



Received

AUG 14 2014

SJVAPCD

**WASTE MANAGEMENT**

35251 Old Skyline Road  
P.O. Box 471  
Kettleman City, CA 93239

August 12, 2014

CERTIFIED MAIL (7012 1640 0001 2541 0626)

John Copp  
San Joaquin Valley Air Pollution Control District  
1990 E. Gettysburg Avenue  
Fresno, California 93726-0244

**RE: CHEMICAL WASTE MANAGEMENT, INC. - KETTLEMAN HILLS FACILITY  
SOURCE TEST REPORT – LANDFILLS B-19 & B-17 GCCS FLARE**

Dear Mr. Copp,

As you'll recall, the Chemical Waste Management, Inc. – Kettleman Hill Facility (KHF) provided the San Joaquin Valley Unified Air Pollution Control District (SJVAPCD) with both the 30-day and 15-day notices that KHF would be source testing the KHF landfills B-19 & B-17 gas collection and control system (GCCS) flare, permitted under PTOs C-283-22-17 and C-283-25-3, on Thursday, July 17, 2014. The SJVAPCD approved the test protocol on June 30, 2014. Attached is the Oxides of Nitrogen, Carbon Monoxide and Non-Methane Organic Compound Emissions from a Landfill Gas Flare, prepared by Horizon Air Measurement Services, Inc., dated August 8, 2014, for that source test event. Also attached is a CD with the raw CEMS data.

SJVAPCD Rule 1081 section 7.3 requires submittal of the source test protocol "within 60 days of completion of field testing".

The source testing requirements can be found under PTO C-283-22-17 conditions 28, 42 - 45, 57 - 60, 68, and 136; and C-283-25-3 conditions 28, 42 - 45, 57 - 60, 68, and 133.

Please note that the testing results indicate that the flare emissions are in compliance with all applicable permit limits.

Please contact me at (559) 386-6151 if further information or clarification is needed.

Sincerely,  
CHEMICAL WASTE MANAGEMENT, INC.

Paul Turek  
Environmental Manager

cc: Jim Swaney, SJVAPCD (w/o attachments)  
Aleah Zapf, SJVAPCD (w/o CD)

***From everyday collection to environmental protection, Think Green® Think Waste Management.***



AIR MEASUREMENT SERVICES, INC.

Received

Aug 14 2014

SJVUAPCD

Horizon Test No.: W07-084-FR

Dates Tested: July 17, 2014

Report Date: August 8, 2014

Revision Number: 0

**OXIDES OF NITROGEN, CARBON MONOXIDE AND  
NON-METHANE ORGANIC COMPOUND  
EMISSIONS FROM A LANDFILL GAS FLARE**

Permits to Operate: C-283-22-17 and C-283-25-3

*Site:*

Chemical Waste Management, Inc.  
35251 Old Skyline Road  
Kettleman City, California 93239

*Prepared for:*

Chemical Waste Management Inc.  
35251 Old Skyline Road  
Kettleman City, California 93239

*Prepared by:*

Horizon Air Measurement Services, Inc.  
310 Cortez Circle  
Camarillo, California 93012

*Regulatory Agency:*

San Joaquin Valley Air Pollution Control District  
1990 E. Gettysburg Avenue  
Fresno, California 93726

Edward S. Swede  
Sr. Project Manager

Richard J. Vacherot  
Technical Director



August 8, 2014

Via Email & UPS

Mr. Paul Turek  
Environmental Manager  
Chemical Waste Management Inc.  
35251 Old Skyline Road  
Kettleman City, California 93239

Dear Mr. Turek:

Please find enclosed three (3) copies of the Final Report entitled, "Oxides of Nitrogen, Carbon Monoxide and Non-Methane Organic Compound Emissions From a Landfill Gas Flare" for your submittal to SCAMQD.

If you have any questions, please call me at (805) 482-8753.

Sincerely,

HORIZON AIR MEASUREMENT SERVICES, INC.

A handwritten signature in black ink that reads "Edward S. Swede" followed by a stylized flourish.

Edward S. Swede  
Sr. Project Manager

cc: Thomas Sandhu, Chemical Waste Management, Inc.

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**Table 1**  
**Summary**

<b>Facility:</b>	Chemical Waste Management Inc.
<b>Test Location:</b>	Kings County, California
<b>Unit Tested:</b>	Flare
<b>Test Requested By:</b>	Chemical Waste Management Inc.
<b>Test Objective:</b>	Annual test to determine compliance with Permits to Operate Limits
<b>Test Dates:</b>	July 17, 2014
<b>Test Performed By:</b>	Horizon Air Measurement Services, Inc.
<b>Test Personnel:</b>	Edward S. Swede and Marshall L. Magincalda
<b>Test Methodology:</b>	EPA Method 19 for Flow Rate CARB Method 100 for NO <sub>x</sub> , CO, O <sub>2</sub> , CO <sub>2</sub> EPA Method 25A Flare Outlet for Non-Methane Organic Compounds EPA Method 25C Flare Inlet for Non-Methane Organic Compounds/Methane ASTM D 3588 Landfill Gas Analysis EPA Method 18 Flare Outlet Methane
<b>Test Observed By:</b>	Ms. Aleah Zapf, San Joaquin Valley Air Pollution Control District (SJVAPCD)
<b>Client Contact:</b>	Mr. Paul Turek, Chemical Waste Management, Inc.

## 1. Introduction

In order to demonstrate compliance with San Joaquin Valley Air Pollution Control District (SJVAPCD) Permits to Operate (PTO) No. C-283-22-17 and No. C-283-25-3, Chemical Waste Management Inc. is required to conduct an annual testing program to quantify emissions of oxides of nitrogen (NO<sub>x</sub>), carbon monoxide (CO), and non-methane organic compounds (NMOC) from a landfill gas flare located at the Chemical Waste Management Inc. Landfill in Kings County, California. The subject test program was conducted by Mr. Edward S. Swede and Mr. Marshall L. Magincalda of Horizon on July 17, 2014 in accordance with the applicable Test Plan (Horizon No. W07-084-TP) which had been formally approved by SJVAPCD. Flare operation was the responsibility of Chemical Waste Management Inc. Ms. Aleah Zapf of the SJVAPCD was present to observe the testing.

Three, 40-minute test runs were performed at the flare exhaust under normal load conditions. The testing procedures utilized for the flare are provided below:

<u>Parameters</u>	<u>Method</u>
Flow Rate	EPA Method 19 (calculated)
Fixed Gases	CARB Method 100
Oxides of Nitrogen	CARB Method 100
Carbon Monoxide	CARB Method 100
Non-Methane Organic Compounds (Inlet)	EPA Method 25C
Non-Methane Organic Compounds (Outlet)	EPA Method 25A
Landfill Gas Analysis	ASTM D 3588
Methane (Outlet)	EPA Method 18
Methane (Inlet)	EPA Method 25C

The results of the test program are summarized in Section 2. Section 3 provides a brief description of the subject flare. Section 4 summarizes the sampling and analytical procedures utilized during the test program. Quality assurance procedures are detailed in Section 5.

## 2. Summary of Results

The results of the test program on the flare are provided in Table 2-1. Emissions of NO<sub>x</sub> and CO were below allowable PTO limits as indicated in Table 2-1

Non-methane organic compound (NMOC) emissions achieved over 98% destruction efficiency. The flare NMOC emissions were also below the alternate PTO limit of 20 ppm as methane @ 3% O<sub>2</sub>. The PTO NMOC limit of 339.5 lb/day and 0.063 lbs/MMBtu were also met.

### Test Critique

During the initial Method 100 linearity check, the CO strip chart pen became stuck and did not record the initial linearity check values for CO. However, these CO calibration values, as well as all others, were recorded by the data acquisition system (DAS). All CEMS values are reported, as is usual, based upon the DAS values.

**Table 2-1**  
**Summary of Results**  
**Chemical Waste Management Inc.**  
**Kettleman Hills Landfill**  
**Flare**  
**July 17, 2014**

Run	1	2	3	Average	Emission Limit
Oxygen, %	14.35	14.18	13.84	14.13	✓
Carbon Dioxide, %	6.04	6.17	6.57	6.26	✓
Flow Rate, dscfm	8184	8154	7852	8064	✓
Oxides of Nitrogen,					
ppm	9.48	9.74	10.44	9.88	
ppm @ 3 % O <sub>2</sub>	25.9	26.0	26.5	26.1	✓
lbs/hr	0.556	0.569	0.587	0.570	✓
lbs/MMBtu	0.0353	0.0354	0.0361	0.0356	✓ 0.06
Carbon Monoxide,					
ppm	9.33	9.20	4.17	7.57	
ppm @ 3 % O <sub>2</sub>	25.5	24.5	10.6	20.2	✓
lbs/hr	0.333	0.327	0.143	0.268	✓
lbs/MMBtu	0.0212	0.0204	0.0088	0.0168	✓ 0.22
Total Non-Methane Organic Compounds,					
ppm, as methane	< 1.00	1.00	< 1.00	< 1.00	
ppm, as methane, @ 3 % O <sub>2</sub>	< 2.73	2.67	< 2.54	< 2.64	✓ 20
lb/hr, as CH <sub>4</sub>	< 0.0204	0.0203	< 0.0196	< 0.0201	✓
lbs/MMBtu, as CH <sub>4</sub>	< 0.00130	0.00126	< 0.00120	< 0.00125	✓ 0.063
lbs/day, as CH <sub>4</sub>	< 0.489	0.488	< 0.469	< 0.482	✓ 339.5
Destruction Efficiency, %	> 99.8	99.8	> 99.8	> 99.8	✓ 98
Methane,					
ppm	0.64	0.79	0.42	0.62	
lbs/hr	0.013	0.015	0.0084	0.012	✓
Destruction Efficiency, %	99.998	99.997	99.999	99.998	✓ 99.0
Operating Parameters,					
Load, % <sup>(a)</sup>	25.6	26.1	26.4	26.0	
LFG Flow Rate, scfm <sup>(b)</sup>	641	652	660	651	
Flare Temperature, deg F <sup>(b)</sup>	1546	1548	1556	1550	
Heat Rate, MMBtu/hr	15.7	16.1	16.3	16.0	✓ 83.6
LFG Heating Value, btu/scf	409	411	411	410	
LFG TNMHC Concentration, ppm C <sub>1</sub>	7,500	8,120	6,900	7507	
LFG TNMHC Flow Rate, lb/hr as CH <sub>4</sub>	12.0	13.2	11.3	12.2	
LFG Methane, ppm	366,000	370,000	366,000	367,333	
LFG Methane, lbs/hr	584	601	601	595	

(a) Based upon actual LFG flow rate vs. rated (2500 scfm)

(b) Based upon 10 minute readings.

No other sampling or analytical problems were encountered during any phase of the test program.

### **3. Equipment Description**

#### **3.1 Flare Description**

The flare is a Parnel Biogas enclosed flare with a maximum firing rate of 83.6 million Btu/hr.

#### **3.2 Flare Operating Conditions During Testing**

During testing, the flare was operated under normal operating conditions as follows:

Landfill Gas Flow Rate -	651 scfm
Flare Temperature -	1,550 °F
Heat Rate -	16.0 MMBtu/hr

Process data was recorded at ten-minute intervals by Horizon staff. Field data sheets are provided in appendix E, Process Data.

### **4. Sampling Procedures**

The sampling program was designed to quantify concentration and emission rate of NO<sub>x</sub>, CO, and NMOC from the flare as identified in Section 1. Three, 40-minute test runs were conducted. The sampling locations and detailed sampling/analytical procedures are discussed below.

#### **4.1 Sample Locations**

The flare was sampled from the 120-inch diameter exhaust stack at a location 2.5 diameters (294 inches) downstream and 0.6 diameters (66 inches) upstream of the nearest flow disturbance as depicted in the Field Data Sheets in Appendix D.

#### **4.2 Stack Gas Flow Rate**

The exhaust flow rate was determined in accordance with EPA Method 19.

#### **4.3 Oxides of Nitrogen, Carbon Monoxide, Carbon Dioxide and Oxygen**

Concentration of NO<sub>x</sub>, CO, CO<sub>2</sub>, and O<sub>2</sub> was determined in accordance with CARB Method 100 as described in Appendix A.

#### **4.4 Total Non-Methane Organic Compounds**

Total non-methane organic compound concentration was determined at the flare outlet in accordance with EPA Method 25A as described in Appendix A. Total non-methane organic compound concentration at the flare inlet was determined in accordance with EPA Method 25C as described in Appendix A.

#### **4.5 Methane**

Methane concentration of the landfill gas and the flare exhaust were determined using EPA Method 25C and EPA Method 18, respectively. Method descriptions are provided in Appendix A.

#### **4.6 Landfill Gas Analysis**

Composition and higher heating value of the landfill gas was determined using ASTM D3588. A description of ASTM D3588 is provided in Appendix A.

### **5. Quality Control/Quality Assurance Summary**

#### **5.1 Field Sampling**

##### **5.1.1 CARB Method 100**

The CARB Method 100 Continuous Emissions Monitoring System (CEMS) QC requirements are as follows:

- to the extent practical, measured concentrations were within the applicable measurement range of the analyzer scale used (10% - 95% of calibration span)
- sampling conditioning requirements were maintained including heated line temperature and knock-out temperature
- ammonia scrubber used, where appropriate
- successful system leak check, when required
- calibration gases recorded and within certification time requirements
- a linearity check ( $\pm 2\%$ ) completed at the start and end of CEMS use (per day at minimum)
- successful stratification check completed and/or stack traversed with proper number of sample ports
- successful system bias check ( $\pm 5\%$ ) completed prior to sampling
- response times recorded
- NO<sub>2</sub> conversion efficiency ( $> 90\%$ ) completed
- zero and calibrations drift checks ( $\pm 3\%$ ) completed at proper intervals
- strip charts properly annotated with calibration gas values/id, calibrations, response times, sample points, start/end times, etc.
- data acquisition system (DAS) values averaged and recorded with proper annotation for calibrations, start/end times, sample ports and at a minimum of one minute intervals

All Method QC requirements were successfully fulfilled.

##### **5.1.2 EPA Method 18**

The EPA Method 18 field sampling QC requirements are as follows:

- sample containers verified to be of sufficient cleanliness

- sample apparatus verified to be of sufficient cleanliness
- successful system pre and post-leak check
- sample collection integrated over sample period ( $\pm 10\%$ )
- sample stored properly pending analyses (tedlar bags protected from sunlight)
- data sheets completed
- final container pressure within Method guidelines (if applicable)
- recovery study completed (if required)

All Method QC requirements were successfully fulfilled.

#### **5.1.3 EPA Method 25C**

The EPA Method 25C field sampling QC requirements are as follows:

- sample containers verified to be of sufficient cleanliness
- sample apparatus verified to be of sufficient cleanliness
- successful system pre and post-leak check
- sample collection integrated over sample period ( $\pm 10\%$ )
- sample stored properly pending analyses
- final container pressure within Method guidelines (if applicable)

All Method QC requirements were successfully fulfilled.

#### **5.1.4 EPA Method 25A**

The Method 25A QC requirements are as follows:

- Concentrations were within the applicable measurement range of the analyzer scale used (0% - 100% of calibration span). The span value should be 1.5 to 2.5 times the applicable emission limit
- heated line was maintained  $\geq 110^{\circ}\text{C}$  ( $230^{\circ}\text{F}$ )
- calibration gases recorded and within certification time requirements
- calibration error ( $\pm 5\%$  of gas value) completed at the start and end of CEMS use (per day at minimum)
- response times recorded
- zero and calibrations drift checks ( $\pm 3\%$  of span value) completed at proper intervals
- strip charts properly annotated with calibration gas values/id, calibrations, response times, sample points, start/end times, etc.
- data acquisition system (DAS) values averaged and recorded with proper annotation for calibrations, start/end times, sample ports and at a minimum of one minute intervals

All Method QC requirements were successfully fulfilled.

