Norcal Waste Systems, Inc.

Jepson Prairie Organics Compost Facility
Vacaville, CA

Air Emissions Source Test

Emissions Evaluation of Complete Compost Cycle VOC and Ammonia Emissions

Report

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Executive Summary

The volatile organic compound (VOC) and ammonia emissions were measured using United States Environmental Protection Agency (USEPA) developed surface isolation flux chamber technology from in-vessel and windrow compost operations located at the Jepson Prairie Organics (JPO) Compost Facility in Vacaville, California. All testing occurred on August 23 through 25, 2005. A full compost cycle emission profile was built based on data from scientifically selected operational days.

Total VOC was analyzed using South Coast Air Quality Management District (SCAQMD) Method 25.3. Ammonia was analyzed per SCAQMD Method 207.1. Sulfur hexafluoride was used as a tracer to determine advective flow in the flux chamber.

Table ES-1 presents a summary of the emission factors developed for this project and a comparison to the green waste emission factors developed by the SCAQMD. The in vessel and windrow ammonia emission factors were quite similar to the SCAQMD factors but the in vessel VOC emission factor was substantially higher. For the in-vessel compost system, the vast majority of the emissions occurred during curing. The differences between the JPO and the SCAQMD emission factors are due to the different nature of the feedstock and compost methods. VOC mass is reported assuming a molecular weight of 16 g/gmole (methane).

Table ES-1. – Measured feedstock, full compost cycle, and finished product storage emissions in pounds per ton of received material for VOC and ammonia.

Source	VOC (#/ton)	NH3 (#/ton)
In-vessel Feed Stock	0.09	0.00043
In-vessel Compost Process	3.06	0.05
In-vessel Curing Process	33.62	0.67
In-vessel Product (#/yd3)	0.24	0.01
Windrow Feedstock	2.95	0.07
Windrow Compost Process	5.65	0.24
SCAQMD Greenwaste Emission Factor	3.80	0.50

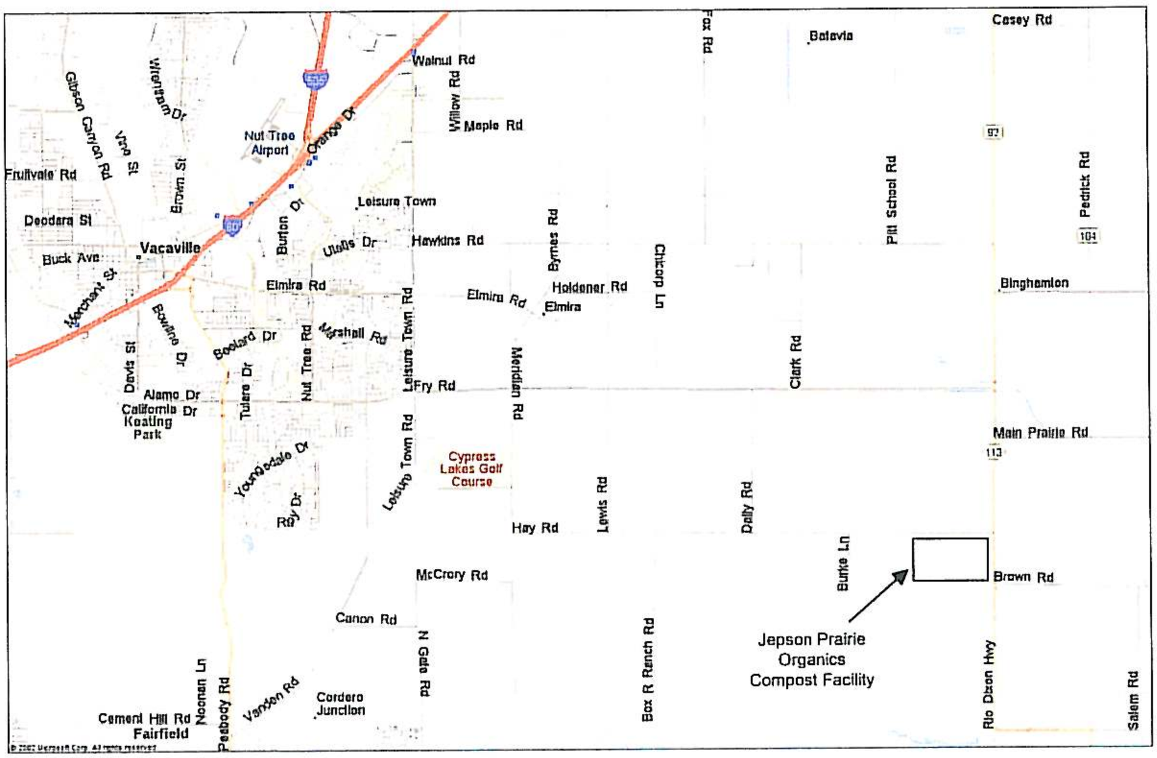
IN-VESSEL PRODUCT
⇒ VOC = 0.3 #/TON
NH3 = 0.02 #/TON

Total site annual emissions can be calculated by multiplying annual throughput by these emission factors.

1.0 Introduction

This project was intended to directly measure the air emissions from compost operations to develop an emission factor for a full compost/cure cycle. All compost operations were located at the Jepson Prairie Organics Compost Facility in Vacaville, CA.

Figure 1-1 Site Vicinity Map



2.0 Sampling

The following table lists the conditions tested and the number of samples taken.

Table 2.1 – Test Conditions

Test Condition	Number of Samples	Comments
In-vessel Receiving	2	
In-vessel Composting, Day 1 (Ag Bag)	2	
In-vessel Composting, Day 4 (Ag Bag)	2	
In-vessel Composting, Day 5 (Ag Bag)	2	
In-vessel Composting, Day 8 (Ag Bag)	5	Bag Wall Porosity Measured
In-vessel Composting, Day 10 (Ag Bag)	3	
In-vessel Composting, Day 22 (Ag Bag)	2	
In-vessel Composting, Day 30 (Ag Bag)	2	
In-vessel Curing, Day 0	1	
In-vessel Curing, Day 3	3	Pre and Post Mix Tested
In-vessel Curing, Day 7	1	
In-vessel Curing, Day 10	2	Pre and Post Mix Tested
In-vessel Curing, Day 13	1	
In-vessel Curing, Day 19	2	Pre and Post Mix Tested
In-vessel Curing, Day 25	1	
In-vessel Curing, Day 31	1	
In-vessel Finished Product Stockpile	3	Pre and Post Mix Tested
Windrow Composting Day 3	1	
Windrow Composting Day 6	1	
Windrow Composting Day 7	3	
Windrow Composting Day 15	1	
Windrow Composting Day 30	1	
Windrow Composting Day 50	1	
Windrow Stockpile	3	
Total	46	

All surface samples were taken using USEPA Surface Isolation Emission Flux Chamber technology per the Quality Assurance Project Plan (QAPP). The technical memorandum in Appendix C presents a summary of data validation, project documentation, and laboratory methods used for this project.

3.0 Sampling Results

All sampling took place between August 23 and 25, 2005. The operation was characterized by a fairly wide data variability most likely due to the variation in the content of the feedstock material. However, sufficient data was obtained to provide valid average emission factors for the operations.. The in-vessel enclosure did not show any significant porosity and should be considered a complete barrier to emissions. Figure 3.1 presents of a summary of sampling results. The appendix contains complete sampling data.

Figure 3.1 Summary of sampling results.

SOURCE	NMNEO Tank (ppmvC)	NH3 (mg/m3)	SF6 Trace (ppbv)	SF6 (ppbv)	Total Flow (lpm)	Total Flow (m3/min)	TNMNEO Flux	NH3 Flux
Media Blank Sample	<2	0.41	104	70	5	0.005	0.37	0.016
System Blank Sample	<2	0.78	105	25	5	0.005	<0.046	0.030
System Blank Sample	<2	0.31	None	0.45	5	0.005	0.14	0.012
Windrow Composting; Day 1, Pile G5	128	1.3	104	25	20.8	0.021	94	0.22
Windrow Composting; Day 3, Pile G5	1,234	8.6	105	16	32.81	0.033	376	2.2
Windrow Composting; Day 6, Pile G3	2.33	1.6	104	25	20.8	0.021	149	0.26
Windrow Composting; Day 7, Pile G3, Top of windrow	27.4	20	104	11	47.27	0.047	21	7.3
Windrow Composting; Day 7, Pile G3, Middle height	9.60	8.2	105	14	37.5	0.038	4	2.4
Windrow Composting; Day 7, Pile G3, Bottom of windrow	<2	3.0	104	26	20	0.02	1	0.46
Windrow Composting; Day 15, Pile G24	2.08	0.62	104	2.4	216.7	0.217	7	1.0
Windrow Composting; Day 30, Pile G10	16.0	5.8	104	32	16.25	0.016	2	0.72
Windrow Composting; Day 50, Pile G4	<2	N/A	104	22	23.64	0.024	1	0.500
Windrow Composting Pile; Unspecified age, Top location	142	8.8	104	17	30.59	0.031	47	2.1
Windrow Composting Pile; Unspecified age, Side location	<2	0.95	105	6.3	83.33	0.083	4	0.61
Windrow Composting Pile; Unspecified age, Side location	307	5.4	104	24	21.67	0.022	110	0.92
In-vessel Waste Received Post Grinder; 1 Hour Aged	193	0.92	104	21	24.76	0.025	164	0.18
In-vessel Waste Received Post Grinder; Store Pile	10.7	0.61	104	20	26	0.026	7	0.12
Compost Vessel Port #1; Day 1, F43, #194	829	N/A	104	2.9	179.3	0.179	2,954	N/A
Compost Vessel Port #2; Day 1, F43, #194	535	2.5	105	3.7	141.9	0.142	1,421	2.7
Compost Vessel Port #1; Day 4, F44, #193	305	0.95	104	4.8	108.3	0.108	793	0.79
Compost Vessel Port #2; Day 4, F44, #193	1,572	2.4	105	1.4	375	0.375	3,336	7.0
Compost Vessel Port #1; Day 5, F41, #192	1,052	39	104	6.3	82.54	0.083	896	25
Compost Vessel Port #2; Day 5, F41, #192	1,475	4.3	105	0.96	546.9	0.547	9,603	18
Compost Vessel Port #1; Day 8, F39, #190	863	4.1	104	1.7	305.9	0.306	3,658	9.6
Compost Vessel Port #2; Day 8, F39, #190	597	4.3	105	2.0	262.5	0.263	2,549	8.8
Compost Vessel Port #3; Day 8, F39, #190	1,504	17	105	2.3	228.3	0.228	6,544	30
Compost Vessel Port #4; Day 8, F39, #190	749	1.7	104	3.9	133.3	0.133	3,259	1.7
Compost Vessel Throug Bag Test, Day 8, F39, #190	8.57	0.14	None	0.72	5	0.005	1	0.0056
Compost Vessel Port #1; Day 10, F37, #188	1,010	37	104	2.4	216.7	0.217	2,632	61
Compost Vessel Port #2; Day 10, F37, #188	614	19	105	1.9	276.3	0.276	1,595	40
Compost Vessel Port #2; Day 10, F37, #188	630	13	105	2.3	228.3	0.228	1,330	24
Compost Vessel Port #1, Day 22, F25, #174	206	18	104	2.7	192.6	0.193	1,012	26
Compost Vessel Port #2, Day 22, F25, #174	248	37	105	1.5	350	0.35	4,270	99
Compost Vessel Port #1; Day 30, F19, #168	25.0	11	105	2.1	250	0.25	139	21
Compost Vessel, Port #2, Day 30, F19, #168	127	2.6	104	3.0	173.3	0.173	674	3.4
Bag Off; Curing Day 0, F19	2.91	6.1	104	1.8	288.9	0.289	33	14
Curing Day 3; F19, #167	125	1.4	105	13	40.38	0.04	146	0.43
Curing Day 3, F19, #167, Post Mixing	404	3.4	104	2.6	200	0.2	3,533	5.2
Curing Day 3, F19, #167 Replicate	734	5.0	105	4.7	111.7	0.112	2,377	4.3
Curing Day 7, F17, #164	6.39	8.9	105	2.2	238.6	0.239	59	16
Curing Day 10, F15, #162	96.7	2.4	104	2.0	260	0.26	746	4.7
Curing Day 10; F15, #162, Post Mixing	193	1.6	104	6.6	78.79	0.079	413	0.97
Curing Day 13; F16, #162	35.9	1.4	105	42	12.5	0.013	26	0.14
Curing Day 19; F10, #157	66.1	1.0	105	3.7	141.9	0.142	186	1.1
Curing Day 19; F10, #157, Post Mixing	414	4.0	105	6.5	80.77	0.081	848	2.5
Curing Day 25; F4	66.5	1.7	105	14	37.5	0.038	105	0.51
Curing Day 31, F62, #145	11.2	3.4	105	25	21	0.021	33	0.54
Unscreened 9 Month Old Compost	70.6	0.45	105	52	10.1	0.01	0	0.035
Unscreened 9 Month Old Compost, Replicate	30.8	1.0	105	50	10.5	0.011	2	0.086
Screened 9 Month Old Compost	<2	11	104	42	12.38	0.012	9	1.1

TNMNEO Flux= (ppmvC methane)(16/25)(flowrate m3/min)/(0.13 m2) = mg/m2,min-1 TNMNEO as methane
NH3 Flux= (mg/m3)(flow rate m3/min)/(0.13 m2) = mg/m2,,min-1 as NH3

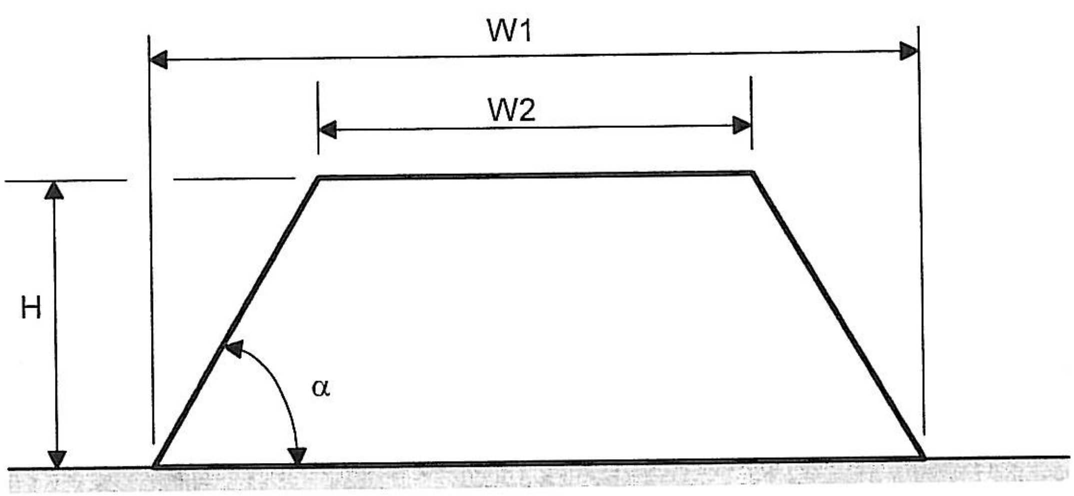
4.0 Emission Factor Development

4.1 Compost Pile Configuration

The in-vessel compost operation consisted of a large "Ag-Bag", approximately 200 feet long and 10 feet in diameter, filled with feedstock. Perforated pipes were inserted into the length of a bag during filling and connected to blowers with a prescribed cycle time. Material was composted in-vessel for 30 days. The bag was then removed and material was cured in a windrow with scheduled mixing using a windrow turner for an additional 30 days. Each vessel held approximately 220 tons of material. Because the in-vessel enclosure provides a complete emission barrier, emissions were calculated by measuring selected exhaust port emissions and multiplying those emissions by the number of ports per vessel.

