capacity. Between May 15 and September 30 the facility's effluent is recycled and used by private property owners to irrigate vineyards, berry farms, and pastures. From October 1 to May 14, treated wastewater is discharged into Jones Creek.

## Treatment Processes

The facility's 2004 NPDES permit indicates that the current treatment processes consist of a rotary hydroscreen, a screenings washer, aeration ponds, microfiltration, chlorination, and dechlorination.

## Summary of Effluent Data and Limits

**Exhibit A-3** summarizes effluent monitoring data for TRC from January 2001 through December 2003, for the discharge period (October 1 – May 14), from the facility's self-monitoring report provided by the North Coast Regional Water Board.

**Exhibit A-3. Effluent Data Summary, Forestville CSD[1]**

| Pollutant | Number of Observations | | | | Summary of Detected Values (mg/L) | | | Current Limit (mg/L)[5] |
|---|---|---|---|---|---|---|---|---|
| | Total | Detect | Nondetect[2] | LDL | Maximum[3] | Mean[4] | Minimum | |
| TRC | 48 | 9 | 39 | 0.1 | 1.40 | 0.15 | 0.10 | 0.1 |

LDL = lowest detection level
TRC = total residual chlorine
1. Represents average and maximum monthly effluent TRC data from January 2001 to December 2003, for the period of discharge (October 1 – May 14), from the facility's self-monitoring reports provided by the North Coast Regional Water Board.
2. Zero values counted as nondetects.
3. Represents the maximum of maximum monthly values.
4. Represent the average of average monthly values.
5. Represents the minimum detection level. The permit states that the discharge shall not contain detectable levels of chlorine using an analytical method or analyzer with a detection level of 0.1 mg/L.

## Controls Needed

Exhibit A-3 indicates that the facility is not in compliance with its current limit for total residual chlorine. From January 2001 to December 2003, detected observations were greater than the current effluent limit despite the fact that the facility currently dechlorinates prior to discharge. The State Water Board assumed that the facility would have to optimize its current dechlorination process for compliance with current limits. These costs are not attributable to the proposed policy.

Once in compliance with current limits, only minor process optimization would likely be necessary for compliance with potential permit limits based on the proposed TRC criteria. **Exhibit A-4** summarizes the potential control costs, which include the cost of increasing the sulfur dioxide dose. The State Water Board also included costs for continuous monitoring and a redundant analyzer back up system because only daily grab samples (analyzed using Standard Methods) are required by the facility's current permit for effluent discharged to Jones Creek.

**Exhibit A-4. Summary of Estimated Compliance Costs, Forestville CSD ($2004)[1]{tc "Exhibit 4-3. Process Modification Cost Components " \f D }**

| Component | Total Capital Costs | O&M Costs |
|---|---|---|
| Process Modifications:<br>-Increasing $SO_2$ Dose | $10,800 | $1,000 |
| Continuous monitoring with back up system | $6,000 | $19,000 |
| Total | $16,800 | $20,000 |

Sources: AACE (2002); Airgas (2004); BLS (2002, 2003, 2004); Chemical Injection Technologies (2004); Foxcroft (2004); Hach Company (2004); ITA (1999); JCI Chemical (2004); Praxair (2004).

## City of Calistoga Wastewater Treatment Plant

### Facility Description

The City of Calistoga WWTP (NPDES permit number CA0037966) is located in northern Napa Valley, California. The facility has a design capacity of 0.80 mgd and treats wastewater from domestic and commercial sources within the City of Calistoga. The facility is a minor discharger that discharges intermittently to the Napa River during the wet weather period from October to May provided an adequate river-to-wastewater dilution of at least 10:1 is available. During dry weather, May through September, discharge is prohibited, and the effluent is stored in wastewater ponds or disposed of to land through a reclamation program.

### Treatment Processes

The 2000 NPDES permit for the facility indicates that the current treatment processes consist of headworks, primary clarification, secondary treatment by two oxidation ponds, tertiary treatment by coagulation, clarification, filtration, and disinfection. The facility is planning an expansion. The new plant will use an extended aeration activated sludge process for primary and secondary treatment, replacing the existing primary clarification and facultative lagoon system. Sludge is pumped to an anaerobic digester and then dewatered and dried. Dried solids are stockpiled in on-site earthen sludge storage beds, and ultimately removed for off-site disposal at an authorized disposal facility.

### Summary of Effluent Data and Limits

**Exhibit A-5** summarizes daily effluent monitoring data for TRC from January 2001 through December 2003, for the period of discharge (October to May), provided by the San Francisco Bay Regional Water Board.

**Exhibit A-5. TRC Effluent Data Summary, Calistoga WWTP[1]**

| Outfall | Number of Observations | | | | Current Limit (mg/L)[3] |
|---|---|---|---|---|---|
| | Total | Detect | Nondetect[2] | LDL (mg/L) | |
| E-1 | 429 | 0 | 429 | Not specified | 0.0 |
| E-2 | 181 | 0 | 181 | Not specified | 0.0 |

LDL = lowest detection level (of nondetects).
TRC = total residual chlorine.
1. Represents daily TRC data from the San Francisco Bay Regional Water Board from January 2001 to December 2003, for the period of discharge (October to May).
2. Zero values counted as nondetects.
3. Limit defined as below the detection limit in standard methods defined in the latest EPA approved edition of "Standard Methods for the Examination of Water and Wastewater."

### Controls Needed

The State Water Board does not have data to indicate that the facility would likely exceed the proposed TRC criteria because all observations are nondetect. The detection limit is not specified in the data set, however, the lowest detection limit for total residual chlorine methods as defined in Standard Methods for Examination of Water and Wastewater is 0.01 mg/L. Therefore, the State Board assumed that all the nondetect values are less than 0.01 mg/L.

Also, the facility is required in its current permit to monitor TRC continuously for outfalls E-1 and E-2, however, a back up monitoring system is not required for times when these analyzers are offline for calibration or maintenance. Therefore, the facility would need a redundant chlorine residual analyzer for each outfall ($2,000 x 2 = $4,000 total) for compliance with the proposed policy (costs based on Chemical Injection Technologies, 2004; Foxcroft, 2004; and Hach Company, 2004).

## Pacific Gas & Electric, Hunter's Point

### Facility Description

The Pacific Gas & Electric, Hunter's Point facility (NPDES permit number CA0005649) is a power plant with the capacity to generate about 396 MW of electricity from three steam-electric generating units. The facility has two once-through cooling water outfalls: outfall 001 is about 266 mgd and outfall 002 is about 146.3 mgd (note that the average flow for the combined outfalls is only about 108 mgd). EPA classifies this facility as a minor discharge. The two outfalls are discharged into San Francisco Bay.

### Treatment Processes

The 1994 NPDES permit for the facility indicates that current treatment processes consist of screening and shock chlorination at the cooling water intake to remove debris and control biological growth in the cooling system. The water is dechlorinated prior to discharge.

### Summary of Effluent Data and Limits

**Exhibit A-6** summarizes daily effluent monitoring data for TRC from the San Francisco Bay Regional Water Board from January 2001 to December 2003.

**Exhibit A-6. TRC Effluent Data Summary, Pacific Gas & Electric[1]**

| Outfall | Number of Observations | | | | Current Limit (mg/L)[3] |
|---|---|---|---|---|---|
| | Total | Detect | Nondetect[2] | LDL (mg/L) | |
| 001 | 483 | 0 | 483 | Not specified | 0.0 |
| 002 | 327 | 0 | 327 | Not specified | 0.0 |

LDL = lowest detection level (of nondetects).
TRC = total residual chlorine.
1. Represents daily TRC data from the San Francisco Bay Regional Water Board from January 2001 to December 2003.
2. Zero values counted as nondetects.
3. Represents an instantaneous maximum limit.

### Controls Needed

The State Water Board does not have data to indicate that the facility would likely exceed the proposed TRC criteria because all observations are nondetect. The detection limit is not specified in the data set, however, the lowest detection limit for total residual chlorine methods as defined in Standard Methods for Examination of Water and Wastewater is 0.01 mg/L. Therefore, the State Board assumed that all the nondetect values are less than 0.01 mg/L.

Only daily grab samples are required for TRC monitoring at outfalls 001 and 002. Therefore, the facility would likely incur continuous monitoring costs for two continuous residual analyzers and redundant back up units). **Exhibit A-7** summarizes these costs.

**Exhibit A-7. Summary of Estimated Compliance Costs, Pacific Gas & Electric ($2004){tc "Exhibit 4-3. Process Modification Cost Components " \f D }**

| Component | Total Capital Costs | O&M Costs |
|---|---|---|
| Continuous monitoring with back up system[1] | $8,000 | $30,600 |

Sources: Chemical Injection Technologies (2004); Foxcroft (2004); Hach Company (2004).
1. Represents costs for both outfalls.

## San Jose/Santa Clara Water Pollution Control Plant

### Facility Description

The San Jose/Santa Clara Water Pollution Control Plant (NPDES permit number CA0037842) is located in San Jose, California. The facility has a design capacity of 167 mgd and treats wastewater from San Jose, Santa Clara, Milpitas County Sanitation District 2-3, and the West Valley, Cupertino, Burbank, and Sunol Sanitary Districts. The service area has a population of about 1.3 million. EPA classifies the discharge as a major discharge. The facility discharges to Artesian Slough, a tributary to Coyote Creek and South San Francisco Bay, and also supplies recycled water for nonpotable purposes via South Bay Water Recycling.

### Treatment Processes

The facility's 2003 NPDES permit indicates that the current treatment processes consist of screening and grit removal, primary sedimentation, secondary treatment (activated sludge), secondary clarification, filtration, chlorination, and dechlorination. Biosolids are thickened, anaerobically digested, and stabilized in lagoons and drying beds. Biosolids are then solar dried to about 75% total solids before reuse by land application or daily cover in an authorized sanitary landfill.

### Summary of Effluent Data and Limits

**Exhibit A-8** summarizes maximum monthly effluent monitoring data for TRC from EPA's PCS database from April 2001 to April 2004.

**Exhibit A-8. Effluent Data Summary, San Jose/Santa Clara WPCP[1]**

| Pollutant | Number of Observations | | | | Current Limit (mg/L)[3] |
|---|---|---|---|---|---|
| | Total | Detect | Nondetect[2] | LDL (mg/L) | |
| TRC | 36 | 0 | 36 | Not specified | 0.0 |

LDL = lowest detection level (of nondetects).
TRC = total residual chlorine.
1. Represents maximum monthly TRC data from EPA's PCS database from April 2001 to April 2004.
2. Zero values counted as nondetects.
3. Limit defined as below the detection limit in standard methods defined in the latest EPA approved edition of "Standard Methods for the Examination of Water and Wastewater."

### Controls Needed

The State Water Board does not have data to indicate that the facility would likely exceed the proposed TRC criteria because all observations are nondetect. The detection limit is not specified in the data set, however, the lowest detection limit for total residual chlorine methods as defined in Standard Methods for Examination of Water and Wastewater is 0.01 mg/L. Therefore, the State Board assumed that all the nondetect values are less than 0.01 mg/L.

The facility's permit requires that effluent chlorine residual concentrations be monitored continuously, or by grab samples taken hourly for a total of 24 chlorine residual readings a day. Therefore, the facility may incur costs for only a back up system, if it is already monitoring continuously, or both continuous monitoring and a back up system. **Exhibit A-9** summarizes these costs.

**Exhibit A-9. Summary of Estimated Compliance Costs, San Jose/Santa Clara WPCP ($2004)[1]{tc "Exhibit 4-3. Process Modification Cost Components " \f D }**

| Component | Total Capital Costs | O&M Costs |
|---|---|---|
| Scenario 1: Back up system only | $2,000 | $0 |
| Scenario 2: Continuous monitoring with back up system | $4,000 | $15,700 |

Sources: BLS (2002, 2003, 2004); Chemical Injection Technologies (2004); Foxcroft (2004); Hach Company (2004); ITA (1999).

