Environmental Consultants
and Contractors

2370 Skyway Drive
Suite 101
Santa Maria, CA 93455

805-346-6591

www.scsengineers.com

SCS ENGINEERS

Formerly Tracer Environmental Sciences & Technologies, Inc., now a part of SCS Engineers.

September 30, 2019

Santa Barbara County Planning Commission
Planning & Development Department
123 East Anapamu Street
Santa Barbara, CA 93013

Subject: CARP Case Study- Cannabis Odor Management

To Commissioners:

SCS Engineers (SCS) would like to note that due to our firm's broad background in environmental engineering, and odor management specifically, we have been retained by the Carpinteria Association of Responsible Producers (CARP) for the purposes of analyzing and addressing cannabis odors related to client facilities in the region. SCS is an industry leader in the assessment of odor emissions and mitigation methods across North America. SCS has provided environmental solutions for various land uses including but not limited to landfills, wastewater treatment plants, and agricultural & food processing facilities for over forty (40) years.

We recently completely a site specific analysis of an active cannabis facility located at 5138 Foothill Road in Carpinteria (Project Site/Facility). SCS field staff confirmed that the Project Facility was similar to proposed cannabis greenhouses throughout the region with adult-flowering cannabis, ancillary cannabis processing, operable roof vents, and an active odor neutralizing vapor system. SCS collected a suite of fourteen (14) total odor samples at strategically appropriate times and locations in an effort to capture potential maximum odors during calm winds (morning samples), steady winds (afternoons), with the Project Facilities' roof vents open, and with active cannabis processing occurring. These sample collections included upwind locations to determine an odor baseline for the region without cannabis, samples taken inside the greenhouse to reflect unmitigated odor released from cannabis cultivation or processing, and samples taken outside the greenhouse, downwind to capture odor conditions after the application of the odor neutralizing vapor.

These samples were then shipped to an independent third-party laboratory (Odor Science and Engineering, Incorporated in Bloomfield, Connecticut) for analysis. The OS&E laboratory has an expert odor panel which conducts blind evaluations of the odor samples (the panel is not informed of the potential type or source of the samples). The odor panel provides both a character (i.e. sour, skunk, exhaust, garbage) and an intensity for each odor sample. The intensity of odor is quantified as a dilution to threshold ratio (D/T) with higher numbers reflecting stronger odors. For example, the baseline odors present in most communities range from 8-12 D/T. Eight (8) D/T represents eight (8) parts of clean, purified air for each unit of odor sample. The specially trained and qualified odor panelists can often detect a net increase of 3-5 D/T over this baseline condition. Members of the general public can typically detect a net increase of 5-10 D/T. As a result, SCS typically considers a persistent net increase of odor intensity of seven (7) D/T or greater above baseline to be a nuisance odor detectable by the public.

Results from the case study indicated that the upwind/baseline odor present in Carpinteria had an intensity of twelve (12) D/T with a character commonly including odor descriptors such as: sour, stale, sulfur, and exhaust. Samples of unmitigated cannabis odors within the Project Site's greenhouse ranged from a net increase in odor intensity of 151 D/T (adult-flowering plants) to 238 D/T (adult-flowering plants plus processing) with a character commonly including odor descriptors such as: skunk, mercaptan, and marijuana/pot. Samples taken outside the Project Site's greenhouse with odor mitigation from the neutralizing vapor had a maximum net increase in odor intensity of three (3) D/T with eight (8) out of ten (10) samples showing no net increase in odor intensity. Because all mitigated odor samples remained significantly below a net increase of seven (7) D/T in intensity, no nuisance level odors are anticipated from the Project Facility. Typical malodor characters observed in these mitigated samples returned to sour, exhaust, and garbage similar to the background sample. Malodors character such as skunk or mercaptan were only observed in two (2) out

of the ten (10) mitigated samples which had net odor intensities of negative one (-1) and three (3) D/T respectively. With D/T of less than seven (7) these odors are unlikely to be detected by the surrounding public. It also important to note that the downwind odor sample locations were taken at a range of 30-165 feet from the exterior walls of the greenhouse, far closer than the 600 foot distance to the nearest sensitive receptor. Natural dispersion and dilution would continue to reduce remnant odors.

