Statewide Wastewater Sector Pooled Emissions Study

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Agenda

- Pooled Emissions Study Structure
- CTR/EICG Two-Step Process Requirements
- Previous Discussions with CARB/SCAQMD
- CASA Steering Committee Objectives
- Compound Selection Criteria
- Proposed Test Methods: Overview and Challenges
- Pooled Emissions Study: Program Simplification
- Proposed Wastewater Sector Statewide Two-Step Process
- Next Steps

Pooled Emissions Study Structure

- CASA (California Association of Sanitation Agencies)
- CASA Steering Committee – 8 members
  - CASA: 2 members
  - Clean Water SoCal: 2 members
  - Bay Area Clean Water Association (BACWA): 2 members
  - Central Valley Clean Water Association (CVCWA): 2 members
- Yorke Engineering – Project Manager

CTR/EICG Two-Step Process Requirements

- On November 19, 2020, the California Air Resources Board (CARB) amended:
  - Criteria & Toxics Reporting Regulation (CTR)
  - Emissions Inventory Criteria & Guidelines for Air Toxics "Hot Spots" Program (EICG)
- Final rulemaking documents approved by Office of Administrative Law in 2022
- Waste sector must submit 2028 data in 2029
- AB 2588 list of air toxics increased from about 700 to over 1,600 compounds*

**Current practice excludes testing compounds without approved test methods or toxicity (e.g., SCAQMD Rule 1401 includes 239 compounds)*

