**ENGINEERING EVALUATION REPORT**
**SONOMA COUNTY LANDFILL**
**APPLICATION NUMBER 006178**

## BACKGROUND:

The Sonoma County Department of Transportation and Public Works has applied for an Authority to Construct the following:

**S-13: Lean Burn IC Engine and Generator Set; Caterpillar 3516 SITA, 1138 HP, Landfill Gas Fired**
**S-14: Lean Burn IC Engine and Generator Set; Caterpillar 3516 SITA, 1138 HP, Landfill Gas Fired**

These engines are designed to run continuously at full load, burning 287 standard cubic feet per minute (scfm) of landfill gas (LFG). The existing Landfill Gas Flare A-2 will be used in a standby capacity, only operating when an engine has failed or is off line for maintenance.

## EMISSION CALCULATIONS:

Certified Emission Rates
Sonoma County has stated that the IC Engines S-13, and S-14 will meet the following emission rates:

- NOx: 0.8 g/bhp-hr
- CO: 2.1 g/bhp-hr
- POC: 0.56 g/bhp-hr

NMOC (POC) Emissions
District Regulation 8-34-301.4 requires an emission control device that reduces the amount of NMOC in the collected gas by at least 98 percent by weight or emits less than 120 ppm (vol) NMOC (expressed as methane @ 3% $O_2$).

Source testing at the facility has shown landfill gas NMOC concentrations to be quite variable and would make a 98% reduction by the IC Engines difficult to attain on a consistent basis. Therefore, in determining the highest allowable NMOC emission rate, the concentration limit (i.e. 120 ppm dry, as methane, @ 3% $O_2$) should be used. The concentration limit can be converted to a mass emission (M) as follows:

| | |
|---|---|
| Maximum Dry Exhaust Flow Rate: | 2,590 dscfm (from source test results) |
| Excess $O_2$ in Dry Exhaust Stream: | 7.2% (from source test results) |
| Oxygen Correction Factor: | 0.77; [e.g.(20.9 – 7.2)/(20.9 – 3)] |
| Corrected Dry Exhaust Flow Rate: | 1982 dscfm @ 3% oxygen |
| Molecular Weight of Methane: | 16 lb/lb-mole |
| Volume of Gas at 70$^{o}$F: | 386 scf/lb-mole |

M = $[(120 \times 10^{-6})(16 \text{ lb/lb-mole})(1{,}982 \text{ dscf/min})]/(386 \text{ scf/lb-mole})$
= 0.01 lb/min
= 0.59 lb/hr
= 0.24 g/bhp-hr

Since the Regulation 8-34-301.4 concentration limit is less than the limit suggested by Sonoma County, the converted 8-34 limit (0.24 g/bhp-hr) will be used to estimate NMOC (i.e. POC) emissions from the engines.

PM10 Emissions
From AP-42 Table 3.2-4, a filterable PM10 emission factor of 0.10 g/bhp-hr is given for 2-stroke lean burn IC engines fired by natural gas. In the absence of any PM10 emissions data from the manufacturer, the AP-42 factor will be assumed.

$SO_2$ Emissions

The District's BACT Guideline for Landfill Gas Fired IC Engines ≥250 HP (Document # 96.2.1, 06/02/95) states that the BACT #2 standard for $SO_2$ is 0.3 g/bhp-hr. Since there is no BACT #1 standard listed, the BACT #2 limit will be adopted for the IC Engines S-13 and S-14.

This limit can be compared to the expected $SO_2$ emissions from S-13 and S-14 as follows:

AP-42 Table 2.4-1 "Default Concentrations For LFG Constituents" provides LFG concentrations for 6 sulfur compounds typically found in landfill gas. $SO_2$ emissions from the IC Engines S-13 an S-14 can be estimated by performing a mass balance, using the default LFG sulfur compound concentrations and assuming all sulfur is converted into $SO_2$ upon combustion. The estimated $SO_2$ emissions from each engine are summarized in Table I Below.

