

BAAQMD Odor Attribution Study Results

South Bay Stakeholders Meeting
5/05/2022

Agenda

- Project Scope
- Odor Assessment
 - Sampling and Analysis
 - Odor Activity Value
 - Odor Persistency
 - Montrose PTR
 - Offsite Field Survey
- Findings and Recommendations
 - Findings and Recommendations
 - Next Steps

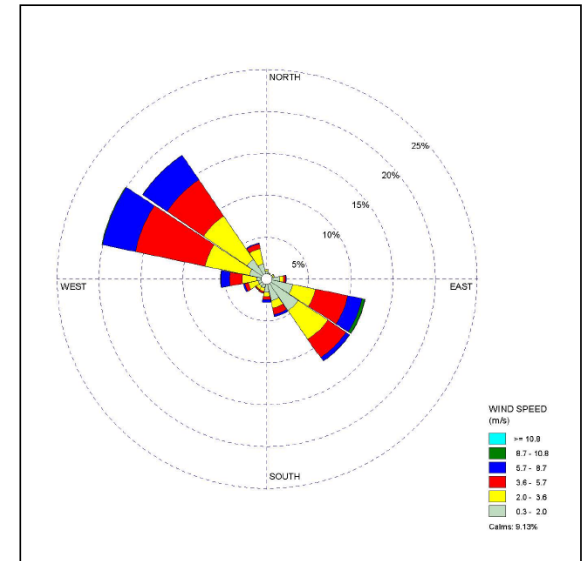
Project Scope

- Determine contribution and variability of key odor causing compounds:
 - Newby: landfill, composting, MRF
 - RWR sewage treatment
 - ZWED dry anaerobic food waste digestion
 - Other potential sources (bay, lift station, estuary)
- Identify key and unique compounds from each facility:
 - Generate a fingerprint or signature
 - Identify site specific processes and/or sources
- Develop method to measure ongoing performance in reducing odors



Odor Assessment – Sampling and Analysis

- Multiple methodologies to obtain scientifically reliable results and cross check results
- Seasonal Sample Events
 - October 2020- Comprehensive
 - Winter 2020 - Limited
 - May 2021 – Tailored and Comprehensive
 - September: Tailored
- Analytical (Quantitative) Testing
 - Reduced sulfur compounds, aldehydes, carboxylic acids, VOCs, amines, ammonia, PTR
- Objective/Subjective (Qualitative) Testing
 - Odor panel, Odor Profile Method, Odor Persistency
- Field Testing: Field olfactometer



Odor Assessment - Odor Activity Value

- OAV: Estimates odor potency/importance in terms of the ratio of measured concentration of an odorant to its odor threshold concentration (OTC).
- Determination of sensorially relevant odorants

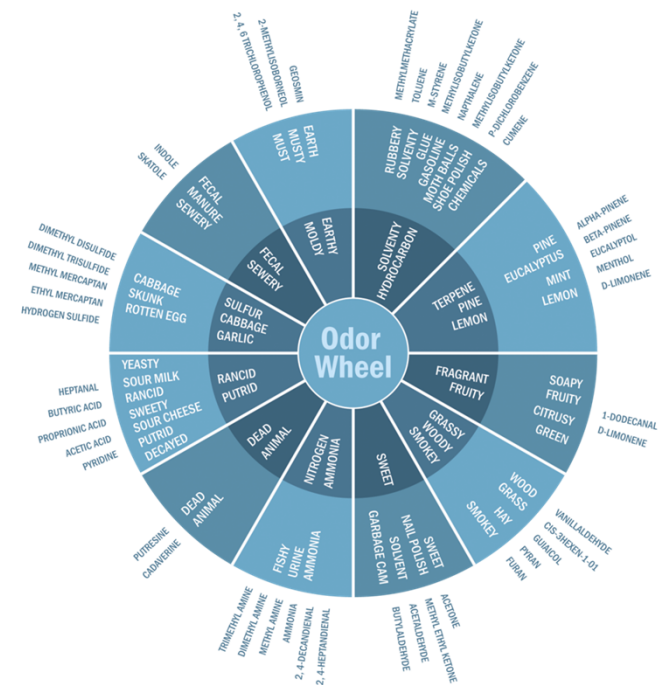
$$OAV = C_o / OTC$$

Where:

C_o = Measured concentration

OTC = odor threshold concentration

- Sulfur (blue) = rotten eggs, rotting vegetables
- Aldehydes (red) = sweet
- Carboxylic Acids – VFA's (yellow) = rancid
- VOCs (green) = varied
- Amines (brown) = fishy



