

Total Residual Chlorine and Chlorine-Produced Oxidants Policy of California

Draft



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Division of Water Quality
STATE WATER RESOURCES CONTROL BOARD
CALIFORNIA ENVIRONMENTAL PROTECTION AGENCY



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Acronyms

CFR	Code of Federal Regulations
CPO	Chlorine-Produced Oxidants
ND	Non-Detect
NPDES	National Pollutant Discharge Elimination System
POTW	Publicly Owned Treatment Works
QRL	Quantification/Reporting Limit
SSO	Site-Specific Objective
TRC	Total Residual Chlorine
U.S. EPA	United States Environmental Protection Agency
WET	Whole Effluent Toxicity

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TOTAL RESIDUAL CHLORINE AND CHLORINE-PRODUCED OXIDANTS POLICY OF CALIFORNIA

Introduction-

Chlorine is extremely toxic to aquatic life in both *freshwater*¹ and *saltwater*. Thus, every discharger that uses chlorine has the potential to cause *acute toxicity*. Although a chlorination-*dechlorination* process can be used and maintained, it can be incomplete, leaving *total residual chlorine* (TRC) in freshwater, or *chlorine-produced oxidants* (CPO) in saltwater. Consequently, TRC and CPO in wastewater discharges must be regulated.

The approach for addressing TRC and CPO currently varies between regions, and enforcement of violations has become difficult. A statewide chlorine policy for TRC and CPO is needed to protect aquatic beneficial uses, promote consistency, and improve clarity for dischargers and Waterboard permit writers.

This Policy establishes:

1. TRC and CPO objectives that apply to all *inland surface waters* and *enclosed bays* and *estuaries* throughout the State to protect aquatic life beneficial uses;
2. Consistent procedures that apply to non-storm water *National Pollutant Discharge Elimination System* (NPDES) permits to regulate TRC and CPO discharges; and
3. A basis for equitable compliance determination to adequately enforce violations of TRC or CPO effluent limitations in non-storm water NPDES permits.

Policy Applicability –

This Policy establishes, in Part I, TRC and CPO objectives that apply to all inland surface waters and enclosed bays and estuaries in California. The objectives protect the aquatic life beneficial uses of these waters, including uses for warm freshwater habitat, cold freshwater habitat, inland saline water habitat, estuarine habitat, rare, threatened, or endangered species, migration of aquatic organisms, and spawning, reproduction and/or early development. Part II of this Policy establishes implementation procedures for the objectives. Part II of this policy applies only to *non-storm water* NPDES permits. Part II does not apply to storm water NPDES permits or other permits that include requirements for best management practices, in lieu of numeric effluent limits, based on a State Water

¹ Italicized words throughout this document have attached definitions located in section titled “Definition of Terms”.

Resources Control Board or Regional Water Quality Control Board (Regional Water Board) finding that numeric effluent limitations are infeasible, as authorized under 40 C.F.R. section 122.44(k). The Policy supersedes any and all numeric TRC or CPO objectives and implementation provisions for TRC or CPO in regional water quality control plans (Basin Plans) for the same waters.

Because this Policy establishes objectives that apply only to inland surface waters and enclosed bays and estuaries, the Policy does not apply to the direct reuse of recycled water that is conveyed to the use site without entering surface waters of the state. The Policy does apply to the indirect reuse of recycled water that is conveyed to the use site through surface waters of the state.

PART I

Objectives-

The following objectives apply to all inland surface waters and enclosed bays and estuaries to protect freshwater and saltwater aquatic life:

Continuous Discharge

	1-hr average (mg/L)	4-day average (mg/L)
TRC (freshwater)	0.019	0.011
CPO (saltwater)	0.013	0.0075

Intermittent Discharge

	Instantaneous Maximum (µg/L)
TRC (freshwater)	$C = \frac{1070}{T^{0.740}}$
CPO (saltwater)	$C = \frac{63.1}{T^{0.43}}$
C = TRC or CPO instantaneous maximum objective (µg/L).	
T = Sum of intermittent discharge times (in minutes) during a 24-hour, not to exceed 120-minutes.	

PART II

Determining the Need for Water Quality-Based Effluent Limits-

If a discharger uses chlorine in its processes, the discharger's permits must include an effluent limit.

Calculation-

Effluent limitations for the continuous discharge of chlorine residual concentrations shall be expressed as the objectives above, in *1-hour average* and *4-day average*, rather than a weekly or monthly average. Because chlorine residual can be acutely toxic within minutes of exposure to fish and other aquatic life, weekly and monthly limits are not protective and are, therefore, impracticable.