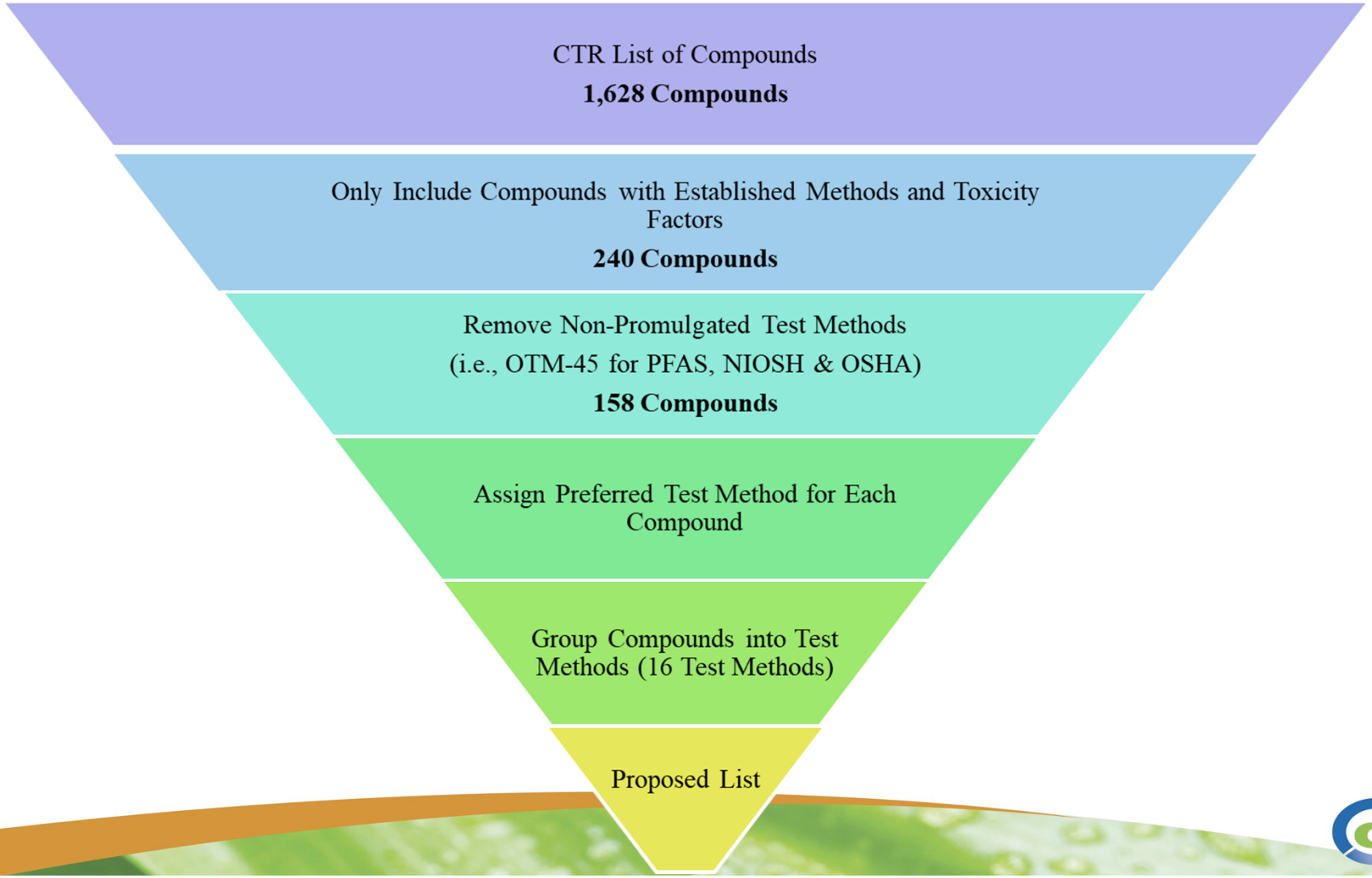
Previous Discussions with CARB/SCAQMD

- EICG allows a two-step process to identify and quantify toxics
- GC/MS scan to tentatively identify compounds to be quantified (Step 1):
  - CARB staff recommended a GC/MS scanning approach
  - SCAQMD expressed concerns that a GC/MS scan would not be sensitive enough to identify targeted compounds
- Quantification of compounds without approved test methods or toxicity (Step 2):
  - CARB staff requested testing for compounds without approved test methods or toxicity
  - SCAQMD and other air districts have expressed an interest in excluding compounds without approved test methods or toxicity

CASA Steering Committee Objectives

- Obtain approval for a statewide testing program that includes the following considerations:
  - Test with approved methods (i.e., unapproved methods may yield erroneous results and may trigger retesting upon development of approved methods)
  - Test for compounds with known toxicity (i.e., obtained data cannot be used for risk-based decisions without compound toxicity)
  - Attempt to simplify the testing program:
    - Test processes that can be used to establish conservative emission factors for the wastewater sector
    - Test facilities to obtain conservative emission factors

Compound Selection Criteria



Grouping 158 Compounds into Test Methods

Methods	Applicable Source Type	Number of Compounds	Class of Compounds
EPA TO-15A	All	74	Toxic Organics
CARB 428	Ducted	30	Dioxins, Furans
CARB 436	Ducted	13	Metals
CARB 429	Ducted	11	PAHs
CARB 5	Ducted	6	PM
EPA 326/CTM-036	Ducted	2	Diisocyanates
CARB 421	Ducted	3	Inorganic Acids
EPA 26/26A	Ducted	2	Halides
CARB 426	Ducted	2	Cyanide
CARB 13B	Ducted	2	Fluoride
CARB 427	Ducted	2	Asbestos
CARB 425	Ducted	1	Hexavalent Chromium
CARB 430	Ducted/Non-Isokinetic	3	Aldehydes
SCAQMD 207.1	Ducted/Non-Isokinetic	1	Ammonia
EPA 308	Ducted/Non-Isokinetic	3	Glycols
SCAQMD 307-91	All	1	Hydrogen Sulfide

Grouping 158 Compounds into Test Methods

Ducted sampling locations are preferred. Sampling using isolation flux chambers poses many challenges:

- Operational challenges (i.e., turbulent liquid surfaces, internal chamber humidity/condensation, sample species “scrubbing” effects)
- Most standard EPA/CARB test methods are not applicable to flux chamber sampling
- Potential for inaccuracies is high in the resulting data from flux chamber sampling

