

# Toxicity Provisions

Proposed Toxicity Provision to the Water Quality Control  
Plan for Inland Surface Waters, Enclosed Bays, and  
Estuaries of California

# Presentation Overview

- \* Current Toxicity Framework
- \* Proposed Toxicity Framework
  - \* Goals
  - \* Interaction with the Basin Plans
  - \* Water Quality Objectives
  - \* Test Methods
  - \* Analysis of Test Results

# Presentation Overview

- \* Proposed Toxicity Framework (Continued)
  - \* Non-Storm water NPDES Dischargers (includes Industry and POTWs)
    - \* Species Sensitivity Screening
    - \* Reasonable Potential Analysis
    - \* Routine Monitoring
    - \* Effluent Limits
    - \* Toxicity Reduction Evaluations
    - \* Exceptions
  - \* Storm water & Nonpoint Source Dischargers

# Toxicity Control Requirements

- \* Chemical Specific Monitoring: Measure directly the amount of that substance (e.g., lead, copper, chlorine)
- \* **Aquatic Toxicity Monitoring:** Effect on aquatic organisms compared to control



# What is Aquatic Toxicity Monitoring

- \* Expose organisms to test & control water
  - Invertebrate
  - Vertebrate
  - Plant
- \* Measure effects
  - Survival
  - Growth
  - Reproduction
- \* Look for a statistical significant difference



# Current Aquatic Toxicity Protections

- \* Inconsistent Implementation of Toxicity testing in permits:
  - \* Reasonable Potential
  - \* Species Sensitivity Screening
  - \* Effluent Limitations
  - \* Monitoring Frequency
  - \* Statistical Approach

# What is the Project?

## Goals of New Toxicity Provisions

- \* Consistent protection of Waters of the State
- \* Statewide water quality objectives
- \* Consistent Toxicity Testing and Statistical Approach
- \* Consistent application in permits

# Interaction with Basin Plans

- \* Supersedes
  - \* Methods for assessing compliance with water quality objectives (acute & chronic)
  - \* Toxicity testing & Interpretation of results
- \* Does not Supersede
  - \* Narrative objectives
  - \* Chemical specific limits, targets, or thresholds
  - \* Site specific Water Quality Objectives
  - \* Total Maximum Daily Loads (TMDLs)



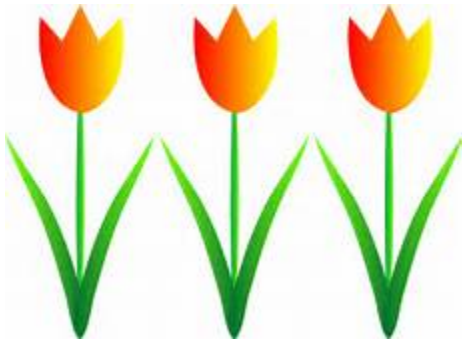
# Null Hypothesis

A hypothesis which the investigator tries to disprove, reject or nullify or a hypothesis to be tested.

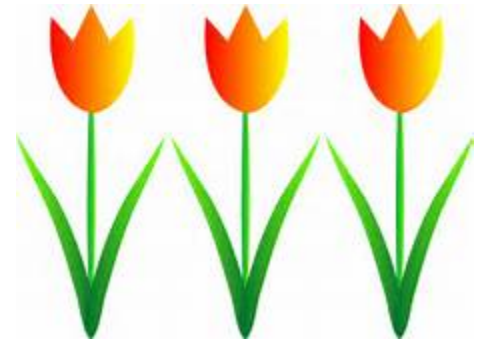
The Alternative Hypothesis is an alternative to the Null Hypothesis, and is generally the opposite statement.