## Sunnyvale Water Pollution Control Plant

### Facility Description

The Sunnyvale Water Pollution Control Plant (NPDES permit number CA0037621) is located in Sunnyvale, California. The facility has a design capacity of 29.5 mgd and treats wastewater from the City of Sunnyvale, Rancho Rinconada, and Moffett Field. The facility's current service area has a population of about 127,000. EPA classifies the discharge as a major discharge. The facility discharges to Moffett Channel, a tributary of Guadalupe Slough and the South San Francisco Bay.

### Treatment Processes

The facility's 2003 NPDES permit indicates that the current treatment processes consist of influent grinding, preaeration and grit removal, primary sedimentation, secondary oxidation ponds, fixed-film reactor nitrification, dissolved air flotation, dual media filtration, chlorination, and dechlorination. Sludge is anaerobically digested, dewatered in lagoons, and dried in solar drying beds. Biosolids are reused in accordance with 40 CFR Part 503 regulations.

### Summary of Effluent Data and Limits

**Exhibit A-10** summarizes maximum monthly effluent monitoring data for TRC from EPA's PCS database from May 2001 to May 2004.

**Exhibit A-10. Effluent Data Summary, Sunnyvale WPCP[1]**

| Pollutant | Number of Observations | | | | Summary of Detected Values (mg/L) | | | Current Limit (mg/L)[3] |
|---|---|---|---|---|---|---|---|---|
| | Total | Detect | Nondetect[2] | LDL (mg/L) | Maximum | Mean | Minimum | |
| TRC | 31 | 4 | 27 | Not specified | 1.48 | 0.76 | 0.01 | 0.0 |

LDL = lowest detection level (of nondetects).
TRC = total residual chlorine.
1. Represents maximum monthly TRC data from EPA's PCS database from May 2001 to May 2004.
2. Zero values counted as nondetects.
3. Limit defined as below the detection limit in standard methods defined in the latest EPA approved edition of "Standard Methods for the Examination of Water and Wastewater."

### Controls Needed

Exhibit A-10 indicates that the facility is not in compliance with current TRC limits. From May 2001 to May 2004, 4 observations were detected, thus, exceeding the current limit of 0.0 mg/L (i.e., a detection level of 0.01 mg/L). The State Water Board estimated that the facility would have to optimize its dechlorination process for compliance with the current permit limit, including conducting a process analysis study, increasing their sulfur dioxide dose, and installing process controls. These costs are not attributable to the proposed policy.

Once in compliance with current TRC limits, only minor process optimization would likely be necessary for compliance with potential permit limits based on the proposed saltwater TRC 1-

hour average (0.013 mg/L) and 4-day average (0.0075 mg/L) criteria (the receiving water is estuarine, therefore, more stringent of freshwater and saltwater criteria apply). **Exhibit A-11** summarizes the potential control costs, which include the cost of increasing sulfur dioxide dose to achieve the additional TRC reductions. Also, the facility's permit requires that effluent chlorine residual concentrations be monitored continuously, or by grab samples taken hourly for a total of 24 chlorine residual readings a day. Therefore, the facility may incur costs for only a back up system, if it is currently monitoring continuously, or both analyzers and continuous monitoring and a back up system.

**Exhibit A-11. Summary of Estimated Compliance Costs, Sunnyvale WPCP ($2004){tc "Exhibit 4-3. Process Modification Cost Components " \f D }**

| Component | Total Capital Costs | O&M Costs |
|---|---|---|
| Scenario 1: | | |
| -Increasing $SO_2$ dose | $28,800 | $28,800 |
| -Back up monitoring system | $2,000 | $0 |
| Scenario 2: | | |
| -Increasing $SO_2$ dose | $28,800 | $28,800 |
| -Continuous monitoring with back up system | $4,000 | $15,700 |
| Total | $30,800 - $32,800 | $28,800 - $44,500 |

Sources: AACE (2002); Airgas (2004); BLS (2002, 2003, 2004); Chemical Injection Technologies (2004); Foxcroft (2004); Hach Company (2004); ITA (1999); JCI Chemical (2004); Praxair (2004).

## Honeywell Inc.

### Facility Description

Formerly Allied Signal Inc., the company changed its name (but not ownership) to Honeywell Inc. (NPDES permit number CA0058688) on January 26, 2000. Honeywell operates an aircraft and auxiliary equipment manufacturing plant in Torrance, California. This minor discharger discharges up to 0.03 mgd water twice per year when the cooling towers are emptied for cleaning and maintenance. The water is discharged to a storm drain that flows to the Dominguez Channel. Process wastes from metal plating as well as cooling tower bleed-off and boiler blowdown are discharged to the sanitary sewer.

### Treatment Processes

The 2001 NPDES permit for the Honeywell facility indicates that the facility does not have any type of treatment.

### Summary of Effluent Data and Limits

**Exhibit A-12** summarizes maximum monthly effluent monitoring data for TRC from December 2003 from the Los Angeles Regional Water Board.

**Exhibit A-12. Effluent Data Summary, Honeywell[1]**

| Pollutant | Number of Observations | | | | Summary of Detected Values (mg/L) | | | Current Limit (mg/L)[2] |
|---|---|---|---|---|---|---|---|---|
| | Total | Detect | Nondetect | LDL (mg/L) | Maximum | Mean | Minimum | |
| TRC | 2 | 1 | 1 | 0.1 | 0.5 | - | - | 0.1 |

LDL = lowest detection level (of nondetects).
TRC = total residual chlorine.
1. Represents TRC data from December 2003 provided by the Los Angeles Regional Water Board.
2. Represents a maximum daily effluent limit.

### Controls Needed

Based on the limited effluent data in Exhibit A-12 (two observations with one detected above the proposed criteria), the one detected observation exceeds the facility's current effluent limit for chlorine. Therefore, for compliance with the current limit the facility would most likely need to dechlorinate its effluent prior to discharging. The cost of dechlorination is not attributable to the proposed policy.

Once in compliance with its current permit limit, only minor process optimization of the new dechlorination system would likely be necessary for compliance with potential effluent limits based on the proposed chlorine criteria. The State Water Board also included the cost of continuous monitoring with a back up system, even though the facility may not be required to continuously monitor if it can demonstrate to the Regional Water Board that continuous monitoring is inappropriate (because it only discharges twice per year). Costs are summarized in **Exhibit A-13**.

**Exhibit A-13. Summary of Estimated Compliance Costs, Honeywell ($2004){tc "Exhibit 4-3. Process Modification Cost Components " \f D }**

| Component | Total Capital Costs | O&M Costs |
|---|---|---|
| Process Modifications:<br>-Increasing $SO_2$ dose[1] | $6,600 | $0 |
| Continuous monitoring with back up system[2] | $4,000 | $700 |
| Total | $10,600 | $700 |

Sources: AACE (2002); Airgas (2004); Chemical Injection Technologies (2004); JCI Chemical (2004); Praxair (2004).
1. Because such a small amount of sulfur dioxide would be needed per year, the State Water Board assumed that the cost of sulfur dioxide would be considered a capital cost, not O&M (the costs would not be incurred every year).
2. O&M costs reflect assumption that maintenance labor costs would only be incurred when the facility is actually discharging (i.e., twice per year).

## Santa Susana Field Laboratory (Boeing-Rocketdyne)

### Facility Description

The Santa Susana Field Laboratory (SSFL - NPDES permit number CA0001309) is located in Simi Hills, California and is owned by Boeing-Rocketdyne and NASA. The Department of Energy also owns several buildings on the property. The developed portion of the site comprises approximately 1,500 acres. There is a 1,200 acre buffer zone of undeveloped land to the south of the site, and an additional 150 acre buffer zone was recently purchased to the north of the site.

Boeing-Rocketdyne conducts research, development, assembly/disassembly, and testing of rocket engines, missile components, advanced lasers, and other operations at SSFL for NASA. Current activities at SSFL that contribute to discharges include rocket engine testing (water is used to cool flame detectors); fire suppression; and cleaning, etching, and pressure testing of rocket testing equipment. On average, about 0.33 mgd exits through outfalls 001 and 002 to Bell Creek, a tributary to the Los Angeles River (note that flow varies depending on volume of storm water). These outfalls comprise treated wastewater, water from the groundwater treatment systems, excess reclaimed water, water from the engine test stands, and a portion of the storm water. The remaining storm water is discharged via Outfalls 003, 004, 005, 006, and 007 to the Arroyo Simi, a tributary to Calleguas Creek. Domestic sewage previously treated at one of three sewage treatment plants onsite is now diverted offsite. SSFL also utilizes a system of natural, unlined, and man-made ponds and channels to collect and reuse water for cooling and fire suppression. Excess reclamation water is discharged through Outfalls 001 and 002. EPA classifies this facility as a major discharge.

### Treatment Processes

The facility's 2004 NPDES permit indicates that the current treatment processes consist of a series of reclamation ponds and onsite groundwater treatment systems which include ultraviolet light and hydrogen peroxide oxidation, carbon adsorption, and air stripping.

### Summary of Effluent Data and Limits

**Exhibit A-14** summarizes average monthly effluent monitoring data for TRC from EPA's PCS database from April 2001 to April 2004 for outfalls 001 and 002 only because they are the only outfalls for which the permit contains chlorine residual effluent limits (outfalls 003 through 007 because these outfalls are storm water outfalls and no chlorine is added).

**Exhibit A-14. TRC Effluent Data Summary, SSFL[1]**

| Outfall | Number of Observations | | | | Current Limit (mg/L)[2] |
|---|---|---|---|---|---|
| | Total | Detect | Nondetect | LDL (mg/L) | |
| 001 | 5 | 0 | 5 | Not specified | 0.1 |
| 002 | 9 | 0 | 9 | Not specified | 0.1 |

**Exhibit A-14. TRC Effluent Data Summary, SSFL[1]**

| Outfall | Number of Observations | | | | Current Limit (mg/L)[2] |
|---|---|---|---|---|---|
| | Total | Detect | Nondetect | LDL (mg/L) | |

LDL = lowest detection level (of nondetects).
TRC = total residual chlorine.
1. Represents average monthly TRC data from EPA's PCS database from April 2001 to April 2004.
2. Represents a daily maximum limit.

## Controls Needed

All the effluent values for chlorine are nondetect and the detection limit is not specified. However, based on information in the facility's fact sheet, there is no indication that the facility uses chlorine in any of its processes or for treatment of wastes. Therefore, the State Water Board does not have data to indicate that the facility would likely exceed the proposed TRC criteria.

The facility's current permit requires only annual TRC grab samples be taken for outfalls 001 and 002. Therefore, the facility would likely incur continuous monitoring costs for outfalls 001 and 002, as well as costs for back up monitoring systems. **Exhibit A-15** summarizes these costs.

**Exhibit A-15. Summary of Estimated Compliance Costs, SSFL ($2004){tc "Exhibit 4-3. Process Modification Cost Components " \f D }**

| Component | Total Capital Costs | O&M Costs |
|---|---|---|
| Continuous monitoring with back up system[1] | $8,000 | $31,400 |

Sources: Chemical Injection Technologies (2004); Foxcroft (2004); Hach Company (2004); ITA (1999).
1. Represents costs for two outfalls (001 and 002).

## City of Los Angeles Tillman Water Reclamation Facility

### Facility Description

The City of Los Angeles Tillman Water Reclamation Facility (NPDES permit number CA0056227) is located in Van Nuys, California. The facility consists of two identical treatment trains, each with a design capacity of 40 mgd (80 mgd total). Classified by EPA as a major discharge, the facility collects, treats, and processes municipal wastewater from domestic, commercial, and industrial sources from Los Angeles, excluding the Terminal Island Service Area surrounding the L.A. Harbor area. The facility discharges into the Los Angeles River through Outfall 008. Reclaimed water from the facility is used to maintain flows in the Japanese Garden, Lake Balboa (outfall 002), and Wildlife Lakes (outfall 003); it is also used in water truck delivery for landscape irrigation, street cleaning, graffiti removal, and construction-related dust control.