Odor Assessment

ZWED Odor Activity Value Summary

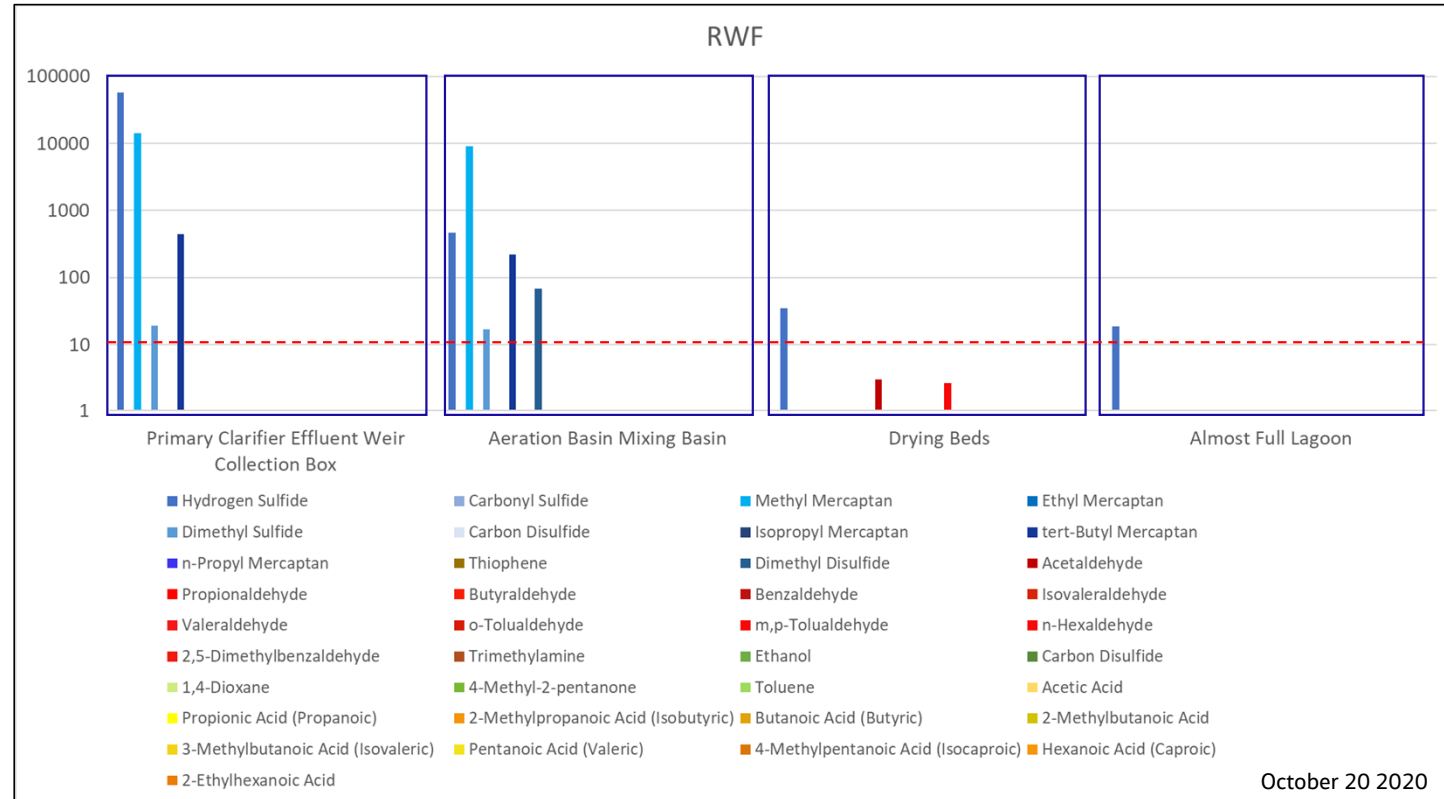
- OAV action level = 10
 - Minimum 10:1 dilution required to reduce concentration to below odor threshold value
- ZWED
 - Combination of sulfur, rancid, and sweet



Odor Assessment

RWF Odor Activity Value Summary

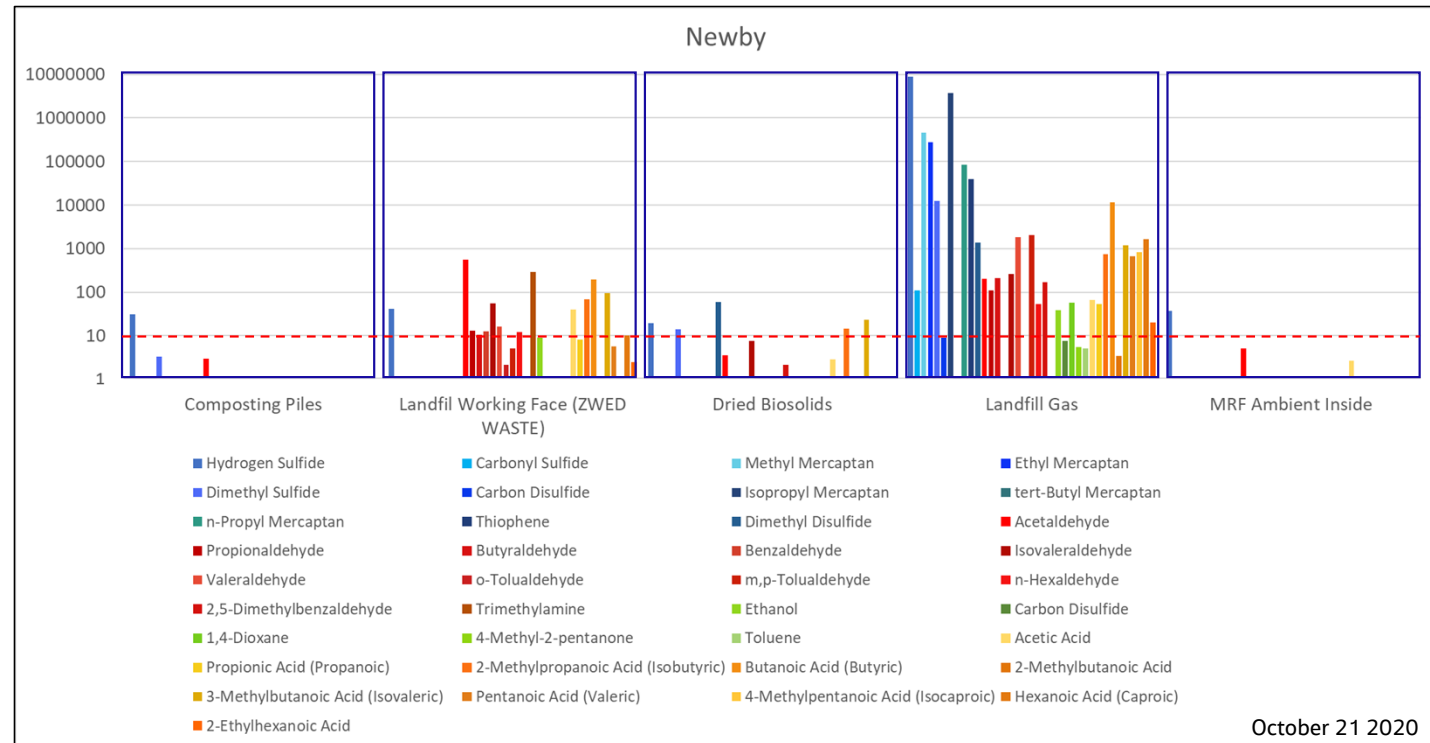
- OAV action level = 10
- RWF
 - All sources mainly sulfur



Odor Assessment

Newby Odor Activity Value Summary

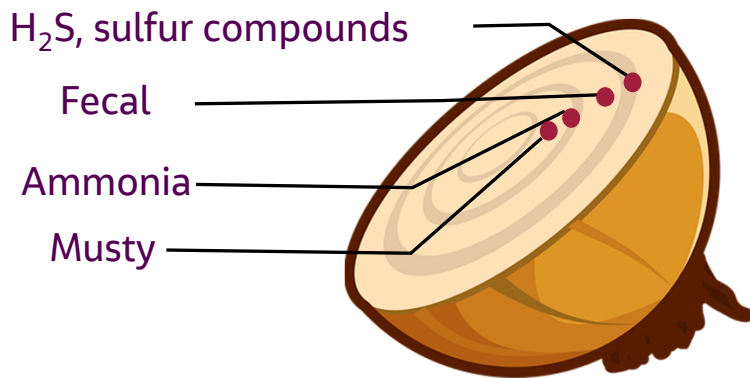
- OAV action level = 10
- Newby
 - Wide variety of odorant types
 - Rancid
 - Sweet
 - Sulfur
 - VOCs (minor)
 - Landfill gas dominant source