The Windrow compost operation consisted of placing ground greenwaste feedstock in a windrow for 60 days. During the 60 day cycle, windrows were turned and mixed using a windrow turner on a prescribed schedule. Figure 4.1 shows the typical windrow cross-section for both in-vessel curing and windrow composting. The windrow dimensions were 180 feet long, 6 feet high (H), top width (W2) of 9 feet and bottom width (W1) of 16 feet. This calculates to an area of about 402.5 m^2 of surface area per windrow. Each windrow contained about 160 tons of material.

Figure 4.1. – Compost Windrow Cross Section.



4.2 Unit Emission Data

All raw data is included in the data validation technical memo. Table 4.1 and Table 4.2 present the measured unit emission data.

Table 4.1 Measured Unit Emission Data for Windrow Composting.

SOURCE	TNMNEO Flux	NH3 Flux	Ports	Area (m2)	VOC (mg/min)	NH3 (mg/min)
Windrow Composting; Day 1, Pile G5	94	0.22		403	37,992	87
Windrow Composting; Day 3, Pile G5	376	2.2		403	151,445	879
Windrow Composting; Day 6, Pile G3	149	0.26		403	59,963	106
Windrow Composting; Day 7, Pile G3, Top of windrow	21	7.3		403	8,456	2,933
Windrow Composting; Day 7, Pile G3, Middle height	4	2.4		403	1,581	970
Windrow Composting; Day 7, Pile G3, Bottom of windrow	1	0.46		403	316	184
Windrow Composting; Day 15, Pile G24	7	1.0		403	2,928	419
Windrow Composting; Day 30, Pile G10	2	0.72		403	945	289
Windrow Composting; Day 50, Pile G4	1	0.500		403	485	201
Windrow Composting Pile; Unspecified age, Top location	47	2.1		403	18,920	844
Windrow Composting Pile; Unspecified age, Side location	4	0.61		403	1,492	245
Windrow Composting Pile; Unspecified age, Side location	110	0.92		403	44,379	371

Table 4.2 Measured Unit Emission Data for In-vessel Composting.

SOURCE	TNMNEO Flux	NH3 Flux	Ports	Area (m2)	VOC (mg/min)	NH3 (mg/min)
In-vessel Waste Received Post Grinder; 1 Hour Aged	164	0.18		30	4,907	5
In-vessel Waste Received Post Grinder; Store Pile	7	0.12		200	1,339	24
Compost Vessel Port #1; Day 1, F43, #194	2,954	N/A	26		9,360	
Compost Vessel Port #2; Day 1, F43, #194	1,421	2.7	26		4,501	9
Compost Vessel Port #1; Day 4, F44, #193	793	0.79	26		2,512	3
Compost Vessel Port #2; Day 4, F44, #193	3,336	7.0	26		10,571	23
Compost Vessel Port #1; Day 5, F41, #192	896	25	26		2,839	84
Compost Vessel Port #2; Day 5, F41, #192	9,603	18	26		30,429	62
Compost Vessel Port #1; Day 8, F39, #190	3,658	9.6	26		11,590	32
Compost Vessel Port #2; Day 8, F39, #190	2,549	8.8	26		8,078	30
Compost Vessel Port #3; Day 8, F39, #190	6,544	30	26		20,736	102
Compost Vessel Port #4; Day 8, F39, #190	3,259	1.7	26		10,328	6
Compost Vessel Throug Bag Test, Day 8, F39, #190	1	0.0056	26		2	0
Compost Vessel Port #1; Day 10, F37, #188	2,632	61	28		8,983	222
Compost Vessel Port #2; Day 10, F37, #188	1,595	40	26		5,055	136
Compost Vessel Port #2; Day 10, F37, #188	1,330	24	26		4,215	80
Compost Vessel Port #1, Day 22, F25, #174	1,012	26	20		2,467	68
Compost Vessel Port #2, Day 22, F25, #174	4,270	99	26		13,530	334
Compost Vessel Port #1; Day 30, F19, #168	139	21	28		475	75
Compost Vessel, Port #2, Day 30, F19, #168	674	3.4	26		2,135	12
Bag Off; Curing Day 0, F19	33	14		403	13,286	5,483
Curing Day 3; F19, #167	146	0.43		403	58,733	174
Curing Day 3, F19, #167, Post Mixing	3,533	5.2		403	1,421,952	2,084
Curing Day 3, F19, #167 Replicate	2,377	4.3		403	956,750	1,725
Curing Day 7, F17, #164	59	16		403	23,727	6,612
Curing Day 10, F15, #162	746	4.7		403	300,362	1,894
Curing Day 10; F15, #162, Post Mixing	413	0.97		403	166,091	390
Curing Day 13; F16, #162	26	0.14		403	10,381	56
Curing Day 19; F10, #157	186	1.1		403	74,847	452
Curing Day 19; F10, #157, Post Mixing	848	2.5		403	341,393	1,003
Curing Day 25; F4	105	0.51		403	42,242	206
Curing Day 31, F62, #145	33	0.54		403	13,191	218
Unscreened 9 Month Old Compost	0	0.035		1000	469	35
Unscreened 9 Month Old Compost, Replicate	2	0.086		1000	1,933	86
Screened 9 Month Old Compost	9	1.1		1000	9,393	1,055

4.3 Full Compost Cycle Simulation

The unit emission data was extended to a full compost cycle using linear interpolation and averaging.

For the active in-vessel compost cycle, emissions were simulated by linearly interpolating data points collected from port sampling. The curing portion of the in-vessel cycle accounted for 'peaking' emissions generated on mixing days by linearly interpolating the pre- and post-mix data points for the three tests performed that included mixing. This peaking factor was applied on every third day for the simulated cycle because the windrow mixing procedure is to mix every third day.

For the windrow cycle, emissions were also simulated through linear interpolation from the data points collected during the 60 day cycle. The data point from compost day 6 was not used and the value was taken as a linear interpolation of day 3 and day 7. This is because the day 6 data point appeared to be an unreasonable outlier. Windrow emissions were also adjusted for the high-bias of measuring only the top surface. A correction factor was calculated based on the full top-sides data point on day 7 and applied to all top measurements. This factor reduces VOC measurements by 0.46 and ammonia measurements by 0.51.

Full cycle emissions are then the sum of the individual daily emission calculations. The emission factor consists of the full cycle emissions divided by the feedstock weight. In-vessel, windrow, and stockpile cycle simulation data tables are provided in the Appendix.

4.4 Simulated Emissions Profile

Figure 4.2 and 4.3 presents the full cycle emissions profile developed for in-vessel and windrow composting respectively for both VOC and ammonia. These emissions profiles were developed using a combination of data averaging and linear interpolation between the data points.

Figure 4.2 Emissions Profile (per bag) for Simulated Full Cycle In-vessel Composting.

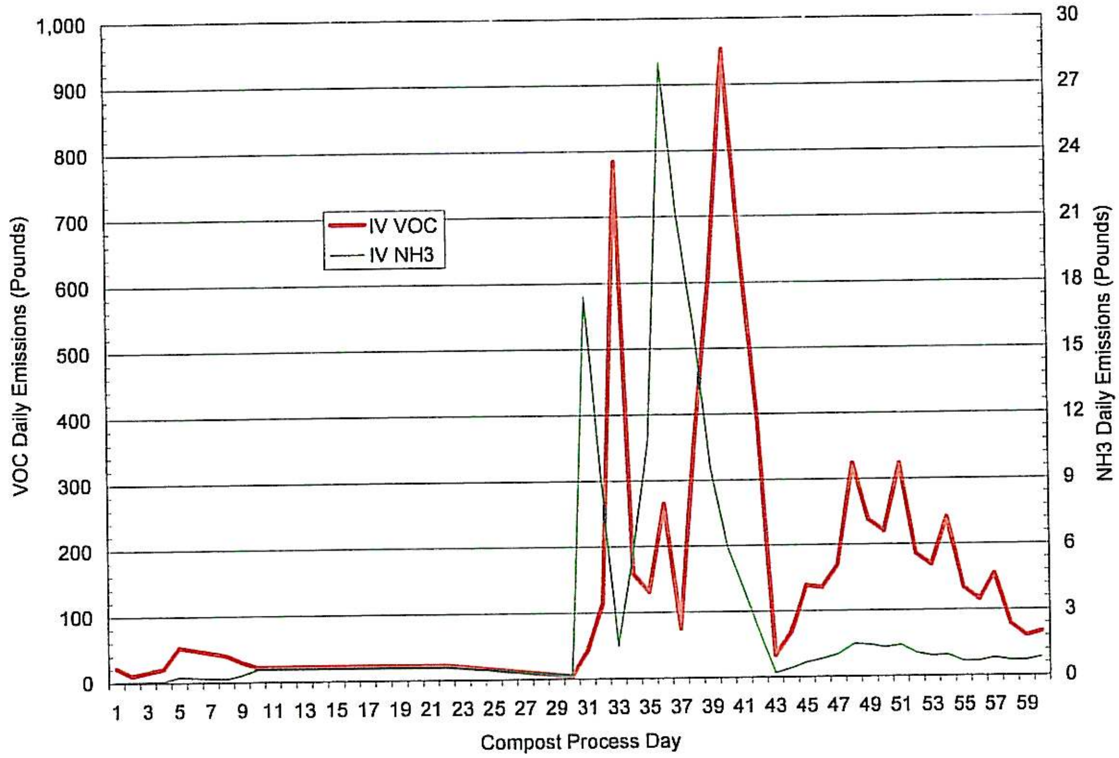
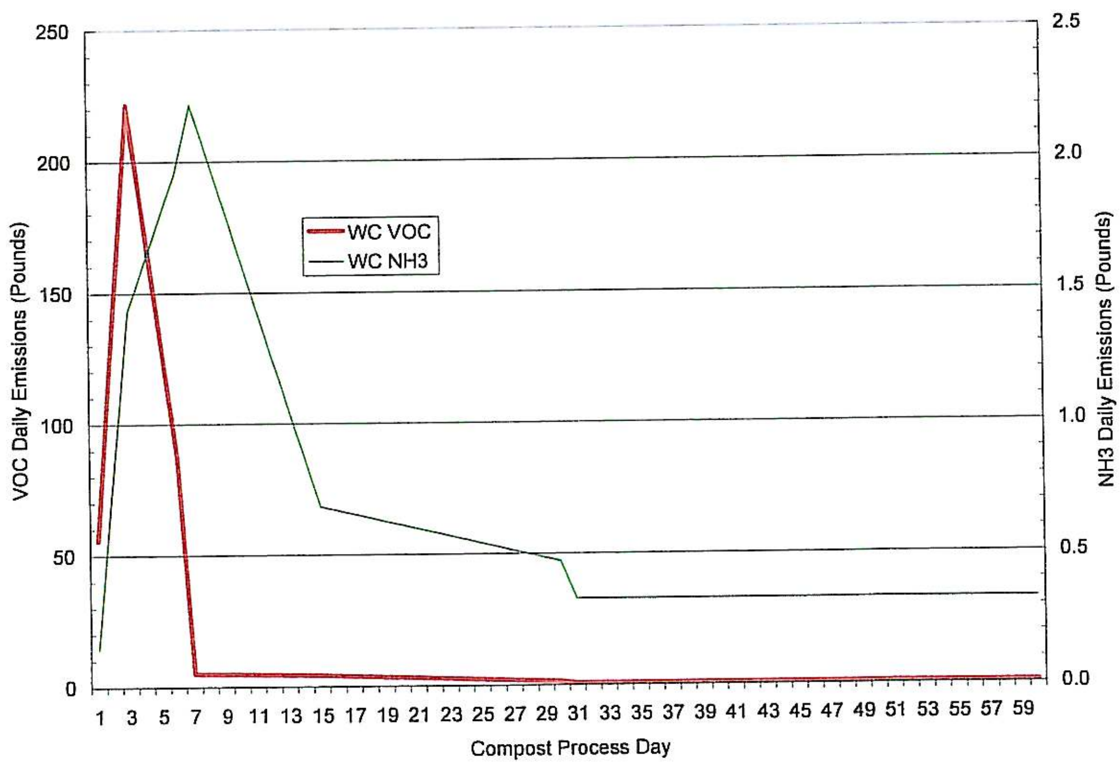


Figure 4.3 Emissions Profile (per windrow) for Simulated Full Cycle Windrow Composting.



Appendix A
Full Cycle Simulation Tables

Table A1 In-vessel Cycle Simulation (All data is per bag).

Measured Data

Component	VOC (mg/min)	NH3 (mg/min)	VOC (#/day)	NH3 (#/day)
Day 1	6,931	9	22.0	0.0
Day 4	6,541	13	20.8	0.0
Day 5	16,634	73	52.8	0.2
Day 8	12,683	43	40.3	0.1
Day 10	6,084	146	19.3	0.5
Day 22	7,998	201	25.4	0.6
Day 30	1,305	43	4.1	0.1
Bag Off	13,286	5,483	42.2	17.4
CD 3	58,733	174	186.5	0.6
CD 3M	1,189,351	1,904	3,776.1	6.0
CD 7	23,727	6,612	75.3	21.0
CD 10	300,362	1,894	953.6	6.0
CD 10M	166,091	390	527.3	1.2
CD 13	10,381	56	33.0	0.2
CD 19	74,847	452	237.6	1.4
CD 19M	341,393	1,003	1,083.9	3.2
CD 25	42,242	206	134.1	0.7
CD 31	13,191	218	41.9	0.7

Peaking Factor due to Cure Mixing

Mix Day	VOC	NH3
Day 3	4.21	2.66
Day 6	2.57	1.76
Day 9	0.93	0.87
Day 12	1.15	0.98
Day 15	1.37	1.09
Day 18	1.59	1.20
Day 21	1.59	1.20
Day 24	1.59	1.20
Day 27	1.59	1.20
Day 30	1.59	1.20

Feed Stock

Mix Weight 220 tons

	VOC	NH3
(mg/min)	3123	15
(#/day)	9.9	0.0
Days	2	2
(#)	19.83	0.09
(#/ton)	0.090	0.00043

PreMix Cure Calcs

Day	VOC	NH3
1	42.2	17.4
2	114.3	9.0
3	186.5	0.6
4	158.7	5.7
5	130.9	10.8
6	103.1	15.9
7	75.3	21.0
8	368.1	16.0
9	660.9	11.0
10	953.6	6.0
11	646.7	4.1
12	339.8	2.1
13	33.0	0.2
14	67.1	0.4
15	101.2	0.6
16	135.3	0.8
17	169.4	1.0
18	203.5	1.2
19	237.6	1.4
20	220.4	1.3
21	203.1	1.2
22	185.9	1.0
23	168.6	0.9
24	151.4	0.8
25	134.1	0.7
26	115.7	0.7
27	97.2	0.7
28	78.8	0.7
29	60.3	0.7
30	41.9	0.7

Simulation

Process Day		VOC (#)	NH3 (#)
Compost Day	1	22.0	0.03
Compost Day	2	10.4	0.02
Compost Day	3	15.6	0.03
Compost Day	4	20.8	0.04
Compost Day	5	52.8	0.23
Compost Day	6	48.6	0.20
Compost Day	7	44.4	0.17
Compost Day	8	40.3	0.13
Compost Day	9	29.8	0.30
Compost Day	10	22.4	0.55
Compost Day	11	22.4	0.55
Compost Day	12	22.4	0.55
Compost Day	13	22.4	0.55
Compost Day	14	22.4	0.55
Compost Day	15	22.4	0.55
Compost Day	16	22.4	0.55
Compost Day	17	22.4	0.55
Compost Day	18	22.4	0.55
Compost Day	19	22.4	0.55
Compost Day	20	22.4	0.55
Compost Day	21	22.4	0.55
Compost Day	22	22.4	0.55
Compost Day	23	20.1	0.50
Compost Day	24	17.8	0.45
Compost Day	25	15.5	0.40
Compost Day	26	13.2	0.34
Compost Day	27	11.0	0.29
Compost Day	28	8.7	0.24
Compost Day	29	6.4	0.19
Compost Day	30	4.1	0.14
Cure Day	1	42.2	17.4
Cure Day	2	114.3	9.0
Cure Day	3	784.8	1.5
Cure Day	4	158.7	5.7
Cure Day	5	130.9	10.8
Cure Day	6	264.7	28.0
Cure Day	7	75.3	21.0
Cure Day	8	368.1	16.0
Cure Day	9	611.4	9.5
Cure Day	10	953.6	6.0
Cure Day	11	646.7	4.1
Cure Day	12	390.1	2.1
Cure Day	13	33.0	0.2
Cure Day	14	67.1	0.4
Cure Day	15	138.7	0.7
Cure Day	16	135.3	0.8
Cure Day	17	169.4	1.0
Cure Day	18	324.3	1.5
Cure Day	19	237.6	1.4
Cure Day	20	220.4	1.3
Cure Day	21	323.7	1.4
Cure Day	22	185.9	1.0
Cure Day	23	168.6	0.9
Cure Day	24	241.2	0.9
Cure Day	25	134.1	0.7
Cure Day	26	115.7	0.7
Cure Day	27	154.9	0.8
Cure Day	28	78.8	0.7
Cure Day	29	60.3	0.7
Cure Day	30	66.7	0.8

	VOC	NH3
Compost Total	672.2	10.9
Cure Total	7,396.4	146.9
Sum	8,068.6	157.7
Mix Weight (ton)	220.0	220
Compost (#/ton)	3.1	0.0
Cure (#/ton)	33.6	0.7
Total (#/ton)	36.7	0.7

Table A2 Windrow Cycle Simulation (All data is per windrow).

