

CYANIDE COMPLIANCE AND REGULATION OF EFFLUENT TOXICITY: *WHERE WE ARE AND WHERE WE ARE HEADING*

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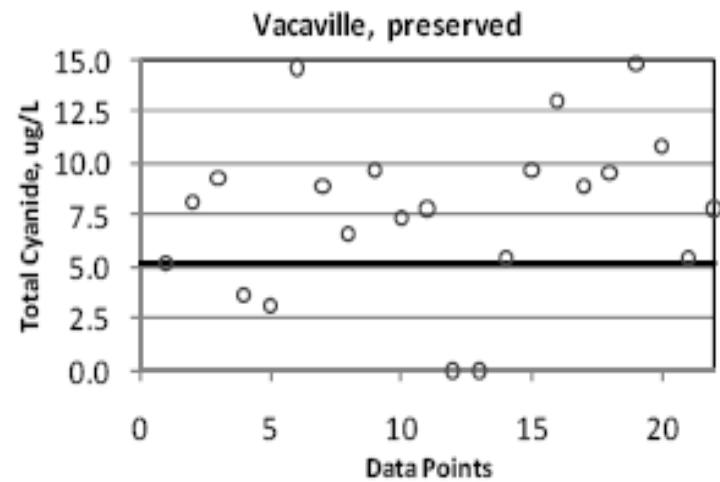
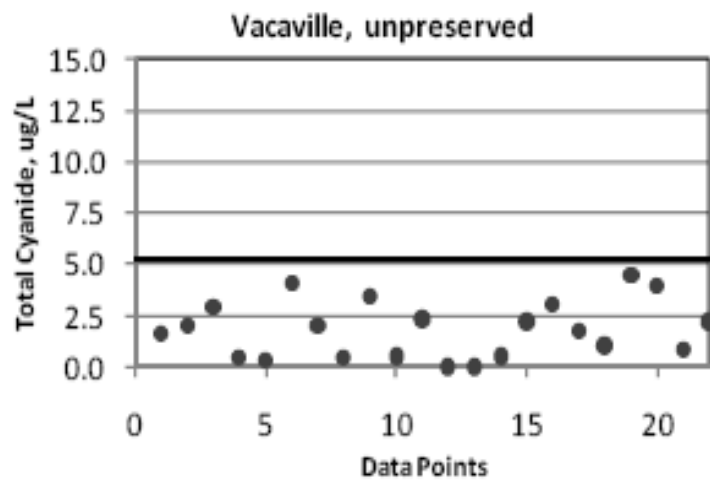
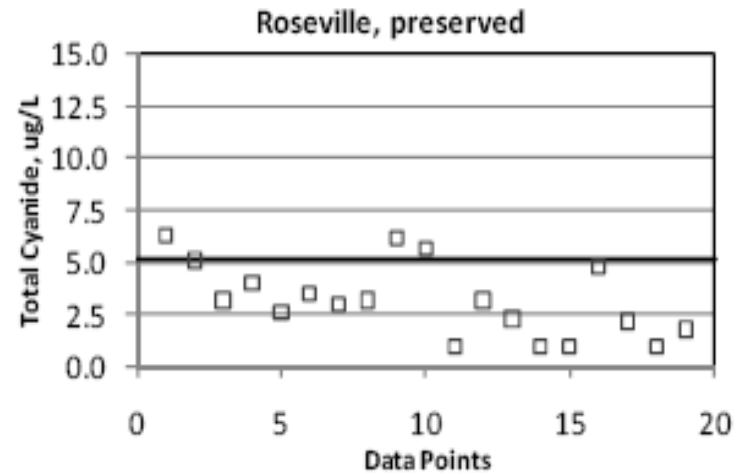
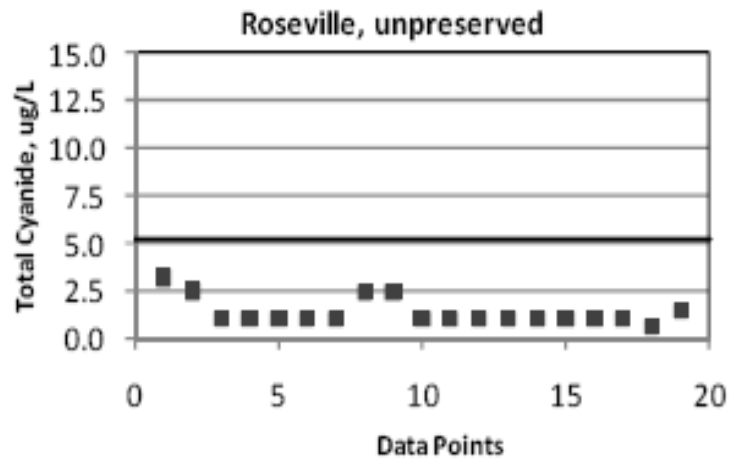
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Solutions for Progress