**Table I: SO2 Emissions**

| Pollutant | Molecular Weight | Sulfur Ions | LFG Concentration (ppmv) | $SO_2$ Emissions (lb/hr) |
|---|---|---|---|---|
| Carbon disulfide | 76.13 | 2 | 0.58 | 0.003 |
| Carbonyl sulfide | 60.07 | 1 | 0.49 | 0.001 |
| Dimethyl sulfide | 62.13 | 1 | 7.82 | 0.022 |
| Ethyl mercaptan | 62.13 | 1 | 2.28 | 0.007 |
| Hydrogen sulfide | 34.08 | 1 | 35.5 | 0.101 |
| Methyl mercaptan | 48.11 | 1 | 2.49 | 0.007 |

Example Calculation – Carbon disulfide ($CS_2$):

$SO_2$ = *(0.58 X $10^{-6}$ lb-mole $CS_2$/lb-mole gas)(2 lb-mole $SO_2$/lb-mole $CS_2$)(64 lb $SO_2$/lb-mole $SO_2$)(lb-mole gas/386 scf)*

= *1.92 x $10^{-7}$ lb $SO_2$/scf LFG*

*At a LFG feed rate of 287 scfm, the expected $SO_2$ emission rate is 5.51 x $10^{-5}$ lb/min or 0.003 lb/hr.*

From Table I, the total $SO_2$ emissions from each engine will be 0.14 lb/hr (equivalent to 0.06 g/bhp-hr). Since this is below the BACT limit, it is assumed that S-13 and S-14 will comply with BACT.

Summary of Emission Factors

In summary, the factors used to calculate emissions of criteria pollutants from S-13 and S-14 will be as follows:

- NOx: 0.80 g/bhp-hr
- CO: 2.10 g/bhp-hr
- POC: 0.24 g/bhp-hr
- PM10: 0.10 g/bhp-hr
- SO2: 0.3 g/bhp-hr

Estimated Annual Emissions

Assuming the following operating conditions for S-13 and S-14:

| Brake Horsepower | Maximum Hours of Operation |
|---|---|
| 1,138 | 8,760 hours/yr |

The highest allowable emissions for each engine will be as follows:

NOx = (0.80 g/bhp-hr)(9,968,880 bhp-hr/yr)(lb/453.6 g)
= 17,582 lb/yr

CO = (2.10 g/bhp-hr)(9,968,880 bhp-hr/yr)(lb/453.6 g)
= 46,152 lb/yr

POC = (0.24 g/bhp-hr)(9,968,880 bhp-hr/yr)(lb/453.6 g)
= 5,275 lb/yr

PM10 = (0.10 g/bhp-hr)(9,968,880 bhp-hr/yr)(lb/453.6 g)
= 2,198 lb/yr

$SO_2$ = (0.3 g/bhp-hr)(9,968,880 bhp-hr/yr)(lb/453.6 g)
= 6,593 lb/yr

**CUMULATIVE EMISSIONS:**

| **(lbs/day)** | | **(tons/yr)** | |
|---|---|---|---|
| NOx | = 96.3 | NOx | = 17.582 |
| CO | = 252.9 | CO | = 46.152 |
| POC | = 28.9 | POC | = 5.275 |
| PM10 | = 12.0 | PM10 | = 2.198 |
| $SO_2$ | = 36.1 | $SO_2$ | = 6.593 |

**TOXIC RISK ASSESSMENT:**

AP-42 Table 2.4-1 “Default Values for LFG Constituents” (11/98) lists default concentrations for 44 compounds commonly found in landfill gas, 24 of which are identified as TACs by the District. The attached spreadsheet estimates emissions of each compound from each of the 2 IC Engines, using the following methodology and assumptions:

- The concentration of each listed TAC is based on the AP-42 Table 2.4-1 default value.
- The LFG fuel feed rate to each engine is assumed to be a continuous 287 scfm (standard conditions: 1 atm, 70 degrees F).
- The IC Engine abatement efficiency for each compound class was taken from AP-42 Table 2.4-3 “Control Efficiencies for LFG Constituents” (11/98). (e.g. Typical control efficiencies; NMOC = 97.2%, Halogenated Species = 93.0 %, Non-Halogenated Species = 86.1%)

Based on the calculations, emissions of Acrylonitrile, 1,1,2,2-Tetrachloroethane, and Vinyl Chloride from each engine exceed the District’s risk screen trigger. In addition to the TAC emissions in the spreadsheet, it is estimated that each engine will emit 628 lb/yr of Hydrogen Chloride, a secondary pollutant from the combustion of chlorinated compounds.

