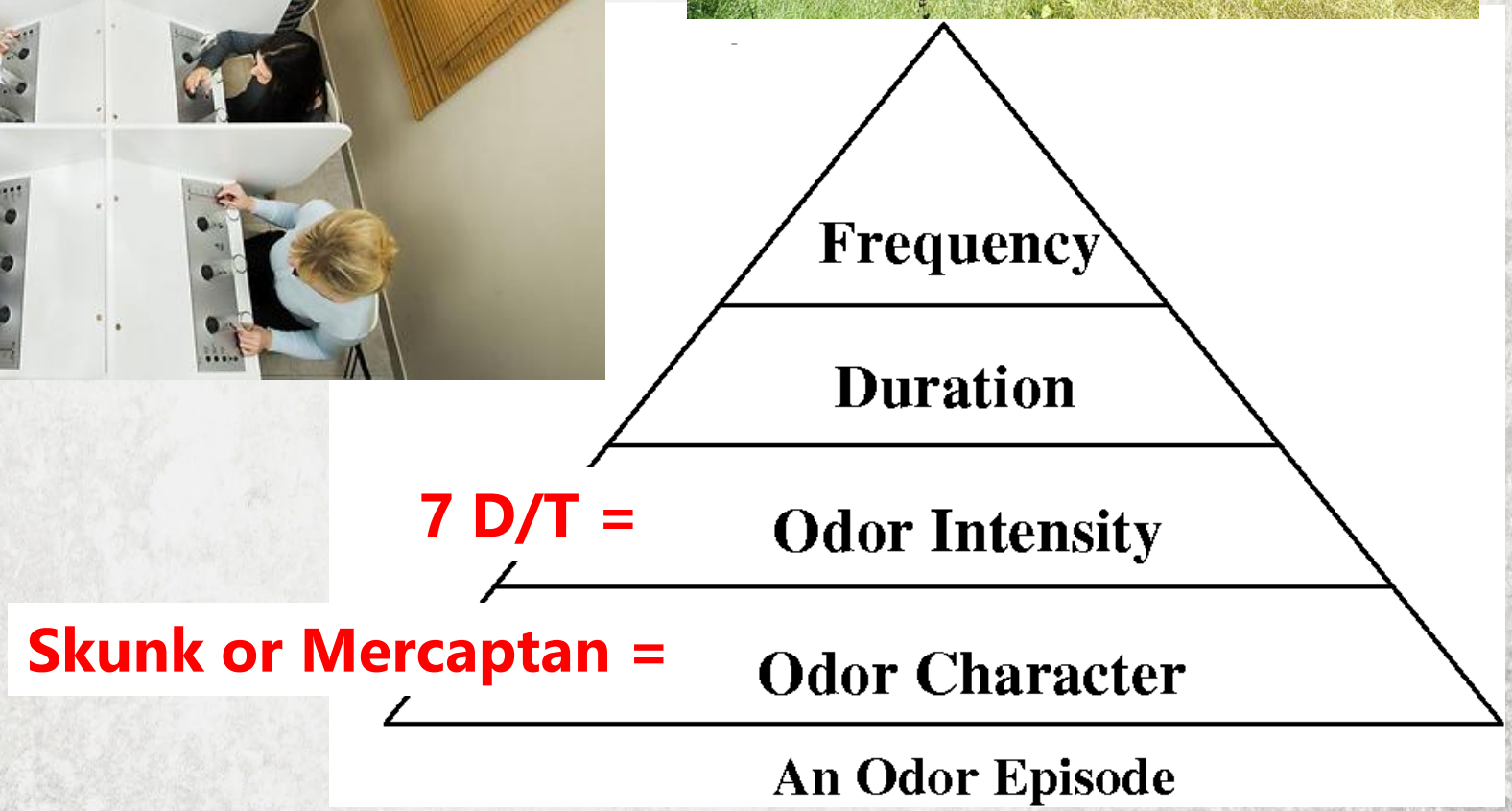
CARPINTERIA AIR QUALITY SAMPLING
CASE STUDY RESULTS & CONCLUSIONS

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