Measured Data

Component	VOC (mg/min)	NH3 (mg/min)	Adjustment Factor VOC	Adjustment Factor NH3	VOC (#/day)	NH3 (#/day)
D1	37,992	87	0.46	0.51	55.6	0.1
D3	151,445	879	0.46	0.51	221.8	1.4
D6	59,963	1,200	0.46	0.51	87.8	2.0
D7	3,451	1,362	0.46	0.51	5.1	2.2
D15	2,928	419	0.46	0.51	4.3	0.7
D30	945	289	0.46	0.51	1.4	0.5
D50	485	201	0.46	0.51	0.7	0.3

Adjustment Factor for Top of Pile Measurement

Measurement Location	Unit Flux (mg/m-m2) VOC	Unit Flux (mg/m-m2) NH3	Width (ft)
Windrow Composting; Day 7, Pile G3, Top of windrow	21.0	7.3	9.00
Windrow Composting; Day 7, Pile G3, Middle height	3.9	2.4	6.95
Windrow Composting; Day 7, Pile G3, Bottom of windrow	0.8	0.5	6.95
			22.89
Adjustment Factor	0.46	0.51	

Feedstock

	VOC (mg/min)	NH3 (mg/min)	(days)	VOC (#/day)	NH3 (#/day)
	21,597	487	7	480	11
Tons				162.5	162.5
#/ton				2.95	0.07

VOC COMPST - 896.9#/30DAY
→ 29.9 #/DAY

VOC CURING - 21 #/30DAY
→ 0.7# /DAY

Simulation

Process Day		VOC (#)	NH3 (#)
Compost Day	1	56	0.14
Compost Day	2	139	0.79
Compost Day	3	222	1.43
Compost Day	4	177	1.60
Compost Day	5	132	1.78
Compost Day	6	88	1.95
Compost Day	7	5.1	2.22
Compost Day	8	5.0	2.02
Compost Day	9	4.9	1.83
Compost Day	10	4.8	1.64
Compost Day	11	4.7	1.45
Compost Day	12	4.6	1.26
Compost Day	13	4.5	1.07
Compost Day	14	4.4	0.87
Compost Day	15	4.3	0.68
Compost Day	16	4.1	0.67
Compost Day	17	3.9	0.65
Compost Day	18	3.7	0.64
Compost Day	19	3.5	0.63
Compost Day	20	3.3	0.61
Compost Day	21	3.1	0.60
Compost Day	22	2.9	0.58
Compost Day	23	2.7	0.57
Compost Day	24	2.5	0.55
Compost Day	25	2.4	0.54
Compost Day	26	2.2	0.53
Compost Day	27	2.0	0.51
Compost Day	28	1.8	0.50
Compost Day	29	1.6	0.48
Compost Day	30	1.4	0.47
Compost Day	1	0.7	0.33
Compost Day	2	0.7	0.33
Compost Day	3	0.7	0.33
Compost Day	4	0.7	0.33
Compost Day	5	0.7	0.33
Compost Day	6	0.7	0.33
Compost Day	7	0.7	0.33
Compost Day	8	0.7	0.33
Compost Day	9	0.7	0.33
Compost Day	10	0.7	0.33
Compost Day	11	0.7	0.33
Compost Day	12	0.7	0.33
Compost Day	13	0.7	0.33
Compost Day	14	0.7	0.33
Compost Day	15	0.7	0.33
Compost Day	16	0.7	0.33
Compost Day	17	0.7	0.33
Compost Day	18	0.7	0.33
Compost Day	19	0.7	0.33
Compost Day	20	0.7	0.33
Compost Day	21	0.7	0.33
Compost Day	22	0.7	0.33
Compost Day	23	0.7	0.33
Compost Day	24	0.7	0.33
Compost Day	25	0.7	0.33
Compost Day	26	0.7	0.33
Compost Day	27	0.7	0.33
Compost Day	28	0.7	0.33
Compost Day	29	0.7	0.33
Compost Day	30	0.7	0.33
TOTAL EMS. (#) →		917.9	39.1
TOTAL TONNAGE (TON) →		163	163
TOTAL EMS. FACTOR [#/TON] →		5.6	0.2

Table A3. Finished In-vessel Stockpile Calculation.

Maximum Volume	140,000		yd3
Windrow size			
Length	500		ft
Width	28		ft
Height	15		ft
Area	9,898		ft2
	920		m2
Volume	105,000		ft3
	3,889		yd3
Number of Windrows	36		
Average Storage Time	270		days
	VOC	NH3	
Emission Factor	1.20	0.06	mg/m2/min
Total Emissions	15,463,271	776,031	gms
	34,093	1,711	pounds
Unit Emission	0.24	0.01	pounds per yd3
Weight of incoming product per yd3 finished product	1620		# finished per incoming yd3
	0.81		ton finished per incoming yd3
Emissions	**0.30**	**0.02**	**#/ton**
	0.24	**0.012**	**#/yd3**

VOC EMS. FACTOR:

$$\left[\frac{\#}{Yd^3}\right] = \left[\frac{0.24\ \#}{140{,}000\ Yd^3}\right]$$

$$= 0.24\ \frac{\#}{Yd^3}$$

Appendix B
Photographs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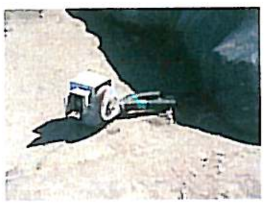
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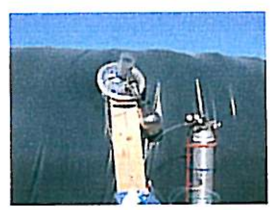
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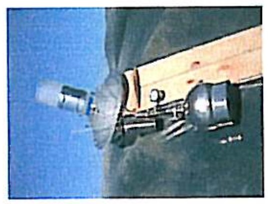
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Appendix C
Data Validation Technical Memorandum

CE Schmidt, Ph.D.
Environmental Consultant

TECHNICAL MEMORANDUM

FLUX CHAMBER SOURCE TESTING OF FUGITIVE AIR EMISSIONS FROM THE JEPSON PRAIRIE ORGANICS IN-VESSEL AND WINDROW COMPOSTING SYSTEMS

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EXECUTIVE SUMMARY

Field measurements were conducted at the Jepson Prairie Organics Composting facility (JPO) located in Vacaville, California for the purpose of developing an emissions profile for total volatile organic compounds (VOCs) and ammonia. The testing was conducted during a three-day field trip on August 23, 24, and 25, 2005. JPO creates compost product from food waste using in-vessel composting technology and green waste from windrow compost technology. Both processes take approximately 60 days to produce a finished product for sale. The analysis focused on the complete cycle of organic material handling on site: feedstock receipt, in-vessel food waste composting and the windrow green waste composting , material curing and product storage. The goal of the project was to collect direct-measure, flux rate data using a time-dependent data collection approach to develop an 'emissions profile' of target species so that the integration of the profile represents the complete air emissions from the process on a per ton material through-put basis. The baseline emissions estimates will be reported in a supplement to this memorandum.

The data collection approach included using the United States Environmental Protection Agency (USEPA)-recommended flux chamber and standard air sample collection methods for VOCs and ammonia. The testing was targeted to create a fugitive emission profile from each individual stage (i.e. feedstock receipt, active composting, curing, etc.). The in-vessel composting cycle was evaluated by collecting fugitive emission samples from stockpiled feedstock; exhaust ports on a total of seven vessels including: Day 1, Day 4, Day 5, Day 8, Day 10, Day 22, and Day 30; curing product, including: Day 0 (bag removal), Day 1, Day 3, Day 7, Day 10, Day 13, Day 19, Day 25, Day 31; and nine month old product. A total of two flux chamber measurements were made on feedstock (fresh chopped and stored),17 flux chamber measurements were made on in-vessel exhaust ports, 11 flux measurements were made on post-vessel organic material in the curing cycle, and 2 flux measurements were made on aged product.

The greenwaste windrow composting system was evaluated by collecting fugitive emission samples from seven days representing the composting cycle, including: Day 1, Day 3, Day 6, Day 7, Day 15, Day 30, and Day 50. In addition, a large stock pile of uncomposted ground greenwaste was also tested. A total of 12 flux chamber measurements were made on the greenwaste windrow composting system.

The assessment of the test surfaces included screening using real time detection in the field (real time instrument for VOCs and ammonia), and sample collection for off site analysis at the selected test location per operational stage. Testing was conducted using the USEPA surface emission isolation flux chamber and SCAQMD Method 25.3 for total VOCs (Total Non-Methane and Non-Ethane Organic Compound Analysis), and SCAQMD Method 207.1 for ammonia. Note that the in-vessel compost phase cycles between positive airflow and atmospheric equilibrium with the use of blower fans. Advective flow from all flux chamber measurements was assessed by using a tracer gas (sulfur hexafluoride) in the flux chamber, gas collection in evacuated stainless steel canisters, and laboratory gas chromatography/electron capture detection (GC/ECD) analysis. The dilution of sulfur hexafluoride was used to calculate advective flow, and these data were used in the calculation of compound emissions from the test sources.

Note that the SCAQMD recommended Method 25.3 bias factor correction of 1.086 was not applied to these data. There is no scientific justification for applying a specific bias correction factor generated from one laboratory to another laboratory, since a given analytical method bias is unique to that laboratory and not intrinsic to the method. Not applying the method bias is a conservative approach as the bias generally increases the calculated emission rate from flux chamber. There are no other recommended correction factors that are applicable.

The data tables generated and reported in this document describe the air emissions from the sources in the in-vessel composting system and the windrow composting system. These flux data, combined with engineering data that describes the composting operations, are the basis for the facility emission factor database and a facility baseline emission estimate for total VOCs and ammonia in a supplement emissions report to this memorandum.

CE Schmidt, Ph.D.
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I. INTRODUCTION

This technical memorandum describes the field testing that was conducted in order to assess ammonia and VOC air emissions from the Jepson Prairie Organics Compost Facility (JPO) in Vacaville, CA. Methodology was reviewed with representatives of the Yolo-Solano Air Quality Management District (YSAQMD) prior to testing. Testing was conducted by Dr. C.E. Schmidt , Mr. Tom Card, and Mr. Harold Litwiler on August, 23, 24, and 25, 2005 with representatives of JPO and the YSAQMD present.

The objective of the study was to determine fugitive air emissions of study compounds for the purpose of generating a baseline facility emission estimate .

This memorandum includes a discussion of the testing methodology, quality control procedures, results, discussion of the results, and summary statements.

II. TEST METHODOLOGY

Testing for surface flux was conducted using the USEPA recommended Surface Isolation Flux Chamber (USEPA. Radian Corporation, February 1986). Flux chamber sampling was performed on feedstock, in-vessel material, post-vessel curing material, active windrows, and various stages of compost product on site .

The operation of the surface flux chamber is given below:

1. Flux chamber, sweep air, sample collection equipment, and field documents were located on-site.

2. The site information, location information, equipment information, date, and proposed time of testing were documented on the Emissions Measurement Field Data Sheet.The exact test locations were selected based on our "Protocol for Flux Chamber Source Testing of Fugitive Air Emissions from the Jepson Prairie Organics In-Vessel and Windrow Composting Systems Baseline Emissions Estimation" proposal dated July 2005.

3. The flux chamber was placed about 0.25" to 0.5" on the material , thus sealing the chamber for surface testing, or on the Ag-Bag positioned to achieve a chamber/interface seal.

4. The sweep air flow rate (ultra high purity [UHP] air with a sulfur hexafluoride tracer gas additive) was initiated and the rotometer, which stabilizes the flow rate, was set at 5.0 liters per minute. A constant sweep air flow rate was maintained throughout the measurement for each sampling location.

5. Flux chamber data were recorded every residence interval (6 minutes) for five intervals, or 30 minutes.
6. At steady-state (assumed to be greater than 5 residence intervals), the screening by colorimetric tube and real-time instrument was performed. After screening, sample collection was performed by interfacing the sample container (acid impinger, trap and canister, and tedlar bag) to the purged, sample line and filling the container with sample gas or collecting the desired sample following sample collection protocols as per the work plan.

7. After the sample was collected (impinger solution, trap and evacuated canister, and tedlar bag) all sample media was sealed, labeled, and stored as per protocol, and sample collection information was documented on the data sheet.

8. After sampling, the flux measurement was discontinued by shutting off the sweep air, removing the chamber, and securing the equipment. The chamber was cleaned by dry wipe with a clean paper towel and the sample lines were purged with UHP air.

9. Sampling locations were recorded on the field data sheet. The equipment was then relocated to the next test location and steps 1) through 9) were repeated.

III. QUALITY CONTROL

Quality control (QC) procedures that were used to assure that data of sufficient quality resulted from the flux chamber study are listed and described below. The application and frequency of these procedures were developed to meet the program data quality objectives as described in the project source test protocol (Card, T. and Schmidt, C.E., June, 2005).

Field Documentation -- A field notebook containing data forms, including sample chain-of-custody (COC) forms, was maintained for the testing program. Attachment A contains the Emission Measurement Data Sheets.

Chain-of-Custody -- Field data were recorded in the field on the Chain-of-Custody forms and these forms are provided in Attachment B.

Real Time TVA-1000 Field QC
TVA-1000 field QC consisted of pre and mid-use instrument blank and single span QC checks. (ppmv span gases used.) Although calibration was not needed since the field data were used only for screening purposes, the calibration of the hydrocarbon compound analyzer was performed and the QC data indicated that the instrument was performing within the instrument specifications.

Ammonia Analysis by SCAQMD Method 207.1
Laboratory Duplicate Analysis- Two laboratory duplicate analyses were performed, and the percent relative standard deviation (RSD) for the duplicate pairs was 0.54 and 1.5. These data indicate acceptable method performance.