## **5.2 Laboratory Analyses**

### **5.2.1 EPA Method 25C**

The EPA Method 25C analytical QC requirements are as follows:

- proper chain of custody maintained
- samples analyzed within holding time
- replicate analyses within limits (<5%)
- daily NMOC analyzer performance verification within limits (ICV and CCV recoveries at 100% +/- 5%, and within 5% RSD)
- method blank within acceptable limits

All Method analytical QC requirements were successfully fulfilled.

### **5.2.2 EPA Method 18**

The EPA Method 18 field analytical QC requirements are as follows:

- proper chain of custody maintained
- samples analyzed within holding time
- duplicate analyses within limits (< 5%)
- pre and post calibration verification standard withing limits (<5% RSD)
- method blank within acceptable limits

All Method analytical QC requirements were successfully fulfilled.

### **5.2.3 ASTM 3588**

The ASTM 3588 analytical QC requirements are as follows:

- samples analyzed within holding time
- proper chain of custody maintained
- calibration verification standard within limits (85%-115%)
- method blank within acceptable limits

All Method analytical QC requirements were successfully fulfilled.

## **APPENDIX A - Test Method Descriptions**

**Method:**

**Sample Velocity Traverses for Stationary Sources**

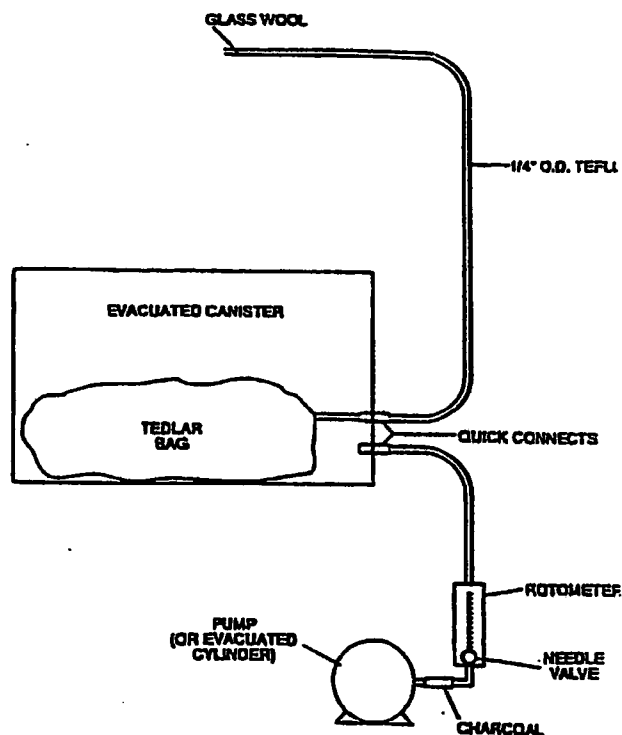
**Applicable for  
Methods:**

EPA Method 1, SCAQMD Method 1.1, CARB Method 1

**Principle:**

To aid in the representative measurements of pollutant emissions and/or total volumetric flow rate from a stationary source, a measurement site where the effluent stream is flowing in a known direction is selected, and the cross section of the stack is divided into a number of equal areas. A traverse point is then located within these equal areas. The method cannot be used when, 1) flow is cyclonic or swirling, 2) stack is small than about 0.30 meter (12 inches) in diameter or 3) the measurement of the site is less than two stack or duct diameters downstream or less than a half diameter upstream from the flow disturbance.

<b>Method:</b>	<b>Measurement of Gaseous Organic Compound Emissions by Gas Chromatography</b>
<b>Reference:</b>	<b>EPA Method 18 (Tedlar Bag)</b>
<b>Principle:</b>	A Tedlar bag is filled with flue gas at a constant rate. The gas contents are analyzed by gas chromatography for speciated organic compounds.
<b>Sampling Procedure:</b>	<p>Exhaust samples are collected in Tedlar bags using the evacuated container sampling system which is capable of collecting an integrated, representative sample while ensuring sample integrity (diagram is included on the following page). The system consists of a 1/4" stainless steel probe followed by a 1/4" Teflon sample line and a non-reactive 10-liter Tedlar bag contained within a leak-free evacuation container. All system components coming in contact with the sample are constructed of Teflon or stainless steel. The probe is maintained at the stack temperature, while the sample line is maintained at 250 °F.</p> <p>Samples are collected by evacuating the canister at a constant rate over each test run using a rotameter/needle valve and a diaphragm pump. Prior to each sampling run, the evacuated canister (containing the Tedlar bag) is leak checked at 2 inches Hg vacuum. At the conclusion of each test run, each Tedlar bag sample is sealed and stored in an opaque container pending analysis.</p>
<b>Analytical Procedure:</b>	Samples are analyzed for speciated organic compounds using the appropriate gas chromatograph column and detector configurations.



**Method:** Determination of Total Gaseous Organic Concentration Using a Flame Ionization Analyzer

**Reference:** EPA Method 25A

**Principle:** A gas sample is extracted from the source through a heated sample line into a flame ionization detector.

**Analyzer:** Ratfisch Instruments Model 55 CA High Temperature Total Hydrocarbon Analyzer

**Measurement Principle:** Flame Ionization Detection

**Accuracy:** 1% of full scale

**Ranges:** 0-10, 100, 1000, 10,000 and 100,000 ppm

**Output:** 0-1 V

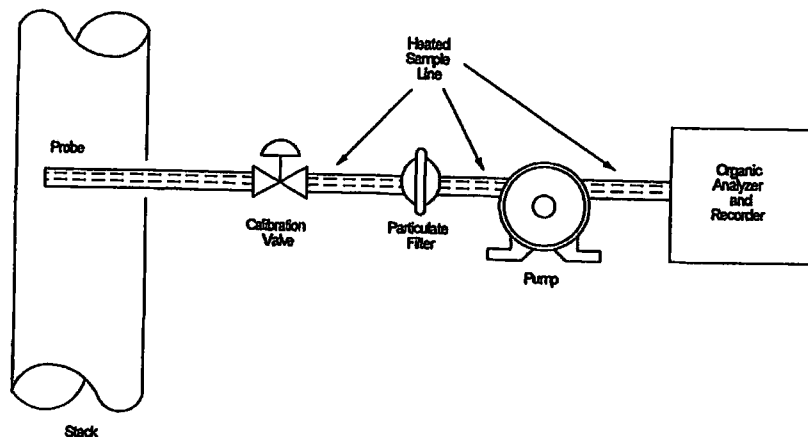
**Interferences:** None

**Response Time:** <5 seconds

**Sampling/Analytical Procedure:**

The sampling extraction system is depicted in the figure. Sample is withdrawn through a heated sample probe and Teflon sample line, if necessary, into the flame ionization analyzer. Total gaseous organic concentration is continuously recorded on a strip chart recorder.

The sample interface (1/4" stainless steel probe and heated Teflon tubing) is assembled and the measurement system operated according to the manufacturers instructions. After spanning the instrument, linearity is checked on site using zero ( $\pm 1\%$  of span value), high level, low level and mid level calibration gases. The mid level calibration gas is then introduced at the probe tip to determine sampling system bias. The sampling system is deemed acceptable for testing if the recorded value is within 5% of the span gas value. At the conclusion of each test a drift determination is made using zero and mid level gases. Prior to and at the conclusion of the test period a leak check, sample system bias and linearity check is performed. Calibration drift is checked and the instruments are recalibrated between each sub-test.



<b>Method:</b>	<b>Methane and Total Non-Methane Hydrocarbons by Total Carbon Analyses</b>
<b>Reference:</b>	<b>EPA Method 25C</b>
<b>Principle:</b>	Gaseous samples are collected in stainless steel canisters. The canisters are then pressurized with nitrogen and analyzed for methane and total non methane hydrocarbons (TNMHC) using a TCA/FID.
<b>Sampling Procedure:</b>	<p>Samples are collected, in duplicate, using stainless steel canisters which are evacuated to less than 10 mm Hg absolute. The tanks are pressurized and evacuated three times with ultrapure nitrogen and leak checked prior to use. A gas flow metering device and stainless steel shutoff valve is located just upstream of the canister. Representative, integrated samples are collected through a heat conditioned 1/4" stainless steel probe. The gas samples are metered into the canisters through the vacuum regulator maintaining a constant flow rate throughout each sampling period.</p> <p>The sampling apparatus is checked for leaks prior to the sampling program by attaching the probe end to an absolute pressure gauge and vacuum pump in series. The sample lines were evacuated to less than 10 mm Hg and the gauge shutoff valve is then closed. The sample lines are deemed to be leak-free if no loss of vacuum occurs as indicated by the vacuum gauge. During sampling the tank pressures are monitored with a 0-30 inch vacuum gauge to ensure integrated sampling.</p>
<b>Analytical Procedure:</b>	Samples are analyzed for methane and total non methane hydrocarbons (TNMHC) by total combustion analyses (TCA)/flame ionization detection (FID).

## **CONTINUOUS EMISSIONS MONITORING SYSTEM - Trailer No. 3**

### **CARB Method 100**

The continuous emissions monitoring system consists of a Thermo Electron Model 10 chemiluminescence NO/NO<sub>x</sub> analyzer, a Servomex Paramagnetic O<sub>2</sub> analyzer, a Thermo Electron Model 48C CO gas filter correlation analyzer and a Horiba PIR 2000 non dispersive infrared CO<sub>2</sub> analyzer. All analyzer specifications are provided in Table 1. All concentrations are determined on a dry basis. Concentrations of NO<sub>x</sub>, CO, O<sub>2</sub> and CO<sub>2</sub> are continuously recorded on a 10-inch strip chart recorder and a Daq View Data Acquisition System (DAS). The extractive monitoring system conforms with the requirements of CARB Method 100.

The sampling probe (heated to 250°F), constructed of 1/2 inch-diameter 316 stainless steel, is connected to a condenser with a six foot length of 3/8 inch Teflon line (heated to 250°F). A Nupro stainless steel filter (10 micron) is connected at the tip of the probe and maintained at stack temperature.

The condenser consists of a series of two stainless steel moisture knock-out bottles immersed in an ice water bath. The system is designed to minimize contact between the sample and the condensate. Condensate is continuously removed from the knock-out bottles via a peristaltic pump. The condenser outlet temperature is monitored either manually at 10-minute intervals or on a strip chart recorder/DAS system. The sample exiting the condenser is then transported through a filter, housed in a stainless steel holder, followed by 3/8 inch O.D. Teflon tubing and a Teflon coated (or stainless steel/viton) diaphragm pump to the sample manifold. The sample manifold is constructed of stainless steel tubing and directs the sample through each of four rotameters to the NO<sub>x</sub> monitor, O<sub>2</sub> monitor, CO monitor, CO<sub>2</sub> monitor and excess sample exhaust line, respectively. Sample flow through each channel is controlled by a back pressure regulator and by stainless steel needle valves on each rotameter. All components of the sampling system that contact the sample are composed of stainless steel, Teflon or glass.

Immediately upstream of the NO<sub>x</sub> analyzer(s) is an ammonia scrubber which removes all ammonia from the sample gas stream prior to introduction to the NO<sub>x</sub> analyzer to avoid interference. The ammonia scrubber consists of a stainless steel or other nonreactive cylindrical housing which contains 135cc of Perma Pure ammonia scrubbing Media A and 65cc of scrubbing Media B.

The calibration system is comprised of two parts: the analyzer calibration and the system bias check. The calibration gases are, at a minimum, certified to  $\pm 1\%$  by the manufacturer. Where necessary to comply with the reference method requirements, EPA Protocol 1 gases are used. The cylinders are equipped with pressure regulators which supply the calibration gas to the analyzers at the same pressure and flow rate as the sample. The selection of zero, span or sample gas directed to each analyzer is accomplished by operation of the zero, calibration or sample selector knobs located on the main flow control panel.

For CARB Method 100 testing, the following procedures are conducted before and after each series of test runs:

#### **Leak Check:**

The leak check is performed by plugging the end of the sampling probe, evacuating the system to at least 20 inches of Hg. The leak check is deemed satisfactory if the system holds 20 inches of Hg vacuum for five minutes with less than one inch Hg loss.

#### **Linearity Check:**

The NO<sub>x</sub>, CO, CO<sub>2</sub> and O<sub>2</sub> analyzers linearity check is performed by introducing, at a minimum, zero gas, mid range calibration gas (40-60% scale) and high range calibration gas (80-100% scale). Instrument span value is set on each instrument with the mid range gas. The high range calibration gas (80-100% scale) is then introduced into each instrument without any calibration adjustments. Linearity is confirmed, if all values agree with the calibration gas value to within 1% of the range.

### **Stratification Check:**

A stack stratification check is performed (pre-test only) by traversing the stack with the appropriate number of traverse alternately with the reference point (center). If the gas composition is homogenous, <10% variation between any traverse points in the gas stream and the normalized average point, single point gas sampling is performed at the reference point. If stratification exceeds the 10% criteria, then the stack cross section is traversed during sampling.

### **System Bias Check:**

The system bias check is accomplished by transporting the same gases used to zero and span the analyzers to the sample system as close as practical to the probe inlet. This is accomplished by opening a valve located on the probe, allowing the gas to flow to the probe and back through the moisture knockout and sample line to the analyzers. During this check the system is operated at the normal sampling rate with no adjustments. The system bias check is considered valid if the difference between the gas concentration exhibited by the measurement system which a known concentration gas is introduced at the sampling probe tip and when the sample gas is introduced directly to the analyzer, does not exceed  $\pm 5\%$  of the analyzer range.

### **Response Time:**

Response time (upscale and downscale) for each analyzer is recorded during the system bias check. Upscale response time is defined as the time it takes the subject analyzer gas to reach 95% of the calibration gas value after introducing the upscale gas to the sample bias calibration system. Downscale response time is defined as the time it takes the subject analyzer to return to zero after the zero gas is introduced into the sample system bias calibration system.

### **NO<sub>x</sub> Conversion Efficiency**

The NO<sub>x</sub> analyzer NO<sub>2</sub> conversion efficiency is determined by injecting a NO<sub>2</sub> gas standard directly into the NO<sub>x</sub> analyzer (after initial calibration). The analyzer response must be a least 90% of the NO<sub>2</sub> standard gas value.

In between each sampling run the following procedures are conducted:

### **Zero and Calibration Drift Check:**

Upon the completion of each test run, the zero and calibration drift check is performed by introducing zero and mid range calibration gases to the instruments, with no adjustments (with the exception of flow to instruments) after each test run. The analyzer response must be within  $\pm 3\%$  of the actual calibration gas value.

### **Analyzer Calibration:**

Upon completion of the drift test, the analyzer calibration is performed by introducing the zero and mid range gases to each analyzer prior to the upcoming test run and adjusting the instrument calibration as necessary.

### **System Bias Check**

(same as above)

A schematic of the sample system and specific information of the analytical equipment is provided in the following pages.

