

APPENDIX B

Draft New Rule 4566 (Composting and Related Operations)
Emission Reduction Analysis

September 22, 2010

SAN JOAQUIN VALLEY UNIFIED AIR POLLUTION CONTROL DISTRICT

I. SUMMARY

This appendix details the estimated volatile organic compounds (VOC) emissions and emission reductions for Draft New Rule 4566 (Composting and Related Operations). Draft New Rule 4566 would begin achieving emissions reductions in 2012, with full implementation starting in 2014.

In the course of rule development for Rule 4566, the District found that the total emissions inventory for the Composting-Greenwaste category is much smaller than estimated in the *2007 Ozone Plan*. However, the District also found that there is a much greater emissions reduction percentage than previously estimated. Table 1 shows the inventory and reductions from the 2007 Ozone Plan as compared to the inventory compiled during the development of Rule 4566. The actual percent reduction from the rule can be applied to the plan baseline to determine the estimated reductions as a “SIP currency” equivalent. Section III of this appendix provides more detail on these data and calculations.

TABLE 1 – Summary of Composting VOC Emissions and Emission Reductions

Year	Inventory	Estimated baseline emissions (tons/year)	Estimated emissions after control (tons/year)	Estimated VOC emission reductions (tons/year)	Percent reduction
2006	Updated, Rule 4566	6,826	--		
2012	2007 Ozone Plan	20,805	17,520	3,285	16%
	Updated, Rule 4566	6,826	NYQ	NYQ	NYQ
	<i>Revised reductions, SIP currency equivalent. Apply Rule 4566 percent reduction to 2007 Ozone Plan baseline.</i>			NYQ	
2014	2007 Ozone Plan	22,630	18,980	3,650	16%
	Updated, Rule 4566	6,826	3,245	3,581	52%
	<i>Revised reductions, SIP currency equivalent. Apply Rule 4566 percent reduction to 2007 Ozone Plan baseline.</i>			11,768 (32 tons per day)	
<i>NYQ: Not yet quantified</i>					

This appendix details the estimated volatile organic compounds (VOC) emissions and emission reductions for Draft New Rule 4566 (Composting and Related Operations). The 2007 Ozone Plan estimated an emission reduction for the Composting Green Waste (S-GOV-5) control measure of 3,285 tons per year (9 tons per day) from the 2012 emissions baseline of 20,805 tons of VOC per year (57 tons per day). This equates to a VOC emission reduction of 16% from the planning baseline, upon final implementation of the rule requirements.

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The following estimates are based on the best available information at the time that this report was written. Table 1 summarizes the results of the detailed calculations, which are shown in Section III of this appendix.

TABLE 1 – Summary of Emissions and Emission Reductions

Operation Category	Estimated Current Emissions (tons/year)	Estimated Emissions After Control (tons/year)	Estimated VOC Emission Reductions (tons/year)
Composting	6,826	3,245	3,581

Based on this data, District staff estimates emission reductions of approximately 3,581 tons per year (tpy) or a reduction of 52% of the baseline VOC emissions. When the 2006 emission inventory baseline reductions (overall of 52%) are applied to the 2014 Ozone Plan baseline emissions, the equivalent reduction is 32 tons per day by the time that this rule is fully implemented.

II. INTRODUCTION

The purpose of Draft New Rule 4566 is to control VOC emissions from composting operations of organic materials and to minimize inadvertent decomposition from related operations. This rule applies to facilities involved with the composting or stockpiling of organic materials. Section 4.0 of the draft rule identifies the operations and facilities which will be exempt from the requirements of this rule. As the draft rule is currently written, operators would be required to control the VOC emissions from their organic material stockpiles and composting piles. Operators will have the option to utilize the rule-required control measures or an alternative control measures that demonstrates equivalent VOC emission reductions. For this emissions reduction analysis, the breakdown of carbon-based chemicals by microorganisms in the organic material is the source of VOC emissions. Section III of this appendix details the calculations for the estimated emissions and emission reductions.

