SECTION VIII. ECONOMIC CONSIDERATIONS

EXECUTIVE SUMMARY

On August 5, 1997, the U.S. EPA proposed water quality criteria for priority toxic pollutants for California inland surface waters and enclosed bays and estuaries. The criteria established by this action, known as the California Toxics Rule (CTR), together with the beneficial uses that are designated in California's ten basin plans, will constitute water quality standards for inland surface waters and enclosed bays and estuaries. These legally enforceable standards will then be implemented by RWQCBs through WDRs, including NPDES permits, or other relevant regulatory approaches.

The SWRCB is considering adoption of a proposed Policy to provide statewide consistency in how the CTR is implemented by the nine RWQCBs. To inform the public about the potential costs that may be associated with this Policy, the SWRCB performed an analysis of the potential impact on dischargers in California. The analysis involved identifying the reasonable means of compliance that dischargers may have to take to meet requirements. This section presents the results of the economic analysis. A technical appendix provides more detailed information on the analysis and results, particularly for the 27 sample facilities used in the analysis. Because the CTR will be implemented using the existing practices of the RWQCBs if the SWRCB does not adopt the proposed Policy, the analysis focuses on the incremental difference in costs between CTR implementation under existing practices and implementation under the Policy.

~~The results reflect the potential impacts of the SWRCB's Interim Draft Policy (which differs somewhat from the proposed Policy discussed in the rest of this FEDnd are summarized in Table VIII–1. Implementation of the CTR under the Interim Draft Policy is estimated to cost potentially affected dischargers statewide $77 million annually. The estimate is $7 million less than the estimated baseline cost of $84 million for implementing the CTR using the existing practices of the RWQCBs. These cost estimates include the costs that indirect dischargers (i.e., industrial facilities discharging to the sewer system) are expected to incur as a result of requirements placed on them by POTWs affected by the CTR~~

The SWRCB estimates that implementing the CTR under the proposed Policy is expected to cost less than implementing the CTR under existing practices (Table VIII-1). The potential cost savings are $32 million annually and would accrue primarily to direct dischargers. The SWRCB estimated that those sample facilities needing to control disinfection byproducts (DBPs) (specifically chloroform, chlorodibromomethane, and dichlorobromomethane) would use process optimization to meet projected effluent limits. However, the SWRCB recognizes the possibility that some facilities may need to use other pollution control measures for DBPs. In a very worst case scenario, assuming that other treatment alternatives [specifically, ultraviolet light (UV) disinfection or anhydrous ammonia addition] would be needed at all facilities requiring control for DBPs, the incremental cost of the proposed Policy could range from -$33 million to -$20 million annually (i.e., still a cost savings over implementation of the CTR under existing practices).

In addition, to address uncertainty regarding the representativeness of the sample facilities for publicly owned treatment works (POTWs), the SWRCB evaluated an additional mid-sized POTW that discharges to a bay and receives dilution credit in its existing permit. The SWRCB estimated that compliance costs for this facility would be within the range of those for other mid-sized POTWs. Therefore, the SWRCB believes that statewide costs would also be comparable with the addition of this facility to the sample and that the current sample provides reasonable estimates of the potential impacts of the proposed Policy.

Table VIII–1. Projected Annual Compliance Costs (Millions of 1998 $/yr)[1]

Scenario	Direct Dischargers	Indirect Dischargers	Total
CTR Under Existing Practices	$74	$10	$84
CTR Under ~~Interim Draft~~ Proposed Policy	$42~~67~~	$10	$52~~77~~
Difference (Cost attributable to the proposed Policy)	($32)	$0	($32)

[1]Estimated costs assuming use of process optimization by facilities needing to reduce DBP levels. The estimated cost attributable to the proposed Policy may range from -$33 annually if ammonia addition is needed instead at facilities using chlorination to -$20 million annually if UV disinfection is required at these facilities.

~~Subsequent to completion of its analysis, the SWRCB made several changes to the Interim Draft Policy. As a result, the estimates presented for the Interim Draft Policy scenario in this section and the technical appendix may not be directly applicable to the proposed Policy. Nonetheless, implications regarding the potential costs and means of compliance can be drawn from the results as presented.~~

~~The current proposed Policy is most similar to Alternative 4 of the SWRCB's analysis. The SWRCB estimates that implementation of the CTR under Alternative 4 will cost $72 million annually to potentially affected dischargers statewide, which is $12 million less than the estimated baseline cost. However, some aspects of the proposed Policy are not reflected in the analysis of Alternative 4. The SWRCB estimates that these changes will result in lower costs for Alternative 4 than those described above.~~

Readers should note that, in conjunction with proposing the CTR, the U.S. EPA performed an economic analysis to assess the costs and benefits of implementing the CTR. Although the SWRCB's economic analysis of proposed Policy uses some of the same data and methodology as U.S. EPA's analysis, there are many differences in assumptions, methodology, and data. Therefore, the results of these two analyses cannot be directly compared.

INTRODUCTION

On August 5, 1997, U.S. EPA proposed the California Toxics Rule, a regulatory action that establishes water quality criteria for priority toxic pollutants for California inland surface waters and enclosed bays and estuaries. The CTR criteria, together with the beneficial uses that are designated in California's 10 basin plans, will constitute water quality standards for these waters. These legally enforceable standards must be implemented by the RWQCBs through NPDES permits.

The SWRCB is considering adoption of the proposed Policy to provide a consistent statewide approach to implementing the CTR criteria. In the absence of such a policy, the RWQCBs will implement the CTR criteria using existing basin plans, applicable State and federal regulations, U.S. EPA guidance for regulating toxic pollutants, and existing RWQCB practices. The proposed Policy establishes statewide implementation provisions for the water quality criteria contained in the CTR, as well as existing NTR criteria and RWQCB basin plan objectives not superseded by the CTR. The proposed Policy also establishes provisions for gathering data regarding congeners of chlorinated dibenzodioxins (2,3,7,8–TCDDs) and chlorinated dibenzofurans (2,3,7,8–CDFs) and statewide narrative chronic toxicity requirements.

Because the proposed Policy is closely tied to the CTR, it focuses on NPDES permitting procedures. NPDES permitting procedures require the incorporation of effluent limitations into permits when there is a reasonable potential for a discharge to cause an exceedance of a water quality criterion/objective. The proposed Policy does not affect existing SWRCB policy or RWQCB policies with regard to site-specific objectives (SSOs), watershed management, total maximum daily loads (TMDLs), or special studies. Although some existing SSOs may be replaced by CTR criteria, the SWRCB assumed for this analysis that all SSOs are replaced by CTR criteria because decisions regarding which SSOs will remain in place had not been made at the time the economic analysis was completed. Exceptions, such as categorical exemptions for legally-mandated activities to protect drinking water and other resources, are typically allowed by RWQCBs so these provisions are not expected to impose additional costs on dischargers.

This analysis is intended to inform the public about the potential costs that may be associated with SWRCB adoption of the proposed Policy. The CTR-based water quality standards would be implemented using the existing RWQCB practices, basin plan provisions, and federal and State regulations and guidance if the SWRCB did not adopt the proposed Policy. Thus, the SWRCB's analysis focuses on the incremental costs of implementation of the CTR under the Policy relative to this baseline. ~~Note, however, that the results reflect the potential impacts of the SWRCB's Interim Draft Policy, which differs somewhat from the proposed Policy discussed in the rest of this document.~~

The ~~Interim Draft~~ proposed Policy is based primarily on U.S. EPA's Technical Support Document for Water Quality-based Toxics Control (U.S. EPA, 1991). The SWRCB also ~~identified eight~~ evaluated nine alternatives to ~~provisions of~~ the ~~Interim Draft~~ proposed Policy (Table VIII-2). ~~In its analysis, the SWRCB evaluated the potential costs associated with these alternatives. The alternatives are divided into four groups, as shown in Table VIII–2.~~These results are described in an attachment to this chapter.

~~Table VIII–2. Policy Alternatives Evaluated~~

~~Issue~~	~~Interim Draft Policy~~	~~Alternatives~~
~~Translating Criteria for Metals from Dissolved to Total~~	~~Choice of site-specific translators or U.S. EPA conversion factors as translators~~[1]	~~Alt 1: U.S. EPA conversion factors as translators~~ ~~Alt 2: 1:1 translator~~
~~Calculating Ambient Background Concentrations~~	~~99^{th} percentile at 99% confidence level~~	~~Alt 3: 95^{th} percentile at 95% confidence level~~ ~~Alt 4: Maximum~~ ~~Alt 5: Geometric mean~~
~~Calculating Occurrence~~	~~99^{th} percentile for calculating long term averages and maximum daily~~	~~Alt 6: 95^{th} percentile for calculating long term averages, maximum daily limits,~~

~~Probability~~	~~limits, 95th for average monthly limits~~	~~and average monthly limits~~
~~Dilution Credits~~	~~Dilution given for those pollutants that got credit in existing permits~~	~~Alt 7: No dilution~~ ~~Alt 8: Maximum dilution based on flows~~

~~[1] Most facilities are expected to perform site-specific translator studies. Since only one sample facility had completed a site-specific study, the SWRCB used theoretical partitioning coefficients as an estimate for site-specific translators.~~

Table VIII–2. Policy Alternatives Evaluated

	Issue			
Alternative	Translating Criteria for Metals from Dissolved to Total	Calculating Ambient Background Concentrations	Calculating Occurrence Probability	Dilution Credits
Interim Draft Policy	Choice of site-specific translators or U.S. EPA conversion factors as translators[1]	99th percentile at 99% confidence level	99th percentile for calculating long term averages and maximum daily limits, 95th for average monthly limits	Dilution given for those pollutants that got credit in existing permits
Alt. 1	U.S. EPA conversion factors as translators	"	"	"
Alt. 2	1:1 translator	"	"	"
Alt. 3	Choice of site-specific translators or U.S. EPA conversion factors as translators[1]	95th percentile at 95% confidence level	"	"
Alt. 4	"	Maximum	"	"
Alt. 5	"	Geometric mean	"	"
Alt. 6	"	99th percentile at 99% confidence level	95th percentile for calculating long term averages, maximum daily limits, and average monthly limits	"
Alt. 7	"	"	99th percentile for calculating long term averages and maximum daily limits, 95th for average monthly limits	No dilution
Alt. 8	"	"	"	Maximum dilution based on flows

[1]Most facilities are expected to perform site-specific translator studies. Since only one sample facility had completed a site-specific study, the SWRCB used theoretical partitioning coefficients as an estimate for site-specific translators.

~~Intake credits may be given where pollutants of concern are not added to a wastestream but are present in the intake water and discharged at levels that would require an effluent limit. Compliance schedules may be used when studies, TMDL development, or engineering design and installation are required before facilities could comply with effluent limits established to meet CTR criteria.~~

A number of provisions in the ~~Interim Draft~~ proposed Policy are not new State policy. RWQCBs now have the authority to prohibit discharges, deny dilution credits, and specify more stringent effluent limitations when necessary. The ~~Interim Draft~~ proposed Policy would not change any of these authorities, and therefore, does not impose any new costs associated with these provisions. In addition, the ~~Interim Draft~~ proposed Policy does not change existing SWRCB or RWQCB practices with regard to nonpoint sources, storm water, or urban runoff, so there are also no new costs associated with these provisions.

The chronic toxicity provisions of the ~~Interim Draft~~ proposed Policy are very similar to existing RWQCB practices and current U.S. EPA guidance for POTWs and industrial dischargers, so these provisions are not expected to result in significant new costs. Therefore, the SWRCB is providing case studies illustrating costs of toxicity monitoring, TIE/TREs, and compliance actions.

Intake credits may be given where pollutants of concern are not added to a wastestream but are present in the intake water and discharged at levels that would require an effluent limit.[1] Compliance schedules may be used when immediate compliance is infeasible and studies (e.g., associated with the implementation of pollution prevention programs), TMDL development, or engineering design and installation are required before facilities could comply with effluent limits established to meet CTR criteria.

~~In conjunction with proposing the CTR, the U.S. EPA performed an economic analysis to assess the costs and benefits of implementing the CTR. Although the SWRCB's economic analysis of its Interim Draft Policy uses some of the same data and methodology as U.S. EPA's analysis, there are many differences between the assumptions, methodology, calculations, and data used for the two analyses. Therefore, the results of these two analyses cannot be directly compared. Similarities and differences between the analyses are discussed later in this section~~.

~~Subsequent to completion of its analysis, the SWRCB made several changes to the Interim Draft Policy. As a result, the estimates presented for the Interim Draft Policy scenario in this section and the technical appendix may not be directly applicable to the final proposal. Nonetheless, implications regarding the potential costs and means of compliance can be drawn from the results as presented.~~

[1] A case study was presented in the October 28, 1997 Draft Addendum to the Supplement to the September 11, 1997 Draft FED. That case study is no longer applicable, as the proposed Policy provisions for determining intake water credits (e.g., the methods for calculating ambient background and intake water concentrations) have been revised. However, the case study did indicate that some dischargers could benefit from intake water credits.

~~One area of change is the calculation of ambient background concentrations. Under the proposed Policy, the concentration will be based on the maximum value instead of the 99th percentile at the 99% confidence level for determining reasonable potential, as well as for calculating effluent limitations. This provision is similar to the SWRCB's Alternative 4. (For data sets with all values below detection limits, the value selected is the lowest of the individual reported detection levels.) For limits based on criteria which are intended to protect human health from carcinogenic effects, the concentration will be based on an average value instead of the maximum. Alternative 4 did not reflect the change for limits based on these human health criteria. This change may result in lower ambient background concentrations for human health criteria, resulting in less stringent effluent limits for facilities receiving dilution. Thus, the costs of the final proposed Policy may be lower than those shown for Alternative 4.~~

~~The SWRCB has also revised the method for determining reasonable potential by eliminating one of the criteria. A pollutant will no longer have reasonable potential if its maximum effluent concentration is greater than the ambient background concentrations (see discusion in FED Section V, Chapter 5.3). Therefore, fewer pollutants will have reasonable potential and thus effluent limits than in Alternative 4 of this analysis. This will result in lower costs for many facilities with data for ambient background concentration. The SWRCB estimates that these cost reductions will not be significant because many facilities may not have ambient data. In addition, the analysis indicates that the facilities with data do not require installation of pollution controls for the affected pollutants. However, since facilities monitor for all pollutants with reasonable potential, monitoring costs will be reduced.~~

~~The SWRCB has also dropped the calculation of mass limits from the final proposed Policy. However, this change did not affect the analysis because it is based on pollutant concentrations. Other areas of change include the calculation of mixing zones and intake credits. The changes to the mixing zone Policy provisions would affect only Alternative 8. The SWRCB does not believe that the changes to the mixing zone calculations would alter the results because there was little data for estimation of Scenario 8. The proposed Policy does not require the use of intake water credits and, therefore, imposes no costs on dischargers.~~

The remainder of this section has two chapters. Chapter 1 ~~outlines~~ summarizes the methodology used to develop estimates of potential costs. Chapter 2 ~~presents~~summarizes the estimated costs of the proposed Policy~~results of the analysis~~. Attachment A to this chapter provides more detailed description of the methodology and the estimated costs of the policy alternatives. Attachment B provides a comparison of the number of pollutants assumed to have reasonable potential to exceed projected effluent limits under the proposed Policy given different methods for determining reasonable potential. [Note that this table replaces Attachment 1 from the previous version of the FED and reflects the current proposed Policy methodology (e.g., reasonable potential is not longer triggered based on the maximum effluent concentration being greater than or equal to the ambient background concentration)]. Attachment C provides case studies of the toxicity control provisions of the proposed Policy. A technical appendix to this chapter provides the supporting facility-specific analyses.

CHAPTER 1. SUMMARY OF METHODOLOGY FOR ESTIMATING COSTS

The SWRCB estimated the potential costs associated with the proposed Policy as the difference between potential costs of implementing the CTR under the existing practices of the RWQCBs (the baseline) and implementing the CTR under the Policy. To do this, the SWRCB followed the general steps of:

- Determining reasonable potential for pollutants to exceed water quality criteria in waters receiving facility effluents
- Calculating projected effluent limits anticipated under the reasonable potential step
- Estimating compliance strategies and associated costs of achieving projected effluent limits
- Estimating other potential costs, such as monitoring
- Extrapolating total potential facility-level costs to all California dischargers.

The SWRCB followed these steps for the baseline and the proposed Policy for a sample of dischargers as described in Chapter VIII of the December 10, 1999 FED. This detail is also found in Attachment A to this chapter, with the methodology for the proposed Policy being similar to the methodology for the Interim Draft Policy and Alternatives except for differences in specific policy provisions. These differences are:[2]

- No reasonable potential is assumed for pollutants not detected in any effluent sample if all detection levels are greater or equal to the most stringent water quality criterion. The SWRCB assumed only that interim monitoring would be required and used the same assumptions to estimate monitoring costs as for pollutants with reasonable potential.
- Reasonable potential is not assumed if the maximum effluent concentration is greater than the ambient background concentration for a particular pollutant.
- In determining reasonable potential, the ambient background concentration is the maximum detected ambient background concentration or the lowest reported detection level (if all observations are reported below detection level).
- In calculating permit limits, the ambient background concentration is the arithmetic mean if the pollutant is a carcinogen and the permit limit is based on a human health criterion;[3] in all

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[2] Note, however, that the SWRCB did not have sufficient information to consider intake water credits allowed under the proposed Policy. The SWRCB also did not use the parameters indicated in Table 3 of the proposed Policy but used the dilution credits that are included in the facility's permit. The SWRCB believes that final decisions regarding dilution credits pertain to the RWQCBs and that most likely dilution credits will be the same as the Regional Boards are currently allowing in existing permits. Finally in determining compliance, the SWRCB compared the average monthly limits with the individual effluent concentrations, although more than one concentration may be reported per month. This assumption differs from the proposed Policy in that the arithmetic mean or median would be used for compliance with the average monthly limit if more than one observation is available per month.

[3] The SWRCB used the reported detection levels for nondetected values to calculate the arithmetic mean. If the arithmetic mean is greater than the maximum detected value, the SWRCB used the maximum detected value as the ambient background concentration.

other cases, it is the maximum detected concentration or the lowest reported detection level (if all observations are below detection level).

The SWRCB also changed its estimate of monitoring costs for 2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD) to $1200 per sample (from $950 per sample), and estimated the cost of acid extractibles and base/neutral extractibles monitoring as a single cost of $300 (instead of $300 each class). The SWRCB estimates that these changes better resemble the capabilities and analytical costs of California laboratories. These assumptions have been incorporated in both the baseline and proposed Policy scenarios.

COMPARISON WITH U.S. EPA'S ANALYSIS

In conducting an economic analysis of its Interim Draft Policy, the SWRCB sought to build on U.S. EPA's economic analysis of the CTR. However, U.S. EPA had to make a number of assumptions regarding how the State might implement the CTR to perform its analysis (and noted that the actual costs would be affected by the State's Policy). The proposed Policy established a number of different implementation procedures than those assumed by U.S. EPA (e.g., the reporting levels provision). In addition, although the SWRCB used the same set of sample facilities and much of the same data to evaluate potential impacts, it also collected additional data and information that make it inappropriate to directly compare the results of these two analyses.

For example, some of the assumptions for determining reasonable potential differ between the two analyses. U.S. EPA used projected effluent quality (PEQ) to determine reasonable potential for a low scenario. PEQ accounts for effluent variability and is therefore greater than the maximum effluent concentration the SWRCB used in its analysis. In some cases (e.g., no dilution given and no ambient background data exist), this likely results in more pollutants with reasonable potential. Also, U.S. EPA treated ambient background concentrations reported below detection level as zero in this scenario, so if all values are below detection the concentration would be zero.

In comparison, the SWRCB uses the lowest of the reported detection levels as the maximum ambient background concentration if all values are below detection level. Otherwise, the SWRCB uses the maximum detected value. The SWRCB uses the same convention for treating effluent concentrations below detection in determining reasonable potential. Both U.S. EPA and the SWRCB did not assign reasonable potential when all effluent concentrations are below detection level. If the maximum ambient background concentration is greater than the most stringent water quality criterion, the pollutant has reasonable potential under the SWRCB's analysis, while the pollutant may not have reasonable potential under U.S. EPA's analysis. In addition, U.S. EPA's convention of using a 1:1 metals translator likely results in more pollutants with reasonable potential than the SWRCB's use of theoretical partitioning coefficients based on total suspended solids (TSS) concentration.

For calculating effluent limitations, assumptions are generally the same except for when dilution is allowed. When dilution is allowed, the SWRCB's method for calculating ambient background concentration may result in more or less stringent limits than U.S. EPA's method. First, the SWRCB's assumptions to treat ambient background observations reported below detection level are the same as for reasonable potential and may result in more stringent limits than U.S. EPA's.

Second, when calculating a permit limit for a carcinogenic pollutant for which the most stringent criterion is based on human health, the SWRCB calculated the ambient background concentration to be the arithmetic mean of the ambient background observations whereas U.S. EPA used the maximum observed concentration. This could result in less stringent limits under the SWRCB's analysis.

A few assumptions result in higher costs under the SWRCB's analysis:

- The SWRCB assumed that facilities would implement PMPs and conduct influent monitoring when projected effluent limits are below minimum levels (reporting levels provision).
- The SWRCB did not assume facilities would pursue regulatory relief while U.S. EPA did for its low scenario.
- U.S. EPA assumed no change in monitoring costs attributable to the CTR.

In addition, the SWRCB collected additional effluent data and ambient background concentration data for some sample facilities. Both U.S. EPA and the SWRCB used facility-specific assumptions (e.g., flow, dilution, existing limits) based on information in existing NPDES permits. However, the SWRCB performed its analysis after U.S. EPA's analysis and a few facilities had been issued new permits, so some facility-specific assumptions differ.

CHAPTER 2. SUMMARY OF COSTS OF THE PROPOSED POLICY

The first step in evaluating the potential compliance cost of the proposed Policy involved determining whether the pollutants regulated under the CTR would require water quality based effluent limitations. The SWRCB calculated effluent limits for all pollutants with reasonable potential. Table VIII-3 provides a summary of how reasonable potential would differ under three different methodologies [existing RWQCB practices (the baseline), proposed Policy, and Great Lakes Initiative (GLI)].

Table VIII-3. Number of Pollutants with Reasonable Potential and Permit Limits at Sample Facilities

Facility	Reasonable Potential Method		
	Baseline	Proposed Policy*	GLI
City of Arcata Wastewater Treatment Plant (WWTP)	17	1	26
City of Colton Municipal WWTP	0	9	28
Coachella Sanitary District WWTP No. 1	55	0	48
E.I. DuPont de Nemours and Company (Antioch)	3	5	1
Exxon Refinery (Benecia)	18	10	15
City of Merced Wastewater Treatment Facility	0	5	5
Riverside Regional Water Quality Control Plant	7	7	47
Sacramento Regional WWTP	4	41	22
San Jose-Santa Clara Water Pollution Control Plant	5	11	8
Sunnyvale Water Pollution Control Plant	3	1	1
City of Los Angeles Tillman Water Reclamation Plant	17	12	14
Unocal (Carson)	13	2	2
City of San Juan Bautista WWTP	34	2	12
City of Biggs	0	0	1
City of Calistoga	12	3	7
Collins Pine (Chester)	1	0	2
Donner Summit PUD WWTP	56	4	45
Forestville County Sanitation District	7	6	6
Great Lakes Chemical Corporation	3	0	0
Navy Public Works Center (San Diego)	0	2	3
Pacific Gas & Electric, Hunters Point (Outfall 001)	8	1	3
Pacific Gas & Electric, Hunters Point (Outfall 002)	8	0	5
Boeing North American (Santa Susana)	7	1	3
San Diego Gas & Electric (South Bay Power Plant)	0	0	2
Airline Signal Aerospace (Torrance)	0	0	0
CA Dept of Fish and Game, Iron Gate Salmon Hatchery	0	0	0
Lennox County Park	0	0	0
Sierra Pacific Industries (Quincy Division)	0	0	0
Total	278	123	306

*Permit (effluent) limitations are based on effluent data for sample facilities. RWQCBs may use other information to determine if a water quality-based effluent is required to protect beneficial uses. In addition, if a pollutant is not detected in any of the effluent monitoring samples and all of the detection levels are greater than or equal to the criterion value, the RWQCB can establish monitoring requirements in place of an effluent limitation.

Then, as part of estimating the potential cost of the proposed Policy, the SWRCB determined the reasonable means for the sample facilities to comply with the CTR-based effluent limits under existing practices (the baseline) and under the Policy. Table VIII-4 provides a comparison of the number of facilities that the SWRCB estimates would require the different control strategies under each scenario.