- \* The power lies in the ability to reject the Null Hypothesis
  - Rejecting the Null Hypothesis confirms the Alternative Hypothesis

# Example of Null Hypothesis



Group A



Group B

# Toxicity Water Quality Objectives

## Null Hypothesis

- \* chronic

$H_0$ : Mean RESPONSE (ambient receiving water)  $\leq 0.75$  •  
mean RESPONSE (control)

- \* Acute

$H_0$ : Mean RESPONSE (ambient receiving water)  $\leq 0.80$  •  
mean RESPONSE (control)

- \* Attainment = rejecting the null hypothesis

# Toxicity Test Methods

- \* Species selected from Table 1 (in the Provisions)
- \* Methods established in the U.S. EPA Methods Manuals
- \* At the Instream Waste Concentration



# Analysis of Test Results

- \* Statistical Approach
  - \* Test of Significant Toxicity (TST)
    - \* Results in either a “pass” or “fail”
- \* Percent Effect
- \* Must report both (pass/fail & percent effect)

# Implementation For Non-Storm Water NPDES Dischargers

- ❖ Species Sensitivity Screening
- ❖ Reasonable Potential Analysis
- ❖ Routine Monitoring
- ❖ Effluent Limitations
- ❖ Toxicity Reduction Evaluation
- ❖ Exceptions

# Species Sensitivity Screening

- \* Chronic
  - \* 4 sets of tests over 1 year
  - \* 3 species (plant, vertebrate, invertebrate)
- \* Acute
  - \* 4 sets of tests over 1 year
  - \* 2 species (vertebrate, invertebrate)
- \* Highest percent effect (typically)

# Reasonable Potential Analysis

Applicability	Required	Not Required
Chronic Toxicity	POTWs < 5 MGD Other non-storm water NPDES Dischargers	POTWs $\geq$ 5 MGD
Acute Toxicity	Other non-storm water NPDES dischargers	* POTWs



# Reasonable Potential Analysis (continued)

- \* All data over the past 5 years
  - \* As long as it is representative of effluent quality
- \* A minimum of 4 tests analyzed using the Test of Significant Toxicity (TST)
- \* Reasonable Potential if:
  - \* Any test results in a “Fail” **or**
  - \* 10% effect at the Instream Waste Concentration
  - \* Other information or data

# Routine Monitoring Frequency

Chronic Toxicity	POTWs $\geq$ 5 MGD	Other NPDES dischargers $\geq$ 5 MGD with RP	POTWs < 5 MGD with RP	Other NPDES dischargers < 5 MGD with RP
Frequency	Monthly	Monthly	Quarterly	Quarterly

- Permitting Authority may increase or decrease frequency

Acute Toxicity	POTWs $\geq$ 5 MGD with RP	Other NPDES dischargers $\geq$ 5 MGD with RP	POTWs < 5 MGD with RP	Other NPDES dischargers < 5 MGD with RP
Frequency	Determined by Permitting Authority	Determined by Permitting Authority	Determined by Permitting Authority	Determined by Permitting Authority

# Maximum Daily Effluent Limit

## Chronic Toxicity

“No {most sensitive species} chronic toxicity test may result in a “fail” at the Instream Waste Concentration for the survival endpoint and a percent effect for the survival endpoint greater than or equal to 50 percent.”

# Survival Endpoint & *Ceriodaphnia*

## Variations:

- \* The survival endpoint is not available for some test species (e.g. plants)
- \* The Test of Significant Toxicity (TST) cannot analyze for the survival endpoint for *Ceriodaphnia dubia*

# Maximum Daily Effluent Limit

## Chronic Toxicity Variation 1:

If the most sensitive species chronic toxicity test does not include the survival endpoint, then the permitting authority shall include the following Maximum Daily Effluent Limit:

“No {most sensitive species} chronic toxicity test may result in a “fail” at the Instream Waste Concentration for any endpoint measured in the test and a percent effect for that endpoint greater than or equal to 50 percent.”

# Maximum Daily Effluent Limit

## Chronic Toxicity Variation 2:

If *Ceriodaphnia dubia* is the most sensitive species, then the permitting authority shall include the following Maximum Daily Effluent Limit:

“No *Ceriodaphnia dubia* chronic toxicity test may result in percent effect for the survival endpoint greater than or equal to 50 percent.”

# Maximum Daily Effluent Limit

## Acute Toxicity

“No {most sensitive species} acute toxicity test may result in a “fail” at the Instream Waste Concentration for the survival endpoint and a percent effect for the survival endpoint greater than or equal to 50 percent.”

