# Yonkers Odor Control Study

## Yonkers Joint Water Resource Recovery Facility

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CDM Smith

# Odor Control Study - Presentation Outline

- Introduction
- Purpose of Odor Control Study
- Background on Odor
- Sampling Overview
- Preliminary Findings

# Introductions

CDM Smith Presenters

- Christopher Korzenko, P.E. – Project Director
- William Nylic, P.E. – Project Manager
- Bruce Singleton, P.E. – Odor Control Specialist

# Firm Introduction

Company Background – CDM Smith

- Established in 1947
- More than 5,000 employees worldwide
- Services include consulting, engineering, construction, and operations
- Solutions in water, environment, transportation, energy, and facilities
- Experienced in the design and evaluation of odor control systems
  - Odor Source Surveys/Emissions Modeling/Dispersion Modeling
  - Technology Assessments
  - Process Cover Design/Odor Control Design
  - Construction Services

# Purpose of Odor Control Study

Goal

- Identify sources of odors and develop recommendations to reduce offsite impacts

Areas of Focus

- Odors associated with taking tanks out of service
- Performance of Existing Odor Control Equipment
- Aeration Tank Odor Control
- Flare Operation

# Odorants Background

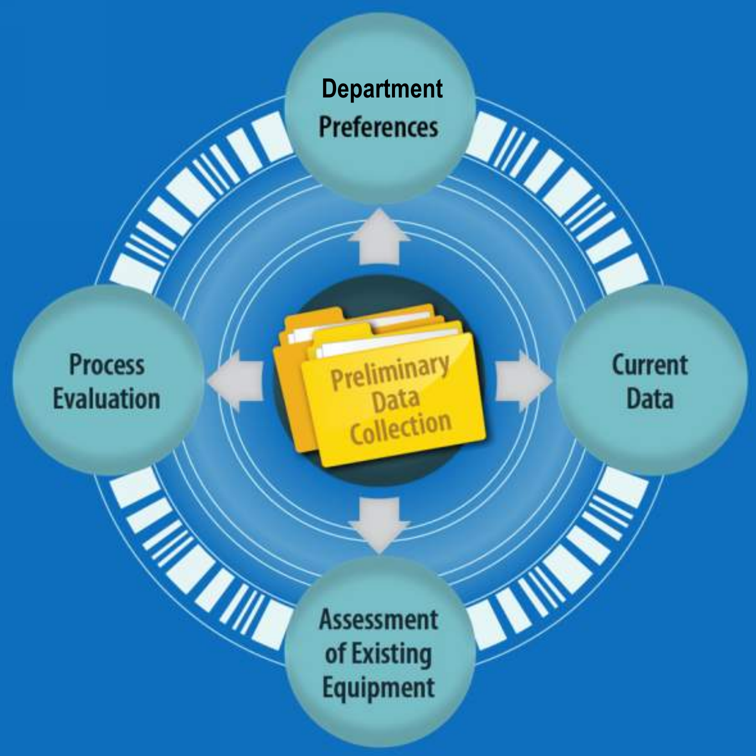
- Odor is the sensing of the odorants
- Identifying the specific odorant leads to the solution
  - Odorous chemical compounds: Odorants
- Resident Odor Observations (in no particular order)
  - Chemicals
  - Dryer Sheets
  - Burning
  - Sewage
  - Rotten Food
  - Baby Diapers

# Common Odorants in Wastewater

| Odorant | Examples | Dominate |
|---|---|---|
| Hydrogen Sulfide | | • Sewer Systems<br>• Wastewater Treatment Systems |
| Organic Sulfur Compounds | • Dimethyl Sulfide<br>• Methyl Mercaptan<br>• Carbon Disulfide | • Sludge holding, thickening, dewatering and stabilization processes |
| Nitrogen Compounds | • Ammonia<br>• Amines<br>• Skatole<br>• Indole | • Wastewater anoxic basins<br>• Sludge digestion (anaerobic, ATAD)<br>• Sludge lime stabilization |
| Volatile Fatty Acids | • Acetic Acid<br>• Butyric Acid<br>• Valeric Acid | • Gravity thickeners<br>• ATAD |
| Aldehydes and Ketones | • Acetaldehyde<br>• Methyl Ethyl Ketone<br>• Acetone | • Sludge holding, thickening, dewatering and stabilization processes |

# Data Collection

- Preliminary Data Collection
  - Collaborative Review of Existing Data with Plant Staff
    - Interviews
      - Plant preferences
    - Plant operations data
      - Odor control process data
      - Odor complaint logs
    - Current data
- Supplemental Data Collection
  - Existing Equipment Assessment
    - Collection and conveyance
    - Treatment Processes
  - Liquid Phase Data
  - Vapor Phase Data



# Sampling Plan Overview

- Comprehensive review of existing emission sources
  - Chemical scrubbers
    - Performance
  - Open Tanks and channels
- Investigation of fugitive emissions sources
  - Leaks in covers
  - Incomplete/unbalanced ventilation
- Interior ventilation
  - Unbalanced ventilation
  - Odorous rooms exposed to the outside

# Sampling Program – Field Equipment Used

Used a variety of sampling methods to capture maximum amount of odorants

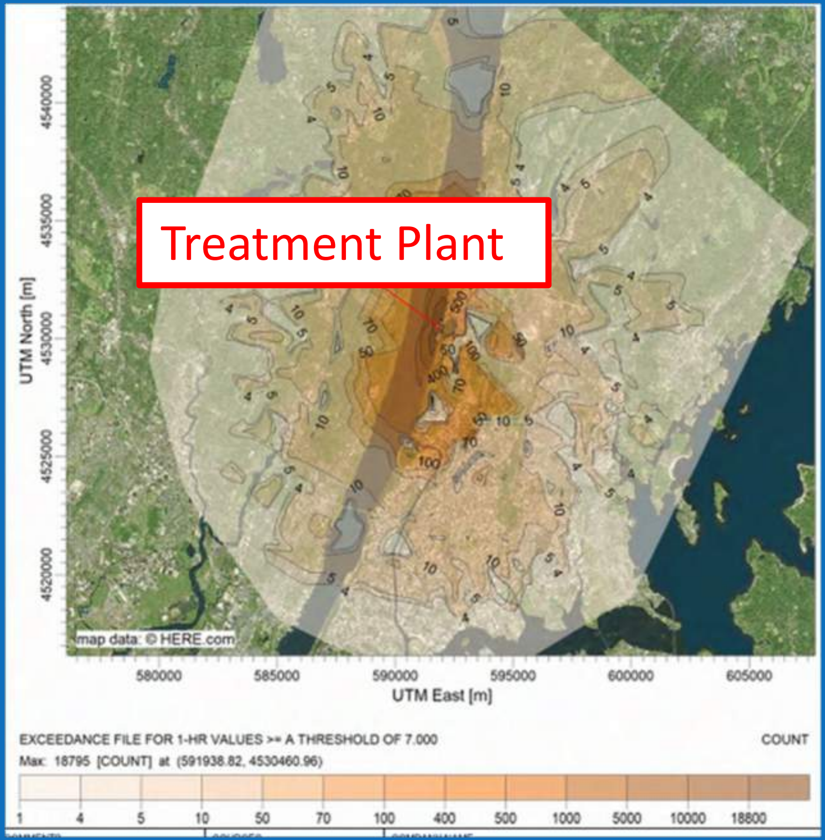
- Colormetric Tubes for specific analytes, $NH_3$
- $H_2S$ Sensors and Data Loggers
- Equipment for liquid measurements


