Title V Permit Evaluation

Site Number: A2266
Site Name: **Browning Ferris Industries of CA, Inc.**
Site Address: 12310 San Mateo Road, Half Moon Bay, CA 94019

Background:

The Browning Ferris Industries (BFI) Ox Mountain Landfill (S-1) is subject to the federal New Source Performance Standards (NSPS) for Municipal Solid Waste Landfills (40 CFR Part 60, Subpart WWW), because the design capacity of the landfill was expanded to 37.9 million cubic yards in 1992. Subject landfills that underwent design capacity modifications between May 30, 1991 and March 12, 1996 were required to comply with all applicable NSPS requirements as of December 10, 1998.

Periodic Monitoring:

Summary Table(s)

The tables below contain only the federally enforceable emission limits for which there is no monitoring.

Lead: S-1

S# & Description	Federally Enforceable Emission Limit Citation	Federally Enforceable Emission Limit	Potential to Emit: tpy	Monitoring
S-1 Ox Mountain Sanitary Landfill	BAAQMD 11-1-302	Ground level concentration $\leq$ 1.0 $\mu g/m^3$ averaged over 24 hours	0.018 TPY of lead	Not Recommended

Organic Compounds: S-5

S# & Description	Federally Enforceable Emission Limit Citation	Federally Enforceable Emission Limit	Potential to Emit: tpy	Monitoring
S-5 Non-Retail Gasoline Dispensing Facility	SIP 8-7-301.2	Phase I Systems Shall Recover ≥ 95% of Gasoline Vapors, During Bulk Loading Events	0.305 TPY of POC	Not Recommended
S-5 Non-Retail Gasoline Dispensing Facility	SIP 8-7-312	Vapor Recovery System Shall Recover ≥ 95% of Gasoline Vapors, When Gasoline is Transferred from Tanks to Delivery Vehicles	0.305 TPY of POC	Not Recommended

Particulate Matter: S-13

S# & Description	Federally Enforceable Emission Limit Citation	Federally Enforceable Emission Limit	Potential to Emit: tpy	Monitoring
S-13 Tub Grinder and Conveyor	BAAQMD 6-311	For Process Throughput, P < 57,320 pounds/hour, the Emission Limit (E, pound/hour) is: E = 0.026*P^0.67 For P ≥ 57,320 pounds/hour, E = 40 pounds/hour	5.023 TPY of PM_{10}	Not Recommended

Particulate Matter: S-14

S# & Description	Federally Enforceable Emission Limit Citation	Federally Enforceable Emission Limit	Potential to Emit: tpy	Monitoring
S-14 Diesel Engine for S-13 Tub Grinder	BAAQMD Permit Condition # 16317, Part 6	0.15 grains/dscf	0.392 TPY of PM_{10}	Not Recommended

Sulfur Dioxide: S-14

S# & Description	Federally Enforceable Emission Limit Citation	Federally Enforceable Emission Limit	Potential to Emit: tpy	Monitoring
S-14 Diesel Engine for S-13 Tub Grinder	BAAQMD 9-1-301	Property Line Ground Level Limits: $\leq$ 0.50 ppm for 3 minutes $\leq$ 0.25 ppm for 60 minutes $\leq$ 0.05 ppm for 24 hours	0.243 TPY of SO_2	Not Recommended

Particulate Matter: A-4, A-5, A-6

S# & Description	Federally Enforceable Emission Limit Citation	Federally Enforceable Emission Limit	Potential to Emit: tpy	Monitoring
A-4, A-5, and A-6 Landfill Gas Flares	BAAQMD 6-310	0.15 grains/dscf	A-4: 2.234 TPY of PM_{10} A-5: 4.468 TPY of PM_{10} A-6: 9.382 TPY of PM_{10}	Not Recommended

Sulfur Dioxide: A-4, A-6, and A-6

S# & Description	Federally Enforceable Emission Limit Citation	Federally Enforceable Emission Limit	Potential to Emit: tpy	Monitoring
A-4, A-5, and A-6 Landfill Gas Flares	BAAQMD 9-1-301	Property Line Ground Level Limits: $\leq$ 0.50 ppm for 3 minutes $\leq$ 0.25 ppm for 60 minutes $\leq$ 0.05 ppm for 24 hours	A-4: 4.449 TPY of PM_{10} A-5: 8.898 TPY of PM_{10} A-6: 18.686 TPY of PM_{10}	Not Recommended