Based upon this initial case study, SCS' findings conclude that the odor neutralizing vapor system was:

- Successfully eliminating 98.7% or more of cannabis odors in distances as little as thirty (30) feet.
- Performing on par with other leading odor control technologies including carbon filtration.
- The system was successfully mitigating odors even with roof vents open and higher intensity odor activities such as cannabis processing occurring during the odor sampling events.

SCS will continue to work with the cannabis industry to implement environmental solutions, including evolving odor management technology. Our staff are available as a resource should the Commission have additional questions and concerns regarding odor management in the region. We have appended a complimentary slide deck to this memorandum for a graphical illustration of this case study analysis.

Sincerely,

Nathan Eady
Land Use Planner/Project Director

Paul Schafer
Air Quality Specialist/Project Director

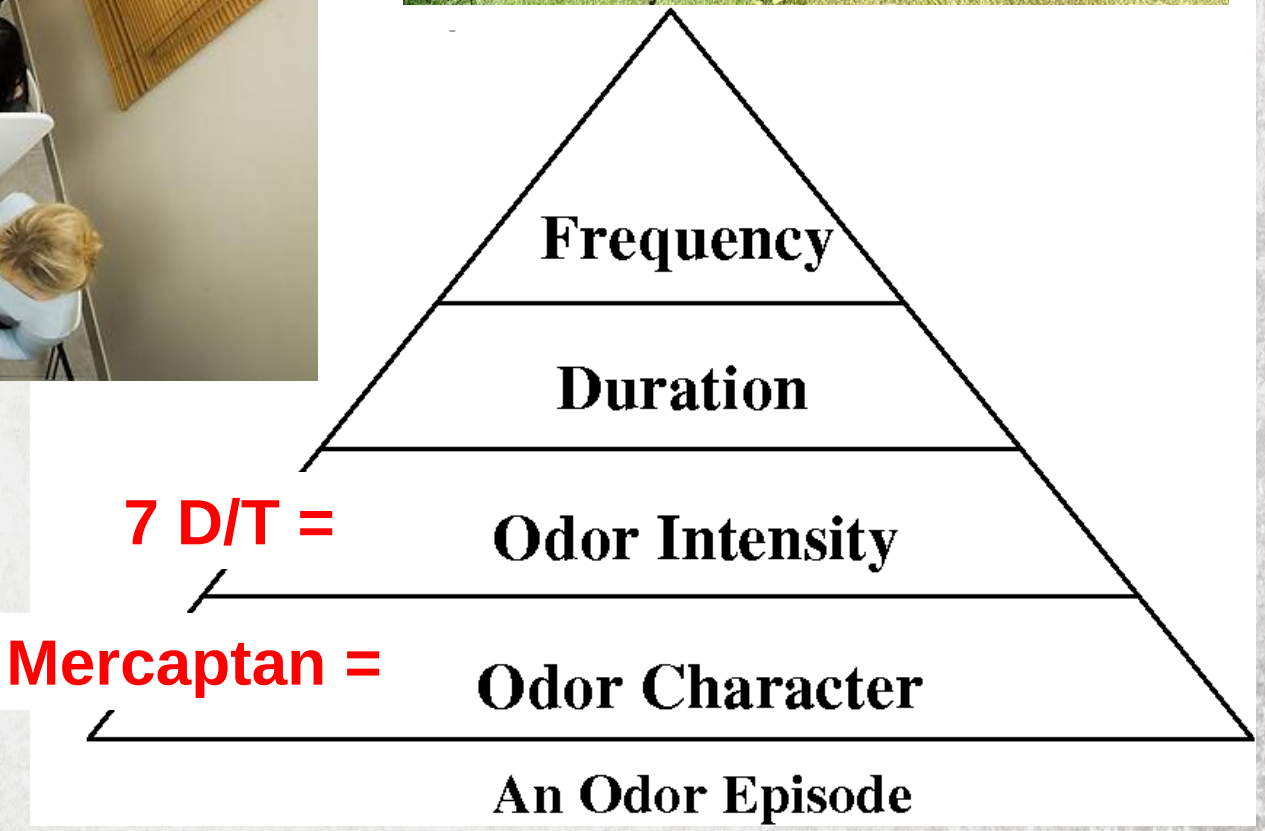
CARPINTERIA AIR QUALITY SAMPLING
CASE STUDY RESULTS & CONCLUSIONS

SCS ENGINEERS
www.scsengineers.com
August 2019

CASE STUDY FINDINGS
CARPINTERIA, CALIFORNIA

- Vapor Odor Neutralizing System reduced odors by 98.7% or better; measured at distances as little as 30 feet from greenhouse.
- Vapor phase performed as good as carbon filtration and is more effective for large volume air spaces such as greenhouses; vapor can also abate odors that escape the primary structure.
- Structure makes a difference, the system performed efficiently with open roof vents.
- Vapor phase system effectively abated odor during harvesting/processing phase, the most odor intensive stage of cannabis cultivation observed.
- Iterations in the technology & application have improved the efficacy of odor neutralizing systems.

