CONTROLLING WHOLE EFFLUENT TOXICITY CAUSED BY INDUSTRIAL USERS

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Shealy Consulting, LLC

USEPA REGION IV – SURCHARGE SURVEY RESULTS FOR 38 WWTP'S

PARAMETER	AVERAGE $ PER lb.	RANGE OF $ PER lb.		AVERAGE CONCENTRATION FOR START OF SURCHARGE mg/l
BOD5	0.232	0.030	0.68	281
TSS	0.186	0.035	0.68	301
O&G	0.291	0.030	1.05	94
AMMONIA	0.561	0.040	1.55	25
TKN	1.170	0.14	2.00	39
PHOSPORUS	1.320	0.64	2.00	10
COD	0.107	0.05	0.15	672

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TOPICS FOR DISCUSSION

- WET– GENERAL FACTS AND COMPLEXITY ISSUES
- ONE WET MANAGEMENT OPTION PERTAINING TO IU'S – EPA'S REFRACTORY TOXICITY ASSESSMENT PROTOCOL
- INCORPORATING RTA's IN YOUR PRETREATMENT PROGRAM
- CASE STUDY FOR SOUTH CAROLINA FACILITY

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PURPOSE OF WHOLE EFFLUENT TOXICITY

DEFINITION

Whole effluent toxicity (WET) is the aggregate toxic effect of an effluent sample measured directly by an aquatic toxicity test.

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PURPOSE OF WHOLE EFFLUENT TOXICITY

EXPANDED DEFINITION

WET tests utilize live organisms to measure actual biological responses to an effluent and, therefore, integrates the effects of all chemicals present in the effluent.

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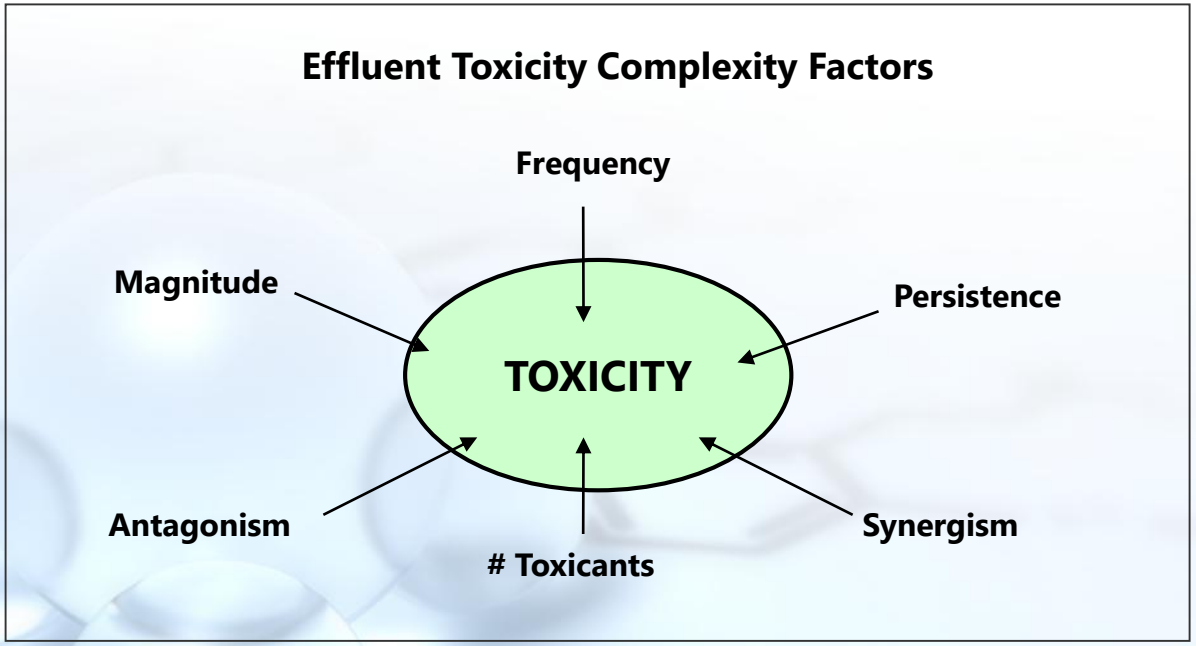
TOXICITY COMPLEXITY FACTORS