Table VIII–4. Projected Means of Compliance at Sample Facilities[1]

Means of Compliance	Number of Facilities	
	Baseline	Proposed Policy
No Action	14	12
Process Optimization	6	7
Pollutant Minimization	9	15
Treatment[2]	4	1

[1]Facilities may require a combination of process optimization, pollutant minimization, and treatment.
[2]Baseline scenario includes two facilities implementing chemical precipitation and filtration, one facility implementing reverse osmosis, and one facility implementing chemical precipitation. Proposed Policy scenario includes one facility implementing chemical precipitation and filtration.

The estimated cost of the proposed Policy is then the difference in statewide extrapolated costs associated with the two compliance scenarios shown in Table VIII-5. The SWRCB estimates that implementing the CTR under the proposed Policy is expected to cost less than implementing the CTR under existing practices. The potential cost savings are $32 million annually and would accrue primarily to direct dischargers.

The SWRCB estimated that those sample facilities needing to control disinfection byproducts (DBPs) (specifically chloroform, chlorodibromomethane, and dichlorobromomethane) would use process optimization to meet projected effluent limits. However, the SWRCB recognizes the possibility that some facilities may need to use other pollution control measures for DBPs [specifically, ultraviolet light (UV) disinfection or anhydrous ammonia addition]. If these other treatment alternatives are needed, the incremental cost of the proposed Policy may decrease by $1 million or increase by $12 million annually, resulting in an estimated cost range of -$33 million to -$20 million annually (i.e., -$32 million - $1 million = -$33 million; -$32 million + $12 million = -$20 million). This change still represents a cost savings under either alternative and is based on the sensitivity analysis presented in Attachment A. In that analysis the SWRCB found that costs attributable to the proposed Policy would increase by approximately $12 million annually through the use of UV light disinfection (from -$7.6 million to $4.6 million, see table A-15). The SWRCB also found that costs associated with the proposed Policy would decrease by approximately $1 million annually if anhydrous ammonia addition is used instead (from -$7.6 million to -$8.4 million, see table A-15). (However, since some facilities in California are already migrating to UV light disinfection, savings may be understated.)

In addition, to address uncertainty regarding the representativeness of the sample facilities for publicly owned treatment works (POTWs), the SWRCB evaluated an additional mid-sized POTW that discharges to a bay and receives dilution credit in its existing permit. POTWs discharging to bays that have dilution in their current permits represent a large portion of POTWs. The SWRCB estimated that compliance costs for this facility would be within the range of those for other mid-sized POTWs. Therefore, the SWRCB believes that statewide costs would also be comparable with the addition of this facility and that project statewide annual compliance costs presented in this FED are reasonable estimates of the potential impacts of the proposed Policy.

Table VIII–5. Projected Annual Compliance Costs (Millions of 1998 $/yr)[1]

Scenario	Direct Dischargers	Indirect Dischargers	Total
CTR Under Existing Practices	$74	$10	$84
CTR Under Proposed Policy	$42	$10	$52
Difference (Cost Attributable to the Proposed Policy)	($32)	$0	($32)

[1]Estimated costs assuming use of process optimization by facilities needing to reduce DBP levels. The estimated cost attributable to the proposed Policy may range from -$33 annually if ammonia addition is needed instead at facilities using chlorination to -$20 million annually if UV disinfection is required at these facilities.

Tables VIII-6 and VIII-7 provide a breakdown of the estimated costs by means of compliance and facility category.

Table VIII–6. Projected Annual Compliance Costs for Direct Dischargers by Control Option (Millions of 1998 $/yr)

Scenario	CTR Under Existing Practices	CTR Under Proposed Policy	Difference (cost attributable to the proposed Policy)
Treatment Capital Cost	$13.0	$3.4	($9.6)
Treatment O&M	$44.2	$12.9	($31.3)
Pollutant Minimization	$10.5	$14.5	$4.0
Process Optimization	$4.4	$9.1	$4.7
Monitoring	$1.8	$2.1	$0.3
Total	$73.9	$42.0	($32.0)

[1]Does not include costs to indirect dischargers (estimated to be $10.1 million per year).

Table VIII–7. Projected Annual Compliance Costs by Facility Category (Millions of 1998 $/yr)

Scenario	CTR Under Existing Practices	CTR Under Proposed Policy	Difference (cost attributable to the proposed Policy)
POTW Majors	$24.4	$16.9	($7.5)
POTW Minors	$21.0	$3.0	($18.0)
Chemicals/Petroleum Products	$13.1	$13.8	$0.7

Electric Utilities	$9.2	$0.2	($9.0)
Metals/Transportation Equipment	$0.2	$0.0[1]	($0.2)
Miscellaneous Majors	$5.8	$3.6	($2.2)
Lumber/Paper[1]	$0.0	$0.0	$0.0
Industrial Minors	$0.2	$4.5	$4.3
Total (direct dischargers)	$73.9	$42.0	($31.9)
Total (indirect dischargers)	$10.1	$10.1	$0.0
Total Annual Costs	$84.0	$52.1	($31.9)

[1]Annual costs for these categories are considerably lower than others and are rounded to zero.

In addition to the compliance costs associated with the implementation of CTR under the proposed Policy, dischargers will incur interim monitoring costs for TCDD equivalents. The proposed Policy requirements for major dischargers are effluent monitoring twice per year for three years. Minors dischargers are required to monitor their effluent twice per year for one year. The SWRCB estimates that these requirements will cost major dischargers each $7,200 and minor dischargers $2,400 each.

ATTACHMENT A

ALTERNATIVES ANALYSIS

~~CHAPTER 1~~ATTACHMENT A-1. METHODOLOGY AND EVALUATION OF POLICY ALTERNATIVES ~~FOR ESTIMATING POTENTIAL COMPLIANCE COSTS~~

The methodology employed to estimate potential costs attributable to implementation of the proposed Policy involves developing detailed cost estimates for a selected subset (sample) of facilities and then extrapolating those costs to the total of potentially ~~regulated~~affected facilities in the State. The ~~total~~number of potentially ~~regulated~~affected facilities includes 184 major and 1,057 minor point source dischargers. The SWRCB evaluated each sample facility for its ability to comply with effluent limitations that would be required to meet CTR criteria in receiving waters. For those facilities that the SWRCB determined would require controls to comply with the CTR-based effluent limitations, the SWRCB estimated the control actions and the associated costs needed to obtain compliance.

In addition to the baseline scenario, t~~T~~he SWRCB performed this analysis for~~for two scenarios: 1) implementation of the CTR using existing practices of the RWQCBs, referred to as the Baseline scenario[4] and 2) implementation of the CTR using procedures specified in the~~ an Interim Draft Policy (referred to as the Interim Draft Policy scenario)~~.~~[5] ~~In addition, the SWRCB analyzed the Interim Draft Policy scenario using the~~ and eight variations to this Interim Draft Policy~~implementation alternatives listed in Table VIII-2~~. These variations ~~alternatives~~ cover four components of the Interim Draft Policy including translation of CTR aquatic life metals criteria from dissolved to total, calculation of ambient background concentrations, calculation of occurrence probability, and granting of dilution credits.

To estimate the Baseline scenario, the SWRCB surveyed the RWQCBs to determine their existing practices for implementing water quality criteria for toxics and combined these practices with the CTR criteria to derive effluent limits for this scenario. In addition, following estimation of the CTR-based effluent limits using existing practices, the SWRCB contacted the RWQCBs again to verify the results.

The SWRCB estimated the Interim Draft Policy scenario using the CTR criteria and the implementation procedures that make up the Interim Draft Policy. Then, the SWRCB subtracted costs associated with the Interim Draft Policy scenario from those associated with the baseline to determine the incremental impact. This incremental impact represents the estimated cost of SWRCB adoption of the Interim Draft Policy. The SWRCB performed the same procedure for the Interim Draft Policy alternatives.

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[4] The Baseline scenario uses current RWQCB practices for determining reasonable potential and deriving effluent limits.

[5] The Interim Draft Policy scenario uses Interim Draft Policy provisions for determining reasonable potential and deriving effluent limits. The most significant differences between the proposed Policy and the Interim Draft Policy evaluated in the economic analysis are (1) Reasonable potential: the Interim Draft Policy required effluent limitations when the MEC > B; the proposed Policy does not require effluent limitations in this situation. (2) The Interim Draft Policy used the 99th percentile of data at the 99% confidence level to establish ambient background concentrations for the purpose of deriving effluent limitations and determining which pollutants would get water quality based effluent limitations. The proposed Policy uses either the maximum observed or arithmetic mean to derive ambient background concentrations. Also see discussion on page VIII-4.

ATTACHMENT~~CHAPTER~~ A-1.1. SAMPLE FACILITY SELECTION

There are approximately184 major and 1,057 minor facilities that discharge to California's enclosed bays, estuaries, and inland surface waters. Of the 184 major facilities, 128 are publicly owned treatment works (POTWs), and 56 are industrial facilities. The SWRCB used a sample of 27 of these facilities—16 majors and 11 minors—in its economic analysis of the Interim Draft Policy. These are the same facilities used by U.S. EPA in its evaluation of the potential economic impacts associated with the CTR.

For the CTR analysis, U.S. EPA selected the 27 facilities in a three-step process. In the first step, U.S. EPA selected five major POTWs, located in metropolitan areas where toxic pollutant concentrations in surface waters were a public concern. In the second step, U.S. EPA selected four major and one minor industrial facilities, in standard industrial classification categories of metal mining, petroleum refining, inorganic chemicals, and electric services, to complement the five major POTWs. In step three, U.S. EPA initially selected an additional ten facilities to supplement the sample. However, later, in response to comments, U.S. EPA selected nine more minor facilities to supplement the sample. U.S. EPA also slightly modified the sample to eliminate two of the original facilities that were closed and to replace another facility that had ceased operation. The SWRCB used U.S. EPA's final set of 27 sample facilities ~~was used for the SWRCB's analysis of the Interim Draft Policy~~. The final list of sample facilities is shown in Table A–1~~VIII–3~~.

Table A–1~~VIII–3~~. List of Sample Facilities

Facility	RWQCB	Major/ Minor	Type of Facility
CA Dept of Fish and Game, Iron Gate Salmon Hatchery	North Coast	Minor	Industrial
City of Arcata Wastewater Treatment Plant (WWTP)	North Coast	Major	POTW
Forestville County Sanitation District	North Coast	Minor	POTW
City of Calistoga	San Francisco Bay	Minor	POTW
Exxon Refinery (Benecia)	San Francisco Bay	Major	Petroleum products
E.I. DuPont de Nemours and Company (Antioch)	San Francisco Bay	Major	Chemicals
Pacific Gas & Electric, Hunters Point	San Francisco Bay	Major	Electric utility
San Jose-Santa Clara Water Pollution Control Plant	San Francisco Bay	Major	POTW
Sunnyvale Water Pollution Control Plant	San Francisco Bay	Major	POTW
City of San Juan Bautista WWTP	Central Coast	Minor	POTW
Airline Signal Aerospace (Torrance)	Los Angeles	Minor	Industrial
Boeing North American (Santa Susana)	Los Angeles	Major	Transportation equipment/metals
City of Los Angeles Tillman Water Reclamation Plant	Los Angeles	Major	POTW
Lennox County Park	Los Angeles	Minor	Industrial
Unocal (Carson)	Los Angeles	Major	Petroleum products
City of Biggs	Central Valley	Minor	POTW

City of Merced Wastewater Treatment Facility	Central Valley	Major	POTW
Collins Pine (Chester)	Central Valley	Major	Lumber/Paper
Donner Summit PUD WWTP	Central Valley	Minor	POTW
Sacramento Regional WWTP	Central Valley	Major	POTW
Sierra Pacific Industries (Quincy Division)	Central Valley	Minor	Industrial
Coachella Sanitary District WWTP No. 1	Colorado River	Major	POTW
Riverside Regional Water Quality Control Plant	Santa Ana	Major	POTW
City of Colton Municipal WWTP	Santa Ana	Major	POTW
Great Lakes Chemical Corporation	Santa Ana	Minor	Industrial
San Diego Gas & Electric (South Bay Power Plant)	San Diego	Major	Electric utility
Navy Public Works Center (San Diego)	San Diego	Minor	Industrial

For each sample facility, the SWRCB compiled discharge monitoring data for the most recently available three-year period from U.S. EPA's Permit Compliance System (PCS), discharge monitoring reports, and the RWQCBs. The SWRCB also compiled receiving water monitoring data for the most recently available three-year period from the RWQCBs and the San Francisco Estuary Institute Regional Monitoring Program. After the initial data collection effort, if only limited data were available for a sample facility, the SWRCB contacted the appropriate RWQCB several more times to request additional effluent and background data. In some cases, there was no more information available or the RWQCB was not able to provide the available information. Some facilities that would be subject to the proposed Policy are likely to have only a small amount of data (e.g., facilities that have not experienced past compliance problems), so the SWRCB staff deemed it representative to retain some facilities with limited data in the sample.

The U.S. EPA compared the total flow contribution of the sample facilities to the total flows for all dischargers that would be affected by the CTR. This analysis indicated that the sample facilities over-represent higher flow facilities. U.S. EPA believes that, in general, costs for these facilities are likely to be higher than for the population of all affected dischargers. Costs are likely to be higher for these dischargers because capital and operation and maintenance (O&M) cost estimates for treatment are derived from unit cost curves based on the amount of flow. Thus, when costs from the sample facilities are used to estimate costs for all the dischargers in the State, the total costs may also be overestimated. The costs of other potential compliance options (e.g., pollutant minimization programs, monitoring) are largely independent of the amount of flow. The over-representation of higher flow facilities in the sample set may also affect the analysis, however the SWRCB does not expect the impact to be large since treatment is not the primary option that would be needed for compliance.

ATTACHMENT~~CHAPTER~~ A-1.2. DETERMINATION OF POLLUTANTS REQUIRING WATER QUALITY-BASED EFFLUENT LIMITATIONS

The first step in evaluating the potential compliance costs associated with the different scenarios involved determining whether the pollutants regulated under the CTR would require water quality based effluent limitations. The SWRCB used existing RWQCB practices for determining reasonable potential in the Baseline scenario and practices specified in the Interim Draft Policy for all other scenarios.

I. BASELINE SCENARIO

Reasonable potential is currently established in a number of ways by RWQCBs. The SWRCB used the definitions given by each RWQCB for each sample facility in its survey of existing practices to determine whether effluent limits would likely be required for any given pollutant for the economic baseline. Each RWQCB's practices for determining reasonable potential for the sample facilities are summarized in Table A–2~~VIII–4~~. Seemingly conflicting practices within a Region exist because of different characteristics of receiving waters and type of facilities or different approaches taken by individual permit writers. The SWRCB used the practices that applied to each sample facility in determining the projected number of effluent limits likely to be required for that facility, as presented in the technical appendix for this economic analysis.

A. Effluent Concentrations

Assessing reasonable potential often involves a determination of a maximum effluent concentration (MEC), which is the maximum of the observed effluent concentrations of a pollutant. If all values of a pollutant are not detected, the value the RWQCBs used for the maximum effluent concentration varied. For example, in one case, if the pollutant was expected to be in the effluent, the method detection level was used and if it was not expected in the effluent, zero was used. In another case, the method detection level was always used.

As shown in Table A–2~~VIII–4~~, reasonable potential may also involve calculation of projected effluent quality (PEQ). To implement this procedure, the SWRCB calculated the PEQ according to procedures in U.S. EPA (1991). This approach multiplies the MEC by a multiplier (from a published table) that accounts for effluent variability and the number of observations for that pollutant. In general, the higher the variability of the effluent (measured by the coefficient of variation, *CV*), the higher the multiplying factor. Also, the higher the percentile (and confidence level), the higher the multiplier.

The SWRCB calculated effluent variation (*CV*s) for developing PEQs when there were more than 10 data points and more than 80% of the data points were detected. If there were less than 10 data points, or if less than 80% of the data points were detected, then it used a default value of 0.6.

B. Ambient Background Concentrations

The survey of existing practices at RWQCBs indicated that the Boards also calculated ambient background concentrations in a variety of ways. Some permit writers used the mean of reported concentrations for a pollutant, some used the median, and some used published values for different water bodies. As with the MECs and PEQs, however, the SWRCB applied the appropriate practices for the evaluation of each sample facility.

Table A–2~~VIII–4~~. Summary of Practices Used By RWQCBs to Determine Reasonable Potential for Sample Facilities[1]

Region	Conditions Establishing Reasonable Potential (RP)	Comments
1 (North Coast)	• MEC> Criteria • PEQ> Criteria, PEQ = 95/95 • Using BPJ, RWQCB expects the facility to discharge a toxic pollutant based on type of industrial activities conducted (e.g., small industry may not be assigned RP).	• Dilution: not used • Metals criteria: 1) dissolved metals criteria or 2) U.S. EPA total metals criteria • ABC: not used
2 (San Francisco Bay)	• MEC> (Criteria + D * [Criteria – ABC]) (the pollutant has been reported at "levels of concern") • PEQ> (Criteria + D * [Criteria – ABC]), PEQ = 99/99 or 95/95 • ABC > Criteria • MEC > previous permit limit (not in compliance with existing limit) • Pollutant is used in or byproduct of production process • Pollutant is on the 303(d) list • Pollutant is identified in fish tissue report issued by the RWQCB and the Department of Fish and Game.	• Dilution ratio: 1) no dilution, 2) 10:1, or 3) 30:1 • Metals criteria: 1) dissolved metals criteria or 2) U.S. EPA total metals criteria
3 (Central Coast)	• The pollutant has an existing effluent limit • BPJ.	
4 (Los Angeles)	• MEC > PQL • MEC > MDL • Criteria < PQL • Chemical compound or element is used by the facility • Using BPJ, RWQCB expects the facility to discharge a toxic pollutant based on the type of industrial activities conducted (e.g., small industry may not be assigned RP).	• Dilution: not considered (hardness-dependent equations use effluent hardness) • Metals criteria: U.S. EPA total metals criteria
5 (Central Valley)	• PEQ > (Criteria + D * [Criteria– ABC]) and the pollutant is reported above MDLs. PEQ = 99/99 or 95/95 • MEC > Criteria • MEC > MDL • ABC > Criteria • Toxicity study results • Using BPJ, RWQCB expects facility to discharge a toxic pollutant based on the type of industrial activities conducted (e.g., small industry may not be assigned RP).	• Metals criteria: 1) dissolved criteria or 2) U.S. EPA total metals criteria • Dilution: chronic and human health criteria: 14:1; acute criteria: do not consider dilution. Exceptions: 1) no dilution for mercury, arsenic, and copper, or 2) no dilution • Ambient background: 1) median of reported values (non-detects set to zero) or 2) mean of reported values
7 (Colorado River)	• MEC > Criteria.	• Set non-detects equal to detection limit
8 (Santa Ana)	• MEC > (Criteria + D * [Criteria – ABC]) <u>and</u> MEC > MDL • Toxic compound is at "levels of concern" based on BPJ.	• ABC: Not used • Dilution: 1) 20:1 (also a discharge prohibition), or 2) no dilution • Metals criteria: 1) Site specific translators, or 2) dissolved criteria
9 (San Diego)	• Toxicity study results • BPJ (qualitative analysis of the facility).	

ABC = Ambient background concentration
BPJ = Best professional judgment
C = Criterion (objective)
D = Dilution factor
MEC = Maximum effluent concentration
MDL = Method detection level
PEQ = Projected effluent quality
WQ = Water quality

[1] Reasonable potential is established when a pollutant meets one or more of the conditions listed for a RWQCB. The conditions used vary by facility.

In the absence of data, permit writers assumed that the pollutant did not exist in the receiving water. If all observations were nondetected values, most permit writers assumed the ambient background concentration to be zero. If there were a mixture of detected and nondetected values, however, permit writers generally assumed that nondetected values were equal to half of the method detection level in calculating means. Otherwise, they assumed nondetected values to be zero.

C. Metals Translators

Criteria for metals in the CTR are expressed in the dissolved form. Most metals measurements, however, are reported in the total recoverable form. Total recoverable metals concentrations are always at least as high as dissolved metals concentrations because some of the metal is generally sorbed to particulate matter in the water. If dissolved criteria are used, then a concentration penalty is imposed on calculations of ambient background concentrations, MECs, and effluent limitations. Some permit writers in the RWQCBs use metals translators to translate dissolved criteria to total recoverable criteria. Others use only dissolved metals concentrations in their calculations, accomplishing the same end. In determining reasonable potential, if the permit writer for a facility used translators (or dissolved metals concentrations), the SWRCB applied that procedure for the baseline cost estimate. The majority of permit writers, however, did not use translators or dissolved concentrations and thus applied dissolved criteria as if they were total recoverable criteria.

Translators, when used by permit writers, were estimated based on the theoretical partitioning coefficient translators developed by U.S. EPA, which are generally related to the total suspended solids concentration of the receiving water (U.S. EPA, 1996a). A translator is specific to a given metal. One facility had previously determined site-specific translators, and the SWRCB applied those site-specific translators for that facility.

II. INTERIM DRAFT POLICY SCENARIO

For the Interim Draft Policy and alternatives scenarios, the SWRCB established reasonable potential when the maximum effluent concentration exceeded the applicable criterion, the maximum effluent concentration exceeded the ambient background concentration, or the ambient background concentration exceeded the criterion.

A. Effluent Concentrations

The SWRCB used the maximum detected effluent concentration as the maximum effluent concentration (MEC). If all of the observations were nondetects, the SWRCB used the minimum of the detection levels used during monitoring as the MEC.

B. Ambient Background Concentrations

The Interim Draft Policy requires the use of the 99^{th} percentile at the 99% confidence level for ambient background concentrations. The procedure is essentially the same as the one used for PEQs (discussed above in the baseline section), except that ambient water quality (rather than effluent quality) values are used.[6] Alternatives scenarios specify either calculating the ambient background concentration as the 95^{th} percentile at the 95% confidence level, setting the ambient background concentration equal to the maximum ambient concentration, or using the geometric mean of the ambient concentrations.

The SWRCB assumed ambient background concentrations to be zero in the absence of data. RWQCBs may require instream monitoring to confirm absence, however. Nondetected values were set to the method detection level, and if all values were not detected the minimum of the method detection levels was used. This has the effect of reducing the variability of ambient background concentration data when there is a mixture of detected and nondetected values, allowing for the use of a lower uncertainty factor in calculating ambient background concentrations.

C. Metals Translators

The Interim Draft Policy requires the use of either empirically determined site-specific translators or U.S. EPA conversion factors for translating dissolved metals criteria to total metals criteria. Only one facility in the sample set had completed a site-specific translator study, so the SWRCB used theoretical partitioning coefficients in determining reasonable potential and calculating effluent limits. The theoretical partitioning coefficient translators were calculated for each metal based on the receiving water total suspended solids concentration.

Theoretical partitioning coefficients were used as surrogates for values that would likely be determined through site-specific studies. The SWRCB expects that most facilities will perform site-specific translator studies, particularly if they are subject to effluent limits for metals, since site-specific translators are likely to result in less stringent limits than those developed using the universal U.S. EPA conversion factors that would otherwise be applied. Therefore, use of theoretical partitioning coefficient translators should yield effluent limits that better approximate what would occur under the proposed Policy. The SWRCB also analyzed the effects of applying two alternative translators to all facilities: U.S. EPA conversion factors as translators (Alternative 1) and a 1:1 translator (Alternative 2).

ATTACHMENT ~~CHAPTER ~~A-1.3. CALCULATING EFFLUENT LIMITATIONS

The next step in estimating potential compliance costs involves calculating projected effluent limits for those pollutants projected to have reasonable potential for each of the sample facilities.

I. BASELINE SCENARIO

RWQCBs do not currently provide dilution credits for the majority of facilities, and for the majority of facilities without dilution, the effluent limit was set to the criterion. For facilities that were allowed dilution credits, the following equation was used by all permit writers but one to determine the effluent limit:

$$EL = C + D * (C - B)$$

[6] Note that PEQs are not used under the proposed Policy.

where *EL* is the effluent limit, *C* is the criterion value (adjusted for any translators or conversion factors used by the permit writer), *D* is the dilution credit (dilution factor), and *B* is the ambient background concentration. The other permit writer used a method equivalent to the U.S. EPA (1991) approach, as described below for the Interim Draft Policy.

A. Mixing Zones and Dilution Credits

Depending on the characteristics of receiving waters and RWQCB policies, dilution credits (mixing zones) are allowed or denied for some or all pollutants at a given facility. In evaluation of the Baseline scenario, the SWRCB applied dilution credits to the CTR criteria if dilution credits were given for the existing permit. If they were given on a pollutant-by-pollutant basis, then they were given to those pollutants which now receive dilution credits, but were denied for all other CTR criteria for which a facility did not have existing effluent limits.