### Treatment Processes

The facility's 1998 NPDES permit indicates that the current treatment processes consist of screening, grit removal, flow equalization, primary sedimentation, activated sludge biological treatment with fine pore aeration, secondary clarification, coagulation, mixed dual media filtration, chlorination, and dechlorination. Waste streams consisting of grit, primary and secondary sludge and skimmings, and filter backwash are returned to the collection system for treatment and processing at the Hyperion Treatment Plant.

### Summary of Effluent Data and Limits

**Exhibit A-16** summarizes maximum monthly effluent monitoring data for TRC from EPA's PCS database from April 2001 to April 2004.

**Exhibit A-16. TRC Effluent Data Summary, Tillman WRF[1]**

| Outfall | Number of Observations | | | | Summary of Detected Values (mg/L) | | | Current Limit (mg/L)[3] |
|---|---|---|---|---|---|---|---|---|
| | Total | Detect | Nondetect[2] | LDL (mg/L) | Maximum | Mean | Minimum | |
| 002 | 35 | 5 | 30 | Not specified | 1.70 | 0.74 | 0.20 | 0.1 |
| 003 | 34 | 5 | 29 | Not specified | 1.70 | 0.74 | 0.20 | 0.1 |
| 008 | 34 | 5 | 29 | Not specified | 1.70 | 0.74 | 0.20 | 0.1 |

LDL = lowest detection level (of nondetects).
TRC = total residual chlorine.
1. Represents maximum monthly TRC data from EPA's PCS database from April 2001 to April 2004.
2. Zero values counted as nondetects.
3. Represents a daily maximum limit. Also, excursions of up to 0.3 mg/L shall not be considered a violation provided the total duration of the excursion does not exceed 15 minutes during any 24-hour period.

## Controls Needed

The observations for outfalls 002, 003, and 008 are exactly the same on the same dates. The facility's permit indicates that the wastewater is treated and then sent off to one of three places through outfalls 002, 003, and 008. Since the water is chlorinated and dechlorinated prior to distribution, the State Water Board assumed that the monitoring location for the three outfalls is the same, and that the facility most likely dechlorinates at a single point, before the wastewater is split for distribution.

Exhibit A-16 indicates that the facility is not currently in compliance with permit limits for TRC. The State Water Board assumed that the facility would have to optimize its dechlorination process for compliance with current permit limits, including conducting a process analysis study, increasing their sulfur dioxide dose, and installing process controls. These costs are not attributable to the proposed policy.

Once in compliance with current limits, only minor process optimization would likely be necessary for compliance with effluent limits based on the proposed criteria. **Exhibit A-17** summarizes the potential control costs, which include the cost of increasing the sulfur dioxide dose. The State Water Board did not include costs for continuous monitoring because the facility's permit requires that effluent chlorine residual concentrations are monitored continuously for all three outfalls. However, one back up system would likely be needed (the continuous monitoring is most likely conducted at a single point).

**Exhibit A-17. Summary of Estimated Compliance Costs, Tillman WRF ($2004){tc "Exhibit 4-3. Process Modification Cost Components " \f D }**

| Component | Total Capital Costs | O&M Costs |
|---|---|---|
| Process Modifications:<br>-Increasing $SO_2$ Dose | $53,400 | $98,800 |
| Back up monitoring system | $2,000 | $0 |
| Total | $55,400 | $98,800 |

Sources: AACE (2002); Airgas (2004); BLS (2002, 2003, 2004); Chemical Injection Technologies (2004); Foxcroft (2004); Hach Company (2004); ITA (1999); JCI Chemical (2004); Praxair (2004).

# City of Biggs Wastewater Treatment Plant

## Facility Description

The City of Biggs WWTP (NPDES permit number CA0078930) is located in Butte County, California. The facility has a design capacity of 0.37 mgd and treats wastewater from the City of Biggs. The facility discharges to Lateral K, an agricultural drain that is a tributary to Hamilton Slough and the Sacramento River. EPA classifies the discharger as a minor discharger.

## Treatment Processes

The 2000 NPDES permit for the City of Biggs facility indicates that the current treatment processes consist of two aerated lagoons, ballast pond, two slow sand filters, chlorination, and dechlorination. The facility is in the process of being upgraded. The upgrade will consist of removing the filters and adding three rock filters for supplementary solids removal, and upgrading the chlorination and dechlorination system.

## Summary of Effluent Data and Limits

**Exhibit A-18** summarizes maximum monthly effluent monitoring data for TRC from August 2001 through August 2004 from the Central Valley Regional Water Board.

**Exhibit A-18. Effluent Data Summary, Biggs WWTP[1]**

| Pollutant | Number of Observations | | | | Summary of Detected Values (mg/L) | | | Current Limit (mg/L)[2] |
|---|---|---|---|---|---|---|---|---|
| | Total | Detect | Nondetect | LDL (mg/L) | Maximum | Mean | Minimum | |
| TRC | 971 | 2 | 969 | 0.01 | 1.90 | 0.98 | 0.05 | 0.01 |

LDL = lowest detection level (of nondetects).
TRC = total residual chlorine.
1. Represents daily effluent TRC data from August 2001 through August 2004 provided by the Central Valley Regional Water Board.
2. Represents a 4-day average effluent limit. The facility's permit also specifies a daily maximum limit of 0.02 mg/L.

## Controls Needed

Exhibit A-18 indicates that the facility only has two detected TRC observations from August 2001 to August 2004. Because the facility's current permit limits are as protective as the proposed criteria, the State Water Board assumed that once in compliance with current permit limits, the facility would also most likely be in compliance with the proposed criteria. The cost of complying with current permit limits is not attributable to the proposed policy. The facility is also required in its current permit to monitor TRC continuously. However, the facility may not have a back up monitoring system. Therefore, the State Water Board estimated that the facility would incur back up monitoring costs of about $2,000 (costs based on Chemical Injection Technologies, 2004; Foxcroft, 2004; and Hach Company, 2004).

## Collins Pine Company

### Facility Description

The Collins Pine Company (NPDES permit number CA0004391) is a sawmill and wood-burning cogeneration plant in Chester, California. The major facility has a design capacity of 3 mgd (and an average flow of 2.5 mgd) and discharges cooling tower blowdown, electrostatic precipitator water, boiler mud drum blowdown water, boiler steam drum blowdown, compressor cooling water, feedwater pump cooling water, demineralization and reverse osmosis concentrate (brine), front ash hopper overflow, ash, wood waste, and storm water runoff. Some of these waste streams contain chemicals used to control scaling and slime growth. The facility discharges to Stover Ditch, a tributary of the North Fork Feather River. All domestic wastes generated from the sawmill and powerhouse are sent to the Chester wastewater treatment plant.

### Treatment Processes

The facility's 2004 NPDES permit indicates that current treatment processes consist of an ash settling pond and a fire pond.

### Summary of Effluent Data and Limits

**Exhibit A-19** summarizes daily effluent monitoring data for TRC from the Central Valley Regional Water Board from February 2004 to June 2004.

**Exhibit A-19. Effluent Data Summary, Collins Pine Company[1]**

| Pollutant | Number of Observations | | | | Summary of Detected Values (µg/L) | | | Current Limit (µg/L) |
|---|---|---|---|---|---|---|---|---|
| | Total | Detect | Nondetect[2] | LDL (µg/L) | Maximum | Mean | Minimum | |
| TRC | 56 | 41 | 15 | Not specified | 0.6 | 0.12 | 0.01 | None |

LDL = lowest detection level (of nondetects).
TRC = total residual chlorine.
1. Represents daily TRC data from the Central Valley Regional Water Board from February 2004 to June 2004.
2. Zero values counted as nondetects.

### Controls Needed

Exhibit A-19 indicates that the facility would not be in compliance with effluent limits based on the proposed criteria. From February 2004 to June 2004 over 97% of the facility's detected observations were greater than the 1-hour and 4-day average TRC criteria for freshwater. The facility uses chlorine to control scaling and algae growth in its cooling tower blowdown, however, it does not currently dechlorinate prior to discharge. Therefore, the State Water Board estimated that the facility would install a dechlorination system for the cooling water only (about 0.42 mgd) prior to discharging to the ash settling pond for compliance with potential permit limits based on the proposed TRC criteria.

**Exhibit A-20** summarizes these potential control costs associated with the proposed policy. The State Water Board also included continuous monitoring costs because only monthly grab samples are required by the facility's current permit.

**Exhibit A-20. Summary of Estimated Compliance Costs, Collins Pine ($2004){tc "Exhibit 4-3. Process Modification Cost Components " \f D }**

| Component | Total Capital Costs | O&M Costs |
|---|---|---|
| Dechlorination: | | |
| -Sulfur dioxide | $7,000 | $4,800 |
| -Feed System | $7,700 | $0 |
| -Piping/pumps[1] | $3,700 | $0 |
| -Contact basin | $4,800 | $0 |
| -Process controls | $2,000 | $15,700 |
| Continuous monitoring with back up system | $4,000 | $15,700 |
| Total | $29,200 | $36,200 |

Sources: AACE (2002); Airgas (2004); American-Marsh Pumps (2002); Aquatic Eco-Systems (2004); BLS (2002; 2003; 2004); Chemical Injection (2004); Chlorinators Inc (2004); Foxcroft (2004); GE Osmonics (2003); Global Treat Inc. (2004); Hach Company (2004); ITA (1999); JCI Jones Chemical (2004); Praxair (2004); RS Means (1998); Tencarva Machinery (2003).

1. The State Water Board assumed that 1-inch pipe and 10 gallon per minute booster pump would be necessary.

## Donner Summit PUD Wastewater Treatment Plant

### Facility Description

The Donner Summit WWTP (NPDES permit number CA0081621), located in Donner Summit, California, is owned and operated by Donner Summit Public Utility District. This minor discharger collects, treats and disposes of wastewater and sewerage from the Norden and Soda Springs areas, the Sugarbowl and Soda Springs Ski Resorts, and the Serene Lakes Subdivision. The facility discharges to the Yuba River from October to June and occasionally portions of July during winters with above-average snowfall. The remaining months the facility spray irrigates between 0.1 and 0.49 mgd of treated wastewater to the Soda Spring Ski Area. The facility proposes to extend the water reclamation efforts through the winter by using tertiary effluent for snowmaking.

### Treatment Processes

The facility's 2002 NPDES permit for the facility indicates that current treatment processes consist of equalization, conventional activated sludge utilizing two Walker-type package plants, three single media filters, chlorination, and dechlorination.

### Summary of Effluent Data and Limits

**Exhibit A-21** summarizes daily TRC effluent monitoring data for the facility's river discharge from the Central Valley Regional Water Board from January 2002 through May 2004.

**Exhibit A-21. TRC Effluent Data Summary, Donner Summit PUD WWTP[1]**

| Discharge | Number of Observations | | | | Summary of Detected Values (mg/L) | | | Current Limit (mg/L)[3] |
|---|---|---|---|---|---|---|---|---|
| | Total | Detect | Nondetect[2] | LDL (mg/L) | Maximum | Mean | Minimum | |
| River | 631 | 0 | 631 | 0.02 | - | - | - | 0.01 |

LDL = lowest detection level (of nondetects).
TRC = total residual chlorine.
1. Represents daily TRC data from the facility's river discharge from the Central Valley Regional Water Board from January 2002 to May 2004. Note, that TRC data for spray irrigation is not presented because this discharge is not to a surface water.
2. Zero values counted as nondetects.
3. Represents a weekly average limit. The facility also has a 1-hour maximum limit of 0.02 mg/L.

### Controls Needed

Exhibit A-21 indicates that the facility is most likely in compliance with its current permit limit. Also, the facility is already required to monitor TRC continuously. However, the facility may not currently have a back up monitoring system for when the continuous monitoring system is offline. Therefore, the facility would incur costs for a back up monitoring system of approximately $2,000 (costs based on Chemical Injection Technologies, 2004; Foxcroft, 2004; and Hach Company, 2004).

