



**CONTROLLING WHOLE EFFLUENT  
TOXICITY CAUSED  
BY INDUSTRIAL USERS**

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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 AND TREATABILITY PROTOCOL**
- **INCORPORATING TREATABILITY IN YOUR PRETREATMENT PROGRAM**

# PURPOSE OF WHOLE EFFLUENT TOXICITY



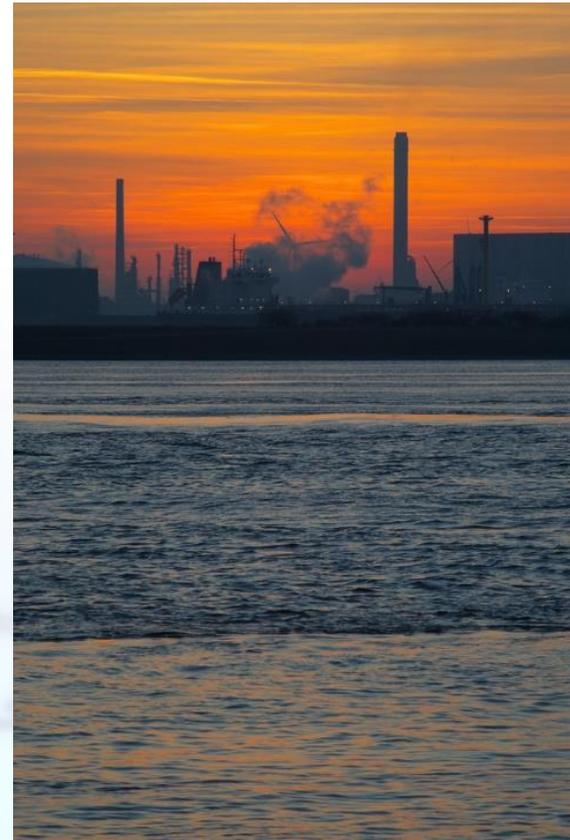
## DEFINITION

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

# 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.

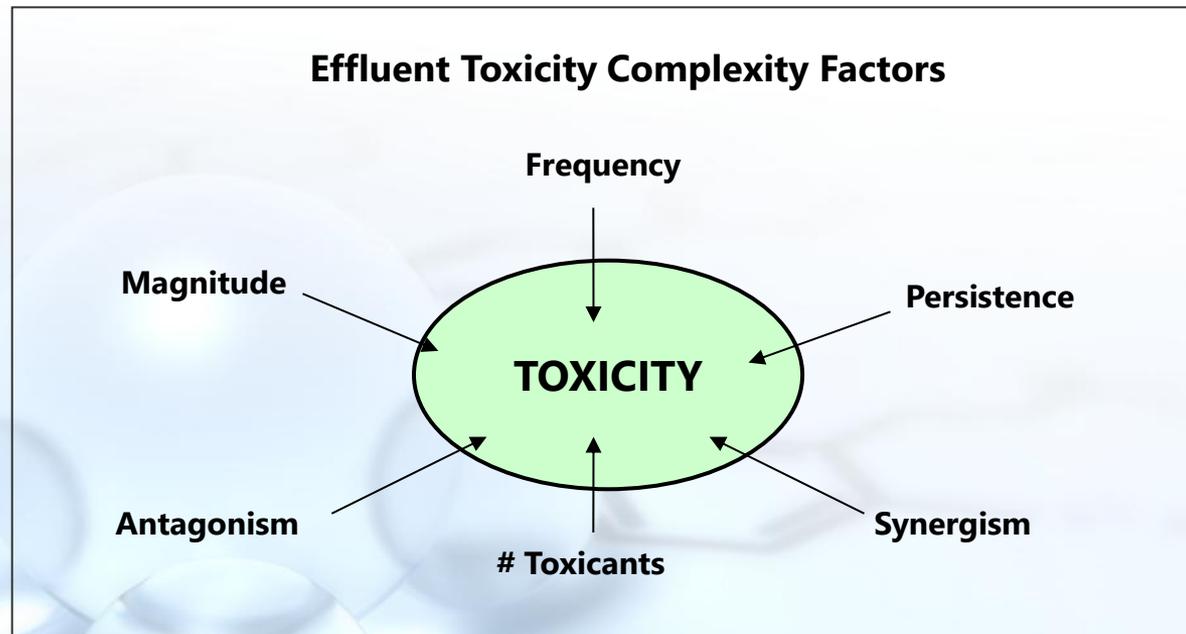






# TOXICITY COMPLEXITY FACTORS

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



# 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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# THE TOXICITY CHALLENGE



Most toxic effluents have one or more of the complexity factors involved making toxicity identification difficult

# 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

# 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**

# If traditional TIE methods do not work

ALTERNATE APPROACHES MAY HELP SUCH AS:

MOLECULAR SIEVES

PBO ADDITION

FTIR

HPLC

MICROTOX

ELECTRON MICROSCOPY

REFRACTORY TOXICITY ASSESSMENT TESTING



# RTA's ARE 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

# 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 estimate the toxicity of an industrial user's waste stream – 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