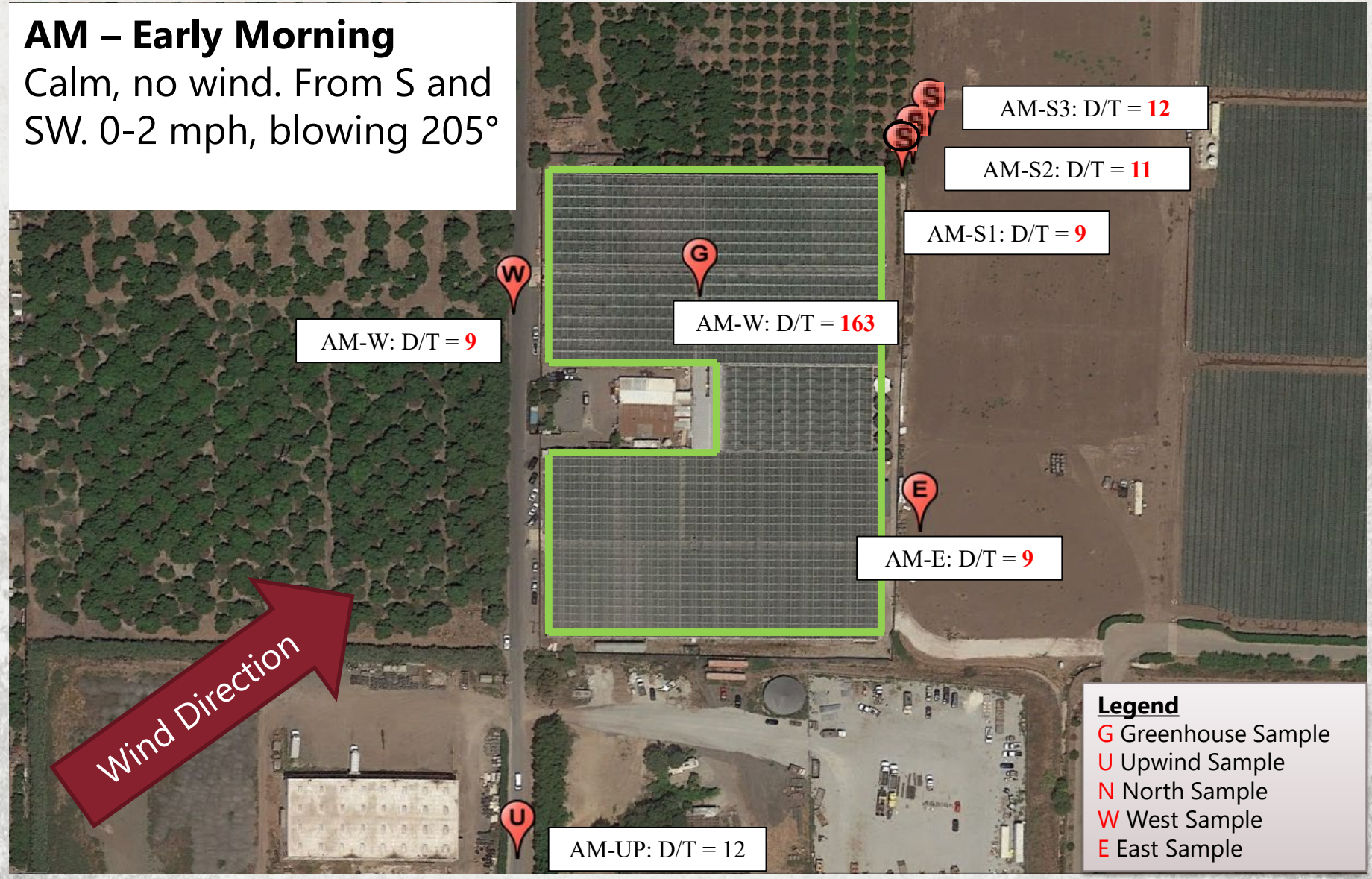
METHODOLOGY

ODOR SAMPLE ANALYSIS

AIR SAMPLING RESULTS (WITH BASELINE)