Proposed Test Methods: Overview & Challenges

- 16 EPA/CARB test methods identified for capturing 158 target compounds
- Of the 16 identified test methods, 10 methods are isokinetic and involve complex sampling trains, operating, recovery, and analytical procedures
- Isokinetic sampling methods are applicable to ducted processes

Proposed Test Methods: Overview & Challenges

- Feasibility issues arise when considering all test methods performed for all unit processes at all selected facilities
  - Typical test approach: Conduct two isokinetic test methods simultaneously per source duct
  - Triplicate sampling (3 runs), 1-3 hours per run depending on required sample volume, detection limits, etc.
  - With 10 isokinetic test methods to perform, testing of each unit process could take 5-10 days assuming maximum efficiency and zero delays
  - 5-10 days of testing assumes non-isokinetic test methods can be completed during this time frame in conjunction with isokinetic testing

Proposed Test Methods: Overview and Challenges

- This means that testing just six unit processes at one facility would require 30-60 days of testing to complete all test methods

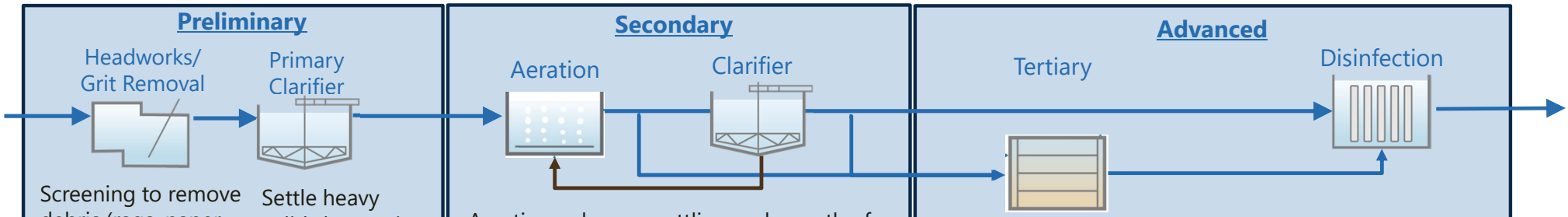
- Even if multiple test teams were employed, the required sampling timeline at even one facility is significant

Pooled Emissions Study: Program Simplification

- **Wastewater Treatment Processes**
  - Processes can be grouped into smaller categories for testing purposes
  - Conservative testing locations can be selected to represent many potential emission sources (i.e., testing the highest emission source to represent many other sources)

- **Wastewater Treatment Plant Selection**
  - Similarly, treatment plants with higher industrial loading should be used to conservatively represent any treatment plant

Stages of Municipal Wastewater Treatment: Liquids



Screening to remove debris (rags, paper, wood, plastics, metals – may include shredder or grinder) & grit (gravel, sand, small heavy material) by gravity.

Settle heavy solids by gravity, skim suspended solids to "clarify" stream (can enhance settling by adding an inorganic non-toxic coagulant).

- **Influent Screening***
- Grit Chamber (can be aerated)
- Settling Tank

***Bold text indicates Sampling Location**

Sample Location 1
Influent screening is a gravity process to separate debris/grit from flow that may include turbulence, in turn chemical stripping to the air.

Aeration enhances settling and growth of microorganisms ('bugs") to break down & feed on organic matter, then settles by gravity for removal (may enhance settling by adding coagulant). Some settled solids are sent back (or a carbon source) is fed to the aeration tank for microbe use. Can manage anoxic zones to remove nutrients.

- **Activated Sludge***
- Trickling Filters
- Oxidation Pond
- Settling Tank

Combined Secondary/Tertiary
Membrane Bioreactor

Sample Location 2
Aeration may influence chemical stripping from the stream into the air.

Polishing step for removing very small particles for high quality effluent. Layers of sand, activated carbon, or membranes of small pore size are used to further filter the stream & adsorb remaining organics from the stream.

- Sand Filtration
- Microfiltration
- Ultrafiltration
- Reverse Osmosis

Process to inactivate pathogens, such as bacteria and viruses.