Discussion

S-1: Ox Mountain Sanitary Landfill

Lead: The Ox Mountain Sanitary Landfill is allowed to accept and dispose of non-hazardous contaminated soil. The soil may also be used as cover material provided that it does not contain more than 50 ppmv of total volatile organic compounds. The contaminated soil is considered non-hazardous if it contains no more than the threshold limit values for various metals and other compounds. The maximum allowable concentration for lead is 350 ppmw. Fugitive particulate matter emissions containing small amounts of lead will occur due to the handling and disposal of this contaminated soil and due to wind erosion when such soil is used as cover material. Since all lead emissions are fugitive, the landfill is not subject to the BAAQMD Regulation 11-1-301 lead emission limit of 15 pounds per day for emission points. However, the landfill is subject to the BAAQMD Regulation 11-1-302 ground level concentration limit of 1.0 $\mu g/m^3$ averaged over 24 hours.

Worst case lead emissions were calculated using AP-42 emission factor equations (see attached) and by assuming that all soil used as cover contained lead at the maximum allowable concentration. Even with these overly conservative assumptions, lead emissions were determined to be no more than 0.10 pounds/day. This emission rate is 150 times lower than the emission point standard and occurs over a very wide area (50,000 ft^2). Lead concentrations in the immediate vicinity of the daily cover operations are expected to be well below the lead concentration standard. Due to the long distances between the cover operations and the property line, lead concentrations at the property line are never expected to exceed the lead concentration limit and are likely to be non-detectable. Therefore, monitoring for lead is not recommended.

S-5: Non-Retail Gasoline Dispensing Facility

POC: The S-5 Non-Retail GDF includes a 1000 gallon above ground storage tank and one gasoline dispensing nozzle. The tank is equipped with a pressure-vacuum valve set at 8 inches of water vacuum and 2.5 inches of water pressure. All bulk loading operations are required to have Phase I control operating at 95% removal efficiency. All vehicle refueling events are required to have Phase II control certified to meet 95% removal efficiency. Maximum potential emissions from S-5 (as equipped) are 0.305 tons/year of POC. Note that the maximum permitted throughput rate for this tank is much higher than actual annual throughput rates. Actual emissions from S-5 are expected to be less than 80 pounds/year.

BFI is required to perform a vapor tightness test on the entire system (the tank, nozzle, vent valves, Phase I and II controls) each year. Although this test does not measure Phase I control efficiency directly, it is designed to reveal any equipment defects or leaks that would reduce the control efficiency of the valves or Phase I or II controls. Since the maximum potential POC emissions from S-5 are insignificant, additional monitoring for vapor control efficiency during bulk loading events (transferring gasoline from either a cargo tank to the storage tank or from the storage tank to a cargo tank) would not be appropriate.

S-13: Tub Grinder and Conveyor

PM: Maximum potential emissions from S-13 are 8.61 pounds/hour of TSP and PM_{10} and 5.023 tons/year of TSP and PM_{10}. As noted in the Emission Calculations section, these maximum potential emissions are based on very conservative emission factors. Using more realistic emission estimates for tub grinding operations, actual emissions are likely to be less than 20% of the maximum potential emissions discussed above.

From Regulation 6-311, the allowable emissions range from 12.4 pounds/hour at the lowest expected processing rate to 40 pounds/hour at the maximum processing rate. Maximum potential emissions from S-13 are well below the allowable emissions, with a margin of compliance ratio ranging from 4.65 to 1.0 (at the maximum processing rate) to more than 17 to 1 (at the lowest expected processing rate). Using more realistic emission estimates, the ratio of allowable emissions to expected emissions is greater than 27 to 1. Since the margin of compliance with the Regulation 6-311 limit is expected to be very high, it would not be appropriate to add periodic monitoring to demonstrate compliance with this limit.

S-14: Diesel Engine for S-13 Tub Grinder

PM: Maximum potential emissions from S-14 are 0.392 tons/year of PM_{10}. Regulation 6-310 limits PM emissions to 0.15 grains/dscf in the exhaust from S-14. As described in the Emission Calculations section, the compliance margin with this limit is 2.4 to 1 at the minimum exhaust rate from S-14. The compliance margin increases to 5.7 to 1 and higher for more typical exhaust rates (based on oxygen concentrations in the exhaust of 12% or more). Due to the variability of the engine loads under normal operating conditions, it is very difficult and expensive to accurately test for PM emissions in the field at diesel engines such as S-14. Although the compliance margin with the Regulation 6-310 limit is not very high, periodic monitoring for compliance this limit would not be appropriate for S-14 because particulate emissions from S-14 are insignificant and source testing for PM emissions in the field would be difficult.