**TABLE 1**

**CONTINUOUS EMISSIONS MONITORING LABORATORY - Trailer No. 3**

**NO<sub>x</sub> CHEMILUMINESCENT ANALYZER -- THERMO ELECTRON MODEL 10 A**

Response Time (0-90%)	1.5 sec -- NO mode/1.7 sec -- NO <sub>x</sub> mode
Zero Drift	Negligible after 1/2 hour warmup
Linearity	± 1% of full scale
Accuracy	Derived from the NO or NO <sub>2</sub> calibration gas, ± 1% of full scale
Operating Ranges (ppm)	2.5, 10, 25, 100, 250, 1000, 2500, 10000
Output	0-1 volt

**O<sub>2</sub> ANALYZER, PARAMAGNETIC -- SERVOMEX MODEL 1400B**

Response Time (0-90%)	15 seconds
Accuracy	0.1% oxygen
Linearity	± 1% scale
Operating Ranges (%)	0-25, 0-100
Output	0-1 volt

**CO GAS FILTER CORRELATION -- THERMO ELECTRON MODEL 48C**

Response Time (0-95%)	1 minute
Zero Drift	± 0.2 ppm CO
Span Drift	Less than 1% full scale in 24 hours
Linearity	± 1% full scale, all ranges
Accuracy	± 0.1 ppm CO
Operating Ranges (ppm)	10, 100, 200, 500, 1,000, 2,000, 5,000, 10,000
Output	0-1 volt

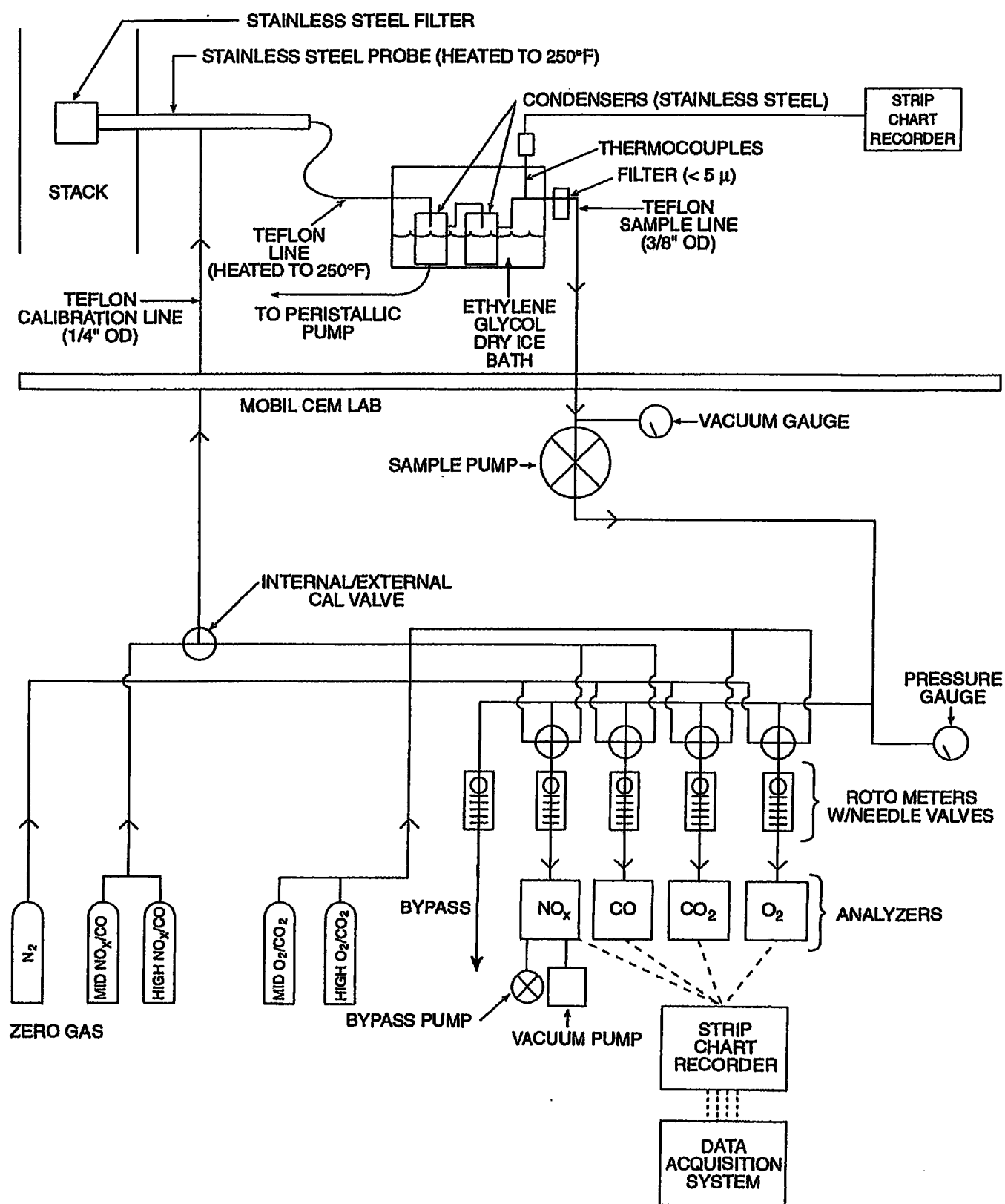
**CO<sub>2</sub> INFRARED GAS ANALYZER -- HORIBA- PIR 2000**

Response Time (0-90%)	5 seconds
Zero Drift	± 1% of full scale in 24 hours
Span Drift	± 1% of full scale in 24 hours
Linearity	± 2% of full scale
Resolution	Less than 1% of full scale
Operating Ranges (%)	0-5, 0-20
Output	0-1 volt

**TABLE 1 (Cont.)**

**YOKOGAWA MODEL LR8100 SIX PEN STRIP CHART RECORDER**

Pen Speed	up to 120 cm/min
Measuring Response	0-20 volts
Linearity Error	0.25%
Accuracy	0.3%
Zero Suppression	Manual (from 1 to 10X full scale)



**CEM System Schematic**

Method:	<b>NO/NO<sub>x</sub> by Continuous Analyzer</b>
Applicable Reference Methods:	EPA 7E, EPA 20; CARB 100, BAAQMD ST-13A, SCAQMD 100.1
Principle:	A sample is continuously withdrawn from the flue gas stream, conditioned and conveyed to the instrument for direct readout of NO or NO <sub>x</sub> .
Analyzer:	TECO Model 10A
Measurement Principle:	Chemiluminescence
Accuracy:	1% of full scale
Ranges:	0-2.5, 0-10, 0-25, 0-100, 0-250, 0-1000, 0-2500, 0-10,000 ppm
Output:	0-1 V or 0-10 V
Interferences:	Compounds containing nitrogen (other than ammonia) may cause interference.
Response Time:	90%, 1.5 seconds (NO mode) and 1.7 seconds (NO <sub>x</sub> mode)
Sampling Procedure:	A representative flue gas sample is collected and conditioned using the CEM system described previously. If EPA Method 20 is used, that method's specific procedures for selecting sample points are used.
Analytical Procedure:	<p>The oxides of nitrogen monitoring instrument is a chemiluminescent nitric oxide analyzer. the operational basis of the instrument is the chemiluminescent reaction of NO and ozone (O<sub>3</sub>) to form NO<sub>2</sub> in an excited state. Light emission results chemiluminescence is monitored through an optical filter by a high sensitivity photomultiplier tube, the output of which is electronically processed so it is linearly proportional to the NO concentration. The output of the instrument is in ppmV.</p> <p>When NO<sub>2</sub> is expected to be present in the flue gas, a supercooled water dropout flask will be placed in the sample line to avoid loss of NO<sub>2</sub>. Since NO<sub>2</sub> is highly soluble in water, "freezing out" the water will allow the NO<sub>2</sub> to reach the analyzers for analysis. The analyzer measures NO only. In the NO<sub>x</sub> mode, the gas is passed through a moly converter which converts NO<sub>2</sub> to NO and a total NO<sub>x</sub> measurement is obtained. NO<sub>2</sub> is determined as the difference between NO and NO<sub>x</sub>. Use of a moly converter instead of a stainless steel converter eliminates NH<sub>3</sub> interference; NH<sub>3</sub> is converted to NO with a stainless converter, but not with a moly converter.</p>

Method:	<b>Oxygen (O<sub>2</sub>) by Continuous Analyzer</b>
Applicable Reference Methods:	EPA 3A, EPA 20, CARB 100, BAAQMD ST-14, SCAQMD 100.1
Principle:	A sample is continuously withdrawn from the flue gas stream, conditioned and conveyed to the instrument for direct readout of O <sub>2</sub> concentration.
Analyzer:	Servo Mex
Measurement Principle:	Paramagnetic
Ranges:	0-25% 0-100%
Accuracy:	1% of full scale
Output:	0-1 V
Interferences:	Halogens and halogenated compounds will cause a positive interference. Acid gases will consume the fuel cell and cause a slow calibration drift.
Response Time:	90% <60 seconds
Sampling Procedure:	A representative flue gas sample is collected and conditioned using the CEM system described previously. If Method 20 is used, that method's specific procedures for selecting sample points are used. Otherwise, stratification checks are performed at the start of a test program to select single or multiple-point sample locations.
Analytical Procedure:	An electrochemical cell is used to measure O <sub>2</sub> concentration. Oxygen in the flue gas diffuses through a Teflon membrane and is reduced on the surface of the cathode. A corresponding oxidation occurs at the anode internally and an electric current is produced that is proportional to the concentration of oxygen. This current is measured and conditioned by the instrument's electronic circuitry to give an output in percent O <sub>2</sub> by volume.

<b>Method:</b>	<b>Carbon Dioxide (CO<sub>2</sub>) by Continuous Analyzer</b>
<b>Applicable Reference</b>	EPA 3A, CARB 100, BAAQMD ST-5, SCAQMD 100.1
<b>Principle:</b>	A sample is continuously drawn from the flue gas stream, conditioned and conveyed to the instrument for direct readout of CO <sub>2</sub> concentration.
<b>Analyzer:</b>	Horiba PIR 2000
<b>Measurement Principle:</b>	Non-dispersive infrared (NDIR)
<b>Accuracy:</b>	1% of full scale
<b>Ranges:</b>	0-5%, 0-15%, 0-25%
<b>Output:</b>	0-1 V
<b>Interferences:</b>	A possible interference includes water. Since the instrument receives dried sample gas, this interference is not significant.
<b>Response Time:</b>	5 seconds
<b>Sampling Procedure:</b>	A representative flue gas sample is collected and conditioned using the CEM system described previously.
<b>Analytical Procedure:</b>	Carbon dioxide concentrations are measured by short path length non-dispersive infrared analyzers. These instruments measure the differential in infrared energy absorbed from energy beams passed through a reference cell (containing a gas selected to have minimal absorption of infrared energy in the wavelength absorbed by the gas component of interest) and a sample cell through which the sample gas flows continuously. The differential absorption appears as a reading on a scale of 0-100%.

<b>Method:</b>	<b>Carbon Monoxide (CO) by NDIR/Gas Filter Correlation</b>
<b>Applicable Reference Methods:</b>	EPA 10; CARB 1-100; BAAQMD ST-6, SCAQMD 100.1
<b>Principle:</b>	A sample is continuously drawn from the flue gas stream, conditioned and conveyed to the instrument for direct readout of CO concentration.
<b>Analyzer:</b>	TECO, Model 48C
<b>Measurement Principle:</b>	NDIR/Gas Filter Correlation
<b>Precision:</b>	0.1% ppm
<b>Ranges:</b>	0-10, 0-100, 0-200, 0-500, 0-1,000, 0-2,000, 0-5,000, 0-10,000
<b>Output:</b>	0-1 V
<b>Interferences:</b>	Negligible interference from water and CO <sub>2</sub>
<b>Rise/Fall times (0-95%)</b>	1 minute @ 1 lpm flow, 30 second integration time
<b>Sampling Procedure:</b>	A representative flue gas sample is collected and conditioned using the CEM system described previously. Sample point selection has been described previously.
<b>Analytical Procedure:</b>	Radiation from an infrared source is chopped and then passed through a gas filter which alternates between CO and N <sub>2</sub> due to rotation of a filter wheel. The radiation then passes through a narrow band-pass filter and a multiple optical pass sample cell where absorption by the sample gas occurs. The IR radiation exits the sample cell and falls on a solid state IR detector.

<b>Method:</b>	<b>Sulfur Dioxide (SO<sub>2</sub>) by Pulsed Fluorescent</b>
<b>Applicable Reference Methods:</b>	EPA 6C; CARB 1-100; BAAQMD ST-6, SCAQMD 100.1
<b>Principle:</b>	A sample is continuously drawn from the flue gas stream, conditioned and conveyed to the instrument for direct readout of SO <sub>2</sub> concentration.
<b>Analyzer:</b>	TECO, Model 43C-HL
<b>Measurement Principle:</b>	Pulsed fluorescence SO <sub>2</sub> analyzer
<b>Precision:</b>	0.1% ppm
<b>Ranges:</b>	5, 10, 20, 50, 100, 200, 500, 1,000, 2,000, 5,000 ppm
<b>Output:</b>	0-10 V
<b>Interferences:</b>	Less than lower detectable limit except for the following: NO <3 ppb, m-xylene <2 ppm, H <sub>2</sub> O <2% of reading.
<b>Response Time:</b>	80 seconds
<b>Sampling Procedure:</b>	A representative flue gas sample is collected and conditioned using the CEM system described previously. Sample point selection has been described previously.
<b>Analytical Procedure:</b>	The sample flows into the fluorescent chamber, where pulsating UV light excites the SO <sub>2</sub> molecules. The condensing lens focuses the pulsating UV light into the mirror assembly. The mirror assembly contains four selecting mirrors that reflect only the wavelengths which excite SO <sub>2</sub> molecules. As excited SO <sub>2</sub> molecules decay to lower energy states they emit UV light that is proportional to the SO <sub>2</sub> concentration. The PMT (photomultiplier tube) detects UV light emission from decaying SO <sub>2</sub> molecules. The PMT continuously monitors pulsating UV light source and is connected to a circuit that compensates for fluctuating in the light.



Designation: D 3588 – 98 (Reapproved 2003)

## Standard Practice for Calculating Heat Value, Compressibility Factor, and Relative Density of Gaseous Fuels<sup>1</sup>

This standard is issued under the fixed designation D 3588; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon ( $\epsilon$ ) indicates an editorial change since the last revision or reapproval.

### 1. Scope

1.1 This practice covers procedures for calculating heating value, relative density, and compressibility factor at base conditions (14.696 psia and 60°F (15.6°C)) for natural gas mixtures from compositional analysis.<sup>2</sup> It applies to all common types of utility gaseous fuels, for example, dry natural gas, reformed gas, oil gas (both high and low Btu), propane-air, carbureted water gas, coke oven gas, and retort coal gas, for which suitable methods of analysis as described in Section 6 are available. Calculation procedures for other base conditions are given.

1.2 The values stated in inch-pound units are to be regarded as the standard. The SI units given in parentheses are for information only.