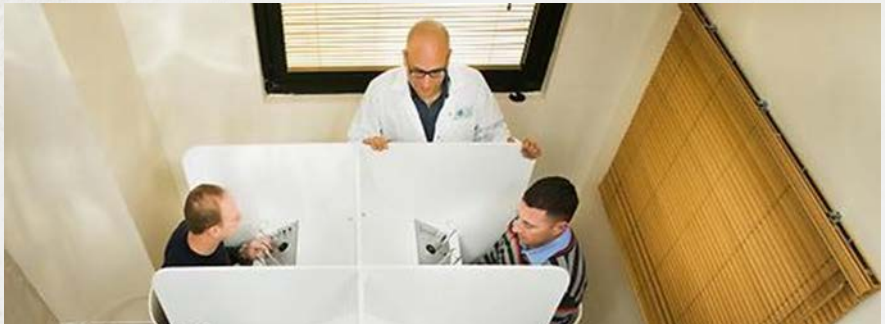
METHODOLOGY
ODOR SAMPLE ANALYSIS



7 D/T =

Skunk or Mercaptan =

METHODOLOGY
ODOR SAMPLE ANALYSIS



Odor Science & Engineering, Inc.
105 Filley Street, Bloomfield, CT 06002
(860) 243-9380 Fax: (860) 243-9431
www.odorscience.com

August 13, 2019

Paul Schafer
SCS Engineers
5963 LaPlace Court
Suite 207
Carlsbad, CA 92008

PSchafer@scsengineers.com

RE: Odor Panel Analysis – August 8, 2019
OS&E Project No. 2151-M-00
SCS Sampling Site: CARP

Dear Paul:

This letter presents the results of the recent odor panel analyses conducted by Odor Science & Engineering, Inc. (OS&E) for SCS Engineers. A total of fourteen (14) odor emission samples were collected on August 7th, 2019 by on-site SCS personnel. The odor samples were collected into Tedlar gas sampling bags provided by OS&E. Following sample collection, the sample bags were shipped via UPS Overnight to OS&E's Olfactory Laboratory in Bloomfield, CT for sensory analysis the next day. The samples arrived intact with a chain of custody requesting sensory analysis attached.

Upon arrival the samples were analyzed by dynamic dilution olfactometry using a trained and screened odor panel of 8 members. The odor panelists were chosen from OS&E's pool of panelists from the Greater Hartford area who actively participate in ongoing olfactory research and represent an average to above average sensitivity when compared to a large population. The samples were quantified in terms of dilution-to-threshold (D/T) ratio and odor intensity in accordance with ASTM Methods E-679-04 and E-544-10, respectively. The odor panelists were also asked to describe the odor character of the samples at varying dilution levels. The odor panel methodology is further described in Attachment A.