SO_2: Maximum potential sulfur dioxide (SO_2) emissions from S-14 are 0.243 tons/year of SO_2. Regulation 9-1-304 limits the sulfur content in liquid fuels to 0.5% by weight. Sources complying with this limit are not expected to result in property line ground level concentrations that are in excess of the limits specified in Regulation 9-1-301. The S-14 Diesel Engine is required by BAAQMD Permit Condition #16317, Part 2 to use only low sulfur diesel fuel, which contains less than 0.05% sulfur (<10% of the 9-1-304 limit). Therefore, the margin of compliance with the ground level concentration limits listed in Regulation 9-1-301 is expected to be very high. Since the compliance margin is high and SO_2 emissions from S-14 are insignificant, periodic monitoring for ground level SO_2 concentrations would not be appropriate.

A-4, A-5, and A-6: Landfill Gas Flares

PM: Particulate emissions from enclosed ground flares burning landfill gas are expected to be similar to flares burning natural gas. As with natural gas combustion, visible emissions are not normally associated with the proper combustion of landfill gas in an enclosed ground flare. Therefore, periodic monitoring for Ringelmann limits would not be appropriate for these flares.

Using the AP-42 emission factor for landfill gas combustion in a flare and a worst case landfill gas heat content of 450 BTU/scf, the particulate emission rate from each of the flares is expected to be 0.012 gr/dscf at 0% oxygen. The BAAQMD Regulation 6-310 of 0.15 gr/dscf is far above any expected PM emissions. It would therefore not be appropriate to add periodic monitoring for this standard.

SO_2: The concentration of total reduced sulfur compounds (TRS) in this facility's landfill gas is limited to 92 ppmv expressed as H_2S by BAAQMD Permit Condition #10164, Part 18. At this limit, the maximum concentration of SO_2 in the exhaust from a flare is 21 ppmv. Regulation 9-1-302 limits sulfur dioxide emissions to 300 ppmv of SO_2 in the flare exhaust. Sources complying with the Regulation 9-1-302 limit are not expected to exceed the ground level concentration limits listed in BAAQMD Regulation 9-1-301. Since the maximum SO_2 emissions from these flares will be well below the Regulation 9-1-302 limit, these flares are expected to have a high margin of compliance with the Regulation 9-1-301 limits. Monitoring for ground level SO_2 concentrations in addition to the proposed landfill gas monitoring for TRS content would not be appropriate for such low levels of SO_2 emissions.

Permit Shield:

No permit shield was requested.

Alternate Operating Scenario:

No alternative operating scenarios were requested, and none have been included in the proposed permit.

Compliance Status:

Browning Ferris Industries of CA, Inc. certified that all equipment was operating in compliance on March 6, 1997. No unresolved non-compliance issues have been identified to date. A detailed Compliance Report is attached.

Alignment of Information in Application and Proposed Permit:

In their application, BFI identified numerous applicable requirements for the Ox Mountain Sanitary Landfill (S-1) and Landfill Gas Flares (A-4, A-5, and A-6). The District agrees that the District and federal regulations identified by BFI are applicable to S-1. However, the District has identified several other regulations with specific applicable requirements including: BAAQMD Regulation 1; Regulation 8, Rule 2; Regulation 11, Rules 1, 2, 3, and 14; and 40 CFR Part 60, Subpart A.

BFI stated in their application that the above ground gasoline storage tank was subject to BAAQMD Regulation 8, Rule 5. This tank is part of the S-5 Non-Retail Gasoline Dispensing Facility. S-5 is also subject to Regulation 8, Rule 7; Permit Condition #7523; and CARB Executive Order G-70-116-F.

For the S-12 Stockpile of Green Waste, BFI indicated that BAAQMD Regulation 6, Sections 301 and 311 and BAAQMD Permit Condition #10328 were the only applicable requirements. The District has indicated that Regulation 6, Sections 305 and 401 are also applicable but Section 311 is not applicable. In addition, Permit Condition #10328 has been superceded by Permit Condition # 16315.

When this application was submitted, the Tub Grinder and Engine were considered a single source number (S-13). BFI indicated that S-13 was subject to BAAQMD Regulation 6-301; Regulation 9, Rule 1, Sections 301 and 302; and Permit Condition #10328. This equipment has now been split into two source numbers (S-13 Tub Grinder and Conveyor and S-14 Diesel Engine for the S-13 Tub Grinder). The District has indicated that S-13 is subject to Regulation 6, Sections 305, 311, and 401, in addition to Section 301. For S-13, Permit Condition #16316 has superceded Permit Condition #10328. For S-14, the District has indicated that S-14 is subject to Regulation 6, Sections 305, 310, and 401, in addition to Section 301. For Regulation 9, Rule 1, the District agrees that Section 301 is applicable to S-14. However, the District has indicated that Section 304 is applicable to S-14 instead of Section 302. Also, BAAQMD Permit Condition #16317 has superceded Permit Condition #10328 for S-14.