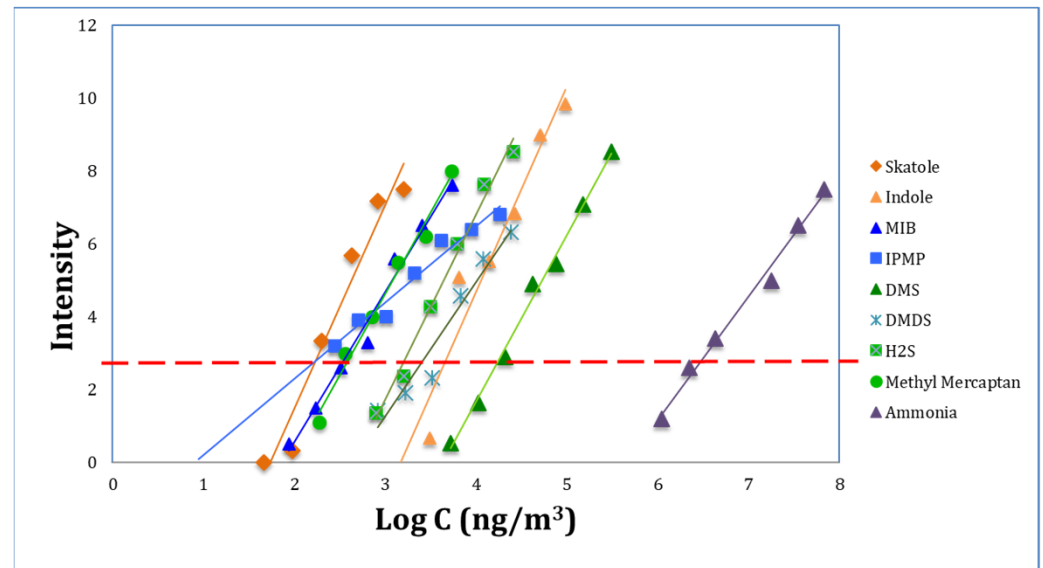
Odor Assessment – Odor Persistency

■ Odor Persistency

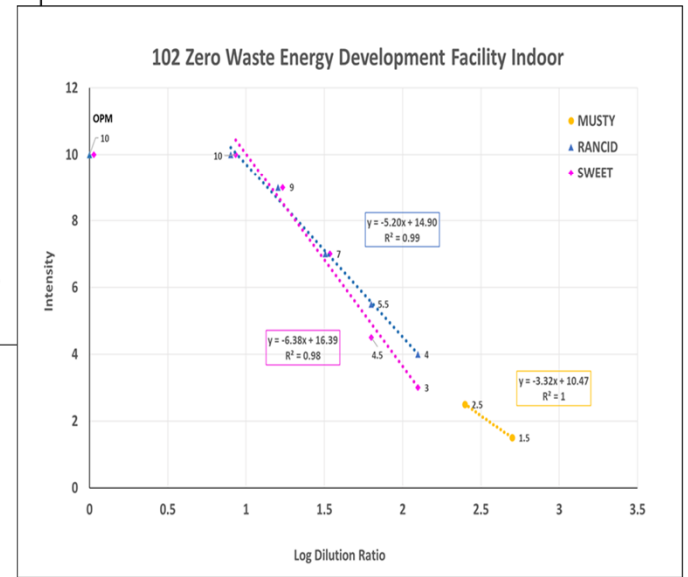
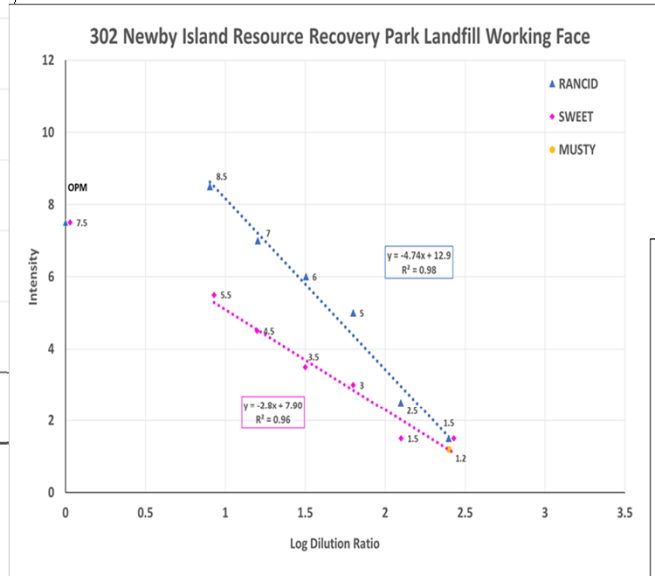
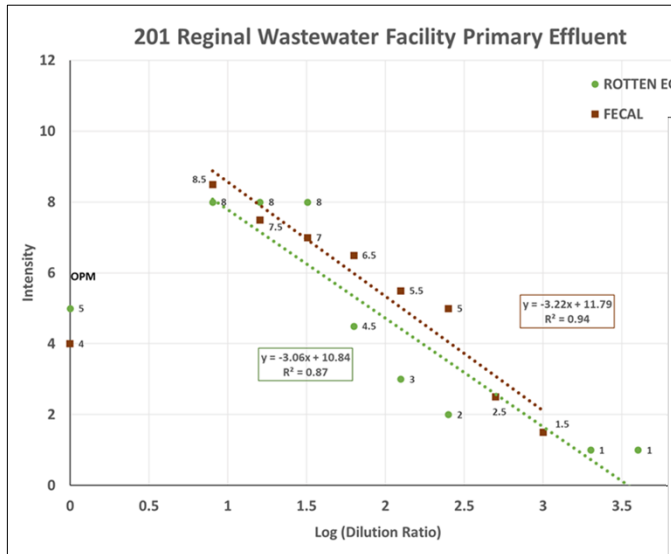
- The rate at which the perceived Odor Intensity decreases as the odor is diluted (downwind from the odor source as it travels into the community)
- Odor intensities decrease with dilution at different rates for different odors
- Specific odorants can mask others