# Measuring Odor

- Samples collected and sent off-site to an “odor laboratory”.
- Use “forced-choice” olfactometer
- Odor concentration
  - Expressed as dilutions-to-threshold, (D/T) or odor units (OUs).
  - Detection level determined by human panelists
- Done in accordance with industry-accepted international standard
  - EN 13725:2006

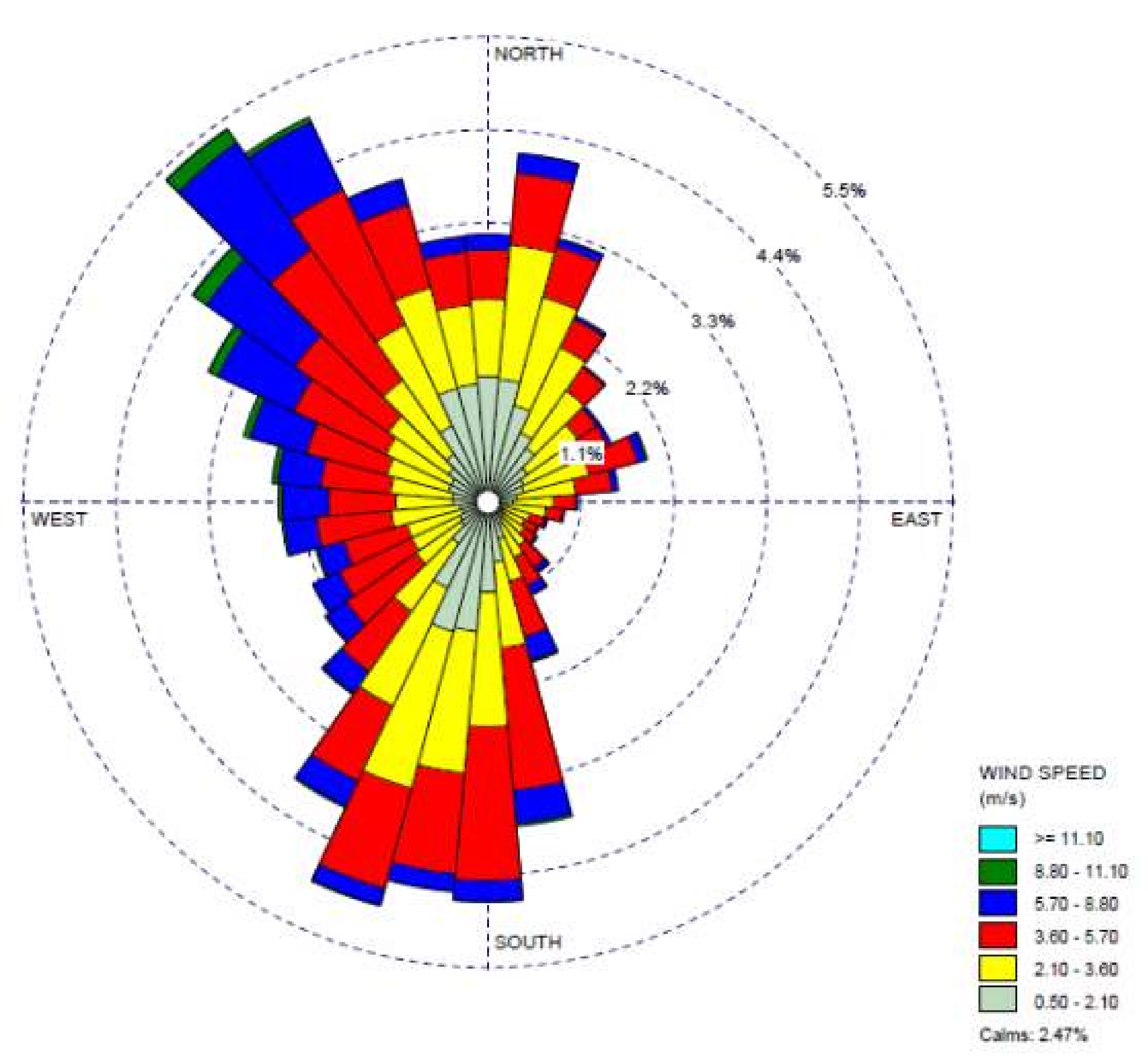
# Application of Data: Modeling Example

- Dispersion Analysis
  - Plant wide source sampling
    - $H_2S$
    - VOCs
    - Odors
  - Local Meteorological data
  - Local Topography
  - Local Complaints
- Provides an assessment of the current (baseline) odor effects
- Confirms the effects of emissions and treatment of various sources.



# Wind Data

- Termed a "Wind Rose"
- Indicates direction wind is blowing **from**
- Created with five years of plant data
- Prevailing winds are:
  - Northwest
  - Southwest