1.3 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

### 2. Referenced Documents

#### 2.1 ASTM Standards:

- D 1717 Method for Analysis of Commercial Butane-Butene Mixtures and Isobutylene by Gas Chromatography<sup>3</sup>
- D 1945 Test Method for Analysis of Natural Gas by Gas Chromatography<sup>4</sup>
- D 1946 Practice for Analysis of Reformed Gas by Gas Chromatography<sup>4</sup>
- D 2163 Test Method for Analysis of Liquefied Petroleum (LP) Gases and Propane Concentrates by Gas Chromatography<sup>5</sup>

#### D 2650 Test Method for Chemical Composition of Gases by Mass Spectrometry<sup>5</sup>

#### 2.2 GPA Standards:

- GPA 2145 Physical Constants for the Paraffin Hydrocarbons and Other Components in Natural Gas<sup>6</sup>
- GPA Standard 2166 Methods of Obtaining Natural Gas Samples for Analysis by Gas Chromatography<sup>6</sup>
- GPA 2172 Calculation of Gross Heating Value, Relative Density, and Compressibility Factor for Natural Gas Mixtures from Compositional Analysis<sup>6,7</sup>
- GPA Standard 2261 Method of Analysis for Natural Gas and Similar Gaseous Mixtures by Gas Chromatography<sup>6</sup>
- GPA Technical Publication TP-17 Table of Physical Properties of Hydrocarbons for Extended Analysis of Natural Gases<sup>6</sup>

GPSA Data Book, Fig. 23-2, Physical Constants<sup>6</sup>

#### 2.3 TRC Document:

TRC Thermodynamic Tables—Hydrocarbons<sup>8</sup>

#### 2.4 ANSI Standard:

ANSI Z 132.1-1969: Base Conditions of Pressure and Temperature for the Volumetric Measurement of Natural Gas<sup>9,10</sup>

### 3. Terminology

#### 3.1 Definitions:

3.1.1 *British thermal unit*—the defined International Tables British thermal unit (Btu).

3.1.1.1 *Discussion*—The defining relationships are:

$$1 \text{ Btu} \cdot \text{lb}^{-1} = 2.326 \text{ J} \cdot \text{g}^{-1} \text{ (exact)}$$

$$1 \text{ lb} = 453.592 37 \text{ g (exact)}$$

<sup>1</sup> This practice is under the jurisdiction of ASTM Committee D03 on Gaseous Fuels and is the direct responsibility of Subcommittee D03.03 on Determination of Heating Value and Relative Density of Gaseous Fuels.

Current edition approved May 10, 2003. Published May 2003. Originally approved in 1998. Last previous edition approved in 1998 as D 3588 – 98.

<sup>2</sup> A more rigorous calculation of  $Z(T,P)$  at both base conditions and higher pressures can be made using the calculation procedures in "Compressibility and Super Compressibility for Natural Gas and Other Hydrocarbon Gases," American Gas Association Transmission Measurement Committee Report 8, AGA Cat. No. XQ1285, 1985, AGA, 1515 Wilson Blvd., Arlington, VA 22209.

<sup>3</sup> Discontinued. See 1981 *Annual Book of ASTM Standards*, Vol 05.01.

<sup>4</sup> *Annual Book of ASTM Standards*, Vol 05.06.

<sup>5</sup> *Annual Book of ASTM Standards*, Vol 05.01.

<sup>6</sup> Available from Gas Processors Association, 6526 E. 60th, Tulsa, OK 74145.

<sup>7</sup> The sole source of supply of the program in either BASIC or FORTRAN suitable for running on computers known to the committee at this time is the Gas Processors Association. If you are aware of alternative suppliers, please provide this information to ASTM International Headquarters. Your comments will receive careful consideration at a meeting of the responsible technical committee<sup>1</sup>, which you may attend.

<sup>8</sup> Available from Thermodynamics Research Center, The Texas A&M University, College Station, TX 77843-3111.

<sup>9</sup> Available from the American National Standards Institute, 25 W. 43rd St., 4th Floor, New York, NY 10036.

<sup>10</sup> Supporting data have been filed at ASTM International Headquarters and may be obtained by requesting Research Report RR: D03-1007.

By these relationships, 1 Btu = 1 055.055 852 62 J (exact). For most purposes, the value (rounded) 1 Btu = 1055.056 J is adequate.

3.1.2 *compressibility factor* ( $z$ )—the ratio of the actual volume of a given mass of gas at a specified temperature and pressure to its volume calculated from the ideal gas law under the same conditions.

3.1.3 *gross heating value*—the amount of energy transferred as heat from the complete, ideal combustion of the gas with air, at standard temperature, in which all the water formed by the reaction condenses to liquid. The values for the pure gases appear in GPA Standard 2145, which is revised annually. If the gross heating value has a volumetric rather than a mass or molar basis, a base pressure must also be specified.

3.1.4 *net heating value*—the amount of energy transferred as heat from the total, ideal combustion of the gas at standard temperature in which all the water formed by the reaction remains in the vapor state. Condensation of any “spectator” water does not contribute to the net heating value. If the net heating value has a volumetric rather than a mass or molar basis, a base pressure must also be specified.

3.1.5 *relative density*—the ratio of the density of the gaseous fuel, under observed conditions of temperature and pressure, to the density of dry air (of normal carbon dioxide content) at the same temperature and pressure.

3.1.6 *standard cubic foot of gas*—the amount of gas that occupies 1 ft<sup>3</sup> (0.028 m<sup>3</sup>) at a temperature of 60°F (15.6°C) under a given base pressure and either saturated with water vapor (wet) or free of water vapor (dry) as specified (see ANSI Z 132.1). In this practice, calculations have been made at 14.696 psia and 60°F (15.6°C), because the yearly update of GPA 2145 by the Thermodynamics Research Center, on which these calculations are based, are given for this base pressure. Conversions to other base conditions should be made at the end of the calculation to reduce roundoff errors.

3.1.7 *standard temperature (USA)*—60°F (15.6°C).

## 3.2 Symbols:

### 3.2.1 Nomenclature:

- 3.2.1.1  $B$ —second virial coefficient for gas mixture
- 3.2.1.2  $\sqrt{\beta_{ij}}$ —summation factor for calculating real gas correction (alternate method)
- 3.2.1.3 (cor)—corrected for water content
- 3.2.1.4 (dry)—value on water-free basis
- 3.2.1.5  $d$ —density for gas relative to the density of air.
- 3.2.1.6  $d^{id}$ —ideal relative density or relative molar mass, that is, molar mass of gas relative to molar mass of air
- 3.2.1.7  $G^{id}$ —molar mass ratio
- 3.2.1.8  $H_m^{id}$ —gross heating value per unit mass
- 3.2.1.9  $H_v^{id}$ —gross heating value per unit volume
- 3.2.1.10  $H_u^{id}$ —gross heating value per unit mole
- 3.2.1.11  $h_m^{id}$ —net heating value per unit mass
- 3.2.1.12  $h_v^{id}$ —net heating value per unit volume
- 3.2.1.13  $h_u^{id}$ —net heating value per unit mole
- 3.2.1.14  $a, b, c$ —in Eq 1, integers required to balance the equation: C, carbon; H, hydrogen; S, sulfur; O, oxygen
- 3.2.1.15 ( $id$ )—ideal gas state
- 3.2.1.16 ( $l$ )—liquid phase
- 3.2.1.17  $M$ —molar mass

- 3.2.1.18  $m$ —mass flow rate
- 3.2.1.19  $n$ —number of components
- 3.2.1.20  $P$ —pressure in absolute units (psia)
- 3.2.1.21  $Q^{id}$ —ideal energy per unit time released as heat upon combustion
- 3.2.1.22  $R$ —gas constant, 10.7316 psia.ft<sup>3</sup>/(lb mol·R) in this practice (based upon  $R = 8.314\ 48\ \text{J}/(\text{mol}\cdot\text{K})$ )
- 3.2.1.23 (sat)—denotes saturation value
- 3.2.1.24  $T$ —absolute temperature, °R = °F + 459.67 or  $K = ^\circ\text{C} + 273.15$
- 3.2.1.25 ( $T, P$ )—value dependent upon temperature and pressure
- 3.2.1.26  $V$ —gas volumetric flow rate
- 3.2.1.27  $x$ —mole fraction
- 3.2.1.28  $Z$ —gas compressibility factor repeatability of property
- 3.2.1.29  $\delta$ —repeatability of property
- 3.2.1.30  $\rho$ —density in mass per unit volume
- 3.2.1.31  $\sum_{j=1}^n$ —property summed for Components 1 through  $n$ , where  $n$  represents the total number of components in the mixture
- 3.2.2 *Superscripts:*
  - 3.2.2.1  $id$ —ideal gas value
  - 3.2.2.2  $l$ —liquid
  - 3.2.2.3  $\sigma$ —value at saturation (vapor pressure)
  - 3.2.2.4  $'$ —reproducibility
- 3.2.3 *Subscripts:*
  - 3.2.3.1  $a$ —value for air
  - 3.2.3.2  $a$ —relative number of atoms of carbon in Eq 1
  - 3.2.3.3  $b$ —relative number of atoms of hydrogen in Eq 1
  - 3.2.3.4  $c$ —relative number of atoms of sulfur in Eq 1
  - 3.2.3.5  $j$ —property for component  $j$
  - 3.2.3.6  $li$ —non-ideal gas property for component  $i$
  - 3.2.3.7  $lj$ —non-ideal gas property for mixture of  $i$  and  $j$
  - 3.2.3.8  $jj$ —non-ideal gas property for component  $j$
  - 3.2.3.9  $w$ —value for water
  - 3.2.3.10 1—property for Component 1
  - 3.2.3.11 2—property for Component 2

## 4. Summary of Practice

4.1 The ideal gas heating value and ideal gas relative density at base conditions (14.696 psia and 60°F (15.6°C)) are calculated from the molar composition and the respective ideal gas values for the components; these values are then adjusted by means of a calculated compressibility factor.

## 5. Significance and Use

5.1 The heating value is a measure of the suitability of a pure gas or a gas mixture for use as a fuel; it indicates the amount of energy that can be obtained as heat by burning a unit of gas. For use as heating agents, the relative merits of gases from different sources and having different compositions can be compared readily on the basis of their heating values. Therefore, the heating value is used as a parameter for determining the price of gas in custody transfer. It is also an essential factor in calculating the efficiencies of energy conversion devices such as gas-fired turbines. The heating values of a gas depend not only upon the temperature and pressure, but also upon the degree of saturation with water vapor.

However, some calorimetric methods for measuring heating values are based upon the gas being saturated with water at the specified conditions.

5.2 The relative density (specific gravity) of a gas quantifies the density of the gas as compared with that of air under the same conditions.

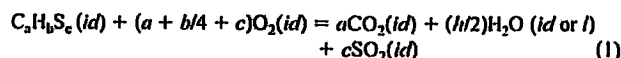
## 6. Methods of Analysis

6.1 Determine the molar composition of the gas in accordance with any ASTM or GPA method that yields the complete composition, exclusive of water, but including all other components present in amounts of 0.1 % or more, in terms of components or groups of components listed in Table 1. At least 98 % of the sample must be reported as individual components (that is, not more than a total of 2 % reported as groups of components such as butanes, pentanes, hexanes, butenes, and

so forth). Any group used must be one of those listed in Table 1 for which average values appear. The following test methods are applicable to this practice when appropriate for the sample under test: Test Methods D 1717, D 1945, D 2163, and D 2650.

## 7. Calculation—Ideal Gas Values; Ideal Heating Value

7.1 An ideal combustion reaction in general terms for fuel and air in the ideal gas state is:



where *id* denotes the ideal gas state and *l* denotes liquid phase. The ideal net heating value results when all the water remains in the ideal gas state. The ideal gross heating value results when all the water formed by the reaction condenses to liquid. For water, the reduction from  $H_2O(id)$  to  $H_2O(l)$  is  $H_{wv}^{id}$ .

TABLE 1 Properties of Natural Gas Components at 60°F and 14.696 psia<sup>a</sup>

Compound	Formula	Molar Mass, lb·lbmol <sup>-1b</sup>	Molar Mass, Rtlo, G <sup>MC</sup>	Ideal Gross Heating Value <sup>c</sup>			Ideal Net Heating Value			Summation Factor, $b_h$ psia <sup>-1</sup>
				$H_g^{id}$ , kJ·mol <sup>-1</sup>	$H_g^{id}$ , Btu·lbm <sup>-1</sup>	$H_g^{id}$ , Btu·ft <sup>-3</sup>	$H_g^{id}$ , kJ·mol <sup>-1</sup>	$H_g^{id}$ , Btu·lbm <sup>-1</sup>	$H_g^{id}$ , Btu·ft <sup>-3</sup>	
Hydrogen	H <sub>2</sub>	2.0159	0.069 60	286.20	6 102.2	324.2	241.79	51 566	273.93	0
Helium	He	4.0026	0.138 20	0	0	0	0	0	0	0
Water	H <sub>2</sub> O	18.0153	0.622 02	44.409	1059.8	50.312	0	0	0	0.0623
Carbon monoxide	CO	28.010	0.967 11	282.9	4342	320.5	282.9	4 342	320.5	0.0053
Nitrogen	N <sub>2</sub>	28.0134	0.967 23	0	0	0	0	0	0	0.0044
Oxygen	O <sub>2</sub>	31.9988	1.104 8	0	0	0	0	0	0	0.0073
Hydrogen sulfide	H <sub>2</sub> S	34.08	1.176 7	562.4	7 094.2	637.1	517.99	6 534	586.8	0.0253
Argon	Ar	39.948	1.379 3	0	0	0	0	0	0	0.0071
Carbon dioxide	CO <sub>2</sub>	44.010	1.519 6	0	0	0	0	0	0	0.0197
Air	<sup>e</sup>	28.9625	1.000 0	0	0	0	0	0	0	0.0050
Methane	CH <sub>4</sub>	16.043	0.553 92	891.63	23 891	1010.0	802.71	21 511	909.4	0.0116
Ethane	C <sub>2</sub> H <sub>6</sub>	30.070	1.038 2	1562.06	22 333	1769.7	1428.83	20 429	1618.7	0.0239
Propane	C <sub>3</sub> H <sub>8</sub>	44.097	1.522 6	2220.99	21 853	2516.1	2043.3	19 922	2314.9	0.0344
i-Butane	C <sub>4</sub> H <sub>10</sub>	58.123	2.006 8	2870.45	21 232	3251.9	2648.4	19 590	3000.4	0.0458
n-Butane	C <sub>4</sub> H <sub>10</sub>	58.123	2.006 8	2879.63	21 300	3262.3	2657.6	19 658	3010.8	0.0478
i-Pentane	C <sub>5</sub> H <sub>12</sub>	72.150	2.491 2	3531.5	21 043	4000.9	3265.0	19 456	3699.0	0.0581
n-Pentane	C <sub>5</sub> H <sub>12</sub>	72.150	2.491 2	3535.8	21 085	4008.9	3289.3	19 481	3703.9	0.0631
n-Hexane	C <sub>6</sub> H <sub>14</sub>	86.177	2.975 5	4198.1	20 943	4755.9	3887.2	19 393	4403.9	0.0802
n-Heptane	C <sub>7</sub> H <sub>16</sub>	100.204	3.459 8	4857.2	20 839	5502.5	4501.9	19 315	5100.3	0.0944
n-Octane	C <sub>8</sub> H <sub>18</sub>	114.231	3.944 1	5515.9	20 759	6248.9	5116.2	19 256	5796.2	0.1137
n-Nonane	C <sub>9</sub> H <sub>20</sub>	128.258	4.428 4	6175.9	20 701	6996.5	5731.8	19 213	6493.6	0.1331
n-Decane	C <sub>10</sub> H <sub>22</sub>	142.285	4.912 7	6834.9	20 651	7742.9	6346.4	19 176	7189.9	0.1538
Neopentane	C <sub>5</sub> H <sub>12</sub>	72.015	2.491 2	3517.27	20 958	3985	3250.8	19 371	3683	...
2-Methylpentane	C <sub>6</sub> H <sub>14</sub>	86.177	2.975 5	4190.43	20 905	4747	3879.6	19 355	4395	0.080
3-Methylpentane	C <sub>6</sub> H <sub>14</sub>	86.177	2.975 5	4193.03	20 918	4750	3882.2	19 367	4398	0.080
2,2-Dimethylbutane	C <sub>6</sub> H <sub>14</sub>	86.177	2.975 5	4180.83	20 856	4736	3869.8	19 306	4384	0.080
2,3-Dimethylbutane	C <sub>6</sub> H <sub>14</sub>	86.177	2.975 5	4188.41	20 895	4745	3877.5	19 344	4393	0.080
Cyclopropane	C <sub>3</sub> H <sub>6</sub>	42.081	1.452 9	2092.78	21 381	2371	1959.6	20 020	2220	...
Cyclobutane	C <sub>4</sub> H <sub>8</sub>	56.108	1.937 3	2747.08	21 049	2747	2569.4	19 688	2911	...
Cyclopentane	C <sub>5</sub> H <sub>10</sub>	70.134	2.421 5	3322.04	20 364	3764	3100.0	19 003	3512	...
Cyclohexane	C <sub>6</sub> H <sub>12</sub>	84.161	2.905 9	3955.84	20 208	4482	3689.4	18 847	4180	...
Ethyne (acetylene)	C <sub>2</sub> H <sub>2</sub>	26.038	0.899 0	1301.32	21 487	1474	1256.9	20 753	1424	0.021
Ethene (ethylene)	C <sub>2</sub> H <sub>4</sub>	28.054	0.988 8	1412.06	21 640	1600	1323.2	20 278	1499	0.020
Propene (propylene)	C <sub>3</sub> H <sub>6</sub>	42.081	1.452 9	2059.35	21 039	2333	1926.1	19 878	2182	0.033
Benzene	C <sub>6</sub> H <sub>6</sub>	78.114	2.697 1	3202.74	18 177	3742	3169.5	17 444	3591	0.069
Butanes (ave)	C <sub>4</sub> H <sub>10</sub>	58.123	2.008 8	2875	21 266	3257	2653	19 623	3006	0.046
Pentanes (ave)	C <sub>5</sub> H <sub>12</sub>	72.150	2.491 2	3534	21 056	4003	3267	19 469	3702	0.062
Hexanes (ave)	C <sub>6</sub> H <sub>14</sub>	86.177	2.975 5	4190	20 904	4747	3879	19 353	4395	0.080
Butenes (ave)	C <sub>4</sub> H <sub>8</sub>	56.108	1.937 2	2716	20 811	3077	2538	19 450	2878	0.046
Pentenes (ave)	C <sub>5</sub> H <sub>10</sub>	70.134	2.421 5	3375	20 691	3824	3153	19 328	3572	0.080