B. Intake Water Credits

Intake water credits may be applied to facilities that obtain water from the same receiving water to which they discharge and which do not add pollutants to the wastestream. While it is unlikely that intake water credits would be applied to all pollutants at a particular facility, they might apply to some. The major benefit of intake water credits is that when ambient background concentrations exceed criteria, a facility would only need to demonstrate that it does not add the pollutant to the discharge, rather than treat the wastestream to criterion levels for the pollutant.

Intake water credits are not now available to RWQCBs, so they are not used in the Baseline scenario.

II. INTERIM DRAFT POLICY SCENARIO

For the Interim Draft Policy scenario, the SWRCB used a five-step process to develop projected effluent limits (based on U.S. EPA, 1991):

(1) Calculate the WLAs for a given pollutant.

(2) Determine the LTAs.

(3) Identify the lowest LTA.

(4) Calculate the MDLs and AMLs using the lowest LTA.

(5) Select the lowest value as the projected effluent limit.

Step 1: Calculate the WLAs

$WLA = C + D * (C - B)$ when $C > B$, *and*

$WLA = C$ when C £ B,

where *C* is the priority pollutant criterion/objective, adjusted, if necessary, for hardness, pH, and translators; *D* is the dilution credit; and *B* is the ambient background concentration.

Metals Translators

Metals translators are used to translate aquatic life water quality criteria for metals and selenium from the dissolved form to total recoverable criteria. As explained in Attachment ~~Chapter~~ A-1.2, the SWRCB used theoretical partitioning coefficients as metals translators for calculating effluent limits for the Interim Draft Policy scenario. The SWRCB also evaluated two alternative scenarios: the use of U.S. EPA conversion factors as translators, and the use of a 1:1 translator.

Dilution Credit

For the Interim Draft Policy scenario, the SWRCB applied the same practices for mixing zones and dilution credits as described for the Baseline scenario. However, for the Interim Draft Policy scenario the practices were applied to all pollutants, rather than the select few they were applied to in the Baseline scenario.

The SWRCB also evaluated two alternatives: the universal denial of dilution credits, and the application of maximum theoretical dilution (based on the flow of the receiving water). The SWRCB obtained receiving water flow data from the United States Geological Survey, and used the 1Q10, 7Q10, and harmonic mean flows (as specified in the Interim Draft Policy) for acute aquatic life criteria, chronic aquatic life criteria, and human health criteria, respectively. The SWRCB used the facility design flow as the effluent flow for aquatic life criteria and human health criteria. The SWRCB calculated the dilution credit, *D*, as the receiving water flow divided by effluent flow (in the same units) for each relevant criterion type.

Ambient Background Concentration

As explained in Attachment ~~Chapter~~ A-1.2, the SWRCB used the 99th percentile at the 99% confidence level for determining ambient background concentrations. The SWRCB also evaluated three alternative Policy scenarios for ambient background concentrations:

- Alternative 3 – 95th percentile at the 95% confidence level,
- Alternative 4 – using the maximum of the ambient background concentration data, and
- Alternative 5 – using the geometric mean of the ambient background concentration data.

Step 2: Determine the LTAs

Using the *WLA*, the SWRCB determined long-term average concentrations *(LTAs)* by either: 1) setting the *LTA* equal to the *WLA* for human health criteria, or 2) multiplying the *WLA* by the appropriate factor for aquatic life criteria, as determined by the formulas in U.S. EPA (1991). The SWRCB determined the appropriate factor by obtaining the *CV* for the parameter and selecting the *CV*'s corresponding value in the Acute Factor (99th Percentile Occurrence Probability) column for acute criteria, or its corresponding value in the Chronic Factor (99th Percentile Occurrence Probability) column for chronic criteria.

One of the alternative Policy scenarios, Alternative 6, used the 95th percentile at 95% occurrence probability for determining both the Acute and Chronic Factors. The SCWRB obtained the appropriate factors for these calculations from equations in U.S. EPA (1991).

Step 3: Identify the lowest LTA.

The SWRCB compared the *LTAs*, selected the lowest one, and used the lowest of the calculated *LTA*s in further calculations.

Step 4: Calculate the AMLs and MDLs.

If the human health *LTA* was the lowest *LTA*, then the SWRCB set the average monthly limitation *(AML)* equal to the *LTA*. In accordance with the method described in the September 1997 draft FED, the SWRCB set the maximum daily limitation *(MDL)* equal to the *LTA* multiplied by the *MDL/AML multiplier* (obtained from Table 2 of the Draft Policy). Table 2 uses the 99th percentile at 99% occurrence probability for the *MDL multiplier* and the 95th percentile at 95% occurrence probability for the *AML multiplier*.

For aquatic life criteria, the SWRCB calculated the *AML* as the *LTA* multiplied by the *AML multiplier*, and the *MDL* as the *LTA* multiplied by the *MDL multiplier*. Again, the SWRCB obtained the *AML multiplier* and the *MDL multiplier* from Table 2 of the September 1997 draft FED.

One of the alternative policy scenarios, Alternative 6, used the 95th percentile at 95% occurrence probability for both the *MDL* and *AML multipliers*. The SWRCB obtained the appropriate factors for these calculations from equations in U.S. EPA (1991).

Step 5: Select the Projected Effluent Limit

The SWRCB always chose the lowest of the calculated values as the projected effluent limit since this value would result in a more conservative (i.e., erring on the side of higher costs) analysis.

A. Intake Water Credits

In evaluating the Interim Draft Policy, the SWRCB did not consider intake water credits. Under the proposed Policy, credit for a pollutant in intake water may be allowed under certain circumstances when the ambient background concentration and the intake water concentration of the pollutant exceed the minimum applicable criterion. However, in evaluating costs of the proposed Policy and the Policy alternatives, the SWRCB did not consider intake water credits. It is estimated that intake water credits would benefit very few dischargers statewide. The primary beneficiaries are expected to be power-generating facilities with once-through cooling water. Of the 27 sample facilities, only two facilities might benefit from intake water credits.

~~A case study was presented in the October 28, 1997 Draft Addendum to the Supplement to the September 11, 1997 Draft FED. That case study is no longer applicable, as the proposed Policy provisions for determining intake water credits (e.g., the methods for calculating ambient background and intake water concentrations) have been revised. However, the case study did indicate that some dischargers could benefit from intake water credits.~~

~~The proposed Policy does not require the use of intake water credits and, therefore, imposes no costs on dischargers. If a discharger chooses to request an intake water credit, and it is allowed by the RWQCB, compliance cost savings may result.~~

ATTACHMENT~~CHAPTER~~ A-1.4. POTENTIAL COSTS FOR ACHIEVING PROJECTED EFFLUENT LIMITS

The next step in evaluating potential compliance costs involves determining the pollutant reductions that facilities would need to make to meet their projected effluent limits and then determining the costs associated with taking actions to achieve the reductions and meet limits. For each facility, the SWRCB estimated pollution control costs for any pollutant reported at an effluent concentration above the projected effluent limit. The SWRCB applied the same methodology for this step to both the Baseline and the Interim Draft Policy scenarios. It then estimated compliance costs as noted below, with capital costs and O&M costs estimated separately when appropriate. To estimate total annual costs, the SWRCB assumed that capital costs would be financed at a rate of 7% over 10 years and then added annual O&M costs.

I. POLLUTANT REDUCTIONS

The SWRCB only evaluated potential compliance costs associated with achieving the pollutant loading reductions required to meet effluent limits established as a result of the CTR. That is, if a facility was in compliance with an existing effluent limit (or did not have an existing effluent limit), the SWRCB calculated the pollutant reduction as the MEC minus the new effluent limit. However, if a facility was not in compliance with an existing permit limit, the SWRCB calculated the needed pollutant reduction as the existing effluent limit minus the new effluent limit. The SWRCB employed this procedure because costs to comply with existing effluent limits are not attributable to the CTR and Interim Draft Policy.

II. CONTROL OPTIONS AND COSTS

To estimate likely control options and costs for the sample facilities, the SWRCB analyzed each facility to determine how it could comply with the projected effluent limitations. The SWRCB used a decision framework that was developed to ensure consistency in estimating the controls that would be necessary. (The decision framework is discussed in detail in the technical appendix for this document.) Under the decision framework, a facility would first examine lower-cost options to see if they would be sufficient for achieving compliance. If the lower-cost options were not likely to be sufficient, the facility would examine options that could result in greater expense and potential liabilities. The control options considered by the SWRCB are process optimization, pollutant minimization, and end-of-pipe treatment.

Process Optimization

Under the decision framework, the SWRCB considered process optimization—minor treatment plant operation and facility changes—first. The SWRCB determined that relatively minor, low-cost modification or adjustment of existing treatment was feasible when literature indicated that the existing treatment process at a facility is capable of achieving the revised effluent limit and it was reasonable given the size of the necessary pollutant reduction. Process optimization costs included two components: an engineering analysis of the existing processes to identify changes for potential improvements and process modification to implement the changes. Process optimization costs for each of these components were estimated for four principal conventional treatment processes:

- Biological treatment (e.g., activated sludge processes),
- Settling (e.g., clarification, sedimentation),
- Precipitation and oil and gas extraction (e.g., membrane processes, vacuum suction), and
- Organics removal (e.g., aeration, granular activated carbon).

These four treatment processes represent the range of treatment processes typically used at the facilities in the sample. Costs of the process modification components for each treatment process varied based on three ranges of discharge flow, as shown in Table A–3~~VIII–5~~.

Table A–3~~VIII–5~~. Process Optimization Costs for Traditional Treatment Processes ($1,000)

Process	Optimization Steps	Flow < 1 MGD	Flow 1 MGD – 10 MGD	Flow > 10 MGD
Biological Treatment	Process analysis study	65	91	117
	Process modification	2–60	3–80	4–116
Settling	Process analysis study	13	13	26
	Process modification	2–47	3–62	4–96
Precipitation and oil & gas extraction	Process analysis study	39	52	78
	Process modification	2–47	3–62	4–96
Organics removal	Process analysis study	13	26	39
	Process modification	2–47	3–62	4–96

Sources: U.S. EPA, 1990; U.S. EPA, 1992b; Truax, 1992

In addition, the SWRCB estimated process optimization costs specific to disinfection byproducts (DBPs) because these pollutants are of concern in a number of sample facilities. The SWRCB estimated costs to reduce DBPs by two methods: removing DBP precursors and removing DBPs after formation, both by modifying or adequately controlling existing treatment processes. Methods to remove DBP precursors include improving the facility's response to changes in influent quality and quantity, reducing chlorine dose, and modifying hydraulic conditions. DBPs can be removed after formation by several methods, including aeration and granular activated carbon (GAC). The SWRCB developed cost estimates for process optimization to reduce DBPs, using the same three flow ranges used for optimization of other treatment processes. The SWRCB estimated costs for both steps of process optimization (process analysis study and process modification) based on 175 labor hours per month at a loaded rate of $75 per hour, as described in greater detail in the technical appendix for this document.

Pollutant Minimization

When it was not technically feasible to adjust existing operations, the SWRCB considered waste minimization/pollution prevention controls. The SWRCB established the potential feasibility of these techniques based on the level of pollutant reductions achievable through waste minimization/pollution prevention, the appropriateness of waste minimization/pollution prevention for the specific pollutant, and knowledge of the manufacturing processes generating the pollutant of concern. Pollutant minimization efforts may include product substitution, waste stream recycling, alternative waste management methods, education of the public and businesses, and other measures.

Estimated costs used by the SWRCB for pollutant minimization programs are shown in Table A–4~~VIII–6~~. The SWRCB estimated the costs of implementing pollutant minimization controls based on the analysis performed in the U.S. EPA assessment of compliance costs resulting from the implementation of the proposed Great Lakes Water Quality Guidance (U.S. EPA, 1993). The SWRCB used the high cost estimates from the Great Lakes analysis to be conservative and generally applied the costs to different pollutant groups considering the likely source of these pollutants. For example, if the SWRCB determined that a sample facility was likely to use pollutant minimization to meet projected effluent limits for copper, lead, and zinc (all in the metals pollutant group) and these pollutants were likely to be coming from the same source (e.g., radiator shops, car washes, and truck cleaners discharging to a POTW), then the SWRCB decided that one pollutant minimization program (PMP) could address the pollutants and the total control cost for the three pollutants would be the cost of one PMP.

Table A–4~~VIII–6~~. Pollutant Minimization Costs

Category	Cost ($1,000)
Pulp and paper	1,500 – 3,000
Organic chemicals/petroleum refining	300 – 500
Metal finishing	200 – 1,000
Steam electric	200 – 400
Major publicly owned treatment works	200 – 400
Minor dischargers	50 – 200

Source: Based on U.S. EPA, 1993

If the SWRCB staff determined that waste minimization/pollution prevention alone was not feasible to reduce pollutant levels to those needed to comply with the projected effluent limits, it considered a combination of waste minimization/pollution prevention, simple treatment, and/or process optimization. If these relatively low-cost controls could not achieve the projected effluent limits, the SWRCB considered more expensive controls (e.g., end-of-pipe treatment).

Treatment

To select appropriate end-of-pipe treatment, the SWRCB reviewed the existing treatment systems at each facility. The SWRCB evaluated: 1) the effluent levels that were currently being achieved at the facility and 2) the levels that are documented in U.S. EPA's Office of Research and Development, Risk Reduction Engineering Laboratory's RREL Treatability Database, Version 5.0 (U.S. EPA, 1992a). The SWRCB selected unit processes from the database that would achieve compliance with the projected effluent limits. The SWRCB used cost curves in the database to estimate costs [capital and operation and maintenance (O&M)] for the processes selected, assuming the treatment would be installed and operated at the design flow rate for the facility. Although treatment of only part of the flow might be appropriate for some facilities, the SWRCB used each facility's design flow to estimate costs. The SWRCB escalated the costs to first quarter 1998 dollars using the *Engineering News Record* (ENR) Construction Cost Index. All capital costs are annualized at 7% per year over 10 years. Since capital equipment may last significantly longer than 10 years, annual capital costs may be overestimated.

To establish the appropriateness of the controls selected for each facility, an engineer familiar with the sample facilities evaluated the results of the analysis. The SWRCB made adjustments to the selected controls or associated costs as necessary based on this review.

ATTACHMENT~~CHAPTER~~ A-1.5. DETERMINING OTHER POTENTIAL COSTS

The costs of reducing pollutants in discharges are only some of the costs associated with the Baseline and the Interim Draft Policy scenarios. In addition, sample facilities may incur costs for:

- Monitoring
- Residuals management
- Site-specific metals translator studies
- Toxicity control
- Dioxin (TCDD) requirements
- Site-specific objectives
- Watershed management/TMDL considerations
- Reporting levels policy.

In addition to the costs incurred by sample facilities, indirect dischargers (industrial facilities discharging to the sewer system) may also incur costs associated with the Baseline and Interim Draft Policy scenarios. Each of these potential cost factors is addressed below.

I. BASELINE SCENARIO

A. Monitoring

Under the Baseline scenario, the SWRCB estimated costs based on facility monitoring requirements to determine compliance with each effluent limitation. The SWRCB assumed requirements of one sample per month for metals and one sample per quarter for organic pollutants.

The SWRCB developed costs based on standard laboratory practices for analyzing groups of chemicals in the same sample. For metals, the SWRCB assumed that mercury and selenium were analyzed separately, but other metals would be analyzed on a single sample. Similarly, for organics, the SWRCB assumed that acid extractables, volatiles, semi volatiles, and base neutrals would be analyzed as a group. When analyzed as a group, the SWRCB distributed the costs among the chemical components of concern in that group. The SWRCB assumed that facilities would use the analytical protocols in 40 CFR 135.

Unit costs for monitoring pollutants by category are shown in Table A–5~~VIII–7~~. The SWRCB estimated monitoring costs for organic pollutants by analytical fraction (volatile organics, acid extractables, base/neutral extractables, and pesticides) and by pollutant for metals and for 2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD).

Table A–5~~VIII–7~~. Monitoring Costs

Parameter	Cost (per sample)	Frequency
Metals (per metal)	$30	Monthly
Organics		Quarterly
Volatile organics	$300	
Acid extractables	$300	
Base/neutral extractables	$300	
Pesticides	$300	
Dioxins	$950	Quarterly

B. Residuals Management

The SWRCB included the costs to dispose of residuals generated by added treatment and assumed that all residuals would be nonhazardous and could be disposed of in a Resource Conservation and Recovery Act (RCRA) Subtitle D facility. Based on the analysis described in Attachment ~~Chapter~~ A-1.4, the SWRCB determined that some facilities would need to install treatment or increase treatment capacity to meet effluent limits under the CTR. For each of these facilities, the SWRCB selected the most appropriate treatment. Treatments selected included chemical precipitation, reverse osmosis (RO), and granular activated carbon (GAC). The SWRCB estimated the residuals likely to be produced by these processes and the associated costs and included these costs as part of treatment O&M costs.

For chemical precipitation, the SWRCB assumed that lime addition would be used since it is generally the most effective method for precipitating toxic metals. The SWRCB estimated that 5000 pounds of sludge would be generated for every million gallons of water treated by lime addition and that disposal would cost $75 per ton of sludge. For RO, residuals management involves brine disposal. For GAC, the SWRCB assumed the spent carbon could be handled in one of three ways: disposal, off-site regeneration, and on-site regeneration. Costs for RO brine disposal and GAC disposal/regeneration are not included in the EPA Treatability Database and therefore are not included in this analysis. To the extent that facilities incur residuals management costs for RO or GAC treatment processes, costs may be understated in the SWRCB's analysis. However, the analysis shows that limited use of these treatment alternatives is likely (only one facility with RO, none with GAC in the Baseline scenario).

C. Indirect Dischargers

As a result of more stringent effluent limits under the CTR and the need to implement pollutant controls, POTWs may impose requirements on nondomestic facilities that discharge wastewater to POTW collection systems. POTWs may impose requirements such as implementation of pollution prevention plans or initiation or tightening of pollutant limits on discharges from nondomestic facilities that discharge to POTWs (i.e., indirect dischargers). These requirements are generally implemented through the POTW's industrial pretreatment program. Through an industrial pretreatment program, POTWs typically issue discharge permits to their significant industrial users (SIUs), although a POTW may also issue permits to its other indirect dischargers. Permits contain discharge conditions and other requirements. Therefore, through permits and other conditions in local sewer use ordinances, indirect dischargers may incur costs as a result of the CTR.

The SWRCB estimated the potential costs to indirect dischargers based on estimates developed by U.S. EPA for its economic analysis of the CTR (U.S. EPA, 1999). EPA estimated an average total cost of $64,400 for each of the affected indirect dischargers. The estimated total cost was annualized at 7% over a five-year period to yield an average annual cost of $15,705 per affected indirect discharger. The SWRCB estimated the number of affected indirect dischargers based on the number of SIUs, since SIUs are most likely to be affected by a POTW controls on discharges to sewer systems. The SWRCB multiplied the estimated number of affected SIUs by the estimated cost per SIU to estimate total costs to indirect dischargers, assuming that 30% of SIUs would be affected by implementation of the CTR.

II. INTERIM DRAFT POLICY SCENARIO

A. Monitoring

For the Interim Draft Policy scenario, the SWRCB estimated effluent monitoring costs for each pollutant with reasonable potential. Facilities would be required to conduct monthly sampling for metals and quarterly sampling for organics (as under the baseline). In addition, if projected effluent limits are below the reporting level (RL) for a pollutant and there is evidence that the facility was discharging between the effluent limit and the RL, the facility would be required to perform quarterly influent monitoring for metals and organics (and a pollutant minimization program would be required). For the analysis, the SWRCB included costs for quarterly samples for influent monitoring for all pollutants with projected effluent limits below the RL, whether or not evidence was present. The SWRCB used the same unit costs and procedures to estimate monitoring costs as under the Baseline scenario.

B. Residuals Management

The SWRCB included the costs to dispose of residuals generated by added treatment and assumed that all residuals would be nonhazardous and could be disposed of in a RCRA Subtitle D facility. The SWRCB used the same procedures to estimate residuals management costs as under the Baseline scenario. As noted for the Baseline scenario, to the extent that facilities incur residuals management costs for RO or GAC treatment processes, costs may be understated in the SWRCB's analysis. However, the analysis shows that limited use of these treatment alternatives is likely (only one facility with GAC, none with RO in the Interim Draft Policy scenario).

C. Site-Specific Translator Studies

The cost of a translator study depends on how much data are needed to develop a credible metals translator. The variability of the receiving water greatly affects the cost involved. Depending on the complexity of the water body, a simple study using existing data and minimal additional monitoring may suffice. In other cases where the system is more complex (e.g., bays), significant additional sampling may be necessary, possibly including more expensive sampling techniques (e.g., offshore sampling) and the establishment of new monitoring stations. Costs also vary based on the time period over which monitoring must span (e.g., six months, 12 months, 18 months), which may be affected by concerns such as adequately considering water quality variability (e.g., seasonal differences).

The SWRCB expects that many facilities that have effluent limits for metals are likely to conduct metals translator studies. Facilities should use as much existing data as possible and use existing monitoring stations to collect additional samples if possible. Developing several metals translators concurrently can be more efficient and result in cost savings in sample collection and data analysis. Additionally, a group of facilities discharging to the same water body may be able to collaborate in conducting a study so that costs can be shared across several dischargers. The SWRCB has not included the cost of metals translator studies in this analysis since the number of facilities that will conduct these studies may vary greatly and costs may also vary significantly based on how many facilities share the costs of a study.

D. Toxicity Control

The Chronic Toxicity Provisions of the proposed Policy are very similar to existing SWRCB practices and to current U.S. EPA guidance for POTWs and industrial dischargers. Therefore, the SWRCB does not expect the proposed Policy to result in significant additional costs to dischargers. SWRCB staff developed toxicity case studies to provide examples of the potential costs for chronic toxicity testing and the costs for TREs/TIEs (toxicity reduction evaluation/toxicity identification evaluation) associated with having a chronic toxicity limit. A facility could incur these costs if it did not previously have a chronic toxicity limit but the RWQCB determines that it should have been given a limit and thus assigns one to the facility. Attachment C~~2~~ contains case studies for the facilities evaluated.

E. Dioxin (TCDD)

The cost of monitoring for dioxins is approximately \$1200 – \$1500 per sample. Under the proposed Policy, major dischargers are required to monitor once during dry weather and once during wet weather for a period of three years. Monitoring costs for major dischargers will, therefore, be \$2400 – \$3000 annually for a period of three years. Minor dischargers would incur these costs for only one year.

F. Site-Specific Objectives

Site-specific objectives (SSOs) are currently in use in some Regions. Some of the existing SSOs would be replaced by CTR criteria/objectives when the CTR is finally promulgated. At the time this analysis was prepared, which SSOs will remain and which will be replaced had not been determined, so the impact of replacing SSOs with CTR criteria/objectives could not be ascertained. In any case, these changes would be attributable to the CTR and not the proposed Policy since the proposed Policy does not affect the use of SSOs.

G. Watershed Management and TMDLs

The SWRCB continues to advocate the use of watershed wide approaches to meeting all criteria/objectives, including those that would be imposed by the CTR. The proposed Policy does not change existing SWRCB and RWQCB programs for watershed management or TMDLs.

H. Reporting Levels Provision

The proposed Policy requires that a facility implement a pollutant minimization program (PMP) for those pollutants that have effluent limits less than the RLs established by the State in the proposed Policy and where there is evidence that effluent concentrations are between the effluent limits and the RLs. However, PMP costs were estimated for all effluent limits below the RL, resulting in an overstatement of costs. The RL requirement includes quarterly influent monitoring in addition to effluent monitoring for these pollutants. Costs attributable to the reporting levels provision are not applicable to the Baseline scenario because the requirements are not an existing practice among any of the RWQCBs.

I. Indirect Dischargers

The SWRCB used the same procedures to estimate costs to indirect dischargers as under the Baseline scenario.

ATTACHMENT~~CHAPTER~~ A-1.6. ESTIMATING STATEWIDE COSTS

The SWRCB developed estimates of statewide costs for each scenario (Baseline, Interim Draft Policy, and Interim Draft Policy alternatives) by extrapolating the costs of sample facilities to the total facilities in the State. The SWRCB extrapolated the sample costs based on the industry and flow categories used by U.S. EPA in its economic analysis of the CTR. U.S. EPA divided facilities into categories based on whether a facility was a major or minor, and within those categories into POTW or industrial dischargers. U.S. EPA further subdivided major facilities based on flow for POTWs and type of industry for industrials, including an "other industrial" category. Facility categories are shown in Table A–6~~VIII–8~~. The SWRCB extrapolated costs for each category on a proportional basis (i.e., based on the ratio of total facilities in the State to the number in the sample for a given category). The extrapolated costs are an estimate of the total costs that would be incurred under the Baseline, under the Interim Draft Policy, and under each alternative to the Interim Draft Policy.