Several factors that effect the complexity of toxicity and make it more difficult to control



THE TOXICITY CHALLENGE

Most toxic effluents have one or more of the complexity factors involved making toxicity identification difficult using EPA's Toxicity Identification Approach

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DIFFICULT TIE'S

Sometimes conventional TIE methods are not appropriate because:

- **MULTIPLE COMPLEXITY FACTORS EXIST**

  MARGINAL CHRONIC TOXICITY AND TOXICITY FREQUENCY

- **INADEQUATE INSTRUMENTATION TO ID ORGANICS**

- **MULTIPLE TOXICANTS BY MULTIPLE SOURCES**

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PLANNING IS CRITICAL

"EPA recommends that permittees develop a basic TRE strategy (USEPA 1989a, 1999a) **before** the need arises to facilitate a rapid response in the event of toxicity (USEPA 2001)". emphasis added

HAVE A PLAN EVEN IF YOU ARE CURRENTLY PASSING

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EPA METHODOLOGIES FOR IDENTIFYING TOXICITY

United States Environmental Protection Agency. 1991. *Methods for Aquatic Toxicity Identification Evaluations: Phase I. Toxicity Characterization Procedures*. 2nd Edition. EPA-600-6-91-003. National Effluent Toxicity Assessment Center, Duluth, MN.

United States Environmental Protection Agency. *Toxicity Identification Evaluation: Characterization of Chronically Toxic Effluents, Phase I.* EPA/600/6-91/005F. May 1992. National Effluent Toxicity Assessment Center, Duluth, MN.

United States Environmental Protection Agency. 1993. *Methods for Aquatic Toxicity Identification Evaluations-Phase II Toxicity Identification Procedures for Samples Exhibiting Acute and Chronic Toxicity*. EPA-600-R-92-080. National Effluent Toxicity Assessment Center, Duluth, MN.

United States Environmental Protection Agency. 1993. *Methods for Aquatic Toxicity Identification Evaluations-Phase III Toxicity Confirmation Procedures for Samples Exhibiting Acute and Chronic Toxicity*. EPA-600-R-92-081. National Effluent Toxicity Assessment Center, Duluth, MN.

United States Environmental Protection Agency. 1996. *Marine Toxicity Identification Evaluation (TIE): Phase I Guidance Document.* EPA/600/R-96-054. National Health and Environmental Effects Laboratory, Narragansett, RI.

United States Environmental Protection Agency. *Toxicity Reduction Evaluation Guidance for Municipal Wastewater Treatment Plants*. EPA-833B-99-002. Office of Water, Washington, D.C.

United States Environmental Protection Agency. 1989. *Generalized Methodology for Conducting Industrial Toxicity Reduction Evaluations*. EPA-600-2-88-070. Office of Research and Development, Cincinnati, OH.

United States Environmental Protection Agency. “Clarifications Regarding Toxicity Reduction and Identification Evaluations in the National Pollutant Discharge Elimination System Program.” March 27, 2001. Office of Wastewater Management, Washington, D.C.

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If traditional TIE methods do not work what do you do?

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RTA's
TOXICITY SPECIFIC TRACKING

RTA's estimate the toxicity of a particular industrial sample or trunkline after bench scale treatment in the laboratory.

Uses

Allows for the individual trunklines and/or industrial users to be tested and the toxicity to be tracked to it's source.

Allows for individual industries to be combined to determine additive effects

If a source is suspected RTA's can be used to confirm that the industry is the culprit for toxicity

Can be used to determine if your facility can handle a particular wastewater

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REFRACTORY TOXICITY ASSESSMENTS

RTA Protocol is an Appendix found in:
United States Environmental Protection Agency. *Toxicity Reduction Evaluation Guidance for Municipal Wastewater Treatment Plants*. EPA-833B-99-002. Office of Water, Washington, D.C.