Emission Calculations:

<u>Lead: S-1</u>

The spreadsheet on the following page summarizes the worst case lead emission rate from the S-1 Ox Mountain Sanitary Landfill due to due to on-site handling and disposal of lead contaminated soil. The tables and equations on pages 9 and 10 show the detailed calculation procedures used to arrive at the Stockpiling and Truck Transfer Emissions and the Wind Erosion Emissions, respectively.

Lead Emissions due to Handling and Disposal of Lead Contaminated Soil At Landfills

Worst Case PM Emissions	Pounds/Year		PM Emissions after Control	Pounds/Year	
	TSP	PM10		TSP	PM10
Stockpiling and Truck Transfers	749	354	Stockpiling and Truck Transfers	41	19
Wind Erosion	106172	53086	Wind Erosion	25099	12549
Total PM Emissions	106921	53440	Total PM Emissions	25139	12569
Worst Case Lead Emissions	Pounds/Year		Lead Emissions after Control	Pounds/Year	
	TSP	PM10		TSP	PM10
Stockpiling and Truck Transfers	0.26	0.12	Stockpiling and Truck Transfers	0.01	0.01
Wind Errosion	37.16	18.58	Wind Errosion	8.78	4.39
Total Annual Lead Emissions	37.42	18.70	Total Annual Lead Emissions	8.80	4.40
	Pounds/Day			Pounds/Day	
Total Daily Lead Emissions	0.10	0.05	Total Daily Lead Emissions	0.02	0.01

Above emissions are based on worst case assumptions for all equation variables and are therefore expected to be an over-estimate of emissions.

Above emissions are based on the use of regular watering to control dust emissions.

Lead Concentration Estimate: (0.10 lbs/day)/(24 hours/day)/(2 miles/hour)/(5280 feet/mile)/(50000 ft^2)*(35.315 ft^3/m^3)*(4.536E8 µg/lb)

$0.13 \mu g/m^3$

Particulate Emissions Due to Stockpiling and Truck Loading

From AP-42 Chapter 13.2.4 Aggregate Handling and Storage Piles
Emission Factor Equation (1) for Each Material Transfer, page 13.2.4-3

E = k * (0.0032) * (U/5)^1.3 / (M/2)^1.4 = lbs particulates / ton transferred

Worst Case Emissions:

	Particle Size				
	< 30 µm	< 15 µm	< 10 µm	< 5 µm	< 2.5 µm
K, particle size multiplier	0.74	0.48	0.35	0.20	0.11
U, wind speed, mph [1]	15	15	15	15	15
M, moisture content % [2]	0.25	0.25	0.25	0.25	0.25
E, emission factor, lbs/ton	0.1815	0.1178	0.0859	0.0491	0.0270
Soil Transferred, tons	2063	2063	2063	2063	2063
Max. Lead Concentration in Soil, (ppmw)	350	350	350	350	350
PM Emissions/Transfer	374.4	242.9	177.1	101.2	55.7
Number of Transfers (to stockpile, to truck)	2	2	2	2	2
PM Emissions due to Transfers, pounds	748.8	485.7	354.2	202.4	111.3
Lead Emissions due to Transfers, pounds	0.262	0.170	0.124	0.071	0.039

1. The applicable wind speed range for the above equation is 1.3 mph to 15 mph. The highest of the applicable range was used to obtain worst case emissions.
2. The applicable moisture range for the above equations is 0.25% to 4.8%. The lowest of the applicable range was used to obtain worst case emissions.

Typical Emissions:

	Particle Size				
	< 30 µm	< 15 µm	< 10 µm	< 5 µm	< 2.5 µm
K, particle size multiplier	0.74	0.48	0.35	0.20	0.11
U, wind speed, mph [1]	15	15	15	15	15
M, moisture content % [2]	2	2	2	2	2
E, emission factor, lbs/ton	0.0099	0.0064	0.0047	0.0027	0.0015
Soil Transferred, tons	2063	2063	2063	2063	2063
Max. Lead Concentration in Soil, (ppmw)	350	350	350	350	350
PM Emissions/Transfer	20.4	13.2	9.6	5.5	3.0
Number of Transfers (to stockpile, to truck)	2	2	2	2	2
PM Emissions due to Transfers, pounds	40.7	26.4	19.3	11.0	6.1
Lead Emissions due to Transfers, pounds	0.014	0.009	0.007	0.004	0.002

1. The applicable wind speed range for the above equation is 1.3 mph to 15 mph. The highest of the applicable range was used to obtain worst case emissions.
2. The applicable moisture range for the above equations is 0.25% to 4.8%. An average soil moisture content of 2% was assumed, because the operator will use regular watering to control dust emissions.