Table A–6~~VIII–8~~. Facility Categories for Estimating Statewide Costs

Facility Category	Number in Sample	Number in Universe
Major Dischargers		
POTW 1 (design flow ≤ 10 MGD)	3	83
POTW 2 (design flow of 10–100 MGD)	4	40
POTW 3 (design flow > 100 MGD)	2	5
Chemicals/Petroleum Products	3	20
Electric Utilities	2	13
Transportation Equipment/Metals	1	7
Lumber/Paper	1	4
Other Industrial[1]	(7)[2]	12

Table A–6~~VIII–8~~. Facility Categories for Estimating Statewide Costs

Facility Category	Number in Sample	Number in Universe
Minor Dischargers		
POTWs	5	185
Industrials	6	872
Totals	27	1,241

[1]Represents industrial categories not covered by the sample facilities.
[2]Equals the total of the major industrials (not seven additional sample facilities).

~~CHAPTER 1.7. COMPARISON WITH U.S. EPA'S CTR ECONOMIC ANALYSIS~~

~~In conducting an economic analysis of its Interim Draft Policy, the SWRCB sought to build on U.S. EPA's economic analysis of the CTR. However, U.S. EPA had to make a number of assumptions regarding how the State might implement the CTR to perform its analysis (and noted that the actual costs would be determined by the State's policy). The Interim Draft Policy established a number of different implementation procedures than those assumed by U.S. EPA (e.g., the reporting levels provision). In addition, although the SWRCB used the same set of sample facilities and much of the same data to evaluate potential impacts, it also collected additional data and information that make it inappropriate to directly compare the results of these two analyses. Some of these differences are described in greater detail below.~~

~~Some of the assumptions for determining reasonable potential differ between the two analyses., For its low scenario, U.S. EPA used projected effluent quality (PEQ) to determine reasonable potential. PEQ accounts for effluent variability and is therefore greater than the maximum effluent concentration the SWRCB used in its analysis. In some cases (e.g., no dilution given and no ambient background data exist), this likely results in more pollutants with reasonable potential. Also, U.S. EPA treats ambient background concentrations reported below detection level as zero in this scenario, so if all values are below detection the concentration would be zero. In comparison, the SWRCB used the lowest of the reported detection levels if all values were below detection level. The SWRCB used the same convention for treating effluent concentrations below detection in determining reasonable potential. U.S. EPA did not find reasonable potential when all effluent concentrations are below detection level, while such pollutants may have reasonable potential under the SWRCB's analysis. If the ambient background concentration is greater than the most stringent water quality criterion, the pollutant has reasonable potential under the SWRCB's analysis, while the pollutant may not have reasonable potential under U.S. EPA's analysis. In addition, U.S. EPA's convention of using a 1:1 metals translator likely results in more pollutants with reasonable potential than the SWRCB's use of theoretical partitioning coefficients based on TSS concentration.~~

~~Under U.S. EPA's high scenario, however, the method for determining reasonable potential results in fewer pollutants with reasonable potential than in the SWRCB analysis.~~

~~For calculating effluent limitations, assumptions are generally the same except for when dilution is allowed. When dilution is allowed, the SWRCB's method for treating ambient background~~

~~concentrations reported below detection level and for calculating ambient concentrations result in more stringent limits than U.S. EPA's method. Some facilities receiving dilution under U.S. EPA's analysis do not receive dilution under the SWRCB's analysis.~~

~~A few assumptions result in higher costs under the SWRCB's analysis:~~

- ~~The SWRCB assumed that facilities would implement PMPs and conduct influent monitoring when projected effluent limits are below minimum levels (reporting levels provision).~~
- ~~The SWRCB did not assume facilities would pursue regulatory relief while U.S. EPA did for its low scenario.~~
- ~~U.S. EPA assumed no change in monitoring costs attributable to the CTR.~~

~~As noted above, the SWRCB collected additional effluent data and ambient background concentration data for some sample facilities. Both U.S. EPA and the SWRCB used facility-specific assumptions (e.g., flow, dilution, existing limits) based on information in existing NPDES permits. However, the SWRCB performed its analysis after U.S. EPA's analysis and a few facilities had been issued new permits, so some facility-specific assumptions differ.~~

ATTACHMENT A-2~~CHAPTER 2~~. RESULTS

The costs attributable to the Interim Draft Policy and Policy alternatives are the differences in costs between the Baseline scenario and the other scenarios. The baseline costs represent costs that would be incurred if the CTR criteria were implemented in the absence of the proposed Policy, i.e., the costs that would be incurred using existing RWQCB policies and practices to determine reasonable potential and calculate effluent limits. Therefore, the impact of the Interim Draft is the cost increment between the Baseline and other scenarios.

The estimated reasonable means of compliance for the sample facilities (Attachment A-2.1~~Chapter 2.1~~) and statewide extrapolated costs are both presented below (Attachment A-2.2 ~~Chapter 2.2~~). These results are presented for the Baseline scenario, the Interim Draft Policy scenario, and the eight scenarios that are alternatives to the Interim Draft Policy. The remainder of the attachment ~~chapter~~ discusses potential biases and uncertainties in the economic analysis and sensitivity analyses performed to evaluate the effects that certain changes would have on the overall results.

ATTACHMENT A-2.1~~CHAPTER 2.1~~. REASONABLE MEANS OF COMPLIANCE

As described in Attachment A-1.4~~Chapter 1.4~~, the SWRCB determined the pollutant loading reductions that facilities would need to make to comply with projected effluent limits. The SWRCB considered only those pollutant loading reductions necessary to meet effluent limits established as a result of the CTR. Based on the amount of pollutant loading reduction needed, the SWRCB estimated which potential pollutant control options facilities would be able to implement to provide a reasonable means of achieving compliance with projected effluent limits. Reasonable means of compliance range from taking no action (e.g., if a facility is generally in compliance with projected effluent limits) to installing potentially expensive end-of-pipe treatment. The SWRCB then estimated the costs associated with using these pollution control methods.

In estimating reasonable means of compliance, the SWRCB first evaluated lower-cost options to see if they would be sufficient for achieving compliance. If the lower-cost options were not likely to be sufficient, the SWRCB considered options that could result in greater expense. Going from lower-cost to higher-cost, the options ranged from process optimization, pollutant minimization, and end-of-pipe treatment. Process optimization was only considered a reasonable means of compliance if the required pollutant loading reduction was relatively small and low-cost modifications of existing treatment were feasible. When process optimization was not appropriate or sufficient, the SWRCB considered waste minimization/ pollution prevention controls. The SWRCB assessed whether pollutant minimization was a reasonable means of compliance based on the required pollutant loading reductions (e.g., 10%–25%), level of pollutant reductions achievable through waste minimization/pollution prevention, appropriateness of waste minimization/pollution prevention for the specific pollutant, and knowledge of the manufacturing processes generating the pollutant of concern. When neither process optimization nor pollutant minimization alone were likely to be adequate to achieve the necessary pollutant loading reduction, the SWRCB considered a combination of both control options, along with simple treatment. When it would not be reasonable to expect a facility to achieve compliance with a combination of these controls, the SWRCB determined that treatment would be the only reasonable means of compliance for a facility.

The following sections and Table A–7~~VIII–9~~ summarize the actions that the SWRCB determined would be reasonable means of complying with projected effluent limits for the sample facilities. Detailed facility-level analyses are presented in the technical appendix for this report.

Table A–7~~VIII–9~~. Means of Compliance at Sample Facilities[1]

Scenario	Number of Facilities with Estimated Means of Compliance				Type of Treatment
	No Action	Process Optimization	Pollutant Minimization	Treatment	
Baseline (CTR with existing practices)	13	6	9	4	Chem ppt and filtration (2); RO (1); chem ppt (1)
Interim Draft Policy	7	7	20	2	Chem ppt and filtration (1); GAC (1)
Alternative 1 (U.S. EPA conversion factors as metals translators	6	7	20	9	Chem ppt (2); chem ppt and GAC (2); chem ppt and filtration (2); RO (2); RO and GAC (1)
Alternative 2 (1:1 metals translators)	6	7	20	9	Same as Alternative 1
Alternative 3 (Ambient background concentration calculated using 95th percentile at 95% confidence)	7	7	20	1	Chem ppt and filtration
Alternative 4 (Ambient background concentration using maximum observed)	7	7	20	1	Same as Alternative 3

Alternative 5 (Ambient background concentration calculated as geometric mean of observed values)	8	6	19	1	Same as Alternative 3
Alternative 6 (95th percentile for calculating LTAs, MDLs, and AMLs)	7	7	21	2	Same as for proposed Policy
Alternative 7 (No dilution)	7	6	19	3	Chem ppt and filtration (1); RO (1); GAC (1)

AMC = Average monthly limit LTA = Long-term average MDL = Maximum daily limit

[1] The total for a scenario may not equal the number of sample facilities (27) because a facility may need to implement more than one action if more than one pollutant requires action (e.g., pollutant minimization for pesticides and chemical precipitation for lead). Does not include monitoring.

BASELINE

Under the Baseline scenario, the CTR would be implemented using existing RWQCB practices. The means of compliance that the SWRCB expects that facilities would have to take range from no action to installing treatment, for one or more pollutants. Some facilities (13 in the sample set) are not likely to need to take any action to comply with effluent limits and other requirements imposed by the CTR. Many facilities would likely need to either make process optimization changes (six of the 27 sample facilities) or undertake pollutant minimization processes (nine facilities) for one or more pollutants. For facilities projected to use process optimization for one or more pollutants, either required pollutant reductions were small (e.g., less than 10%), the facility was already in compliance most of the time (e.g., 90% of the time), or process optimization was solely for controlling DBPs. Facilities projected to use pollutant minimization generally either required small pollutant reductions (e.g., less than 30%) or most of their data were below detection levels. The SWRCB projected that a few facilities (four of the 27) would need to install treatment to comply with projected effluent limits. Three of these four facilities required pollutant loading reductions of 59% or more for at least one metal and the fourth facility required reductions of 52% for two metals, so the SWRCB determined that treatment would be the only reasonable means of compliance. Of those facilities expected to install treatment in order to comply with projected effluent limits, treatment processes included chemical precipitation, filtration, and reverse osmosis treatment.

INTERIM DRAFT POLICY

Similar to the Baseline scenario, the SWRCB determined that some facilities (seven of the 27) are not likely to need to take any action and most facilities would likely need to make relatively minor, low cost modifications to their treatment processes or institute pollutant minimization programs. A total of seven facilities may need to use treatment process optimization to reach compliance with projected effluent limits, while 20 facilities may need to use pollutant minimization programs for one or more pollutants. A few facilities (two of the 27) are likely to need more extensive controls, including chemical precipitation, filtration, and granular activated carbon (GAC) treatment. The SWRCB's rationale for considering these pollutant control options to be reasonable means of compliance is similar to the Baseline scenario.

ALTERNATIVE 1 – Effects of Using U.S. EPA Conversion Factors for Metals Translators

Under Alternative 1, all facilities would use U.S. EPA conversion factors to translate metals and selenium criteria from the dissolved form into total recoverable effluent limits. In general, this alternative has the effect of lowering effluent limits for metals at most facilities, often resulting in greater required loading reductions and more costly means of compliance (e.g., treatment) in order to achieve the pollutant loading reductions. For Alternative 1, the SWRCB projects that:

- Six facilities would not need to take any action
- Twenty facilities would implement pollutant minimization programs
- Seven facilities would institute process optimization measures
- Nine facilities would need to install treatment.

The types of treatment the SWRCB projects are chemical precipitation alone (two facilities), chemical precipitation and GAC (two facilities), chemical precipitation and filtration (two facilities), reverse osmosis (two facilities), and reverse osmosis and GAC (one facility). Pollutant control options used at a facility may address more than one pollutant.

ALTERNATIVE 2 – Effects of Using 1:1 Metals Translators

Under Alternative 2, all facilities would use 1:1 factors to translate metals and selenium criteria from the dissolved form into total recoverable effluent limits. As with Alternative 1, this alternative generally has the effect of lowering effluent limits for metals at most facilities, often resulting in greater required loading reductions and more costly means of compliance (e.g., treatment) in order to achieve the pollutant loading reductions. For Alternative 2, the SWRCB projects the same actions as for Alternative 1:

- Six facilities would not need to take any action
- Twenty facilities would implement pollutant minimization programs
- Seven facilities would institute process optimization measures
- Nine facilities would need to install treatment.

The types of treatment are the same as in Alternative 1.

ALTERNATIVE 3– Effects of Lowering the Certainty Factors for Ambient Background Concentrations

Under Alternative 3, ambient background concentrations would be calculated using the 95th percentile at the 95% confidence level, rather than the Interim Draft Policy's 99th percentile at the 99% confidence level. Ambient background concentrations calculated using Alternative 3 will generally be lower than the values calculated for the Interim Draft Policy since using the 95th percentile at 95% confidence level results in less certainty. The effect that this will have on the determination of reasonable potential varies because of the criteria for establishing reasonable potential. The effect that this will have on projected effluent limits is to result in less stringent limits, but only when the ambient background concentration is less than the applicable criterion and a facility receives dilution (five facilities in the sample receive dilution). Reasonable means of compliance under Alternative 3 are no action for seven facilities, pollutant minimization for 20 facilities, process optimization for seven facilities, and treatment for one facility. The type of treatment projected by the SWRCB is chemical precipitation combined with filtration.

ALTERNATIVE 4 – Effects of Using the Maximum for Ambient Background Concentration

Under Alternative 4, the ambient background concentration is set to the maximum observed value from receiving water monitoring, instead of the 99th percentile at 99% confidence level value of the of the monitoring data. Ambient background concentrations calculated using Alternative 4 will generally be lower than the values calculated for the Interim Draft Policy (and lower than the values calculated for Alternative 3) since using the maximum observed value is lower than the 99th percentile at 99% confidence level value which factors in uncertainty. As described in Alternative 3, the effect this has on reasonable potential varies, while it may make effluent limits less stringent for some facilities receiving dilution. (Five facilities in the sample receive dilution.) Reasonable means of compliance under Alternative 4 are the same as those projected for Alternative 3.

ALTERNATIVE 5 – Effects of Using the Geometric Mean for Ambient Background Concentrations

The geometric mean of the observed ambient background concentrations is used for Alternative 5, in place of the 99th percentile at 99% confidence level used for the Interim Draft Policy. Ambient background concentrations calculated using Alternative 5 will generally be lower than the 99th percentile at 99% confidence level value, which factors in uncertainty. As described in Alternative 3, the effect this has on reasonable potential varies, while it may result in less stringent effluent limits for some facilities receiving dilution. (Five facilities in the sample receive dilution.) Reasonable means of compliance under Alternative 5 are no action for eight facilities, pollutant minimization for 19 facilities, process optimization for six facilities, and treatment for one facility. The SWRCB projects the same type of treatment as for Alternative 3.

ALTERNATIVE 6 – Effects of Lowering the Occurrence Probability

Alternative 6 uses a different occurrence probability, the 95th percentile, to calculate long term averages (LTAs) and maximum daily limits than the 99th percentile used for the Interim Draft Policy. Since the SWRCB selected the lowest of the calculated effluent limits as the projected effluent limit for compliance determinations, and the maximum daily limit is typically not the lowest, the SWRCB estimates the overall effect of this alternative on projected effluent limits to be minimal (one facility is affected). So the sample facilities have similar reasonable means of compliance to the Interim Draft Policy scenario. Reasonable means of compliance under Alternative 6 are no action for seven facilities, pollutant minimization for 21 facilities, process optimization for seven facilities, and treatment for two facilities. The SWRCB projects that one facility would use GAC treatment and one facility would use chemical precipitation and filtration.

ALTERNATIVE 7 – Effects of No Dilution

For the analysis of the Interim Draft Policy scenario, the SWRCB provided dilution to those facilities that currently receive dilution under their existing permits. Alternative 7 estimated the effects of providing no dilution to the sample facilities, and therefore provides an estimate of the changes to reasonable means of compliance if facilities currently receiving dilution lose their dilution. If a facility loses its dilution, pollutants with ambient background concentrations less than the applicable criterion will have more stringent effluent limits. Only five of the 27 sample facilities (which currently have dilution) are projected to receive different effluent limits for some pollutants under Alternative 7 than they would be expected to receive under the Interim Draft Policy, so eliminating facilities' dilution would likely result in little change in means of compliance for most facilities. Reasonable means of compliance under Alternative 7 are no action for seven facilities, pollutant minimization for 19 facilities, process optimization for six facilities, and treatment for three facilities. The SWRCB projects that the types of treatment to be used would be chemical precipitation and filtration for one facility, GAC for one facility, and RO for one facility.

ALTERNATIVE 8 – Effects of Maximum Dilution

Under Alternative 8, facilities were given maximum theoretical dilution based on the flow of the receiving water. The SWRCB could not determine projected effluent limits and reasonable means of compliance for six of the sample facilities because the flow data needed to determine maximum theoretical dilution were not available for some of the facilities. For the other 21 sample facilities, maximum dilution either did not affect or slightly decreased costs for most of the facility categories in the analysis. Reasonable means of compliance under Alternative 8 are no action for seven facilities, pollutant minimization for 14 facilities, and process optimization for five facilities. No facilities were projected to need treatment to comply with effluent limits under Alternative 8.

ATTACHMENT ~~CHAPTER~~ A-2.2. STATEWIDE COSTS

The SWRCB estimates that implementation of the CTR under the Interim Draft Policy will cost $76.7 million annually to potentially affected dischargers statewide compared to a cost of $84.3 million for implementing the CTR using the existing practices of the RWQCBs. For the alternative scenarios, costs are estimated to range from $68.9 million to $415.5 million. These results are summarized in Tables A–8~~VIII–10~~ through A–11~~VIII–13~~ and Figure A–1~~VIII–1~~, and are discussed further on a scenario-by-scenario basis later in this attachment~~chapter~~. These cost estimates include the $10.1 million annual costs that indirect dischargers (i.e., industrial facilities discharging to the sewer system) are expected to incur as a result of requirements placed on them by POTWs affected by the CTR. For Alternative 8, a statewide cost estimate could not be developed due to a lack of data (see below).

Table A–8~~VIII–10~~. Projected Annual Compliance Costs of Different Scenarios for Implementing the CTR (Millions of 1998 $/yr)

Scenario	Direct Dischargers	Indirect Dischargers[1]	Total
Baseline	74.2	10.1	84.3
Interim Draft Policy	66.6	10.1	76.7
Alternative 1: USEPA Conversion Factors	405.4	10.1	415.5
Alternative 2: 1:1 Conversion Factors	405.4	10.1	415.5
Alternative 3: Ambient Background as 95th Percentile with 95th Confidence	63.6	10.1	73.7
Alternative 4: Ambient Background as Maximum Concentration	62.2	10.1	72.3
Alternative 5: Ambient Background as Geometric Mean	58.8	10.1	68.9
Alternative 6: 95th Percentile for LTA, MDL, and AML Occurrence Probability	66.3	10.1	76.4
Alternative 7: Zero Dilution	83.7	10.1	93.8

[1] Assumes 2,144 standard industrial users (SIUs) at an impacted rate of 30%, and a cost of $64,400 per SIU. Total costs are annualized at an interest rate of 7% over 5 years.

Table A–9~~VIII–11~~. Projected Annual Compliance Costs Attributable to the Interim Draft Policy (Millions of 1998 $/yr)

Scenario	Interim Draft Policy	Alternative 1: U.S. EPA Conversion Factors as Translators	Alternative 2: 1:1 Translator	Alternative 3: Ambient Background as 95th Percentile with 95th Confidence	Alternative 4: Ambient Background as Maximum Concentration	Alternative 5: Ambient Background as Geometric Mean	Alternative 6: 95th Percentile for LTA, MDL, and AML Occurrence Probability	Alternative 7: Zero Dilution
CTR under Interim Draft Policy	76.7	415.5	415.5	73.7	72.3	68.9	76.4	93.8
CTR under Existing Practices	84.3	84.3	84.3	84.3	84.3	84.3	84.3	84.3
Difference[1]	(7.6)	331.2	331.2	(10.6)	(12.0)	(15.4)	(7.9)	9.5

[1] Equals the cost of implementing the CTR under the Interim Draft Policy minus the cost of implementing the CTR under existing practices.

Table A–10~~VIII–12~~. Projected Annual Costs by Pollutant Control Option (Millions of 1998 $/yr)

Cost Component	Baseline	Interim Draft Policy	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5	Alternative 6	Alternative 7
Treatment Capital Cost	13.0	4.5	103.3	101.5	3.4	3.4	3.4	4.5	8.5
Treatment O&M	44.2	14.8	239.2	239.2	12.9	12.9	12.9	14.8	25.7
Pollutant Minimization	10.5	35.2	38.6	38.6	35.2	33.7	32.7	35.2	37.3
Process Optimization	4.4	9.1	21.1	22.9	9.1	9.1	6.8	8.8	9.1
Monitoring	2.1	3.0	3.3	3.3	3.0	3.1	3.0	3.0	3.1
Total[1]	74.2	66.6	405.4	405.4	63.6	62.2	58.8	66.3	83.7

[1] Does not include costs to indirect dischargers (estimated to be $10.1 million per year for all scenarios). Numbers may not add to totals due to rounding.

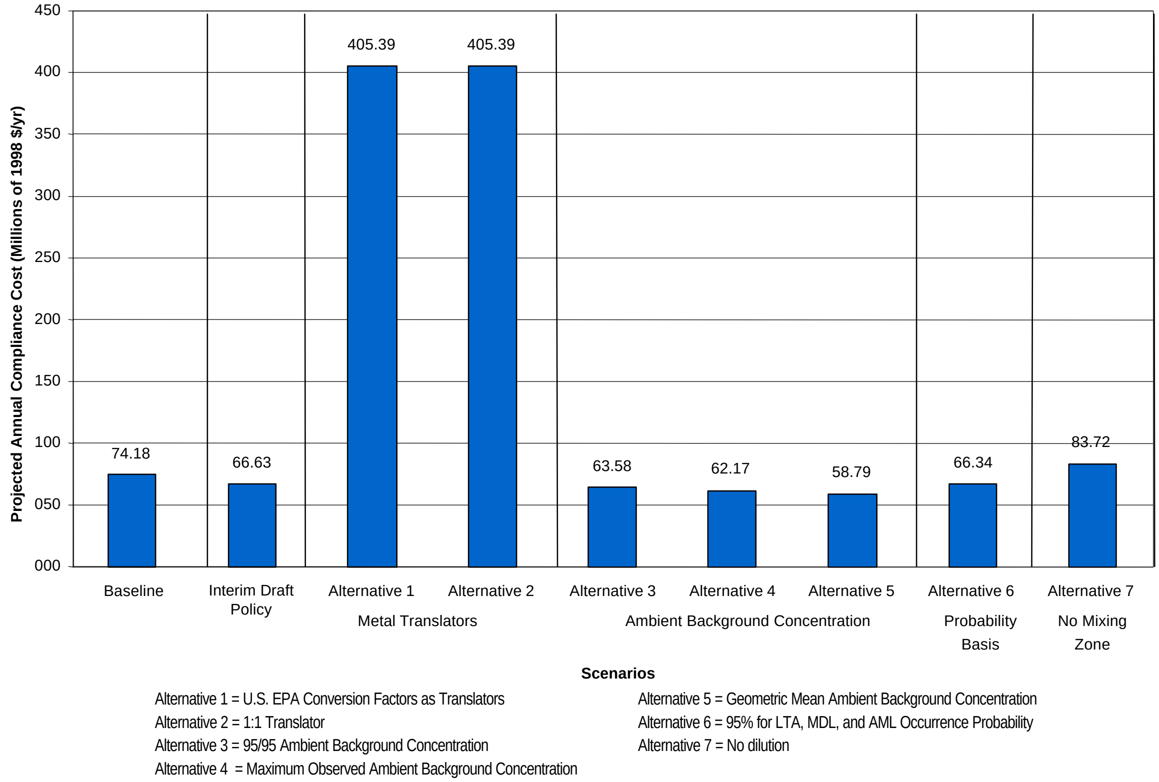
Table A–11~~VIII–13~~. Estimated Annual Compliance Costs by Facility Category (Millions of 1998 $/yr)

Category	Baseline	Interim Draft Policy	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5	Alternative 6	Alternative 7
POTW Majors	24.4	33.8	326.5	326.5	33.8	33.8	31.1	33.5	35.4
POTW Minors	21.3	3.9	21.6	21.6	3.9	3.6	3.6	3.9	3.9
Chemicals/Petroleum Prod.	13.1	17.4	30.5	30.5	14.9	14.0	13.5	17.4	29.7
Electric Utilities	9.2	1.1	10.5	10.5	1.1	1.1	1.1	1.1	1.1
Metals/Transport. Equip.	0.2	0.003	0.005	0.005	0.003	0.003	0.003	0.003	0.003
Miscellaneous Majors	5.8	4.8	10.6	10.6	4.1	3.9	3.8	4.8	7.9
Lumber/Paper	0.02	0	0.02	0.02	0	0	0	0	0
Industrial Minors	0.2	5.7	5.7	5.7	5.7	5.7	5.7	5.7	5.7
Total (direct dischargers)	74.2	66.6	405.4	405.4	63.6	62.2	58.8	66.3	83.7
Total (indirect dischargers)	10.1	10.1	10.1	10.1	10.1	10.1	10.1	10.1	10.1
Total Annual Costs[1]	84.3	76.7	415.5	415.5	73.7	72.3	68.9	76.4	93.8

[1]Numbers may not add to totals due to rounding.