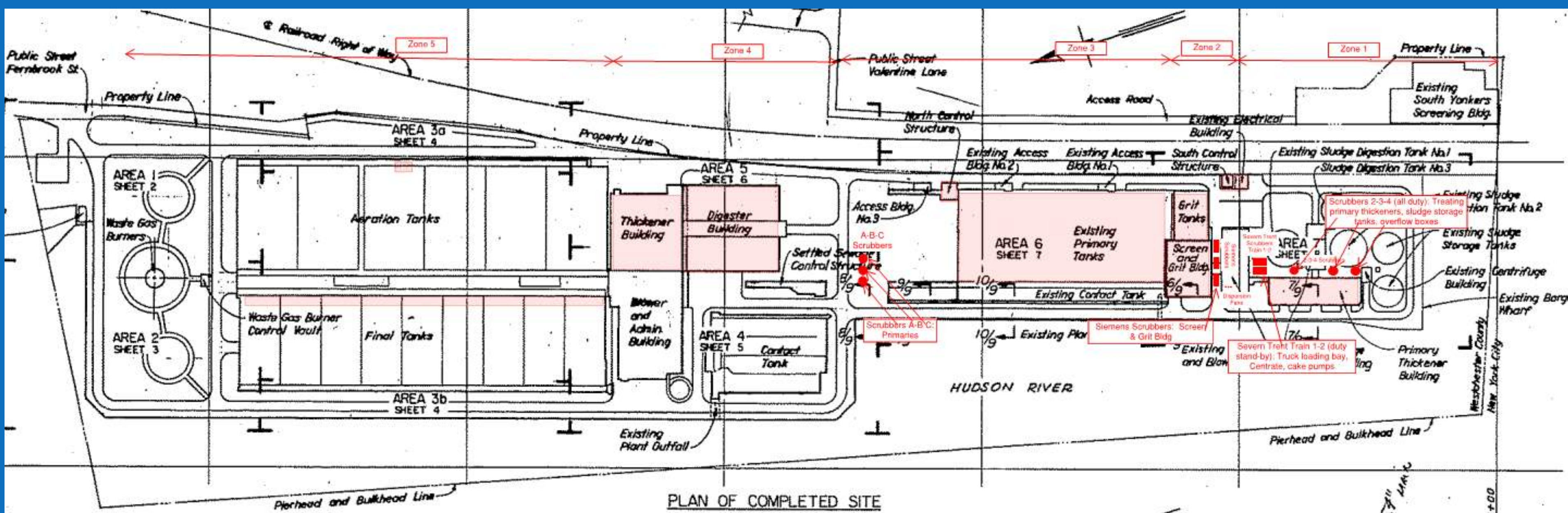


# Odor Magnitude and Frequency Plots

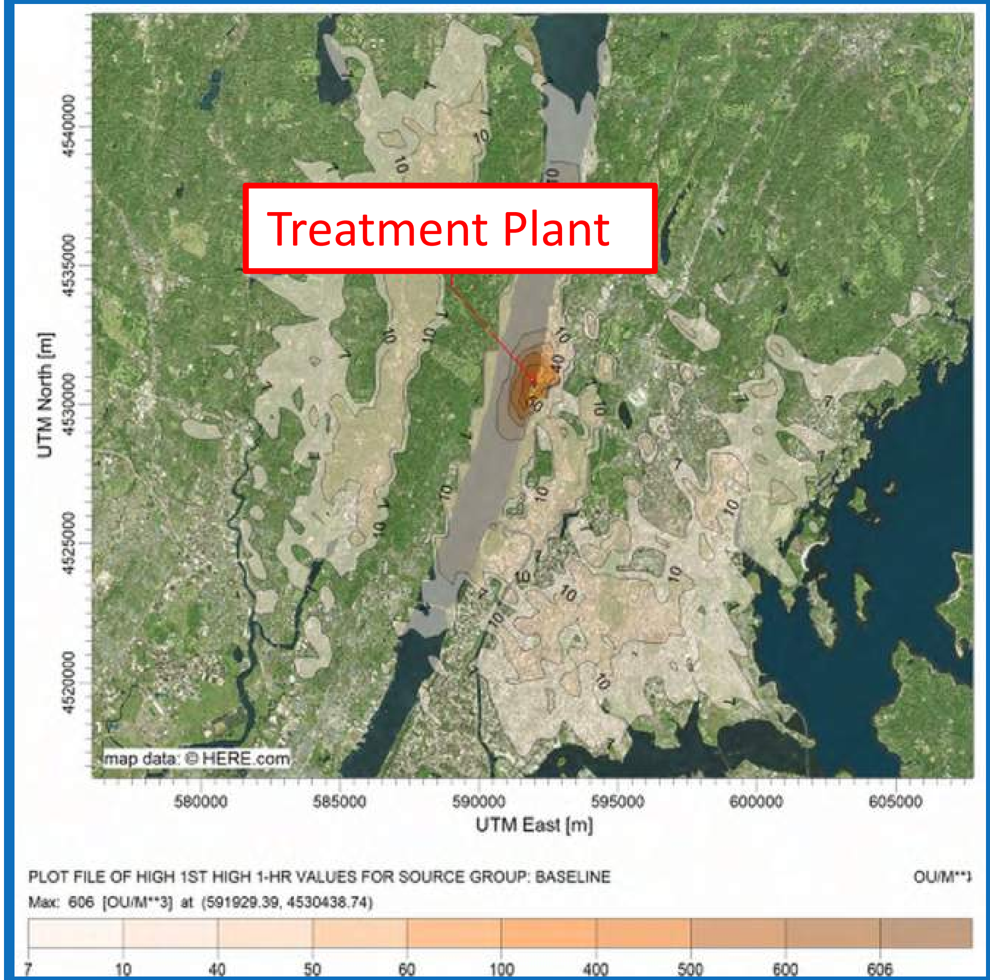
- Next Pages show two plots
- Left Hand Side – Magnitude Isopleth
  - Indicates maximum odor strength
  - Averaged at five minute intervals
- Right Hand Side – Frequency
  - Indicates maximum number of exceedances greater than 7 OUs possibly detected during over a 5 year period
  - 7 OUs (odor units) is an industry standard for a nuisance odor