<sup>a</sup> This table is consistent with GPA 2145-89, but it is necessary to use the values from the most recent edition of GPA 2145 for custody transfer calculations.

<sup>b</sup> 1984 Atomic Weights: C = 12.011, H = 1.00794, O = 15.9994, N = 14.0067, S = 32.06.

<sup>c</sup> Molar mass ratio is the ratio of the molar mass of the gas to that of air.

<sup>d</sup> Based upon ideal reaction; the entry for water represents the total enthalpy of vaporization.

<sup>e</sup> Composition from: F. E. Jones, *J. Res. Nat. Bur. Stand.*, Vol. 83, 419, 1978.

–  $H_w^I$ , the ideal enthalpy of vaporization, which is somewhat larger than the enthalpy of vaporization  $H_w^v - H_w^I$ .

7.1.1 Because the gross heating value results from an ideal combustion reaction, ideal gas relationships apply. The ideal gross heating value per unit mass for a mixture,  $H_m^{id}$ , is:

$$H_m^{id} = \sum_{j=1}^n x_j M_j H_{m,j}^{id} / \sum_{j=1}^n x_j M_j \quad (2)$$

where:  $x_j$  is the mole fraction of Component  $j$ ,  $M_j$  is the molar mass of Component  $j$  from Table 1, and  $n$  is the total number of components.

7.1.2  $H_{m,j}^{id}$  is the pure component, ideal gross heating value per unit mass for Component  $j$  (at 60°F (15.6°C) in Table 1). Values of  $H_{m,j}^{id}$  are independent of pressure, but they vary with temperature.

## 7.2 Ideal Gas Density

7.2.1 The ideal gas density,  $\rho^{id}$ , is:

$$\rho^{id} = (P/RT) \sum_{j=1}^n x_j M_j = MP/RT \quad (3)$$

where:  $M$  is the molar mass of the mixture,

$$M = \sum_{j=1}^n x_j M_j \quad (4)$$

$P$  is the base pressure in absolute units (psia),  $R$  is the gas constant, 10.7316 psia.ft<sup>3</sup>/(lb mol.°R) in this practice, based upon  $R = 8.31448$  J/(mol.K),  $T$  is the base temperature in absolute units (°R = °F + 459.67). Values of the ideal gas density at 60°F (15.6°C) and 14.696 psia are in GPA Standard 2145.

## 7.3 Ideal Relative Density:

7.3.1 The ideal relative density  $d^{id}$  is:

$$d^{id} = \sum_{j=1}^n x_j d_j = \sum_{j=1}^n x_j M_j / M_a = M/M_a \quad (5)$$

where:  $M_a$  is the molar mass of air. The ideal relative density is the molar mass ratio.

## 7.4 Gross Heating Value per Unit Volume:

7.4.1 Multiplication of the gross heating value per unit mass by the ideal gas density provides the gross heating value per unit volume,  $H_v^{id}$ :

$$H_v^{id} = \rho^{id} H_m^{id} = \sum_{j=1}^n x_j H_{v,j}^{id} \quad (6)$$

$H_{v,j}^{id}$  is the pure component gross heating value per unit volume for Component  $j$  at specified temperature and pressure (60°F (15.6°C) and 14.696 psia in Table 1, ideal gas values).

7.4.2 Conversion of values in Table 1 to different pressure bases results from multiplying by the pressure ratio:

$$H_v^{id}(P) = H_v^{id}(P = 14.696) \times P/14.696 \quad (7)$$

## 7.5 Real Gas Values—Compressibility Factor:

7.5.1 The compressibility factor is:

$$Z(T,P) = \rho^{id}/\rho = (MP/RT)/\rho \quad (8)$$

where  $\rho$  is the real gas density in mass per unit volume. At conditions near ambient, the truncated virial equation of state satisfactorily represents the volumetric behavior of natural gas:

$$Z(T,P) = 1 + BP/RT \quad (9)$$

where  $B$  is the second virial coefficient for the gas mixture. The second virial coefficient for a mixture is:

$$B = x_1^2 B_{11} + x_2^2 B_{22} + \dots + x_n^2 B_{nn} + 2x_1 x_2 B_{12} + \dots + 2x_{n-1} x_n B_{n-1,n} \\ = \sum_{i=1}^n \sum_{j=1}^n x_i x_j B_{ij} \quad (10)$$

where  $B_{jj}$  is the second virial coefficient for Component  $j$  and  $B_{ij}$  is the second cross virial coefficient for Components  $i$  and  $j$ . The second virial coefficients are functions of temperature. Eq 9 can be used with Eq 10 for calculation of the compressibility factor for the various pressure bases, but it is not accurate at pressures greater than two atmospheres. Special treatment is not required for H<sub>2</sub> and He at mole fractions up to 0.01. Calculations can be made with  $B_{ij} = 0$  for hydrogen and helium.

7.5.2 Eq 9 and Eq 10 for calculation of  $Z(T,P)$  for a gas mixture are rigorous but require considerable calculations and information that is not always available. An alternative, approximate expression for  $Z(T,P)$  that is more convenient for hand calculations is:

$$Z(T,P) = 1 - P \left( \sum_{j=1}^n x_j \sqrt{\beta_{jj}} \right)^2 \quad (11)$$

where  $\beta_{jj} = B_{jj}/RT$  and  $\sqrt{\beta_{jj}}$  is the summation factor for Component  $j$ . Values of  $\sqrt{\beta_{jj}}$  at 60°F (15.6°C) appear in Table 2. The method based upon Eq 11 has been adopted for this practice.

## 7.6 Real Gas Density:

7.6.1 The real gas density  $\rho$  at a specific temperature and pressure is:

$$\rho = \rho^{id}/Z \quad (12)$$

where:  $\rho^{id}$  and  $Z$  are evaluated at the same temperature and pressure.

## 7.7 Real Relative Density:

7.7.1 The real relative density  $d$  is:

$$d = \rho/\rho_a = MZ_a/M_a Z \quad (13)$$

7.8 Real Heating Value—The real heating value is not given by division of the ideal heating value by the compressibility factor. Real gas heating values differ from the ideal gas values by less than one part in 10<sup>4</sup> at 14.696 psia, which is of the order of the accuracy of the heating values.

## 7.9 Gross Heating Value of Water Wet Gas:

7.9.1 If the gas contains water as a component but the compositional analysis is on a dry basis, it is necessary to adjust the mole fractions to reflect the presence of water. The corrected mole fractions are:

$$x_j(\text{cor}) = x_j(1 - x_w) \quad (14)$$

The mole fraction of water can range from zero up to the saturated value. The saturated value for  $x_w$  is, assuming Raoult's Law:

$$x_w(\text{sat}) = P_w^s/P \quad (15)$$

where:  $P_w^s$  is the vapor pressure of water (0.256 36 psia at 60°F (15.6°C)).

7.9.2 Technically, water has a gross heating value, the ideal enthalpy of condensation. If only the water that is formed

TABLE 2 Example Calculations of Gas Properties at 60°F and 14.696 psia (Gas Analysis on Dry Basis)<sup>a</sup>

Note—Division of  $H_v^{id}$  by  $Z$  does not give a real gas heating value but rather an ideal gas heating value per real cubic foot. Any digits carried beyond 1 part in 1000 are not significant but only alleviate roundoff error. Although  $\text{CO}_2$  has a carbon atom, its  $\alpha = 0$  because it is not part of the fuel formula  $C_n H_p S_y$ .

Compound	$x_i$	$\alpha_i$	$\beta_i$	$\gamma_i$	$H_v^{id}$	$G_i^{id}$	$b_i$	$x_{p,i}$	$x_{\beta,i}$	$x_{\gamma,i}$	$x_i H_v^{id}$	$x_i G_i^{id}$	$x_i b_i$
Methane	0.8302	1	4	0	1010.0	0.553 92	0.0116	0.8302	3.3208	0	838.5	0.4599	0.009 63
Ethane	0.0745	2	6	0	1769.7	1.038 20	0.0239	0.1490	0.4470	0	131.8	0.0773	0.001 78
Propane	0.0439	3	8	0	2518.1	1.522 60	0.0344	0.1317	0.3512	0	110.5	0.0668	0.001 51
<i>i</i> -Butane	0.0083	4	10	0	3251.9	2.006 80	0.0458	0.0332	0.0830	0	27.0	0.0167	0.000 38
<i>n</i> -Butane	0.0108	4	10	0	3262.3	2.006 80	0.0478	0.0432	0.1080	0	35.2	0.0217	0.000 52
<i>i</i> -Pentane	0.0031	5	12	0	4000.9	2.491 20	0.0581	0.0155	0.0372	0	12.4	0.0077	0.000 18
<i>n</i> -Pentane	0.0025	5	12	0	4008.9	2.491 20	0.0631	0.0125	0.03	0	10.0	0.0062	0.000 16
Hexane	0.0030	6	14	0	4755.9	2.975 50	0.0802	0.0180	0.0420	0	14.3	0.0089	0.000 24
Helium	0.0003	0	0	0	0	0.138 20	0	0	0	0	0	0.0000	0.000 00
Nitrogen	0.0032	0	0	0	0	0.867 23	0.0044	0	0	0	0	0.0031	0.000 01
Carbon dioxide	0.0202	0	0	0	0	1.519 60	0.0197	0	0	0	0	0.0307	0.000 40
Summation	1.0000	...	...	...	...	...	...	1.2333	4.4192	0	1179.7	0.6991	0.014 81

$x_w = (0.256\ 36)/14.696 = 0.0174$   
 $G^{id}(\text{dry gas}) = 0.6991$   
 $Z(\text{dry gas}) = 1 - [0.014\ 81]^2(14.696) = 0.9968$   
 $Z(\text{dry air}) = 1 - [0.0050]^2(14.696) = 0.9996$   
 $G(\text{dry gas, dry air}) = 0.6991(0.9996)/0.9968 = 0.7011$   
 $G(\text{dry gas, sat air}) = 0.6991(0.9995)/0.9968 = 0.7010$   
 $H_v^{id}(\text{dry gas, dry air}) = 1179.7\ \text{Btu}\cdot\text{ft}^{-3}$   
 $H_v^{id}(\text{sat gas, dry air}) = 1179.7(0.9826) = 1159.1\ \text{Btu}\cdot\text{ft}^{-3}$   
 $1 - x_w = 0.9826$   
 $G^{id}(\text{sat gas}) = 0.6991(0.9826) + 0.0174(0.622\ 02) = 0.6978$   
 $Z(\text{sat gas}) = 1 - [0.9826(0.014\ 81) + 0.0174(0.0623)]^2(14.696) = 0.9964$   
 $Z(\text{sat air}) = 1 - [0.9826(0.0050) + 0.0174(0.0623)]^2(14.696) = 0.9995$   
 $G(\text{sat gas, dry air}) = 0.6978(0.9995)/0.9964 = 0.7001$   
 $G(\text{sat gas, sat air}) = 0.6978(0.9995)/0.9964 = 0.7000$   
 $(H_v^{id}/Z)(\text{dry gas, dry air}) = 1179.7/0.9968 = 1183.5\ \text{Btu}\cdot\text{ft}^{-3}$   
 $(H_v^{id}/Z)(\text{sat gas, dry air}) = 1159.1/(0.9964) = 1163.3\ \text{Btu}\cdot\text{ft}^{-3}$

during the combustion condenses, then the heat released upon combustion of a wet gas with dry air becomes:

$$H_v^{id}(\text{wet gas}) = (1 - x_w)H_v^{id}(\text{dry gas}) \quad (16)$$

For water-saturated gas,  $x_w$ , at 60° F (15.6° C) is  $0.256\ 36/P_b$ , where  $P_b$  is the base pressure. Eq 16 is adequate for custody transfer applications as a matter of definition. However, this equation does not accurately describe the effect of water upon the heating value. Appendix XI contains a rigorous examination of the effect of water.

#### 7.10 Calculation of the Ideal Energy Released as Heat:

7.10.1 When multiplied by the gas flow rate, the ideal gross heating value provides the ideal energy released as heat upon combustion,  $\dot{Q}^{id}$ , an ideal gas property:

$$\dot{Q}^{id} = \dot{m}H_v^{id} \quad (17)$$

where  $\dot{m}$  is the mass flow rate. For an ideal gas, the mass flow rate is related to the volumetric flow rate,  $\dot{V}^{id}$ , by:

$$\dot{m} = \dot{V}^{id} \rho^{id} \quad (18)$$

and

$$\dot{Q}^{id} = \dot{V}^{id} H_v^{id} \quad (19)$$

7.10.2 The ideal gas flow rate is related to the real gas flow rate by:

$$\dot{V}^{id} = \dot{V}/Z \quad (20)$$

where  $\dot{V}$  is the real gas volumetric flow rate and  $Z(T, P)$  is the real gas compressibility factor at the same  $T$  and  $P$ . Hence, combining Eq 19 and Eq 20 gives:

$$\dot{Q}^{id} = H_v^{id} \dot{V}/Z(T, P) \quad (21)$$

NOTE 1—The ideal energy released per unit time as heat upon combustion,  $\dot{Q}^{id}$ , can be calculated using the mass flow rate (Eq 17), the ideal gas flow rate (Eq 19), or the real gas flow rate (Eq 21), but is always an ideal gas property. Division of  $H_v^{id}$  by the gas compressibility factor  $Z(T, P)$  does not produce a real gas heating value but only allows calculation of  $\dot{Q}^{id}$  using the real gas flow rate rather than the ideal gas flow rate.