RTAs are an estimation – predictive tool

FLEXIBLE - Can be performed on a case by case basis after toxicity is found or can be used as part of the pretreatment program

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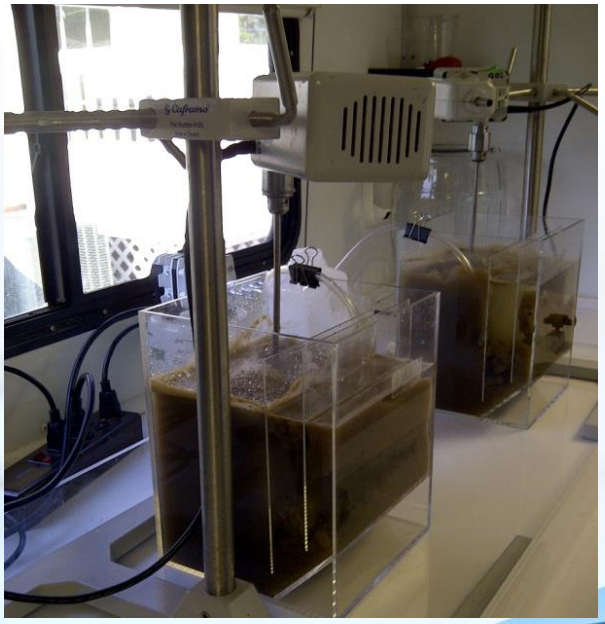
TYPES OF REFRACTORY TOXICITY SIMULATIONS

SIMULATE BIOLOGICAL PROCESSES OF MUNICIPAL FACILITIES

continuously fed reactors

"fill and draw"



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INFLUENT

CAN ALSO SIMULATE PRETREATMENT PROCESSES

GRANULAR ACTIVATED CARBON TREATMENT

RTA REACTOR PARAMETERS SHOULD SIMULATE ACTUAL WWTP (AS CLOSELY AS FEASIBLE)

PROCESS SPECIFICATIOS	WWTP	RTA SIMULATION
ACTIVATED SLUDGE PROCESS		
MLSS	√	√
DISSOLVED OXYGEN	√	√
HRT	√	√
SAND FILTER PROCESS		
FILTRATION RATE (gpm/sf)	√	√
FILTER AREA (sf)	√	√
SAND PARTICLE SIZE	√	√
SAND DEPTH (mm)	√	√
WATER DEPTH (ft)	√	√

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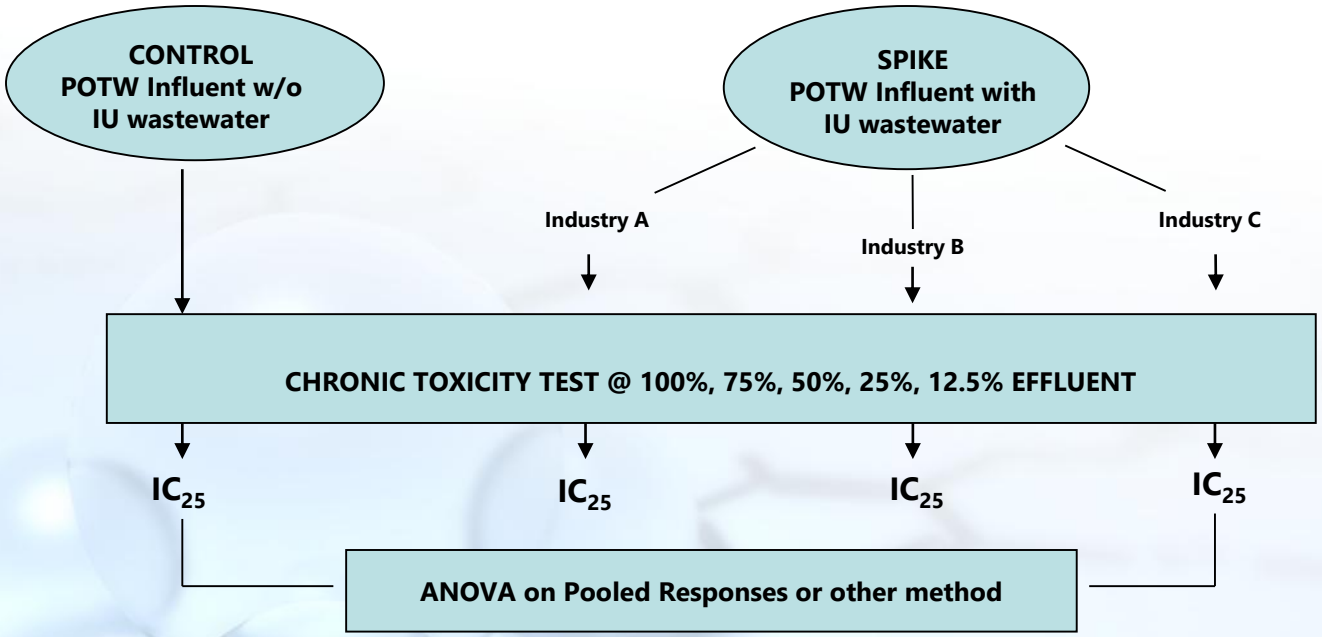
TYPICAL RTA DESIGN FOR MUNICIPAL FACILITY