Odors can be revealed as other odors are diminished, like peeling an onion – there are layers

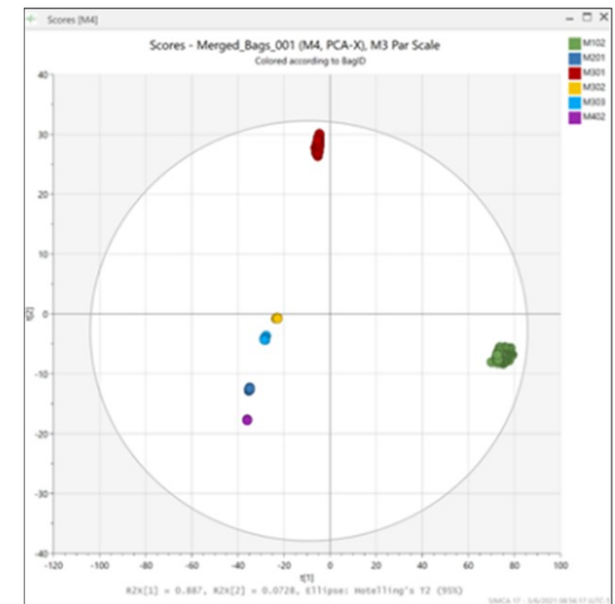
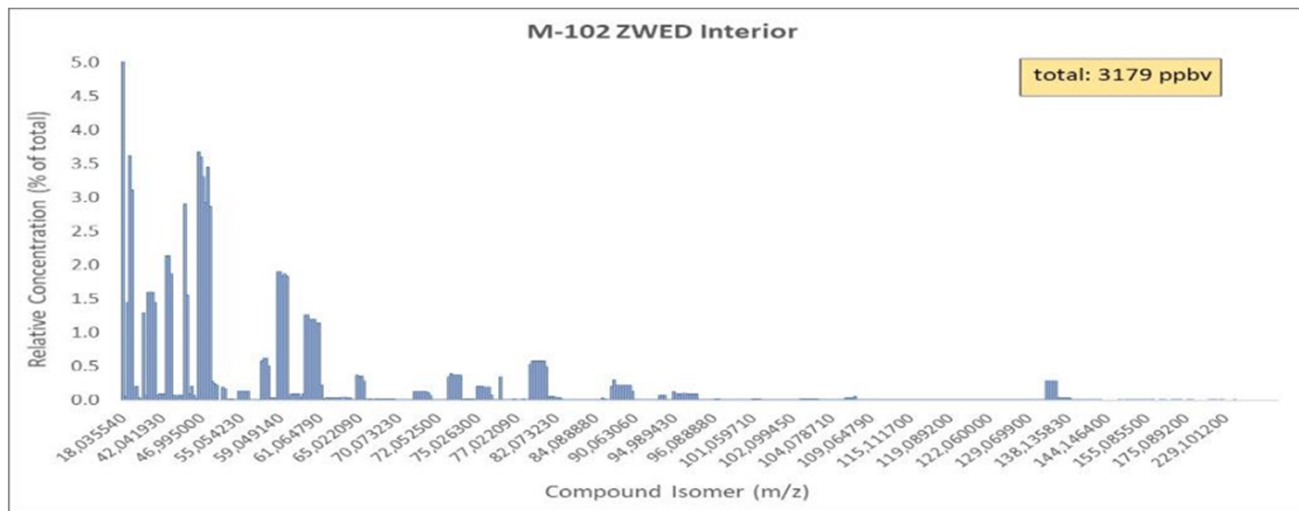


Odor Assessment– Odor Persistency Examples



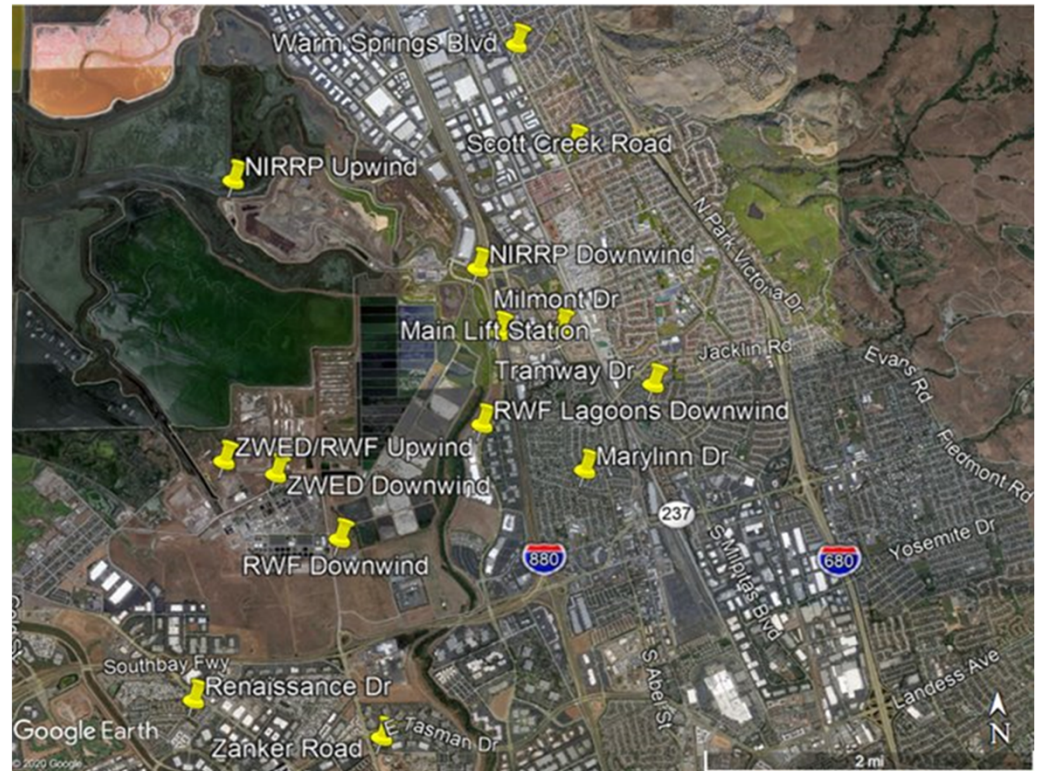
Odor Assessment – Montrose PTR

- Montrose PTR-MS results revealed unique individual compounds associated with specific facilities/sources. Graphics illustrate compound mass versus concentration.
- Principle Component Analysis (PCA) allows for fingerprinting each facility/source to generate a model to determine uniqueness.
- Plumes measured in the community can be compared to the model to provide correlation.