III. EMISSION REDUCTION ANALYSIS

A. Throughput Calculations

Throughout the rulemaking process, District staff has researched and acquired available data for the organic material throughput for green material facilities. District staff has also involved participants in this process to obtain the best estimates for the amount of organic material that is generated in and imported into the SJVAB for the 2006 source inventory. Staff will continue to refine the analysis as new information and data becomes available during the rule development process.

In November 2007, the District distributed applications to all organic material processing facilities within the SJVAB to determine permit status. The completed and returned applications were used to refine the source inventory for a more accurate analysis.

An inventory was obtained for organic material composting. District staff reviewed and considered the following sources during the analysis:

- CalRecycle (formerly California Integrated Waste Management Board (CIWMB)) Solid Waste Information System (SWIS) (available online at <http://www.calrecycle.ca.gov/SWFacilities/Directory/>)
- Lists of green material facilities, submitted by CalRecycle in November 2007 and January 2008
- Public comment letters
- Stakeholders' comments and facility information
- The District Permit to Operate database
- Completed PTO applications

The following table shows a list of the organic material composting facilities that are likely to be impacted by the draft rule. An estimated throughput (for both potential and actual) of each facility is provided in Table 2. For the purpose of this rule development project, District staff used the actual throughput to conduct the emissions analysis. The potential throughput is the maximum permitted throughput and is used for the permitting process through the District's Permit Services Department. Some composting facilities that are currently operating and are not listed in Table 2 are considered co-composting facilities and are already subject to District Rule 4565 requirements.

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Table 2: Composting Facilities Organic Material Throughputs

SWIS #	Potential Throughputs ¹ (Tons/Year)	Actual Throughputs ² (Tons/Year)
10-AA-0182	169,290	101,546
15-AA-0307	1,347,580	510,672
15-AA-0311	356,240	205,001
16-AA-0016*	32,850	22,835
16-AA-0022	312,000	105,839
24-AA-0020	25,000	23,000
24-AA-0029	8,325	7,000
24-AA-0033	12,500	2,200
39-AA-0024	53,976	9,118
39-AA-0026	75,000	11,973
39-AA-0037	21,900	3,000
50-AA-0016	171,915	70,439
50-AA-0018	130,000	66,000
50-AA-0020	730,000	157,060
54-AA-0026	156,000	68,894
54-AA-0028	124,800	29,000
TOTAL	3,727,376	1,393,577

1. Potential Throughputs: maximum from CalRecycle Solid Waste Information System

2. Actual Throughputs: revised estimate from PTO forms, comments letters, and operators

*Facility Number 16-AA-0016 has ceased to compost at this time. Since the throughput is part of the 2006 emissions inventory, District staff will incorporate the throughput from this facility.

The revised estimates from Table 2 were used to determine the emissions and emissions reduction for composting facilities.

B. Emission Factors Used

In May 2008, the District hired a consultant to review and analyze all available emissions factors from several source tests for green material composting. An emission factor analysis report was released for public review in July 2008. The District has considered all public comments regarding the report and will present the revised emission factors in the District's preliminary Green Waste Compost Report which will be released at a later date.

The District has not identified relevant emission factors for uncontrolled food material composting. Source tests from controlled composting operations have yielded emission factors ranging from 3.4 lb VOC per ton food material composted (micropore cover) to 37.1 lb VOC per ton food material composted (Ag Bag). In addition to the wide range of values observed, it is also unlikely that emissions from a covered system would accurately represent emissions from the open windrow commonly used by facilities in the District. This is because covered systems offer many process control advantages,

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including weather protection and water retention. For these reasons, the District will use the green material composting emission factors as determined in the preliminary Green Waste Compost Report to represent this feed stock until a more representative emission factor can be identified.

The District has not identified relevant emission factors for pomace composting. Pomace can contain VOC-containing liquids, not found in normal green material, that may be released during stockpiling or composting. The District will use the green material composting emission factors as determined in the preliminary Green Waste Compost Report to represent this feed stock until a more representative emission factor can be identified.