## City of Merced Wastewater Treatment Plant

### Facility Description

The City of Merced Wastewater Treatment Plant (NPDES permit number CA0079219) is located in Merced, California. The facility has a design capacity of 10 mgd and provides sewerage service to industry and the City's 62,000 residents. EPA classifies the facility as a major discharge. The facility discharges to Hartley Slough, just upstream of its confluence with Owens Creek. Owens Creek combines with natural and artificial channels tributary to the San Joaquin River.

### Treatment Processes

The 2000 NPDES permit for the City of Merced facility indicates that the current treatment processes consist of headworks, a septage receiving area, two primary clarifiers, two activated sludge aeration basins, two secondary clarifiers, chlorination, and dechlorination. Sludge is thickened, anaerobically digested and dried in six unlined drying beds. About 645 metric tons of nonhazardous sludge is applied to an industrial wastewater disposal site between crop plantings.

### Summary of Effluent Data and Limits

**Exhibit A-22** summarizes average monthly effluent monitoring data for TRC from EPA's PCS database from May 2001 to May 2004.

**Exhibit A-22. Effluent Data Summary, Merced WWTP[1]**

| Pollutant | Number of Observations | | | | Summary of Detected Values (mg/L) | | | Current Limit (mg/L)[3] |
|---|---|---|---|---|---|---|---|---|
| | Total | Detect | Nondetect[2] | LDL (mg/L) | Maximum | Mean | Minimum | |
| TRC | 70 | 43 | 27 | 0.01 | 1.6 | 0.026 | 0.006 | 0.1 |

LDL = lowest detection level (of nondetects).
TRC = total residual chlorine.
1. Represents average monthly TRC data from EPA's PCS database from May 2001 to May 2004.
2. Zero values counted as nondetects.
3. Represents the average monthly limit. The facility also has a maximum daily limit of 0.5 mg/L.

### Controls Needed

Exhibit A-22 indicates that the facility would most likely not be in compliance with its current permit limit. From May 2001 to May 2004, 1 of the facility's detected observations exceeded its current average monthly limit, and 6 of the detected observations exceeded the maximum daily limit, despite the fact that the facility currently dechlorinates prior to discharge. Therefore, the State Water Board assumed that the facility would need to optimize its dechlorination process for compliance with current effluent limits, including conducting a process analysis study, increasing their sulfur dioxide dose, and installing process controls. These costs would not be attributable to the proposed policy.

Once in compliance with current permit limits, only minor process optimization would likely be necessary for compliance with effluent limits based on the proposed TRC criteria. **Exhibit A-23** summarizes the potential control costs, which include the cost of increasing the sulfur dioxide dose. The State Water Board also included costs for a continuous monitoring system with back up because only daily grab samples are required by the facility's current permit.

**Exhibit A-23. Summary of Estimated Compliance Costs, Merced WWTP ($2004){tc "Exhibit 4-3. Process Modification Cost Components " \f D }**

| Component | Total Capital Costs | O&M Costs |
|---|---|---|
| Process Modifications:<br> -Increasing $SO_2$ Dose | $28,800 | $17,500 |
| Continuous monitoring with back up system | $4,000 | $15,700 |
| Total | $32,800 | $33,200 |

Sources: AACE (2002); Airgas (2004); BLS (2002; 2003; 2004); Chemical Injection (2004); Foxcroft (2004); Hach Company (2004); ITA (1999); JCI Jones Chemical (2004); Praxair (2004).

## Sacramento Regional Wastewater Treatment Plant

### Facility Description

The Sacramento Regional Wastewater Treatment Plant (NPDES permit number CA0077682) is located in Elk Grove, California, about 8 miles south of Sacramento. The facility has a design capacity of 181 mgd and treats wastewater from Sacramento, Citrus Heights, Folsom, and urbanized areas of the County of Sacramento. EPA classifies this facility as a major discharge. The facility also accepts storm runoff from the downtown Sacramento combined collection system during wet weather. The facility may discharge to the Sacramento River as long as the river-to-discharge ratio is 14:1 and the river flow is greater than 1300 cfs. Otherwise the effluent is stored in emergency storage basins. Prohibitive discharge conditions do not typically last more than one hour.

### Treatment Processes

The 2000 NPDES permit for the Sacramento facility indicates that the current treatment processes consist of mechanical bar screening, aerated grit removal, primary sedimentation, pure oxygen activated sludge aeration, secondary clarification, chlorination, dechlorination, and a diffuser for discharge. Solids are processed with dissolved air flotation thickeners, gravity thickeners, digesters, solid storage basins, and biosolids disposal.

### Summary of Effluent Data and Limits

**Exhibit A-24** summarizes maximum monthly effluent monitoring data for TRC from EPA's PCS database from May 2001 to May 2004.

**Exhibit A-24. Effluent Data Summary, Sacramento WWTP[1]**

| Pollutant | Number of Observations | | | | Summary of Detected Values (mg/L) | | | Current Limit (mg/L)[3] |
|---|---|---|---|---|---|---|---|---|
| | Total | Detect | Nondetect[2] | LDL (mg/L) | Maximum | Mean | Minimum | |
| TRC | 36 | 18 | 18 | 0.1 | 0.014 | 0.005 | 0.001 | 0.011 |

LDL = lowest detection level (of nondetects).
TRC = total residual chlorine.
1. Represents maximum monthly TRC data from EPA's PCS database from May 2001 to May 2004.
2. Zero values counted as nondetects.
3. Represents an average monthly limit. The facility also has an average daily limit of 0.018 mg/L.

### Controls Needed

Exhibit A-24 indicates that the facility may not be in compliance with potential permit limits based on the proposed TRC criteria for freshwater because the maximum detected value is greater than the 4-day average criteria. Therefore, the State Water Board estimated that the facility would have to optimize its dechlorination process for compliance with the proposed policy. The facility's current permit requires continuous TRC monitoring, and the facility also has redundant back up residual analyzers to minimize equipment failure and to ensure compliance while the main analyzer is offline for cleaning and calibration (Mulkerin, 2004).

**Exhibit A-25** summarizes the potential control costs, which include the cost of process analysis to determine the cause of the exceedances, and process modifications (e.g., adding a continuous chlorine residual analyzer to be used when discharging, and increasing the sulfur dioxide dose).

**Exhibit A-25. Summary of Estimated Compliance Costs, Sacramento WWTP ($2004){tc "Exhibit 4-3. Process Modification Cost Components " \f D }**

| Component | Total Capital Costs | O&M Costs |
|---|---|---|
| Process Analysis | $6,400 | $0 |
| Process Modifications:<br>-Increasing $SO_2$ Dose<br>-Residual Analyzer (process controls) | <br>$95,700<br>$2,000 | <br>$356,300<br>$15,700 |
| Total | $139,500 | $372,000 |

Sources: AACE (2002); Airgas (2004); BLS (2002; 2003; 2004); Chemical Injection (2004); Foxcroft (2004); Hach Company (2004); ITA (1999); JCI Jones Chemical (2004); Praxair (2004).
1. O&M costs reflect the assumption that maintenance labor costs would only be incurred when the facility is actually discharging (i.e., about 14 times per year).

## Coachella Wastewater Treatment Plant

### Facility Description

The Coachella Wastewater Treatment Plant (NPDES permit number CA0104493) is located in Coachella, California. This major discharger has a design capacity of 2.4 mgd and provides sewerage services to the City of Coachella. The facility discharges to Coachella Valley Storm Water Channel, which flows into the Salton Sea.

### Treatment Processes

The 2000 NPDES permit for the Coachella facility indicates that the current treatment processes consist of a holding tank, a primary comminutor, activated sludge, secondary clarifier, secondary aeration tank, chlorination, and dechlorination. Sludge is pumped from the secondary clarifier into the aeration section and then to the drying beds. The sludge is allowed to dry for one year. After drying, the sludge is disposed of at the facility by incorporating it into the on-site soil.

### Summary of Effluent Data and Limits

**Exhibit A-26** summarizes daily effluent monitoring data for TRC from the Colorado River Basin Regional Water Board from June 2001 through March 2004.

**Exhibit A-26. Effluent Data Summary, Coachella WWTP[1]**

| Pollutant | Number of Observations | | | | Summary of Detected Values (mg/L) | | | Current Limit (mg/L)[3] |
|---|---|---|---|---|---|---|---|---|
| | Total | Detect | Nondetect[2] | LDL (mg/L) | Maximum | Mean | Minimum | |
| TRC | 634 | 44 | 590 | Not specified | 0.01 | 0.003 | 0.001 | 0.01 |

LDL = lowest detection level (of nondetects).
TRC = total residual chlorine
1. Represents daily TRC data from the Colorado River Basin Regional Water Board from June 2001 to March 2004.
2. Zero values counted as nondetects.
3. Represents an average monthly limit. The facility also has a maximum daily limit of 0.02 mg/L.

### Controls Needed

Exhibit A-26 indicates that the facility would most likely be in compliance with potential permit limits based on the proposed TRC criteria for saltwater because all detected observations are below the 1-hour average criteria (0.013 mg/L). Also, no 4-day average of daily observation from June 2001 through March 2004 exceeds the 4-day average criterion of 0.0075 mg/L. The facility's current permit also requires continuous TRC monitoring. However, the facility may not currently have a back up monitoring system for times when the continuous monitoring system is offline. Therefore, the facility would most likely incur costs of a continuous monitoring back up system of $2,000 (costs based on Chemical Injection, 2004; Foxcroft, 2004; and Hach Company, 2004).

# Disneyland Resort

## Facility Description

The Disneyland Resort (NPDES permit number CA0106283) is located in Anaheim, California. The facility owns and operates two theme parks and three hotels: Disneyland Park and Disney's California Adventure Park, and Disneyland Hotel, Disney's Paradise Pier Hotel, and Disney's Grand California Hotel. The facility also manages Downtown Disney, a retail, dining, and entertainment district. The two parks consist of a number of attractions such as mechanical rides, amusement rides, amusement devices, live entertainment, refreshment stands, and other food services. Water systems are an integral part of a number of attractions. Excess water from the facility's attraction water systems, storm water, and washdown water from street washings are discharged to the Anaheim-Barber City (ABC) Channel, then to the Bolsa Chica Channel, a tributary to Anaheim Bay and Sunset Bay.

## Treatment Processes

The facility's 2003 NPDES permit indicates that it discharges from three categories of ornamental water systems, two of which contain wastewater that is permitted to be discharged to the ABC Channel. Category 2 water systems are clear water systems that may be treated with acids to maintain pH and chlorine. No hydraulic systems that may result in oil and grease or other pollutants discharged to the system are permitted. Category 3 water systems contain hydraulic features and attraction vehicles (e.g., Jungle Cruise, Splash Mountain), and are treated with chlorine, acids, or dyes.

## Summary of Effluent Data and Limits

**Exhibit A-27** summarizes effluent TRC monitoring data for discharge events from January 2000 to April 2003 provided by the Santa Ana Regional Water Board.

**Exhibit A-27. TRC Effluent Data Summary, Disneyland Resort[1]**

| Outfall | Number of Observations | | | | Summary of Detected Values (mg/L) | | | Current Limit (mg/L)[3] |
|---|---|---|---|---|---|---|---|---|
| | Total | Detect | Nondetect[2] | LDL (mg/L) | Maximum | Mean | Minimum | |
| 001 | 9 | 4 | 5 | Not specified | 0.08 | 0.045 | 0.020 | 0.1 |
| 002 | 8 | 6 | 2 | Not specified | 0.07 | 0.035 | 0.010 | 0.1 |
| 5E | 7 | 5 | 2 | Not specified | 0.08 | 0.066 | 0.040 | 0.1 |
| 34A | 1 | 0 | 1 | Not specified | - | - | - | 0.1 |

'-' indicates not applicable.
LDL = lowest detection level (of nondetects).
TRC = total residual chlorine.
1. Represents TRC data from the Santa Ana Regional Water Board from January 2000 to April 2003. Note, one detected observation for the "Gadget's Go Coaster" ride is not reported in the table because the outfall it discharges to is not specified in the permit.
2. Zero values counted as nondetects. Includes two observations reported as "below permit limit, actual value not reported."
3. Represents a maximum daily limit.