#### 8. Precision

8.1 The properties reported in this practice derive from experimental enthalpy of combustion measurements which, in general, are accurate to 1 part in 1000. The extra digits that appear in the accompanying tables alleviate problems associated with roundoff errors and internal consistency, but they are not significant. Table 3

8.2 The values of properties in this practice are those that appear in GPA Standard 2172-97, Fig. 23-2 of the GPSA Engineering Data Book, GPA TP-17, and the TRC Thermodynamic Tables—Hydrocarbons. GPA Standard 2145 is updated annually and the values in that standard should be used in all calculations.

NOTE 2—Three sources of error must be considered: errors in heating values of the components, errors in the calculated compressibility factor, and errors in the composition. The uncertainty (twice the standard deviation) of the ideal gas heating values for components should be 0.03 %. Such errors affect the bias and the agreement between calculated and measured heating values, but they do not affect the precision. Error in the calculated compressibility factor varies with the composition of the gas, but for natural gas, this error should be less than 0.03 % and

TABLE 3 Example Calculations of Gas Properties at 60°F and 14.696 psia (Gas Analysis on Wet Basis)<sup>A</sup>

NOTE—Division of  $H_v^{fd}$  by  $Z$  does not give a real gas heating value but rather an ideal gas heating value per real cubic foot. Any digits carried beyond 1 part in 1000 are not significant but only alleviate roundoff error. Although  $\text{CO}_2$  has a carbon atom, its  $\alpha = 0$  because it is not part of the fuel formula  $\text{C}_x\text{H}_y\text{S}_z$ .

Compound	$x_i$	$\alpha_i$	$\beta_i$	$\gamma_i$	$H_v^{fd}$	$G_i^{fd}$	$b_i$	$x_i\alpha_i$	$x_i\beta_i$	$x_i\gamma_i$	$x_i H_v^{fd}$	$x_i G_i^{fd}$	$x_i b_i$
Methane	0.8157	1	4	0	1010.0	0.553 92	0.0116	0.8157	3.2629	0	823.9	0.4518	0.009 46
Ethane	0.0732	2	6	0	1769.7	1.038 20	0.0239	0.1464	0.4392	0	129.5	0.0760	0.001 75
Propane	0.0431	3	8	0	2516.1	1.522 60	0.0344	0.1294	0.3451	0	108.5	0.0657	0.001 48
<i>i</i> -Butane	0.0082	4	10	0	3251.9	2.006 80	0.0458	0.0326	0.0816	0	26.5	0.0164	0.000 37
<i>n</i> -Butane	0.0106	4	10	0	3262.3	2.006 80	0.0478	0.0424	0.1061	0	34.6	0.0213	0.000 51
<i>i</i> -Pentane	0.0030	5	12	0	4000.9	2.491 20	0.0581	0.0152	0.0366	0	12.2	0.0076	0.000 18
<i>n</i> -Pentane	0.0025	5	12	0	4008.9	2.491 20	0.0631	0.0123	0.0295	0	9.8	0.0061	0.000 15
Hexane	0.0029	6	14	0	4755.9	2.975 60	0.0802	0.0177	0.0413	0	14.0	0.0088	0.000 24
Helium	0.0003	0	0	0	0	0.138 20	0	0	0	0	0	0	0
Nitrogen	0.0031	0	0	0	0	0.967 23	0.0044	0	0	0	0	0.0030	0
Carbon dioxide	0.0198	0	0	0	0	1.519 60	0.0197	0	0	0	0	0.0302	0.000 39
Water	0.0174	0	0	0	50.3	0.622 02	0.0623	0	0	0	0.9	0.0108	0.001 09
Summation	1.0000	...	...	...	...	...	...	1.2118	4.3421	0	1160.0	0.6977	0.015 64

<sup>A</sup> $G^{fd}$  (sat gas) = 0.6977

$Z$  (sat gas) =  $1 - [0.015\ 64]^2(14.696) = 0.9964$

$Z$  (dry air) =  $1 - [0.0050]^2(14.696) = 0.9996$

$G$  (sat gas, dry air) =  $0.6977(0.9996)/0.9964 = 0.6999$

$H_v^{fd}$  (sat gas, dry air) =  $1160.0 - 0.9 = 1159.1\ \text{Btu}\cdot\text{ft}^{-3}$

$Z$  (sat air) =  $1 - [0.9826(0.050) + 0.0174(0.0623)]^2(14.696) = 0.9995$

$G$  (sat gas, sat air) =  $0.6977(0.9995)/0.9964 = 0.6999$

$(H_v^{fd}/Z)$  (sat gas, dry air) =  $1159.1/(0.9964) = 1163.3\ \text{Btu}\cdot\text{ft}^{-3}$

negligible compared to errors arising from uncertainty in composition. In this practice, the errors in the heating values of the components and the calculated compressibility factor,  $Z$ , are neglected. The precision of the method is related to the repeatability and reproducibility of the analysis. An example appears in .

NOTE 3—It is essential to include all components in the gas sample that appear with mole fractions greater than or equal to 0.001 in the analysis. Some routine analyses do not determine compounds such as He and  $\text{H}_2\text{S}$ , but these compounds are important to the calculations.

### 8.3 Repeatability:

8.3.1 If all the components are analyzed and the results are normalized, then the repeatability of the heating value,  $\delta H$  is:

$$\frac{\delta H}{H^{fd}} = \sqrt{\frac{1}{(H^{fd})^2} \sum_{j=1}^n [(H^{fd} - H_j^{fd})\delta x_j]^2} \quad (22)$$

8.3.2 If the results of the analysis are made to sum to 1.0 by calculating the methane mole fraction as the difference between 1.0 and the sum of the mole fractions of the other components, then

$$\frac{\delta H}{H^{fd}} = \sqrt{\frac{1}{(H^{fd})^2} \sum_{j=1}^n [H_j^{fd}\delta x_j]^2} \quad (23)$$

where  $\delta x_j$  is the repeatability of the method of analysis for Component  $j$ . The differences between heating values calculated from successive pairs of analysis performed by the same operator using the same sample of gas and the same instrument should exceed  $2\delta H$  in only 5 % of the tests when  $\delta H$  is taken as one standard deviation.

8.4 Reproducibility—The reproducibility  $\delta H'$  is calculated from Eq 22 and Eq 23 using  $\delta x'_j$ , the reproducibility of the method of analysis for Component  $j$ . The difference between heating values calculated from analysis obtained in different laboratories is expected to exceed  $\delta H'$  for only 5 % of the analyses.

## APPENDIXES

### (Nonmandatory Information)

#### X1. EFFECT OF WATER UPON THE HEATING VALUE

X1.1 Custody transfer of natural gas uses a simple pricing equation that states that the cost of gas is the rate of energy released upon combustion multiplied by the price of gas per energy unit multiplied by the time or accounting period. The rate of energy released upon combustion is the product of the heating value of the gas and the flow rate of the gas. The flow rate of the gas requires knowledge of the compressibility factor and the relative density of the gas. All three custody transfer properties (heating value, compressibility factor, and relative

density) can be calculated from the composition given pure component property tables. The equations for calculating the properties of dry natural gas are well known, but this appendix also presents an account of the effects of water contained in the gas and in the air used to burn the gas.

X1.2 The heating value of a natural gas is the absolute value of its enthalpy of combustion in an ideal combustion reaction. The heating value is, therefore, an ideal gas property

that can be calculated unambiguously from tables of pure component values and it has no pressure dependence.

X1.3 An ideal combustion reaction with fuel and air in the ideal gas state and the possibility of water in the fuel and air is:

$$\begin{aligned} & C_u H_\beta S_\gamma (id) + (\alpha + \beta/4 + \gamma)(1 + \epsilon) O_2 (id) \\ & + 0.043\,83(\alpha + \beta/4 + \gamma)(1 + \epsilon) Ar (id) \quad (X1.1) \\ & + [0.001\,62(\alpha + \beta/4 + \gamma)(1 + \epsilon) + x_c/(1 - x_N - x_C)] CO_2 (id) \\ & + [3.728\,73(\alpha + \beta/4 + \gamma)(1 + \epsilon) + x_N/(1 - x_N - x_C)] N_2 (id) + (n_w^g \\ & + n_w^a) H_2O (id) \\ & = [\alpha + 0.001\,62(\alpha + \beta/4 + \gamma)(1 + \epsilon) + x_c/(1 - x_N - x_C)] CO_2 (id) \\ & + n_w^g H_2O (id) + n_w^l H_2O (l) + \gamma SO_2 (id) \\ & + [3.728\,73(\alpha + \beta/4 + \gamma)(1 + \epsilon) \\ & + x_N/(1 - x_N - x_C)] N_2 (id) \\ & + 0.043\,83(\alpha + \beta/4 + \gamma)(1 + \epsilon) Ar (id) + (\alpha + \beta/4 + \gamma)\epsilon O_2 (id) \end{aligned}$$

where:  $\alpha$ ,  $\beta$ , and  $\gamma$  are stoichiometric coefficients,  $\epsilon$  is the fraction excess air, the composition of air is assumed to be that of Table X1.1,  $n_w^g$  and the moles of water contained in the gas,  $n_w^a$  are the moles of water contained in the air,  $n_w^v$  are the moles of water contained in the product gas mixture,  $n_w^l$  are the moles of gas that actually condense,  $x_c$  is the mole fraction of  $CO_2$  in the gas, and  $x_N$  is the mole fraction of  $N_2$  in the gas. If air has been injected into the gas, it is assumed that the effect is accounted for in the excess fraction  $\epsilon$ . Fuel gas mixtures would have non-integer values of  $\alpha$ ,  $\beta$  and  $\gamma$ .

X1.4 It is customary to define hypothetical reference states for the water formed by the reaction denoted by Eq 1 (as opposed to "spectator" water that enters the reaction carried by the gas or air). If we assume that the water formed in the reaction remains in the ideal gas state, the heating value is termed "net." If we assume that the water formed in the reaction condenses totally to the liquid state, the heating value is termed "gross." The gross heating value is greater than the net heating value by the ideal enthalpy of vaporization for water:

$$\text{heating value (gross)} - \text{heating value (net)} = H_w(id) - H_w(l) \quad (X1.2)$$

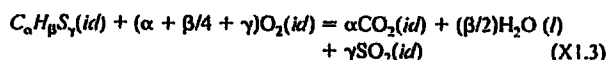
where:

$H$  = enthalpy,  
 $l$  = liquid state, and  
 $w$  = water.

The quantity  $H_w(id) - H_w(l)$  is the ideal enthalpy of vaporization for water.

X1.5 It is possible to calculate a real gas heating value rather than using a hypothetical state, but the calculations are tedious, the numerical values are negligibly different, and the mathematical simplicity of the defining equation is lost. It is customary in the gas industry to use gross heating value for most calculations, so for the remainder of this appendix, the term "heating value" refers to the gross value.

X1.6 Eq 7 in Section 7 provides the recipe to convert the heating value from one base pressure to another. Note that when using Eq 7,  $H_v^{id}$  should be calculated using the values from Table 1 before converting the pressure; the individual values in Table 1 should not be converted. Conversion to another temperature is more complicated. Heating value data exist at 25°C based upon the reaction:



X1.7 The experiments use pure oxygen and are corrected to stoichiometric proportions. It is necessary to correct the sensible heat effects to arrive at a different temperature:

$$H_{it}^{id}(T) = H_{it}^{id}(25) + \int_{25}^T \sum_r C_p^{id} - \sum_r C_p^{id} dT \quad (X1.4)$$

where:

$$\sum_r C_p^{id} = \alpha C_{p,CO_2}^{id} + (\beta/2) C_{p,H_2O}^{id} + \gamma C_{p,SO_2}^{id} \quad (X1.5)$$

$$\sum_r C_p^{id} = C_{p,CuH_\beta S_\gamma}^{id} + (\alpha + \beta/4 + \gamma) C_{p,O_2}^{id} \quad (X1.6)$$

and:  $C_p^{id}$  is the ideal specific heat at constant pressure,  $r$  denotes reactants and  $r'$  denotes products.

TABLE X1.1 Example Calculation of Precision

Compound	Composition, $x_j$	$H_v^{id} - H_w^{id}$ Btu·ft <sup>-3</sup>	Repeatability		Reproducibility	
			$\delta x_j$	$[(H_v^{id} - H_w^{id})\delta x_j]^2$ (Btu·ft <sup>-3</sup> ) <sup>2</sup>	$\delta x_j$	$[(H_v^{id} - H_w^{id})\delta x_j]^2$ (Btu·ft <sup>-3</sup> ) <sup>2</sup>
Methane	0.8302	169.7	0.0010	0.029	0.0020	0.115
Ethane	0.0745	-590.0	0.0002	0.014	0.0004	0.056
Propane	0.0439	-1336.4	0.0002	0.071	0.0004	0.286
Isobutane	0.0083	-2072.2	0.0001	0.043	0.0002	0.171
Butane	0.0108	-2082.6	0.0002	0.173	0.0004	0.694
Isopentane	0.0031	-2821.2	0.0001	0.080	0.0002	0.318
Pentane	0.0025	-2829.2	0.0001	0.080	0.0002	0.320
Hexane	0.0030	-3576.2	0.0001	0.128	0.0002	0.512
Helium	0.0003	1179.7	0.0001	0.014	0.0002	0.056
Nitrogen	0.0032	1179.7	0.0001	0.014	0.0002	0.056
Carbon dioxide	0.0202	1179.7	0.0002	0.056	0.0004	0.223
Total	1.0000			0.702		2.807

## X2. ACCOUNTING FOR WATER

X2.1 If the gas contains water (or must be assumed to be saturated) but the compositional analysis is on a dry basis, it is necessary to adjust the mole fractions to account for the fact that water has displaced some gas, thus lowering the heating value. The mole fraction of water in the gas results from the definition of relative humidity:

$$x_w = h^s P_w^s / P = n_w / (1 + n_w) \quad (X2.1)$$

(Based upon one mole of the fuel  $C_\alpha H_\beta S_\gamma$ ) where  $h^s$  is the relative humidity of the gas,  $P_w^s$  is the vapor pressure of water, and  $n_w$  denotes moles of water. For saturated gas  $h^s$  is unity. Rearranging Eq X2.1 gives the moles of water:

$$n_w = x_w / (1 - x_w) \quad (X2.2)$$

The corrected mole fractions then become:

$$x_i(\text{cor}) = x_i \left[ \frac{1}{1 + n_w} \right] = x_i \left[ \frac{1}{1 + x_w / (1 - x_w)} \right] = (1 - x_w) x_i \quad (X2.3)$$

and the heating value becomes:

$$Hv^{hl} = (1 - x_w) \sum_{i=1}^N x_i^{dry} Hv_i^{hl} \quad (X2.4)$$

where water is not included in the  $N$  components of the summation. If the compositional analysis determines  $x_w$  and water is included in the  $N$  components of the summation:

$$Hv^{hl} = \sum_{i=1}^N x_i^{wet} Hv_i^{hl} - x_w Hv_w^{hl} \quad (X2.5)$$

X2.2 It is necessary to remove the effect of water because, although water has a heating value, it is only a condensation effect. Water carried by wet gas (spectator water) does not actually condense, and only water formed in the reaction contributes to heating value.