District staff recently released the San Joaquin Valley Air Pollution Control District's Composting VOC Emission Factors report, which presents the emission factors that the District will use for permitting and rule development purposes. The emission factors used for all calculations are presented in Table 3, below. The emission factors presented are subject to revision should additional information become available.

Process Type	Stockpile EF (lb/ton received)	Active Phase Windrow Composting EF (lb/ton processed)	Curing Phase Windrow Composting EF (lb/ton processed)	Total EF (lb/ton processed)
Green Material, Food Material, and Pomace	4.09 (Wt. Avg.) (1.063 lb/ton/day)	5.14	0.57	9.80

C. Emission Reduction Efficiencies Used

For this analysis, District staff reviewed the results from the 2009 compost field study conducted by the San Diego State University Research Foundation to determine the emission reduction efficiencies. The field study assessed feasibility and effectiveness of VOC emission reductions of four mitigation measures. The two most effective mitigation measures identified in the field study were used for this analysis as listed below:

- **Additional Irrigation:** Consists of utilizing a sprinkler system to apply water to the active phase composting pile before turning to provide a resulting VOC reduction efficiency of at least 24% by weight only to the active phase composting piles.
- **Finished Compost Cover:** Consists of utilizing at least a 6 inch layer of finished compost to be placed on top of the active phase composting piles to provide a resulting VOC reduction efficiency of at least 53% by weight to the active and curing phase composting piles.

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The stockpile VOC emission reduction efficiency was estimated from the above facilities typical stockpile storage times and the proposed rule required maximum three-day stockpile storage time. The resulting VOC emission reduction efficiency will be used for this analysis as listed below:

- **Maximum Three-Day Stockpile Storage Time:** Consists of processing and placing the stockpiled organic materials in the active phase windrow piles within three days of receipt or covering each stockpile with at least 6 inches of finished compost within three days of receipt. This option will provide a significant emission reduction for large composting facilities (facilities with an organic material receiving volume of $\geq 25,000$ tpy) and for medium composting facilities (facilities with an organic material receiving volume of $< 25,000$ tpy and $\geq 10,000$ tpy).

D. Emissions and Reductions Calculations

In performing the analyses, several assumptions were made to estimate the emission reductions. These include:

- All of the existing composting facilities would implement the proposed VOC emission reduction control methods or an equivalent alternative mitigation measure, based on the facility throughput limit.
- Large facilities are facilities with an organic material receiving volume of greater than or equal to 25,000 tpy. Emission reductions are based on utilizing the above finished compost cover and the maximum three-day stockpile storage time mitigation measures.
- Medium facilities are facilities with an organic material receiving volume of less than 25,000 tpy and greater than or equal to 10,000 tpy. Emission reductions are based on utilizing the above additional irrigation mitigation measure and the maximum three-day stockpile storage time mitigation measures.
- Small facilities are facilities with an organic material receiving volume of less than 10,000 tpy. No additional emission reductions are proposed for these facilities at this time.

Composting Operations

With the throughput information from the District's PTO application forms, staff calculated the estimated actual VOC emissions using the following equations:

$$\text{Actual Stockpile VOC Emissions (tpy)} = \frac{[\text{Throughput (tpy)} \times \text{Stockpile Storage Time (days)} \times \text{Stockpile EF (lb/ton/day)}]}{2,000 \text{ lb/ton}}$$

$$\text{Actual Windrow VOC Emissions (tpy)} = \frac{[\text{Throughput (tpy)} \times (\text{Active Phase Windrow EF (lb/ton)} + \text{Curing Phase Windrow EF (lb/ton)})]}{2,000 \text{ lb/ton}}$$

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$$\text{Total Current VOC Emissions (tpy)} = \text{Actual Stockpile VOC Emissions (tpy)} + \text{Actual Windrow VOC Emissions (tpy)}$$