For intermittent discharges of less than two hours per day, the objectives for intermittent discharges apply in lieu of the 1-hour and 4-day averages. Intermittent discharges shall not exceed two hours in a 24-hour period. The combined length of time for all intermittent discharges within a 24-hour period cannot exceed 2 hours, and the combined discharge time shall be used in the intermittent discharge calculation in Part I above. For example a 15-minute discharge, which occurs 4-times in a 24-hour period will have a *T* of 60 minutes.

Compliance Schedules-

Where an *existing* discharger demonstrates that it is *infeasible*² to promptly comply with a new or more restrictive effluent limit or other provision of this Policy, the discharger may request a compliance schedule from the permitting authority. A compliance schedule can be granted to existing dischargers, for example, to investigate the feasibility of acquiring new equipment, hire or train staff, or reconfigure treatment processes to help achieve compliance with this Policy.

A schedule of compliance shall require actions to be undertaken for the purpose of achieving compliance with this Policy. These actions shall demonstrate reasonable progress toward attaining TRC and/or CPO effluent limitations or other provisions of this Policy.

The discharger must provide justification for the allowance of a compliance schedule, which shall include the following:

1. Documentation of efforts to control chlorine residual;

² Both terms "existing" and "infeasible" should be interpreted in the same manner as used in the Policy for Implementation of Toxics Standards for Inland Surface Waters, Enclosed Bays, and Estuaries of California.

2. Documentation that facility upgrades are underway, if applicable;
3. Documentation of an overall plan to gain compliance; and
4. A demonstration that the proposed schedule is as short as practicable.

Compliance schedules shall not exceed five years from the date that the permit is issued, reissued, or modified to include the new or more stringent effluent limits or other policy requirements. The compliance schedule shall include interim TRC or CPO limitations that apply during the compliance period. Compliance schedules shall not be allowed in permits for *new dischargers*.

Monitoring Requirements –

Continuous monitoring of chlorine residual or dechlorination residual concentrations shall be required in all facilities. Continuous monitoring is defined as monitoring that produces one or more data points, every minute. Calibration and maintenance shall be upheld per manufacture's specifications. The Regional Water Board may, however, exempt facilities on a case-by-case basis from the continuous monitoring requirement where the discharger demonstrates and the Regional Water Board determines that continuous monitoring does not appropriately characterize the discharge and the exemption is adopted by the Regional Water Board through the NPDES permitting process. For example, facilities with intermittent flows can appropriately be exempt from the continuous monitoring requirement.

Intermittent chlorine discharge monitoring must however, adequately characterize the discharge. If continuous monitoring is not required, grab samples shall be collected at least every 30-minutes during each intermittent period of chlorination. In addition, regardless of the duration of the intermittent chlorination event, at least one grab sample shall be collected when the discharge concentration is expected to be at a maximum from the chlorination event.

Quantification/Reporting Requirements –

On-line chlorine residual devices must have the ability to record measurements at no less than one per minute and record concentrations in parts per million (mg/L or ppm) to two decimals. On-line devices must have a manufacturer's stated detection limit, scale range, or sensitivity of 1 part per billion (0.001 parts per million). During calibration processes, the discharger shall limit the calibration solution to no more than 0.500 part per million and verify the solution concentration by Method 4500-Cl E as found in - Standard Methods for the Examination of Water and Wastewater, 20th edition, whose stated detection limit is 0.010 part per million. All off-line measurements of chlorine residual shall be this analytical method.

The quantification/reporting limit (QRL) shall not exceed the facilities effluent limitation. However, if the Regional Water Board determines on a case-by-case basis that a discharger cannot meet the QRL set at the effluent limitation and that it is infeasible for

the discharger to show compliance via the presence of residual dechlorination agent or by another means (see the Compliance Determination section of this Policy), an alternative QRL may be established providing the discharger completes and submits a QRL study.

All readings at or above the QRL shall be recorded to two decimals and all readings below the QRL are to be recorded as non-detects (ND) for averaging purposes. To determine compliance the discharger shall do the following:

Compliance with the One-Hour Limit

All readings recorded beginning with the hour and for 59 minutes afterwards shall be collected. All ND readings within this time frame shall be converted to zero. From the readings, the discharger shall compute the arithmetic mean, which shall be the value that is compared with the permit effluent limit. A new determination shall be made of the next hour time period beginning with the next hour. There shall be 24 determinations per day.