E = emission factor, g/m^2
k = particle size multiplier
N = number of disturbances per year
P_i = erosion potential, g/m^2
u* = fiction velocity, m/s
u_t* = threshold friction velocity, m/s From Tables 13.2.5-1 and 13.2.5-2, u_t* ranges from 0.43 to 1.33 m/s.
u_{10}^+ = fastest mile of wind, m/s, at reference anemometer height of 10 m. Assume u_{10}^+ = 40 mph (17.88 m/s)

$$u^* = 0.053 * u_{10}^+$$

$$P_i = 58*(u^* - u_t^*)^2 + 25*(u^* - u_t^*)$$

$$E = k * \sum_{i=1}^{N} P_i$$

u_{10}^+ = 17.88
u* = 0.95
u_t* = 0.43 (worst case)
P_i = 28.48
N = 364 (7 days/week, 52 weeks/year)

	Particle Size				
	< 30 µm	< 15 µm	< 10 µm	< 2.5 µm	
K =	1.0	0.6	0.5	0.2	
E =	10367.51	6220.51	5183.75	2073.50	
Area, m^2	4645	4645	4645	4645	(assume 50,000 ft^2)
PM Emissions					
grams/year	48158656	28895193	24079328	9631731	
pounds/year	106172	63703	53086	21234	
Lead Emissions					
ppmw in soil	350	350	350	350	
pounds/year	37.160	22.296	18.580	7.432	

u_{10}^+ = 17.88
u* = 0.95
u_t* = 0.76 (estimate for watered soil)
P_i = 6.73
N = 364 (7 days/week, 52 weeks/year)

	Particle Size				
	< 30 µm	< 15 µm	< 10 µm	< 2.5 µm	
K =	1.0	0.6	0.5	0.2	
E =	2450.85	1470.51	1225.43	490.17	
Area, m^2	4645	4645	4645	4645	(assume 50,000 ft2)
PM Emissions					
grams/year	11384578	6830747	5692289	2276916	
pounds/year	25099	15059	12549	5020	
Lead Emissions					
ppmw in soil	350	350	350	350	
pounds/year	8.785	5.271	4.392	1.757	

Organic Compounds: S-5

The California Air Pollution Control Officers' Association (CAPCOA) has developed emission factors for Gasoline Dispensing Facilities (GDFs) that the BAAQMD uses for all evaluations. From the 1997 "CAPCOA Gasoline Service Station Industry-Wide Risk Assessment Guidelines", the emission factors for a GDF with an above ground storage tank equipped with vent valves and employing Phase I and Phase II controls are as follows:

Tank Filling Losses (with Phase I):	0.420 pounds/M gallon (assumes 95% control)
Tank Breathing Losses (with vent valves):	0.053 pounds/M gallon (assumes 75% control)
Vehicle Refueling Losses (with Phase II):	0.630 pounds/M gallon (assumes 90% control)
Spillage:	0.420 pounds/M gallon (assumes 0% control)
Total Emission Factor (S-5 as equipped):	1.523 pounds/M gallon transferred

The maximum permitted throughput rate for S-5 is 400,000 gallons per year of gasoline. Maximum potential emissions are:
(400 M gals/year)*(1.523 pounds/M gal)/(2000 pounds/ton) = 0.305 tons/year of POC

The maximum potential POC emissions are insignificant and do not warrant monitoring specifically for vapor control efficiency in addition to the required annual test for vapor tightness.

Based on historical data, the throughput at this tank is not expected to exceed 50,000 gallons/year of gasoline. Expected emissions are therefore:
(50 M gals/year)*(1.523 pounds/M gal)/(2000 pounds/ton) = 0.038 tons/year of POC

If there were no controls at all on this GDF, the emission factors would be:

Tank Filling Losses (no Phase I):	8.400 pounds/M gallon
Tank Breathing Losses (no vent valves):	0.210 pounds/M gallon
Vehicle Refueling Losses (no Phase II):	6.300 pounds/M gallon
Spillage:	0.420 pounds/M gallon
Total Emission Factor (S-5, no controls):	15.330 pounds/M gallon

In the unlikely event that none of the control measures were working at all, uncontrolled emissions are expected to be no more than:
(50 M gals/year)*(15.33 pounds/M gal)/(2000 pounds/ton) = 0.383 tons/year of POC

If the control measures were achieving only 50% control instead of the required control efficiency, emissions are expected to be no more than:
(50 M gals/year)*(7.875 pounds/M gal)/(2000 pounds/ton) = 0.197 tons/year

Based on the expected gasoline throughput rate of 50 M gallons/year, poorly controlled POC emissions are not expected to exceed maximum potential POC emissions and completely uncontrolled POC

emissions are still insignificant (< 800 pounds/year). Therefore, additional monitoring for vapor control efficiency is not justifiable.