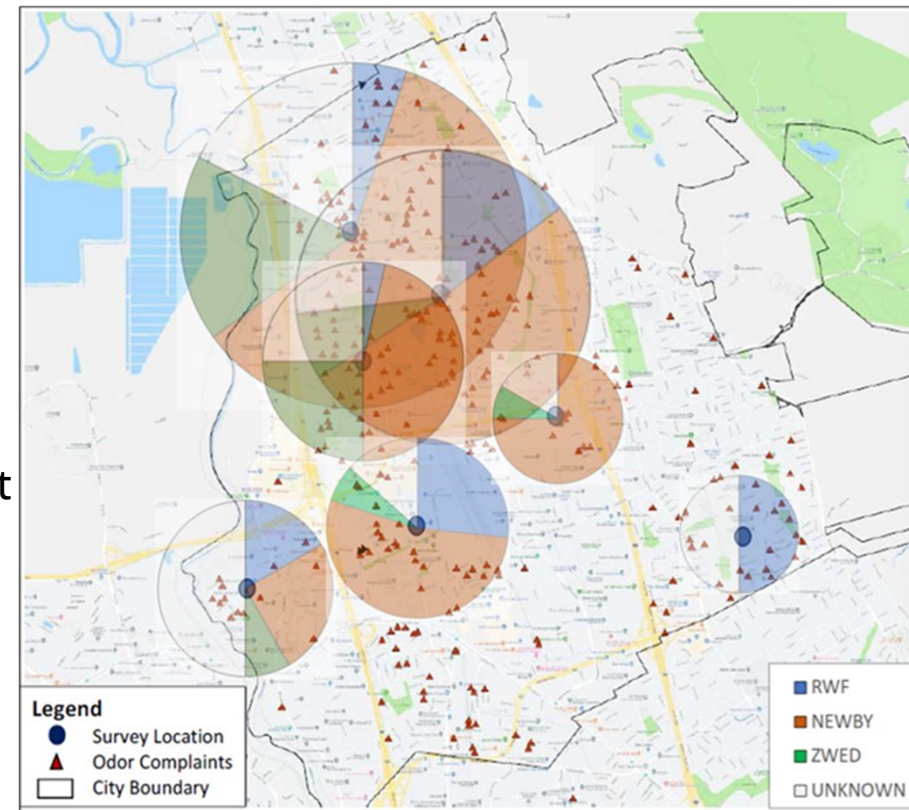
Odor Assessment – Field Surveys

- Field Olfactometer (Scentroid SM100): Detection to Threshold
- Odor Qualifications:
 - Odor Character: smells like....
 - Odor Intensity
 - Hedonic Tone



Odor Assessment – Field Surveys

- BLOB Map
 - Illustrative method for depicting link between odors in the community and facilities/sources.
 - Data collection over 21 months
 - All three main odor-emitting facilities contribute to odors in the community
 - Odors emitted from ZWED are the most intense and most unpleasant
 - Reach limited to first locations west and southwest of the community in the City of Milpitas.
 - NIRRP odors contribute to most of the discrete survey locations
 - RWF odors contribute to a lesser extent but more to the further away locations



Findings and Recommendations

■ Findings

- Study successfully met the originally defined goals and objectives of the project.
- The three key facilities have all made significant improvements in odor containment and mitigation over the years.
- Each facility has a unique fingerprint: odor character and chemical compounds.
- All 3 facilities contribute to the offsite odors depending on wind direction and facility operations
- Persistency curves provided understanding of the “peeling the onion” effect and how specific odor types persist as they travel downwind into the community
- Individual compound identification using PTR-MS technology for identifying “chemical fingerprints” unique to each facility/source and confirmed via PCA.
- Each methodology built on the other methodology findings, provided validation, and was considered essential.

Findings and Recommendations

Recommendations

- Implement odor monitoring systems at all three facilities and at strategic locations within the community
 - Multi-sensor devices, a weather station, and data process platform for visualization and alarming. Auto bag samplers included at community locations.
 - Approximate cost is \$45K per unit. Additional \$700 for each Montrose analysis. Multiple units along each facility fence line and up to four in the community.
- Facility odor mitigation improvements

Source	Odor Fingerprints	Thresholds	Recommendations
ZWED			
Indoor Space	Sweet, Rancid, Musty	Low	Seal openings. Alarm at open doors.
Rooftop Carbon	Burned Rubber	Low	Media testing and change out carbon
Final Product	Sweet, Rancid, Musty	Low	Limit activities when wind is blowing into community
PRVs	Sweet, Burned Rubber	Low	Maintain PRVs to prevent leakage

Findings and Recommendations

■ Recommendations (cont.)

Source	Odor Fingerprints	Thresholds	Recommendations
RWF Primaries Bioreactors Digester PRVs Liquids	Sulfur Sulfur Sweet, Burned Rubber Sulfur	Moderate Moderate Low Low	Covers at high emitting areas Covers at inlet/mixing zone Maintain PRVs to prevent leakage Continue dosing ferrous
NIRRP Green Waste Landfill Gas Flares Multiple Biogas	Pine, Rancid, Sulfur Rancid, Sweet, VOCs Mix (Sulfur) Multiple Mix (Sulfur)	Low Low Low Low Low	Build process building with odor control Continue leak detection surveys Measure and consider pre-treatment Housekeeping practices (cake, leachate, stormwater) Biogas utilization system for energy production
Milpitas Lift Station	Sulfur	Moderate	Ventilation study and new odor control system
Estuary Culvert	Sulfur	Moderate	Change outlet to reduce turbulence and stripping

Next Steps

- Next Steps
 - Air Dispersion Modeling
 - Pilot Testing of Monitoring Systems
 - Implementation of Monitoring Systems

Questions?