Calibration – A five point calibration curve was performed for the ammonia method, and the correlation curve was reported as 0.9992. These data indicate acceptable method performance.

Trip Blank—Three trip blank samples were conducted and the levels reported were 0.02, 0.02, and 0.05 mg per sample (MDL 0.01 mg). These data indicate low levels of ammonia detection but do not indicate the need to subtract the ammonia blank response. These data indicate acceptable method performance.

Field Replicate Sample Analysis -- Three field samples were collected and analyzed for the project. The RPD values were 3.2, 4.4, and 6.7 (QC criteria 50 RPD). These data indicate acceptable method repeatability and method performance.

Total Non-Methane and Non-Ethane Organic Compound Analysis by SCAQMD Method 25.3
Method Quality Control –Method quality control included duplicate analysis of all samples, method

blank determinations, and method response to four-point calibration curves. All method QC testing was within method specifications, and these data indicate acceptable method performance.

Laboratory Duplicate Sample Analysis- All samples were analyzed in duplicate, and the data showed acceptable method precision with all carbon monoxide, methane, carbon dioxide, oxygen, ethane, and NMNEO from the tank at less than 30% difference from the mean. The exception to this are five replicate analyses for methane (tank analysis) which ranged from 38% to 97% (38%, 40%, 43%, 67% and 97%). Five of 52 replicate analysis exceeding criteria for one of six criteria for Method SCAQMD 25.3 is common and within expected method performance (note- it is not expected that all criteria will be met for all species, but it is expected that most will). Likewise, the coefficient of variation (COV) for replicate trap analyses were less than the criteria at 8.3 COV or less. The data indicated acceptable method performance.

Field System Blank – One media (field) blank sample and two system blank samples were analyzed as blind QC samples. Methane was non-detect at the method detection limit (MDL) of 2 ppmvC and NMNEO was not detected in the tanks at the MDL of 2 ppmvC. However levels above MDL were detected in one or more of the blank trap samples. NMNEO compounds were detected in the trap at <1, 5.0 and 13 ppmvC, and total NMNEO levels in the blank samples ranged from <2, to 5.9, to 15 ppmvC. These data establish sensitivity for the method (project QC criteria), and indicate some probable hydrocarbon carryover from sample to sample, which is acceptable considering the high levels of hydrocarbon compounds found in the trap samples, and the semi-volatile nature of the dominant compounds known to exist in the air emissions from the organic waste composting materials. These data indicate acceptable method performance and do not require data adjustment or baseline subtraction, although high blank levels can be subtracted from the field samples if desired.

Field Replicate Sample – All field samples were collected and analyzed in replicate. Summarized field data for key compounds are presented below. Typical precision for field replicate samples is less than 50 RPD.

Sample ID	*Methane*	*Tank NMNEO*	*Trap NMNEO*	*TNMNEO*
L/G-313	6.56	404	3185	3588
L/G-314	5.32	734	3577	4311
RPD	***21***	***58***	***12***	***17***

Sample ID	*Methane*	*Tank NMNEO*	*Trap NMNEO*	*TNMNEO*
L/G-214	24.0	71	873	
L/G-215	23.8	<2	483	4311

RPD	*1.7*	*NA*	*58*	*17*

In this data set, study compounds detected showed precision within precision criteria for field samples (RPD 50) for most of the replicate species pairs (two of the eight sample results were outside the limits with one non-replicate). Field precision of 50 RPD is difficult to achieve with complex sample collection and analysis techniques, and these data represent typical precision for SCAQMD 25.3 as applied to area sources, in particular area sources that have emissions that are time and process related. These data indicate acceptable method precision and performance.

Tracer Sulfur Hexafluoride Analysis by GC/ECD

Laboratory Blank Samples- One method blank sample was performed, and sulfur hexafluoride was not detected above the method detection limit (MDL) at 0.60 ppbv. These data indicate acceptable method performance.

Laboratory Control Spike and QC Duplicate Analysis- The recovery of the laboratory control spike was 72% (criteria 70% to 130%), and the duplicate recovery analysis showed a relative percent difference (PRD) of the duplicate sample of 8.0 (criteria ±30 RPD). These data indicate acceptable method performance.

Laboratory Precision– The analysis of the control spike (72%)and duplicate analysis of the control spike (80%) showed acceptable method precision with an RPD of 11.

Tracer Recovery Sample- One media blank sample was performed in the field by filling a canister for analysis in order to determine tracer recovery apart from the flux measurement technology or the advective flow from sources. The tracer was recovered from the media blank sample at 70%, which at the limit of the QC recovery for the method at 70%-to-130% and better than the total system QC recovery criteria (±50%). This QC test was repeated for confirmation by running an additional two tests directly from the tracer gas compressed cylinder and from clean canisters as media blanks. These results showed an 86% recovery of tracer and a 90% recovery of tracer. Given that all three media blank sample sets were within criteria the overall criteria, and the two follow-on QC samples were within the media recovery criteria, the recovery of tracer from the canister samples was considered acceptable, and no correction for tracer recovery was recommended. These data indicate acceptable method performance.

System (Flux Chamber) Recovery Sample- One field blank sample was collected in the field with the tracer sweep air, and a recovery of tracer was reported at 25% (G-101). The criteria for the full system is ±50%. As such, this test was repeated in the laboratory and the repeat recovery was 82%, which was well within the system QC criteria. It is unknown why the first field flux chamber recovery showed less than acceptable system recovery. But given that the laboratory QC and all other field QC data show acceptable method performance, it is likely that the low recovery is related to a sample collection error that happened during the first flux system recovery sample. There is no indication in the field notes as a possible source for this error as recorded by the field technician. Given that the method QC is acceptable, and the repeat system recovery data are acceptable, no qualification of field data is recommended.

Field Replicate Sample – Two field samples were collected in replicate. The precision (relative percent difference) for the field replicate sample pairs was 19 and 31, which is less than the QC criteria of 50 RPD. These data indicate acceptable method performance.

IV. <u>RESULTS AND DISCUSSIONS</u>

All field data for the on site surface flux chamber testing (screening) for ammonia, temperature, FID compound response, PID compound response, and sample identification information are presented in Table 1 (species reported in concentration units ppmv). All laboratory data including quality control data are presented in Table 2. These flux data include measured advective flow rate in the flux calculation. Surface flux data are shown in flux units for hydrocarbon emissions (mg/m2,min-1 as methane, ppmvC) and for ammonia (mg/m2,min-1 as ammonia).

Surface flux data for a surface area source are calculated using measured target compound concentrations and flux chamber operating parameter data (sweep air flow rate of 5.0 liters per minute [or 0.005 m3/min] plus advective flow [m3/min], surface area of 0.13 square meters [m^2]). The site emissions can be calculated by multiplying the flux by the surface area of the source. The flux is calculated from the sweep air flow rate Q (cubic meters per minute [m^3/min]), the species concentration Yi (micrograms per cubic meter [mg/m^3)], and exposure to the chamber surface area A (square meters [m^2]), as follows:

$$Fi = (Q)\,(Yi) \,/\, (A)$$

Emission rates from each source can be calculated by multiplying unit or average flux data per compound by surface area and reported as a function of area source.

Note that the recommended SCAQMD method bias factor correction of 1.086 was not applied to these data. There is no scientific justification for applying a specific bias correction factor generated from one laboratory to another laboratory, since a given analytical method bias is unique to that laboratory and not intrinsic to the method.

V. SUMMARY

Emissions testing was performed on the Jepson Prairie Organics in-vessel and windrow composting systems in order to generate a facility baseline emissions estimate for VOCs and ammonia. Testing was conducted for the purpose of obtaining representative air emissions of ammonia and VOCs from each compost stage. The following is a summary of activities and results associated with this objective:

- Surface flux measurements of study compounds were measured at multiple test locations on the food waste composting system and the green waste windrow composting system using the USEPA recommended surface flux chamber technology, including: 2 representative test locations on compost feedstock (fresh copped and stored), 17 representative test locations on ports for the in-vessel composting system, 11 locations on the in-vessel curing cycle, 2 locations on the aged, product (storage), and 12 locations on ground windrow feedstock. This technology quantitatively measures flux at the test surface of study compounds.

- Field quality control data indicate acceptable data quality for the field analyzers. Field and laboratory quality control data indicate acceptable data quality for SCAQMD Method 207.1 (ammonia) and SCAQMD Method 25.3 (organic gases). System blank levels for Method 25.3 showed some blank level contamination or baseline drift, but give the low level of blank levels, field data correction was not recommended or conducted.

- The results of the quantitative analysis using the dilution of the tracer gas indicated advective flows from up to 375 liters per minute (lpm).

- Note that the recommended SCAQMD method bias factor correction of 1.086 was not applied to these data. There is no scientific justification for applying a specific bias correction factor generated from one laboratory to another laboratory, since a given analytical method bias is unique to that laboratory and not intrinsic to the method.

- The flux data can be used to calculate ammonia and VOC emissions from the test pile surfaces. Emission rate data is obtained by multiplying surface areas of the test piles by the surface area of the test piles. The emission rate estimates are provided in a supplement emissions report to this memorandum.

REFERENCES

USEPA. 1986. "Measurement of Gaseous Emission Rates From Land Surfaces Using an Emission Isolation Flux Chamber, Users Guide." EPA Environmental Monitoring Systems Laboratory, Las Vegas, Nevada, EPA Contract No. 68-02-3889, Work Assignment No. 18, Radian Corporation, February 1986. NTIS # PB 86-223161.

Card, Tom, CE Schmidt, *Protocol for Flux Chamber Source Testing of Fugitive Air Emissions from a Proprietary Composting System*, June 2005.

Table 1. Summary of Field Sample Collection Information.

DATE	TIME	SOURCE	PID (pmv)	FID (pmv)	NH3 (ppmv)
8/23/2005	719	Media Blank Sample	NA	NA	NA
8/24/2005	719	System Blank Sample	NA	NA	NA
8/25/2005	740	System Blank Sample	NA	NA	NA
8/23/2005	1555	Greenwaste; Day 1, Pile G5	240	1100	0.2
8/25/2005	800	Greenwaste; Day 3, Pile G5	NA	NA	3
8/23/2005	1216	Greenwaste; Day 6, Pile G3	NA	NA	10
8/24/2005	748	Greenwaste; Day 7, Pile G3, Top of windrow	NA	NA	100
8/24/2005	918	Greenwaste; Day 7, Pile G3, Middle height	NA	NA	20
8/24/2005	925	Greenwaste; Day 7, Pile G3, Bottom of windrow	NA	NA	8
8/23/2005	1418	Greenwaste; Day 15, Pile G24	1.1%	11	4
8/23/2005	1417	Greenwaste; Day 30, Pile G10	9500	120	10
8/23/2005	1217	Greenwaste; Day 50, Pile G4	NA	NA	27
8/25/2005	1150	Greenwaste Pile; Unspecified age, Top location	NA	NA	
8/24/2005	1140	Greenwaste Pile; Unspecified age, Side location	NA	NA	2
8/23/2005	1636	Greenwaste Pile; Unspecified age, Side location	NA	NA	1
8/23/2005	755	Food Waste Received Post Griinder; 1 Hour Aged	NA	NA	<0.05
8/23/2005	943	Food Waste Received Post Grinder; Store Pile	NA	NA	0.2
8/23/2005	836	Compost Vessel Port #1; Day 1, F43, #194	NA	NA	NA
8/23/2005	912	Compost Vessel Port #2; Day 1, F43, #194	NA	NA	NA
8/23/2005	1118	Compost Vessel Port #1; Day 4, F44, #193	NA	NA	NA
8/23/2005	1125	Compost Vessel Port #2; Day 4, F44, #193	NA	NA	NA
8/23/2005	1318	Compost Vessel Port #1; Day 5, F41, #192	>1.5%	1,100	46
8/23/2005	1324	Compost Vessel Port #2; Day 5, F41, #192	>1.5%	1,600	<0.5
8/24/2005	811	Compost Vessel Port #1; Day 8, F39, #190	970	600	<0.5
8/24/2005	818	Compost Vessel Port #2; Day 8, F39, #190	950	700	<0.5
8/24/2005	1007	Compost Vessel Port #3; Day 8, F39, #190	250	2500	<0.5
8/24/2005	1015	Compost Vessel Port #4; Day 8, F39, #190	370	3,500	<0.5
8/24/2005	1025	Compost Vessel Throug Bag Test, Day 8, F39, #190	3	24	<0.5
8/23/2005	1548	Compost Vessel Port #1; Day 10, F37, #188	NA	NA	30
8/23/2005	1610	Compost Vessel Port #2; Day 10, F37, #188	NA	NA	14
8/23/2005	1610	Compost Vessel Port #2; Day 10, F37, #188	NA	NA	14
8/24/2005	1302	Compost Vessel Port #1, Day 22, F25, #174	>1.5%	630	22
8/25/2005	1305	Compost Vessel Port #2, Day 22, F25, #174	8,000	1,000	46
8/24/2005	1533	Compost Vessel Port #1; Day 30, F19, #168	32	130	8
8/24/2005	1546	Compost Vessel, Port #2, Day 30, F19, #168	100	620	<0.5
8/25/2005	808	Bag Off; Curing Day 0, F19	NA	NA	6
8/25/2005	1002	Curing Day 3; F19, #167	NA	NA	NA
8/25/2005	1413	Curing Day 3, F19, #167, Post Mixing	NA	NA	<0.5
8/25/2005	1413	Curing Day 3, F19, #167 Replicate	NA	NA	<0.5
8/25/2005	829	Curing Day 7, F17, #164	NA	NA	8
8/25/2005	1012	Curing Day 10, F15, #162	NA	NA	0.5
8/25/2005	1054	Curing Day 10; F15, #162, Post Mixing	NA	NA	<0.5
8/25/2005	1200	Curing Day 13; F16, #162	NA	NA	<0.5
8/25/2005	1007	Curing Day 19; F10, #157	NA	NA	<0.5
8/25/2005	1152	Curing Day 19; F10, #157, Post Mixing	NA	NA	<0.5
8/25/2005	1013	Curing Day 25; F4	NA	NA	<0.5
8/25/2005	1300	Curing Day 31, F62, #145	NA	NA	0.3

Table 1. Summary of Field Sample Collection Information.

8/24/2005	1405	Unscreened 9 Month Old Compost	NA	NA	0.4
8/24/2005	1405	Unscreened 9 Month Old Compost, Replicate	NA	NA	0.4
8/24/2005	1420	Screened 9 Month Old Compost	NA	NA	20

Table 1. Summary of Field Sample Collection Information.