## Controls Needed

Exhibit A-27 indicates that the facility would not be in compliance with potential permit limits based on the proposed TRC criteria. The facility discharges chlorinated water from a number of different amusement rides and attractions. The low residual levels (e.g., less than 1 mg/L) indicate that the facility most likely dechlorinates prior to discharging.[5] Therefore, the State Water Board estimated that the facility would have to optimize its dechlorination process for compliance with the proposed policy. The State Water Board also assumed that the facility would need continuous monitoring with a back up system.

**Exhibit A-28** summarizes the potential control costs, which include the cost of process analysis to determine the cause of the exceedances, and process modifications (e.g., adding a continuous chlorine residual analyzer to be used when discharging, and increasing the sulfur dioxide dose).

**Exhibit A-28. Summary of Estimated Compliance Costs, Disneyland ($2004){tc "Exhibit 4-3. Process Modification Cost Components " \f D }**

| Component | Total Capital Costs | O&M Costs |
|---|---|---|
| Process Analysis | $6,400 | $0 |
| Process Modifications:<br>-Increasing $SO_2$ Dose<br>-Residual Analyzer (process controls) | <br>$5,900<br>$2,000 | <br>$500<br>$4,200 |
| Continuous monitoring with back up system[1] | $4,000 | $4,200 |
| Total | $18,300 | $8,900 |

Sources: AACE (2002); Airgas (2004); BLS (2002; 2003; 2004); Chemical Injection (2004); Foxcroft (2004); Hach Company (2004); ITA (1999); JCI Jones Chemical (2004); Praxair (2004).
1. O&M costs reflect the assumption that maintenance labor costs would only be incurred when the facility is actually discharging (i.e., about 14 times per year).

[5] Typical chlorine concentrations of pool-type water range from 1.0-1.5 mg/L (MSU PE, 1997).

# Riverside Regional Water Quality Control Plant

## Facility Description

The Riverside Regional Water Quality Control Plant (NPDES permit number CA0105350) is located in Riverside, California. This major discharger has a design capacity of 40 mgd and treats domestic and industrial wastewater from the City of Riverside, Edgemont Community Services District, Jurupa Community Services District, and Rubidoux Community Services District. The facility discharges to Reach 3 of the Santa Ana River.

## Treatment Processes

The 2001 NPDES permit for the Riverside facility indicates that the current treatment processes consist of bar screens and vortex grit removal, primary sedimentation, aeration basins, secondary activated sludge treatment, sedimentation basins, equalization basins, alum or polymer injection, dual media filtration, chlorination, dechlorination by sulfur dioxide, and nitrogen removal by constructed wetlands. Solids handling includes dissolved air flotation thickeners, anaerobic digesters, belt presses for dewatering, and sludge drying beds for air drying.

## Summary of Effluent Data and Limits

**Exhibit A-29** summarizes maximum monthly effluent monitoring data for TRC from EPA's PCS database from May 2001 to May 2004.

**Exhibit A-29. Effluent Data Summary, Riverside WQCP[1]**

| Pollutant | Number of Observations | | | | Summary of Detected Values (mg/L) | | | Current Limit (mg/L)[2] |
|---|---|---|---|---|---|---|---|---|
| | Total | Detect | Nondetect | LDL (mg/L) | Maximum | Mean | Minimum | |
| TRC | 35 | 18 | 17 | 0.01 | 2.03 | 0.69 | 0.10 | 0.1 |

LDL = lowest detection level (of nondetects).
TRC = total residual chlorine.
1. Represents maximum monthly TRC data from EPA's PCS database from May 2001 to May 2004.
2. Represents an instantaneous maximum limit.

## Controls Needed

Exhibit A-29 indicates that the facility is not in compliance with its current effluent limit. From May 2001 to May 2004 all of the facility's detected observations were greater than the current instantaneous maximum limit, despite the fact that the facility currently dechlorinates prior to discharge. Therefore, the State Water Board estimated that the facility would have to optimize its dechlorination process for compliance with current effluent limits, including conducting a process analysis study, increasing their sulfur dioxide dose, and installing process controls. These costs are not attributable to the proposed policy.

Once in compliance with current TRC limits, only minor process optimization would likely be necessary for compliance with potential permit limits based on the proposed TRC criteria. **Exhibit A-30** summarizes the potential control costs, which include cost of increasing sulfur dioxide dose to achieve the additional TRC reductions. The State Water Board did not include continuous monitoring costs because the facility is already required to continuously monitor for TRC. However, since the facility may not have a back up monitoring system for times when the continuous monitoring system is offline, back up monitoring costs may be incurred.

**Exhibit A-30. Summary of Estimated Compliance Costs, Riverside WQCP ($2004){tc "Exhibit 4-3. Process Modification Cost Components " \f D }**

| Component | Total Capital Costs | O&M Costs |
|---|---|---|
| Process Modifications:<br>-Increasing $SO_2$ Dose | $41,300 | $70,000 |
| Back up monitoring system | $2,000 | $0 |
| Total | $43,300 | $70,000 |

Sources: AACE (2002); Airgas (2004); Chemical Injection (2004); Foxcroft (2004); Hach Company (2004); JCI Jones Chemical (2004); Praxair (2004).

## Duke Energy South Bay, LLC

### Facility Description

The Duke Energy Plant (NPDES permit number CA0001368) is located in Chula Vista, California. The facility has a capacity to generate 709 MW of electricity from its 4 steam turbine electrical generating units and one gas turbine generator. Operation of the four steam turbine units involves a closed cycle in which steam is produced in the boilers, passed through the turbines to generate electricity, and then condensed to a liquid by the cooling water system before returning to the boilers. In addition to the generating units the industrial complex is composed of five exhaust stacks, three fuel oil storage tanks, separate seawater (cooling water) intake and discharge channels, an electrical switchyard, and various office buildings and warehouses. Classified by EPA as a major discharge, the facility can discharge up to 602.2 mgd of elevated temperature once-through cooling water and other waste discharges to the San Diego Bay, including traveling screen washwater, condenser pre-filter and ball recirculation system water, forebay cleaning washwater, manual cleaning of encrusting organisms from tunnels and condenser units, chlorination system wastewater, and circulating water pump station sump water.

### Treatment Processes

The facility's draft 2002 NPDES permit indicates that the current treatment processes consist of oil/solids separation and filtration for low volume wastes and coagulation, flocculation, chemical precipitation, neutralization, and filtration for metal cleaning wastes. The facility also uses chlorine to control scaling and slime growth. Sodium hypochlorite is injected into pipes immediately upstream of the circulating water pumps in the cooling water system.

### Summary of Effluent Data and Limits

**Exhibit A-31** summarizes maximum monthly effluent monitoring data for TRC from EPA's PCS database from March 2001 to March 2004.

**Exhibit A-31. Effluent Data Summary, Duke Energy[1]**

| Pollutant | Number of Observations | | | | Summary of Detected Values (mg/L) | | | Current Limit (mg/L) |
|---|---|---|---|---|---|---|---|---|
| | Total | Detect | Nondetect | LDL (mg/L) | Maximum | Mean | Minimum | |
| TRC | 27 | 26 | 1 | 0.040 | 0.070 | 0.050 | 0.040 | Varies |

LDL = lowest detection level (of nondetects).
TRC = total residual chlorine.
1. Represents maximum monthly TRC data from EPA's PCS database from March 2001 to March 2004.

The facility's residual chlorine limit is based on relating chlorine toxicity to the concentration of chlorine and time of exposure. The limit varies with the duration of uninterrupted chlorine discharge in minutes. Based on the linear regression-derived equation in the permit, a longer discharge time results in a more stringent effluent limit. Therefore, assuming that the facility discharges at its maximum duration of uninterrupted chlorine discharge, or 80 minutes (i.e. 20 minutes per condenser per cycle), the total chlorine residual effluent limit would be 0.085 mg/L.

## Controls Needed

Sodium hypochlorite is injected into the pipes immediately upstream of the circulating water pumps at each of the four units. Each injection point is individually controlled. **Exhibit A-32** summarizes the pump types and flows for each unit.

**Exhibit A-32. Circulating Water Pumps Summary**

| Unit | Pump Types | Flow (mgd) |
|---|---|---|
| 1 | 2 vertical centrifugal pumps | 112.3 |
| 2 | 2 vertical centrifugal pumps | 112.3 |
| 3 | 2 vertical submerged pumps | 179.4 |
| 4 | 2 vertical submerged pumps | 197.0 |

Liquid sodium hypochlorite is injected every four hours on a timed cycle each day. Each unit is chlorinated for approximately 20 minutes. The injections are staggered so that no two units are chlorinated at the same time. The maximum uninterrupted cycle time of chlorine injection is 80 minutes.

The State Water Board estimated that the facility would most likely dechlorinate the entire 601 mgd effluent at one time, but only during chlorination (i.e., every four hours for approximately 20 minutes per unit). This would also allow the facility to dechlorinate only when and where chlorine is injected. **Exhibit A-33** summarizes the potential control costs, which include the cost of dechlorination (e.g., direct and feed-forward chlorine and sulfur dioxide analyzers), dechlorination chemicals and feed systems, and a contact basin. The State Water Board also included costs for continuous monitoring with back up because the facility's current permit does not require continuous monitoring.

**Exhibit A-33. Summary of Estimated Compliance Costs, Duke Energy ($2004){tc "Exhibit 4-3. Process Modification Cost Components " \f D }**

| Component | Total Capital Costs | O&M Costs |
|---|---|---|
| Dechlorination System: | | |
| -Sulfur dioxide | $56,600 | $100,000 |
| -Feed System | $104,000 | $0 |
| -Piping/Pumps[2] | $13,400 | $0 |
| -Contact basin | $618,600 | $0 |
| -Process controls | $2,000 | $15,700 |
| Continuous Monitoring with back up system | $4,000 | $15,700 |
| Total | $798,500 | $131,400 |

Sources: AACE (2002); Airgas (2004); American-Marsh Pumps (2002); Aquatic Eco-Systems (2004); BLS (2002; 2003; 2004); Chemical Injection (2004); Chlorinators Inc (2004); Foxcroft (2004); GE Osmonics (2003); Global Treat Inc. (2004); Hach Company (2004); ITA (1999); JCI Jones Chemical (2004); Praxair (2004); RS Means (1998); Tencarva Machinery (2003).

1. Assumed that an 8-inch pipe and 750 gallon per minute booster pump would be necessary.

At current borrowing rates, the facility could finance this upgrade for an annualized capital cost of $69,600 over 20 years, and a total annual cost of $201,000 (i.e., annualized capital plus annual O&M). [6]

[6] The State Water Board used an interest rate of 6% to illustrate potential annualized compliance costs, which is near the high end of recent domestic commercial and industrial lending rates for moderate risk loans over 365 days. According to the Federal Reserve's Survey of Terms of Business Lending (Aug 2-6, 2004), the weighted average effective rate was 3.7% for such loans from large banks, and 6.47% from small banks. Actual rates obtained by facilities will vary based on credit history, among other factors, including timing of the loan.

## References


Federal Reserve. 2004. Survey of Terms of Business Lending. Online at http://www.federalreserve.gov/releases/e2/current/default.htm.

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Mulkerin, Mike. 2004. Sacramento Regional Wastewater Treatment Plant Operator. Personal communication, October 2004.

U.S. EPA. 2004. Permit Compliance System (PCS) Database. Online at http://www.epa.gov/enviro/html/pcs/adhoc.html.