Particulate Matter: S-13

From BAAQMD Permit Application #14088, the particulate emissions from the Tub Grinder were based on emission factors developed for plywood manufacturing operations as described in AP-42 (fourth edition) Chapter 10.3.

The emission factor for the tub grinding operation was assumed to be the average of the AP-42 factors for log debarking (0.024 pounds of TSP/ton) and log sawing (0.230 pounds of TSP/ton):
(0.024 + 0.230)/2 = 0.187 pounds of TSP/ton of material processed

The emission factor for the wood chip conveyor is based on the AP-42 factor for sawdust handling (1.0 pounds of TSP/ton) and the assumption that 10% of the wood chips are sawdust:
(0.1 tons sawdust/ton of wood chips)*(1.0 pounds of TSP/ton of sawdust)
= 0.1 pounds of TSP/ton of wood chips

The total uncontrolled emission factor for the tub grinder and conveyor is (0.187 + 0.1) = 0.287 pounds of TSP/ton of material processed. Water sprays are assumed to achieve 50% control of TSP emissions, resulting in an emission factor (after control) of 0.1435 pounds/ton. All emissions remaining after water spray are assumed to be PM_{10}.

The emission factors and assumptions discussed above are very conservative and are expected to result in an overestimate of emissions. Using these conservative factors, maximum potential emissions from S-13 (after control by water sprays) are:
(70,000 tons/year)*(0.1435 pounds of PM_{10}/ton)/(2000 pounds/ton) = 5.023 tons/year of PM_{10}

For other similar operations, BAAQMD has used an emission factor of 0.024 pounds/ton (the factor for log debarking) to more closely estimate actual emissions. Using this more realistic factor, maximum expected emissions are 0.84 tons/year of PM_{10}.

The S-13 Tub Grinder and Conveyor can process up to 60 tons/hour (120,000 pounds/hour) of wood waste. The maximum potential emission rate (after control by water sprays) is:
(60 tons/hour)*(0.1435 pounds of PM_{10}/ton) = 8.61 pounds/hour of PM_{10}
Using the more realistic emission factor, the maximum expected emission rate is:
(60 tons/hour)*(0.024 pounds of PM_{10}/ton) = 1.44 pounds/hour of PM_{10}

From Regulation 6-311, the maximum allowable emission rate for sources processing more than 57,320 pounds per hour is 40 pounds/hour of filterable particulate matter (FP). The ratio of allowable emissions to maximum potential emissions (40/8.61) is 4.65 to 1.0. At lower processing rates, the margin of compliance is even higher. For instance at the lowest expected processing rate of 5 tons/hour, the allowable emission rate is 12.44 pounds/hour. The maximum potential emission rate

drops to 0.72 pounds/hour and the margin of compliance increases to 17.3 to 1.0. When comparing maximum allowable emissions (40 pounds/hour) to maximum expected emissions (1.44 pounds/hour), the compliance margin increases to more than 27 to 1.

Particulate Matter: S-14

Maximum potential particulate emissions from the S-14 Diesel Engine for S-13 Tub Grinder were based on the capacity of the engine (650 bhp), the maximum permitted operating rate (2080 hours/year), and the vendor specified maximum emission rate (0.263 grams of PM_{10}/bhp-hour):
(0.263 g PM_{10}/bhp-hour)*(650 bhp)*(2080 hours/year)/(453.6 g/pound)/(2000 pounds/ton)
= 0.392 tons/year of PM_{10}

Maximum potential hourly emissions are:
(0.263 g PM_{10}/bhp-hour)*(650 bhp)/(453.6 g/pound) = 0.377 pounds/hour of PM_{10}

Regulation 6-310 limits the FP emission rate to 0.15 grains/dscf of exhaust.
At the maximum operating rate and minimum theoretical exhaust rate (42,550 dscf/hour), maximum allowable particulate emissions are:
(0.15 grains/dscf)/(7000 grains/pound)*(42,550 dscf/hour) = 0.912 pounds/hour of FP
At the maximum operating rate and typical exhaust rate (99,600 dscf/hour), maximum allowable particulate emissions are:
(0.15 grains/dscf)/(7000 grains/pound)*(99,600 dscf/hour) = 2.134 pounds/hour of FP
At the minimum exhaust rate, the margin of compliance ratio (allowable emissions to maximum potential emissions) is 2.4 to 1. This compliance margin increases to 5.7 to 1 for the typical exhaust rate.