Risk screen modeling was performed by the District using the ISCST3 model and SCREEN3 meteorological data. The potential risk values were calculated using standard risk assessment methodology. Estimates of residential risk assume continuous 70-year exposure to the annual average pollutant concentrations.

The increased cancer risk to the maximally exposed individual receptor was found to be 3 in a million. The chronic hazard index was 0.1. Therefore, in accordance with the District’s risk management policy, the risk screen passes for sources that meet TBACT.

**BACT/TBACT REVIEW:**

Best Available Control Technology (BACT) review is triggered for any new source that results in a potential emission on a pollutant specific basis equal to or greater than 10 pounds per highest day of POC, NPOC, NOx, SO2, PM10, or CO. Based on the emission calculations presented in this evaluation, BACT review is triggered for POC, NOx, and CO.

From the District's BACT Guideline (Document # 96.2.1, 06/02/95), the following emission standards have been established as BACT #1 "technologically feasible if cost effective" or BACT #2 "achieved in practice" for Landfill Gas Fired IC Engines $\geq$250 HP:

- NOx: 1.0 g/bhp-hr (BACT #1)
- CO: 2.1 g/bhp-hr (BACT #1)
- POC: 0.6 g/bhp-hr (BACT #1)
- $SO_2$: 0.3 g/bhp-hr (BACT #2)

The manufacturer's certified emission rates for NOx, CO, and POC and the estimated $SO_2$ emission rate for the IC Engines S-13 and S-14 meet BACT.

TBACT has not been specified for this engine category, but it is assumed that meeting BACT #1 for POC emissions satisfies the TBACT requirement for risk screening purposes.

**PSD REVIEW:**

In accordance with Regulation 2-2-304, a PSD review is required for a major modification of a major facility if the cumulative increase, from the PSD Baseline Date, minus the contemporaneous emission reduction credits at the facility are in excess of 40 tons per year of sulfur dioxide or nitrogen oxides, or 15 tons per year of PM10. Similarly, Regulation 2-2-305 requires a PSD review for a major modification of a major facility with an increase of 100 tons per year or more of carbon monoxide.

Based on the maximum permitted emissions from the existing (8) IC Engines S-4 through S-12, the current emissions estimates from the Landfill S-1, and the maximum potential emissions from the Flare A-2, the current facility-wide potential emissions for the Sonoma County Landfill (P# 2254) are calculated to be:

| | |
|---|---|
| NOx: | 90.048 tons/yr |
| CO: | 189.968 tons/yr |
| POC: | 43.143 tons/yr |
| PM10: | 21.984 tons/yr |
| $SO_2$: | 39.053 tons/yr |

Including the emissions for the IC Engines S-13 and S-14, the new potential to emit for the facility would be:

| | |
|---|---|
| NOx: | 107.630 tons/yr |
| CO: | 236.120 tons/yr |
| POC: | 54.403 tons/yr |
| PM10: | 24.182 tons/yr |
| $SO_2$: | 39.053 tons/yr |

The potential NOx emissions now exceeding 100 tons/yr, the Sonoma County Landfill would become a "Major Facility" for NOx.

Since the permit applications for the existing (8) IC Engines were received after the PSD Baseline Date (February 8, 1988), all potential NOx emissions from these engines are included in the cumulative increase for the facility. Including the emissions from the new IC Engines S-13 and S-14 and subtracting 22.430 tons/yr that the District previously offset, the facility has a cumulative NOx increase of 83.060 tons/yr.

Therefore, since the Sonoma County Landfill would now be a major facility for NOx emissions and has a cumulative NOx increase since the PSD baseline date greater than 40 tons/yr, PSD modeling would be required.