25.3 ID	NH3 ID	SF6	SF6 (ppbv)	SURF T Deg F	Blower Side	COMMENT
G/L-101	A-101	G-101	104	NA		
G/L-201	A-201	G-201	105	NA		
G/L-301	A-301	G-301	None	NA		
G/L-116	A-116	G-116	104	123		
G/L-302	A-302	G-302	105	149		
G/L110	A-110	G-110	104	124		
G/L-202	A-202	G-202	104	148		
G/L-205	A-205	G-205	105	102		
G/L-206	A-206	G-206	104	111		
G/L-115	A-115	G-115	104	123		
G/L-114	A-114	G-114	104	135		
G/L-111	A-111	G-111	104	134		
G/L-211	A-211	G-211	104	145		
G/L-210	A-210	G-210	105	107		
G/L-120	A-120	G-120	104	136		
G/L-103	A-102	G-102	104	75	NA	
G/L-107	A-105	G-105	104	141	NA	Up to 30 days old storeage pile
G/L-104	A-104	G-104	104	89	No	26 Ports
G/L-106	A-103	G-106	105	99	Yes	
G/L-108	A108	G-108	104	134	Yes	26 Ports
G/L-109	A-109	G-109	105	112	No	
G/L-113	A-113	G-113	104	125	No	28 Ports
G/L-112	A-112	G-112	105	136	Yes	
G/L-204	A-204	G-204	104	NA	No	28 Ports; with filter PID 23 ppmv, FID 27 ppmv
G/L-203	A-203	G-203	105	NA	Yes	
G/L-207	A-207	G-207	105	122	Yes	Mid Bag Port
G/L-209	A-209	G-209	104	112	Yes	End of Bag Port
G/L-208	A-208	G-208	None	94	Yes	Chamber on continuous Ag bag surface
G/L-117	A-117	G-117	104	106	Yes	28 Ports
G/L-118	A-118	G-118	105	117	Yes	
G/L-119	A-119	G-119	105	117	Yes	Sample Replicate
G/L-213	A-213	G-213	104	133	No	20 Ports
G/L-212	A-212	G-212	105	130	Yes	
G/L-217	A-217	G-217	105	108	No	28 Ports
G/L-218	A-218	G-218	104	107	Yes	With filter PID 3 ppmv, FID 230 ppmv
G/L-304	A-304	G-304	104	77	NA	O-101; Odor sample; bag off at 0807
G/L-305	A-305	G-305	105	103	NA	
G/L-313	A-313	G-313	104	122	NA	O-104; Odor Sample
G/L-314	A-314	G-314	105	122	NA	Replicate Sample
G/L-303	A-303	G-303	105	112	NA	
G/L-308	A-308	G-308	104	92	NA	
G/L-311	A-311	G-311	104	114	NA	O-103 Odor sample
G/L-310	A-310	G-310	105	122	NA	
G/L-307	A-307	G-307	105	120	NA	
G/L-309	A-309	G-309	105	132	NA	O-102 Odor sample
G/L-306	A-306	G-306	105	125	NA	
G/L-312	A-312	G-312	105	120	NA	

Table 1. Summary of Field Sample Collection Information.

G/L-214	A-214	G-214	105	120	NA	
G/L-215	A-215	G-215	105	120	NA	
G/L-216	A-216	G-216	104	114	NA	

Tab Summary of All Testing Flow Rate, Concentration Data, and Cal ɘd Flux (mg or (D/T)/m2,min-1).

SOURCE	PID	FID	NH3	25.3 ID	Methane	Ethane	TNMNEO	NMNEO Trap
	(pmv)	(pmv)	(ppmv)		(ppmvC)	(ppmvC)	(ppmvC)	(ppmvC)
Media Blank Sample	NA	NA	NA	G/L-101	<2	ND	15.2	12.9
System Blank Sample	NA	NA	NA	G/L-201	<2	ND	<2	<1
System Blank Sample	NA	NA	NA	G/L-301	<2	ND	5.88	4.99
Greenwaste; Day 1, Pile G5	240	1100	0.2	G/L-116	2.15	ND	913	785
Greenwaste; Day 3, Pile G5	NA	NA	3	G/L-302	18.2	ND	2,316	1,082
Greenwaste; Day 6, Pile G3	NA	NA	10	G/L-110	64.0	2.33	1441	1441
Greenwaste; Day 7, Pile G3, Top of windrow	NA	NA	100	G/L-202	618	ND	90.8	63.4
Greenwaste; Day 7, Pile G3, Middle height	NA	NA	20	G/L-205	6.14	ND	21.0	11.4
Greenwaste; Day 7, Pile G3, Bottom of windrow	NA	NA	8	G/L-206	18.9	ND	7.98	7.11
Greenwaste; Day 15, Pile G24	1.1%	11	4	G/L-115	9.48	ND	6.81	4.73
Greenwaste; Day 30, Pile G10	9500	120	10	G/L-114	91.6	ND	29.8	13.8
Greenwaste; Day 50, Pile G4	NA	NA	27	G/L-111	18.7	ND	10.2	9.28
Greenwaste Pile; Unspecified age, Top location	NA	NA		G/L-211	5009	ND	308	166
Greenwaste Pile; Unspecified age, Side location	NA	NA	2	G/L-210	2.03	ND	9.07	7.65
Greenwaste Pile; Unspecified age, Side location	NA	NA	1	G/L-120	39.9	ND	1,018	711
Food Waste Received Post Grinder; 1 Hour Aged	NA	NA	<0.05	G/L-103	7.9	ND	1,329	1,137
Food Waste Received Post Grinder; Store Pile	NA	NA	0.2	G/L-107	4.09	ND	52.3	41.6
Compost Vessel Port #1; Day 1, F43, #194	NA	NA	NA	G/L-104	6.58	ND	3,352	2,524
Compost Vessel Port #2; Day 1, F43, #194	NA	NA	NA	G/L-106	6.75	ND	2,032	1,497
Compost Vessel Port #1; Day 4, F44, #193	NA	NA	NA	G/L-108	9.73	ND	1,491	1,186
Compost Vessel Port #2; Day 4, F44, #193	NA	NA	NA	G/L-109	27.8	ND	1,807	234
Compost Vessel Port #1; Day 5, F41, #192	>1.5%	1,100	46	G/L-113	8.75	ND	2,193	1,141
Compost Vessel Port #2; Day 5, F41, #192	>1.5%	1,600	<0.5	G/L-112	13.2	ND	3,566	2,092
Compost Vessel Port #1; Day 8, F39, #190	970	600	<0.5	G/L-204	7.52	ND	2,428	1,566
Compost Vessel Port #2; Day 8, F39, #190	950	700	<0.5	G/L-203	7.83	ND	1,969	1,372
Compost Vessel Port #3; Day 8, F39, #190	250	2500	<0.5	G/L-207	8.08	ND	5,830	4,326
Compost Vessel Port #4; Day 8, F39, #190	370	3,500	<0.5	G/L-209	2.03	ND	4,978	4,230
Compost Vessel Throug Bag Test, Day 8, F39, #190	3	24	<0.5	G/L-208	4.21	ND	30.5	21.9
Compost Vessel Port #1; Day 10, F37, #188	NA	NA	30	G/L-117	3.2	ND	2,464	1,454
Compost Vessel Port #2; Day 10, F37, #188	NA	NA	14	G/L-118	3.00	ND	1,174	560
Compost Vessel Port #2; Day 10, F37, #188	NA	NA	14	G/L-119	4.81	ND	1,185	555
Compost Vessel Port #1, Day 22, F25, #174	>1.5%	630	22	G/L-213	14.9	ND	1,065	859
Compost Vessel Port #2, Day 22, F25, #174	8,000	1,000	46	G/L-212	9.51	ND	2,478	2,230

Tat . Summary of All Testing Flow Rate, Concentration Data, and Cal ed Flux (mg or (D/T)/m2,min-1).

Compost Vessel Port #1; Day 30, F19, #168	32	130	8	G/L-217	71.5	ND	113	88.3
Compost Vessel, Port #2, Day 30, F19, #168	100	620	<0.5	G/L-218	135	ND	791	664
Bag Off; Curing Day 0, F19	NA	NA	6	G/L-304	6.40	ND	23.2	20.3
Curing Day 3; F19, #167	NA	NA	NA	G/L-305	3.91	ND	741	616
Curing Day 3, F19, #167, Post Mixing	NA	NA	<0.5	G/L-313	6.56	ND	3,588	3,185
Curing Day 3, F19, #167 Replicate	NA	NA	<0.5	G/L-314	5.32	ND	4,311	3,577
Curing Day 7, F17, #164	NA	NA	8	G/L-303	7.6	ND	50.1	43.7
Curing Day 10, F15, #162	NA	NA	0.5	G/L-308	52.1	ND	583	486
Curing Day 10; F15, #162, Post Mixing	NA	NA	<0.5	G/L-311	46.8	ND	1,061	868
Curing Day 13; F16, #162	NA	NA	<0.5	G/L-310	8.44	ND	403	367
Curing Day 19; F10, #157	NA	NA	<0.5	G/L-307	32.4	ND	266	200
Curing Day 19; F10, #157, Post Mixing	NA	NA	<0.5	G/L-309	43.3	ND	2,127	1,713
Curing Day 25; F4	NA	NA	<0.5	G/L-306	106	ND	561	495
Curing Day 31, F62, #145	NA	NA	0.3	G/L-312	114	ND	317	306
Unscreened 9 Month Old Compost	NA	NA	0.4	G/L-214	24.0	ND	9.52	8.73
Unscreened 9 Month Old Compost, Replicate	NA	NA	0.4	G/L-215	23.6	ND	35.7	4.86
Screened 9 Month Old Compost	NA	NA	20	G/L-216	9.94	ND	159	88.0

Methane Flux= (ppmvC methane)(16/25)(flowrate m3/min)/(0.13 m2) = mg/m2,min-1 Methane as methane
TNMNEO Flux= (ppmvC methane)(16/25)(flowrate m3/min)/(0.13 m2) = mg/m2,min-1 TNMNEO as methane
Odor Flux= (D/T)(flow rate m3/min)/0.13 m2) = (D/T)/m2,min-1 as Odor concentration
NH3 Flux= (mg/m3)(flow rate m3/min)/(0.13 m2) = mg/m2,,min-1 as NH3

Note 1- SCAQMD 25.3 G-101 trap was mislabled as G-110 and visa versa
Note 2- SCAQMD 25.3 G-214 was mislabled as G-216 and visa versa
Note 3- SCAQMD 25.3 G-201 trap was mislabled as G-215 and visa versa

Tal Summary of All Testing Flow Rate, Concentration Data, and Ca ed Flux (mg or (D/T)/m2,min-1).

NMNEO Tank	NH3 ID	NH3	NH3 Vol	NH3	Odor	SF6 Trace	SF6	Total Flow	Total Flow	Methane Flux	TNMNEO Flux
(ppmvC)		(mg)	(m3)	(mg/m3)	(D/T)	(ppbv)	(ppbv)	(lpm)	(m3/min)		
<2	A-101	0.02	0.0493	0.41		104	70	5	0.005	<0.049	0.37
<2	A-201	0.05	0.0640	0.78		105	25	5	0.005	<0.049	<0.049
<2	A-301	0.02	0.0653	0.31		None	0.45	5	0.005	<0.049	0.14
128	A-116	0.08	0.0595	1.3		104	25	21	0.021	0.22	94
1,234	A-302	0.53	0.0616	8.6		105	16	33	0.033	3.0	376
2.33	A-110	0.10	0.0614	1.6		104	25	21	0.021	6.6	149
27.4	A-202	1.3	0.0645	20		104	11	47	0.047	143	21
9.60	A-205	0.40	0.0485	8.2		105	14	38	0.038	1.1	3.9
<2	A-206	0.19	0.0641	3.0		104	26	20	0.020	1.9	0.79
2.08	A-115	0.03	0.0481	0.62		104	2.4	217	0.217	10	7.3
16.0	A-114	0.36	0.0618	5.8		104	32	16	0.016	7.2	2.3
<2	A-111	Broken	0.0541	N/A		104	22	24	0.024	2.2	1.2
142	A-211	0.41	0.0466	8.8		104	17	31	0.031	764	47
<2	A-210	0.06	0.0630	0.95		105	6.3	83	0.083	0.83	3.7
307	A-120	0.35	0.0643	5.4		104	24	22	0.022	4.3	110
193	A-102	0.06	0.0655	0.92		104	21	25	0.025	0.97	164
10.7	A-105	0.05	0.0822	0.61		104	20	26	0.026	0.52	6.7
829	A-104	Broken	0.0688	N/A		104	2.9	179	0.179	5.8	2954
535	A-103	0.12	0.0479	2.5		105	3.7	142	0.142	4.7	1421
305	A-108	0.06	0.0634	0.95		104	4.8	108	0.108	5.2	793
1,572	A-109	0.16	0.0664	2.4		105	1.4	375	0.375	51	3336
1,052	A-113	2.5	0.0639	39		104	6.3	83	0.083	3.6	896
1,475	A-112	0.27	0.0623	4.3		105	0.96	547	0.547	36	9603
863	A-204	0.27	0.0661	4.1		104	1.7	306	0.306	11	3658
597	A-203	0.23	0.0531	4.3		105	2.0	263	0.263	10	2549
1,504	A-207	1.3	0.0754	17		105	2.3	228	0.228	9.1	6544
749	A-209	0.12	0.0725	1.7		104	3.9	133	0.133	1.3	3259
8.57	A-208	0.01	0.0690	0.14		None	0.72	5.0	0.005	0.10	0.75
1,010	A-117	2.1	0.0575	37		104	2.4	217	0.217	3.4	2632
614	A-118	1.3	0.0688	19		105	1.9	276	0.276	4.1	1595
630	A-119	0.90	0.0671	13		105	2.3	228	0.228	5.4	1330
206	A-213	0.89	0.0506	18		104	2.7	193	0.193	14	1012
248	A-212	2.1	0.0572	37		105	1.5	350	0.350	16	4270

Tabl Summary of All Testing Flow Rate, Concentration Data, and Calc d Flux (mg or (D/T)/m2,min-1).

25.0	A-217	0.63	0.0586	11		105	2.1	250	0.250	88	139
127	A-218	0.16	0.0623	2.6		104	3.0	173	0.173	115	674
2.91	A-304	0.22	0.0359	6.1	1,600	104	1.8	289	0.289	9.1	33
125	A-305	0.09	0.0642	1.4		105	13	40	0.040	0.77	146
404	A-313	0.21	0.0624	3.4	53,000	104	2.6	200	0.200	6.5	3533
734	A-314	0.29	0.0583	5.0		105	4.7	112	0.112	2.9	2377
6.39	A-303	0.52	0.0582	8.9		105	2.2	239	0.239	8.9	59
96.7	A-308	0.12	0.0510	2.4		104	2.0	260	0.260	67	746
193	A-311	0.09	0.0565	1.6	5,500	104	6.6	79	0.079	18	413
35.9	A-310	0.08	0.0578	1.4		105	42	13	0.013	0.54	26
66.1	A-307	0.06	0.0583	1.0		105	3.7	142	0.142	23	186
414	A-309	0.20	0.0500	4.0	53,000	105	6.5	81	0.081	17	848
66.5	A-306	0.11	0.0629	1.7		105	14	38	0,038	20	105
11.2	A-312	0.22	0.0656	3.4		105	25	21	0.021	12	33
70.6	A-214	0.03	0.0665	0.45		105	52	10	0.010	1.2	0.47
30.8	A-215	0.07	0.0690	1.0		105	50	11	0.011	1.3	1.9
<2	A-216	0.60	0.0525	11		104	42	12	0.012	0.59	9.4

Ta 2. Summary of All Testing Flow Rate, Concentration Data, and Ca ted Flux (mg or (D/T)/m2,min-1).

Odor Flux	NH3 Flux	COMMENT
N/A	0.016	Mis-labled; L-101 labled as L-110
N/A	0.030	PROBABLY G-210 poor SF6 recovery from system blank (+50% Criteria)
N/A	0.012	No SF6 (UHP air only)- spot on for low end SF6 analysis; should be zero
N/A	0.22	
N/A	2.2	
N/A	0.26	Mis-labled; G-110 labled as G-101
N/A	7.3	
N/A	2.4	
N/A	0.46	
N/A	1.0	
N/A	0.72	
N/A	N/A	
N/A	2.1	
N/A	0.61	
N/A	0.92	
N/A	0.18	RECORED AS G-102, on flux data sheet
N/A	0.12	Up to 30 days old storeage pile, RECORED AS G-105 on flux data sheet
N/A	N/A	26 Ports
N/A	2.7	
N/A	0.79	26 Ports
N/A	7.0	
N/A	25	28 Ports
N/A	18	
N/A	9.6	28 Ports; with filter PID 23 ppmv, FID 27 ppmv; bag variability test
N/A	8.8	Bag variability test
N/A	30	Mid Bag Port; bag variability test
N/A	1.7	End of Bag Port- note variability in flow down to the bag end; makes sense
N/A	0.0056	Chamber on continuous Ag bag surface, UHP air- no SF6, should be zero SF6
N/A	61	28 Ports
N/A	40	
N/A	24	Sample Replicate
N/A	26	20 Ports
N/A	99	

Ta.. .. Summary of All Testing Flow Rate, Concentration Data, and Ca... ted Flux (mg or (D/T)/m2,min-1).