Sulfur Dioxide: S-14

Maximum potential sulfur dioxide (SO_2) emissions from the S-14 diesel engine are based on an AP-42 emission factor and the maximum sulfur content of the fuel. From AP-42 Chapter 3.4 "Large Stationary Diesel and All Stationary Dual-Fuel Engines", Table 3.4-1 (page 3.4-5), the sulfur oxides emission factor (pounds of SOx/MM BTU of diesel fuel input) is 1.01*S, where S is the sulfur content of the fuel (% by weight). BAAQMD Permit Condition #16317, Part 2 limits the sulfur content of the diesel fuel used in this engine to 0.05% by weight. Therefore, the SO_x emission rate is (1.01*0.05) = 0.0505 pounds SO_x/MM BTU of diesel fuel. Assuming all SO_x is SO_2, the maximum potential SO_2 emission rate is:
(0.0505 pounds SO_2/MM BTU)*(4.63 MM BTU/hour)*(2080 hours/year)/(2000 pounds/ton) =
0.243 tons/year of SO_2

Particulate Matter: A-4, A-5, and A-6

Worst case emissions will occur when landfill gas has a low methane content and low heat content. The following emission calculations assume that the landfill gas contains 45% methane and has a heat content of 450 BTU/scf of landfill gas. For landfill gas containing 45% methane, the amount of flue gas generated is estimated to be 4.3949 cubic feet of flue gas per cubic foot of landfill gas at 0% excess oxygen. All PM emissions are assumed to be PM_{10}.

Emissions Allowed by the Standard in Regulation 6-310

A-4 Flare:
(30 E6 BTU/hour)/(450 BTU/ft^3 LFG)*(4.3949 ft^3 flue/ft^3 LFG)*(0.15 grains/ft^3)/
(7000 grain/lb)*(24 hours/day)
= 150.7 lbs/day = 27.500 tons/year FP from A-4 (allowed)

A-5 Flare:
(60 E6 BTU/hour)/(450 BTU/ft^3 LFG)*(4.3949 ft^3 flue/ft^3 LFG)*(0.15 grains/ft^3)/
(7000 grain/lb)*(24 hours/day)
= 301.4 lbs/day = 54.999 tons/year FP from A-5 (allowed)

A-6 Flare:
(126 E6 BTU/hour)/(450 BTU/ft^3 LFG)*(4.3949 ft^3 flue/ft^3 LFG)*(0.15 grains/ft^3)/
(7000 grain/lb)*(24 hours/day)
= 632.9 lbs/day = 115.478 tons/year FP from flare (allowed)

Potential to Emit

Emission Factors from AP-42 Chapter 2.4 "Municipal Solid Waste Landfills", Table 2.4-5:
(17 lbs $PM_{10}/10^6$ dscf CH_4)*(0.45 scf CH_4/scf LFG)/(4.3949 ft^3 flue/ft^3 LFG)*(7000 grains/lb)
= 0.012 grains/dscf of flue gas at 0% oxygen
(17 lbs $PM_{10}/10^6$ dscf CH_4)*(0.45 scf CH_4/scf LFG)/(450 BTU/scf LFG)*(10^6 BTU/MM BTU)
= 0.017 lbs PM_{10}/MM BTU

A-4 Flare:
(30 MM BTU/hour)*(0.017 lbs PM_{10}/MM BTU)*(24 hours/day)
= 12.24 lbs PM_{10}/day = 2.234 tons/year PM_{10} from A-4 (potential)

A-5 Flare:
(60 MM BTU/hour)*(0.017 lbs PM_{10}/MM BTU)*(24 hours/day)
= 24.48 lbs PM_{10}/day = 4.468 tons/year PM_{10} from A-5 (potential)

A-6 Flare:
(126 MM BTU/hour)*(0.017 lbs PM_{10}/MM BTU)*(24 hours/day)
= 51.41 lbs PM_{10}/day = 9.382 tons/year PM_{10} from A-6 (potential)

The ratio of allowable FP emissions to potential PM_{10} emissions is 12.3 to 1 for each of the three flares. Therefore, the margin of compliance is high. While it is true that the quality of the AP-42 emission factor is "E", it is presumed that the emission factor contains condensable particulate matter, while the District standard (FP) does not. Therefore, the margin of compliance is higher by an unknown quantity.