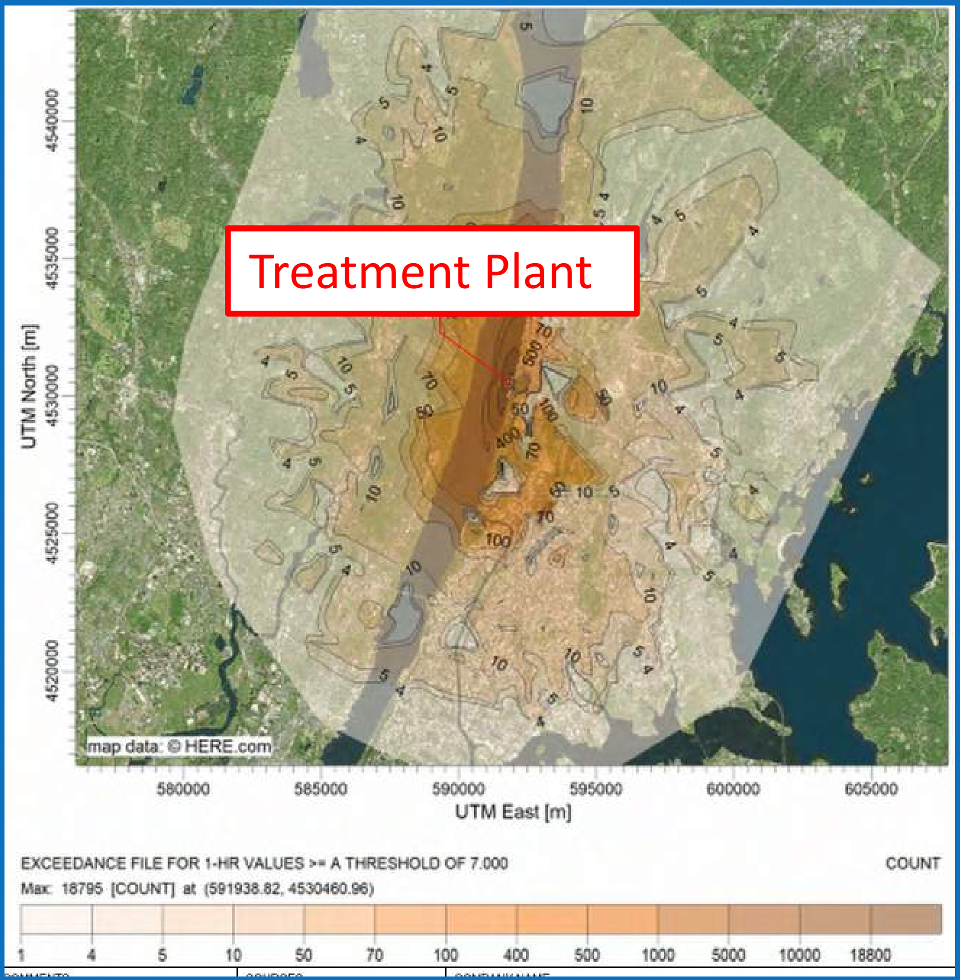
# Review of Strongest Odor Sources

- Common exhaust for Mist Scrubbers 2, 3, and 4 and the Severn Trent Three Stage Scrubbers 1 and 2.
- Siemens Dual Stage LoPro Scrubbers 1, 2, and 3
- Mist Scrubbers A, B, and C
- Aeration tanks