# Median Monthly Compliance Monitoring

## MMEL Compliance

Routine Monitoring	Compliance Test 1	Compliance Test 2	Violation
Pass	* NA	* NA	No
Fail	Pass	Pass	No
Fail	Pass	Fail	Yes
Fail	Fail	* NA	Yes

\* Tests are not required



# Median Monthly Effluent Limit

## Chronic Toxicity

“No more than one {most sensitive species} chronic toxicity test initiated in a calendar month may result in a “fail” at the Instream Waste Concentration for any endpoint.”

Two or more most sensitive species chronic toxicity tests initiated in a calendar month resulting in a “fail” at the Instream Waste Concentration for any endpoint is a violation of the Median Monthly Effluent Limit

# Median Monthly Effluent Limit

## Acute Toxicity

“No more than one {most sensitive species} acute toxicity test initiated in a calendar month may result in a “fail” at the Instream Waste Concentration for the survival endpoint”

Two or more most sensitive species acute toxicity tests initiated in a calendar month resulting in a “fail” at the Instream Waste Concentration for the survival endpoint is a violation of the Median Monthly Effluent Limit

# Toxicity Reduction Evaluation (TRE)

A study conducted in a step-wise process designed to:

- \* Identify the causative agents of effluent or ambient toxicity,
- \* Isolate the sources of toxicity,
- \* Evaluate the effectiveness of toxicity control options,
- \* Confirm the reduction in toxicity.

# Toxicity Reduction Evaluation (TRE)

- \* A Toxicity Reduction Evaluation is required when:
  - \* Two violations in the same month OR
  - \* Two violations in successive months
- \* Violations can be any combination
  - \* Maximum Daily
  - \* Median Monthly
  - \* Chronic
  - \* Acute

# Exceptions

- \* Small disadvantaged communities
  - \* Specific to Publicly Owned Treatment Works (POTWs)
  - \* Finding of No Reasonable Potential
- \* Insignificant dischargers
  - \* Finding of No Reasonable Potential

# Nonpoint Source & Storm Water

- \* If Toxicity monitoring requirements with species in Table 1
  - \* Issue order (within 1 year)
- \* Use Test of Significant Toxicity (TST) for analysis (within 1 year of order)

# Schedule

Task Name	Target Date
Outreach	April 11, 12, 24th, 2017
Public Comment Period	Summer 2017
Workshop	Mid to late Summer 2017
Hearing	Fall 2017
Board Consideration	By end of 2017

# Contact Information

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# Questions/Comments



# Table 1 Species

EPA Toxicity Test Method	Bioequivalence Value (b)	Tier	False Negative ( $\alpha$ Error)
Chronic Freshwater Methods			
Ceriodaphnia dubia (water flea) survival and reproduction	0.75	I	0.20
Pimephales promelas (fathead minnow) survival and growth	0.75	I	0.25
Selenastrum capricornutum (green alga) Growth	0.75	I	0.25
Chronic West Coast Marine Methods			
Atherinops affinis (topsmelt) survival and growth	0.75	I	0.25
Dendraster excentricus (sand dollar); Strongylocentrotus purpuratus (purple urchin) fertilization	0.75	I	0.05
Dendraster excentricus (sand dollar); Strongylocentrotus purpuratus (purple urchin) larval development	0.75	I	0.05
Haliotis rufescens (red abalone) larval development	0.75	I	0.05
Mytilus sp. (mussels); Crassostrea gigas (oyster) larval development	0.75	I	0.05

# Table 1 Species (Cont.)

Macrocystis pyrifera (giant kelp) germination and germ-tube length	0.75	I	0.05
Chronic East Coast Marine Methods			
Menidia beryllina (inland silverside) survival and growth	0.75	II	0.25
Americamysis bahia (mysid) survival and growth	0.75	II	0.15
Acute Freshwater Methods			
Ceriodaphnia dubia (water flea); Daphnia magna (water flea); Daphnia pulex (water flea); Hyalella azteca (amphipod) Survival	0.80	I	0.10
Pimephales promelas (fathead minnow); Oncorhynchus mykiss (rainbow trout); Salvelinus fontinalis (brook trout) Survival	0.80	I	0.10
Acute Marine Methods			
Atherinops affinis (topsmelt) Survival	0.80	I	0.10
Americamysis bahia (mysid) Survival	0.80	II	0.10
Menidia beryllina (inland silverside) Survival	0.80	II	0.10