N/A	21	28 Ports
N/A	3.4	With filter PID 3 ppmv, FID 230 ppmv
3557	14	O-101; odor sample; bag off at 0807
N/A	0.43	
81538	5.2	O-104 (not recorded)
N/A	4.3	Replicate Sample
N/A	16	
N/A	4.7	
3342	0.97	O-103 Odor sample
N/A	0.14	
N/A	1.1	
33023	2.5	O-102 Odor sample
N/A	0.51	
N/A	0.54	
N/A	0.035	
N/A	0.086	
N/A	1.1	

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PROTOCOL FOR FLUX CHAMBER SOURCE TESTING OF FUGITIVE AIR EMISSIONS FROM THE JEPSON PRAIRIE ORGANICS IN-VESSEL AND WINDROW COMPOSTING SYSTEMS

"BASELINE EMISSIONS ESTIMATION"

DRAFT

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1.0 INTRODUCTION

This protocol describes the methodology and sampling procedure for using the U.S. Environmental Protection Agency (USEPA) surface emission isolation flux chamber (flux chamber) to perform an air pathway analysis (APA) for the purpose of assessing the fugitive volatile organic compounds (VOCs) and ammonia emissions.

The proposed assessment includes following a commonly used test procedure for assessing fugitive air emissions from area sources at compost facilities. Fugitive air emissions are measured using an environmental chamber designed for the purpose of measuring mass transfer of study compounds from a given source. The area sources of interest in the Jepson Prairie Organics (JPO) in-vessel aerated compost system for this testing effort includes fugitive air emissions from: feedstock as received and staged; ventilation exhaust ports in the compost vessels (agricultural use bags) that range from one to 30 days old; compost after bag removal including turning and mixing; and compost in curing of various ages up to nine months. The area sources of interest in the windrow compost system for this testing effort includes fugitive air emissions from various ages of the piles in the compost and curing cycles.

The flux chamber will be operated as per the USEPA protocol and, at equilibrium in the chamber, screening level testing will conducted including hydrocarbon response (photo ionization detector (PID) and flame ionization detector (FID) response). Following screening, a tank and trap will be used to collect VOCs in accordance with the South Coast Air Quality Management District's (SCAQMD) Method 25.3, and an impinger with acid sorbent media will be used to collect ammonia in accordance with SCAQMD Method 207.1. In addition, a tracer species will be added to the flux chamber sweep air gas (sulfur hexafluoride- SF6) to assess the system advective flow into the chamber- a required component of the emissions assessment. SF6 will be analyzed by gas chromatography/electron capture detection (GC/ECD). The testing program is summarized in Table 1 for the in-vessel compost system and Table 2 for the windrow compost system.

A description of the history, background, and operation of the USEPA-recommended, dynamic flux chamber is provided in this document, along with sampling and analytical protocol, sampling strategy, quality control requirements, and sample management protocol.

This test protocol is intended to provide area source flux data representative of air emissions of selected study compounds from the JPO in-vessel and windrow compost systems. The technical effort includes: preparing and submitting a source test protocol for the collection of flux data (i.e., the present submittal); preparation of field test equipment including flux chamber testing equipment and expendable field supplies; field testing including the collection of up to 47 flux samples (47 VOC and 47 ammonia flux samples including quality control (QC) samples); sample chain-of-custody; sample shipping; sample analysis; laboratory reporting; and qualifying/reporting of the source test results.

2.0 HISTORY, BACKGROUND, AND OPERATION OF THE SURFACE EMISSION ISOLATION FLUX CHAMBER

This section briefly describes the history, background, and operation of the USEPA-recommended flux chamber. This device is used to measure the emission rates from surfaces emitting gas species[1].

2.1 History

Assessing the rate of gas phase species emissions from area sources has been, and continues to be, a challenge for scientists and engineers. The interest in assessing emission rates from area or "fugitive" sources has been steadily increasing over the past 30 years, largely due to two factors:

1) Fugitive emission sources are contributing to the non-attainment of state and federal ambient air quality standards; and

2) Fugitive emissions from controlled and uncontrolled facilities are often toxic (air toxics) and the impact to receptors near these sources is an issue.

The later has been the primary driving force in the development of the current emission assessment methods, in particular, the flux chamber method.

There are four basic approaches for assessing air emissions rates: direct measurement technologies; indirect measurement technologies; fenceline monitoring and modeling technologies; and predictive emission modeling. The most promising of these approaches is the direct measurement approach[2]. One reason for this is that there is no modeling or estimation involved which reduces the uncertainty in the assessment.

Although the other three approaches have been used successfully, the direct approach is versatile, provides reproducible emission rate data, and is a cost-effective assessment approach. Other advantages include superior detection limit capabilities, the lack of upwind interferences, and the operation of the technology not being dependent upon meteorological conditions.

The use of enclosures for assessing emission rates was first reported in the literature by Zimmerman[3] (1977) and Adams[4] (1978). The basic approach uses an enclosure or chamber of some design to isolate a surface emitting gas species (Figure 2). The chamber must be well characterized and qualify as a continuously stirred reactor. Clean sweep air is added to the chamber at a controlled, fixed rate, and the contents are sampled and analyzed for species of concern. The emission rate of a species, ERi (micrograms per minute per square meter [$ug/m^2, min^{-1}$]), is calculated by knowing the sweep air flow rate, Q (cubic meters/minute [m^3, min^{-1}]), species concentration Yi, (micrograms/cubic meters [ug/m^3]), and surface area, A (square meters[m^2]) as follows:

$$Eri = (Yi)\,(Q)\,/\,(A) \qquad \text{Equation \#1}$$

Emissions can also be expressed on a per foot basis (seam or crack for indoor infiltration testing).

This emission assessment approach has been used on a variety of solid and liquid surfaces and for a variety of species[5].

2.2 Background

The development of the current USEPA-recommended flux chamber method began with the need to assess the emissions of air toxics at uncontrolled hazardous waste landfills (Superfund Sites) as part of a Remedial Investigation (RI) effort. Literature on direct measurement technologies was used to develop flux chambers of different sizes, shapes, and construction materials. After several site assessment reports became available presenting this technology, the USEPA became interested in using the approach to characterize fugitive emissions from controlled treatment, storage, and disposal facilities (TSDFs). This interest led to a study where the most promising direct, indirect, and predictive modeling technologies were evaluated by conducting side-by-side emission rate assessments at TSDFs. The results of this study demonstrated the advantages of the flux chamber measurement technology when compared to the other assessment technologies. Further interest led to the redesign and parametric evaluation of the flux chamber as described in the USEPA Users Guide[1], which also provides the results of the chamber evaluation and recommended operating protocols. This design represents the best compromise in design, construction materials, and suitability for different types of applications.

Test data indicate that the flux chamber is a reliable assessment technology. Precision is reported at ± 5 percent and accuracy is ± 30 percent[1]. The recovery studies conducted on 40 hydrocarbons (alkanes, alkenes, aromatics, halogenated, sulfur containing, cyclic) averaged 103 percent[1]. The sensitivity and range of the technology is a function of the analytical methods used, the selection of operating conditions, the level of the emission source, and, to some degree, the type of species measured.

3.0 QUALITY CONTROL

Quality control (QC) procedures that are used to assure data quality from flux chamber measurement are listed and described below. USEPA recommends no specific QC requirements except that a flow meter is used to introduce the sweep air at rate of 5.0 liters per minute (l/min), which requires calibration (i.e., multipoint calibration using a primary standard current for the year). The rotometer used as part of the emission measurement test should not be used for other applications, insuring the clean operation of the air introduction system. Operation of the chamber should follow the specific protocol for use described in the USEPA User's Guide. This includes using a 5.0 l/min sweep airflow rate and allowing for 5 residence times to achieve equilibration prior to sample collection. Other sampling quality control procedures related to the sample collection and analysis are listed below.

- Media Blank -- A media blank sample is prepared by filling sample collection media with reagent in the field, packaging the blank as a blind QC sample, and submitting the sample to the laboratory that operates the instrument as described in the analytical method protocol. The frequency of the blank sample analysis is a minimum of 5 blanks analyzed per 100 samples (5%) or one blank per every batch (regardless of batch size). Blank levels will be used to establish the system baseline. The media blanks for this effort include a tank and trap for Method 25.3 and an impinger solution blank for Method 207.1.

- Field Replicate Sample – Field replicate samples will be collected in the field and will be used to determine sample precision. A replicate sample will be collected simultaneously with or immediately after a field sample is collected. The frequency of replicate sample collection is 5% or one per trip (is that per day or per site?). The criteria for acceptable field precision is ±50% relative percent difference (RPD).

- o Specific Method Performance -- Specific method QC is conducted as per analytical method requirements. Typically this includes laboratory blanks, species recovery, laboratory duplicate samples, and adherence to other method performance objectives such as calibration and retention time identifications.

- o Sample Management -- Sample management is defined by the specific sampling method used to satisfy the program objectives. Sample management typically includes all activities involving the recording, preserving, storing, handling, and shipping of the field samples. A summary of the sample management information and field quality control is given in Tables 3 and 4.

Data qualifiers that will be used to assist in data usage include: J- estimated value or below method reporting limit (MRL); B- value found in blank sample and baseline corrected; and E- value found at level that exceeds calibration range. Laboratory recovery and precision data, as well as field precision data, will be used to qualify data usage for the site flux chamber program.

3.1 FIELD QC SUMMARY

The field QC activities scheduled for the field testing are summarized in Table 4. Deviation in schedule or frequency of QC activities will require corrective action, including documentation of corrective action in the field notebook and notifying Norcal Waste Systems Hay Road Landfill Inc. (NWSHRLI) of the deviation and corrective action.

4.0 SAMPLING STRATEGY

Testing will be conducted using the USEPA surface emission isolation flux chamber, and compound emissions will be detected using a real time instrument (TVA-1000, PID/FID), SCAQMD Method 25.3 for VOCs, and SCAQMD Method 207.1 for ammonia. This approach will provide data of high quality (accuracy and precision) that will be representative of air emissions of study compounds from both the in-vessel and windrow composting processes. A conceptual layout of the facility is provided as Figure 3. Data obtained from this testing effort will be used to generate a baseline emissions estimate from the compost systems.

The sample collection plan is described below, and also provided in Tables 1 and 2. A time line of testing or testing schedule is provided in Table 5. This testing schedule is solely intended for planning and is not a tight schedule for executing the scope of work. The scope of work includes a total of 47 flux tests, which includes 6 QC samples (3 blanks and 3 replicate flux samples).

4.1 IN-VESSEL COMPOSTING SYSTEM

The design of the testing program is based on historical experience regarding assessing fugitive air emissions from various types and designs of composting facilities and a site visit to the JPO facility, which included screening various area sources from the in-vessel compost system using a real-time hydrocarbon analyzer. The information collected from the site visit was then used to simulate a profile of the emissions as shown in Figure 1. In Figure 1, the solid line represents mass in milligrams? (mg) of VOC emissions per compost activity (not intended to be quantitative or time-specific). Over the course of the compost operations, the simulation results in '100%' of the emissions, or in a more practical sense, these compost operations add up to the total VOC and ammonia emissions from the operation. The character of the profile is useful information in that it helps to indicate where in the compost operations and at what level of testing, sample collection is recommended. Based on this projection of emissions, the test plan was broken into seven categories representing the compost operations as indicated below. An explanation of rationale for testing is also provided.

The testing of the in-vessel compost operation includes:

1	Feedstock as received and aged	2 Flux tests
2	Feedstock in-vessel, Day 1	2 Flux tests
	Feedstock in-vessel, Day 3	2 Flux tests
	Feedstock in-vessel, Day 5	2 Flux tests
	Feedstock in-vessel, Day 7	2 Flux tests
	Feedstock in-vessel, Day 10	2 Flux tests
	Feedstock in-vessel, Day 20	2 Flux tests
	Feedstock in-vessel, Day 30	2 Flux tests
3	Through bag fugitive test, Day 7	1 Flux tests
4	Variability of emissions per bag, Day 7	2 Flux tests
5	Bag removal/mixing (immediate)	1 Flux tests
6	Curing- Day 3, before and after mixing	2 Flux test
	Curing- Day 7, after mixing	1 Flux test
	Curing- Day 10, before and after mixing	2 Flux test
	Curing- Day 13, after mixing	1 Flux test
	Curing- Day 19, before and after mixing	2 Flux test
	Curing- Day 25, after mixing	1 Flux test
	Curing- Day 31, after mixing	1 Flux test
7	Product- 9 Months, before and after screening	2 Flux tests
Blank testing		2 Flux tests

Replicate testing	2 Flux tests
TOTAL (In-vessel)	36 Flux tests

Category 1 Feedstock will be tested as received, given that the age of the waste may be a day old and static pile composting may be occurring. One sample will be collected as received (within the first hour), and one later representing one-day old (on site age) feedstock. The simulation profile (Figure 1) indicates that this will be a minor emissions source.

Category 2 Feedstock in the compost vessels will be tested on Day 1, Day 3, Day 5, Day 7, Day 10, Day 20, and Day 30. A photograph showing in in-vessel system is provided as Photo 2. Field screening using a real time hydrocarbon analyzer indicated that peak in-vessel emissions occurred between day 5 and day 7, certainly most of the high level emissions occur prior to day 10. Testing on 7 of the 30 vessels, that represents a 30-day compost cycle, is adequate in order to account for the gross air emissions from the compost cycle, which is the dominate source for the compost operations. The test will be conducted on two of the approximate 24 exhaust ports on each selected vessel. The two samples will be collected from the first third of the vessel, longitudinally, (starting from the blower side) and on both sides laterally. .

Category 3 Testing of fugitive emissions through the vessel will be performed on the vessel that represents Day 7, which is anticipated to have the highest "through the bag wall" breakthrough potential. One location will be selected and the flux chamber will be placed on an unperforated section of the vessel (between exhaust ports) and tested for fugitive air emissions. The VOC and ammonia emission from this source is expected to be below the method detection limit.

Category 4 The variability of emissions per vessel will be determined by conducting two additional exhaust port flux tests on the Day 7 compost (high emissions potential). The purpose of this test is to establish the variability in flux from different exhaust ports in the front, middle, and back of a given vessel. The front end of the vessel will be tested as part of the Category 2 testing (see above). The variability testing will be conducted in the middle and end (longitudinally) and on one side (laterally) of the vessel.

Category 5 After the in-vessel composting cycle is complete, the compost is removed from the vessel. Flux testing on the freshly exposed surface will be conducted by selecting one, top of the pile, location and assessing immediate VOC/ammonia release from the exposed compost material. It is not known if this will be a significant source, however testing is necessary in order to address the potential for emissions.

Category 6 Curing phase testing will include material both before and after mixing in order to establish the emissions profile during curing. Testing at one location on top of the pile will be conducted on Days 3, 7, 10, 13, 19, 25, and 31 after mixing, and on Days 3, 10, and 19 before mixing.

Category 7 The final test on curing will be before and after screening at approximately nine months in the curing cycle.

Quality control testing includes a minimum of 2 blank test samples and 2 replicate samples in order to satisfy the area source testing protocol. (Note that collecting the SCAQMD Method 25.3 samples in replicate is not recommended- the sample count required for the minimum testing effort, in order to address the variability in the air emissions from the process far exceeds the variability in replicate sample collection and analysis.)