# Appendix B. Policy Alternatives

This appendix provides an analysis of the economic considerations associated with various alternative implementation approaches to the proposed policy. A quantitative estimate of costs is presented whenever possible, however, in many cases only a qualitative discussion of economic impacts is appropriate given the availability of data.

**Exhibit B-1** summarizes alternatives the State Water Board considered.

**Exhibit B-1. Summary of Proposed Policy Approach and Alternatives**

| Issue | Proposed Approach | Alternatives |
|---|---|---|
| Water Quality Objectives | Adopt 1984 EPA criteria. | • No action.<br>• Derive new criteria by conducting toxicity studies.<br>• Statistical approach based on TRC concentration and exposure time.<br>• Use whole effluent toxicity in lieu of criteria. |
| Mixing Zones | Mixing zones may be allowed. | • Prohibit mixing zones. |
| Calculation of Limits | Express limits as 1-hour and 4-day average limits. | • No action.<br>• Santa Ana Regional Water Board criteria based on 99% compliance.<br>• Adopt TSD and/or SIP language. |
| Compliance Schedules | Five-year compliance schedules. | • No action.<br>• Two-year schedule, or two-year schedule with Regional Board discretion to allow up to a five-year schedule. |
| Interim Requirements | No action. | • Provide statewide interim requirements. |
| Monitoring and Reporting | Continuous monitoring with back up system for times when systems are offline. | • No action.<br>• Use grab sampling (e.g., once per hour) |
| Storm Water | No action. | • Require storm water discharges to comply with policy. |
| Nonpoint Sources | No action. | • Require nonpoint sources to comply with policy. |
| Site-Specific Objectives | May be developed. | • No action. |

TRC = total residual chlorine.
TSD = Technical Support Document
SIP = Policy for Implementation of Toxics Standards for Inland Surface Waters, Enclosed Bays, and Estuaries of California

Any alternative that requires no actions to be taken would not result in a change to current conditions, and thus, would have no economic impact. Also, alternatives regarding compliance schedules and interim requirements would likely only affect the timing of costs because they do not impact final effluent limits for a facility.

## B.1 Derive New Criteria

Under this alternative, the State Water Board would develop new criteria by conducting scientific acute and chronic toxicity studies on various aquatic species in California. Such studies would most likely take years to complete, and the results cannot be predicted. However, if criteria more stringent than the proposed criteria are developed, costs to dischargers are likely to increase.  Conversely, less stringent criteria would most likely result in lower or zero costs to dischargers.

## B.2 Statistical Calculation of Criteria

This approach calculates chlorine criteria based on the exposure times corresponding to the 1-hour and 4-day average concentrations based on the following equation from the California Ocean Plan:

$$C = \frac{1.070}{T^{0.740}}$$

Where,
$C$ = chlorine concentration in mg/L
$T$ = chlorine exposure time in minutes.

**Exhibit B-2** summarizes the criteria that would be calculated with the above equation.

**Exhibit B-2.  Potential Effluent Limits Using Statistical Approach and Proposed Criteria**

| Exposure Time | Statistical Approach (mg/L) | Proposed Criteria (mg/L) |
|---|---|---|
| 1 hour (60 minutes) | 0.052 | 0.019 |
| 4 days (5,760 minutes) | 0.0018 | 0.011 |

The 1-hour average criteria under this approach would be less stringent than EPA 1984 criteria. However, the 4-day average criteria would be much more stringent (about an order of magnitude lower) than EPA's 1984 criteria.

The State Water Board does not have data to indicate that facilities can consistently achieve a 4-day average concentration of less than 0.0018 mg/L.  According to data in EPA's PCS database, the only facility in California that achieves a 4-day average of 0.0018 mg/L is Sacramento Regional WWTP (about 98% of the time).  This facility is already dosing sulfur dioxide in a 4:1 ratio to chlorine residual and has a back up sodium bisulfite dechlorination system.  Therefore, it is unlikely that dechlorination or process optimization of dechlorination alone would result in attainment of the 4-day average criteria under this statistic approach.

Facilities would most likely need to switch to another type of disinfection (e.g., ozone or UV light), and eliminate the use of chlorine throughout the plant.  The cost of such controls is very site-specific, depending on factors such as current operating conditions and available space for new technologies.  However, these costs would most likely be much greater than costs associated with the proposed approach (i.e., adopting EPA's 1984 criteria).

## B.3 Whole Effluent Toxicity

This alternative involves the use of whole effluent toxicity (WET) tests in lieu of adopting EPA's 1984 criteria.  With the WET approach, aggregate toxic effects of chlorine in the effluent are tested on organisms.  Both acute and short-term chronic flow-through tests would be needed using surrogate fresh and marine test species, including fish, invertebrates, and plants. In doing so, these tests would measure toxic effects of effluent discharges. If flow-through WET testing is required, costs associated with this approach would most likely be more than costs associated with the proposed policy.

## B.4 Allow Mixing Zones

Under this alternative, the policy would prohibit mixing zones, and the discharger would have to comply with the criteria end-of-pipe. In its analysis of the proposed policy, the State Water Board estimated potential costs assuming that the facilities have to meet the proposed criteria end-of-pipe. Thus, costs associated with this alternative would be the same as the costs the State Water Board estimated for the proposed policy.

## B.5 Santa Ana Regional Water Board Approach

This alternative uses the Santa Ana Regional Water Quality Control Board (Regional Water Board) approach for determining compliance with TRC limits. The Regional Board's basin plan specifies that chlorine residual shall not exceed 0.1 mg/L. To determine compliance, the Regional Water Board uses the following conditions:

- The total time during which the total chlorine residual values are above 0.1 mg/L (instantaneous maximum value) shall not exceed 7 hours and 26 minutes in any calendar month (99% of the time)
- No individual excursion above 0.1 mg/L shall exceed 30 minutes
- No individual excursion shall exceed 2 mg/L.

NPDES dischargers in the Santa Ana Region are required to comply with a chlorine residual concentration requirement 99% of the time, while concurrently not exceeding specified maximum concentration and duration threshold values. The above conditions are intended to reflect that chlorine residual monitoring systems sometimes give inappropriately high values for short time periods.

Using this 99% compliance approach with EPA's 1984 criteria would allow dischargers to exceed the 1-hour average concentration 1% of the time as long as no single excursion lasts longer than 30 minutes. For most of the case study facilities the State Water Board evaluated, per minute TRC data are not available. However, the State Water Board estimated whether dischargers are likely to incur the same control costs under this 99% compliance approach as under the proposed approach (i.e., compliance 100% of the time).

Because the 99% compliance approach is less stringent than the proposed approach, the State Water Board assumed that any facility that would not incur costs under the proposed approach would also not incur costs when allowed to exceed the proposed criteria 1% of the time. Therefore, the State Water Board only evaluated those case study facilities that would incur costs under the proposed approach (Arcata, Forestville, Sunnyvale, Tillman, Honeywell, Merced, Collins Pine, Riverside, Disneyland, and Duke Energy).

**Arcata WWTP**

Available data indicate that this facility exceeded the proposed criteria five times in three years. Although there were no more than 7 hours and 26 minutes of exceedance in any given month, 2 of the 5 exceedances lasted longer than 30 minutes. Therefore, the facility would not be in compliance with the proposed criteria assuming 99% compliance, and would most likely still incur the cost of the additional sulfur dioxide feeder.

**Forestville County SD**

Available data indicate that this facility is not currently in compliance with current effluent limits for TRC. However, the current limit (0.1 mg/L) is less stringent than the proposed criteria (0.011 mg/L). Therefore, even once the facility is in compliance with its current limit, it is likely that additional minor process optimization would be necessary for 99% compliance with the proposed criteria because meeting such low TRC levels even only 99% of the time would require adequate process controls and a similar sulfur dioxide dose (e.g., 1 mg/L excess sulfur dioxide). Therefore, the costs for this facility would not likely change under this proposed alternative approach.

**Sunnyvale WWTP**

Available data indicate that this facility is not in compliance with current effluent limits for TRC. However, the current limit (nondetect with detection limit of 0.01 mg/L) is less stringent than the proposed criteria (0.0075 mg/L). Therefore, even once the facility is in compliance with its current limit, it is likely that additional minor process optimization would be necessary for 99% compliance with the proposed criteria because meeting such low TRC levels, even only 99% of the time, would require adequate process controls and a similar sulfur dioxide dose (e.g., 1 mg/L excess sulfur dioxide). Therefore, the costs for this facility would not likely change under this proposed alternative approach.

**Honeywell**

Available data indicate that this facility is not in compliance with current effluent limits for TRC. However, the current limit (0.1 mg/L) is less stringent than the proposed criteria (0.011 mg/L). Therefore, even once the facility is in compliance with its current limit, it is likely that process optimization would be necessary for 99% compliance with the proposed criteria because meeting such low TRC levels, even only 99% of the time, would require adequate process controls and a similar sulfur dioxide dose (e.g., 1 mg/L excess sulfur dioxide). Therefore, the costs for this facility would not likely change under this proposed alternative approach.

**Tillman WRP**

Available data indicate that this facility is not in compliance with current effluent limits for TRC. However, the current limit (0.1 mg/L) is less stringent than the proposed criteria (0.011 mg/L). Therefore, even once the facility is in compliance with its current limit, it is likely that additional minor process optimization would be necessary for 99% compliance with the proposed criteria because meeting such low TRC levels, even only 99% of the time, would require adequate process controls and a similar sulfur dioxide dose (e.g., 1 mg/L excess sulfur dioxide). Therefore, the costs for this facility would not likely change under this proposed alternative approach.

**Collins Pine**

Effluent data from this facility indicate that 97% of the detected observations exceed the 1-hour and 4-day average freshwater criteria for TRC (much more than the 1% allowed under the proposed alternative approach). Therefore, the facility would still need to install dechlorination for compliance with the proposed criteria 99% of the time, and costs for this facility would not likely change under for this alternative approach.

**Merced WWTP**

Available data indicate that this facility is not in compliance with current effluent limits for TRC. However, the current limit (0.1 mg/L) is less stringent than the proposed criteria (0.011 mg/L). Therefore, even once the facility is in compliance with its current limit, it is likely that additional minor process optimization would be necessary for 99% compliance with the proposed criteria because meeting such low TRC levels, even only 99% of the time, would require adequate process controls and a similar sulfur dioxide dose (e.g., 1 mg/L excess sulfur dioxide). Therefore, the costs for this facility would not likely change under this alternative approach.

**Disneyland Resort**

About 90% of the detected observations at this facility exceed the 1-hour and 4-day average TRC criteria. To ensure 99% compliance with the proposed criteria, the facility would need to optimize its dechlorination process. However, the process optimization measures applicable to 99% compliance (e.g., process controls, increasing sulfur dioxide dose) would not vary from the process optimization measures necessary for 100% compliance. Therefore, costs for this facility would not likely change under this alternative approach.

**Riverside Regional WWTP**

Available data indicate that this facility is not in compliance with current effluent limits for TRC. However, the current limit (0.1 mg/L) is less stringent than the proposed criteria (0.011 mg/L). Therefore, even once the facility is in compliance with its current limit, it is likely that additional minor process optimization would be necessary for 99% compliance with the proposed criteria because meeting such low TRC levels, even only 99% of the time, would require adequate process controls and a similar sulfur dioxide dose (e.g., 1 mg/L excess sulfur dioxide). Therefore, the costs for this facility would not likely change under this alternative approach.

**Duke Energy**

About 96% of this facility's TRC observations are above the 1-hour and 4-day average criteria. The facility does not currently dechlorinate its effluent. Therefore, to ensure 99% compliance with the proposed criteria, the facility would need to install dechlorination. However, the costs for dechlorination for 99% compliance would not vary from the dechlorination costs for 100% compliance, and the costs for this facility would not likely change under this alternative approach.

Given the results of the case study analyses of this alternative approach, the economic impacts of the proposed policy are not likely to differ substantially from a policy incorporating the 99% compliance approach.