CVCWA Annual Conference
May 19, 2011

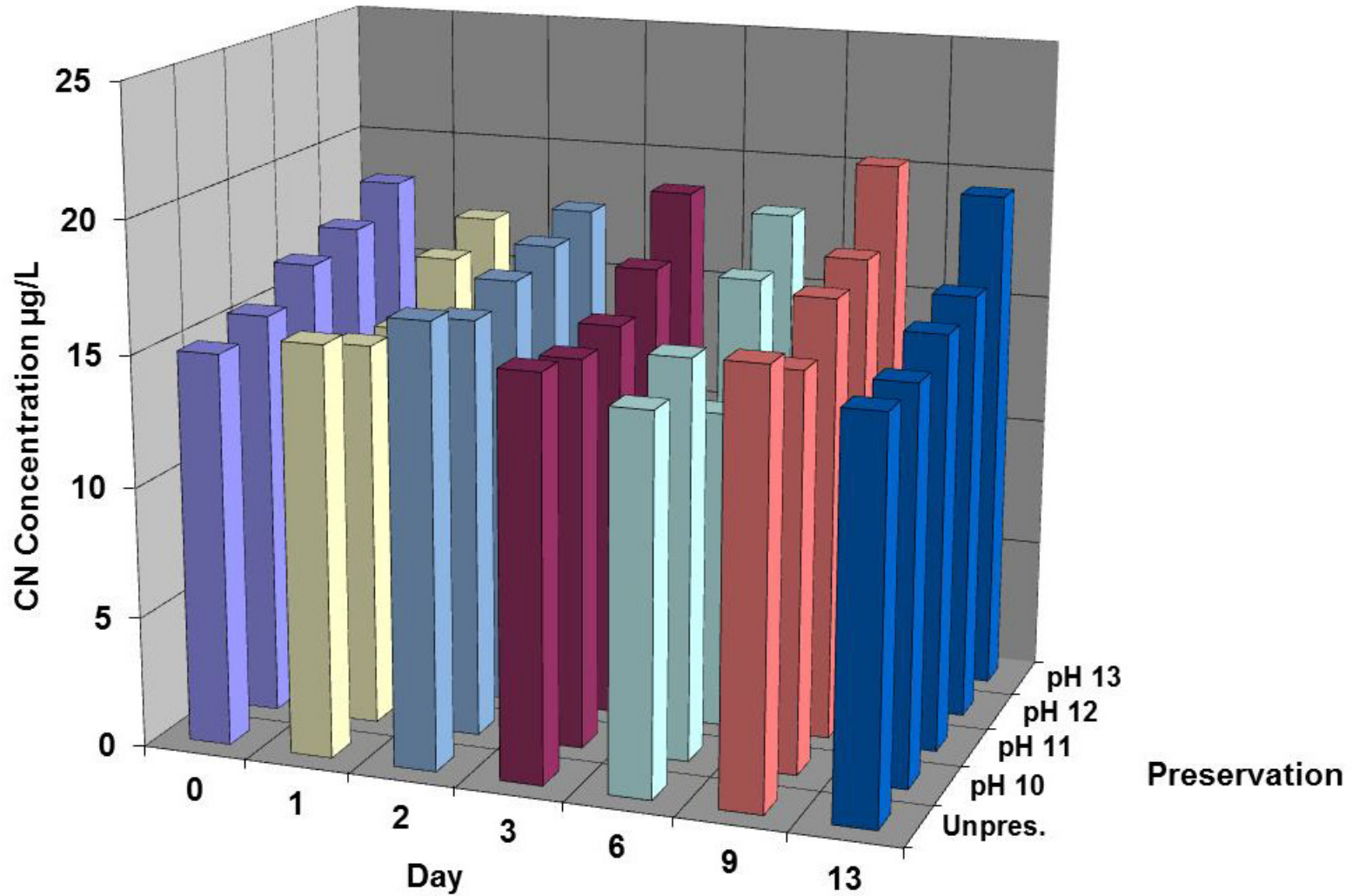
Cyanide Compliance

Cyanide (CN) Background

- Often problematic compliance for dischargers without dilution credit
 - EPA Aquatic Life Criterion 5.2 $\mu\text{g/L}$
 - 4.1 – 4.3 $\mu\text{g/L}$ NPDES Permit AMEL, without dilution credit
- Approved EPA test methods experience numerous interferences
 - Total CN – acid distillation (EPA 335.2, 335.4, SM 4500-CN)
 - Both matrix (e.g., carbonates, nitrite/nitrate, thiocyanate, etc.) and preservation (e.g., NaOH) related interferences