Compliance with the Four-Day Limit

All readings recorded beginning at 12:00 AM until 11:59 PM of the fourth day shall be collected. All ND readings within this time frame shall be converted to zero. From the readings, the discharger shall compute the arithmetic mean, which shall be the value that is compared with the permit effluent limit. The discharger may collect the values used to determine compliance with the One Hour limit within the above time frame and compute the arithmetic average. A new determination shall be for the next four-day period beginning at midnight.

Compliance with the Intermittent Limit

A single grab sample cannot exceed the instantaneous maximum effluent limitation for TRC or CPO. If the analytical result of a single grab sample is higher than the instantaneous maximum effluent limitation for TRC or CPO, a violation will be flagged and the discharger will be considered out of compliance for that single sample. Non-compliance for each sample will be considered separately.

Compliance Determination –

Use of continuous monitoring analyzers for chlorine and dechlorination agent residual in the effluent is an appropriate method of process control. A positive residual dechlorination agent in the effluent indicates that chlorine is not present in the discharge, which can validate a zero residual reading on the chlorine analyzer. This type of monitoring can prove that some chlorine residual exceedances are false-positives. Reporting of these two constituents when dechlorination agent is present and chlorine is zero shall sufficiently ensure compliance with the chlorine residual effluent limit, as long as the instruments are maintained and calibrated in accordance with the manufacturer's recommendations.

When continuous monitoring systems are off-line for calibration and maintenance, a back-up system must be in place to show compliance. These systems can include, but are not limited to, monitoring for dechlorination residual (bisulfite or sulfite analyzer), redundant analyzers, *stoichiometry* method, *Whole Effluent Toxicity*³ (WET) testing, or grab samples (according to 40 CFR 136.3 Table 1B, revised as of July 1, 2004) using U.S. Environmental Protection Agency approved methods. However, if grab samples are used they must adequately characterize the discharge. This means at least one sample in 30-minute intervals of the discharge prior to its release into the receiving water and until the continuous monitoring system is back on-line. If the system is off-line less than 30-minutes, at least one sample must be obtained.

If grab samples taken at the end-of-pipe show chlorine residual above the stated effluent limit, the discharger must begin receiving water monitoring to adequately characterize and assess impacts to aquatic life within the receiving water. During situations where sampling the receiving water becomes a safety hazard, such as during the night in a swift moving river, the discharger can develop an alternative method to assess impacts to the receiving water and aquatic life, but must be approved prior to the exceedance.

Any excursion over the 1-hour average, 4-day average, or instantaneous maximum of the intermittent discharge is a violation. However, where a discharger conducts continuous monitoring, the discharger can demonstrate, through data collected from the discharger's back-up monitoring system, that a purported excursion is not an actual excursion because the chlorine analyzer has reported false-positives.

Mixing Zones and Site Specific Objectives –

To the extent authorized by the applicable regional water quality control plan (Basin Plan), a Regional Water Board may grant a *mixing zone* for a discharge of TRC or CPO. Allowance of a mixing zone is discretionary. If a Regional Water Board grants a mixing zone, the objectives for TRC and CPO shall be met throughout the receiving water except within the mixing zone.

A Regional Water Board may develop a site-specific objective for TRC and CPO, or both, whenever it determines, based on its best professional judgment, that the objectives in this Policy are inappropriate for a particular water body. Any site-specific objectives must be developed in compliance with state and federal laws and regulations.

³ Some WET methods allow the exclusion of chlorine in the sample; however, to measure chlorine toxicity accurately, chlorine must remain in the sample.

Definition of Terms

Acute Toxicity

Refers to a stimulus severe enough to rapidly induce an effect; in aquatic toxicity tests, an effect observed in 96- hours or less is typically considered acute. When referring to aquatic toxicology or human health, an acute affect is not always measured in terms of lethality.

Chlorine Produced Oxidants (CPO)

Refers to the sum of oxidative products [hypobromous acid (HOBr), hypobromous ion (OBr-), and bromamines] in salt water.

Continuous Monitoring

For the purpose of this Policy, continuous monitoring is defined as one data point or more every minute.

Dechlorination

A process by which residual chlorine is neutralized, usually through the addition of a sulfite or bisulfite reductant.

Direct Reuse

The use of recycled water that has been transported from a wastewater treatment plant to a reuse site without passing through a natural body of either surface or groundwater.