The results of the odor panel tests are presented in the attached Table.

We appreciate the opportunity to be of continued service to SCS Engineers. Please feel free to call Martha O'Brien or me if you have any questions concerning these results.

Sincerely,
ODOR SCIENCE & ENGINEERING, INC.

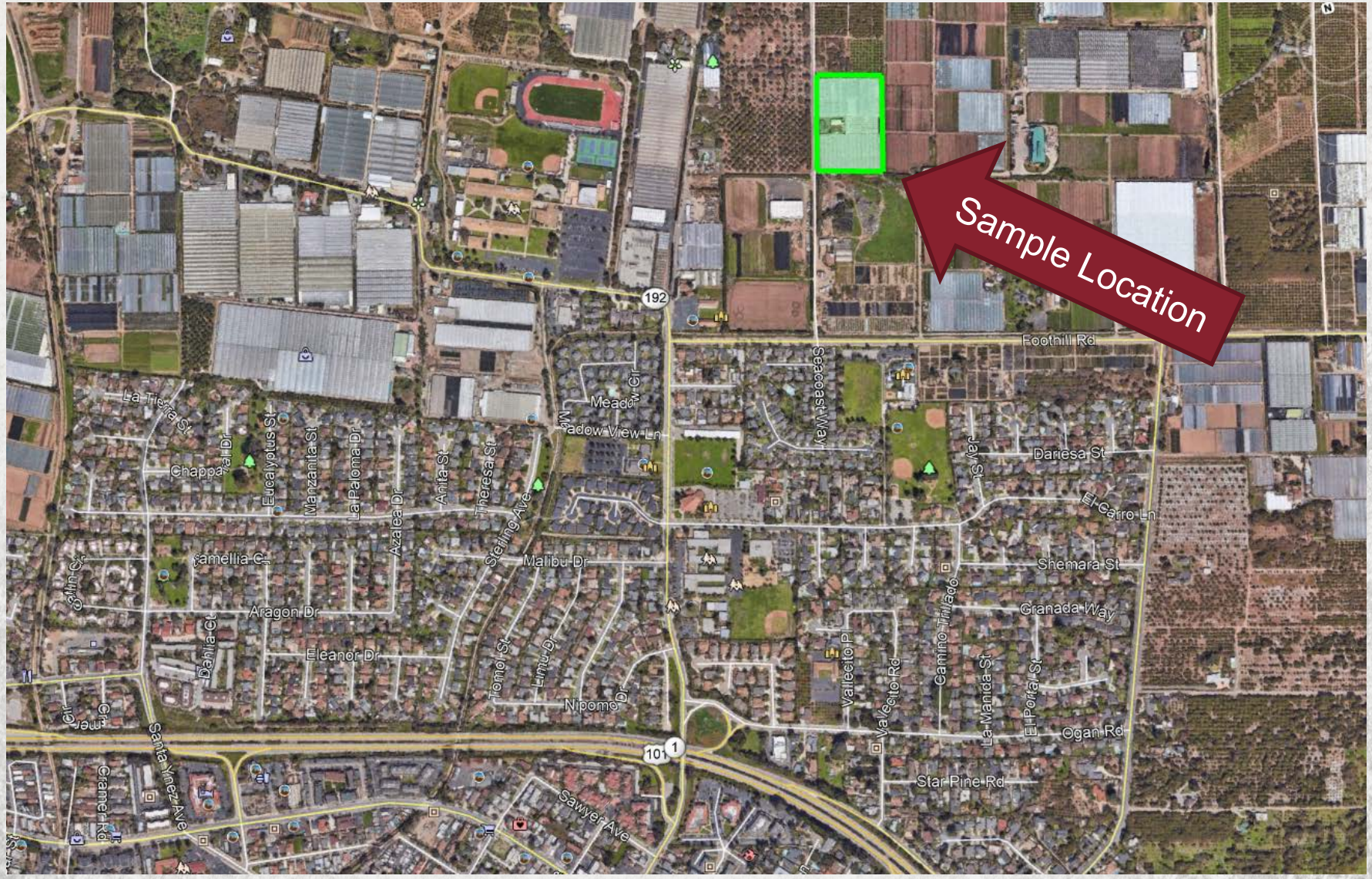
Gary K. Grumley
Associate Scientist

Table 1. Results of dynamic dilution olfactome
SCS Engineers – Sampling S
OS&E Project No. 2151