Alternative 1 = U.S. EPA Conversion Factors as Translators
Alternative 2 = 1:1 Translator
Alternative 3 = 95/95 Ambient Background Concentration
Alternative 4 = Maximum Observed Ambient Background Concentration
Alternative 5 = Geometric Mean Ambient Background Concentration
Alternative 6 = 95% for LTA, MDL, and AML Occurrence Probability
Alternative 7 = No dilution

Figure A–1~~VIII-1~~. Projected Annual Compliance Costs by Scenario (direct discharges only)



The SWRCB estimates that under the Interim Draft Policy a significantly higher portion of the costs (66% of the costs to direct dischargers) would be incurred for pollutant minimization programs (PMP) and process optimization than under the Baseline scenario (20%). Treatment costs (capital and O&M) are projected to account for a much lower portion of the estimated total costs under the Interim Draft Policy (29% of the costs to direct dischargers) than under the Baseline (77%). This is a reflection, in part, of the PMP requirement of the reporting levels provision of the proposed Policy. However, as noted earlier, the SWRCB has likely overstated the cost of the reporting levels provision in this analysis. The reporting levels provision requires that certain evidence exist that a pollutant is present in the effluent above the projected effluent limit. The SWRCB assumed that this evidence exists and thus that sample facilities will incur costs associated with this provision, even though this will not likely be the case for many facilities.

Projected annual costs to direct dischargers, broken down by pollution control options, are listed in Table A–10~~VIII–12~~. Table A–11~~VIII–13~~ displays the projected costs for each scenario, broken down by facility category.

BASELINE

Under the Baseline scenario, the SWRCB estimated that CTR implementation would cost $84.3 million annually (1998 dollars). These projected costs are $7.6 million greater than estimated costs under the Interim Draft Policy scenario. For the Baseline scenario, POTWs (majors and minors) would bear the greatest portion of costs, $45.7 million annually (54% of the total and 62% of the total costs to direct dischargers). Facilities expected to bear the next highest portion of costs are majors in the chemical and petroleum products industry, with total estimated costs of

$13.1 million per year (16% of total costs and 18% of total direct discharger costs). Total estimated costs per facility category are shown in Table A–11~~VIII–13~~.

To control pollutant discharges, facilities may be expected to implement one or more pollution control options. On an annual cost basis, the SWRCB estimated that the greatest costs for pollution control would be for operations and maintenance (O&M) for treatment installed to reduce effluent pollutant levels. The next highest annual costs would be significantly lower and would be incurred for capital costs for treatment equipment, followed closely by pollutant minimization program costs. Total estimated costs per pollutant control option are shown in Table A–10~~VIII–12~~.

INTERIM DRAFT POLICY

Under the Interim Draft Policy, the SWRCB estimated that CTR implementation would cost $76.7 million annually (1998 dollars). These projected costs are $7.6 million less than estimated costs under the Baseline scenario. For the Interim Draft Policy scenario, POTWs (majors and minors) would bear the greatest portion of costs, $37.7 million annually (49% of the total, and 57% of the total costs to direct dischargers). Facilities expected to bear the next highest portion of costs are majors in the chemical and petroleum products industry, with total estimated costs of $17.4 million per year (23% of total costs, and 26% of total direct discharger costs). Total estimated costs per facility category are shown in Table A–11~~VIII–13~~.

To control pollutant discharges, facilities may be expected to implement one or more pollution control options. On an annual cost basis, the SWRCB estimated that the greatest costs for pollution control would be for pollutant minimization (53% of costs to direct dischargers). The next highest annual costs would be significantly lower and would be incurred for O&M for treatment installed to reduce pollutant effluent levels (22% of costs to direct dischargers). Total estimated costs per pollutant control option are shown in Table A–10~~VIII–12~~. Note that the costs for pollutant minimization are likely overstated since a portion of those costs are attributed to the reporting levels provision of the Interim Draft Policy. To require a PMP and influent monitoring under the reporting levels provision requires that certain evidence exist that a pollutant is present in the effluent above the projected effluent limit. The SWRCB assumed that this evidence exists and thus that sample facilities will incur costs associated with this provision for all effluent limits below the RL, even though this will not likely be the case for many facilities.

ALTERNATIVE 1 – Effects of Using U.S. EPA Conversion Factors for Metals Translators

Under Alternative 1, the SWRCB would implement the Interim Draft Policy using U.S. EPA conversion factors for metals translators, rather than giving facilities the option of either conducting site-specific studies or using U.S. EPA conversion factors as under the Interim Draft Policy. The projected cost of Alternative 1, $415.5 million annually, is substantially higher than the projected cost of the baseline ($84.3 million annually) and of the Interim Draft Policy ($76.7 million annually). Thus, on a statewide basis, facilities would be expected to incur almost $331.2 million of additional costs per year under Alternative 1 in comparison with the Baseline and $338.8 million of additional costs annually in comparison with the Interim Draft Policy. This cost difference indicates that not allowing facilities to perform studies to develop site-specific metals translators would have a major impact on the cost incurred by facilities to comply with effluent limits resulting from the CTR. Most facilities are expected to perform site-specific studies if they would be subject to metals effluent limits since metals translators developed from the studies are likely to result in less stringent limits for metals. However, if many of these facilities choose not to perform site-specific translator studies, costs under the Interim Draft Policy could approach the level of costs estimated for Alternative 1.

ALTERNATIVE 2 – Effects of Using 1:1 Metals Translators

Alternative 2 is similar to Alternative 1, except that the SWRCB would implement the Interim Draft Policy using 1:1 metals translators. The 1:1 translators would be used instead of the Interim Draft Policy method of giving facilities the option of either conducting site-specific studies or using U.S. EPA conversion factors. The projected cost of Alternative 2 is nearly the same as for Alternative 1 and is also $415.5 million annually, again substantially higher than the projected cost for the Baseline and the Interim Draft Policy. Thus, on a statewide basis, facilities would be expected to incur almost $331.2 million of additional costs per year under Alternative 2 compared to the Baseline and $338.8 million of additional costs annually compared to the Interim Draft Policy. This cost difference indicates that not allowing facilities to perform studies to develop site-specific metals translators would have a major impact on the cost incurred by facilities to comply with effluent limits resulting from the CTR. Most facilities are expected to perform site-specific studies if they would be subject to metals effluent limits metals translators developed from the studies are likely to result in less stringent limits for metals.

ALTERNATIVE 3 – Effects of Lowering the Certainty Factors for Ambient Background Concentrations

With Alternative 3, ambient background concentrations would be calculated using the 95th percentile at the 95% confidence level, rather than the Interim Draft Policy's 99th percentile at the 99% confidence level. The effect of changing how ambient background concentrations are calculated reduces projected costs by nearly $3.1 million annually from the Interim Draft Policy cost of $76.7 million a year. Under Alternative 3 projected costs are $73.7 million annually, resulting in projected cost savings of $10.6 million annually compared to the Baseline.

Ambient background concentrations calculated using Alternative 3 will generally be lower than the values calculated for the Interim Draft Policy scenario since using the 95th percentile at 95% confidence level results in less certainty. Lower ambient background concentrations result in less stringent effluent limits if the ambient background concentration is less than the applicable criterion for a given pollutant, therefore costs to comply with the effluent limits are likely to be lower. Much of the cost reduction (79%) is projected for the chemicals and petroleum products industry.

ALTERNATIVE 4 – Effects of Using the Maximum for Ambient Background Concentration

Under Alternative 4, the ambient background concentration is set to the maximum observed value from receiving water monitoring, instead of the 99th percentile at 99% confidence level value of the of the monitoring data. This change in determining the ambient background concentration results in projected costs of $72.3 million annually, which is $4.5 million less on an annual basis than for the Interim Draft Policy scenario. Alternative 4 results in projected cost savings of $12.0 million annually in comparison with the Baseline.

Ambient background concentrations calculated using Alternative 4 will generally be lower than the values calculated for the Interim Draft Policy since using the maximum observed value is lower than the 99th percentile at 99% confidence level value which factors in uncertainty. Lower ambient background concentrations result in less stringent effluent limits if the ambient background concentration is less than the applicable criterion for a given pollutant, therefore costs to comply with the effluent limits are likely to be lower. Much of the cost reduction (75%) is projected for the chemicals and petroleum products industry.

ALTERNATIVE 5 – Effects of Using the Geometric Mean for Ambient Background Concentrations

The geometric mean of the observed ambient background concentrations is used for Alternative 5, in place of the 99th percentile at 99% confidence level used for the Interim Draft Policy. The effect of using the geometric mean is to lower projected costs to $68.9 million annually, which is $7.8 million lower than the projected annual costs under the Interim Draft Policy. Alternative 5 is projected to provide cost savings of $15.4 million annually in comparison with the Baseline.

Ambient background concentrations calculated using Alternative 5 will generally be lower than the 99th percentile at 99% confidence level value, which factors in uncertainty. Lower ambient background concentrations result in less stringent effluent limits if the ambient background concentration is less than the applicable criterion for a given pollutant, therefore costs to comply with the effluent limits are likely to be lower. The projected cost reduction is projected for POTWs (38% of the cost reduction) and the chemicals and petroleum products industry (50% of the cost reduction).

ALTERNATIVE 6 – Effects of Lowering the Occurrence Probability

Alternative 6 uses a different occurrence probability, the 95th percentile, to calculate long term averages (LTAs) and maximum daily limits than the 99th percentile used for the Interim Draft Policy. The effect of this alternative is estimated to be minimal, with a projected cost reduction of $0.3 million annually statewide in comparison with the Interim Draft Policy. Costs for Alternative 6 are estimated to be $76.4 million annually, representing a cost savings of $7.9 million annually compared to the Baseline.

Based on the methodology used by the SWRCB to calculate projected effluent limits, changing the occurrence probability affects the LTAs calculated for acute and chronic aquatic life criteria. If one of these LTAs is not the lowest of the calculated LTAs, the LTA would be the same under both Alternative 6 and the Interim Draft Policy since the lowest LTA is used to calculate average monthly limits and maximum daily limits. Even if the lowest LTA is not based on aquatic life criteria, use of the 95th percentile could result in a lower maximum daily limit since the maximum daily limit multiplier would be lower using the 95th percentile. In determining projected effluent limits for this analysis, the SWRCB always selected the lowest calculated effluent limit since this would result in a more conservative analysis.

ALTERNATIVE 7 – Effects of No Dilution

For the analysis of the Interim Draft Policy scenario, the SWRCB provided dilution to those facilities that currently receive dilution under their existing permits. Alternative 7 reflects the effects of providing no dilution to any facilities, and therefore provides an estimate of additional costs that could be incurred if facilities currently receiving dilution lose their dilution. The projected costs under Alternative 7 show that eliminating facilities' dilution would likely result in an estimated cost increase of $17.1 million per year over the Interim Draft Policy scenario. Alternative 7 is projected to cost $93.8 million annually, which is $9.5 million a year more compared to the Baseline.

The projected increase in cost over the Interim Draft Policy would mostly be incurred by facilities in the chemicals and petroleum products category ($12.3 million, or 72%). The effect of eliminating dilution for the facilities that currently receive dilution may be significant for some facilities (estimated annual costs increased 22% under Alternative 7 in comparison to the Interim Draft Policy), but will likely have little effect on other facilities receiving dilution. Many facilities do not receive dilution and would not be affected by a change in granting of dilution.

ALTERNATIVE 8 – Effects of Maximum Dilution

Under Alternative 8, facilities were given maximum theoretical dilution based on the flow of the receiving water. The SWRCB could not estimate costs for Alternative 8 because the flow data needed to determine maximum theoretical dilution were not available for some of the facilities in the sample set. Since projected costs for the full sample could not be developed, the SWRCB could not develop a reasonable extrapolation to a statewide basis.

INDIRECT DISCHARGERS

There are an estimated 2,144 SIUs that discharge to POTWs situated on California inland surface waters and enclosed bays and estuaries. The SWRCB estimated that 30% of these dischargers, or 643 SIUs, would be affected by implementation of the CTR. At an average annual cost of $15,705 per year for each SIU, the estimated total cost to indirect dischargers is $10.1 million. This cost would be the same under both the Baseline and the Interim Draft Policy. Therefore, the cost attributed to the Interim Draft Policy is zero.

ATTACHMENT ~~CHAPTER~~ A-2.3. POTENTIAL BIASES AND UNCERTAINTIES IN THE ANALYSIS

The SWRCB made several assumptions to facilitate the economic analysis and address data limitations. The SWRCB generally chose assumptions that would tend to result in more stringent effluent limits and therefore more costly controls than may ultimately be required under the Interim Draft Policy. As a result, overall costs attributed to the Interim Draft Policy may be overstated. However, a few of the assumptions may have a downward bias, potentially understating costs. The assumptions and their potential impact on the analysis are summarized in Table A–12~~VIII–14~~.

Table A–12~~VIII–14~~. Biases and Uncertainties in the Analysis

Assumption	Potential Impact on Costs	Comments
Facilities always required to implement a PMP if projected effluent limit and discharge concentrations are below the RL	+	Under the reporting levels provision, facilities only required to implement PMPs and conduct influent monitoring if there is evidence that the facility is discharging the pollutant between the ML and the effluent limit.
Comparing the AML to data representing only one sample per month	?	Additional samples in a month could either raise or decrease the monthly average.

Table ~~A–12VIII–14~~. Biases and Uncertainties in the Analysis

Assumption	Potential Impact on Costs	Comments
Use of theoretical partitioning coefficients for metals translators	–	The cost of metals translator studies is not included. If facilities do not perform site-specific metals translator studies, the translators that would be used are likely to result in more stringent effluent limits for metals.
Use of lowest of the calculated limits rather than setting separate daily and monthly limits	+	Results in higher estimated costs since monthly limits are typically lower than daily limits
Effluent monitoring costs included for all pollutants with reasonable potential; influent monitoring costs included for all pollutants falling under the reporting levels provision, and for some other pollutants with PMPs	+	Monitoring costs may be overstated since many facilities are already monitoring for these pollutants or monitoring may not actually be required.
Treatment costs based on U.S. EPA (1992a)	?	Facilities may experience higher or lower actual treatment costs
Capital costs will be financed over 10 years	+	The useful life of capital equipment is often more than 10 years, so costs may be overstated
Residuals management costs for RO and GAC not included	–	Cost curves in EPA's treatability manual (1992a) do not include residuals management costs for RO and GAC. Facilities could incur costs for these residuals, however, the analysis shows limited use of these treatment methods (only one facility used GAC under Interim Draft Policy scenario; none used RO)
Use of water effects ratios (WERs) not included	+	Costs may be overstated since WERs may be available to dischargers on a site-specific basis. Use of WERs may result in less stringent effluent limits and, thus, lower costs.
Use of SSOs and TMDLs not included.	?	If SSOs and TMDLs apply, a facility may experience higher or lower compliance costs.

Key: + = Costs are potentially overstated – = Costs are potentially understated ? = Affect on costs is unknown.

ATTACHMENT ~~CHAPTER~~ A-2.4. SENSITIVITY ANALYSES

IMPACTS OF REPORTING LEVELS PROVISION

The estimated cost of the Interim Draft Policy scenario, presented in the previous attachment~~chapter~~, includes the cost of implementing the reporting levels provision. The reporting levels provision specifies that, when evidence exists that a pollutant is present in the effluent above the projected effluent limit and the projected effluent limit is lower than the RL, the discharger must implement a PMP and conduct influent monitoring.[7] To evaluate the impact of this provision on the estimated costs of the Interim Draft Policy scenario, the SWRCB assessed how removing the provision would affect pollution control choices for the sample facilities.

In estimating the cost of the Interim Draft Policy scenario, the SWRCB assumed that a facility would implement a PMP and conduct influent monitoring when a projected effluent limit and the

[7] Types of evidence include fish consumption advisories in the receiving waters, monitoring results from more sensitive methods, whole effluent toxicity, and benthic and aquatic organism tissue sampling.

existing discharge condition are below the RL for a particular pollutant.[8] The SWRCB also assumed that facilities would take these actions even if they do not have an existing permit limit or effluent monitoring data for a pollutant but the projected effluent limit is below the RL. Finally, the SWRCB assumed that facilities would take the same actions to comply with the reporting levels provision for pollutants with projected effluent limits below the RL and for which the facility would need to implement controls to reduce discharge concentrations to the RL. However, if the control needed to reach the RL is a PMP, the SWRCB did not add the cost of a PMP for the reporting levels provision. These assumptions may result in an overestimate of the cost. This is because the reporting levels provision requires that certain evidence exist that a pollutant is present in the effluent above the projected effluent limit. The SWRCB assumed that this evidence exists and thus the sample facilities will incur costs associated with this provision, even though this will not likely be the case for many facilities.

In estimating the impact of the reporting level provision on the cost of implementing the CTR under the Policy, the SWRCB found that 21 of the 27 sample facilities would likely incur the same pollution control costs with or without the reporting levels provision. The main reason for this is that, in both scenarios, the sample facilities would need to implement a PMP (in one case because of the reporting levels provision and in the other to meet projected effluent limits). Also, some facilities would find that particular pollutants no longer require actions without the reporting levels provision, but that they would nonetheless incur the cost of a PMP to meet projected effluent limits for other similar pollutants. Therefore, the controls needed would remain unchanged.[9] However, for the remaining six sample facilities, fewer compliance actions may be required without the reporting levels provision.

When the cost of these changes is extrapolated to the total facilities in the State, the impact is minimal. As shown in Table A–13~~VIII–15~~, the cost savings attributable to the Interim Draft Policy is $7.6 million with the reporting levels provision and is $13.7 million without the provision.

Table A–13~~VIII–15~~. Sensitivity of Costs to Reporting Levels Provision (Millions of 1998 $/yr)

Scenario	Total Estimated Annual Cost[1]	Incremental Cost	Percent Change in Cost from Baseline
Baseline	74.2	NA	NA
Interim Draft Policy with Reporting Levels Provision	66.6	–7.6	–10%
Interim Draft Policy without Reporting Levels Provision	60.5	–13.7	–18%

[1]Does not include costs to indirect dischargers (estimated to be $10.1 million per year) for all scenarios.

[8] The existing discharge condition is the lower of the existing permit limit and the maximum observed effluent concentration from monitoring.

[9] In estimating needed pollutant controls and monitoring, the SWRCB grouped similar pollutants (e.g., copper and lead) since the pollutants are likely to come from the same source and can be addressed by the same PMP or other control and a single sample can be analyzed for the group.

EFFECT OF USING DIFFERENT COMPLIANCE METHODS TO CONTROL DISINFECTION BYPRODUCTS (DBPS)

The estimated costs presented in Chapter 2 include pollution controls for disinfection byproducts (DBPs). DBPs such as chloroform, chlorodibromomethane, and dichlorobromomethane are found at concentrations of concern in six out of the 27 sample facilities. The SWRCB estimated that these six sample facilities would need DBP controls to meet projected effluent limits for the Interim Draft Policy scenario, and three of these six facilities would need DBP controls for the Baseline scenario. The SWRCB estimated that process optimization would likely be sufficient for the control of DBPs in all of these facilities.

As a sensitivity analysis, the SWRCB estimated the potential cost impacts of using other methods for DBP control at facilities where DBPs are discharged at levels significantly above projected effluent limits (five of the six facilities).[10] The SWRCB believes that these facilities may consider other DBP control options including: 1) replacing chlorine disinfection with ultraviolet light (UV) disinfection treatment, and 2) adding ammonia to the treated effluent. These methods would only be options for facilities currently using chlorination. The SWRCB estimated capital and O&M costs for UV disinfection and ammonia addition for these facilities using the assumptions and references presented in Table A–14~~VIII–16~~.

Table A–14~~VIII–16~~. Assumptions for Estimating DBP Control Costs

UV Disinfection	Ammonia Addition
▪ Open unit continuous wave low pressure UV disinfection ▪ For high turbidity wastewater effluent, sedimentation and/or filtration prior to UV disinfection (1-micron pretreated filter) ▪ Iron content < 0.1ppm ▪ Turbidity < 5 NTU ▪ Dosage: 140 mWs/cm^2 minimum ▪ Wavelength: 250–265 nm ▪ Lamp length: 6 feet ▪ Minimum nominal detention time: 10 seconds	▪ Anhydrous ammonia used ▪ Dosage: 3:1 chlorine/ammonia ratio ▪ Costs based on ammonia and feed facilities ▪ Storage facilities provide a 10-day storage ▪ Dry ammonia gas is fed directly to the point of application

Source: Parrota and Bekdash (1998), U.S. EPA (1996), U.S. EPA (1979), and WERF (1995).

The SWRCB estimated that the use of UV disinfection would result in annual costs for the Interim Draft Policy of $124.9 million (including direct and indirect dischargers). Compared to the estimated cost of the Interim Draft Policy using the initial projected means of compliance (process optimization), this reflects an increase of $48.2 million per year. The addition of ammonia to control the discharge of DBPs would result in annual costs of $74.9 million, which is a decrease of $1.8 million per year compared to the initial projected means of compliance. Table A–15~~VIII–17~~ presents projected statewide costs, including the cost attributable to the Interim Draft Policy. Note that since some facilities in California are already migrating to UV disinfection, implementation of the CTR under any of the scenarios may result in lower costs for

[10] The SWRCB did not include the sixth facility (Sacramento) because DBP discharges are at very low levels. Therefore, the SWRCB believes that process optimization is a reasonable means of compliance with projected effluent limits and the facility is not likely to explore other DBP control options.

DBP control than projected.

Table A–15~~VIII–17~~. Total Projected Annual Compliance Costs with Alternative Controls for DBPs (Millions of 1998 $/yr)

Scenario	Process Optimization	UV Disinfection	Ammonia Addition
CTR Under Baseline	84.3	120.3	83.3
CTR Under Interim Draft Policy	76.7	124.9	74.9
Difference	(7.6)	4.6	(8.4)

As shown in Table A–15~~VIII–17~~, if most facilities chose to install UV disinfection treatment to control the level of DBPs in their discharges, the SWRCB estimates the cost of the Interim Draft Policy ($124.9 million annually) to be greater than the cost of the Baseline scenario ($120.3 million annually). Since more facilities are projected to need DBP control under the Interim Draft Policy than the Baseline and UV disinfection costs are greater than process optimization, switching to UV disinfection increases Interim Draft Policy costs relative to the Baseline. Alternatively, if most facilities were to use ammonia addition as a means of controlling DBPs, the Interim Draft Policy may result in an overall cost savings of $8.4 million a year.

EFFECT OF USING MAXIMUM DAILY LIMITS TO CALCULATE EFFLUENT LIMITS

The estimated costs presented in the previous attachment ~~chapter~~ are based on effluent limits based on the average monthly limit (AML) which is the most stringent of the AML and the maximum daily limit. As another sensitivity analysis, the SWRCB evaluated the potential impact of using the maximum daily limit instead of the AML to estimate compliance costs. The SWRCB performed this analysis for the Interim Draft Policy scenario.

Using the maximum daily limit to estimate potential compliance costs resulted in a substantial decrease in cost (30%) with respect to the Interim Draft Policy Scenario (i.e., using the AML). The SWRCB estimated that only one of the 27 sample facilities would be likely to install treatment to meet maximum daily limits. In comparison, the SWRCB anticipated that two facilities would need to install treatment to meet AMLs. The facility that would no longer need to install treatment would likely use process optimization instead to meet projected effluent limits. This is because the necessary pollutant reductions would be lower and reported effluent data suggested that the facility is most often in compliance with the maximum daily limit. Using the maximum daily limit also results in fewer PMP and process optimization costs in three other sample facilities.