ODOR INTENSITY AND CHARACTER

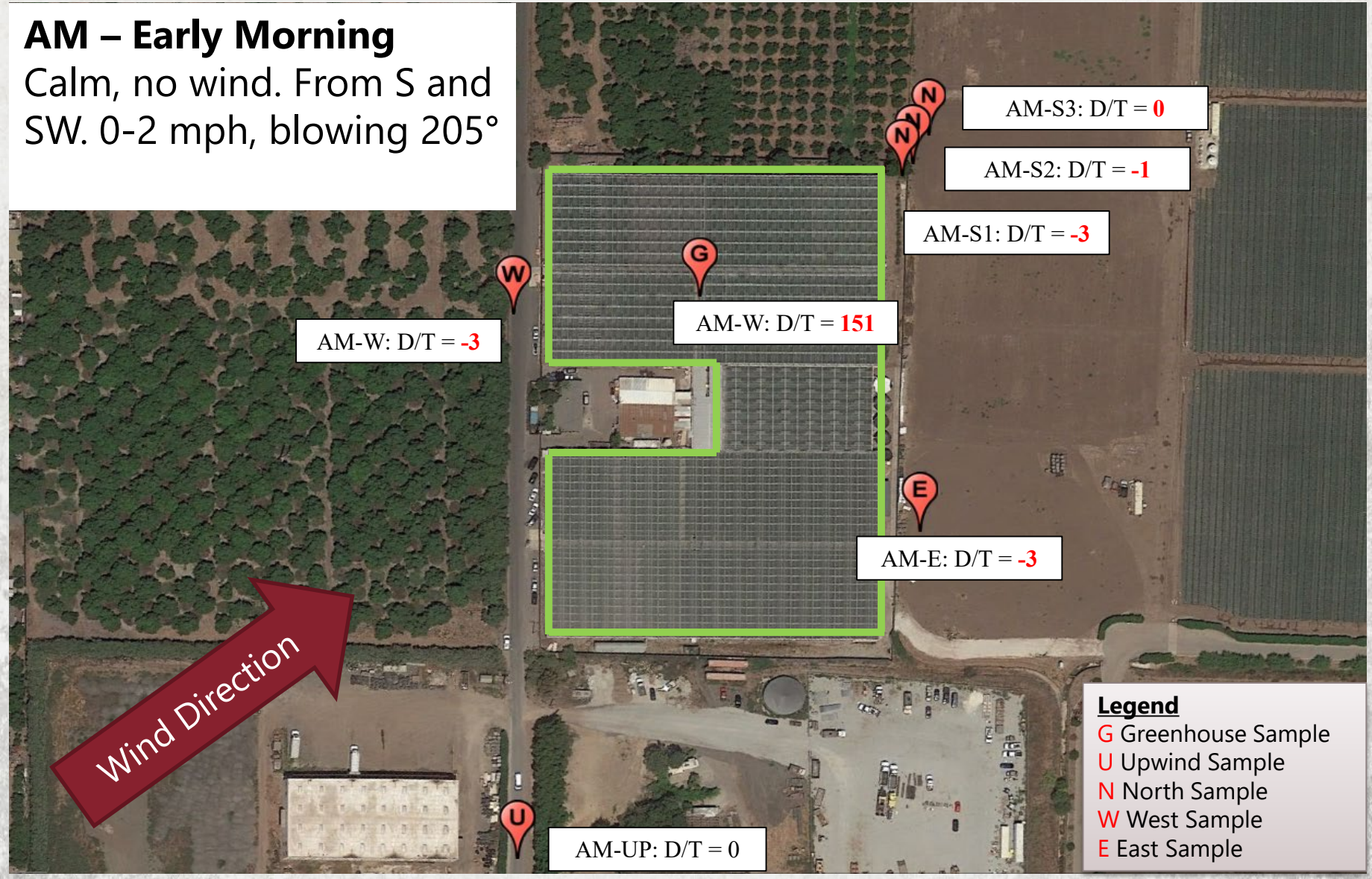
AM – Early Morning
Calm, no wind. From S and SW. 0-2 mph, blowing 205°



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 **9** sour, rubber, garbage, sewage, plastic, burnt, exhaust **9** sour, plastic, swampy, sulfur, exhaust	**12** sour, sweet, rubber, garbage, exhaust, rubber, plastic, 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°

AIR SAMPLING RESULTS (NET INCREASE)

ODOR INTENSITY AND CHARACTER

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

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