# TYPES OF REFRACTORY TOXICITY SIMULATIONS

SIMULATE BIOLOGICAL PROCESSES OF MUNICIPAL FACILITIES

*continuously fed reactors*



*"fill and draw"*





INFLUENT

Influent  
Solids II

# CAN ALSO SIMULATE PRETREATMENT PROCESSES

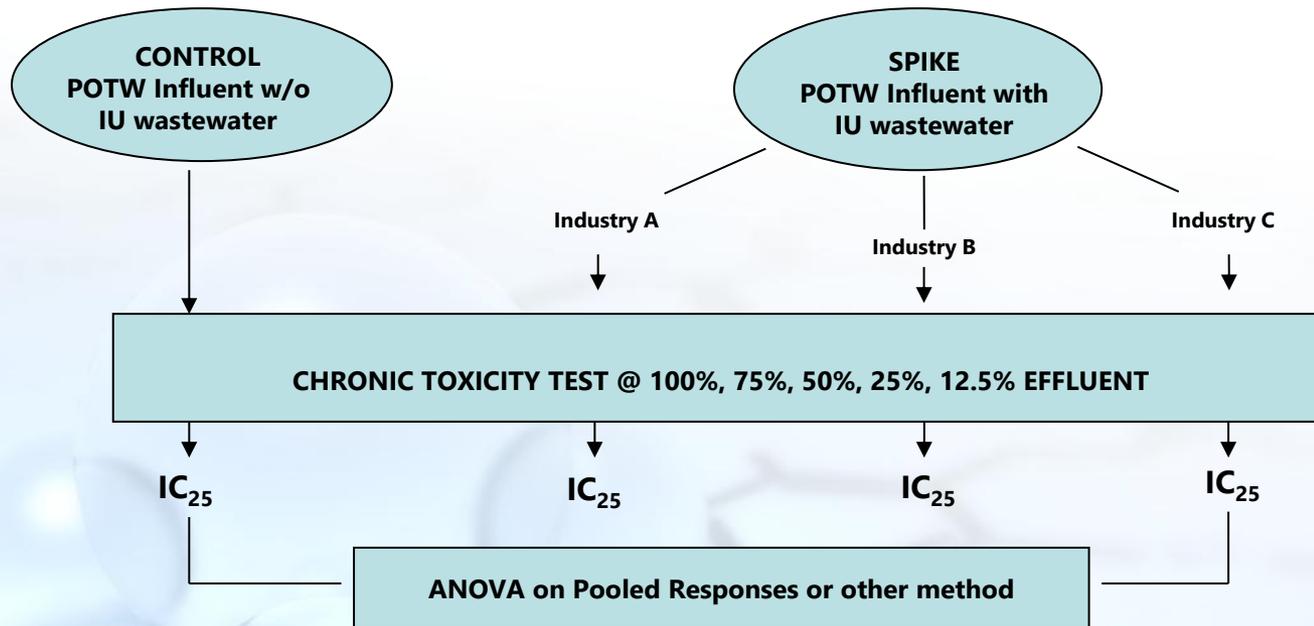
## GRANULAR ACTIVATED CARBON TREATMENT



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

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

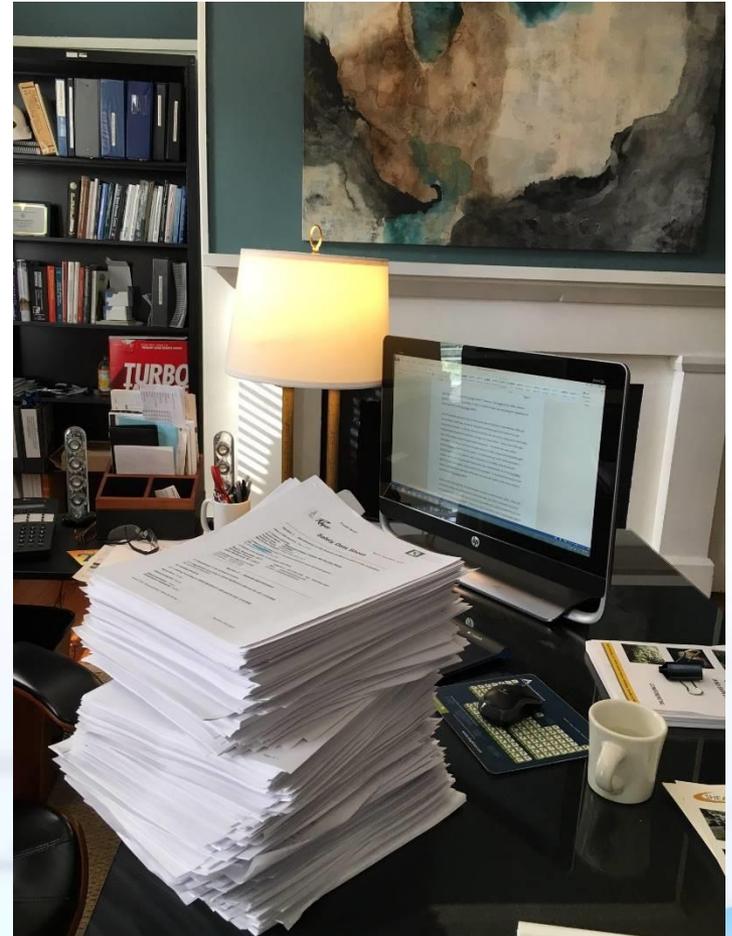
# TYPICAL RTA DESIGN FOR MUNICIPAL FACILITY



# Which IU's to Sample?

**Need to Prioritize**

**Which Industries have  
POTENTIAL to Cause Toxicity**



# 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**