Thus, the SWRCB estimates that the use of effluent limits based on maximum daily limits would likely lead to a substantial reduction in cost since facilities would be faced with less stringent effluent limits. The effluent limits would be less stringent since the maximum daily limit is higher than the AML.

EFFECT OF ADDING ANOTHER SAMPLE FACILITY

As a sensitivity analysis, the SWRCB analyzed an additional facility and the effect on estimated statewide compliance costs if this facility were included in the sample. The additional facility is a medium size POTW (discharge flow between 10 MGD and 100 MGD) discharging to San

Francisco Bay. The SWRCB randomly selected the facility, Delta Diablo Sanitation District, from the list of San Francisco Bay dischargers provided by the California Association of Sanitation Agencies.

The SWRCB estimated compliance costs for Delta Diablo and included this facility in the sample for extrapolating costs to the State. For all the scenarios except the Baseline and Alternative 7, the projected statewide compliance costs are lower with Delta Diablo as part of the sample. A summary of the projected costs is presented in Table A–16~~VIII–18~~. The statewide projected compliance costs are lower with Delta Diablo because estimated costs for Delta Diablo are lower than the average compliance costs for the other sample facilities in the same category.

Table A–16~~VIII–18~~. Compliance Costs with Additional Sample Facility[1]

Scenario	Projected Compliance Costs (Millions of 1998 $/yr)[2]	
	Original Sample	With Delta Diablo
Baseline	74.2	74.3
Interim Draft Policy	66.6	66.5
Alternative 1	405.4	376.6
Alternative 2	405.4	376.6
Alternative 3	63.6	62.9
Alternative 4	62.2	61.5
Alternative 5	58.8	58.2
Alternative 6	66.3	66.2
Alternative 7	83.7	84.2

[1] Subsequent to this analysis, the SWRCB obtained additional data for ambient background concentrations. The SWRCB will revise this sensitivity analysis to incorporate these data in the next round of the analysis.
[2] Direct dischargers only.

EFFECT OF THE GLI METHOD FOR DETERMINING REASONABLE POTENTIAL

As a final sensitivity analysis, the SWRCB analyzed how the costs presented in Attachment ~~Chapter~~ A-2.3 would be affected if reasonable potential were determined using the method established in the Great Lakes Water Quality Guidance (GLI method). For the sample facilities, the number of pollutants with reasonable potential under the Interim Draft Policy and GLI methods, as well as under the Baseline (existing practices), is shown in Table A–17~~VIII–19~~. (A more detailed table showing reasonable potential on a pollutant-by-pollutant basis for each sample facility is included in Attachment B~~1~~.) The estimated change in statewide costs is presented in Table A–18~~VIII–20~~.

Under the GLI method, the number of pollutants with reasonable potential drops to 338 from the 455 estimated using the Interim Draft Policy method. Estimated annual statewide costs are $56.8 million using the GLI method, compared to $66.6 million using the Interim Draft Policy method (a 15% decrease). These estimates do not include costs to indirect dischargers.

Fewer pollutants are shown to have reasonable potential under the GLI method because dilution is considered or because ambient background concentrations are not considered, compared to the Interim Draft Policy method. Estimated cost reductions are moderate, however, because many of the pollutants affected are ones that require only PMPs under the Interim Draft Policy, often because of the reporting levels provision, as opposed to a more costly control. In addition, since the SWRCB was conservative in estimating PMP costs under the reporting levels provision (see above sensitivity analysis) and therefore likely overstated costs, the difference in cost between the two reasonable potential methods may also be overstated.

Table A–17~~VIII–19~~. Number of Pollutants with Reasonable Potential at Sample Facilities

Facility	Reasonable Potential Method		
	Baseline	Interim Draft Policy	GLI
City of Arcata Wastewater Treatment Plant (WWTP)	17	25	~~27~~26
City of Colton Municipal WWTP	0	57	~~44~~28
Coachella Sanitary District WWTP No. 1	55	54	48
E.I. DuPont de Nemours and Company (Antioch)	3	12	~~3~~1
Exxon Refinery (Benecia)	18	38	~~20~~15
City of Merced Wastewater Treatment Facility	0	7	5
Riverside Regional Water Quality Control Plant	7	61	~~46~~47
Sacramento Regional WWTP	4	82	~~31~~22
San Jose-Santa Clara Water Pollution Control Plant	5	23	8
Sunnyvale Water Pollution Control Plant	3	1	1
City of Los Angeles Tillman Water Reclamation Plant	17	13	14
Unocal (Carson)	13	3	2
City of San Juan Bautista WWTP	34	12	12
City of Biggs	0	0	1
City of Calistoga	~~11~~12	13	~~8~~7
Collins Pine (Chester)	1	0	2
Donner Summit PUD WWTP	56	38	45
Forestville County Sanitation District	7	6	~~5~~6
Great Lakes Chemical Corporation	3	1	0
Navy Public Works Center (San Diego)	0	3	3
Pacific Gas & Electric, Hunters Point (Outfall 001)	8	2	3
Pacific Gas & Electric, Hunters Point (Outfall 002)	8	1	5
Boeing North American (Santa Susana)	7	1	3
San Diego Gas & Electric (South Bay Power Plant)	0	2	2
Airline Signal Aerospace (Torrance)	0	0	0
CA Dept of Fish and Game, Iron Gate Salmon Hatchery	0	0	0
Lennox County Park	0	0	0
Sierra Pacific Industries (Quincy Division)	0	0	0
Total	~~277~~278	455	~~338~~306

Table A–18~~VIII–20~~. Estimated Annual Statewide Costs to Direct Dischargers for Different Reasonable Potential Methods (Millions of 1998 $/yr)

Baseline	Interim Draft Policy	GLI Method
$74.2	$66.6	$56.8

ATTACHMENT B

POLLUTANTS WITH REASONABLE POTENTIAL AT SAMPLE FACILITIES

Note that this table replaces Attachment 1 from the previous draft of the FED and reflects the current proposed Policy methodology for determining which priority pollutants will require water quality-based effluent limitations.

Comparison of Reasonable Potential by Facility and Pollutant under the Baseline, Proposed Policy, and Great Lakes Initiative Methods[1, 2]

	Arcata			Colton			Coachella			DuPont			Exxon			Merced			Riverside			Sacramento		
Pollutants	BL	PP	GLI	BL	PP	GLI	BL	PP	GLI	BL	PP	GLI	BL	PP	GLI	BL	PP	GLI	BL	PP	GLI	BL	PP	GLI
Antimony									X															
Arsenic (As-III)																								
Cadmium (Cd)	X		X				X															X		
Chromium-VI (Cr-VI)			X						X														X	
Copper (Cu)	X	X	X		X		X		X				X	X					X	X	X	X		
Lead (Pb)	X		X				X			X	X		X									X	X	
Mercury (Hg)	X				X		X						X	X					X	X	X		X	
Nickel (Ni)	X		X						X				X											
Selenium (Se)									X				X	X					X	X	X			
Silver (Ag)							X						X	X	X				X					
Thallium							X																	
Zinc (Zn)													X									X		
1,1,2,2-Tetrachloroethane																							X	
1,1,2-Trichloroethane							X														X			
1,1-Dichloroethylene			X																				X	
1,2-Dichlorobenzene																								
1,2-Dichloroethane							X																X	
1,2-Dichloropropane							X														X			
1,2-Diphenylhydrazine																							X	
1,2-Trans-Dichloroethylene																								
1,3-Dichlorobenzene																								
1,3-Dichloropropylene																								
1,4-Dichlorobenzene																								
2,4,6-Trichlorophenol							X																X	

Comparison of Reasonable Potential by Facility and Pollutant under the Baseline, Proposed Policy, and Great Lakes Initiative Methods[1, 2]

Pollutants	Arcata			Colton			Coachella			DuPont			Exxon			Merced			Riverside			Sacramento		
	BL	PP	GLI	BL	PP	GLI	BL	PP	GLI	BL	PP	GLI	BL	PP	GLI	BL	PP	GLI	BL	PP	GLI	BL	PP	GLI
2,4-Dichlorophenol																								
2,4-Dimethylphenol																								
2,4-Dinitrophenol																					X			
2,4-Dinitrotoluene							X																X	
2-Chloronaphthalene																								
2-Chlorophenol																								
2-Methyl-4,6-Dinitrophenol									X															
3,3-Dichlorobenzidine							X																X	
4,4'-DDD							X																X	
4,4'-DDE							X																X	
4,4'-DDT	X						X																X	
Acenaphthene																								
Acrolein									X												X			
Acrylonitrile							X																X	
Aldrin	X		X			X	X		X						X						X		X	X
alpha-BHC	X		X			X	X		X						X						X		X	
alpha-Endosulfan	X		X				X		X						X						X			
Anthracene																								
Benzene							X		X												X			
Benzidine						X	X		X												X		X	X
Benzo (a) Anthracene			X			X	X		X				X								X		X	X
Benzo (a) Pyrene			X			X	X		X				X								X		X	X
Benzo (b) Fluoranthene			X			X	X		X				X								X		X	
Benzo (k) Fluoranthene			X			X	X		X				X	X	X						X		X	X
beta-BHC	X		X				X		X												X			
beta-Endosulfan			X				X		X												X			X
Bis (2-Chloroethyl) Ether						X	X		X												X		X	X

Comparison of Reasonable Potential by Facility and Pollutant under the Baseline, Proposed Policy, and Great Lakes Initiative Methods[1, 2]

Pollutants	Arcata			Colton			Coachella			DuPont			Exxon			Merced			Riverside			Sacramento		
	BL	PP	GLI	BL	PP	GLI	BL	PP	GLI	BL	PP	GLI	BL	PP	GLI	BL	PP	GLI	BL	PP	GLI	BL	PP	GLI
Bis (2-Chloroisopropyl) Ether																								
Bis (2-Ethylhexyl) Phthalate						X	X		X						X						X		X	
Bromoform							X		X															
Butylbenzyl Phthalate																								
Carbon Tetrachloride			X		X	X	X		X		X										X		X	
Chlordane						X	X		X						X						X		X	X
Chlorobenzene																								
Chlorodibromomethane					X	X	X		X		X						X	X	X	X	X		X	
Chloroform					X	X	X		X								X	X	X	X	X		X	
Chrysene			X			X	X		X				X	X	X						X		X	X
Dibenzo (a,h) Anthracene			X			X	X		X				X		X						X		X	X
Dichlorobromomethane					X	X	X		X								X	X	X	X	X		X	
Dieldrin	X		X			X	X		X					X	X						X		X	X
Diethyl Phthalate																								
Dimethyl Phthalate																								
Di-n-Butyl Phthalate																								
Endosulfan Sulfate																								
Endrin	X		X				X		X						X						X			X
Endrin Aldehyde									X															
Ethylbenzene																								
Fluoranthene													X											
Fluorene																								
gamma-BHC					X		X		X						X		X	X			X		X	
Heptachlor	X		X			X	X		X					X	X						X		X	X
Heptachlor Epoxide	X		X			X	X		X												X		X	X
Hexachlorobenzene						X	X		X												X		X	X
Hexachlorobutadiene						X	X		X												X			X

Comparison of Reasonable Potential by Facility and Pollutant under the Baseline, Proposed Policy, and Great Lakes Initiative Methods[1, 2]

Pollutants	Arcata			Colton			Coachella			DuPont			Exxon			Merced			Riverside			Sacramento		
	BL	PP	GLI	BL	PP	GLI	BL	PP	GLI	BL	PP	GLI	BL	PP	GLI	BL	PP	GLI	BL	PP	GLI	BL	PP	GLI
Hexachlorocyclopentatadiene																								
Hexachloroethane						X	X		X												X			
Indeno (1,2,3-cd) Pyrene			X			X	X		X				X								X		X	X
Isophorone							X		X												X			
Methyl Bromide																								
Methylene Chloride					X		X		X											X	X		X	
Nitrobenzene									X												X			
N-Nitrosodimethylamine						X	X		X												X		X	X
N-Nitrosodi-n-Propylamine						X	X		X												X		X	X
N-Nitrosodiphenylamine							X		X												X			
PCBs	X		X			X	X		X	X	X		X	X	X						X			X
Pentachlorophenol						X	X		X												X		X	X
Phenol																								
Pyrene																								
TCDD	X		X										X	X	X						X			
Tetrachloroethylene					X					X	X	X					X	X			X			
Toluene													X											
Toxaphene	X		X			X	X		X												X		X	X
Trichloroethylene																								
Vinyl Chloride							X		X															

Comparison of Reasonable Potential by Facility and Pollutant under the Baseline, Interim Draft Policy, and Great Lakes Initiative Methods[1, 2]

	San Jose			Sunnyvale			Tillman			Unocal			Bautista			Biggs			Calistoga			Collins		
Pollutants	BL	PP	GLI	BL	PP	GLI	BL	PP	GLI	BL	PP	GLI	BL	PP	GLI	BL	PP	GLI	BL	PP	GLI	BL	PP	GLI
Antimony										X														
Arsenic (As-III)							X			X			X											
Cadmium (Cd)										X			X						X					
Chromium-VI (Cr-VI)							X	X	X				X	X	X									
Copper (Cu)	X	X	X	X			X	X	X	X	X	X	X		X				X			X		X
Lead (Pb)		X					X		X				X					X	X					
Mercury (Hg)	X		X	X	X	X	X	X	X				X						X					
Nickel (Ni)	X	X		X			X						X											
Selenium (Se)													X	X	X									
Silver (Ag)							X						X		X				X					
Thallium																								
Zinc (Zn)	X									X	X	X	X											X
1,1,2,2-Tetrachloroethane																								
1,1,2-Trichloroethane																								
1,1-Dichloroethylene																								
1,2-Dichlorobenzene													X											
1,2-Dichloroethane																								
1,2-Dichloropropane																								
1,2-Diphenylhydrazine																								
1,2-Trans-Dichloroethylene																								
1,3-Dichlorobenzene													X											
1,3-Dichloropropylene																								
1,4-Dichlorobenzene													X											
2,4,6-Trichlorophenol													X											
2,4-Dichlorophenol																								
2,4-Dimethylphenol																								

Comparison of Reasonable Potential by Facility and Pollutant under the Baseline, Interim Draft Policy, and Great Lakes Initiative Methods[1, 2]

	San Jose			Sunnyvale			Tillman			Unocal			Bautista			Biggs			Calistoga			Collins		
Pollutants	BL	PP	GLI	BL	PP	GLI	BL	PP	GLI	BL	PP	GLI	BL	PP	GLI	BL	PP	GLI	BL	PP	GLI	BL	PP	GLI
2,4-Dinitrophenol										X														
2,4-Dinitrotoluene																								
2-Chloronaphthalene																								
2-Chlorophenol																								
2-Methyl-4,6-Dinitrophenol																								
3,3-Dichlorobenzidine																								
4,4'-DDD		X																						
4,4'-DDE		X																						
4,4'-DDT		X					X	X	X				X											
Acenaphthene																								
Acrolein																								
Acrylonitrile																								
Aldrin			X				X	X	X				X		X									
alpha-BHC			X				X	X	X				X											
alpha-Endosulfan			X																					
Anthracene																								
Benzene													X											
Benzidine																								
Benzo (a) Anthracene																			X	X	X			
Benzo (a) Pyrene		X																	X		X			
Benzo (b) Fluoranthene		X																	X	X	X			
Benzo (k) Fluoranthene																			X	X	X			
beta-BHC							X	X	X				X											
beta-Endosulfan																								
Bis (2-Chloroethyl) Ether																								
Bis (2-Chloroisopropyl) Ether																								
Bis (2-Ethylhexyl) Phthalate																								

Comparison of Reasonable Potential by Facility and Pollutant under the Baseline, Interim Draft Policy, and Great Lakes Initiative Methods[1, 2]

Pollutants	San Jose			Sunnyvale			Tillman			Unocal			Bautista			Biggs			Calistoga			Collins		
	BL	PP	GLI	BL	PP	GLI	BL	PP	GLI	BL	PP	GLI	BL	PP	GLI	BL	PP	GLI	BL	PP	GLI	BL	PP	GLI
Bromoform										X														
Butylbenzyl Phthalate																								
Carbon Tetrachloride										X														
Chlordane													X		X									
Chlorobenzene																								
Chlorodibromomethane										X														
Chloroform							X	X	X	X			X											
Chrysene																			X		X			
Dibenzo (a,h) Anthracene																			X		X			
Dichlorobromomethane							X	X	X	X														
Dieldrin		X	X				X	X	X				X		X									
Diethyl Phthalate																								
Dimethyl Phthalate																								
Di-n-Butyl Phthalate																								
Endosulfan Sulfate																								
Endrin													X		X									
Endrin Aldehyde																								
Ethylbenzene																								
Fluoranthene													X											
Fluorene																								
gamma-BHC	X		X				X	X	X				X											
Heptachlor			X				X	X	X				X											
Heptachlor Epoxide		X											X											
Hexachlorobenzene													X		X									
Hexachlorobutadiene																								
Hexachlorocyclopentatadiene																								
Hexachloroethane																								

Comparison of Reasonable Potential by Facility and Pollutant under the Baseline, Interim Draft Policy, and Great Lakes Initiative Methods[1, 2]

	San Jose			Sunnyvale			Tillman			Unocal			Bautista			Biggs			Calistoga			Collins		
Pollutants	BL	PP	GLI	BL	PP	GLI	BL	PP	GLI	BL	PP	GLI	BL	PP	GLI	BL	PP	GLI	BL	PP	GLI	BL	PP	GLI
Indeno (1,2,3-cd) Pyrene																			X		X			
Isophorone																								
Methyl Bromide																								
Methylene Chloride							X		X	X														
Nitrobenzene																								
N-Nitrosodimethylamine																								
N-Nitrosodi-n-Propylamine																								
N-Nitrosodiphenylamine																								
PCBs		X											X		X									
Pentachlorophenol													X											
Phenol										X			X											
Pyrene																								
TCDD													X		X									
Tetrachloroethylene																								
Toluene													X											
Toxaphene													X		X									
Trichloroethylene																								
Vinyl Chloride																								

Comparison of Reasonable Potential by Facility and Pollutant under the Baseline, Interim Draft Policy, and Great Lakes Initiative Methods[1, 2]

Pollutants	Donner			Forestville			Great Lakes			Navy			PG&EO1			PG&EO2			Boeing			South Bay		
	BL	PP	GLI	BL	PP	GLI	BL	PP	GLI	BL	PP	GLI	BL	PP	GLI	BL	PP	GLI	BL	PP	GLI	BL	PP	GLI
Antimony	X																							
Arsenic (As-III)																			X					
Cadmium (Cd)	X												X			X								
Chromium-VI (Cr-VI)																			X		X			
Copper (Cu)	X	X	X	X	X	X					X	X	X	X	X	X		X	X		X			X
Lead (Pb)	X			X	X	X							X			X		X	X	X	X			
Mercury (Hg)	X		X	X	X	X							X			X								
Nickel (Ni)	X		X								X	X	X			X		X	X					
Selenium (Se)	X		X																					
Silver (Ag)	X			X		X							X		X	X		X	X					
Thallium	X		X										X		X	X		X						
Zinc (Zn)	X		X	X								X	X			X			X					
1,1,2,2-Tetrachloroethane	X																							
1,1,2-Trichloroethane	X		X																					
1,1-Dichloroethylene	X																							
1,2-Dichlorobenzene																								
1,2-Dichloroethane	X						X																	
1,2-Dichloropropane							X																	
1,2-Diphenylhydrazine	X																							
1,2-Trans-Dichloroethylene																								
1,3-Dichlorobenzene																								
1,3-Dichloropropylene																								
1,4-Dichlorobenzene																								
2,4,6-Trichlorophenol	X	X	X																					
2,4-Dichlorophenol																								
2,4-Dimethylphenol																								

Comparison of Reasonable Potential by Facility and Pollutant under the Baseline, Interim Draft Policy, and Great Lakes Initiative Methods[1, 2]

Pollutants	Donner			Forestville			Great Lakes			Navy			PG&EO1			PG&EO2			Boeing			South Bay		
	BL	PP	GLI	BL	PP	GLI	BL	PP	GLI	BL	PP	GLI	BL	PP	GLI	BL	PP	GLI	BL	PP	GLI	BL	PP	GLI
2,4-Dinitrophenol																								
2,4-Dinitrotoluene	X																							
2-Chloronaphthalene																								
2-Chlorophenol																								
2-Methyl-4,6-Dinitrophenol	X		X																					
3,3-Dichlorobenzidine	X																							
4,4'-DDD																								
4,4'-DDE																								
4,4'-DDT	X																							
Acenaphthene																								
Acrolein																								
Acrylonitrile																								
Aldrin	X		X																					
alpha-BHC	X		X																					
alpha-Endosulfan																								
Anthracene																								
Benzene	X		X				X																	
Benzidine	X		X																					
Benzo (a) Anthracene	X		X																					
Benzo (a) Pyrene	X		X																					
Benzo (b) Fluoranthene	X		X																					
Benzo (k) Fluoranthene	X		X																					
beta-BHC	X		X																					
beta-Endosulfan																								
Bis (2-Chloroethyl) Ether	X		X																					
Bis (2-Chloroisopropyl) Ether																								
Bis (2-Ethylhexyl) Phthalate	X		X																					

Comparison of Reasonable Potential by Facility and Pollutant under the Baseline, Interim Draft Policy, and Great Lakes Initiative Methods[1, 2]

Pollutants	Donner			Forestville			Great Lakes			Navy			PG&EO1			PG&EO2			Boeing			South Bay		
	BL	PP	GLI	BL	PP	GLI	BL	PP	GLI	BL	PP	GLI	BL	PP	GLI	BL	PP	GLI	BL	PP	GLI	BL	PP	GLI
Bromoform																								
Butylbenzyl Phthalate																								
Carbon Tetrachloride	X		X																					
Chlordane	X		X																					
Chlorobenzene																								
Chlorodibromomethane	X		X																					
Chloroform	X		X	X	X	X																		
Chrysene	X		X																					
Dibenzo (a,h) Anthracene	X		X																					
Dichlorobromomethane	X		X	X	X	X																		
Dieldrin	X		X																					
Diethyl Phthalate																								
Dimethyl Phthalate																								
Di-n-Butyl Phthalate																								
Endosulfan Sulfate																								
Endrin	X		X																					
Endrin Aldehyde																								
Ethylbenzene																								
Fluoranthene																								
Fluorene																								
gamma-BHC	X	X	X																					
Heptachlor	X		X																					
Heptachlor Epoxide	X		X																					
Hexachlorobenzene	X		X																					
Hexachlorobutadiene	X		X																					
Hexachlorocyclopentadiene																								
Hexachloroethane																								

Comparison of Reasonable Potential by Facility and Pollutant under the Baseline, Interim Draft Policy, and Great Lakes Initiative Methods[1, 2]

	Donner			Forestville			Great Lakes			Navy			PG&EO1			PG&EO2			Boeing			South Bay		
Pollutants	BL	PP	GLI	BL	PP	GLI	BL	PP	GLI	BL	PP	GLI	BL	PP	GLI	BL	PP	GLI	BL	PP	GLI	BL	PP	GLI
Indeno (1,2,3-cd) Pyrene	X		X																					
Isophorone	X		X																					
Methyl Bromide																								
Methylene Chloride																								
Nitrobenzene	X		X																					
N-Nitrosodimethylamine	X		X																					
N-Nitrosodi-n-Propylamine																								
N-Nitrosodiphenylamine	X		X																					
PCBs	X		X																					
Pentachlorophenol	X	X	X																					
Phenol																								
Pyrene																								
TCDD																								
Tetrachloroethylene	X		X																					
Toluene																								
Toxaphene	X		X																					X
Trichloroethylene	X		X																					
Vinyl Chloride	X		X																					

[1]Four facilities did not have reasonable potential for any pollutant under any of the three methods. These facilities are: Sierra Pacific Industries, Airline Signal Aerospace, Lennox County Park, and California Department of Fish and Game.
[2]BL=Baseline Method, PP= Proposed Policy Method, GLI=Great Lakes Initiative Method

ATTACHMENT C~~2~~

TOXICITY CASE STUDIES

CHRONIC TOXICITY CONTROL PROVISIONS

The information presented in this attachment was developed when the draft Supplement to the FED was released in October of 1997. The information is still valid; however, costs have gone down and, thus, the costs stated in chapter are probably overestimated. For example, costs for TIEs have gone down over the years, as the labs have become more experienced in performing the procedures. A Northern California consulting lab quoted the following prices in January of 1999:

Phase I TIE:	*$1,500 - $3,500*
Phase II TIE:	*$3,500 - $10,000*
Phase III TIE:	*$3,000 - $5,000*

The costs vary by the class of the chemical(s) found and what the RWQCB permit writer wants from the TIE process (i.e., identification of a class of chemicals versus specific chemicals).