Bullpen Slides

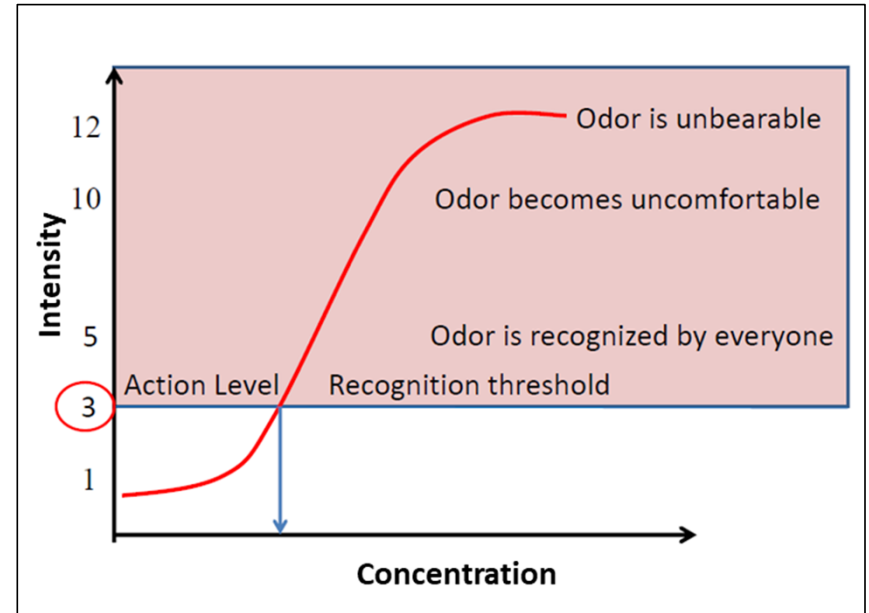
Methodology

- Federally Approved Sampling Methods and Equipment
 - EPA approved flux hoods
 - Vacuum chambers
 - Sorption tubes – compliant volumetric flows
 - Continuous H₂S Monitoring
 - Wind Direction/Speed Monitoring
- Test Methods Employed
 - Sulfur: ASTM D5504
 - Ammonia and Amines: Sorption tubes
 - Aldehydes: EPA Method TO-11A, sorption tubes
 - Carboxylic Acids (VFAs): Sorption tubes
 - VOCs: EPA Method TO-17
 - Odor Concentration (Detection to Threshold): ASTM E679 and EN13725
 - Odor Profile Method (UCLA)



Odor Profile Method (OPM)

- What is OPM?
 - Judgement is made by selected and trained panelists as a team
 - Flavor profile analysis intensity scale
 - Breaks apart the overall perception into individual components
 - Numerical intensities define the strength of each
 - Weber-Fechner Law
 - Semi-logarithmic relationship
 - Different compounds have different curves

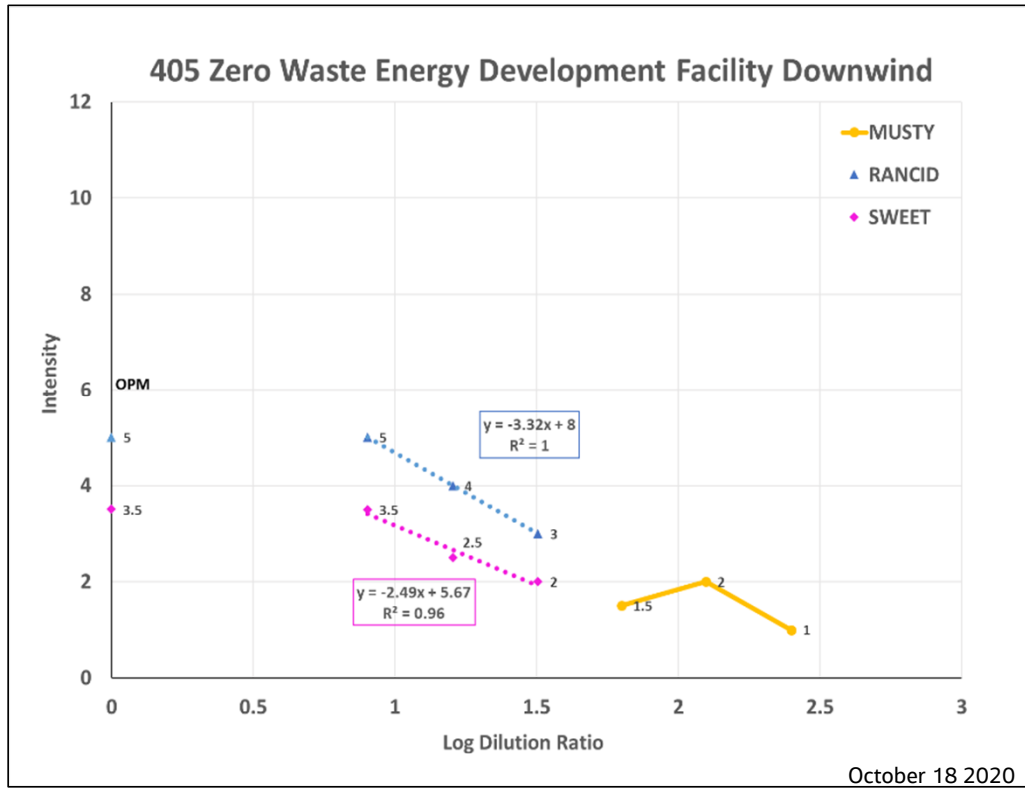


Flavor Profile Analysis Intensity Scale

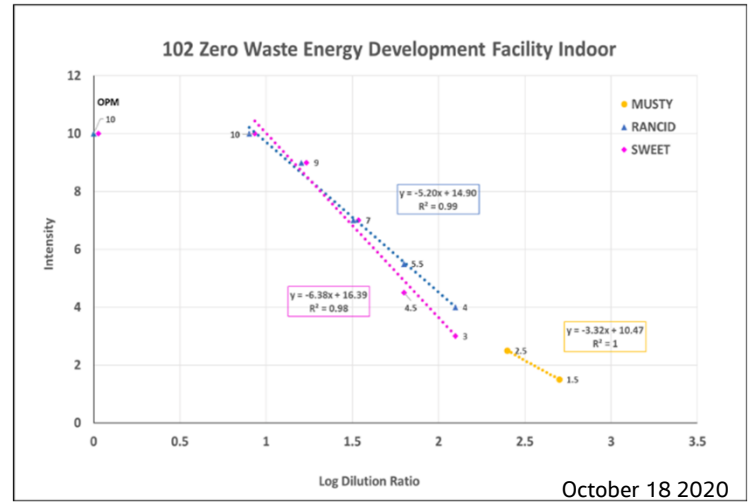
No Odor	0
Threshold	0 or 1
Very Weak	2
Weak	4
Weak-Moderate	6
Moderate	8
Moderate-Strong	10
Strong	12