## B.6 Adopt TSD/SIP Procedures

EPA's Technical Support Document (TSD) for Water Quality Based Toxics Control (1991) describes several methods for calculating effluent limits. These methods rely on mass balance equations to calculate the effluent quality required to meet water quality criteria. The Policy for Implementation of Toxics Standards for Inland Surface Waters, Enclosed Bays, and Estuaries of California (SIP) builds on the technical guidance in the TSD, and provides additional flexibility to dischargers.

The calculation of average monthly effluent limits (AMEL) and maximum daily effluent limits (MDEL) outlined in both the TSD and SIP take into account effluent variability using the coefficient of variation (CV), and the number of samples collected for a given time period. For TRC, high CVs result in AMELs much less than the proposed criteria, and low CVs result in AMELs that approach the proposed criteria. **Exhibit B-3** provides examples of AMELs and MDELs for various CVs. Note that the number of samples for calculation of the limits is based on the number of samples taken in one month as specified in the proposed policy, or 43,200 (1 sample per minute for 30 days). In other words, the AMEL and MDEL would replace 4-day and 1-hour average limits.

**Exhibit B-3. Four-Day and One-Hour Average Limits Using TSD/SIP Procedures**

| Coefficient of Variation | Average Monthly Limit (µg/L) | Maximum Daily Limit (µg/L) |
|---|---|---|
| 0.05 | 0.0104 | 0.0117 |
| 0.1 | 0.0098 | 0.0123 |
| 0.2 | 0.0088 | 0.0136 |
| 0.5 | 0.0064 | 0.0172 |
| 0.6 | 0.0058 | 0.0182 |
| 0.9 | 0.0043 | 0.0191 |
| 1.0 | 0.0039 | 0.0192 |
| 1.5 | 0.0028 | 0.0192 |
| 2.0 | 0.0023 | 0.0193 |
| 3.0 | 0.0016 | 0.0175 |
| 5.0 | 0.0012 | 0.0152 |
| 10 | 0.0009 | 0.0134 |
| 15 | 0.0009 | 0.0130 |
| 20 | 0.0009 | 0.0129 |

The average monthly limit under this approach would most likely always be less than the proposed 4-day average criteria. Therefore, facilities would at least have to implement the controls the State Water Board estimated in its analysis of the proposed policy for compliance with this alternative approach. At higher CVs, however, the average monthly limit is much more stringent than the proposed 4-day average criteria. For facilities with high CVs, the addition of dechlorination or the optimization of their existing dechlorination process may not be sufficient to ensure compliance. The CVs for facilities for which the State Water Board has daily effluent TRC data range from 0.9 to 16.4; values for continuous monitoring may differ but current CVs are not necessarily representative of CVs resulting from calculations on data values every minute). These facilities would most likely need to switch to another type of disinfection (e.g., ozone or UV light), and eliminate the use of chlorine throughout the plant.

The cost of switching to another disinfection method is highly site-specific, depending on factors such as current operating conditions and available space for new technologies. Depending on the permit limits ultimately calculated, the economic impacts associated with this alternative could exceed those associated with the proposed approach (i.e., applying EPA's 1984 criteria as the effluent limits).

## B.7 Grab Sampling

Grab sampling is currently required in many permits in California. Required sampling frequencies include daily, weekly, monthly, and quarterly. However, grab samples at these intervals would not be considered representative of the discharge under the proposed policy. To obtain representative data, grab samples would need to be increased to a level that would be protective of the receiving water (e.g., one sample per minute or per five minutes). Such frequencies would require intensive labor, especially since sampling would need to be conducted 24 hours per day, or during the time of discharge. This alternative would result in increased costs compared to the costs associated with continuous monitoring equipment and maintenance.

## B.8 Storm Water Discharges

Under this alternative, storm water permits would contain numeric effluent limits for TRC or CPO, and these dischargers would need to install continuous monitoring and a backup monitoring system for their outfalls. According to the State Water Board's database of active regulated dischargers, there are 71 discharges of municipal storm water classified as designated, nonhazardous, or inert storm water runoff. Assuming that each discharge represents only one outfall point, the costs associated with continuous monitoring and backup monitoring systems would include approximately $284,000 for capital equipment, and $632,000 for annual O&M. Data are not available for determining the extent of current compliance with the effluent limits, or whether any additional compliance costs would be incurred. Since discharges of water containing chlorine to municipal storm collection systems are not permitted except in emergencies, potential controls could be limited to illegal discharge detection and elimination. However, current permits may already require such controls (illicit discharge detection and elimination is one of the minimum measures required under Phase II of U.S. EPA's storm water program).

## B.9 Nonpoint Sources

This alternative approach would require nonpoint sources to comply with the implementation procedures associated with the proposed chlorine policy. However, nonpoint source discharges do not usually contain free chlorine. Although, agricultural runoff may contain chlorine-containing pesticides, the chlorine originating from these pesticides generally undergoes dechlorination anaerobically. Because anaerobic conditions are not conducive to the formation of TRC or CPO compounds, it is unlikely that measurable chlorine concentrations would be present in nonpoint source discharges. Thus, because the policy does not require numeric effluent limits and continuous monitoring for dischargers that do not use chlorine in their processes, including nonpoint sources under the policy's implementation procedures would most likely not result in any costs.

# Appendix C. Calculation of Potential Statewide Impacts

This appendix provides a summary of the data in PCS for major municipal and industrial facilities, and the results of the statewide analysis. The assumptions regarding the means of compliance and estimated costs are described in Section 5.3.

**Exhibit C-1. Calculation of Statewide Cost Impacts: Major Municipals**

| NPDES Number | Flow (mgd) | Data Basis | Effluent TRC (mg/L) | Effluent Limits (mg/L) | | Means of Compliance | Estimated Costs[1] | |
|---|---|---|---|---|---|---|---|---|
| | | | | Average | Maximum | | Capital | O&M |
| CA0004995 | 1.38 | Maximum | 0.011 | ADDMON | 0.1 | Process Optimization | $25,800 | $44,800 |
| CA0022721 | 1 | Maximum | 3.83 | DELMON | 0 | None | $4,000 | $15,700 |
| CA0022730 | 1.2 | Maximum | 0.11 | DELMON | 0 | None | $4,000 | $15,700 |
| CA0022748 | 1 | Maximum | 3.8 | DELMON | 0 | None | $4,000 | $15,700 |
| CA0022888 | 2.8 | Maximum | 0 | DELMON | 0 | None | $4,000 | $15,700 |
| CA0023060 | 1.3 | Maximum | 0 | DELMON | 0 | None | $4,000 | $15,700 |
| CA0023345 | 1.6 | Maximum | 0 | DELMON | 0 | None | $4,000 | $15,700 |
| CA0037532 | 3 | Maximum | 7.24 | DELMON | ADDMON | Process Optimization | $65,800 | $78,900 |
| CA0037541 | 13.6 | Maximum | 0 | DELMON | 0 | None | $4,000 | $15,700 |
| CA0037664 | 150 | Maximum | -0.72 | DELMON | 0 | None | $4,000 | $15,700 |
| CA0037699 | 12.5 | Maximum | 0 | DELMON | 0 | None | $4,000 | $15,700 |
| CA0037702 | 79.6 | Maximum | 0.02 | DELMON | 0 | None | $4,000 | $15,700 |
| CA0037753 | 0.98 | Maximum | 0 | DELMON | 0 | None | $4,000 | $15,700 |
| CA0037788 | 5.5 | Maximum | >2 | DELMON | 0 | None | $4,000 | $15,700 |
| CA0037796 | 4.06 | Average | 0 | ADDMON | ADDMON | None | $4,000 | $15,700 |
| CA0037800 | 3 | Maximum | 0.32 | DELMON | 0 | None | $4,000 | $15,700 |
| CA0037810 | 5.2 | Maximum | 0.75 | 0 | 0 | None | $4,000 | $15,700 |
| CA0037834 | 38 | Maximum | 0 | DELMON | 0 | None | $4,000 | $15,700 |
| CA0037851 | 2.92 | Maximum | 0 | ADDMON | ADDMON | None | $4,000 | $15,700 |
| CA0037869 | 97.1 | Maximum | 0.0012 | DELMON | 0 | None | $4,000 | $15,700 |
| CA0037958 | 6.55 | Maximum | 0.93 | DELMON | 0 | None | $4,000 | $15,700 |
| CA0038008 | 6.25 | Maximum | 8.64 | ADDMON | ADDMON | Process Optimization | $65,800 | $146,400 |
| CA0038024 | 17.5 | Maximum | 1.99 | ADDMON | ADDMON | Process Optimization | $65,800 | $131,400 |
| CA0038067 | 1.8 | Maximum | 0 | DELMON | 0 | None | $4,000 | $15,700 |
| CA0038130 | 13 | Average | 0 | ADDMON | ADDMON | None | $4,000 | $15,700 |
| CA0038318 | 2.2 | Maximum | 8.55 | DELMON | 0 | None | $4,000 | $15,700 |
| CA0038539 | 28.5 | Maximum | 0.21 | DELMON | 0 | None | $4,000 | $15,700 |
| CA0048127 | 5 | Maximum | 0.53 | DELMON | 0.1 | Minor Process Optimization | $57,400 | $25,700 |
| CA0049224 | 5.2 | Maximum | 0.89 | DELMON | 2 | Process Optimization | $65,800 | $50,200 |
| CA0053619 | 15 | Maximum | 2.28 | ADDMON | ADDMON | Process Optimization | $52,500 | $125,200 |
| CA0053651 | 15.05 | Average | 0.1 | DELMON | 0.1 | Process Optimization | $52,500 | $62,700 |
| CA0053716 | 15 | Maximum | 0.44 | ADDMON | 0.1 | Minor Process Optimization | $44,100 | $47,000 |
| CA0053856 | 30 | Maximum | 0.0077 | 0 | 0.1 | None | $4,000 | $15,700 |
| CA0053911 | 100 | Maximum | 3.38 | ADDMON | ADDMON | Process Optimization | $186,000 | $865,200 |
| CA0053953 | 20 | Maximum | 0.33 | DELMON | 0.1 | Minor Process Optimization | $44,100 | $58,200 |