Sulfur Dioxide: A-4, A-5, and A-6

Emissions Allowed by Standard in Regulation 9-1-302

As shown below, the federally enforceable emission limit of 300 ppmv of sulfur dioxide (SO_2) in the exhaust gas (BAAQMD Regulation 9-1-302) is equivalent to a total reduced sulfur concentration of 1318 ppmv in the landfill gas. This concentration was rounded down to 1300 ppmv of TRS to establish a federally enforceable concentration limit.

(300 E-6 ft^3 SO_2/ft^3 flue gas)*(4.3949 ft^3 flue/ft^3 LFG)*(1 ft^3 S/1 ft^3 SO_2)*(1 ft^3 H_2S/1 ft^3 S)*(10^6)
= 1318.5 ppmv of total reduced sulfur (TRS) as H_2S in landfill gas

A concentration limit of 1300 ppmv of TRS in the landfill gas will be used as a surrogate for the 300 ppmv SO_2 limit in the combustion gases.

A-4 Flare:
(30 E6 BTU/hour)/(450 BTU/ft^3 LFG)*(1300 E-6 ft^3 S/ft^3 LFG)*(1 ft^3 SO_2/1 ft^3 S)/
(386.8 ft^3 SO_2/lbmol SO_2)*(64.06 lbs SO_2/lbmol SO_2)*(24 hours/day)
= 344.5 pounds/day SO_2 = 62.868 tons/year SO_2 from A-4 (allowed)

A-5 Flare:
(60 E6 BTU/hour)/(450 BTU/ft^3 LFG)*(1300 E-6 ft^3 S/ft^3 LFG)*(1 ft^3 SO_2/1 ft^3 S)/
(386.8 ft^3 SO_2/lbmol SO_2)*(64.06 lbs SO_2/lbmol SO_2)*(24 hours/day)
= 689.0 pounds/day SO_2 = 125.735 tons/year SO_2 from A-5 (allowed)

A-6 Flare:
(126 E6 BTU/hour)/(450 BTU/ft^3 LFG)*(1300 E-6 ft^3 S/ft^3 LFG)*(1 ft^3 SO_2/1 ft^3 S)/
(386.8 ft^3 SO_2/lbmol SO_2)*(64.06 lbs SO_2/lbmol SO_2)*(24 hours/day)
= 1446.8 pounds/day SO_2 = 264.044 tons/year SO_2 from A-6 (allowed)

Potential to Emit

Although the federally enforceable concentration limit is 1300 ppmv of TRS, BAAQMD Permit Condition #10164, Part 18 limits the maximum amount of TRS in the collected landfill gas to 92 ppmv as H_2S as a RACT requirement. Therefore, maximum potential sulfur dioxide emissions will be based on this RACT limit.

(92 E-6 ft^3 H_2S/ft^3 LFG)/(4.3949 ft^3 flue/ft^3 LFG)*(1 ft^3 S/1 ft^3 H_2S)*(1 ft^3 SO_2/1 ft^3 S)*(10^6)
= 21 ppmv of SO_2 in the flare exhaust at 0% oxygen

A-4 Flare:
(30 E6 BTU/hour)/(450 BTU/ft^3 LFG)*(92 E-6 ft^3 S/ft^3 LFG)*(1 ft^3 SO_2/1 ft^3 S)/
(386.8 ft^3 SO_2/lbmol SO_2)*(64.06 lbs SO_2/lbmol SO_2)*(24 hours/day)

= 24.4 pounds/day SO_2 = 4.449 tons/year SO_2 from A-4 (potential)

A-5 Flare:
(60 E6 BTU/hour)/(450 BTU/ft^3 LFG)*(92 E-6 ft^3 S/ft^3 LFG)*(1 ft^3 SO_2/1 ft^3 S)/
(386.8 ft^3 SO_2/lbmol SO_2)*(64.06 lbs SO_2/lbmol SO_2)*(24 hours/day)
= 48.8 pounds/day SO_2 = 8.898 tons/year SO_2 from A-5 (potential)

A-6 Flare:
(126 E6 BTU/hour)/(450 BTU/ft^3 LFG)*(92 E-6 ft^3 S/ft^3 LFG)*(1 ft^3 SO_2/1 ft^3 S)/
(386.8 ft^3 SO_2/lbmol SO_2)*(64.06 lbs SO_2/lbmol SO_2)*(24 hours/day)
= 102.4 pounds/day SO_2 = 18.686 tons/year SO_2 from A-6 (potential)

The ratio of allowable SO_2 emissions to potential SO_2 emissions is 14.1 to 1 for each of the three flares. Therefore, the margin of compliance is high.