- Effluent cyanide violations may in fact be erroneous analytical measurements



Effect of Holding Time and Preservation on Spiked CN



CN Regulatory Developments

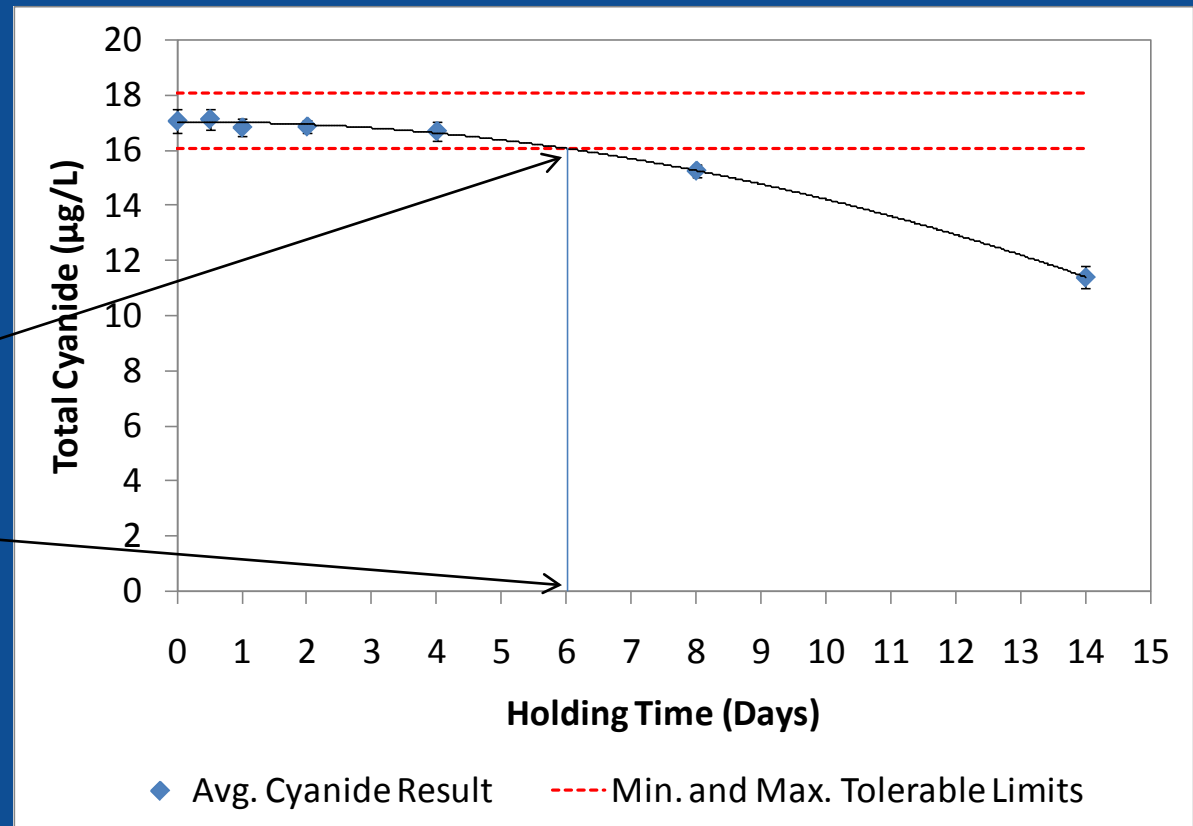
- Existing Regulatory Solutions
 - Analyze CN in-house within 15 minutes
 - Costly, Complex, Hazardous
 - EPA approved Alternate Test Procedure (ATP)
 - Requires matrix specific holding time study as part of ATP application
 - Requires EPA Approval
 - Allows for analysis of unpreserved sample at commercial lab

