

Title V Permit Evaluation

Site Number: B1668

Site Name: Gas Recovery Systems, Inc.

Site Address: Marsh Road, Menlo Park, CA 94025

Periodic Monitoring:

Summary Table(s)

Particulate Matter: S-2, S-3, S-4 and S-5

S# & Description	Federally Enforceable Emission Limit Citation	Federally Enforceable Emission Limit	Potential to Emit: tpy	Monitoring
S-2, S-3, S-4 & S-5 Internal Combustion Engines	BAAQMD 6-301	Ringelmann 1	1.42 TPY (each engine) 5.68 tons/year (worst case, which is all engines running at all times)	Not Recommended
S-2, S-3, S-4 & S-5 Internal Combustion Engines	BAAQMD 6-310	0.15 grains/dscf	1.42 TPY (each engine) 5.68 tons/year (worst case, which is all engines running at all times)	Not Recommended

Sulfur Dioxide: S-2, S-3, S-4 and S-5

S# & Description	Federally Enforceable Emission Limit Citation	Federally Enforceable Emission Limit	Potential to Emit: tpy	Monitoring
S-2, S-3, S-4 & S-5 Internal Combustion Engines	BAAQMD 9-1-301	Property line ground level limits ≤ 0.50 ppm for 3 minutes ≤ 0.25 ppm for 60 minutes ≤ 0.05 ppm for 24 hours	4.35 TPY (each engine) 17.40 TPY (worst case combined, from all 4 engines)	Not Recommended

The tables above contain only the limits for which there is no monitoring.

Discussion

S-2, S-3, S-4 & S-5: Internal Combustion Engines

PM: Particulate emissions from rich-burn internal combustion engines fired on landfill gas are expected to be similar to engines burning natural gas. As with natural gas combustion, visible emissions are not normally associated with the proper combustion of landfill gas. Therefore, periodic monitoring for Ringelmann limits would not be appropriate for these engines.

Using the AP-42 emission factor for landfill gas combustion and a worst case landfill gas heat content of 450 BTU/scf, the particulate emission rate from the engines is expected to be 0.034 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.

SO₂: This facility will be subject to a federally enforceable limit of 1300 ppmv of total reduced sulfur (TRS) compounds in the landfill gas. This limit will ensure compliance with the BAAQMD and SIP Regulation 9-1-302 emission limit of 300 ppmv of SO₂ in the engine exhaust. Staff has proposed permit conditions that require the landfill gas to be monitored for total reduced sulfur content (on a weekly basis, initially) to ensure compliance with this limit. Sources complying with the 9-1-302 limit are not expected to exceed the ground level concentration limits listed in BAAQMD Regulation 9-1-301. Furthermore, a District source test indicated that the actual concentration of total reduced sulfur compounds in this facility's landfill gas was only 21 ppmv. At 21 ppmv of TRS, maximum SO₂ emissions are 0.23 tons/year of SO₂ from each engine and 0.92 tons/year of SO₂ from all four engines combined. Monitoring for ground level SO₂ concentrations in addition to the proposed landfill gas monitoring would not be appropriate for such low levels of SO₂ emissions.

Permit Shield:

The applicant requested a permit shield from the area monitoring requirements of Regulation 9, Rule 2. (Regulation 9, Rule 2 is not included in the State Implementation Plan.) The District rule has been revised since the application was submitted and the monitoring that was previously required by Regulation 9-2-501 is no longer required. Therefore, the request is not necessary.

Alternate Operating Scenario:

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

Compliance Status:

On December 22, 1995, Gas Recovery Systems, Inc. certified that all equipment was operating in compliance. No non-compliance issues have been identified to date.

Alignment of Information in Application and Proposed Permit:

In the application, both Gas Recovery Systems, Inc. and the District staff identified numerous rules that apply to this facility. The District staff's findings are detailed in the Title V permit.

Emission Calculations:

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.

PM₁₀ from Engines

Emissions Allowed by the Standard in Regulation 6-310

$$\begin{aligned} & (6.75 \text{ E6 BTU/hour/engine}) / (450 \text{ BTU/ft}^3 \text{ LFG}) * (4.3949 \text{ ft}^3 \text{ flue/ft}^3 \text{ LFG}) * \\ & (0.15 \text{ grains/ft}^3) / (7000 \text{ grain/lb}) * (24 \text{ hours/day}) \\ & = 33.91 \text{ lbs/day/engine} = 6.19 \text{ tons/year PM per engine} \\ & (6.19 \text{ tons/year/engine}) * (4 \text{ engines}) = 24.76 \text{ tons/year PM from all engines combined} \end{aligned}$$

All PM emissions are assumed to be PM₁₀.