# Baseline Odor Strength and Frequency

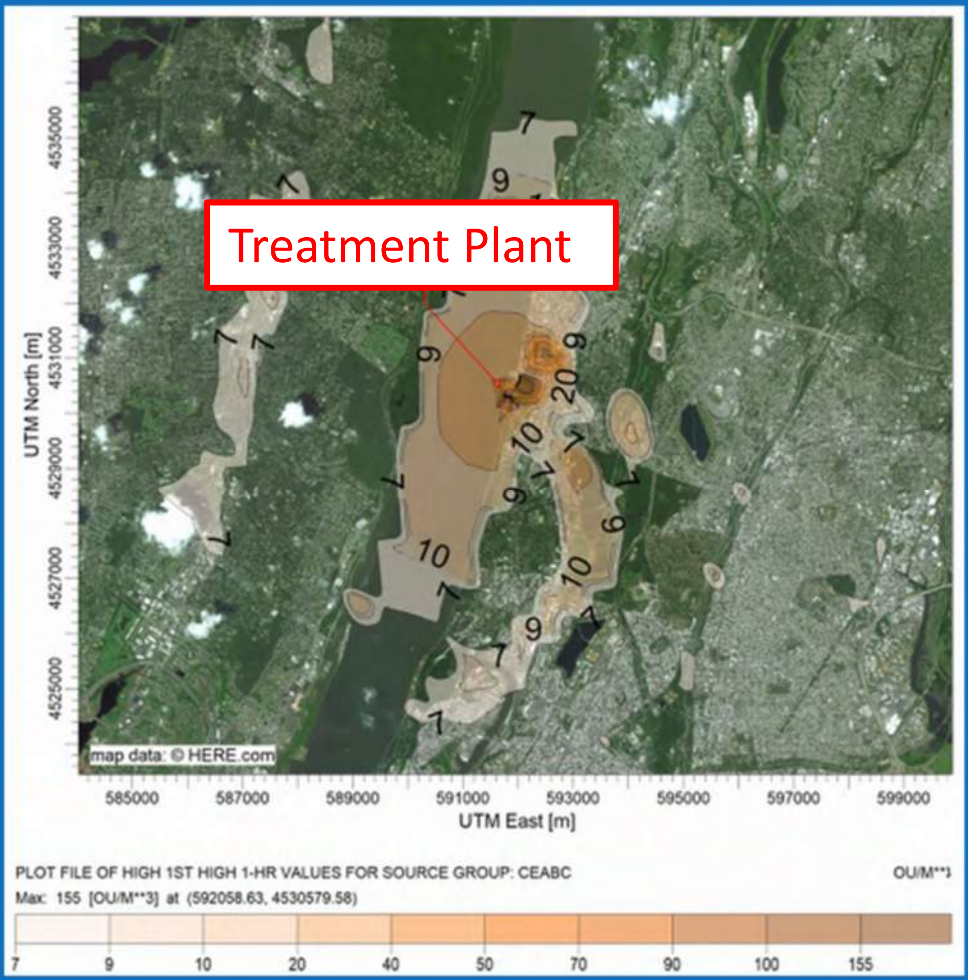


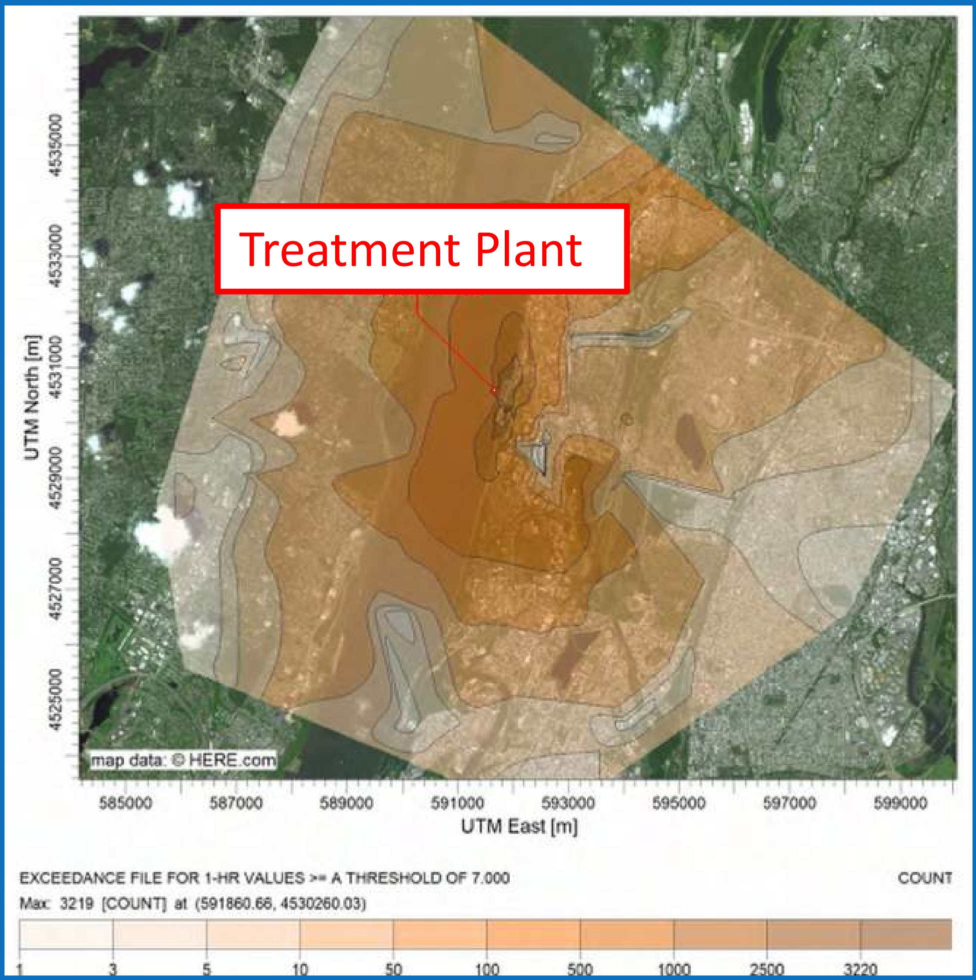



# Scrubbers A, B, and C

- Scrubbers A, B, and C treat air from the Primary Settling Tanks.
- Two scrubbers operate at a time with one as stand-by.
- $H_2S$ levels 10 -12 ppm maximum
- Exhaust odor was high indicating problems with the scrubber operation due to internal mechanism or chemistry.
- Creates odor levels up to 20 OUs east of the plant
- Frequency of impacts > 7 OUs, up to 500 times/ 5 years
- Low OUs, high frequency