### Exhibit C-1. Calculation of Statewide Cost Impacts: Major Municipals

| NPDES Number | Flow (mgd) | Data Basis | Effluent TRC (mg/L) | Effluent Limits (mg/L) | | Means of Compliance | Estimated Costs[1] | |
|---|---|---|---|---|---|---|---|---|
| | | | | Average | Maximum | | Capital | O&M |
| CA0054011 | 37.5 | Maximum | 1.31 | ADDMON | 0.1 | Minor Process Optimization | $44,100 | $94,500 |
| CA0054097 | 32 | Maximum | 0.22 | ADDMON | ADDMON | Process Optimization | $52,500 | $105,200 |
| CA0054224 | 2.55 | Maximum | 0.1 | 0 | 0 | None | $4,000 | $15,700 |
| CA0055221 | 12.5 | Maximum | 0.1 | DELMON | 0.1 | Process Optimization | $39,100 | $57,700 |
| CA0055531 | 9 | Maximum | 6.46 | 0.2 | 0.5 | Minor Process Optimization | $30,700 | $35,700 |
| CA0056014 | 16.1 | Maximum | 0 | ADDMON | 0.1 | None | $4,000 | $15,700 |
| CA0056294 | 10.8 | Maximum | 0.1 | DELMON | 0.1 | Process Optimization | $39,100 | $53,900 |
| CA0077691 | 6.9 | Maximum | 0.13 | 0.01 | 0.02 | None | $4,000 | $15,700 |
| CA0077704 | 2 | Average | 0 | 0.01 | 0.02 | None | $4,000 | $15,700 |
| CA0077712 | 1.67 | Maximum | 1.1 | ADDMON | 0.02 | Minor Process Optimization | $17,400 | $32,400 |
| CA0077836 | 1.8 | Average | 0.005 | 0.01 | 0.02 | None | $4,000 | $15,700 |
| CA0077950 | 7.8 | Average | 0 | 0.01 | 0.02 | None | $4,000 | $15,700 |
| CA0078034 | 1.12 | Maximum | 0.43 | 0.01 | 0.02 | None | $4,000 | $15,700 |
| CA0078662 | 2.5 | Average | 0 | 0.01 | 0.02 | None | $4,000 | $15,700 |
| CA0078671 | 3 | Average | 0.02 | 0.01 | 0.02 | None | $4,000 | $15,700 |
| CA0078891 | 2.5 | Average | 0 | 0.01 | 0.02 | None | $4,000 | $15,700 |
| CA0078948 | 20 | Average | 0.01 | 0.01 | 0.02 | None | $4,000 | $15,700 |
| CA0078956 | 2.3 | Average | 0.01 | 0.01 | 0.02 | None | $4,000 | $15,700 |
| CA0078981 | 2.5 | Maximum | 0.1 | ADDMON | 0.1 | Process Optimization | $25,800 | $36,400 |
| CA0079049 | 7.5 | Maximum | 0 | 0.01 | 0.02 | None | $4,000 | $15,700 |
| CA0079081 | 9 | Maximum | 0.97 | DELMON | 0.1 | Minor Process Optimization | $57,400 | $34,500 |
| CA0079103 | 70 | Maximum | 0.24 | ADDMON | 0.02 | Minor Process Optimization | $44,100 | $152,000 |
| CA0079111 | 130 | Maximum | 0 | DELMON | 0.02 | None | $4,000 | $15,700 |
| CA0079138 | 55 | Average | 0 | 4.6 | 0.02 | None | $4,000 | $15,700 |
| CA0079154 | 9 | Maximum | 0.019 | 0 | 0.1 | None | $4,000 | $15,700 |
| CA0079189 | 20 | Maximum | 8.75 | ADDMON | ADDMON | Process Optimization | $92,500 | $402,700 |
| CA0079197 | 6 | Maximum | 0.52 | ADDMON | ADDMON | Process Optimization | $65,800 | $48,900 |
| CA0079235 | 6.5 | Maximum | 0.75 | 0 | 0.1 | None | $4,000 | $15,700 |
| CA0079243 | 8.5 | Average | 0 | 0.01 | 0.019 | None | $4,000 | $15,700 |
| CA0079502 | 18 | Maximum | 0.0071 | 0.01 | 0.02 | None | $4,000 | $15,700 |
| CA0079731 | 8.8 | Average | 0.1 | 0.01 | 0.02 | None | $4,000 | $15,700 |
| CA0079898 | 2.78 | Maximum | 0 | 0.01 | 0.02 | None | $4,000 | $15,700 |
| CA0081759 | 1 | Maximum | 0 | DELMON | 0.02 | None | $4,000 | $15,700 |
| CA0082589 | 4 | Average | 0 | 0.01 | 0.02 | None | $4,000 | $15,700 |
| CA0102695 | 1.2 | Maximum | 0.097 | ADDMON | ADDMON | Process Optimization | $25,800 | $44,300 |
| CA0102822 | 9.5 | Maximum | 0.0091 | 0.011 | 0.019 | None | $4,000 | $15,700 |
| CA0104477 | 5.2 | Average | 0 | 0.01 | 0.02 | None | $4,000 | $15,700 |
| CA0105015 | 1.7 | Maximum | 0.02 | 0.01 | 0.02 | None | $4,000 | $15,700 |
| CA0105279 | 51 | Maximum | 3.72 | DELMON | 0.1 | Minor Process Optimization | $57,400 | $122,000 |

### Exhibit C-1. Calculation of Statewide Cost Impacts: Major Municipals

| NPDES Number | Flow (mgd) | Data Basis | Effluent TRC (mg/L) | Effluent Limits (mg/L) | | Means of Compliance | Estimated Costs[1] | |
|---|---|---|---|---|---|---|---|---|
| | | | | Average | Maximum | | Capital | O&M |
| CA0105295 | 12.7 | Maximum | 0.32 | DELMON | 0.1 | Minor Process Optimization | $30,700 | $42,000 |
| CA0105619 | 4.5 | Maximum | 0.1 | DELMON | 0.1 | Process Optimization | $25,800 | $41,400 |
| CA0107611 | 26.5 | Maximum | 0.40 | 0.5 | 16 | Process Optimization | $52,500 | $102,700 |
| CA0109347 | 3.6 | Maximum | 240 | 162 | 650 | Minor Process Optimization | $244,400 | $1,133,200 |
| CA0110116 | 2 | Maximum | 0.17 | DELMON | 0 | None | $4,000 | $15,700 |
| CA0110299 | 5 | Maximum | 0.0056 | 0 | 0.1 | None | $4,000 | $15,700 |
| CA8000027 | 8 | Maximum | 0.01 | 0.01 | 0.1 | None | $4,000 | $15,700 |
| CA8000073 | 10.2 | Maximum | 0.38 | DELMON | 0.1 | Minor Process Optimization | $44,100 | $37,000 |
| CA8000326 | 15 | Maximum | 0.078 | DELMON | 0.1 | Process Optimization | $52,500 | $62,700 |
| CA8000402 | 15 | Maximum | 0.05 | 4.5 | 0.1 | Process Optimization | $39,100 | $61,400 |
| CA0022977 | 0.66 | NA | NA | 1.5 | DELMON | Minor Process Optimization | $17,400 | $31,900 |
| CA0024449 | 5.24 | NA | NA | DELMON | 0 | None | $4,000 | $15,700 |
| CA0037613 | 11 | NA | NA | DELMON | 0 | None | $4,000 | $15,700 |
| CA0038091 | 3 | NA | NA | DELMON | 0 | None | $4,000 | $15,700 |
| CA0038369 | 29 | NA | NA | DELMON | 0 | None | $4,000 | $15,700 |
| CA0038547 | 16.5 | NA | NA | DELMON | 0 | None | $4,000 | $15,700 |
| CA0038628 | 10 | NA | NA | DELMON | 0 | None | $4,000 | $15,700 |
| CA0038768 | 2.5 | NA | NA | DELMON | 0 | None | $4,000 | $15,700 |
| CA0053597 | 6.75 | NA | NA | DELMON | 0.1 | Minor Process Optimization | $44,100 | $29,500 |
| CA0053961 | 3 | NA | NA | DELMON | 0.1 | Minor Process Optimization | $30,700 | $22,000 |
| CA0054119 | 25 | NA | NA | ADDMON | 0.1 | Minor Process Optimization | $30,700 | $68,200 |
| CA0054216 | 21.6 | NA | NA | ADDMON | 0.1 | Minor Process Optimization | $44,100 | $60,700 |
| CA0054313 | 6.5 | NA | NA | ADDMON | 0.1 | Minor Process Optimization | $17,400 | $29,500 |
| CA0079171 | 7.5 | NA | NA | 0.01 | 0.02 | None | $4,000 | $15,700 |
| CA0079260 | 7 | NA | NA | 0.01 | 0.02 | None | $4,000 | $15,700 |
| CA0079511 | 1.3 | NA | NA | 0.01 | 0.02 | None | $4,000 | $15,700 |
| CA0079651 | 1.5 | NA | NA | 0.01 | 0.02 | None | $4,000 | $15,700 |
| CA0081230 | 2.83 | NA | NA | DELMON | 0.1 | Minor Process Optimization | $30,700 | $22,000 |
| CA0081485 | 1.47 | NA | NA | DELMON | 1 | Minor Process Optimization | $17,400 | $20,700 |
| CA0081558 | 6.95 | NA | NA | 0.01 | 0.02 | None | $4,000 | $15,700 |
| CA0082660 | 1.8 | NA | NA | 0.011 | 0.019 | Minor Process Optimization | $21,800 | $33,300 |
| CA0084239 | 1.65 | NA | NA | ADDMON | 0.1 | Minor Process Optimization | $21,800 | $33,300 |
| CA0104426 | 8 | NA | NA | 0.01 | 0.02 | None | $4,000 | $15,700 |

### Exhibit C-1. Calculation of Statewide Cost Impacts: Major Municipals

| NPDES Number | Flow (mgd) | Data Basis | Effluent TRC (mg/L) | Effluent Limits (mg/L) | | Means of Compliance | Estimated Costs[1] | |
|---|---|---|---|---|---|---|---|---|
| | | | | Average | Maximum | | Capital | O&M |
| CA0104973 | 4.4 | NA | NA | 0.01 | DELMON | None | $4,000 | $15,700 |
| CA0107492 | 2 | NA | NA | 0.002 | 0.008 | None | $4,000 | $15,700 |

Source: EPA's PCS Database, accessed November 18, 2004.
NA = not available
DELMON = delete monitoring
ADDMON = add monitoring
mgd = million gallons per day
mg/L = milligrams per liter
1. Costs include continuous monitoring and back up system for every facility.

### Exhibit C-2. Calculation of Statewide Cost Impacts: Major Industrials

| NPDES Number | SIC Code | Flow (mgd) | Data Basis | Effluent TRC (mg/L) | Effluent Limits (mg/L) | | Means of Compliance | Estimated Costs[1] | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | Average | Maximum | | Capital | O&M |
| CA0001139 | 4911 | 1275 | Maximum | 0.13 | 0.2 | 0.5 | Dechlorination | $2,031,400 | $2,770,200 |
| CA0004111 | 3761 | 35.8 | Maximum | 0.0033 | 0.01 | 0.02 | None | $4,000 | $15,700 |
| CA0005053 | 2911 | 2.4 | Maximum | 0.94 | DELMON | 0 | None | $4,000 | $15,700 |
| CA0005240 | 2062 | 40 | Maximum | 0 | DELMON | 0 | None | $4,000 | $15,700 |
| CA0028070 | 4581 | 1.7 | Maximum | 2.13 | DELMON | 0 | None | $4,000 | $15,700 |
| CA0047856 | 9223 | 1.2 | Maximum | 16.79 | DELMON | 2 | Minor Process Optimization | $17,400 | $22,000 |
| CA0047953 | 4939 | 4.9 | Maximum | 0.069 | DELMON | 0 | None | $4,000 | $15,700 |
| CA0052949 | 2999 | 4.32 | Maximum | 0.13 | DELMON | 0.1 | Minor Process Optimization | $17,400 | $24,500 |
| CA0107336 | 7999 | 3.75 | Maximum | 0.05 | 0.21 | 0.42 | Process Optimization | $25,800 | $38,900 |
| CA0000353 | 4911 | 1014 | NA | NA | 0.2 | 0.5 | Dechlorination | $1,678,000 | $2,347,700 |
| CA0000361 | 4911 | 170 | NA | NA | 0.2 | 0.377 | Dechlorination | $347,600 | $420,200 |
| CA0000680 | 1311 | 7.57 | NA | NA | DELMON | 0.1 | Dechlorination | $79,600 | $47,700 |
| CA0003778 | 2911 | 2.88 | NA | NA | DELMON | 0.1 | Dechlorination | $55,800 | $37,700 |
| CA0004863 | 4911 | 1000 | NA | NA | 0.01 | 0.02 | None | $4,000 | $15,700 |
| CA0004880 | 4911 | 1000 | NA | NA | DELMON | 0 | None | $4,000 | $15,700 |
| CA0004961 | 2911 | 3.1 | NA | NA | DELMON | 0 | None | $4,000 | $15,700 |
| CA0055387 | 2911 | 1.43 | NA | NA | DELMON | 0.1 | Dechlorination | $51,400 | $46,700 |
| CA0077895 | 8221 | 2.7 | NA | NA | 0.01 | 0.02 | None | $4,000 | $15,700 |
| CA0104965 | 4911 | 4.3 | NA | NA | 0.01 | 0.02 | None | $4,000 | $15,700 |

Source: EPA's PCS Database, accessed November 18, 2004.
NA = not available
DELMON = delete monitoring
mgd = million gallons per day
mg/L = milligrams per liter
1. Costs include continuous monitoring and back up system for every facility.