- **Chlorination***
- Ultraviolet (UV) Light
- Advanced Oxidation (usually after UV)
- Ozonation

Sample Location 3
Chlorine is the most common form of disinfection could influence chemical stripping.

Preliminary Wastewater Treatment

Primary Wastewater Treatment

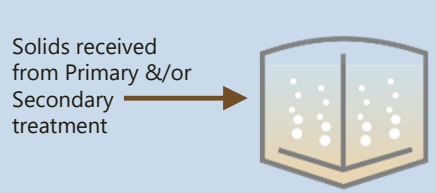
Secondary Wastewater Treatment

Advanced Wastewater Treatment

Stages of Municipal Wastewater Treatment: Solids

Note: Liquid treatment processes represent the more conservative emission factors

Solids Thickening



Sludge thickening is a process (driven primarily by gravity or compressed air released at atmospheric pressure) that increases solids concentration and decreases total sludge volume while making sure the sludge still behaves like a liquid for pumping/treatment.

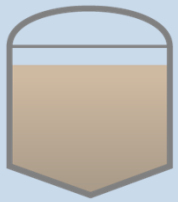
- Gravity Thickeners
- **Dissolved Air Flotation (DAF)***

***Bold text indicates Sampling Location**

Sample Location 4

In the DAF, compressed air is pumped into the flocculation chamber at atmospheric pressure, forming tiny bubbles that adhere to the suspended matter, may lead to chemical stripping to the air.

Solids Treatment



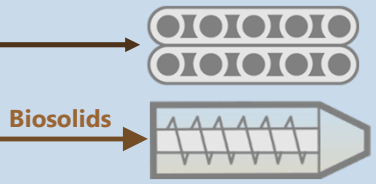
Solids treatment is performed using EPA approved process for achieving use or disposal standards. Anaerobic digestion (AD) is the most common process in CA treating >90% of the sewered population's solids. The AD's contain microorganisms that break down sludge and other organics into biosolids and biogas.

- AD: Mesophilic
- AD: Thermophilic
- Aerobic Digestion

Sampling Not Applicable

AD is the dominant solids treatment process and is a closed system where the raw biogas is collected and routed to use and/or abatement.

Biosolids Dewatering



Biosolids are dewatered from 3-5% to 15-30% to be transported to an end use (land application), third party (for further processing to compost or liquid fertilizer), or disposal (at a landfill).

- Belt Filter Press
- Centrifuge

Sampling Not Applicable

BFPs use gravity and physical compression (low pressure) and centrifuges use a physical process to rapidly rotate stabilized solids (or biosolids) that is enclosed, both processes limit emissions.

Biosolids Drying

Sometimes biosolids are further dried prior to being transported to an end use (land application) or disposal (at a landfill).

- Solids Drying Bed
- Thermal Dryer

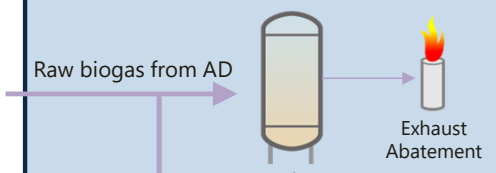
Sampling Not Applicable

Drying is often performed offsite or not needed.

Dissolved Air Flotation (DAF)

Stages of Municipal Wastewater Treatment: Biogas

Biogas Conditioning



Biogas from AD is routed to either a flare for abatement or conditioned for use. Minor cleanup is needed if it is used in a boiler or an engine to generate electricity and heat. A higher purity standard is needed (removal of water, hydrogen sulfide, carbon dioxide, & other trace elements, siloxanes) to produce biomethane comparable to conventional natural gas suitable for pipeline-injection & transportation fuel.

- Moisture & Sulfur Removal
- +Carbon Dioxide & Siloxane Removal

Sampling Not Applicable
Conditioning is a closed process & abatement of exhaust is required for safety reasons/meeting local regulations.

Biogas Utilization

Onsite combustion of biogas (that has undergone minor cleanup) in a boiler (to generate heat) and/or in an engine (to generate electricity and heat) to meet wastewater treatment plant demand; in turn, offsetting purchased electricity and natural gas use.