Date	Time	Sample ID	Odor Conc. D/T[1]	Stevens' Law Constants[2] a	b	
8/07/2019	07:12	AM-S1	9	--	--	sour, rubber, burn
8/07/2019	07:17	AM-S2	11	--	--	stale, musty, onio
8/07/2019	07:21	AM-S3	12	--	--	sour, sweet, rubber, garbage, exhaust, rubber, plastic, exhaust
8/07/2019	07:29	AM-E	9	--	--	sour, rubber, garbage, sewage, plastic, burnt, exhaust
8/07/2019	06:52	AM-UP	12	--	--	sour, stale, sulfur, H_2S, rubber, exhaust
8/07/2019	07:11	AM-W	9	--	--	sour, plastic, swampy, sulfur, exhaust
8/07/2019	07:23	AM-GH	163	.44	.76	skunk, rotten, mercaptan, burnt sulfur
8/07/2019	13:48	PM-GH	250	.53	.89	skunk, dead skunk, marijuana/"pot"
8/07/2019	13:36	PM-N1	13	--	--	sour, rubber, glue, paste, putty, plastic, exhaust
8/07/2019	13:33	PM-L1	11	--	--	sour, sweet, rubber, garbage, exhaust, rubber, floor chemical, plastic, exhaust
8/07/2019	13:25	PM-M2	12	--	--	sour, burnt, rubber, sewage, garbage, exhaust, plastic, exhaust
8/07/2019	13:30	PM-L2	9	--	--	sour, sweet, rubber, musty, vegetation, chemical, plastic, exhaust
8/07/2019	13:21	PM-M1	15	--	--	rotten, skunk, mercaptan, garlic, sulfur, sewage, plastic, exhaust
8/07/2019	13:20	PM-UP	12	--	--	sour, sulfur, sewage, H_2S, stale, plastic, exhaust