Where: Throughput = Facility throughput in tons per year
 Stockpile Storage Time = Facility stated stockpile storage time in days.
 Stockpile EF = 1.063 lb/ton/day
 Active Phase Windrow EF = 5.14 lb/ton
 Curing Phase Windrow EF = 0.57 lb/ton
 2,000 lb/ton = Conversion factor

The VOC emissions resulting from the mitigation measures identified in Section III.C. above will be calculated using the following equation:

$$\text{Stockpile Emissions After Reductions (tpy)} = [\text{Throughput (tpy)} \times \text{3-day Stockpile Storage Time} \times \text{Stockpile EF (lb/ton/day)}] \div 2,000 \text{ lb/ton}$$

$$\text{Active Phase Emissions After Reductions (tpy)} = [\text{Throughput (tpy)} \times (\text{Active Phase EF (lb/ton)} \times (1 - \text{CE}))] \div 2,000 \text{ lb/ton}$$

$$\text{Curing Phase Emissions After Reductions (tpy)} = [\text{Throughput (tpy)} \times (\text{Curing Phase EF (lb/ton)} \times (1 - \text{CE}))] \div 2,000 \text{ lb/ton}$$

$$\text{Total Emissions After Reductions (tpy)} = \text{Stockpile Emissions After Reductions (tpy)} + \text{Active Phase Emissions After Reductions (tpy)} + \text{Curing Phase Emissions After Reductions (tpy)}$$

Where: Throughput = Facility throughput in tons per year
 Stockpile EF = 1.063 lb/ton/day
 Active Phase Windrow EF = 5.14 lb/ton
 Curing Phase Windrow EF = 0.57 lb/ton
 CE = Percentage reductions from the mitigation measure.
 2,000 lb/ton = Conversion factor

Table 4 shows the estimated current VOC emissions from composting facilities within the District.

Table 4: Total Current VOC Emissions from Composting						
Throughput Classification	Number of Facilities	Estimated Throughput (tpy)	Stockpile Emissions (tpy)	Active-Phase Emissions (tpy)	Curing-Phase Emissions (tpy)	Total Current Emissions (tpy)
< 10,000 tpy	4	21,318	26	55	6	87
≥ 10,000 tpy & < 25,000 tpy	3	57,808	179	149	16	344
≥ 25,000 tpy	9	1,314,451	2,644	3,376	375	6,395
Total	16	1,393,577	2,849	3,580	397	6,826

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Table 5 shows the estimated VOC emissions after reductions from composting facilities within the District.

Table 5: Total VOC Emission After Reductions from Composting						
Throughput Classification	Number of Facilities	Estimated Throughput (tpy)	Stockpile Emissions (tpy)	Active-Phase Emissions (tpy)	Curing-Phase Emissions (tpy)	Total Emissions After Reductions (tpy)
< 10,000 tpy	4	21,318	26 (No Control)	55 (No Control)	6 (No Control)	87
≥ 10,000 tpy & < 25,000 tpy	3	57,808	92 (Control)	113 (24% Control)	16 (No Control)	221
≥ 25,000 tpy	9	1,314,451	1173 (Control)	1,588 (53% Control)	176 (53% Control*)	2,937
Total	16	1,393,577	1,291	1,756	198	3,245

* Although the rule does not require a finished compost cover or other control during the curing phase, the 53% control factor for the finished compost cover was based on total composting emissions, not just those of the active composting phase.

The total estimated composting emission reductions are the following:

$$\begin{aligned}
 \text{Estimated VOC Emission Reductions} &= \text{Total Current VOC Emissions (tpy)} \\
 &\quad - \text{Total VOC Emissions After Reduction (tpy)} \\
 &= 6,826 \text{ tpy} - 3,245 \text{ tpy} \\
 &= \mathbf{3,581 \text{ tpy}}
 \end{aligned}$$

District staff estimates that current VOC emissions from current composting facilities are about 6,826 tons per year. After full rule implementation, the current facilities will emit about 3,245 tons per year of VOCs for an estimated VOC emission reduction of about 3,581 tons per year or 52%.

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