Enclosed Bays

Indentations along the coast that enclose an area of oceanic water within distinct headlands or harbor works. Enclosed bays include all bays where the narrowest distance between the headlands or outermost harbor works is less than 75 percent of the greatest dimension of the enclosed portion of the bay. Enclosed bays include, but are not limited to, Humboldt Bay, Bodega Harbor, Tomales Bay, Drake's Estero, San Francisco Bay, Morro Bay, and San Diego Bay. Enclosed bays do not include inland surface waters or ocean waters.

Estuaries

Water, including coastal lagoons, located at the mouths of streams that serve as areas of mixing for fresh and ocean waters. Coastal lagoon and mouths of streams that are temporarily separated from the ocean by sandbars shall be considered estuaries. Estuarine waters shall be considered to extend from a bay or the open ocean to a point upstream where there is no significant mixing of fresh water and seawater. Estuarine waters include, but are not limited to, the Sacramento-San Joaquin Delta, as defined in Water Code Section 12220, Suisan Bay, Carquinez Strait downstream to the Carquinez Bridge, and appropriate areas of the Smith, Mad, Eel, Noyo, Russian, Klamath, San Diego, and Otay rivers. Estuaries do not include inland surface waters or ocean waters.

Existing

Any discharger that is not a new discharger. An existing discharger includes an "increasing discharger" (i.e., an existing facility with treatment systems in place for its current discharge that is or will be expanding, upgrading, or modifying its existing permitted discharge after the effective date of this Policy).

Four (4)-day Average

For the purpose of this policy, four-day average is an average, discrete data set in four-day intervals.

Freshwater

Waters in which the salinity is equal to or less than 1 part per thousand 95 percent or more of the time. The applicable criteria for these waters are the freshwater criteria. For waters in which the salinity is between 1 and 10 parts per thousand, the applicable criteria are the more stringent of the freshwater and saltwater criteria unless defensible information and data demonstrate that on a site-specific basis the biology of the water body is dominated by freshwater aquatic life and that freshwater criteria are more appropriate; or, conversely, saltwater criteria are more appropriate.

Indirect Reuse

The use of recycled water indirectly after it has passed through a natural body of water after discharge from a wastewater treatment plant.

Infeasible

Means not capable of being accomplished in a successful manner within a reasonable period of time, taking into account economic, environmental, legal, social, and technological factors.

Inland Surface Waters

All surface waters of the State that do not include the ocean, enclosed bays, or estuaries.

Mixing Zone

Is a limited volume of receiving water that is allocated for mixing with a wastewater discharge where water quality criteria can be exceeded without causing adverse effects to the overall water body.

National Pollutant Discharge Elimination System

A permit program under Section 402 of the Clean Water Act that imposes discharge limitations on point sources by basing them on the effluent limitation capabilities of a control technology or on local water quality standards.

New Dischargers

Includes any building, structure, facility, or installation from which there is, or may be, a discharge of pollutants, the construction of which commenced after the effective date of this Policy.

Non-Storm Water

Any discharge to a storm drain system or receiving water that is not composed entirely of storm water.

One (1)-hour Average

For the purpose of this Policy, one-hour average is an average, is the average of 60 data points whether discrete or rolling, discrete data set of 60 data points or more in one-hour intervals.

Recycled Water

Wastewater that is suitable for a beneficial use as a result of treatment.

Saltwater

Waters in which the salinity is equal to or greater than 10 parts per thousand 95 percent or more of the time. The applicable criteria for these waters are the saltwater criteria. For waters in which the salinity is between 1 and 10 parts per thousand, the applicable criteria are the more stringent of the freshwater and saltwater criteria, unless defensible information and data demonstrate that on a site-specific basis the biology of the water body is dominated by freshwater aquatic life and that freshwater criteria are more appropriate; or, conversely, saltwater criteria are more appropriate.

Stoichiometry

In chemistry, stoichiometry is the study of the combination of elements in chemical reactions. The related term stoichiometric is often used to refer to the "perfect mixture" in this case chlorine and a dechlorinating agent. Stoichiometry rests upon the law of definite proportions (i.e., the law of constant composition) and the law of multiple proportions. In general chemical reactions will combine definite ratios of chemicals.

Total Residual Chlorine (TRC)

Refers to the sum of free chlorine and combined chlorine in fresh water.

Whole Effluent Toxicity (WET)

The total toxic effect of an effluent measured directly with a toxicity test.