METHODOLOGY

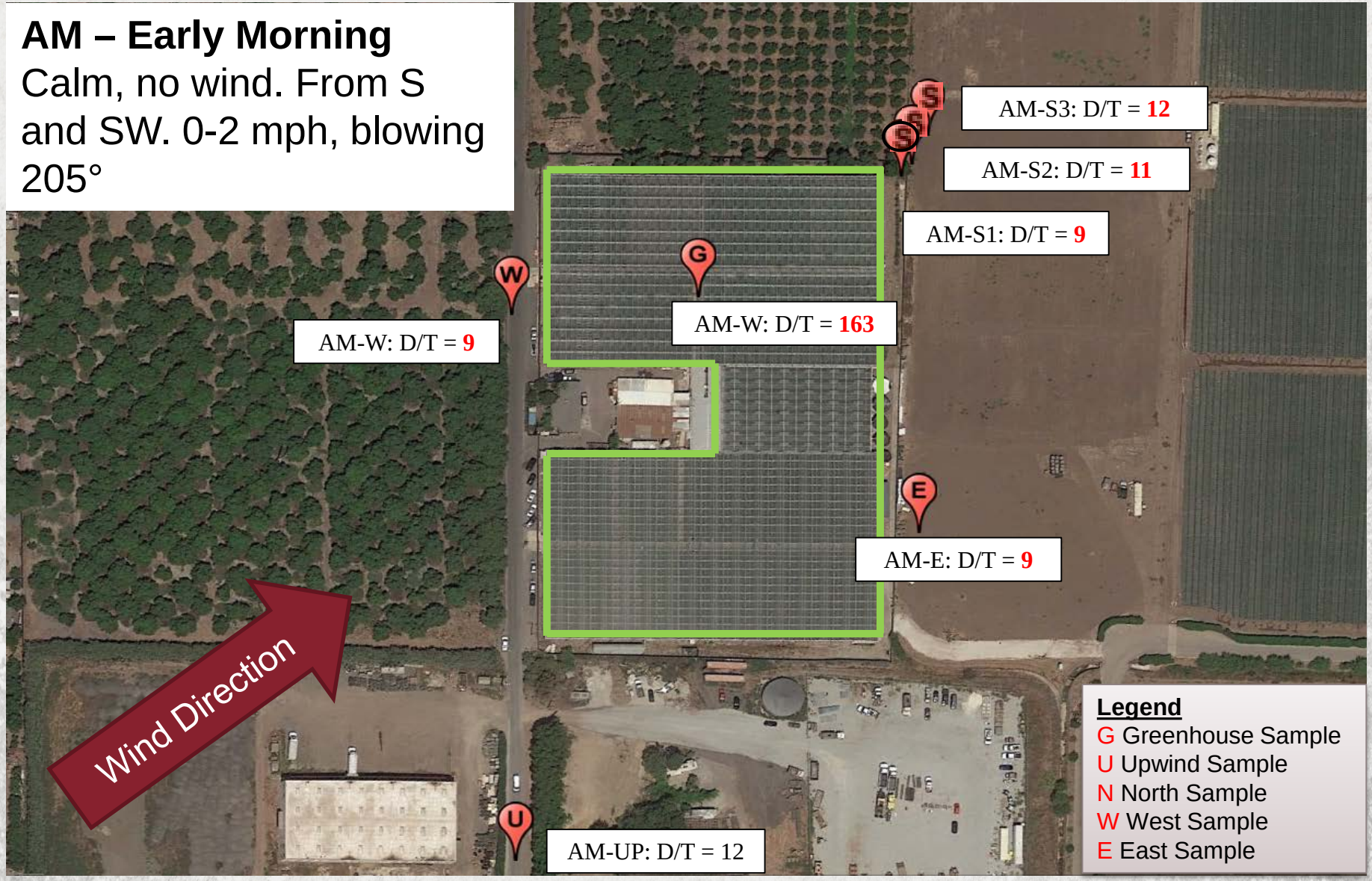
ODOR SAMPLE ANALYSIS



AIR SAMPLING RESULTS (WITH BASELINE)