Use of RTA Testing – Shealy Clients

SHEALY RESULTS (2018)

5 POTW's using RTA testing as part of pretreatment program

All of those have significantly reduced or eliminated toxicity.

>12 Municipal and Industrial Facilities have used RTA testing in conjunction with toxicity identification evaluations to Identify toxic waste streams – all were successful.

RTA COSTS

EPA Protocol $4800 (includes a control)

Includes SOUR to access treatability and chronic toxicity

Screening Method $2200 (includes a control)

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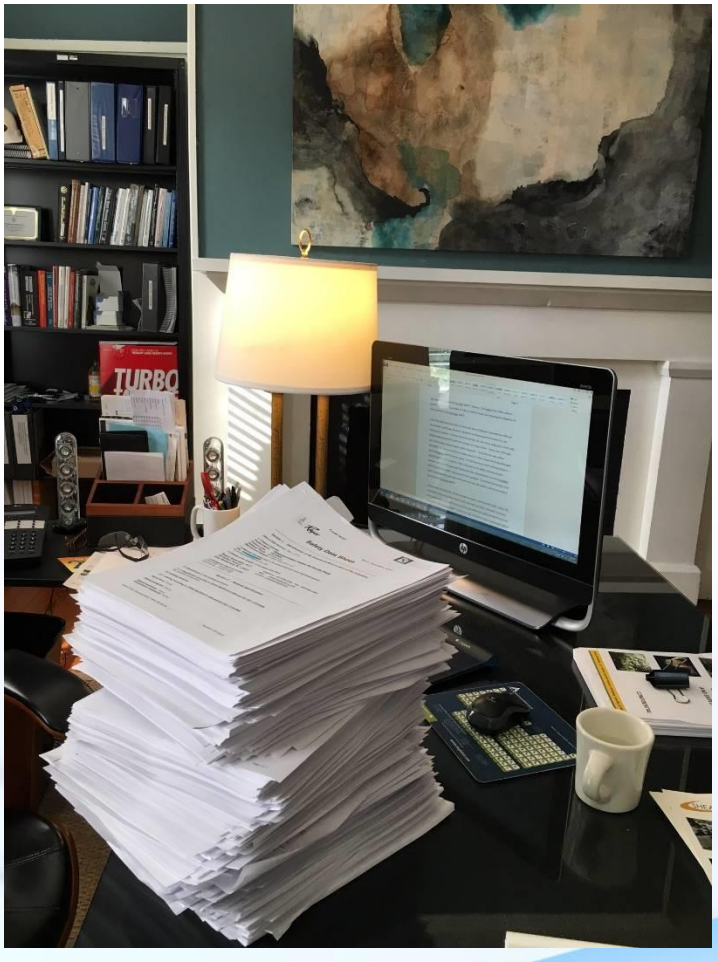
Which IU's to Sample?