# Scrubbers A, B, and C Odor Strength and Frequency

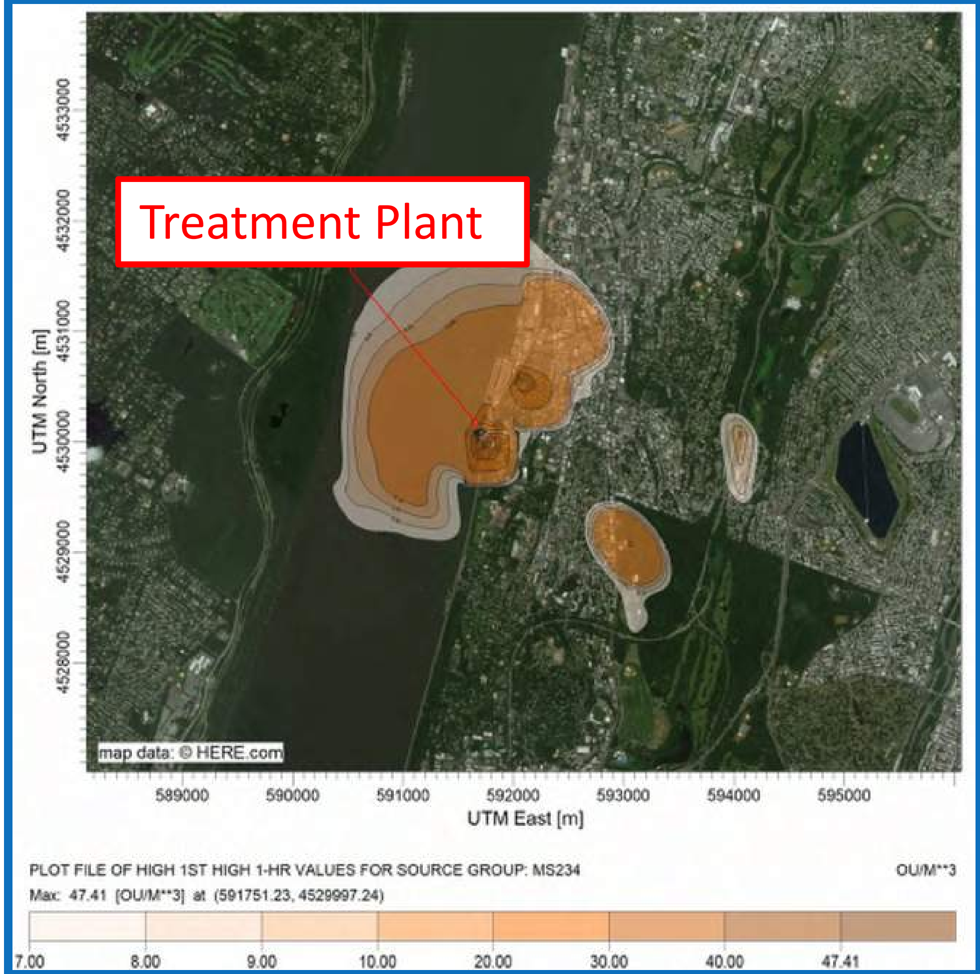


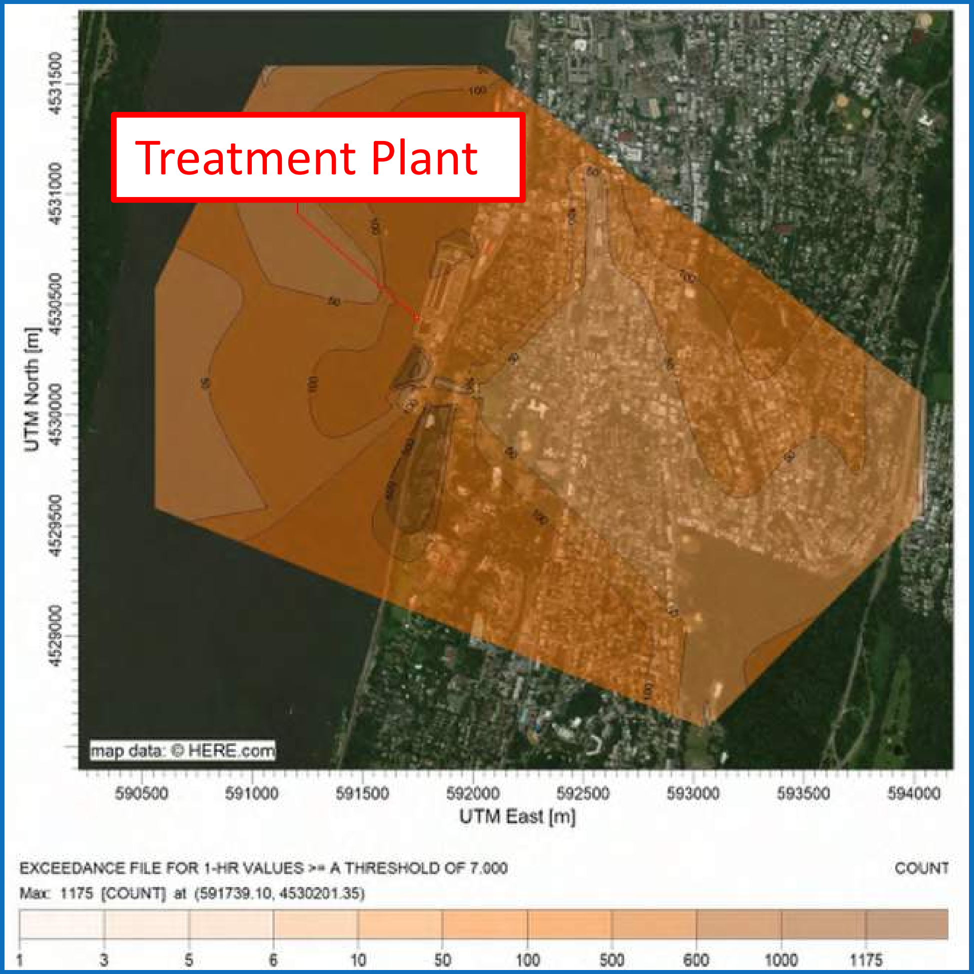



# Scrubber 2, 3, and 4 and Severn Trent Scrubber 2: Common Exhaust

- Scrubbers 2 ,3, and 4 mist scrubbers treat emission from the primary thickening building, overflow tanks, and sludge storage tanks.  Only Scrubbers 3 and 4 were operating (scrubber 2 in stand-by mode).
- Severn Trent Scrubber 2, three stage treats air from the dewatering building
- Low loading rates for $H_2S$ and organics
- Odor removal is mixed but not optimized for scrubbers 2, 3, and 4
- Odor removal at <90% for Severn Trent Scrubber 2
- Odor levels of 41 OUs east of the plant
- Frequency of impacts > 7 OUs, up to 100 times/5 years.
- Odor removal performance requires improvement
- Moderate OUs, moderate frequency