In order to avoid lengthy PSD modeling, Sonoma County has agreed to voluntarily accept a NOx emission limit of 0.8 g/bhp-hr on all 10 IC Engines (the existing 8 engines currently have a NOx limit of 1.0 g/bhp-hr). This will reduce the potential NOx emissions at the facility to 87.910 tons/yr, below the major facility threshold. Therefore, since the Sonoma County Landfill will not be a major facility for NOx, PSD modeling for is not triggered for the cumulative NOx emissions at the site.

The Sonoma County Landfill is a major facility for CO. However, in accordance with Regulation 2-2-305.2, PSD modeling is not triggered for this application because the CO emissions increase from the IC Engines S-13 and S-14 will be less than 100 tons/yr.

**OFFSET REVIEW:**

As previously discussed, Sonoma County has agreed to take a lower NOx limit (0.8 g/bhp-hr) for the existing IC Engines at the landfill in order to avoid PSD modeling. This action reduces the potential to emit NOx at the facility by 17.582 tons/yr. This is exactly equal to cumulative increase of NOx from the new engines S-13 and S-14. Therefore, potential NOx emissions from the facility will not increase. However, the reduction is not actual because source testing over several years indicates that the existing engines currently emit less than the proposed new NOx limit. Therefore, offsets are required for this application.

NOx and POC Offset Requirement

In accordance with Regulation 2-2-302, facilities which emit 50 or more tons per year of precursor organic compounds or nitrogen oxides are required to provide federally enforceable offsets at a ratio of 1.15 to 1.0 for the emissions from any new or modified source and any pre-existing cumulative increase, minus any onsite contemporaneous emission reduction credits. However, the California Health and Safety Code (H&SC) Section 42314 requires air districts to provide offsets for “cogeneration projects” or “resource recovery projects”, if the district has established a sufficient growth allowance to cover the emissions from the project, and if the project meets the following five criteria identified in H&SC Section 42314(a)(1-5):

1. *The project produces less than 50 MW or less of electricity or less than 80 MW of electricity if the project processes municipal wastes.*
2. *The project will use the appropriate degree of pollution control technology (BACT or LAER), as defined and required by the district permitting system.*
3. *Existing permits for equipment to be replaced by the project be surrendered to the district or modified as necessary to satisfy district offset requirements. Any emission reduction credits associated with the shut down of equipment shall be credited to the project as offsets.*
4. *The applicant has provided offsets to the extent that they are reasonably available from facilities it owns or operates in the air basin and that mitigate the remaining impacts of the project.*
5. *For new projects that burn municipal waste, landfill gas, or digester gas, the applicant has, in the judgment of the district, made a good faith effort to secure all reasonably available emissions offsets to mitigate the remaining impact of the project, and has secured all reasonably available offsets.*

The above requirements, as they pertain to the addition of the IC Engines S-13 and S-14, are satisfied as follows:

1. The two new IC Engine/Generator Sets will add 1.5 MW of electrical production capacity to the existing facilities. This will bring the total electrical capacity of the facility to approximately 7.5 MW.

2. The IC Engines S-13 and S-14 meet the District’s BACT #1 standards.

3. There will be no replacement or modification of existing equipment. Therefore no emission reduction credits are available.

4. In addition to the landfill, Sonoma County operates one other facility with District air permits. P# 9080 "Sonoma County Facilities Operations" is the County's central steam and hot water plant. This facility operates four boilers; a 3.3MMBTU/hr boiler and a 4.0 MMBTU/hr boiler that have been retrofit to meet the requirements of Regulation 9, Rule 7, and two 10.2 MMBTU/hr boilers that meet BACT. Due to the relatively low NOx emissions from the non-BACT boilers (est. 1.2 tons/yr), it would not be cost effective to retrofit them to BACT to generate a small amount of NOx credit. Therefore, Sonoma County does not have any reasonably available credits to mitigate the emissions from the proposed new IC Engines at the landfill.