Need to Prioritize

Which Industries have POTENTIAL to Cause Toxicity



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Using RTA in Pretreatment Programs

ONE OPTION WITH MINIMAL EXPENSE

Collect samples of IU wastewater each time POTW samples for toxicity and HOLD sample

If POTW fails then run RTA on some or all IU samples collected

Using RTA in Pretreatment Programs

ANOTHER OPTION WITH MINIMAL EXPENSE

Have IU collect wastewater each time POTW samples for toxicity and HOLD sample

If POTW fails then IU sends samples to lab

Using RTA in Pretreatment Programs

ANOTHER OPTION WITH MINIMAL EXPENSE TO POTW

Require Industrial Users to perform RTA testing at some frequency.

MAJOR BENEFIT FOR PRETREATMENT RTA PROGRAM

Industrial users become concerned about their discharges' potential for toxicity at the POTW

South Carolina Case Study

KERSHAW COUNTY UTILITIES' LUGOFF WWTP

Small SBR Plant with 500,000 GPD FLOW

Monthly NPDES Toxicity Requirement

Must Pass Toxicity at 7.5% Effluent (CTC)

Periodic Failures 2X/year

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WET LIMITS IN SC

Based on effluent mixing in stream

Depends on Stream 7Q10 and Mixing Zone

Facilities Must Pass at CTC

Case Study

2 Industries

- Textile Manufacturer (Industry A)
- Organic Chemical Manufacturer (Industry B)

Kershaw County requires both industries to run chronic toxicity 2X/month until 1 year Passing Tests

Industries must pass toxicity at a concentration equal to the IU's percent contribution of the POTW's CTC (7.5%).

Case Study

For Example, Industry B's maximum permitted flow corresponds to 25% of the Lugoff WWTP total flow

25% of 7.5% (CTC) is 1.875%

Industry B must pass toxicity at 2%

Case Study

INDUSTRY B

Must pass toxicity at 2% twice a month and 1 of the tests must be conducted at the same time as the Lugoff WWTP's NPDES test.

RTA TRIGGER

If the Lugoff WWTP fails toxicity at 15% Effluent and Industry B fails toxicity at 2% effluent, an RTA is triggered. If Industry B fails an RTA test a Toxicity Identification Evaluation (TIE) must be conducted

E. Refractory Toxicity Assessment Testing

In the event the Permittee's WET Chronic Testing at a CTC = 2.0% exceeds IC25 (test concentration at which 25% inhibition is observed), and for the same testing period Kershaw County's WET Chronic Testing at a CTC = 15.0% exceeds IC25, the Permittee is required to perform Refractory Toxicity Assessment (RTA) testing. RTA testing shall be performed in accordance with the most current RTA Protocol developed and approved by Kershaw County based upon the *Toxicity Reduction Evaluation Guidance for Municipal Wastewater Treatment Plants* (EPA, 1999) and in accordance with the following:

The RTA test shall be performed at a test condition representing 25 percent of the actual wastewater flow received by the Kershaw County WWTP.

An individual RTA test is considered a failure if the IC25 of the Permittee's spiked test reactor is less than 15.0%. If at any time, the Control Reactor IC25 is less than 15.0%, the test will be invalid and must be repeated with new MLSS.

Should the Permittee fail any RTA test (performed by the Permittee or Kershaw County), the facility will be considered to be in non-compliance for toxicity and shall perform a Toxicity Identification Evaluation (TIE) to determine the cause(s) of the toxicity. Kershaw County shall be reimbursed for its expense associated with any failed RTA test performed on the Permittee's discharge.

The Permittee will be considered to be in non-compliance until such time as a subsequent RTA test passes or subsequent Kershaw County NPDES WET Chronic testing at a CTC = 15.0% is less than or equal IC25.

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Questions?
More Information?

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