# Strength and Frequency Plots for Common Exhaust

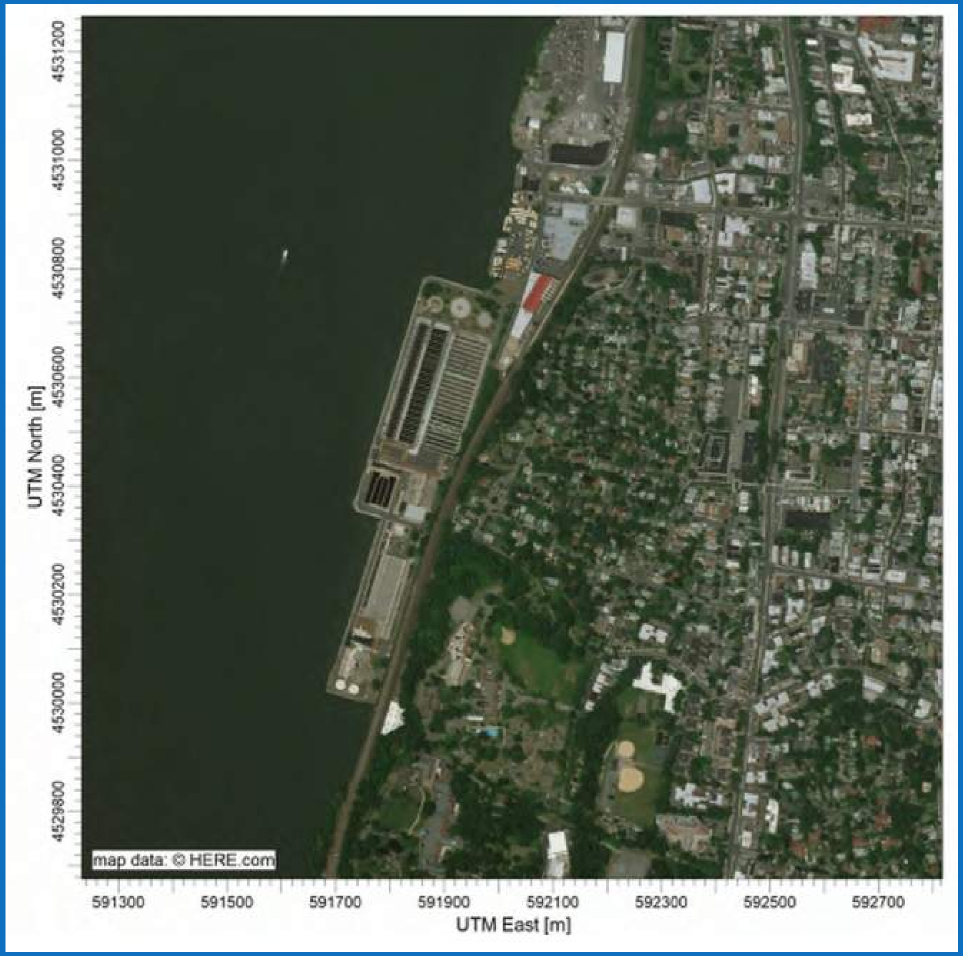


# Siemens LoPro Scrubbers

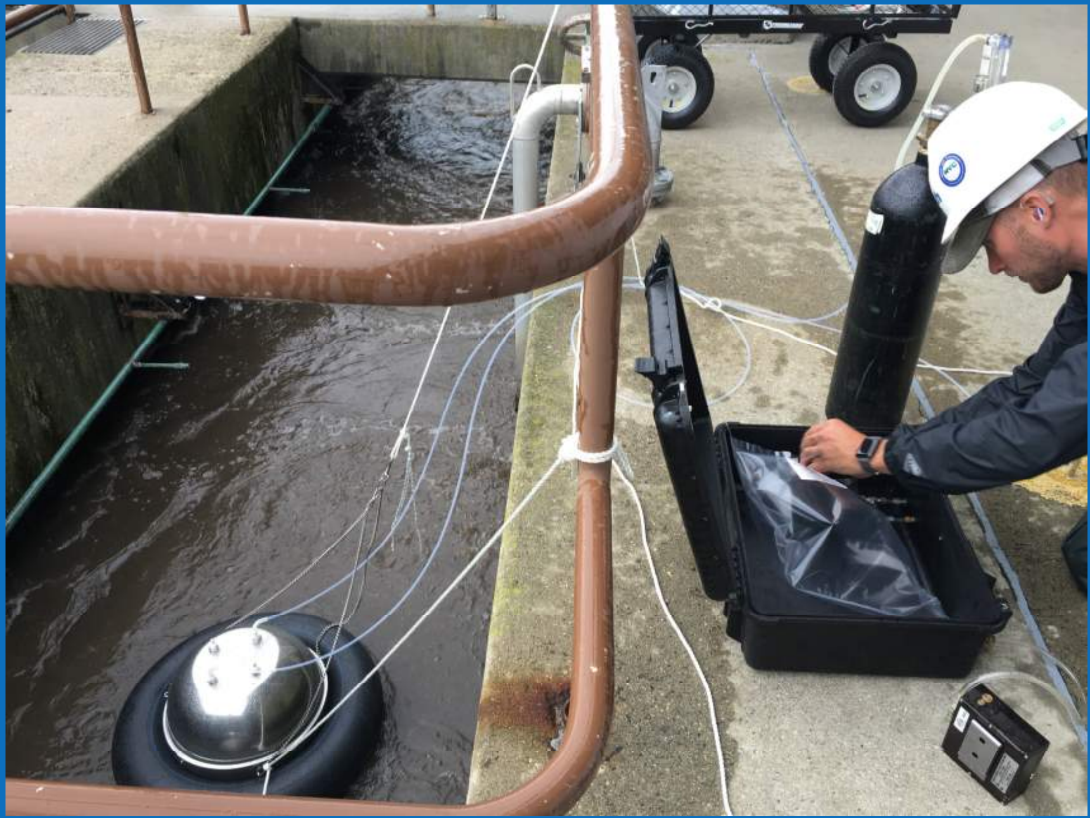
- Scrubbers 1, 2, and 3 treat air from the headworks
- Only Scrubber 1 was operating as the ventilation to the other scrubbers was not yet installed
- Lightly loaded
- Odor concentrations inlet and outlet were low
- Scrubber exhaust goes to a dispersion fan
- Low odor exhaust no offsite impacts
- Low OUs, low/no frequency