CN Holding Time Study

- Establishes maximum unpreserved holding time before cyanide falls outside of statistically defined boundaries

Best-fit line crosses
minimum tolerable limit

Maximum allowable
holding-time = 6 days



CN Regulatory Developments

- Proposed Solution - EPA proposed amendments to 40 CFR 136
 - **Conduct matrix-specific unpreserved CN holding time study if analytical interference due to preservation is suspected – must be consistent with ASTM 4841**
 - No ATP application or EPA approval necessary
 - Local permitting authority (RWQCB) will have more discretion—Regional Approach
 - On behalf CVCWA, RBI working with RWQCB

Conclusions

- Under current regulations, dischargers with cyanide compliance issues attributable to preservation must either:
 - Analyze within 15 minutes of sample collection; or
 - Conduct an unpreserved holding-time study and obtain EPA approved ATP.
 - Less costly than gearing up for in-house analysis
- When proposed regulations are adopted, RWQCB will have more discretion and a regional approach may emerge

Regulation of Effluent Toxicity

Outline

- Introduction to regulations and chronic bioassays
- Current toxicity provisions
- Changes under State Board Draft Toxicity Policy

EPA's Integrated Approach to Water Quality-Based Toxics Control

“It is the national policy that the discharge of toxic pollutants in toxic amounts be prohibited.” *Clean Water Act § 101(a)(3)*

- Chemical-specific
- Whole effluent toxicity (WET)
- Biological criteria



Chronic WET Bioassay Tests

Expose organisms to effluent and assess biological responses for potential environmental harm/to meet narrative objective

Example Test Species	Chronic Endpoints
Fathead minnow <i>Pimephales promelas</i>	Survival & Growth (weight)
Water flea <i>Ceriodaphnia dubia</i>	Survival & Reproduction (# neonates per female)
Green alga <i>Selenastrum capricornutum</i>	Growth (number of cells)



Photos: U.S. EPA, NC Division of Water Quality, & UC San Diego

Current Toxicity Monitoring Provisions

- Routine toxicity monitoring
- Numeric toxicity monitoring trigger
 - Defined in chronic toxicity units (TUc) based on “no observed effects concentration” (NOEC)
 - 1 TUc is not toxic; >1 TUc is toxic
- Accelerated monitoring
- Toxicity Reduction Evaluation (TRE)
 - Discharger lead study to identify toxicity and/or control it
 - Facility Performance Review
 - Toxicity Identification Evaluations (TIE)
 - Toxicity control measures

Case Study

- Community of 20,000
- No dilution credit
- No historical toxicity
- Oxidation ditch plant with chlorine disinfection
- Toxicity monitoring trigger of >1 TU_c in NPDES permit
 - $TU_c = 100/NOEC$
 - $NOEC =$ “no observed effects concentration”

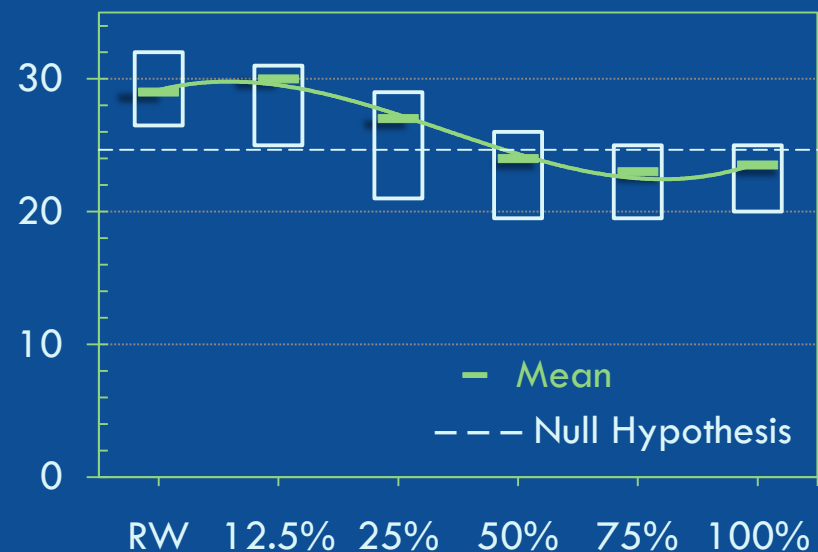


Case Study: Existing Provisions

- Routine toxicity test in October shows statistically significant 19% reduction in *Ceriodaphnia dubia* reproduction compared to receiving water control