5. Sonoma County reviewed the District's "BAAQMD Emission Bank Status" listed on the website. Of the 246 certificates listed, 93 had NOx offsets. Of the 93, twelve had NOx offsets for sale. Sonoma county contacted these 12 companies and found that 6 had offsets for sale. The lowest offer to sell was $30,000 per ton. Cantor Fitzgerald, the leading emissions trading broker in the Bay Area reports that POC offsets are selling from $19,000 to $28,000 per ton. Part 5 of H&SC Section 42314(a) requires that the applicant "in the judgment of the district" make a "good faith effort to secure all reasonably available emissions offsets". It has been the past practice of the District to base the reasonableness of obtaining offsets for resource recovery projects on the maximum cost guidelines for requiring BACT (e.g. see Application #003540). Since the District's maximum cost limit for requiring BACT for NOx or POC control is $17,500 per ton, the highest reasonable cost for obtaining NOx or POC offsets for resource recovery projects is $17,500 per ton. In accordance with H&SC Section 42314(a)(5), NOx and POC offsets are not reasonably available for this project.

Since the requirements for obtaining offsets have been met, the availability of District offsets must now be considered. H&SC Section 42314(b) states that any required offsets should be provided from a growth allowance account meeting the requirements of H&SC Section 41600. While the District has not established a specific growth allowance account for resource recovery projects, the District's Small Facility Banking Account (SFBA) meets all the requirements of a H&SC Section 41600 growth allowance. Therefore, it is recommended that the District supply the offsets required for this project.

The Sonoma County Landfill has no pre-existing cumulative increase for POC or NOx. Therefore, the required POC and NOx offsets will be as follows in Table II:

**Table II: Required Offsets**

| Pollutant | Emissions Increase (tons/yr) | Offset Ratio | Offsets Required (tons/yr) |
|---|---|---|---|
| POC | 5.275 | 1.0:1.0 | 5.275 |
| NOx | 17.582 | 1.0:1.0 | 17.582 |

Offsets are not required for PM10 and $SO_2$ increases because the Sonoma County Landfill is not a major facility for PM10 or $SO_2$.

**STATEMENT OF COMPLIANCE:**

NOx and CO

The IC Engines S-13 and S-14 are subject to the requirements of Regulation 9, Rule 8 "Nitrogen Oxides and Carbon Monoxide from Stationary Internal Combustion Engines". For lean-burn engines firing either natural gas or waste derived fuel gas, NOx emissions are limited to 140 ppmv @ 15% oxygen and CO emissions are limited to 2000 ppmv @ 15% oxygen. As previously discussed, S-13 and S-14 will have NOx and CO permit limits as follows:

- NOx: 0.80 g/bhp-hr
- CO: 2.10 g/bhp-hr

In order to demonstrate compliance with Regulation 9-8, a units conversion must be made. Given the following:

| | |
|---|---|
| LFG Fuel Factor (Stoichiometric): | 4.77 scf dry c.p./scf fuel |
| LFG Fuel Factor (@ 15% $O_2$): | 16.88 scf dry c.p./scf fuel |
| IC Engine Fuel Consumption Rate: | 287 scfm |
| Volume of Gas at 70$^o$F: | 386 scf/lb-mole |
| NOx Emission Rate: | 2.0 lb/hr |
| NOx Molecular Weight: | 46 lb/lb-mole |
| CO Emission Rate: | 5.3 lb/hr |
| CO Molecular Weight: | 28 lb/lb-mole |

the NOx and CO emissions for S-13 and S-14 in terms of ppmv @ 15% $O_2$ will be:

NOx = (2.0 lb NOx/hr) x (lb-mole NOx/46 lb NOx) x (hr/60 min) x (scf fuel/16.88 scf dry c.p.) x (min/287 scf fuel) x (386 scf dry c.p./lb-mole dry c.p.)
= $5.77 \times 10^{-5}$ (lb-mole NOx/lb-mole dry c.p.)
= 57.7 ppmv @ 15% $O_2$

CO = (5.3 lb CO/hr) x (lb-mole CO/28 lb CO) x (hr/60 min) x (scf fuel/16.88 scf dry c.p.) x (min/287 scf fuel) x (386 scf dry c.p./lb-mole dry c.p.)
= $2.51 \times 10^{-4}$ (lb-mole CO/lb-mole dry c.p.)
= 251 ppmv @ 15% $O_2$

Since the converted NOx and CO emission rates are below the Regulation 9-8 limits for both NOx and CO, compliance with permit condition limits will assure compliance with Regulation 9-8.