OPM - Odor Persistence

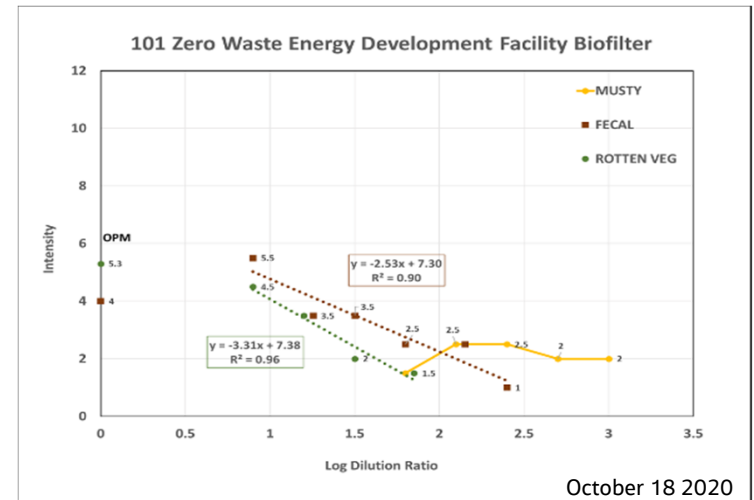
Example of Data Analysis



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Offsite Field Survey Results

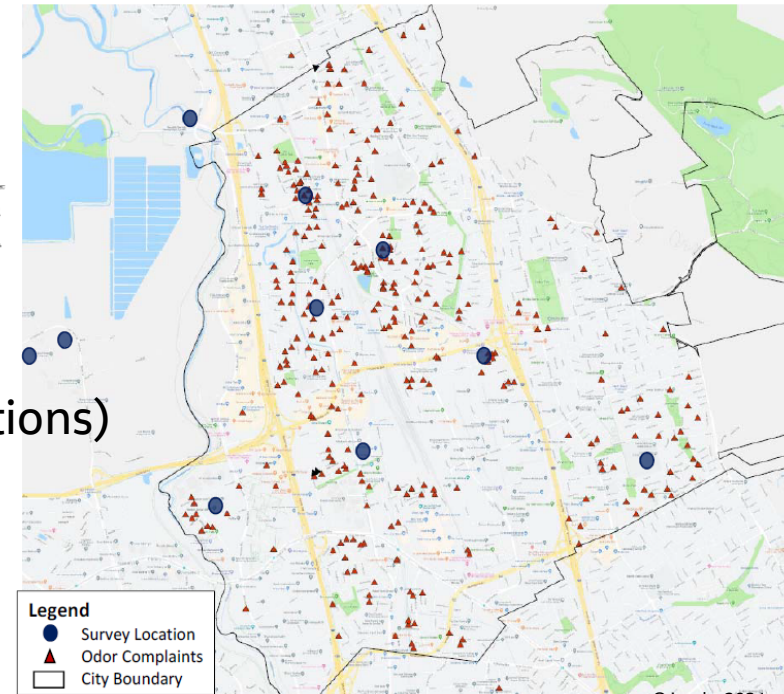
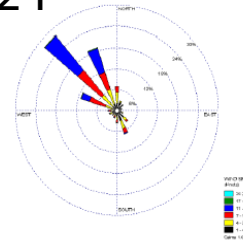
1. Field survey - during the Sampling Events

- Jacobs team
- at the facilities, upwind & downwind of the facilities and in the community
- several days in October 2020 and May 2021



2. Field survey – randomly every fortnight

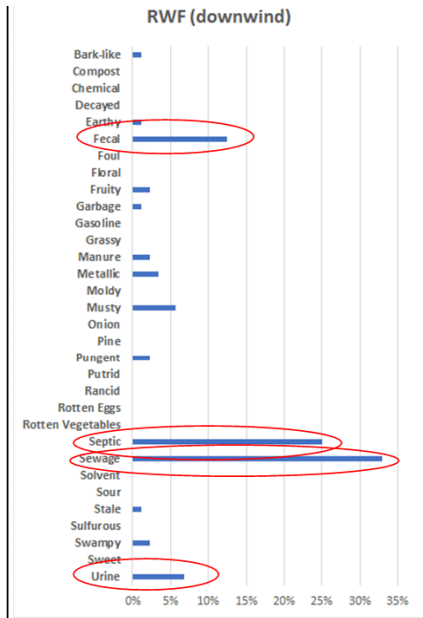
- City of Milpitas staff team
- downwind of facilities and in the community (11 locations)
- 50 surveys between October 2019 and June 2021



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Odor Analysis at Offsite Locations

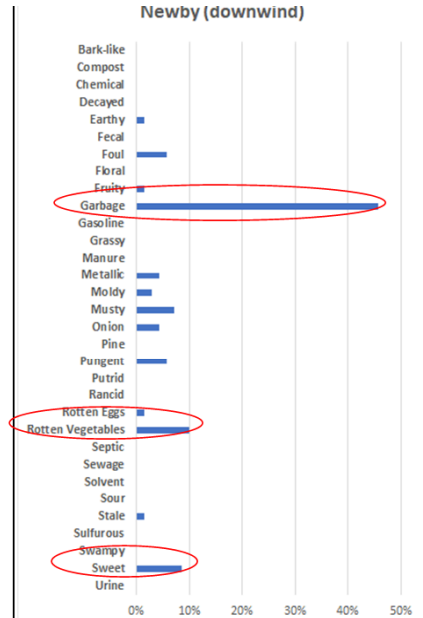
October 2019 – December 2020



Sewage	33%
Septic	0%
Fecal	13%
Urine	7%
77%	

Garbage	1%
Rotten Vegetables	0%
Sweet	0%

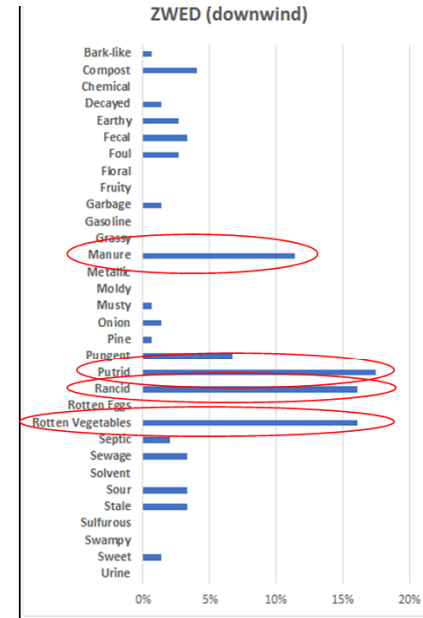
Putrid	0%
Rancid	0%
Rotten Vegetables	0%
Manure	2%