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Financial Assistance information: (916) 341-5700
Water Quality information: (916) 341-5455
Water Rights information: (916) 341-5300

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NORTH COAST REGION (1)

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CENTRAL COAST REGION (3)

www.waterboards.ca.gov/centralcoast
895 Aerovista Place, Suite 101
San Luis Obispo, CA 93401
info3@waterboards.ca.gov
(805) 549-3147 TEL • (805) 543-0397 FAX

LAHONTAN REGION (6)

www.waterboards.ca.gov/lahontan
2501 Lake Tahoe Blvd.
South Lake Tahoe, CA 96150
info6@waterboards.ca.gov
(530) 542-5400 TEL • (530) 544-2271 FAX

SAN FRANCISCO BAY REGION (2)

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1515 Clay Street, Suite 1400
Oakland, CA 94612
info2@waterboards.ca.gov
(510) 622-2300 TEL • (510) 622-2460 FAX

LOS ANGELES REGION (4)

www.waterboards.ca.gov/losangeles
320 W. 4th Street, Suite 200
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Victorville branch office

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CENTRAL VALLEY REGION (5)

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11020 Sun Center Drive, Suite 200
Rancho Cordova, CA 95670
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(916) 464-3291 TEL • (916) 464-4645 FAX

COLORADO RIVER BASIN REGION (7)

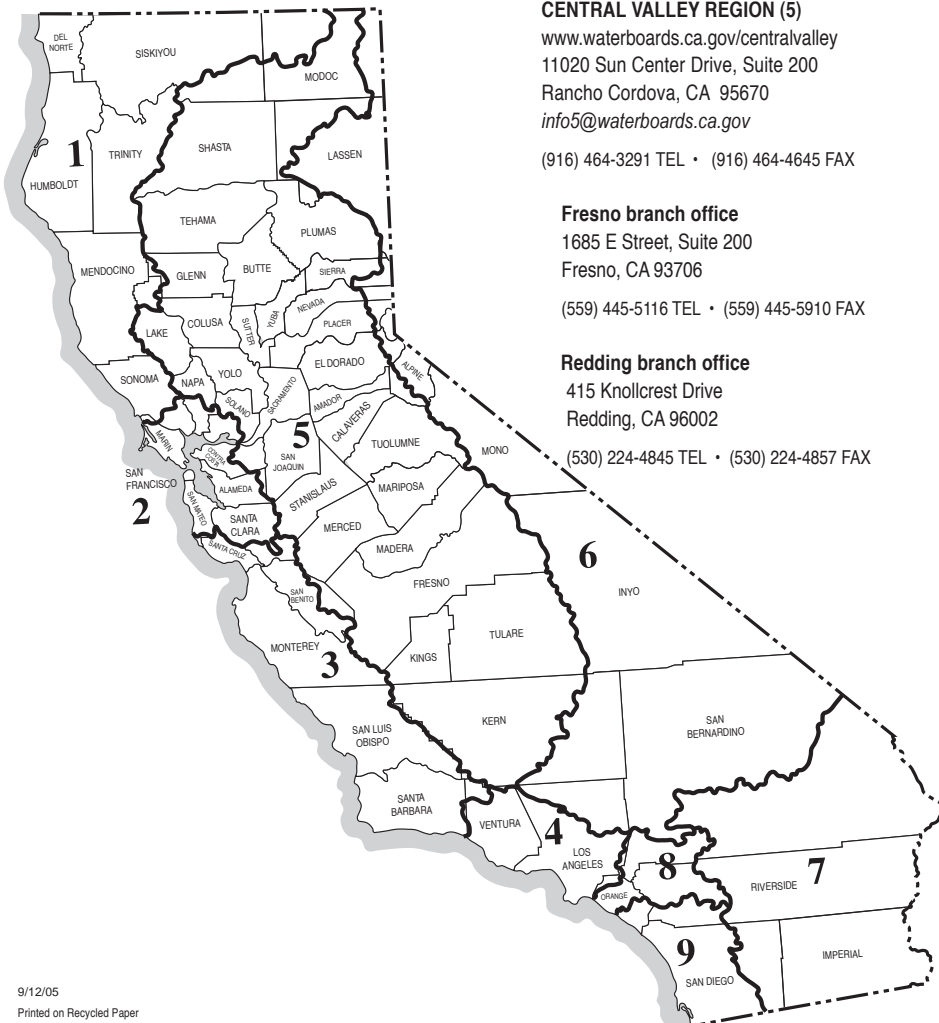
www.waterboards.ca.gov/coloradriver
73-720 Fred Waring Dr., Suite 100
Palm Desert, CA 92260
info7@waterboards.ca.gov
(760) 346-7491 TEL • (760) 341-6820 FAX

SANTA ANA REGION (8)

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