Particulate Matter and Visible Emissions

BAAQMD Regulation 6-310 limits PM emissions to 0.15 gr/dscf. If it is assumed that the IC engine exhaust gases contain 15% excess oxygen under normal operating conditions, the Regulation 6-310 limit can be compared to the AP-42 emission factor of 0.10 g/bhp-hr (i.e. 0.25 lb/hr) as follows:

As previously stated, the dry gas combustion factor at 15% excess oxygen for the landfill gas at this facility combustion is 16.88 scf dry c.p./scf fuel.

The conversion of 0.15 gr/dscf @ 15% $O_2$ to lb/hr is then:

(16.88 dscf c.p./scf fuel) x (287 scf fuel/min) x (60 min/hr) x (0.15 gr/dscf) x (lb/7,000 gr)
= 6.2 lb/hr

Since the AP-42 PM emission rate used for S-13 and S-14 (0.25 lb/hr) is well below the converted Regulation 6-310 limit (6.2 lb/hr), compliance is assumed.

Compliance with the Ringelmann 1.0 limit of Regulation 6-301 can be demonstrated by casual observation.

$SO_2$ Emissions

Regulation 9-1-302 limits $SO_2$ emissions from the exhaust stream of any source (other than a ship) to 300 ppm (dry).

Given the following:

| | |
|---|---|
| $SO_2$ Emission Factor for S-13 and S-14: | 0.75 lb/hr (from BACT limit) |
| Excess $O_2$ in Dry Exhaust Stream: | 7.2% (from source test results) |
| LFG Fuel Factor (@ 7.2% $O_2$): | 7.28 scf dry c.p./scf fuel |
| IC Engine Fuel Consumption Rate: | 287 scfm |
| Volume of Gas at 70$^o$F: | 386 scf/lb-mole |
| Molecular Weight of $SO_2$: | 64 lb/lb-mole |

$SO_2$ = (0.75 lb $SO_2$ /hr) x (lb-mole $SO_2$/64 lb $SO_2$) x (hr/60 min) x (scf fuel/7.28 scf dry c.p.) x (min/287 scf fuel) x (386 scf dry c.p./lb-mole dry c.p.)
= $3.61 \times 10^{-5}$ lb-mole $SO_2$/lb-mole dry c.p.
= 36.1 ppm $SO_2$ @ 7.2% $O_2$ dry

Since the $SO_2$ concentration based on the BACT emission rate of 0.75 lb/hr is well below 300 ppm it is assumed that S-20 will comply with Regulation 9-1-302.

Major Facility Review: Regulation 2, Rule 6
The Sonoma County Landfill was issued a Title V permit on February 27, 2001. The permitting of the IC Engines S-13 and S-14 will require a modification of the Title V permit. The addition of S-13 and S-14 does not constitute a "Significant Permit Revision" as defined in Regulation 2-6-226, nor does it qualify as a "Administrative Permit Amendment" (2-6-201). Therefore, a "Minor Permit Revision" to the Title V permit will be required. Regulation 2-6-404.4 requires that an application for a minor permit revision be submitted by the applicant prior to commencing any operation associated with the minor permit revision.

A permit condition will be added to the Authority to Construct for S-13 and S-14 requiring that an application for a Minor Permit Revision to the Title V permit be submitted prior to the start-up of either engine.

Subpart WWW: 40 CFR 60.752(b)(2)(iii)(B)
This regulation requires a control system to either reduce NMOC by 98 weight percent or reduce the outlet NMOC concentration to less than 20 ppm by volume (expressed as hexane @ 3% $O_2$).

The Regulation 8-34-301.4 requirement (reduce NMOC at least 98 percent by weight or emit less than 120 ppm (vol) NMOC expressed as methane @ 3% $O_2$) is equivalent to the federal requirement. Therefore, compliance with Regulation 8-34-301.4 ensures compliance with 40 CFR 60.752(b)(2)(iii)(B).