4.2 WINDROW COMPOSTING SYSTEM

The testing on the windrow compost system includes:

Windrow compost - Day 1	1 Flux test
Windrow compost - Day 3	1 Flux test
Windrow compost - Day 5	1 Flux test
Windrow compost - Day 7	3 Flux test
Windrow compost - Day 15	1 Flux test
Windrow compost - Day 30	1 Flux test
Windrow compost - Day 60	1 Flux test
Blank testing	1 Flux tests
Replicate testing	1 Flux tests
TOTAL	11 Flux tests

The testing on the windrow compost system was designed to characterize the emission profile during the composting of greenwaste with emphasis on the "peak emissions phase" of the cycle or the first seven days. Flux testing will be conducted on Day 1 and then every two days for the first week in order to capture the emissions during this portion of the cycle. After that, the testing cycle will be characterized by testing on Day 15 (second week), then approximately every two weeks (Days 30 and 60). This data, or testing on seven days of the 60-day cycle will be used to represent the complete cycle. A stream-lined testing effort is planned for the windrow compost system because emission profiles like the one shown in Figure 1, are available for windrow style composting[6]. A photograph showing a typical set-up of the flux chamber is provided as Photo 1.

Most of the testing will be conducted on the top of the windrow pile. However, on Day 7, testing will be conducted in order to define the spatial differences in emissions from the bottom to mid to top of the windrow. Two additional locations will be tested on Day 7, including the bottom or foot of the pile, and the mid-height of the pile. The information may be used to normalize the data so that a representative estimate of emissions can be provided considering spatial differences that may occur on the piles.

5.0 PROJECT INSTRUCTIONS

It is estimated that this sample matrix will require one trip lasting up to three days, baring any restrictions onsite. This will require a crew of three persons and four complete flux chamber systems. The goal is to collect the listed source assessment data within three days in one batch of lab samples.

5.1 SCHEDULE

The project will be executed on the schedule given below. The project team will assemble on the day prior to testing, conduct a site visit and some preliminary tests, then start the quantitative testing on the next day at approximately 7:00 a.m. (or sooner). All equipment and field supplies will be inventoried and pre-testing calibrations will be performed that day. The first order of business will be to inspect potential test locations and inform site personnel of the locations that meet the conditions stated herein. After this, testing will be conducted the remainder of the day as is convenient for site personnel. It is anticipated that all testing will be completed within three days. All field progress will be recorded in a project log book and all chain-of-custodies will be completed on the day of sample collection. All shipping records will be retained as part of the field data set. Project staff will be responsible for shipping the samples and contacting the laboratory prior to sample receipt.

PROJECT SCHEDULE

Field Sampling	07/26/05 – 07/28/05
Draft Report	Ten (10) Working After Receipt of Lab Data
Final Report	Within 5 Days of Receipt of Comments

5.2 EQUIPMENT LIST

The list of field equipment and expendable supplies for the proposed field testing is provided below. All sampling media (prepared as per method specifications) is to be provided by the contract laboratory, including stainless steel traps/canisters and impinger solution. The laboratory will provide the sampling media for these methods and will conduct blank testing to insure proper laboratory service. Dr. C.E. Schmidt will supply all other sampling equipment and expendable supplies.

Dr. CE Schmidt will supply four flux chamber systems that will be required for this effort. Four complete flux chamber systems (see Figure 2) shall include the following listed items. Other support equipment is also listed. Note that two systems will include modified chambers (6" diameter exhaust port).

1) USEPA flux chamber as per USEPA design including stainless steel Swage-lock fittings,

2) Support cooler with a mounted rotometer (0 to 5 liter per minute) through the cooler walls,

3) Brass, 2-stage regulator for bottled air (CGA 590 fitting for air and 1/4" Swage-lock (male) adaptor fitting,

4) Ten foot, 1/4" Teflon™ line with female fittings,

5) Ten foot, 1/4" Teflon™ air inlet/outlet support line,

6) Large size plastic support cooler,

7) Set of miscellaneous hand-tools including an adjustable crescent wrench for the CGA 590 regulator fitting, small adjustable crescent wench for the 1/4" swage fittings, assorted medium and small size screw drivers,

8) Teflon sheet (1/32" or thicker) for blank system testing,

9) Type K thermocouple wires (2, 12') and temperature readout,

10) Rigid-wall shipping/storage crate for the flux chamber mounted on roller wheels,

11) Open-bed truck or van,

12) Decontamination supplies including Alkanes soap, paper towels, and wash water,

13) Three (3) bottles of ultra high purity air with tracer (UP); size #150,

14) Cleaning supplies (soap, water, paper towels),

15) Hand tools, impingers, impinger pumps, and calibrator,

16) Three (3) small hand-trucks for mounting the air bottle,

17) Three (3) pavement sealing systems (may be needed), and

18) Forty-seven (47) sample media (Method 25.3 tanks/traps/HC free water, impinger solution and bottles) supplied by the laboratories.

Note: JPO will provide the compost and compost operational support needed for the testing effort.

6.0 SAMPLING PROTOCOLS

6.1 USEPA RECOMMENDED SURFACE ISOLATION FLUX CHAMBER

The USEPA flux chamber (Figure 2) can be used on any liquid surface and solid surface. The only requirement regarding application is that there must be access to the surface for testing. The most critical issue regarding application is that the location and number of locations for testing be sufficient so that these data can be used to meet the program objectives. The USEPA Users Guide[1] provides guidance that relies on the area involved and the homogeneity of the source; or the coefficient of variation of these emission data for determining representative testing. For this effort, the focus of the testing will be on a variety of sources, mostly time dependent, collecting flux data that will be used to develop an emissions profile of key compounds for both the in-vessel and windrow compost systems.

The operation of the flux chamber involves: 1) identifying the test area; 2) initiating sweep gas flow rate to the flux chamber; 3) operating the chamber for at least four residence times; 4) collecting exhaust gas for analysis and/or recording instrument response; 5) decontaminating the chamber; and 6) relocating the measurement equipment to the next test area. The specific operating protocol for soil surfaces is given below.

1) Locate the flux chamber, sweep gas, sample collection equipment, and field documents at the test location.

2) Document site information, location information, equipment information, name of sampler, date, and time on the Field Data Sheet.

3) Select the exact test location and seal the chamber by burying the bottom of the chamber in the solid compost, or using the bottom seal system to seal the

chamber to the compost vessel. The chamber should be sealed along the base preventing air infiltration.

4) Initiate the sweep gas flow rate and set the rotometer at 5.0 liters per minute. Constant sweep gas flow rate is critical. Record time.

5) Collect instrument background data (air and surface temperature inside and outside of the flux chamber, site description) and record data.

6) Connect the purge pump. A total of 5.0 liters per minute is added to the chamber and the gas not sampled is exhausted out the pressure equalization port in the top of the chamber. The chamber is operated at near atmospheric pressure. Do not exceed an exhaust gas sample/purge rate of 2.5 liters per minute. This will prevent entraining of ambient air into the chamber and maintain an exhaust rate of at least 2.5 liters per minute out of the pressure equalization port.

7) Operate the chamber sweep air flow rate at 5.0 liters per minute and record data (check on flow rate , temperature as needed, real time VOC and ammonia data as needed)every residence time (6 minutes) for four to five residence times or 24 to 30 minutes. Record data. The chamber is at steady-state.

8) Interface the sample collection media (trap/evacuated canister or impinger and sampling pump) to the purged sample line and collect the gas sample at the method-specific sample collection rate. Do not exceed a collection rate of 2.5 liters per minute at any time. This will prevent unwanted dilution of chamber exhaust gas by ambient air. Keep sample collection to the minimum time interval while meeting target detection limits. Discontinue sample collection and repeat for each sample collection media until complete. Discontinue sample collection media.

9) Label samples, record sample collection or real-time monitoring data on the data sheet.

10) Store the sample media in the appropriate storage or shipping media (bags in plastic shipping crate, canisters in cardboard shipping container, trap catch and impinger catch in sealed glass sample bottles on ice).

11) Document sample collection in field master log book.

12) Discontinue the flux measurement, shut off the sweep air, remove chamber and secure equipment.

13) Decontaminate the chamber where contact was made with the soil using a clean paper towel and water (if needed). Purge the sample lines with sweep gas (5 liters/minute) for 2 minutes.

14) Relocate equipment to the next test location and follow steps 1) through 14).

The modified flux chamber will be used for the high advective flow exhaust ports on the in-vessel testing activity. The modification of the standard EPA chamber includes an exhaust port that consists of a 6" diameter port and short exhaust stack. This design modification eliminates the concern for any 'back-pressure' that might occur with high advective flow systems. Two chambers with this modification will be available for testing of the in-vessel compost emissions assessment. A tracer gas, sulfur hexafluoride (SF6), will be used for all testing, and the average or integrated advective flow rate into the flux chamber will be assessed by the analytical recovery of the tracer gas in the Method 25.3 tank (canister). The operation cycle of the vessel blower system is a 5-minute 'on' and a 10-minute 'off' forced air cycle. The flux chamber operation includes a 6-minute residence time or a 30 minute equilibration time period, meaning that there will be two complete on/off blower cycles occurring during the equilibration time period prior to sample collection, and four complete on/off blower cycles occurring during the Method 25.3 and Method 207.1 integrated sample collection time period of 60 minutes. As such, the integrated concentration of tracer in the Method 25.3 tank, will represent the average advective flow from the vessel port during the integrated time period, and the data will be used to calculate the average VOC and ammonia emissions by knowing the integrated VOC and ammonia concentrations in the samples. The goal is to collect VOC and ammonia emissions over the integrated sample collection interval representative of the emissions from the process under normal operating conditions (blower operating cycle) without altering the composting cycle, and then use the data to estimate 24-hour cycle emissions which will be used to estimate facility emissions by developing a time-dependent emissions profile for the in-vessel composting process.

6.2 REAL TIME INSTRUMENT DETECTION

VOC gas detection by real time instrument will be collected from the exhaust line of the flux chamber at steady-state conditions for screening purposes. Real time instruments are interfaced to the sample collection line withdrawing gas and measuring species until a stable reading is obtained at chamber equilibrium. The data may be used to demonstrate equilibrium conditions in the flux chamber, or to assist in sample location selection. The data will not be used quantitatively.

7.0 ANALYTICAL PROTOCOLS

This section describes the analytical protocols that will be used to analyze the field samples. Copies of all protocols used are available upon request.

7.1 SCAQMD METHOD 25.3 FOR VOCs

Flux chamber air samples will be analyzed by SCAQMD Method 25.3 for methane, ethane, and total VOCs. Method 25.3 Retrieves an ice bath trap for condensable VOCs and a whole air sample from a Summa polished, stainless-steel canister. The air sample is transferred from the trap (4 cc hydrocarbon free water) to the canister that collects up to 4.8 liters in a 6-liter canister to the GC. The hydrocarbon compounds from both the trap and the tank are oxidized to carbon dioxide, reduced to methane, and then analyzed as methane by GC/FID. Methane and ethane is measured from the tank prior to oxidation/reduction and the difference is total non-methane non-ethane organic content or TNMNEOC (VOC). The analyte target list MDLs for this analysis is typically <1.0 ppmv per compound/TNMNEOC. A copy of the method is available on request.

7.2 SCAQMD METHOD 207.1 FOR THE DETERMINATION OF AMMONIA

Ammonia is determined by the collection of analytes in an acid impinger (0.1 N H_2SO_4) and analyzed by either ion chromatography or spectrophotometry. Sample gas is drawn through impinger solution at a calibrated rate for a known amount of time. The impinger solution is transferred into a sample bottle, shipped to the laboratory, analyzed, and the volume of gas drawn through the impinger is used to calculate the gas concentration of analyte.

7.3 SCREENING USE REAL-TIME DETECTION

Screening of sample gas is conducted by testing for various analyte species in the flux chamber by connecting a real time instrument or a color indictor detection tube to the exhaust of the flux chamber and testing chamber gas. VOCs are detected using a real time TVA-1000 photoionization and flame ionization detector. Ammonia is detected using a colorometric tube-the tube sorbent changes color when in contact with ammonia gas and the advance of the color as 100 cc's of gas is drawn through the tube (calibrated sight tube).

7.4 F6 TRACER GAS DETERMINATION

Sulfur hexafluoride (SF6) will be added to the flux chamber sweep air gas at approximately 100 ppbv. The dilution of SF6 tracer will represent the average advective flow into the chamber from the source tested that has an advective flow component to the emissions event tested. SF6 concentration in the Method 25.3 tank, collected over an integrated 1-hour time period as per method, will be analyzed by gas chromatography and electron capture detection (GC/ECD). The canister will be received by one laboratory (Almega Environmental, Huntington Beach, CA), pressurized, tested for SF6, shipped to a second laboratory (Environmental Analytical Service, San Luis Obispo, CA, and analyzed for the tank or volatile portion of SCAQMD Method 25.3. Both methods promote an identical canister preparation (pressurization) step. The canister preparation information will be conveyed to the second lab for the quantitation of VOCs.

REFERENCES

1) US EPA, "Measurement of Gaseous Emission Rates from Land Surfaces Using an Emission Isolation Flux Chamber- User's Guide," EPA 600/8-86-008 (NTIS PB86-223161), February 1986.

2) US EPA, "Procedures for Conducting Air Pathway Analysis for Superfund Activities, Interim Final Documents, Volume 2- Estimation of Baseline Air Emissions at Superfund Sites, EPA-450/1-89-002a (NTIS PB90-270588), August 1990.

3) Zimmerman, Pat. "Procedures for Conducting Hydrocarbon Emission Inventories of Biogenic Sources and Some Results of Recent Investigations." Presented at the 1977 EPA Emissions Inventory/Factor Workshop, Raleigh, North Carolina, September 13-15, 1977.

4) Adams, D.T., et al, "Measurement of Biogenic Sulfur-Containing Gas Emissions from Soils and Vegetation." Presented at the 1st Annual Meeting of the ALCA, Houston, Texas, June 25-30, 1978.

5) Vinegar, E.D., L.H. Keith editors, Sampling and Analysis of Airborne Pollutants, C.E. Schmidt, Chapter 3, "Theory and Applications of the US EPA Recommended Surface Emission Isolation Flux Chamber for Measuring Emission Rates of Volatile and Semivolatile Species." Lewis Publishers, Ann Arbor, Michigan, 1993.

6) Smyth, Brenda, CE Schmidt, "Air Quality Issues on Composting Horizon", Biocycle, October, 2002, P. 42-51.

Photo 1. – Example Flux Chamber Test for Uncovered Compost.

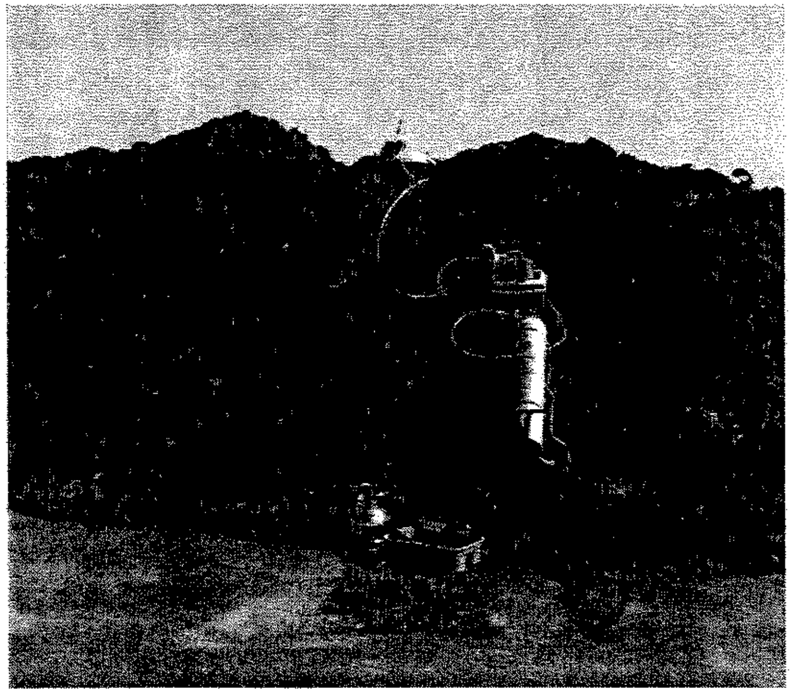


Photo 2. Example JPO In-Vessel Compost Operation.