- Variability is low
- 25% effluent is NOEC
- 4 TUC; toxicity present

Ideal Dose-Response Example



Case Study: Existing Provisions

- Four accelerated monitoring tests conducted October through December with no additional toxicity
- PMSD = percent minimum significant difference
- Low PMSD reflects less variability; greater precision

Test	Number of neonates per female		Inhibition		PMSD
	Receiving Water	100% Effluent			
October	29	23.5	19%	>	15%
Late October	24	21	12.5%	<	15%
Early November	28	26	7%	<	12%
Late November	26	20	23%	<	34%
Early December	26	22	15%	<	16.5%

BOLD = significant toxicity relative to control

- Return to routine monitoring in January

Changes Needed to WET Practices?



- State Board has delayed addressing the need for WET effluent limitations
- Environmental groups believe current provisions are underprotective
- USEPA seeks to refine statistical analysis
- There are inconsistencies in toxicity control provisions across the state

Future WET – State Draft Toxicity Policy

- Policy would supersede SIP and Regional Water Quality Control Plans (Basin Plans)
 - Public draft and workshop last fall
 - Comments were extended to January
 - State Board staff working on revised draft

Priorities for New State Toxicity Policy

State Board:



- Conservatively protect resources/uses
- Simpler to evaluate; costs less to implement
- Establish numeric toxicity effluent limitations

U.S. EPA:



- Limit “pass” when toxicity present (*false negatives*)
- Set toxic and non-toxic effect thresholds

Dischargers:



- Limit “fail” when toxicity not present (*false positives*)
- Accurately indicate potential environmental harm
- Easy to implement (cost-effective)
- Provide tools to achieve compliance

Draft Toxicity Policy: Overview

- Numeric toxicity objectives and effluent limitations
 - Numeric objectives presume effluent is toxic
 - Chronic numeric objective is $>75\%$ of control
 - Class II violations
- More frequent routine & accelerated testing will result in more frequent TREs
 - Monthly versus quarterly or semi-annually
 - Six accelerated monitoring tests instead of four

Draft Toxicity Policy: Overview

- Use of EPA's Test of Significant Toxicity (TST)
 - High variability results in failed tests
 - 90% control deemed toxic 5 – 15% of time
 - >75 – 90% control, (highly) probable deemed toxic
- No compliance schedules or tools to resolve toxicity

Case Study: Proposed Provisions

- State adopts its Draft Toxicity Policy as proposed

Test	Number of neonates per female		% Inhibition	Coefficient of Variance (CV)
	Receiving Water	100% Effluent		
October	29	23.5	19	15
Late October	24	21	12.5	18
Early November	28	26	7	12
Late November	26	20	23	25
Early December	26	22	15	16.5
Late December	29	23.5	19	10
Early January	25	22.5	10	15

BOLD = significant toxicity relative to control

- Small % inhibition increasingly identified as toxic
- TRE required

Conclusions

□ Current Provisions

- Effective when all parties engaged
- Need process to consider dilution credit in toxicity trigger

□ Draft Toxicity Policy

- RBI continue to work with CVCWA to negotiate improved Policy
- Need to improve quality of bioassay testing/data interpretation
- Budget for increased routine/accelerated monitoring cost

□ Toxicity Reduction Evaluations

- Only one well-defined exit – six “clean” accelerated tests
- More TREs means greater need to evaluate information/options

Questions ?

CASA/CVCWA Comments

- Two-phased trigger approach
 - If routine monitoring exceedance, confirm in 1 or 2 add. tests
 - Need 2 exceedances out of 6 accelerated to trigger TRE
- 25% effect threshold for toxicity trigger (EC/IC 25)
- Reasonable potential
 - Assumed if ≥ 5 mgd
 - Identified if $\geq 25\%$ effect; reassess each permit renewal
- Toxicity monitoring
 - Monthly if ≥ 5 mgd
 - Quarterly if ≥ 1 mgd and < 5 mgd
 - Annual if < 1 mgd
- Violations if fail to perform testing or TRE