CEQA
This application is exempt from the requirements of a CEQA review because the permitting of "Internal Combustion Engines" as outlined in Permit Handbook Chapter 2.3 is a ministerial operation.

**MODIFIED PERMIT CONDITIONS:**

It is recommended that Permit Condition #6117 be modified as shown below to account for the two new IC Engines and new emissions limits for all engines.

For S-4, S-5, S-6, S-7, S-9, S-10, S-11, S-12, S-13, S-14: Lean Burn Internal Combustion Engines and Generator Sets

1. All collected landfill gas shall be vented to properly operating abatement equipment including the Internal Combustion Engines (S-4, S-5, S-6, S-7, S-9, S-10, S-11, ~~and~~ S-12, S-13, and S-14) and/or the Landfill Gas Flare (A-2). Under no circumstances shall raw landfill gas be vented to the atmosphere. This limitation does not apply to unavoidable landfill gas emissions that occur during control system installation, maintenance, or repair that is performed in compliance with Regulation 8, Rule 34, Sections 113, 116, 117, or 118 or to inadvertent component or surface leaks that do not exceed the limits specified in 8-34-301.2 or 8-34-303. (basis: Regulation 8-34-301)

2. The A-2 Landfill Gas Flare shall be operated as necessary to combust excess gas ~~when one or more of the Internal Combustion Engines (S-4, S-5, S-6, S-7, S-9, S-10, S-11, and S-12) are down and~~ whenever the flow of landfill gas exceeds the capacity of ~~these~~ the IC Engines in service. (basis: Regulation 8-34-301)

3. The Internal Combustion Engines (S-4, S-5, S-6, S-7, S-9, S-10, S-11, ~~and~~ S-12, S-13, and S-14) shall be fired exclusively on landfill gas. If required, natural gas can be used as a supplemental fuel, but it shall not reduce or replace landfill gas available for use in these engines. Natural gas shall not

be used as supplemental fuel when the A-2 Flare is operating concurrently with these engines. (basis: Offsets and Cumulative Increase)

4. District approved flowmeters, to measure landfill gas flow into the engines, shall be installed prior to any operation and maintained in good working condition. An automatically controlled landfill gas valve shall be installed, and maintained to insure that landfill gas is immediately made available for flaring to the A-2 Landfill Gas Flare when one or more of the engines are down. (basis: 8-34-301)

5. Nitrogen Oxide (NOx) emissions, calculated as NO2, from each Internal Combustion Engine (S-4, S-5, S-6, S-7, S-9, S-10, S-11, ~~and~~ S-12, S-13, and S-14) shall not exceed ~~78 ppmv, corrected to 15% O2, dry basis~~ 0.80 grams per brake horsepower hour (g/bhp-hr). (basis: BACT and Offsets)

6. Carbon Monoxide (CO) emissions from each Internal Combustion Engine (S-4, S-5, S-6, S-7, S-9, S-10, S-11, ~~and~~ S-12, S-13, and S-14) shall not exceed ~~283 ppmv, corrected to 15% O2, dry basis~~ 2.1 g/bhp-hr. (basis: BACT)

~~7. Precursor Organic Compound (POC) emissions from each Internal Combustion Engine (S-4, S-5, S-6, S-7, S-9, S-10, S-11, and S-12) shall not exceed 126 ppmv, expressed as methane, corrected to 15% O2, dry basis. When demonstrating compliance with this condition, the concentration of total non-methane organic compounds (NMOC) measured in the engine exhaust shall be assumed to be 100% POC, unless the Permit Holder concurrently tests the engine exhaust for one or more non-precursor organic compounds (NPOC). If the engine exhaust is concurrently tested for one or more NPOCs, then the following equation shall be used to determine the concentration of POC (CPOC) that is subject to this requirement:~~