- **Combustion Device(s)***
  - Internal Combustion Engine
  - Turbine Engine
  - Boiler

***Bold text indicates Sampling Location**

Sample Location 5
Though regulatory requirements are becoming increasingly restrictive for stationary sources, we recommend sampling low temperature combustion devices to conservatively estimate toxic emissions.

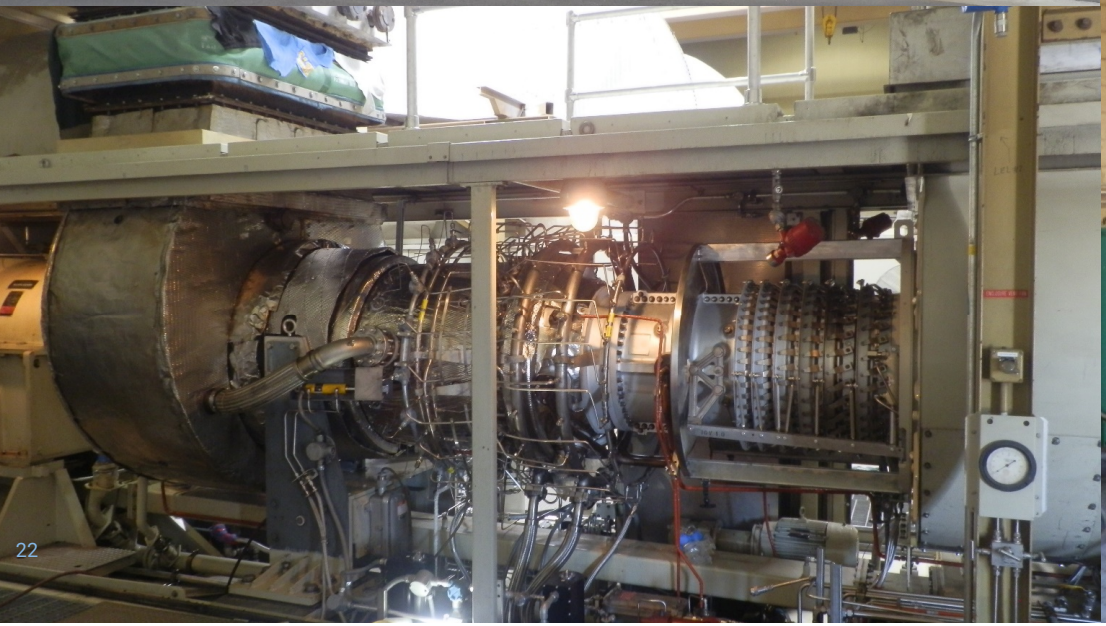
Abatement

Onsite abatement of biogas (raw to conditioned) that is not used on- or offsite beneficially is achieved through a flare (via combustion). This device is required to adhere to safety and air quality regulations.

- Flare
- Thermal Oxidizer

Sampling Not Applicable
Biogas utilization processes will conservatively represent emissions from combustion sources.

Biogas Combustion Device(s)



Proposed Wastewater Sector Statewide Two-Step Process

Step 1: Screening for Compounds

- Obtain triplicate samples at the headworks of a WWTP with the highest toxics potential to emit
- Test for the list of 158 compounds
- Any compounds detected will be tested at selected CA WWTPs in Step 2

Proposed Wastewater Sector Statewide Two-Step Process

Step 2: Proposed Testing Locations

- Air toxics identified in Step 1 to be tested at 5 WWTP Unit Processes:
  1. Primary – Influent Screening
  2. Secondary – Activated Sludge
  3. Advanced – Chlorination
  4. Solids Thickening – Dissolved Air Flotation (DAF)
  5. Biogas – Combustion Device(s)

Next Steps

- SCAQMD informal feedback
  - Is the conceptual approach outlined herein reasonable?
  - Any recommendations?
- Meet with other air districts
- Meet with CARB and air districts
- Submit statewide proposal to CARB for approval

CASA Pooled Emissions Study Team

CASA Steering Committee

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