Potential to Emit

From AP-42 Chapter 2.4, Table 2.4-5:

$$\begin{aligned} \text{Engine: } & (48 \text{ lbs PM}_{10} / 10^6 \text{ dscf methane}) * (0.45 \text{ scf methane/scf LFG}) / (450 \text{ BTU/scf LFG}) \\ & = 0.048 \text{ lbs PM}_{10} / \text{MM BTU} \end{aligned}$$

$$\begin{aligned} & (6.75 \text{ MM BTU/hour/engine}) * (0.048 \text{ lbs PM}_{10} / \text{MM BTU}) * (24 \text{ hours/day}) \\ & = 7.78 \text{ lbs PM}_{10} / \text{day/engine} = 1.42 \text{ tons/year PM}_{10} \text{ per engine} \\ & (1.42 \text{ tons/yr/engine}) * (4 \text{ engines}) = 5.68 \text{ tons/year PM}_{10} \text{ from all engines combined} \end{aligned}$$

The ratio of allowable emissions to potential emissions is 4.4 to 1. 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, while the District standard does not. Therefore, the margin of compliance is higher by an unknown quantity.

SO₂ from Engines

Emissions Allowed by the Standard in Regulation 9-1-302

As shown below, the federally enforceable emission limit of 300 ppmv of SO₂ 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.

$$(300 \text{ E-6 ft}^3 \text{ SO}_2/\text{ft}^3 \text{ flue gas}) * (4.3949 \text{ ft}^3 \text{ flue}/\text{ft}^3 \text{ LFG}) * (1 \text{ ft}^3 \text{ S}/1 \text{ ft}^3 \text{ SO}_2) * (1 \text{ ft}^3 \text{ H}_2\text{S}/1 \text{ ft}^3 \text{ S}) * (10^6) \\ = 1318.5 \text{ ppmv of total reduced sulfur (TRS) as H}_2\text{S in landfill gas}$$

A concentration limit of 1300 ppmv TRS in the landfill gas will be used as a surrogate for the 300 ppmv SO₂ limit in the combustion gases.

$$(6.75 \text{ E6 BTU}/\text{hour}/\text{engine}) / (450 \text{ BTU}/\text{ft}^3 \text{ LFG}) * (1300 \text{ E-6 ft}^3 \text{ S}/\text{ft}^3 \text{ LFG}) * (1 \text{ ft}^3 \text{ SO}_2/1 \text{ ft}^3 \text{ S}) / \\ (386.8 \text{ ft}^3 \text{ SO}_2/\text{lbmol SO}_2) * (64.06 \text{ lbs SO}_2/\text{lbmol SO}_2) * (24 \text{ hours}/\text{day}) \\ = 77.51 \text{ pounds}/\text{day SO}_2 \text{ per engine} = 14.15 \text{ tons}/\text{year SO}_2 \text{ per engine} \\ (14.15 \text{ tons}/\text{year}/\text{engine}) * (4 \text{ engines}) = 56.58 \text{ tons}/\text{year SO}_2 \text{ from all engines combined}$$

Potential to Emit

Although the federally enforceable concentration limit is 1300 ppmv of TRS, the maximum amount of TRS detected in any Bay Area landfill to date is 350 ppmv. Using a statistical analysis on the available data, Bay Area landfill gas is determined to contain no more than 400 ppmv of TRS. This worst case concentration (400 ppmv of TRS) will be used to calculate the maximum potential sulfur dioxide emissions, instead of the federally enforceable concentration limit (1300 ppmv of TRS).

$$(6.75 \text{ E6 BTU}/\text{hour}/\text{engine}) / (450 \text{ BTU}/\text{ft}^3 \text{ LFG}) * (400 \text{ E-6 ft}^3 \text{ S}/\text{ft}^3 \text{ LFG}) * (1 \text{ ft}^3 \text{ SO}_2/1 \text{ ft}^3 \text{ S}) / \\ (386.8 \text{ ft}^3 \text{ SO}_2/\text{lbmol SO}_2) * (64.06 \text{ lbs SO}_2/\text{lbmol SO}_2) * (24 \text{ hours}/\text{day}) \\ = 23.85 \text{ pounds}/\text{day SO}_2 \text{ per engine} = 4.35 \text{ tons}/\text{year SO}_2 \text{ per engine} \\ (4.35 \text{ tons}/\text{year}/\text{engine}) * (4 \text{ engines}) = 17.40 \text{ tons}/\text{year SO}_2 \text{ from all engines combined}$$

Expected Emissions

District source tests indicated a maximum landfill gas sulfur content of 21 ppmv of TRS for this facility.

$$(6.75 \text{ E6 BTU}/\text{hour}/\text{engine}) / (450 \text{ BTU}/\text{ft}^3 \text{ LFG}) * (21 \text{ E-6 ft}^3 \text{ S}/\text{ft}^3 \text{ LFG}) * (1 \text{ ft}^3 \text{ SO}_2/1 \text{ ft}^3 \text{ S}) / \\ (386.8 \text{ ft}^3 \text{ SO}_2/\text{lbmol SO}_2) * (64.06 \text{ lbs SO}_2/\text{lbmol SO}_2) * (24 \text{ hours}/\text{day}) \\ = 1.26 \text{ pounds}/\text{day SO}_2 \text{ per engine} = 0.23 \text{ tons}/\text{year SO}_2 \text{ per engine} \\ (0.23 \text{ tons}/\text{year}/\text{engine}) * (4 \text{ engines}) = 0.92 \text{ tons}/\text{year SO}_2 \text{ from all engines combined}$$

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The ratio of allowable emissions to expected emissions is 61.5 to 1. Therefore, the margin of compliance is very high.