~~CPOC (as CH4) = CNMOC (as CH4) – CNPOC (as CH4)~~

~~(basis: BACT and Offsets)~~

7. Each Internal Combustion Engine (S-4, S-5, S-6, S-7, S-9, S-10, S-11, S-12, S-13, and S-14) shall comply with either the destruction efficiency requirements or the non-methane organic compound (NMOC) outlet concentration limit specified in Regulation 8-34-301.4 (basis: BACT, Offsets, and Regulation 8-34-301.4)

8. In order to demonstrate compliance with Parts #5, #6, and #7 above, Regulation 8, Rule 34, Sections 114 and 301.4, Regulation 9, Rule 8, Sections 302.1 and 302.3, and 40 CFR 60 .752(b)(2)(iii)(B), the Permit Holder shall ensure that a District approved source test is conducted annually on each Internal Combustion Engine (S-4, S-5, S-6, S-7, S-9, S-10, S-11, ~~and~~ S-12, S-13, and S-14). As a minimum, the annual source tests shall determine the following:
   a. landfill gas flow rate to each engine (dry basis);
   b. concentrations (dry basis) of carbon dioxide (CO2), nitrogen (N2), oxygen (O2), CH4, NMOC, and total hydrocarbons (THC) in the landfill gas;
   c. exhaust gas flow rate from each engine (dry basis);
   d. concentrations (dry basis) of NOx, CO, CH4, NMOC, THC, and O2 in the exhaust gas from each engine;
   e. the CH4, NMOC, and THC destruction efficiencies achieved by each engine; and
   f. the combustion temperature of each engine during the test period.

   The first annual source test for each engine shall be conducted by no later than October 1, 2002 or no later than 12 months after the issue date of the MFR Permit, whichever date occurs first. Subsequent source tests for each engine shall be conducted no sooner than 9 months and no later than 12 months after the previous source test. The Source Test Section of the District shall be contacted to obtain their approval of the source test procedures at least 14 days in advance of each source test. They shall be notified of the scheduled test date at least 7 days in advance of each source test. The source test report shall be submitted to the Compliance and Enforcement Division within 45 days of the test date.
   [basis: BACT, Offsets, Regulations 8-34-114, 8-34-301.4, 8-34-412, 9-8-302.1, 9-8-302.3, and 40 CFR 60.752(b)(2)(iii)(B)]

9. The Permit Holder shall maintain the following records in a District approved logbook:
   a. On a daily basis, record the operating times for each engine.
   b. On a daily basis, calculate and record the amount of landfill gas burned in each engine.
   c. On any day that natural gas is burned in an engine, record the amount of natural gas burned in each engine.
   d. On a monthly basis, summarize all daily records for each engine.
   e. On a monthly basis, calculate and record the maximum daily and total monthly heat input rate (in BTU) to each engine based on the average methane concentration in the landfill gas (as measured during the most recent source test), a high heating value for methane of 1013 BTU/scf, a high heating value for natural gas of 1050 BTU/scf, and the amounts of landfill gas and natural gas burned in each engine (recorded pursuant to subparts b. and c. above).

   All records shall be maintained on site or shall be made readily available to District staff upon request for at least 5 years from the date of entry. These record keeping requirements do not replace the record keeping requirements contained in any applicable rules or regulations. (basis: Cumulative Increase and Offsets)

10. The heat input to each Internal Combustion Engine (S-4, S-5, S-6, S-7, S-9, S-10, S-11, ~~and~~ S-12, S-13, and S-14) shall not exceed 206.64 million BTU per day or 75,423.6 million BTU per year. (basis: Regulation 2-1-301)

11. Prior to the start-up of either of the IC Engines S-13 or S-14, the Sonoma County Landfill shall submit an application for a Minor Permit Revision to their Title V permit in accordance with District Regulation 2-6-406. (basis: Regulations 2-6-404 and 2-6-406)

**RECOMMENDATIONS:**

It is recommended that an Authority to Construct be issued to the Sonoma County Landfill for the following:

**S-13: Lean Burn IC Engine and Generator Set; Caterpillar 3516 SITA, 1138 HP, Landfill Gas Fired**
**S-14: Lean Burn IC Engine and Generator Set; Caterpillar 3516 SITA, 1138 HP, Landfill Gas Fired**

By: _____
Ted Hull
Air Quality Engineer II