# Dispersion Fan Odor Strength and Frequency

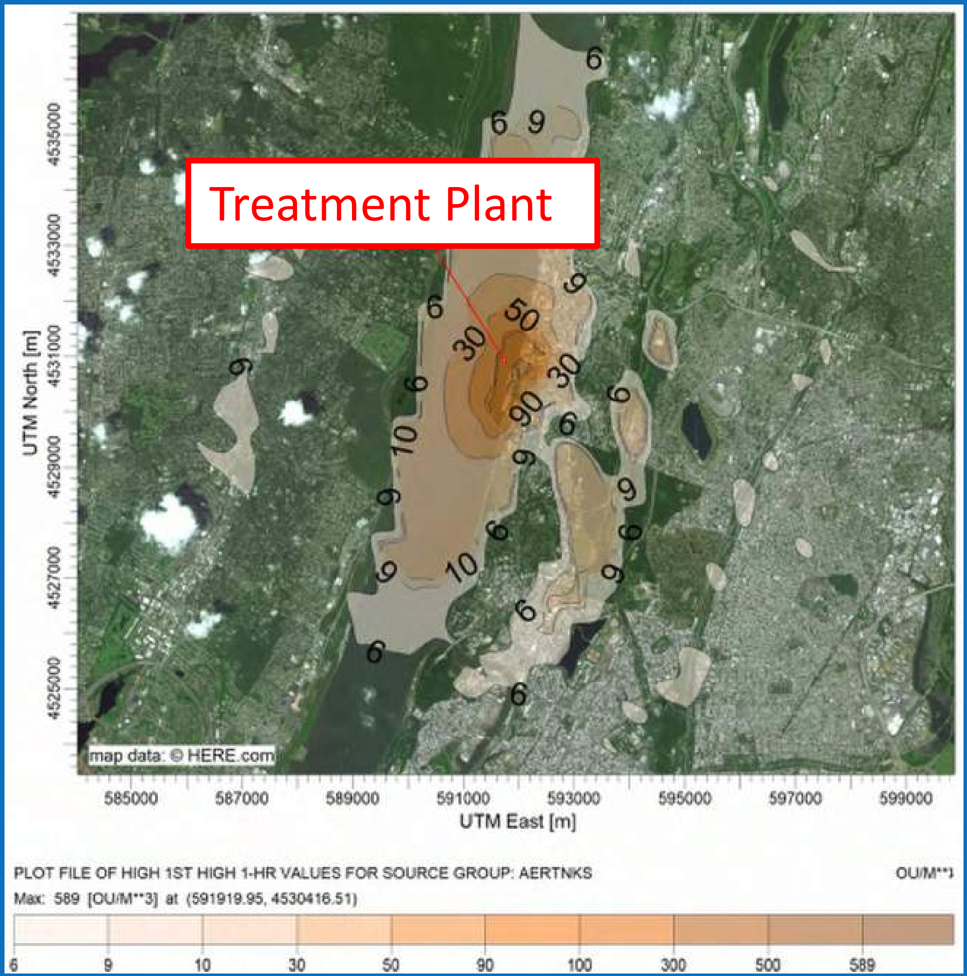



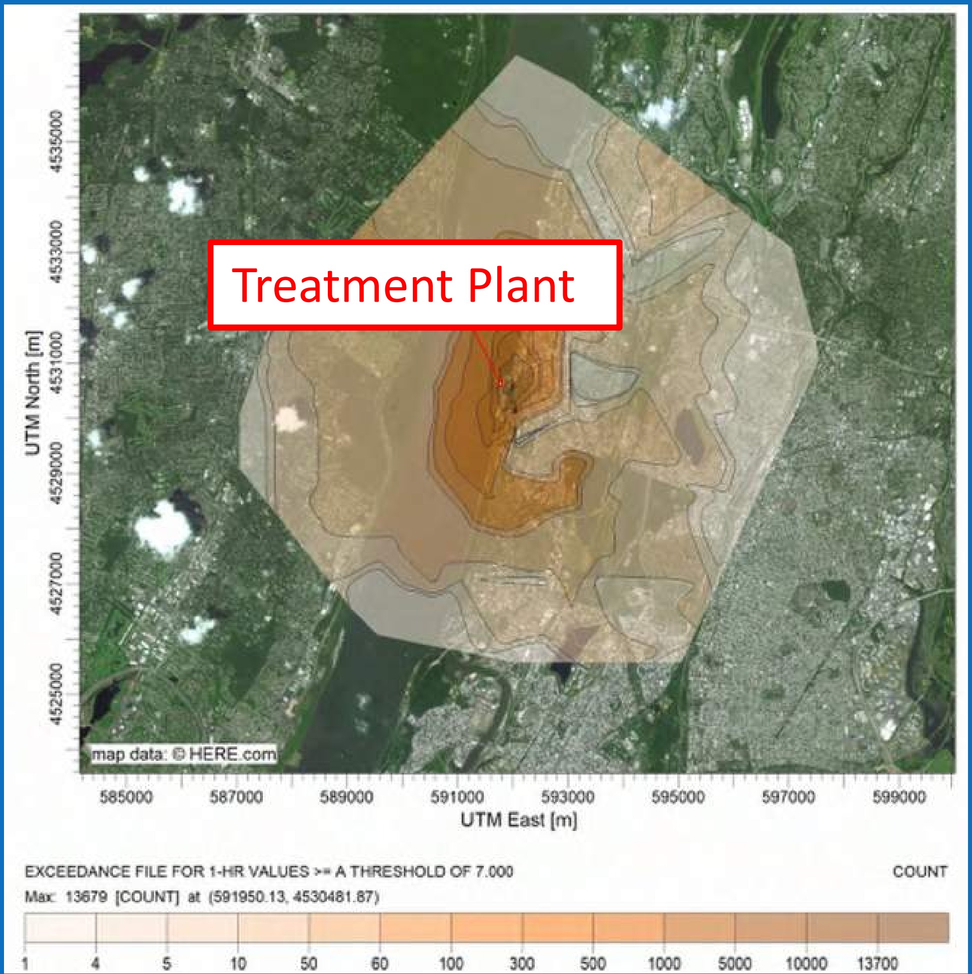
# Aeration Tanks

- Large open and aerated ground level emission source
- Low $H_2S$ and organic sulfur compound levels
- No treatment
- Odor levels to 50 OUs east of the plant
- Frequency of impacts > 7 OUs, up to 500 times/5 years
- Moderate OUs, high frequency



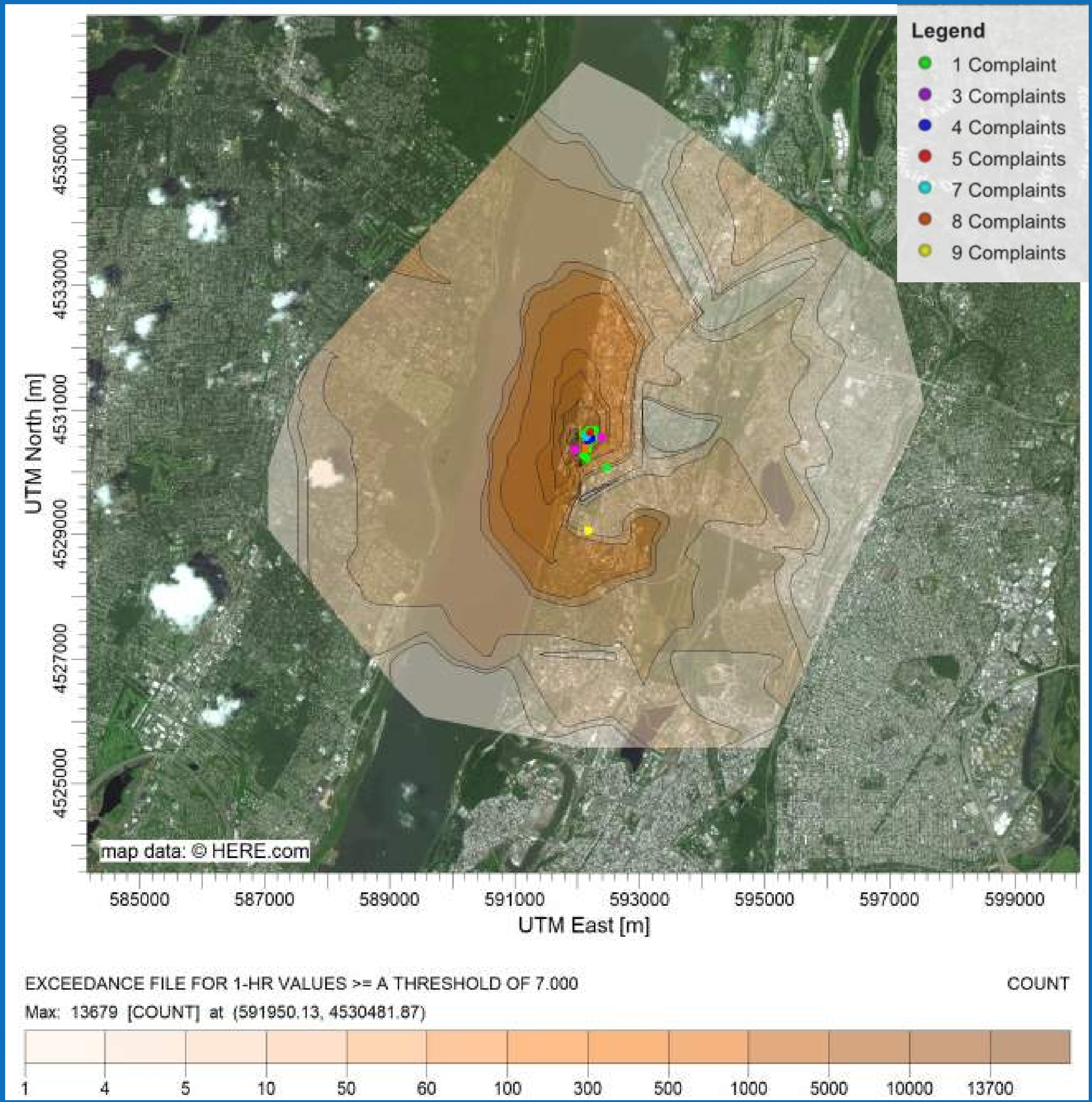
# Aeration Tanks Odor Strength and Frequency



# Aeration Tank Plot with Complaint Occurrences

- Represents complaints received in 2017
- Frequency plot of aeration tanks
- Location of complaints correlates with odor frequency



# Additional Ongoing Odor Control Measures

- Potassium Permanganate Building ($KMnO4$) is being constructed
- Chemical addition oxidizes hydrogen sulfide and organic odors
- Provides an oxidizing environment to convert hydrogen sulfide back to sulfate
- Helps to eliminate “rotten egg” odor

# Operational Conclusions

- Scrubbers 2, 3, and 4
  - Well operated
  - Air flow should be decreased
  - Internal liquid nozzle should be inspected
- Severn Trent Scrubbers
  - Recirculation system should be evaluated: nozzles etc
  - Inspect packing
  - Media cleaning
- Siemens LoPro w/ Strobic
  - Operating as designed
- Scrubbers A, B, and C
  - Internal liquid nozzle should be inspected
- Aeration tanks
  - Greatest offsite odor impact

# Next Steps

- Structural Inspections of Scrubbers
  - Provide recommendations
- Grit and Primary Tanks
  - Review out of service procedures
  - Provide strategy for containing odors
- Aeration Tanks and Influent/Effluent Channels
  - Provide conceptual layout
  - Complete cost estimate
- Final Report
- Schedule
  - Plan on presenting completed results by next meeting

Questions?