0%
0%
0%
0%

46%	
10%	
9%	
64%	

0%
0%
10%
0%



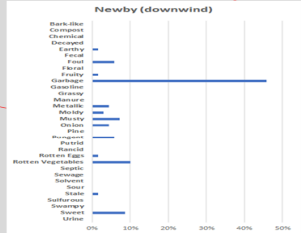
3%
2%
3%
0%

1%
16%
1%

17%	
16%	
11%	
61%	

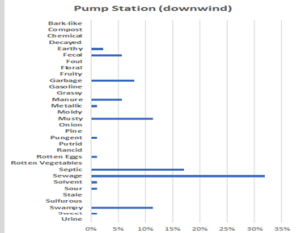
NEWBY

	avg	max
Intensity	4.0	6
Detection/Threshold	80	720
Hedonic Tone	-1.6	-3.0
odor present (%)	100	



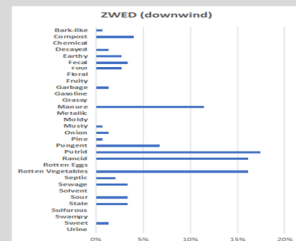
LIFT STATION

	avg	max
Intensity	2.9	5.0
Detection/Threshold	27	259
Hedonic Tone	-1.1	-2.0
odor present (%)	100	



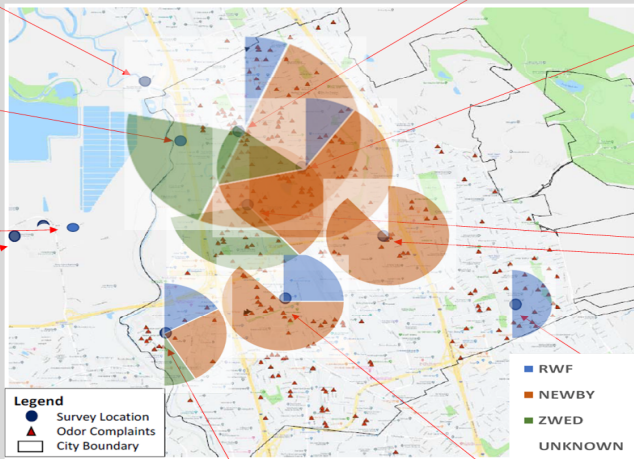
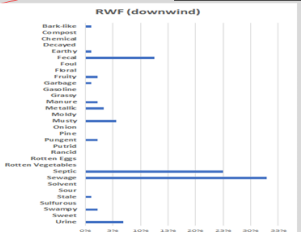
ZWED

	avg	max
Intensity	5.7	6.0
Detection/Threshold	415	1033
Hedonic Tone	-2.6	-3.0
odor present (%)	100	



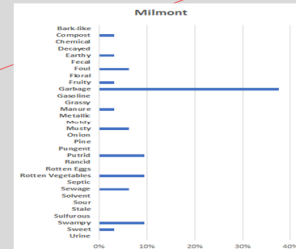
RWF

	avg	max
Intensity	4.1	6.0
Detection/Threshold	59	411
Hedonic Tone	-1.7	-3.0
odor present (%)	100	



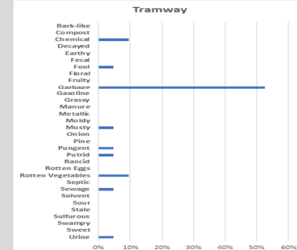
Milmont Dr

	avg	max
Intensity	1.1	4.0
Detection/Threshold	5	20
Hedonic Tone	-1.0	-2.0
odor present (%)	53	



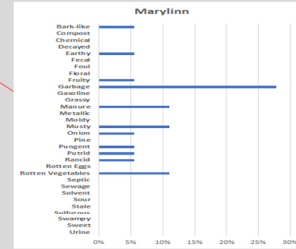
Tramway

	avg	max
Intensity	0.7	3.0
Detection/Threshold	5	28
Hedonic Tone	-1.0	-1.0
odor present (%)	39	



Marilynn Dr

	avg	max
Intensity	0.5	3.0
Detection/Threshold	5	20
Hedonic Tone	-0.9	-2.0
odor present (%)	30	



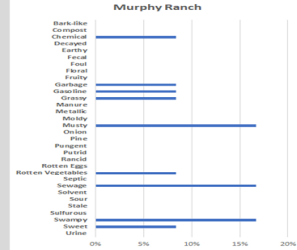
Los Coches

	avg	max
Intensity	0.3	2.0
Detection/Threshold	3	8
Hedonic Tone	-1.0	-1.0
odor present (%)	23	



Murphy Ranch

	avg	max
Intensity	0.3	4.0
Detection/Threshold	3	6
Hedonic Tone	-0.7	-1.0
odor present (%)	23	



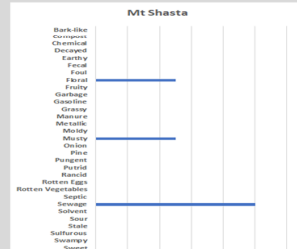
Alvarez

	avg	max
Intensity	0.3	2.0
Detection/Threshold	3	5
Hedonic Tone	-0.7	-1.0
odor present (%)	23	



Mt Shasta

	avg	max
Intensity	0.1	1.0
Detection/Threshold	3	5
Hedonic Tone	-0.3	-1.0
odor present (%)	10	



Notes:
 The averages are the average values of all occasions when odor was detected
 Detection/Threshold values are the odour concentration as measured with a field olfactometer (Scentroid SM100)
 Odor Intensity Scale: Not Detectable (0), Very Weak (1), Weak (2), Distinct (3), Strong (4), Very Strong (5), Extremely Strong (6)
 Hedonic Tone Scale: Pleasant (1), Neutral (0), unpleasant (-1), revolting (-2), nauseating (-3)