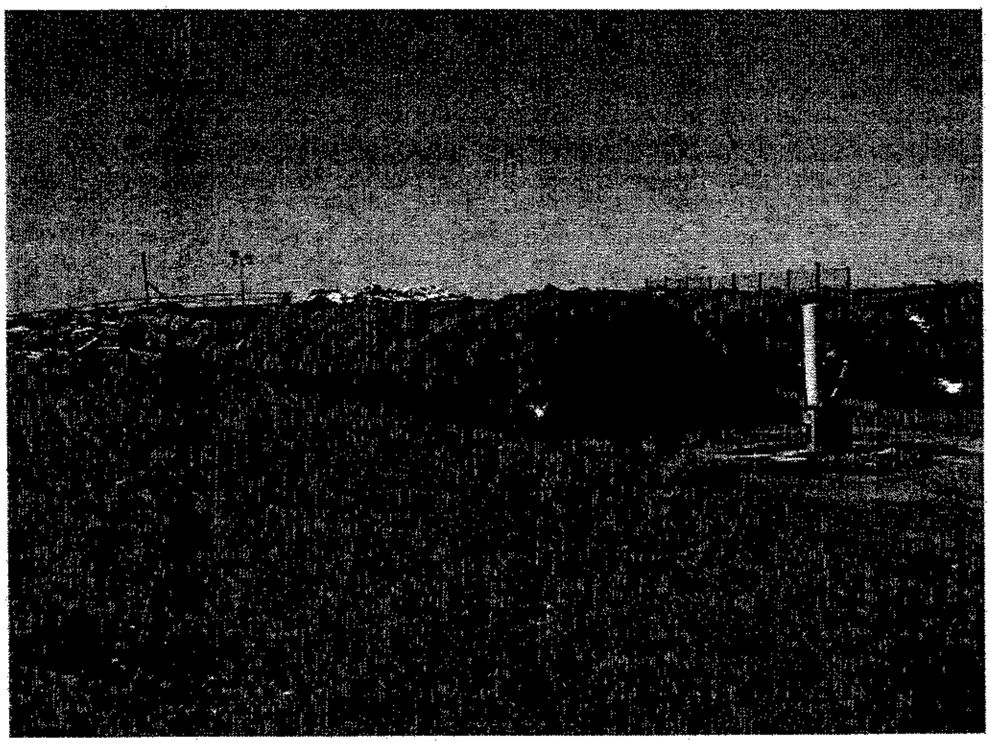
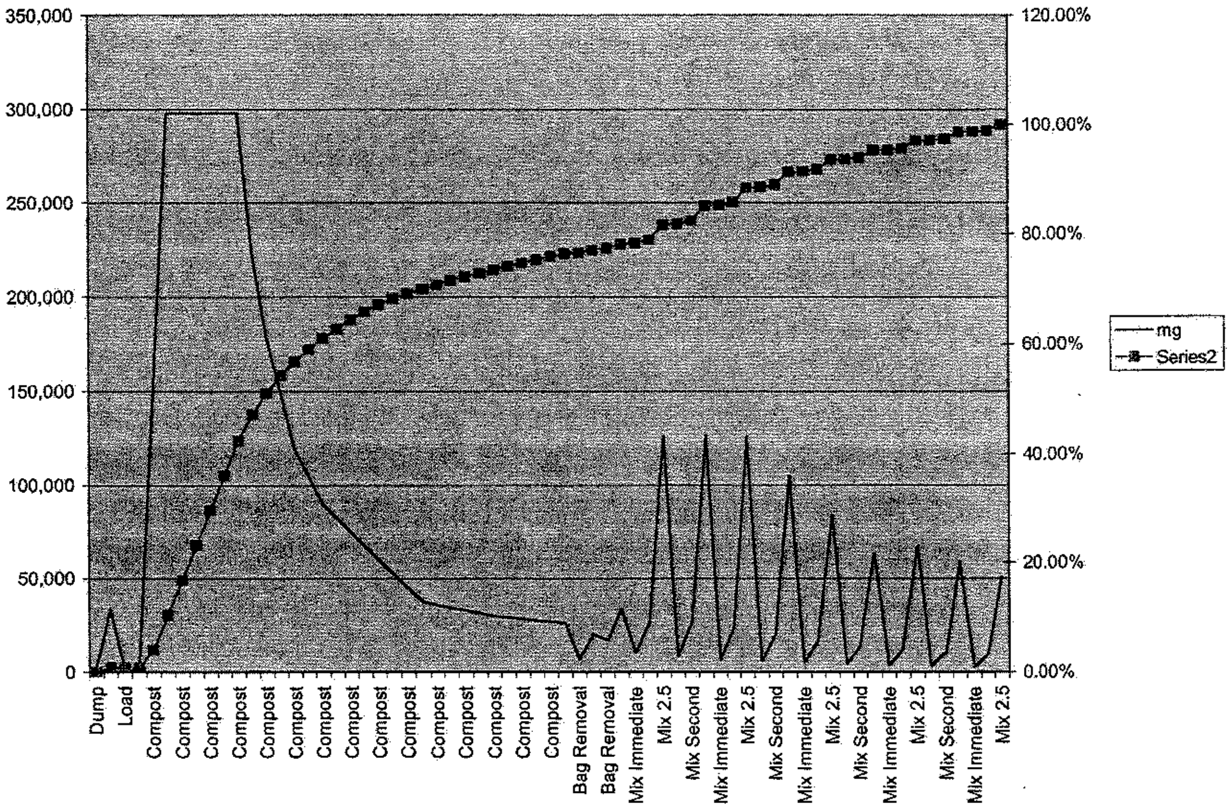


Figure 1. Simulation of Fugitive VOC Air Emissions from the In-Vessel Compost Operations.



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Note- Solid line and the y-axis represents the mass of VOC emissions. The x-axis describes components in the composting operation and is not a time scale. Series 2 line represents the cumulative emissions from all compost emission sources, that sum to 100% of the emissions in the simulation.

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Figure 2. Diagram of the Surface Emission Isolation Flux Chamber.

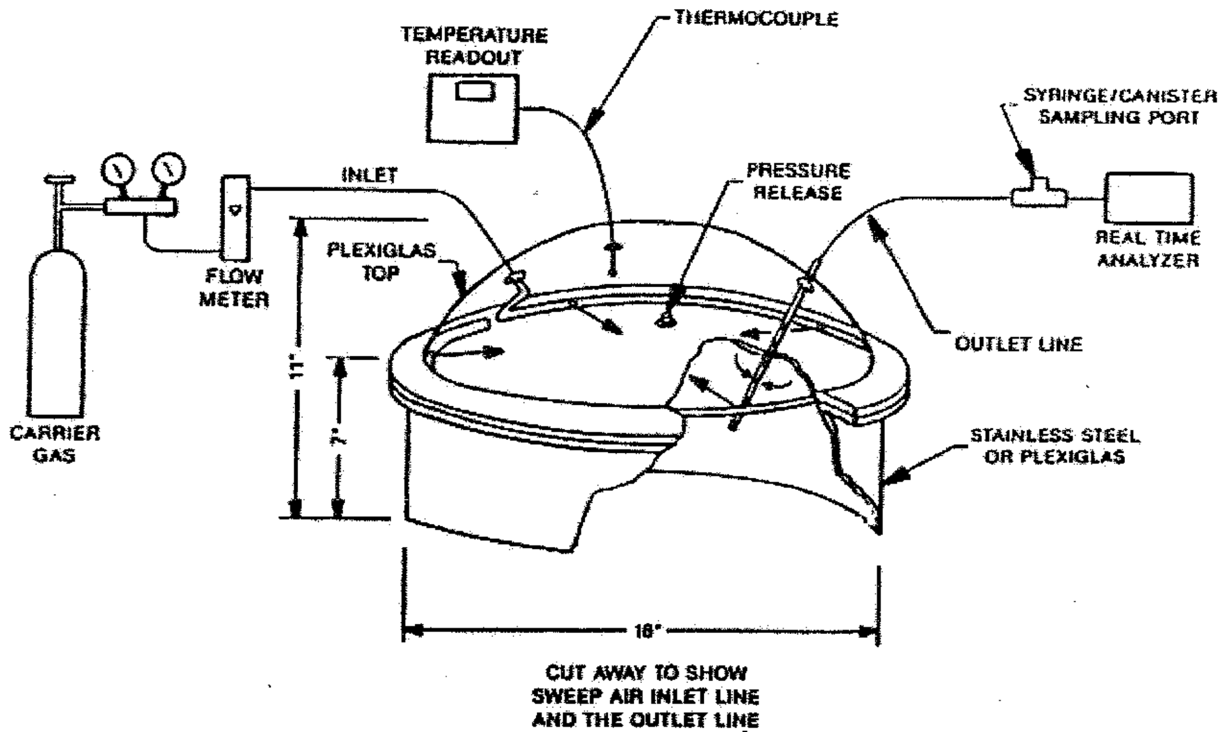

Table 1. Summary of Sample Collection Schedule for the In-Vessel Compost System.

TEST CONDITION	*Flux Chamber 25.3/ Ammonia*	*Comment*
Flux Testing on In-Vessel Compost System		**Testing of feedstock as received, placed in vessels during compost cycle, removal from vessel, and after mixing**
1- Feedstock Receipt	2	During first 24 hours of feedstock on site: pre processing in storage pile (fresh and aged). Testing will be conducted on feedstock at the same location at the time of arrival on site (hour 1) and at the same location at 24 hours (Day 0 for compost).
2- In-vessel Compost (on bag exhaust ports)	14	Two tests on compost in-vessel on Day 1, 3, 5, 7, 10, 20, and 30. Two exhaust ports will be tested on the front (blower end) of the vessel in the first one-third of the vessel, one on each lateral side.
3- Through Vessel	1	Fugitive emissions will be tested through vessel wall on Day 7 (high breakthrough potential); one location will be tested to confirm the expected low 'through vessel' wall emissions.
4- Variability within a bag	2	Test one port in the other two-thirds of the vessel by length (middle and end) on the blower side of the vessel in order to assess variability along the length of the bag; testing on Day 7 vessel.
Flux Testing on In-vessel Curing System		**Time-Dependent Curing Phase**
5- Immediate Removal from the Vessel, Day 0 Curing	1	High percentage of emissions will occur when material is removed from the vessel. Testing to be conducted on the top of material at one location.
6- Testing During Curing Phase	10	Time dependent testing on material pile during curing cycle. Testing at one location on top of curing pile at Day 3, 7, 10, 13, 19, 25, 31 after turning, and before turning on Day 3, Day 10, and Day 19. This provides for an adequate characterization of mixed and non-mixed curing

		emissions during the active curing phase
7- Screening	2	One test on curing pile pre and post-screening at nine months; data completes the curing emissions profile.
Field Blank	2	Minimum QC; approx. 5%
Field Replicate	2	Minimum QC; approx. 5%
Total	36	

Table 2. Sample Collection Schedule for the Windrow Compost System.

TEST CONDITION	***Flux Chamber 25.3/ Ammonia***	***Comment***
Flux Testing on Windrow Compost System	9 Measurements	Conduct representative flux chamber measurements: top of pile location on Day 1, Day 3, Day 5, Day 7, Day 15, Day 30, and Day 60; test an additional two locations on Day 7 at bottom and mid-height of the pile.
Field Blank	1	Minimum QC; approx. 5%
Field Replicate	1	Minimum QC; approx. 5%
Total	11	

Note- Requires 4 chambers; two modified and two standard chambers.

Table 3. Summary of Sample Management Information

Analytical Method	Sample Container	Hold Time	Preservation	Special Consider-ations	Comment
SCAQMD 25.3	6-Liter Canister	14-days	None	Wrap Valves, Ship in Cardboard	None
	4-cc Cold Trap	14-days	Store at 4 Deg C	Seal Sample Vial	None
SCAQMD 207.1	Impinger	7-days	Store at 4 Deg C	Seal Sample Vial	None

Table 4. Summary of Field Quality Control Information

Sampling Method	Activity	Frequency	Criteria	Comment
Flux Chamber	Rotometer Single-Point Calib.	Once per year	Define Rotometer Setting	None
Laboratory Blank	All media	5% for VOC and NH3	5 Times S/N Ratio	Recalibrate if Unacceptable
Laboratory Replicate	All media	5% for VOC and NH3	±30% RPD	Recalibrate If Unacceptable
Field Blank	All media	5% for VOC, NH3	None	Use As Baseline Data
Replicate Sample	All media	5% for VOC, NH3	± 50% RPD	Qualify Exceedences

Table 5. Sample Collection Schedule- Time of Day/Activity.

Test	Time	Windrow Compost	In-Vessel Compost
Day 1 Testing			
Feedstock received (hour 1)	0700-0900		1
In-Vessel, Composting; Exhaust Port, Day 1	9000-1100		2
In-Vessel, Composting; Exhaust Port, Day 3	1100-1300		2
In-Vessel, Composting; Exhaust Port, Day 5	1300-1500		2
In-Vessel, Composting; Exhaust Port, Day 7	1500-1700		2
Replicate	1500-1700		1
In-Vessel, Composting; Exhaust Port, Day 7 variability	1700-1900		2
In-Vessel, Composting; Day 7 through bag	1900-2100		1
Blank test	Any time		1
Day 2 Testing			
Feedstock received (hour 24)	0700-0900		1
In-Vessel, Composting; Exhaust Port, Day 10	0700-0900		2
In-Vessel, Composting; Exhaust Port, Day 20	0900-1100		2
In-Vessel, Composting; Exhaust Port, Day 30	0900-1100		2
Material Removal, Curing-Day 0; Immediate (hour 1) non-mixed	1100-1300		1
Replicate	1100-1300		1
Material Pile, Curing – Day 3; before and after mixing	1300-1500		2
Material Pile, Curing, Day 7; after mixing	1500-1700		1
Material Pile, Curing, Day 10; before and after mixing	1500-1700		2
Material Pile, Curing, Day	1700-1900		1

13; after mixing			
Material Pile, Curing, Day 19; before and after mixing	1700-1900		2
Material Pile, Curing, Day 25; after mixing	1900-2100		1
Material Pile, Curing, Day 31; after mixing	1900-2100		1
Blank test	Any time		1
Day 3 Testing			
Screening (9 month pile); before and after screening	0700-0900		2
Windrow Compost, Day 1 (top location)	0900-1100	1	
Windrow Compost, Day 3 (top location)	0900-1100	1	
Replicate	0900-1100	1	
Windrow Compost, Day 5 (top location)	1100-1300	1	
Windrow Compost, Day 7 (bottom, middle and top location)	1100-1300	3	
Windrow Compost, Day 15 (top location)	1300-1500	1	
Windrow Compost, Day 30 (top location)	1300-1500	1	
Windrow Compost, Day 60 (top location)	1300-1500	1	
Blank test	Any time	1	
Total		11	36

Note- Requires 4 chambers; 2 modified and 2 standard chambers.