All RWQCB basin plans currently have a narrative toxicity objective. These objectives and accompanying implementation procedures vary from region to region. The SWRCB has proposed ~~a~~ uniform ~~chronic toxicity objective and~~ implementation procedures to promote statewide consistency.

The purpose of a toxicity objective is to prevent harmful effect of pollutants on the survival, growth, and reproduction of aquatic life in surface waters. Studies have confirmed that effluent toxicity, when properly related to ambient conditions, can provide an indication of receiving water impact (U.S. EPA 1991; Waller et al. 1996; Dickson et al. 1996; de Vlaming 1997a). Toxicity tests provide information on effluents that can not be fully defined through chemical analysis. One reason is that toxicity tests measure the aggregate toxicity of all constituents in complex effluents, including chemicals which are not routinely monitored or for which there are no water quality criteria. Toxicity tests also integrate the combined effects of effluent constituents (e.g., additivity, antagonism, and synergism), which can not be practically assessed on a chemical by chemical basis.

As discussed in the September 11, 1997 draft FED, most major point source dischargers in California currently have chronic toxicity limitations or chronic toxicity monitoring requirements in their discharge permits, if the RWQCB believes there is potential to cause or contribute to chronic toxicity. Also, included in these permits are requirements to conduct Toxicity Identification Evaluations (TIEs)/Toxicity Reduction Evaluation (TREs) if unacceptable toxicity is observed. As a result, economic impacts to dischargers are not anticipated because the current requirements are consistent with the proposed chronic toxicity objective.

If a point source discharger does not currently have chronic toxicity limits or testing requirements, and a RWQCB determines there is a reasonable potential for toxicity, the discharger could be affected by the proposed chronic toxicity implementation provisions. Therefore, this chapter presents information on the costs that may be anticipated by those dischargers. Potential costs for the affected dischargers include costs for effluent toxicity monitoring and, if unacceptable toxicity is found, the costs of conducting a TIE/TRE.

SURVEY OF SELECTED CALIFORNIA DISCHARGERS

Information was gathered for the sample facilities evaluated in the SWRCB September 1997 draft economic analysis to determine the number of facilities with chronic toxicity limits and chronic toxicity monitoring requirements. A description of these facilities is provided in the FED. Two of the twenty sample facilities in the September 1997 analysis are not currently operating and do not discharge to surface waters [i.e., ARCO Products (San Joaquin) and San Diego Gas & Electric (Silvergate)] and one facility is a minor discharger who would not be expected to receive chronic toxicity limits or monitoring requirements (Navy Public Works) due to no reasonable potential; therefore, information was collected for the remaining 17 facilities. Sources of information included the current discharge permits and, if necessary, the RWQCBs were contacted to confirm the monitoring requirements for the facilities.

As shown in Exhibit ~~3–~~1, ten of the seventeen facilities currently have chronic toxicity limits. These facilities also have monitoring requirements for chronic toxicity and requirements to perform a TIE/TRE should unacceptable effluent toxicity be observed. Of the seven facilities without limits, five have requirements for chronic toxicity monitoring as well as TIE/TRE requirements. Therefore, of the 17 surveyed facilities, 13 are monitoring for chronic effluent toxicity and must take steps to reduce chronic toxicity if results show that the effluent may cause chronic toxicity instream.

Sample facilities in the 1997 draft economic analyses that did not have chronic toxicity limits or monitoring requirements are the Alta Gold facility in Shasta County, a power plant in the San Francisco Bay region (operated by Pacific Gas & Electric), Collins Pine Co. and a Unocal facility. In these cases, reasonable potential for chronic toxicity has not been demonstrated. According to the San Francisco Bay Regional Basin Plan, if chronic effluent toxicity is observed at the Pacific Gas & Electric (Hunter's Point) facility, as TRE requirement may be established.

Based on the survey of facilities and an SWRCB survey of RWQCBs (deVlaming 1997b), it appears that most major dischargers either have chronic toxicity limits or chronic toxicity monitoring requirements that have been issued by the RWQCBs to protect against the occurrence of chronic toxicity instream. This information suggests that most California dischargers already have chronic toxicity permit requirements that are consistent with the narrative chronic toxicity objective proposed in the SWRCB’s Policy. Those facilities without limits and/or monitoring demonstrate no reasonable potential for toxicity. However, the following costs are provided to address those situations where chronic toxicity requirements are added to a permit.

SUMMARY OF COSTS FOR EFFLUENT TOXICITY TESTING

The proposed Policy recommends adopting the Ocean Plan list of critical life stage protocols for measuring the toxicity of discharges to salt waters and the U.S. EPA’s 40 CFR Part 136 test methods for discharges to fresh waters. The SWRCB will also consider the adoption of additional test methods where applicable.

Exhibit 1. Toxicity Requirements Assessment of Seventeen Sample Facilities with NPDES Permits

Facility	Chronic Toxicity Limit* or Testing Requirement	TIE/TRE Required If Toxicity Observed	Comment
Alta-Gold	No	No	No reasonable potential for toxicity.
Arcata	Yes	Yes	
Coachella	Acute Limits; Chronic Testing	Yes	Monitoring for chronic toxicity required in permit to evaluate need for chronic toxicity limit.
Collins Pine Co.	Acute Limits and Testing	No	Reasonable potential for toxicity not demonstrated.
Colton	Yes	Yes	
E.I. Dupont	Acute Limits; Chronic Testing	No	Monitoring for chronic toxicity required in permit. No reasonable potential for toxicity demonstrated as no toxicity found in studies conducted before permit was adopted.
Exxon	Yes	Yes	
Hunter's Point	Acute Limits	Yes, in Basin Plan	Studies of PG&E effluent have not indicated a need for chronic toxicity limits. Monitoring programs require that all violations of permit limits be reported to the RWQCB, and the TRE provisions are included in the region's basin plan and would be enforced if necessary.
Merced	Yes	Yes	Permit does not specifically mention TREs, but requires workplan to investigate toxicity and steps to be taken to reduce or eliminate toxicity.
Riverside	Acute Limits; Chronic Testing	Yes	Monitoring for chronic toxicity required. Accelerated monitoring if over 1.0 TU_c.
Rockwell	Yes	Yes	
Sacramento	Acute Limits; Chronic Testing	Yes	Monitoring for chronic toxicity required. TIE required in monitoring proposal. Previous monitoring showed no toxicity.
San Jose	Yes	Yes, in process	Blanket Chronic Toxicity Order #92-104 included as part of permit.
San Juan	Yes	Yes	
Sunnyvale	Yes	Yes, in process	Blanket Chronic Toxicity Order #92-104 included as part of permit.
Tillman	Yes	Yes	
Unocal	No	Yes	Reasonable potential for chronic toxicity not demonstrated.

*Unless otherwise noted, if a limit is included in the permit, then a monitoring requirement is included in the permit.

U.S. EPA Region 9 performed a recent survey of toxicology laboratories to determine the costs of toxicity tests recommended for adoption. The results of this survey are summarized in Exhibits 2 and 3. The costs for chronic toxicity test procedures, shown in Exhibits 2 and 3, are based largely on U.S. EPA methods for freshwater (1989a) and marine/estuarine (1988a, West Coast Testing Manual) species. These costs assume a full dilution series (i.e., five effluent concentrations and a control). Several factors will affect costs including the ease of obtaining test organisms or broodstock and the chronic endpoints to be measured; however, the costs shown assume readily available test organisms and the use of standard chronic endpoints.

SUMMARY OF COSTS FOR TIE/TRE

This subchapter describes the costs associated with studies that may be required to identify and control the discharge of effluent toxicity. As described below, each TRE will be unique; therefore, the costs for performing TIE/TREs vary widely. Nonetheless, costs for selected TRE components are fairly well-defined. Case study summaries of TIE/TREs are also presented to provide examples of the costs that may be expected for various types of TIE/TREs.

EXHIBIT 2. SURVEY OF CALIFORNIA LABORATORIES: COSTS OF CONDUCTING EFFLUENT TOXICITY TESTS USING FRESHWATER ORGANISMS

Test	Laboratory							
	A	**B**	**C**	**D**	**E**	**F**	**G**	**H**
Chronic								
Pimephales promelas	$900	$1,000	-	$1,200	$1,100	$1,000	$810	-
Ceriodaphnia dubia	$1,000	$1,000	$800	$1,200	$1,100	$1,000	$700	$1,350
Selenastrum capricornutum	$600	$950	$650	$900	$950	$600	$335	$710

I. TIE/TRE REQUIREMENT

If a discharge causes or contributes to chronic toxicity in receiving waters, a TIE/TRE is required to identify the source(s) of toxicity. Once the source(s) is determined, reasonable steps shall be taken to eliminate toxicity.

II. OVERVIEW OF TRE PROCEDURES

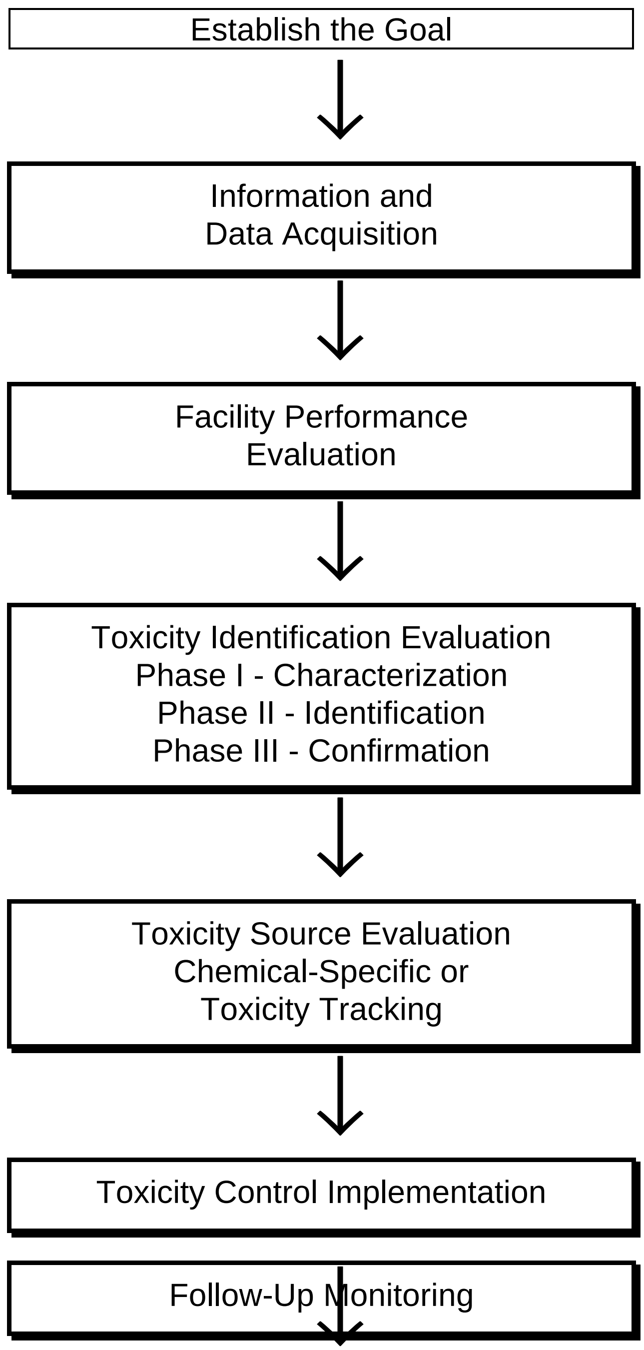
The purpose of TRE studies is to identify the causes and sources of effluent toxicity and select and implement control measures to achieve compliance with the toxicity limit or requirement. As depicted in Exhibit 4, the initial phase of the TRE usually focuses on acquiring pertinent

EXHIBIT 3. SURVEY OF CALIFORNIA LABORATORIES:
COSTS OF CONDUCTING EFFLUENT TOXICITY TESTS
USING MARINE AND ESTUARINE ORGANISMS

Test	Laboratory						
	A	**B**	**C**	**D**	**E**	**F**	**G**
Chronic							
Atherinops affinis	$920	$1,250	$1,050	$900	$1,200	$1,000	-
Menidia beryllina	$900	$1,250	$1,050	$1,200	$1,200	$1,000	-
Haliotis rufescens	$800	$1,500	$800	$1,100	$1,200	$1,000	$950
Mytilus sp.	$800	$1,500	$800	$950	$1,100	$800	$1,050
Strongylocentrotus purpuratus & *Dendraster excentricus* fertilization	$750	$1,250	$800	$650	$1,100	$600	$825
Strongylocentrotus purpuratus & *Dendraster excentricus* development	$750	$1,250	-	$950	$1,200	$800	$1,050
Holmesimysis costata	$920	$1,250		$1,200	$1,400	-	-
Mysidopsis bahia	$920	$1,250	-	$1,200	$1,100	$1,200	-
Macrocystis pyrifera	$850	$1,850	-	-	$1,300	$1,000	$850

information, reviewing the facility's operation and performance and its impact on effluent toxicity, and conducting Toxicity Identification Evaluation (TIE) tests to identify the effluent toxicant(s). Subsequent work may involve tracking the sources of toxicity, evaluating various toxicity control methods, implementing the controls, and follow-up monitoring to confirm the reduction of effluent toxicity. Each TRE is unique because the nature and sources of toxicity and the options available to control toxicity are different at each facility. Therefore, dischargers may utilize different components of the general TRE protocols (U.S. EPA 1988b and 1989b) depending on the conditions in effect at the time of the TRE.

Exhibit 4. Generalized Flow Chart for TREs



Some RWQCBs require dischargers to submit a TRE plan that describes the work to be performed and a schedule for implementation to be followed in the event toxicity occurs.. Following review of the TRE plan, the schedule may be incorporated into the discharger's permit. Other RWQCBs require dischargers to perform TIE tests at the onset of toxicity. In this case, a TIE plan may be requested.

The TIE is usually a fundamental component of the TRE process. The TIE is performed in three phases: the type of toxicant(s) (e.g., metals, nonpolar organics) is characterized in Phase I, specific toxicant identification is performed in Phase II, and the identified toxicant(s) is confirmed in Phase III (U.S. EPA 1992, 1993a, 1993b). As depicted in Exhibit ~~3-~~5, the chronic TIE Phase I procedure involves a series of bench-scale steps designed to remove or isolate a specific group of toxicants (e.g., filtration, aeration, EDTA chelation). Toxicity tests performed on the treated samples and the original sample provide clues about the type of toxicant(s) in the effluent. Phase III is usually performed at the same time as Phase II to confirm that the identified toxicants are the causes of effluent toxicity.

As discussed, the scope of the TRE process is different for each facility. For example, a discharger may find that effluent toxicity is corrected by simply reducing the use of treatment additives (e.g., polymers), while another discharger must identify and control multiple sources of toxicity that change over time. For this reason, it is not possible to provide definitive costs for TREs. However, costs are available for some TRE components such as selected TIE tests. Exhibit ~~3-~~6 lists the range of costs for chronic TIE Phase I, and selected Phase II and Phase III procedures Denton 1997). These costs assume that the laboratory will apply the procedures as described by U.S. EPA (1992, 1993a, 1993b).

III. TIE/TRE EXAMPLES

A summary of the TRE study examples, including costs, is presented in Exhibit ~~3-~~7. It is important to note that the costs for TREs are highly site-specific. The costs shown in Exhibit ~~3-~~7 are specific to the discharge conditions of the facilities described below.

Exhibit 5. Chronic TIE - Tier 1 sample preparation and testing overview.

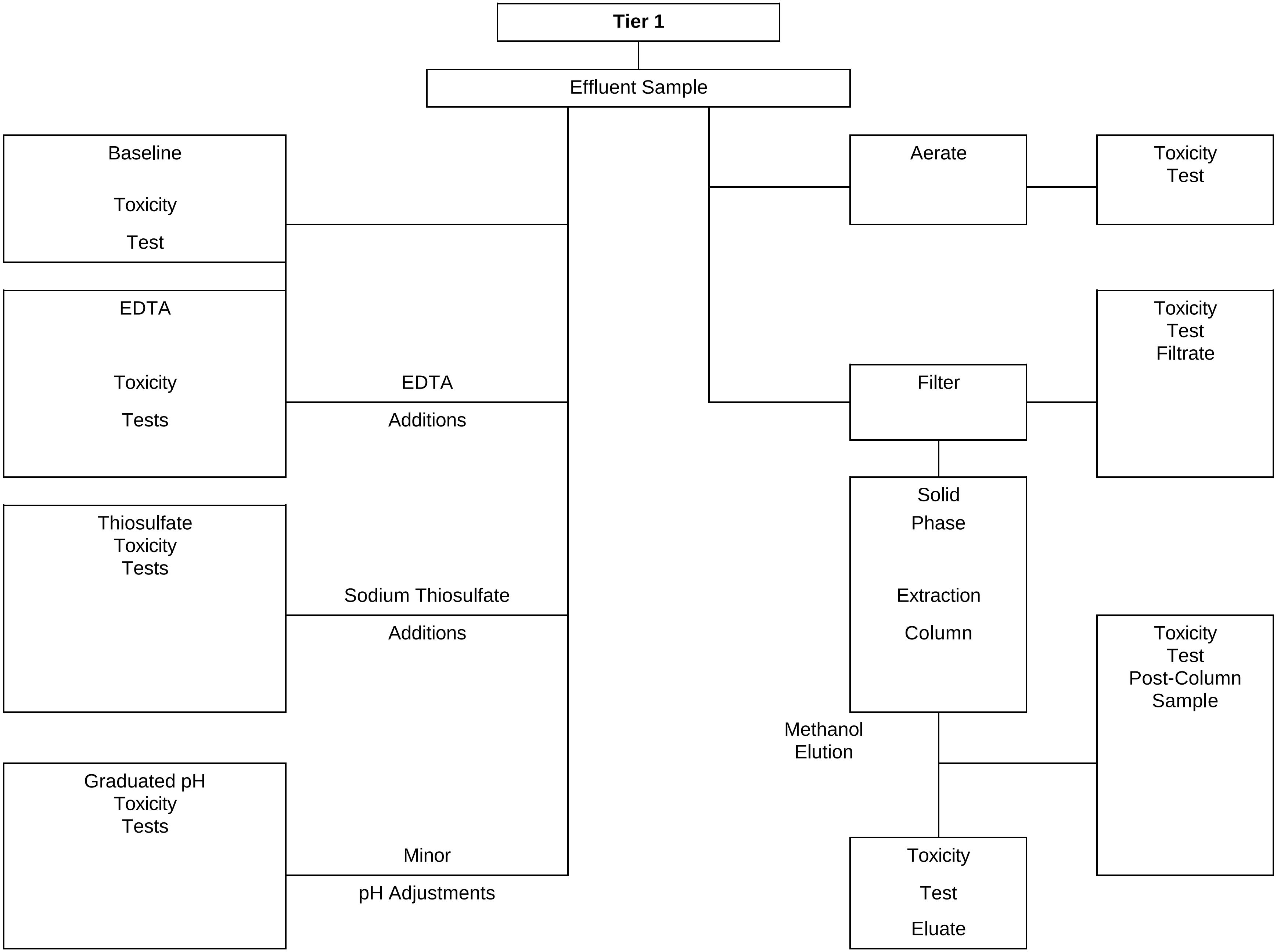


EXHIBIT 6. SUMMARY OF COSTS FOR SELECTED TOXICITY IDENTIFICATION EVALUATION PROCEDURES*

Toxicant	Phase I	Phase II	Phase III
General	$1,500 - 3,000	-	-
Ammonia	$3,000 - 5,000 for Phases I, II and III	-	-
Organophosphate Pesticides	$1,500 - 3,000	$5,000 - 8,000	$5,000 - 8,000

* Utilizing the procedures described by U.S. EPA (1992, 1993a, 1993b).

EXHIBIT 7. SUMMARY OF TRE CASE STUDIES DESCRIBED IN THIS REPORT

Facility	TRE Goal	Toxicant(s) Identified	Toxicity Control Method	Costs
Central Contra Costa Sanitary District	NOEC >10%	Copper	Ongoing source control program	$20,000
East Bay Municipal Utility District, Orinda Filter Plant	Do not exceed the 90th percentile of 90% survival values from the ten most recent quarterly tests	Polymer	Optimizing polymer use and obtaining toxicity data on polymers	$7,500
Chino Basin Municipal Water District	TU =1	Organophosphate pesticides at 2 of 3 facilities; chlorine, dechlorination practices, and ammonia at all 3 facilities	Operating redundant treatment units and performing public education and outreach	$15,000 - 20,000 for each pesticide TIE; $60,000 for chorine/de-chlorination TIE
City of Palo Alto Regional Water Quality Control Plant	TU_c=1	Zinc, hardness	Ongoing source control program	$120,000 for TIE

A. TRE Case Study - Central Contra Costa Sanitary District

TRE Goal: No observed effect concentration (NOEC) > 10%
Test Organism: Echinoderms (*S. purpuratus* and *D. excentricus*)
TRE Elements: TIE
Toxicant Identified: Copper
Toxicity Controls: Pretreatment requirements
TRE Costs: $20,000, including TIE

1. Key Elements

- TIE procedures for fresh water organisms can be successfully applied to the echinoderm fertilization toxicity test.

- This study demonstrated that copper could have accounted for the intermittent effluent toxicity observed.

- Echinoderms exhibited comparatively high sensitivity to copper with EC50s for both species of approximately 25 µg/l.

- Source control measures were successful in reducing copper concentrations by approximately 25%.

2. Permit Requirements

Central Contra Costa Sanitary District (CCCSD) was required to monitor the effluent of its wastewater treatment plant in Martinez on a monthly basis using echinoderm fertilization assays. Results indicated chronic effluent toxicity at levels that exceeded the discharge permit limit of an NOEC of 10 % effluent. As a result, the San Francisco Bay Regional Water Quality Control Board required CCCSD to conduct a TRE to identify the effluent constituents that were responsible for the observed chronic toxicity.

3. Facility Description

The CCCSD wastewater treatment plant provides secondary level treatment for combined domestic, commercial, and industrial wastewater from a 126-square mile area with a population of approximately 400,000. The treatment plant has an average dry weather design capacity of 45 mgd and currently discharges annual average flow of 38.7 mgd into the upper San Francisco Bay. Treatment facilities consist of screening, primary sedimentation, biological activated sludge, and secondary clarification followed by chlorination in contact basins. In the treatment process, waste-activated sludge is thickened via flotation thickeners, and lime is added to assist in dewatering with centrifuges. The combined primary and waste-activated sludge is dewatered and incinerated in multiple-hearth furnaces. The effluent total suspended solids (TSS) and biochemical oxygen demand (BOD) concentrations averaged <10 mg/l. Total ammonia concentrations range from 10-35 mg/l with an average of 25 mg/l.

4. Toxicity Identification Evaluation

Identification of the effluent toxicant involved testing using the U.S. EPA TIE protocols (1988c, 1989c, 1989d). The echinoderm fertilization toxicity tests (Dinnel, et. al., 1982, as modified by S. Anderson, 1989) were used in TIE testing. These tests use the West Coast species *S. purpuratus* and *D. excentricus* to determine the concentrations of a test substance that reduce egg fertilization by exposed sperm relative to that attained by sperm in control solutions. Effluent samples used in testing were 24-hour flow-proportional composites. Samples were screened for toxicity within 36 hours of collection.

a. Phase I - Toxicity Characterization

The Phase I TIE included the following effluent manipulations as described by U.S. EPA (1988c):

- Pressure filtration
- Aeration at original pH, pH 3, and pH 11
- C18 solid phase extraction (SPE) following filtration at pH 3 and pH 9
- Add-back of SPE column methanol eluate
- Sodium thiosulfate addition
- EDTA addition

Results of the Phase I tests suggested that EDTA (ethylenediaminetetracetate) and sodium thiosulfate were consistently the most effective treatments in reducing toxicity. Treatment of the sample with C18 SPE columns did not reduce toxicity, suggesting that non-polar organics and weak organic acids and bases were not contributing to the observed toxicity. This conclusion was supported by the fact that methanol eluate from the columns did not produce toxicity. The effectiveness of EDTA in eliminating toxicity suggested that a divalent cation(s) was responsible for toxicity in the samples tested. The concurrent effectiveness of sodium thiosulfate suggested that the potential suite of cations was limited to silver, cadmium, copper, and mercury (USEPA, 1988c). In one case, toxicity also appeared to be increased by temporarily reducing the sample pH to 3; greater toxicity at lower pHs has been associated with copper.