ODOR INTENSITY AND CHARACTER

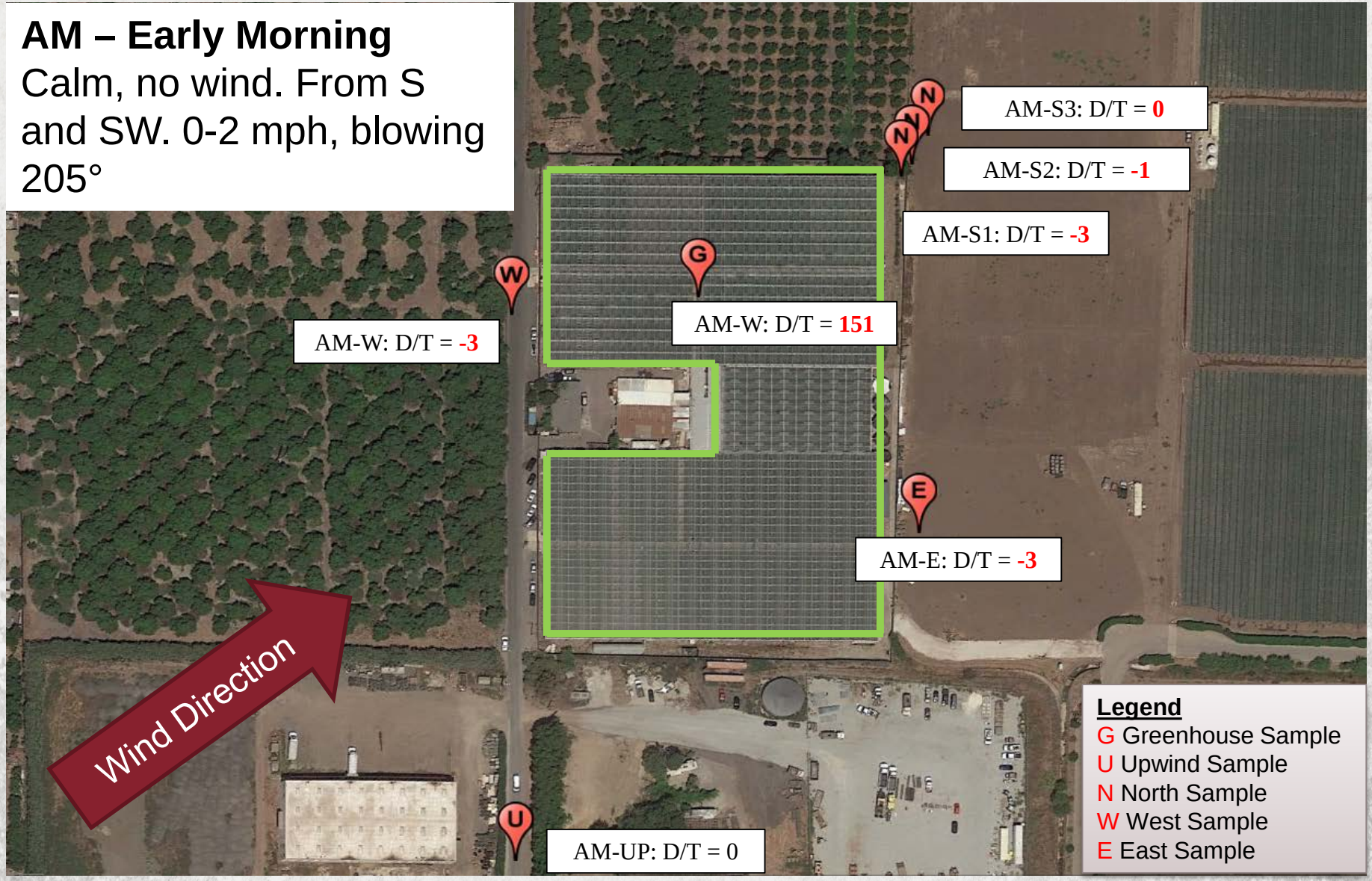
AM – Early Morning
Calm, no wind. From S and SW. 0-2 mph, blowing 205°



AIR SAMPLING RESULTS (NET INCREASE)

ODOR INTENSITY AND CHARACTER

AM – Early Morning
Calm, no wind. From S and SW. 0-2 mph, blowing 205°



AIR SAMPLING RESULTS

ODOR INTENSITY AND CHARACTER

AM – Early Morning
Calm, no wind. From S and SW. 0-2 mph, blowing 205°

ODOR INTENSITY WITH BASELINE

Baseline/Upwind Intensity & Character	In Greenhouse Gross Intensity Increase & Character	Short-Range (0-30 feet) Gross Intensity Increase & Character	Medium-Range (Approx. 31-60 feet) Gross Intensity Increase & Character	Long-Range (Approx. more than 60 feet) Gross Intensity Increase & Character
12 sour, stale, sulfur, H_2S, rubber, exhaust	**163** skunk, rotten, mercaptan, burnt sulfur	**9** sour, rubber, burning, plastic, musty, moldy, light sewage, exhaust	**11** stale, musty, oniony, mercaptan, sewage, H_2S, plastic, wet cardboard, exhaust	**12** sour, sweet, rubber, garbage, exhaust, rubber, plastic, exhaust
			9 sour, rubber, garbage, sewage, plastic, burnt, exhaust	
			9 sour, plastic, swampy, sulfur, exhaust	