Due to the presence of moderate effluent levels of ammonia (20-25 mg/l total ammonia), the potential for ammonia toxicity was evaluated. Test results showed that large differences existed between the response of the two species. For *S. purpuratus*, the inhibition concentration (IC25) was greater than 100 mg/l N at total ammonia (1.69 mg/l N as unionized ammonia) compared with an IC25 estimate of 16.5 mg/l N (0.34 mg/l N as unionized ammonia) for *D. excentricus*. However, the ammonia concentration at the NOEC value typically reported for the treatment plant effluent (i.e., 33%) would be no more than 8.25 mg/l N as total ammonia. Therefore, these results suggest that ammonia alone could not account for effluent toxicity.

b. <u>Phase II and III - Identification and Confirmation of the Role of Cationic Metals</u>

Once it appeared that a divalent cation was responsible for effluent toxicity, candidate metal ions were evaluated for toxicity to *D. excentricus* and *S. purpuratus*. Metal solutions were prepared in moderately hard freshwater using reagent grade salts of silver, copper, cadmium, and mercury. Results of toxicity tests using these metals are summarized in Exhibit 8.

The NOECs for each of the metals were compared with the discharger's analytical records to determine which metals were present individually in the effluent at concentrations high enough to inhibit fertilization success. Toxicity ratios were calculated for each metal [metal concentration in effluent (µg/l)/NOEC (µg/l)]. As shown in Exhibit 9, the comparatively small ratios associated with silver, cadmium, and mercury ($\leq$ 0.2 to 0.6) suggest that effluent concentrations of these metals were not high enough to produce the intermittent toxicity associated with the effluent. Copper was the most promising of the metals to be identified in this analysis as effluent/toxicity ratios frequently exceeded 1.

EXHIBIT 8. NOECS (µg/l) FOR ECHINODERMS EXPOSED TO SELECTED METALS

Metal	No Observed Effect Concentration	
	D. excentricus	***S. purpuratus***
Silver	>13.4	>13.4
Cadmium	>9.4 to >67.0	>67.0
Copper	3.8 to 13.1	19.7 to 20.0
Mercury	>0.7 to >2.2	>0.7

Fertilization success was also evaluated in effluent samples spiked with different concentrations of copper. In one series of tests, *D. excentricus* was exposed to an effluent sample and seawater spiked with copper at concentrations measured in the effluent sample. The NOECs and LOECs were the same between the effluent sample and the concurrent toxicity test with seawater spiked with copper (i.e., 3.8 µg/l and 7.5 µg/l, respectively, as copper). Copper spiking tests performed on another effluent sample also suggested that copper accounted for the reduction in fertilization success in *D. excentricus*.

EXHIBIT 9. COMPARISON OF EFFLUENT CONCENTRATIONS OF SELECTED METALS WITH NOECs DERIVED FROM LABORATORY STUDIES WITH *D. excentricus*

Metal	Effluent Concentration	NOEC	Ratio of Effluent Concentration to NOEC
Silver	<0.2-4.0	>13.4	$\leq$0.3
Cadmium	<0.2	>9.4, >67	$\leq$0.2
Copper	5.0-20.0	3.8-13.1	0.4-5.3
Mercury	<0.2-.04	>0.7, >2.2	$\leq$0.6

5. Toxicity Control Measures

The results of this study suggest that copper accounts for the intermittent toxicity demonstrated by the echinoderm fertilization test. Source control measures implemented by CCCSD successfully reduced copper concentrations in the effluent by 25%. The reduction in effluent copper levels made it difficult to obtain samples with sufficient toxicity to fully complete the confirmatory phase of the TIE. Nearly all recent effluent samples failed to produce a measurable response with *S. purpuratus*. The results of this TIE have been published elsewhere (Bailey et. al., 1995).

6. Costs

The cost of the TIE study was approximately $20,000. No costs were incurred for control of copper because CCCSD already had implemented operational measures at the treatment facility and source control efforts to reduce copper.

7. Acknowledgments

This TIE study was conducted by AQUA-Science under contract to CCCSD.

B. TRE Case Study - East Bay Municipal Utility District, Orinda Filter Plant

TRE Goal: Do not exceed 90th percentile of 90% survival values from the ten most recent quarterly tests
Test Organism: *Pimephales promelas* (fathead minnows, 30-90 days old) and *Gasterosteous aculeatus* (threespine sticklebacks, 30-90 days old)
TRE Elements: TIE
Toxicant Identified: Polymer
Toxicity Controls: Optimize polymer usage and review vendor toxicity data
TRE Costs: $7,500, includes TIE plan, laboratory work, and reporting

1. Key Elements

- Treatment additives can contribute to effluent toxicity.
- TIE studies can be relatively inexpensive, if well-focused through an initial review of operational/process information.
- Flexibility in study design is key to a successful TIE.

2. Permit Requirements

EBMUD's Orinda Filter Plant operates under a NPDES permit that includes an acute effluent toxicity limit. EBMUD must monitor the plant effluent quarterly using fathead minnows and threespine stickleback. An acute toxicity event in August 1993 triggered a permit requirement to conduct a TIE/TRE.

3. Facility Description

The Orinda Filter Plant treats raw water by coagulation, precipitation, filtration, and disinfection. The water treatment filters are backwashed regularly. The backwash is dechlorinated, detained in a settling basin, and then discharged to San Pablo Creek, a tributary to the San Francisco Bay.

4. Toxicity Identification Evaluation

During a review of the treatment process at the Orinda facility, three treatment chemicals were found to be in use: a primary coagulant (either alum or Hyper Ion), cationic polymer, and chlorine. In addition, the backwash water was dechlorinated with sulfur dioxide prior to detention in the settling basin. Samples collected for toxicity testing were routinely analyzed for residual chlorine and sulfur dioxide and the results confirmed that the backwash water did not contain residual chlorine or excessive amounts of dechlorinating agent that may contribute to effluent toxicity. Toxicity tests performed on alum and Hyper Ion showed that these coagulants were not contributing to the observed effluent toxicity. Also, a comparison of historical effluent toxicity data and information on the usage of the two coagulants provided evidence that alum and Hyper Ion were not the toxicants of concern. The cationic polymer was found to be highly toxic when tested in laboratory control water; however, it was anticipated that suspended solids in the raw water would bind most, if not all, of the polymer, thereby reducing its potential to cause toxicity.

EBMUD designed an approach to qualitatively evaluate the effluent (backwash) for the presence of residual polymer and to determine if removal of the polymer would mitigate toxicity. This modified TIE involved observing the effect of two manipulations on toxicity: filtration using a 1.0 µm pore size filter and the addition of Kaolin powder (clay). Both of these manipulations completely removed effluent toxicity. When clay was added to control water or nontoxic backwash water, it remained suspended for the duration of the toxicity test. However, when clay was added to toxic backwash samples, it clumped together and settled to the bottom of the container, a qualitative indication of the presence of residual polymer. Toxicity tests performed on the clay treated samples showed no acute effluent toxicity.

Shortly after the TIE study, toxicity was no longer observed in the Orinda Filter Plant backwash water. The study continued by using backwash waters from water treatment plants upstream of the Orinda Filter Plant. After eight months, EBMUD had gathered sufficient evidence to proceed with implementing some low-cost control measures. The primary control measure was to optimize the use of polymers by adjusting for varying water conditions (e.g., suspended solids and temperature). As a result, polymer use was cut approximately in half without adversely affecting treatment goals. Another toxicity control approach involved requesting aquatic toxicity data on polymers from prospective vendors and using that information in the vendor selection process.

5. Toxicity Control Measures

As noted, effluent toxicity has no longer been observed in the Orinda Filter Plant backwash. EBMUD credits their efforts in selecting polymers of low toxicity and optimizing the amount of polymer used as factors in achieving consistent compliance with the toxicity limit.

This case study demonstrates that it is possible to conduct a successful TIE/TRE without incurring excessive costs. EBMUD's familiarity with the treatment processes and system at the Orinda Filter Plant was helpful in developing a well-focused TIE study plan.

This study also demonstrated the importance of applying creative approaches in TIE/TREs. Before using modified TIE procedures, however, a study plan should be prepared and submitted to the RWQCB for review and comment.

6. Costs

The EBMUD laboratory performed the TIE over an 8 month period at a total estimated cost of $7,500. In addition to laboratory work ($6,000), costs were incurred in preparation of the TIE study plan ($500), data and process review ($500), and reporting ($500).

7. Acknowledgments

The SWRCB acknowledges Patti L. TenBrook, Aquatic Toxicologist with EBMUD, for her assistance in providing this case study.

C. TRE Case Study - Chino Basin Municipal Water District

TRE Goal: Identify effluent toxicant(s) if effluent TUc > 1
Test Organism: *Ceriodaphnia dubia* and *Pimephales promelas* (fathead minnow)
TRE Elements: TIE
Toxicant Identified: Organophosphate pesticides at Regional Plant #2 and Carbon Canyon Water Reclamation Facility, and chlorine, dechlorination practices, and ammonia at Regional Plant #2
Toxicity Controls: Operating redundant treatment units and public education
TRE Costs: $15,000 to 20,000 for each TIE study involving organophosphate and $60,00 for a TIE study to investigate toxicity caused by chlorination/dechlorination practices

1. Key Elements

- Organophosphate pesticides are a common cause of effluent toxicity at municipal wastewater treatment plants.

- Organophosphate pesticides can be removed in the wastewater treatment plant if sufficient capacity is provided; however, this treatment regime may involve the use of redundant process units that may not be otherwise needed.

- Public education can be useful in preventing the discharge of large slug loads of pesticides to municipal wastewater treatment plants.

2. Permit Requirements

As required by their NPDES permit, CBMWD monitors each of the treatment plant effluents monthly for chronic toxicity using *Ceriodaphnia dubia* (water flea). Chronic effluent toxicity is also monitored annually using *Pimephales promelas* (fathead minnow). The NPDES permit requires weekly toxicity monitoring if chronic toxicity is observed and if unacceptable toxicity is found in two consecutive tests, CBMWD must perform a TIE to identify the causes of effluent toxicity. CBMWD has experienced several episodes of chronic effluent toxicity since 1990. TIE tests have been performed at each of the three treatment plants to identify the responsible effluent toxicants. This case study summary focuses on effluent toxicity caused by organophosphate pesticides, only the cost of the case studies for ammonia and chlorine toxicity are presented.

3. Facility Description

The Chino Basin Municipal Water District owes and operates three wastewater treatment plants in the western portion of San Bernardino County. Regional Plant No. 1 currently treats about 44 MGD by screening/grit removal, primary sedimentation, activated sludge (with nitrification/denitrification), tertiary filtration, and chlorination/dechlorination. In addition to discharging to the Santa Ana River Basin, treated effluent is used for golf course irrigation and as supply water for a regional park lake. Regional Plant No. 2 treats about 5 MGD by screening/grit removal, primary sedimentation, activated sludge (with nitrification/denitrification), tertiary filtration, and chlorination/dechlorination. Final treated effluent is discharged to a tributary of the Santa Ana River. Carbon Canyon Water Reclamation Facility was completed in 1992 to treat 10.2 MGD by screening/grit removal, primary sedimentation, activated sludge (with nitrification/denitrification), tertiary filtration, and chlorination/dechlorination. This facility is designed to meet a 10 mg/l nitrogen limitation for discharge to a tributary of the Santa Anna River.

4. Toxicity Identification Evaluation

Three observations made prior to TIE testing were useful in helping to identify the effluent toxicants at two of the CBMWD facilities (Regional Plant #2 and Carbon Canyon Water Reclamation Facility). First, of the two test species used in testing, only *Ceriodaphnia* was sensitive to the effluent. Second, effluent toxicity at the Regional Plant #2 has been observed only in the period starting from April to June through October, which corresponds with the seasonal occurrence of pests such as ants and fleas. Third, since the occurrence of effluent toxicity, CBMWD has been operating redundant treatment units (e.g., aeration basins) which have helped to reduce the final effluent toxicity. The episodes of chronic toxicity occur when the redundant process units are taken off line for maintenance. These observations, when considered together with the results of TIE testing, were useful in providing clues about the identity of the effluent toxicants.

CBMWD performed Phase I TIE tests using the general procedures described above (Section II of this subchapter). Results showed that chronic toxicity was removed by passing the effluent sample through a C18 SPE column, which preferentially adsorbs non-polar organic compounds and some metals. As recommended by U.S. EPA (1988c), elution of the C18 column using methanol was performed; however, it was not possible to isolate and identify the toxic compound.

The TIE results and observations about the occurrence of effluent toxicity provided evidence that organophosphate pesticides were causing effluent toxicity. This evidence included:

- *Ceriodaphnia dubia* is nearly 100 times more sensitive to organophosphate pesticides than fathead minnows

- The seasonal occurrence of effluent toxicity corresponds with increased organophosphate pesticide usage by homeowners, carpet cleaning companies, and commercial pesticide applicators.

- The occurrence of effluent toxicity during periods when redundant treatment units are taken off line for maintenance suggests that the toxicant(s) is treatable under optimum operating conditions.

- Organophosphate pesticides are non-polar compounds that are readily adsorbed onto a

C18 SPE column. Although it was not possible to isolate and identify the nonpolar toxicants from the C18 column, the reduction of toxicity by C18 column treatment could be related to the presence of organophosphate pesticides.

Based on this information, CBMWD decided to monitor the treatment plant effluents for organophosphate pesticides. Two organophosphate pesticides were found: chlorpyrophos and diazinon. Each of these pesticides was found at concentrations that would be expected to cause chronic toxicity to Ceriodaphnia.

5. <u>Toxicity Control Measures</u>

CBMWD believed that there was sufficient information to show that organophosphate pesticides were causing chronic effluent toxicity. The primary sources in the sewer collection system were believed to be homeowners, carpet cleaning companies, and pesticide applicators. Other municipalities, who have experienced organophosphate pesticide toxicity, have decided to implement public education and outreach programs to reduce the input of pesticides to their treatment plants. Although CBMWD is able to treat most or all of the organophosphate pesticide loading, especially when redundant treatment units are online, there is concern about large slug loads of pesticides entering the treatment plants. As a result, CBMWD initiated a public education and outreach effort. This effort involves publishing newspaper articles and advertisements to advise the public about the need to control the discharge of organophosphate pesticides to the sewer. CBMWD also informed the public that pesticide wastes could be handled through the ongoing domestic hazardous waste collection program, instead of disposal into the sewer. In addition, CBMWD developed and mailed a notice of about pesticide problems/ remedies to many homeowners and businesses throughout the district.

Since February 1997, CBMWD has experienced at least two toxic events at the Regional Plant #2 and Carbon Canyon Water Reclamation Facility. CBMWD continues to optimize the treatment of organophosphate pesticides by enhancing the operation of processes that achieve the greatest removal efficiencies. The public education campaign has had limited success; recent analyses of the influent to the treatment plants show continued high slug loads of pesticides.

6. <u>Costs</u>

CBMWD conducts their own TIE testing. CBMWD estimates the cost of each TIE study to be about $15,000 to $20,000.

7. <u>Acknowledgments</u>

The SWRCB acknowledges Douglas D. Drury, Manager of CDMWD’s Operations Division, for his assistance in providing this case study.

D. TRE Case Study - City of Palo Alto

TRE Goal: TUc = 1
Test Organism: *Selenastrum capricornutum* (algae)
TRE Elements: TIE
Toxicant Identified: Zinc, hardness
Toxicity Controls: Ongoing source control program
TRE Costs: $120,000 for TIE

1. Key Elements

- TIE procedures can be adapted to evaluate toxicity to different test species (e.g., *Selenastrum* sp.).
- Hardness in effluents may be a factor affecting *Selenastrum* growth.

2. Permit Requirements

According to the NPDES permit, the City must meet the following limits for chronic effluent toxicity:

* An eleven (11) sample median value of 1 chronic toxic unit (TUc); and
* A 90th percentile value of 2 TUc.
* The City utilizes the alga, Selenastrum, for toxicity compliance monitoring.

3. Facility Description

The City of Palo Alto owes and operates the Regional Water Quality Control Plant, which serves the communities of East Palo Alto, Los Altos, Los Altos Hills, Mountain View, and Palo Alto. The facility processes 20 to 25 mgd of domestic and industrial wastewater. Approximately 60 percent of this flow is from residences, 10 percent is from industries, and the remaining 30 percent is from commercial businesses and institutions.

The facility uses physical, biological, and chemical treatment to remove solids and organic matter from sewage. In 1980, polishing filters were installed and later additional coagulation and filtration were added to produce reclaimed water suitable for landscaping and agriculture.

4. Toxicity Identification Evaluation

At the time of this TRE study, procedures for toxicant identification had not been developed using *Selenastrum* as the test organism. Therefore, initial TIE testing focused on evaluating the applicability of available U.S. EPA procedures and developing additional methods, as needed. Tests were performed using a “clean” laboratory water to determine if any of the TIE treatment steps may cause artifactual toxicity (e.g., acid and base used for pH adjustment or the addition of EDTA and sodium thiosulfate). The test results showed that U.S. EPA’s Phase I TIE procedures and an alternative protocol (Walsh and Garnas 1983) could be applied to characterize effluent toxicants using *Selenastrum*.

a. <u>Phase I - Toxicity Characterization</u>

Five effluent samples were tested using U.S. EPA's Phase I TIE methods and the Walsh and Garnas procedure. Effluent toxicity was reduced by several Phase I treatments, which indicated the characteristics noted in Exhibit 10.

Although sodium thiosulfate addition in the TIE did not reduce toxicity, it provided an additional clue about the type of metal that may be contributing to toxicity. As shown in Exhibit 3-11, the metals affected by EDTA addition, but <u>not</u> affected by thiosulfate addition include zinc, manganese, lead and nickel.

EXHIBIT 10. RESULTS OF PHASE I TIE CHARACTERIZATION

Treatment Steps	Toxicant Indicated
Adjustment to pH 11 followed by neutralization	pH sensitive compound; Dissociates or precipitates under alkaline conditions (e.g., forms insoluble precipitates)
Aeration at pH 3 (occasional reduction)	Volatile, oxidizable, or precipitating material
Addition of EDTA, a metals chelating agent	EDTA-chelatable metals such as copper, cadmium, mercury, manganese, lead, nickel, and mercury; Also, divalent cations responsible for hardness (calcium and magnesium)

EXHIBIT 11. MATRIX OF METALS AFFECTED BY EDTA AND SODIUM THIOSULFATE ADDITION

		EDTA Addition	
Sodium Thiosulfate		Yes	No
	Yes	Copper chloride Cadmium chloride Mercury chloride	Silver chloride Sodium selenate
	No	***Zinc chloride*** ***Manganese chloride*** ***Lead nitrate*** ***Nickel chloride***	Aluminum chloride Chromium (III) chloride Potassium dichromate Sodium m-arsenite Sodium arsenate Sodium selenite

The Walsh and Garnas approach indicated a nonpolar organic toxicant in one of the five effluent samples. Also, toxicity was reduced by passing samples through cation and anion exchange resins, which suggested the presence of both cationic and anionic toxicants.

b. <u>Phase II - Toxicant Identification</u>

Analytical results showed the presence of arsenic, cadmium, chromium, lead, nickel, selenium, and silver in the five effluent samples used in TIE characterization testing. A comparison of the measured metals concentrations to reported minimum effect levels for *Selenastrum* indicated zinc to be a potential toxicant (Exhibit 12).

Additional tests were performed to determine the toxicity of zinc at the hardness level typical observed in the effluent (i.e., 300 mg/l). In an attempt to replicate the hardness composition of the effluent, an artificial effluent sample was created using laboratory water spiked with concentrations of calcium, magnesium, potassium, and sodium typically found in local POTW effluents. When the artificial effluent was spiked with zinc, significant reductions in *Selenastrum* population growth were observed at 25 ppb zinc. These experiments also provided evidence that the composition of the hardness may affect the physiological condition of the test organisms (S.R. Hansen & Associates 1992).

The hardness of the effluent was relatively high during the TIE, varying from 256 to 308 mg/l as $CaCO_3$. Based on the results of tests performed at different hardnesses, the effect of hardness could not be easily defined. Of the eighteen sets of paired tests (performed using both soft and hard control water), twelve indicated that elevated hardness inhibited growth and six indicated biostimulation of *Selenastrum*. In Phase II, elevated hardness appeared to affect algal growth; however, the impact appeared to be variable (S.R. Hansen & Associates 1992).

c. Phase III - Toxicant Confirmation

In this phase of the TIE a series of tests were performed to confirm the effect of hardness and zinc on algal growth inhibition. These tests involved correlation analysis of the zinc and hardness data to effluent toxicity, zinc spiking experiments, and an examination of the effect of removal and re-introduction of zinc in effluent samples.

Based on the Phase III tests, hardness appeared to be well correlated with effluent toxicity (i.e., R2 =91.7%)(R2= correlation coefficient). This result implied that hardness was an important factor in the observed effluent toxicity.

The regression analysis for zinc was less clear. Based on all seven data points, zinc levels were poorly correlated with algal growth inhibition (R2 =11.6%). However, when only the highest tested zinc concentrations were considered (i.e., >80 µg/l), the correlation became significant (i.e., R2 =98.8%). These results suggested that the threshold of zinc toxicity was approximately 80 µg/l.

EXHIBIT 12. COMPARISON OF METALS CONCENTRATIONS IN EFFLUENT SAMPLES WITH KNOWN MINIMUM EFFECT LEVELS FOR *Selenastrum*.

Metals	Concentrations in Effluent Samples (µg/l)					LOEC*
	A	B	C	D	E	
Arsenic	1.9	2.1	1.5	1.9	1.6	**690**
Cadmium	1.4	<1	<1	<1	<1	**50**
Chromium	<5	<5	<0.5	<5	1.0	**397**
Copper	19.4	26.7	17.2	12.7	14.4	**50**
Lead	4.0	2.7	4.4	<1	1.9	**500**
Mercury	<0.1	<0.1	<0.1	0.1	<0.1	**59**
Nickel	2.9	2.3	6.0	3.8	4.8	**1000****
Selenium	1.0	1.1	<1	1.2	<1	**199**
Silver	0.5	1.5	0.4	1.6	0.2	**25+**
Zinc	92	52	82	88	101	**30++**

* Lowest observed effect concentration reported by U.S. EPA (1987).
** Based on in-house test performed at hardness of 308 mg/l.
+ Based on in-house test performed at hardness of 324 mg/l.
++ Appears to be dependent on the specific chemical composition of the hardness.

Multiple regressions using both hardness and zinc data showed a good correlation (i.e., R2 =90.5%). However, it appeared that hardness and zinc were acting independently because the correlation was no better than the correlation for hardness alone.

Spiking experiments clearly showed a decrease in *Selenastrum* growth as zinc concentrations were increased in effluent samples. The correlation coefficient (R2) for the spike concentrations compared to the resulting toxicity was 94.3%.

The removal/readdition experiments involved removing zinc from an effluent sample, testing its toxicity, adding zinc back to its original concentration, and testing for toxicity again. Previous testing had determined that removal by adjustment to pH 11 and filtering was more efficient than passing the sample through a cation exchange resin column. This treatment reduced zinc in an effluent sample from 74 µg/l to 33 µg/l. Toxicity test results showed stimulated algal growth in the treated sample as compared to the original sample. However, re-introduction of zinc to its original concentration did not increase toxicity. These results suggest that zinc was not the principal toxicant in this effluent sample. Additional measurements made during the test showed that pH 11 adjustment and filtration reduced hardness as well as zinc. Given the effect of hardness demonstrated earlier, it is possible that the altered hardness level may have affected the result.

A final confirmation test involved more closely evaluating the role of EDTA in removing zinc. Laboratory control water (hardness = 308 mg/l) was spiked with 80 µg/l zinc and then treated with EDTA. Toxicity test results showed that addition of EDTA resulted in no observed toxicity at the lowest concentration added (125 ppm). These results confirmed that zinc toxicity is removed EDTA.

5. <u>Toxicity control measures</u>

Zinc toxicity is being addressed through an ongoing source reduction program. Although progress has been made in the source control program, chronic effluent toxicity continues to be observed in about half of the toxicity compliance tests. Zinc concentrations in the effluent have remained unchanged since the beginning of the TRE.

6. <u>Costs</u>

The cost of the City of Palo Alto's TIE was about $120,000. This cost included approximately $60,000 for development of appropriate TIE procedures using *Selenastrum* as the test organism. The cost for actual TIE testing was about $20,000 per year for a total of $60,000.

Costs for controlling zinc toxicity are difficult to define. The City is currently conducting an intensive program to reduce the discharge of several metals of concern, including zinc, in wastewater and storm water. It is estimated that the costs for control measures specifically targeted to zinc are a small portion of the $1.5 million appropriated for the source control program.

7. <u>Acknowledgments</u>

The SWRCB gratefully acknowledges Mr. Phillip Bobel, Manager of Environmental Compliance Division for the City of Palo Alto, for his assistance in providing this case study.

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