AIR SAMPLING RESULTS

ODOR INTENSITY AND CHARACTER

AM – Early Morning
Calm, no wind. From S and SW. 0-2 mph, blowing 205°

NET INCREASE ODOR INTENSITY

Baseline/Upwind Intensity & Character	In Greenhouse Net Intensity Increase & Character	Short-Range (0-30 feet) Net Intensity Increase & Character	Medium-Range (Approx. 31-60 feet) Net Intensity Increase & Character	Long-Range (Approx. more than 60 feet) Net Intensity Increase & Character
0 sour, stale, sulfur, H2S, rubber, exhaust	**151** skunk, rotten, mercaptan, burnt sulfur	**-3** sour, rubber, burning, plastic, musty, moldy, light sewage, exhaust	**-1** stale, musty, oniony, mercaptan, sewage, H2S, plastic, wet cardboard, exhaust **-3** sour, rubber, garbage, sewage, plastic, burnt, exhaust **-3** sour, plastic, swampy, sulfur, exhaust	**0** sour, sweet, rubber, garbage, exhaust, rubber, plastic, exhaust

AIR SAMPLING RESULTS (WITH BASELINE)

ODOR INTENSITY AND CHARACTER

PM-Early Afternoon
Steady breeze from SW. 6 mph, blowing 225°

Legend
G Greenhouse Sample
U Upwind Sample
S Short Distance
M Medium Distance
L Long Distance

AIR SAMPLING RESULTS (NET INCREASE)

ODOR INTENSITY AND CHARACTER

PM-Early Afternoon
Steady breeze from SW. 6 mph, blowing 225°

Legend
G Greenhouse Sample
U Upwind Sample
N North Sample
W West Sample
E East Sample

AIR SAMPLING RESULTS
ODOR INTENSITY AND CHARACTER

PM-Early Afternoon
Steady breeze from SW. 6 mph, blowing 225°

ODOR INTENSITY WITH BASELINE

Baseline/Upwind Intensity & Character	In Greenhouse Gross Intensity Increase & Character	Short-Range (50 feet) Gross Intensity Increase & Character	Medium-Range (Approx. 75 feet) Gross Intensity Increase & Character	Long-Range (Approx. 165 feet) Gross Intensity Increase & Character
12 sour, sulfur, sewage, H_2S, stale, plastic, exhaust	**250** skunk, dead skunk, marijuana/"pot"	**13** sour, rubber, glue, paste, putty, plastic, exhaust	**12** sour, burnt, rubber, sewage, garbage, exhaust, plastic, exhaust	**9** sour, sweet, rubber, musty, vegetation, chemical, plastic, exhaust
			15 rotten, skunk, mercaptan, garlic, sulfur, sewage, plastic, exhaust	**11** sour, sweet, rubber, garbage, exhaust, rubber, floor chemical, plastic, exhaust

AIR SAMPLING RESULTS
ODOR INTENSITY AND CHARACTER

PM-Early Afternoon
Steady breeze from SW. 6 mph, blowing 225°

NET INCREASE ODOR INTENSITY

Baseline/Upwind Intensity & Character	In Greenhouse Net Intensity Increase & Character	Short-Range (50 feet) Net Intensity Increase & Character	Medium-Range (Approx. 75 feet) Net Intensity Increase & Character	Long-Range (Approx. 165 feet) Net Intensity Increase & Character
0 sour, sulfur, sewage, H2S, stale, plastic, exhaust	**238** skunk, dead skunk, marijuana/"pot"	**1** sour, rubber, glue, paste, putty, plastic, exhaust	**0** sour, burnt, rubber, sewage, garbage, exhaust, plastic, exhaust	**-3** sour, sweet, rubber, musty, vegetation, chemical, plastic, exhaust
			3 rotten, skunk, mercaptan, garlic, sulfur, sewage, plastic, exhaust	**-1** sour, sweet, rubber, garbage, exhaust, rubber, floor chemical, plastic, exhaust