X2.3 Accounting for water in the above manner is sufficient for defined custody transfer conditions, but when trying to model actual situations, the question becomes much more complicated. It is obvious that all of the reaction water actually cannot condense because in a situation in which both gas and air are dry some of the reaction water saturates the product gases and the remainder condenses. It is possible to account for these effects in a general manner. To do so, it is necessary to calculate  $n_w^e$ ,  $n_w^a$ ,  $n_w^p$ , and  $n_w^c$ .

$$n_w^e / [1 + (x_N + x_C) / (1 - x_N - x_C) + n_w^e] = h^s P_w^s / P \quad (X2.6)$$

$$n_w^e = (h^s P_w^s / P) / [(1 - x_N - x_C) / (1 - h^s P_w^s / P)]$$

$$n_w^a / [4.774 \ 18(\alpha + \beta/4 + \gamma)(1 + \epsilon) + n_w^a] = h^a P_w^a / P \quad (X2.7)$$

$$n_w^a = 4.774 \ 18(\alpha + \beta/4 + \gamma)(1 + \epsilon) (h^a P_w^a / P) / (1 - h^a P_w^a / P)$$

$$n_w^p / \{ \alpha + \gamma + (x_N + x_C) / (1 - x_N - x_C) + (\alpha + \beta/4 + \gamma) [0.001 \ 62(1 + \epsilon) \quad (X2.8)$$

$$+ 3.728 \ 73(1 + \epsilon) + 0.043 \ 83(1 + \epsilon) + \epsilon] + n_w^p \} = P_w^p / P$$

$$n_w^c = \{ \alpha + \gamma + (x_N + x_C) / (1 - x_N - x_C) + (\alpha + \beta/4 + \gamma) [0.001 \ 62(1 + \epsilon)$$

$$+ 3.728 \ 73(1 + \epsilon) + 0.043 \ 83(1 + \epsilon) + \epsilon] \} (P_w^p / P) / (1 - P_w^p / P)$$

$$n_w^l = \beta/2 + n_w^e + n_w^a - n_w^c \quad (X2.9)$$

where:  $h_a$  is the relative humidity of the air. Eq X2.6 and Eq X2.7 are reformulations of Eq X2.1 to reflect inlet conditions. Eq X2.8 reflects Eq X2.1 for the saturated product gas (it must be saturated before any water can condense). Eq X2.9 is a water balance:  $\beta/2$  are the moles of water formed by the reaction,  $n_w^e$  and  $n_w^a$  are the moles of water that enter with the gas and air,  $n_w^p$  are the moles of water that saturate the product gas, and  $n_w^l$  are the moles of water that condense. Therefore, the complete correction for the effect of water on heating value is:

$$Hv_c^{hl} = Hv^{hl} \text{ (Eq X2.4 or Eq X2.5)} + (h^s P_w^s / P) (1 - x_w - x_c) (1 - h^s P_w^s / P) \quad (X2.10)$$

$$+ 4.774 \ 18(\alpha + \beta/4 + \gamma)(1 + \epsilon) (h^a P_w^a / P) / (1 - h^a P_w^a / P) - [\alpha + \gamma$$

$$+ (x_N - x_C) + (\alpha + \beta/4 + \gamma)(3.774 \ 18 + 4.774 \ 18 \ \epsilon)]$$

$$\times (P_w^p / P) / (1 - P_w^p / P) \} Hv_w^{hl}$$

X2.4 Depending upon the relative humidities of the gas and air, the observed heating value can be greater or smaller than that calculated using Eq X2.4 or Eq X2.5. A humidity of air exists for each gas above which  $Hv^{hl}$  is greater than that calculated by Eq X2.4 or Eq X2.5. That critical value depends upon the gas composition, the humidity of the gas, and the amount of excess air. For pure, dry methane with no excess air,  $h_a = 0.793 \ 45$ .

## X3. REAL GAS PROPERTIES

X3.1 In principal, we have enough information to convert the heating value to a real gas property (it is not necessary to do so for relative density because the molar mass ratio,  $G^{hl}$ , is

the desired property). This is simply a matter of evaluating the integral:

$$H_n - H_n^H = \int_0^P \left\{ \left[ \left( \frac{\partial H}{\partial P} \right)_T \right]_L - \left[ \left( \frac{\partial H}{\partial P} \right)_T \right]_R \right\} dP \quad (X3.1)$$

where:

$$\left( \frac{\partial H}{\partial P} \right)_T = V - T \left( \frac{\partial V}{\partial T} \right)_P = B - T \frac{dB}{dT} = 2RT^2 b \frac{db}{dT} \quad (X3.2)$$

where  $V$  is the molar volume. The temperature dependence of  $b$  must be defined, but in the custody transfer region it is easy to do so. The products and reactants again correspond to Eq X1.3.

X3.2 While it is obviously possible to make the required calculations to convert the heating value into a real gas

property, it serves no custody transfer purpose to do so. As we have seen, the cost equation is unchanged; the calculations while obvious are tedious.  $H_v$  is slightly different from  $H_v^H$  because the base pressure is low; the likelihood of having all the information required to use Eq X3.1 is remote. The heating value is defined in a hypothetical state. It is not possible, at base conditions, to have all the water formed in the reaction be either all gas or all liquid; some of the water formed is in each state. Thus, if the definition is of a hypothetical state, using a hypothetical real gas rather than an ideal gas state adds nothing but complexity.

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## **APPENDIX B - Computer Printout of Results**

# CEM Emission Rates

**Facility:** Chemical Waste Management, Inc. - Kettleman Hills L.F.  
**Source:** Flare  
**Job No.:** W07-084  
**Date:** 7/17/14

Run Number	*****	1	2	3
<b>Outlet</b>				
Stack Flow Rate	dscfm	8184	8154	7852
Oxygen	%	14.35 ✓	14.18 ✓	13.84 ✓
Carbon Dioxide	%	6.04	6.17	6.57 ✓
<b>Oxides of Nitrogen</b>				
Concentration	ppm	9.48 ✓	9.74 ✓	10.4 ✓
Concentration @ 3 % O2	ppm	25.9 ✓	26.0	26.5
Concentration	lb/dscf	1.13E-06	1.16E-06	1.25E-06
Emission Rate	lb/hr	0.556 ✓	0.569	0.587
Emission Rate (F-factor)	lb/MMbtu	0.0353 ✓	0.0354	0.0361
<b>Carbon Monoxide</b>				
Concentration	ppm	9.33 ✓	9.20 ✓	4.17 ✓
Concentration @ 3 % O2	ppm	25.5 ✓	24.5	10.6
Concentration	lb/dscf	6.78E-07 ✓	6.68E-07	3.03E-07
Emission Rate	lb/hr	0.3330 ✓	0.327	0.143
Emission Rate (F-factor)	lb/MMbtu	0.0212 ✓	0.0204	0.0088
<b>Total Non Methane Hydrocarbons</b>				
Concentration	ppm	< 1.00 ✓	1.00 ✓	< 1.00 ✓
Concentration, as CH4 @ 3 % O2	ppm	< 2.73 ✓	2.67	< 2.54
Concentration	lb/dscf	< 4.15E-08	4.15E-08	< 4.15E-08
Emission Rate	lb/hr	< 0.0204 ✓	0.0203	< 0.0196
Emission Rate (F-factor)	lb/MMbtu	< 0.00130 ✓	0.00126	< 0.00120
<b>Inlet</b>				
Flow Rate	dscfm	641	652	660
Oxygen	%	2.30	2.19	2.22
Carbon Dioxide	%	34.99	35.17	35.12
Methane	%	40.01	40.17	40.23
Heat Rate	MMBtu/hr	15.7	16.1	16.3
<b>Total Non Methane Hydrocarbons</b>				
Concentration	ppm	7500 ✓	8120 ✓	6900 ✓
Concentration	lb/dscf	3.11E-04	3.37E-04	2.86E-04
Emission Rate	lb/hr	11.97	13.18	11.34
<b>TNMHC Destruction Efficiency</b>				
		>99.83 ✓	99.85 ✓	>99.83 ✓

# Fuel Flow Calculations

Facility: Chemical Waste Management, Inc. - Kettleman Hills L.F.

Source: Flare

Job No.: W07-084

Date: 07/17/14

Run No.: 1

Calculated Exhaust Flow Rate

$$\frac{641 \text{ cubic feet}}{60 \text{ seconds}} \times \frac{0 \text{ psi} + 14.7 \text{ psi}}{14.7 \text{ psi}} \times \frac{528 \text{ deg R}}{528 \text{ deg R}} \times \frac{409 \text{ BTU}}{\text{SCF}} \times \frac{9784}{\text{MM Btu}} \times \frac{20.9 \% \text{O}_2}{20.9 \% \text{O}_2 - 14.35 \% \text{O}_2} \times \frac{\text{MM}}{1000000} \times \frac{60 \text{ sec}}{\text{min}}$$

$$= \underline{\underline{8184}} \text{ DSCFM}$$

Calculated Fuel Flow Rate

$$\frac{641 \text{ cubic feet}}{60 \text{ seconds}} \times \frac{0 \text{ psi} + 14.7 \text{ psi}}{14.7 \text{ psi}} \times \frac{528 \text{ deg R}}{528 \text{ deg R}} \times \frac{60 \text{ sec}}{\text{min}} \times \frac{60 \text{ min}}{\text{hour}}$$

$$= \underline{\underline{38436}} \text{ SCFH}$$

Calculated Btu Heat Rate

$$38436 \text{ SCFH} \times \frac{409 \text{ BTU}}{\text{SCF}} \times \frac{\text{MMBtu/hour}}{10\text{E}+06 \text{ Btu}}$$

$$= \underline{\underline{15.723}} \text{ MMBtu/hour}$$

Run No.: 2

Calculated Exhaust Flow Rate

$$\frac{652 \text{ cubic feet}}{60 \text{ seconds}} \times \frac{0 \text{ psi} + 14.7 \text{ psi}}{14.7 \text{ psi}} \times \frac{528 \text{ deg R}}{528 \text{ deg R}} \times \frac{411 \text{ BTU}}{\text{SCF}} \times \frac{9788}{\text{MM Btu}} \times \frac{20.9 \% \text{O}_2}{20.9 \% \text{O}_2 - 14.18 \% \text{O}_2} \times \frac{\text{MM}}{1000000} \times \frac{60 \text{ sec}}{\text{min}}$$

$$= \underline{\underline{8154}} \text{ DSCFM}$$

Calculated Fuel Flow Rate

$$\frac{652 \text{ cubic feet}}{60 \text{ seconds}} \times \frac{0 \text{ psi} + 14.7 \text{ psi}}{14.7 \text{ psi}} \times \frac{528 \text{ deg R}}{528 \text{ deg F}} \times \frac{60 \text{ sec}}{\text{min}} \times \frac{60 \text{ min}}{\text{hour}}$$

$$= \underline{\underline{39096}} \text{ SCFH}$$

Calculated Btu Heat Rate

$$39096 \text{ SCFH} \times \frac{411 \text{ BTU}}{\text{SCF}} \times \frac{\text{MMBtu/hour}}{10\text{E}+06 \text{ Btu}}$$

$$= \underline{\underline{16.062}} \text{ MMBtu/hour}$$

Run No.: 3

Calculated Exhaust Flow Rate

$$\frac{660 \text{ cubic feet}}{60 \text{ seconds}} \times \frac{0 \text{ psi} + 14.7 \text{ psi}}{14.7 \text{ psi}} \times \frac{528 \text{ deg R}}{528 \text{ deg R}} \times \frac{411 \text{ BTU}}{\text{SCF}} \times \frac{9782}{\text{MM Btu}} \times \frac{20.9 \% \text{O}_2}{20.9 \% \text{O}_2 - 13.84 \% \text{O}_2} \times \frac{\text{MM}}{1000000} \times \frac{60 \text{ sec}}{\text{min}}$$

$$= \underline{\underline{7852}} \text{ DSCFM}$$

Calculated Fuel Flow Rate

$$\frac{660 \text{ cubic feet}}{60 \text{ seconds}} \times \frac{0 \text{ psi} + 14.7 \text{ psi}}{14.7 \text{ psi}} \times \frac{528 \text{ deg R}}{528 \text{ deg F}} \times \frac{60 \text{ sec}}{\text{min}} \times \frac{60 \text{ min}}{\text{hour}}$$

$$= \underline{\underline{39576}} \text{ SCFH}$$

Calculated Btu Heat Rate

$$39576 \text{ SCFH} \times \frac{411 \text{ BTU}}{\text{SCF}} \times \frac{\text{MMBtu/hour}}{10\text{E}+06 \text{ Btu}}$$

$$= \underline{\underline{16.268}} \text{ MMBtu/hour}$$

Facility: Chemical Waste Management, Inc. - Kettleman Hills L.F.  
Source: Flare  
Job No.: W07-084  
Date: 07/17/14

Run No.: 1  
Fuel: LFG  
Std. O2: 3

	O2 %	CO2 %	NOx ppm	CO ppm	THC ppm
Range:	25	15	25	100	10.0
Span:	11.99	6.98	12.18	45.96	5.02
Low:					2.57
High:	22.52	13.66	24.48	90.36	7.94

**\*\* PRE-TEST BIAS \*\***

Values

Zero:

Span:

0.05	0.06	0.12	0.35	0.01
11.93	6.93	12.25	46.66	5.01

**\*\* POST-TEST BIAS \*\***

Values

Zero:

Span:

0.12	0.05	-0.10	0.62	0.02
11.95	7.00	12.23	46.28	5.00

**\*\* BIAS CORRECTION \*\***

Zero Average

Span Average

0.09	0.05	0.01	0.49	0.01
11.94	6.97	12.24	46.47	5.01

**\*\* POST-TEST DRIFT (BIAS)\*\***

Percent Drift

Zero:

Span:

-0.25	0.04	0.90	-0.26	-0.10
-0.11	-0.47	0.08	0.38	0.10

Bias-Corrected Concentration

Bias-Corrected Conc.(O2 adjusted)

14.35	6.04	9.48	9.33	0.46
		25.92	25.52	1.25

**\*\* RAW AVERAGE CONCENTRATION \*\***

Average:

O2 adjust:

Date

Time

3.0

		O2	CO2	NOx	CO	THC	
17-Jul-14	857	14.33	5.88	9.58	5.67	1.28	Start A-8
17-Jul-14	857.5	15.63	4.49	7.54	3.20	0.71	
17-Jul-14	858	15.83	4.55	7.57	6.91	0.55	
17-Jul-14	858.5	15.29	4.98	8.22	7.99	0.44	
17-Jul-14	859	15.81	4.27	7.13	14.69	0.34	
17-Jul-14	859.5	15.86	4.58	7.24	25.41	0.53	7
17-Jul-14	900	15.71	4.57	7.48	24.25	2.99	
17-Jul-14	900.5	15.01	5.43	8.77	7.59	1.52	
17-Jul-14	901	15.43	4.65	7.64	2.63	0.18	
17-Jul-14	901.5	15.45	5.07	7.71	13.67	0.06	
17-Jul-14	902	14.73	5.37	8.72	22.00	1.07	6
17-Jul-14	902.5	14.83	5.68	8.76	9.04	0.44	
17-Jul-14	903	14.39	5.89	9.39	12.09	-0.02	
17-Jul-14	903.5	14.23	6.09	9.69	3.47	-0.10	
17-Jul-14	904	14.47	5.80	9.26	2.12	-0.01	
17-Jul-14	904.5	15.21	5.02	8.17	4.72	-0.04	5
17-Jul-14	905	15.09	5.25	8.55	9.18	-0.03	
17-Jul-14	905.5	14.00	6.46	10.32	6.88	-0.09	
17-Jul-14	906	13.90	6.31	10.14	4.53	-0.01	
17-Jul-14	906.5	14.49	5.86	9.34	9.97	-0.19	
17-Jul-14	907	15.76	4.25	7.24	9.60	-0.07	4
17-Jul-14	907.5	15.78	4.49	7.06	20.76	-0.19	
17-Jul-14	908	15.05	5.76	8.67	44.02	1.71	
17-Jul-14	908.5	13.67	6.48	10.49	27.12	6.17	
17-Jul-14	909	14.96	5.20	8.48	2.09	0.65	
17-Jul-14	909.5	14.31	5.83	8.49	6.99	-0.19	3
17-Jul-14	910	15.83	4.84	6.83	22.95	1.00	
17-Jul-14	910.5	13.20	7.33	11.37	9.02	3.13	
17-Jul-14	911	14.13	5.91	9.89	2.87	0.89	
17-Jul-14	911.5	14.23	6.43	9.67	6.56	0.76	

17-Jul-14	912	13.33	7.00	10.06	16.90	0.83	2
17-Jul-14	912.5	13.35	6.62	8.98	25.94	0.84	
17-Jul-14	913	14.48	5.94	7.37	57.24	0.80	
17-Jul-14	913.5	15.72	4.41	7.10	51.06	0.82	
17-Jul-14	914	14.60	6.06	7.74	16.60	0.85	
17-Jul-14	914.5	12.86	7.44	10.93	38.08	0.88	1
17-Jul-14	915	13.51	6.83	11.24	31.04	0.85	
17-Jul-14	915.5	13.95	6.18	10.59	5.60	0.89	
17-Jul-14	916	13.19	7.73	12.02	0.45	0.81	
17-Jul-14	916.5	11.91	8.39	13.54	0.78	2.25	
17-Jul-14	920	13.29	6.86	11.82	0.58	-0.12	B-8
17-Jul-14	920.5	13.58	6.84	11.34	2.13	-0.08	
17-Jul-14	921	13.58	6.84	10.78	3.74	-0.06	
17-Jul-14	921.5	12.69	7.56	12.01	5.01	-0.06	
17-Jul-14	922	14.66	5.29	8.84	2.87	-0.08	
17-Jul-14	922.5	14.00	6.52	10.13	4.07	-0.05	7
17-Jul-14	923	13.82	6.65	10.52	2.78	-0.01	
17-Jul-14	923.5	13.75	6.49	10.42	1.76	-0.03	
17-Jul-14	924	13.69	6.66	10.74	1.12	-0.04	
17-Jul-14	924.5	13.77	6.40	10.57	2.35	-0.07	
17-Jul-14	925	14.39	5.81	9.62	3.06	-0.09	6
17-Jul-14	925.5	14.73	5.36	8.88	1.14	-0.08	
17-Jul-14	926	14.67	5.97	9.30	2.79	-0.05	
17-Jul-14	926.5	13.24	6.96	11.10	1.63	-0.05	
17-Jul-14	927	13.75	6.64	10.48	2.84	-0.15	
17-Jul-14	927.5	13.70	6.62	10.52	2.05	-0.17	5
17-Jul-14	928	14.31	5.72	9.12	1.82	-0.15	
17-Jul-14	928.5	14.45	6.02	9.28	3.69	-0.15	
17-Jul-14	929	13.49	6.99	10.73	13.23	-0.10	
17-Jul-14	929.5	13.60	6.51	10.41	7.55	0.45	
17-Jul-14	930	14.69	5.56	8.96	4.04	0.14	4
17-Jul-14	930.5	14.82	5.46	8.33	9.38	0.11	
17-Jul-14	931	13.45	6.81	10.95	5.64	0.24	
17-Jul-14	931.5	13.89	6.58	10.12	2.05	0.13	
17-Jul-14	932	13.64	6.67	10.58	3.57	-0.06	
17-Jul-14	932.5	14.08	6.19	9.75	2.86	-0.03	3
17-Jul-14	933	13.38	6.85	11.03	6.18	-0.08	
17-Jul-14	933.5	13.29	7.37	10.87	7.77	-0.03	
17-Jul-14	934	13.07	6.95	11.46	8.23	-0.13	
17-Jul-14	934.5	13.91	6.19	10.04	1.68	0.00	
17-Jul-14	935	16.23	4.03	6.18	7.30	-0.10	2
17-Jul-14	935.5	15.60	4.92	7.02	15.45	0.35	
17-Jul-14	936	14.25	6.01	9.25	25.04	0.52	
17-Jul-14	936.5	14.97	5.48	8.56	14.08	3.25	
17-Jul-14	937	12.68	7.86	12.82	6.48	0.23	
17-Jul-14	937.5	12.32	8.01	13.13	1.06	0.00	1
17-Jul-14	938	14.15	5.77	9.33	0.54	-0.19	
17-Jul-14	938.5	14.84	5.53	8.54	2.67	-0.16	
17-Jul-14	939	14.40	5.97	9.29	2.27	-0.04	
17-Jul-14	939.5	13.85	6.48	10.56	1.55	0.20	End

**Facility:** Chemical Waste Management, Inc. - Kettleman Hills L.F.  
**Source:** Flare  
**Job No.:** W07-084  
**Date:** 07/17/14

**Run No.:** 2  
**Fuel:** LFG  
**Std. O2:** 3

	O2 %	CO2 %	NOx ppm	CO ppm	THC ppm
Range:	25	15	25	100	10
Span:	11.99	6.98	12.18	45.96	5.02
Low:					2.57
High:	22.52	13.66	24.48	90.36	7.94

**\*\* PRE-TEST BIAS \*\***

Values					
Zero:	0.12	0.05	-0.10	0.62	0.02
Span:	11.95	7.00	12.23	46.28	5.00

**\*\* POST-TEST BIAS \*\***

Values					
Zero:	0.05	0.05	0.17	0.37	0.01
Span:	12.03	7.08	12.17	45.84	5.08

**\*\* BIAS CORRECTION \*\***

Zero Average	0.08	0.05	0.03	0.49	0.02
Span Average	11.99	7.04	12.20	46.06	5.04

**\*\* POST-TEST DRIFT (BIAS)\*\***

Percent Drift					
Zero:	0.26	0.01	-1.08	0.24	0.08
Span:	-0.29	-0.52	0.24	0.44	-0.80

Bias-Corrected Concentration	14.18	6.17	9.74	9.20	1.00
Bias-Corrected Conc.(O2 adjusted)			25.95	24.51	2.65

**\*\* RAW AVERAGE CONCENTRATION \*\***

Average:		14.17	6.23	9.76	9.61	1.00	
O2 adjust:	3.0			25.96	25.57	2.65	
Date	Time	O2	CO2	NOx	CO	THC	
17-Jul-14	953.5	13.66	6.70	10.61	32.17	1.14	Start R-2 B-8
17-Jul-14	954	13.14	7.49	11.58	4.65	1.08	
17-Jul-14	954.5	12.60	7.66	11.90	0.72	1.12	
17-Jul-14	955	13.79	6.49	10.15	4.26	1.14	
17-Jul-14	955.5	14.37	5.93	9.18	19.38	1.29	
17-Jul-14	956	13.94	6.54	10.09	28.19	1.78	7
17-Jul-14	956.5	14.25	6.21	9.81	9.51	1.36	
17-Jul-14	957	14.20	6.14	9.68	6.76	1.39	
17-Jul-14	957.5	14.60	5.37	8.85	10.68	2.09	
17-Jul-14	958	15.54	5.05	7.82	7.25	2.29	
17-Jul-14	958.5	15.74	4.46	7.21	17.57	1.34	6
17-Jul-14	959	15.22	5.29	8.44	17.50	1.26	
17-Jul-14	959.5	13.88	6.82	10.55	4.92	1.22	
17-Jul-14	1000	13.55	6.73	10.76	1.51	1.20	
17-Jul-14	1000.5	14.14	6.20	9.72	1.82	1.20	
17-Jul-14	1001	14.61	5.72	9.16	5.89	1.18	5
17-Jul-14	1001.5	14.24	5.96	9.67	10.01	1.19	
17-Jul-14	1002	14.28	6.57	9.64	10.75	1.25	
17-Jul-14	1002.5	13.45	6.93	10.32	4.83	1.22	
17-Jul-14	1003	12.82	7.64	11.50	3.20	1.22	
17-Jul-14	1003.5	13.25	7.16	10.89	1.12	1.43	4
17-Jul-14	1004	13.01	7.32	11.47	0.40	1.38	
17-Jul-14	1004.5	13.89	6.59	10.38	0.54	1.21	
17-Jul-14	1005	13.24	7.21	11.28	2.09	1.11	
17-Jul-14	1005.5	13.36	7.14	10.98	1.82	0.14	
17-Jul-14	1006	13.61	6.65	9.98	1.47	-0.15	3
17-Jul-14	1006.5	13.87	6.59	9.95	5.67	-0.12	
17-Jul-14	1007	13.73	6.60	10.00	6.01	-0.09	
17-Jul-14	1007.5	13.40	7.08	10.56	4.09	-0.19	
17-Jul-14	1008	14.01	6.16	9.65	4.56	-0.20	
17-Jul-14	1008.5	14.89	5.46	7.69	5.21	-0.25	2

17-Jul-14	1009	15.27	5.06	6.89	19.89	0.28	
17-Jul-14	1009.5	15.68	4.55	5.89	37.41	0.53	
17-Jul-14	1010	15.13	5.31	7.92	42.45	0.71	
17-Jul-14	1010.5	15.53	4.69	6.69	18.16	3.55	
17-Jul-14	1011	15.69	4.76	6.52	26.88	0.36	1
17-Jul-14	1011.5	15.28	4.85	6.88	26.38	1.31	
17-Jul-14	1012	14.42	6.39	9.61	21.16	0.66	
17-Jul-14	1012.5	13.51	6.96	11.29	8.62	1.83	
17-Jul-14	1013	13.47	6.92	11.31	0.47	0.01	
17-Jul-14	1017	14.86	5.17	8.73	1.91	1.55	R-2 A-8
17-Jul-14	1017.5	16.42	3.98	6.72	7.38	1.25	
17-Jul-14	1018	16.00	4.58	7.51	25.56	1.38	
17-Jul-14	1018.5	15.04	5.37	8.84	20.73	1.40	
17-Jul-14	1019	13.94	6.49	10.52	12.52	1.34	
17-Jul-14	1019.5	14.04	6.39	10.60	2.51	1.33	7
17-Jul-14	1020	14.25	6.04	9.91	0.61	1.32	
17-Jul-14	1020.5	15.20	5.12	8.63	1.87	1.14	
17-Jul-14	1021	15.71	4.48	7.56	7.16	0.91	
17-Jul-14	1021.5	15.30	5.02	8.45	14.17	0.25	
17-Jul-14	1022	15.59	4.91	8.03	8.18	1.58	6
17-Jul-14	1022.5	14.19	6.11	10.00	13.20	1.13	
17-Jul-14	1023	15.26	4.97	8.21	7.15	1.20	
17-Jul-14	1023.5	15.46	4.97	7.98	9.99	1.14	
17-Jul-14	1024	15.18	4.94	8.30	13.78	1.29	
17-Jul-14	1024.5	15.62	4.66	7.72	9.24	1.23	5
17-Jul-14	1025	15.28	5.24	8.38	13.99	1.32	
17-Jul-14	1025.5	15.45	4.73	7.78	20.50	1.43	
17-Jul-14	1026	15.77	4.66	7.30	28.46	1.36	
17-Jul-14	1026.5	14.76	5.79	8.85	48.60	1.38	
17-Jul-14	1027	14.86	5.29	8.41	20.93	1.34	4
17-Jul-14	1027.5	14.23	6.57	9.73	12.72	1.31	
17-Jul-14	1028	12.60	7.91	12.37	13.59	1.73	
17-Jul-14	1028.5	12.50	7.96	12.55	2.23	1.85	
17-Jul-14	1029	13.01	7.46	11.90	0.40	1.57	
17-Jul-14	1029.5	12.26	8.16	13.09	0.25	1.54	3
17-Jul-14	1030	13.56	6.92	11.00	0.10	2.71	
17-Jul-14	1030.5	13.03	7.42	11.60	0.45	0.81	
17-Jul-14	1031	12.30	8.24	13.08	1.13	0.25	
17-Jul-14	1031.5	13.09	7.35	11.46	0.90	0.16	
17-Jul-14	1032	13.05	7.48	11.72	1.97	0.07	2
17-Jul-14	1032.5	13.19	6.77	11.16	2.28	0.06	
17-Jul-14	1033	13.50	7.46	11.20	0.93	-0.01	
17-Jul-14	1033.5	12.90	7.57	11.70	1.11	0.10	
17-Jul-14	1034	12.92	7.47	11.75	1.00	-0.02	
17-Jul-14	1034.5	14.41	5.73	9.01	0.64	-0.04	1
17-Jul-14	1035	14.43	6.08	9.38	1.63	-0.09	
17-Jul-14	1035.5	13.69	6.99	10.87	1.73	0.17	
17-Jul-14	1036	12.61	7.91	12.44	1.07	0.42	
17-Jul-14	1036.5	11.87	8.69	13.88	0.51	0.32	End 2

**Facility:** Chemical Waste Management, Inc. - Kettleman Hills L.F.  
**Source:** Flare  
**Job No.:** W07-084  
**Date:** 07/17/14

**Run No.:** 3  
**Fuel:** LFG  
**Std. O2:** 3

	O2 %	CO2 %	NOx ppm	CO ppm	THC ppm
Range:	25	15	25	100	10.00
Span:	11.99	6.98	12.18	45.96	5.02
Low:					2.57
High:	22.52	13.66	24.48	90.36	7.94

**\*\* PRE-TEST BIAS \*\***

Values

Zero:

Span:

0.05	0.05	0.17	0.37	0.01
12.03	7.08	12.17	45.84	5.08

**\*\* POST-TEST BIAS \*\***

Values

Zero:

Span:

0.08	0.05	0.27	0.21	-0.09
12.07	7.03	12.07	45.83	5.04

**\*\* BIAS CORRECTION \*\***

Zero Average

Span Average

0.06	0.05	0.22	0.29	-0.04
12.05	7.05	12.12	45.84	5.06

**\*\* POST-TEST DRIFT (BIAS)\*\***

Percent Drift

Zero:

Span:

-0.10	0.02	-0.43	0.16	0.97
-0.18	0.34	0.40	0.01	0.40

Bias-Corrected Concentration  
 Bias-Corrected Conc.(O2 adjusted)

13.84	6.57	10.44	4.17	0.67
		26.46	10.59	1.69

**\*\* RAW AVERAGE CONCENTRATION \*\***

Average:

O2 adjust:

3.0

13.90	6.64	10.42	4.43	0.67
		26.63	11.32	1.70
O2	CO2	NOx	CO	THC

Date	Time	O2	CO2	NOx	CO	THC	
17-Jul-14	1056	14.94	5.60	8.83	5.02	1.20	Start R-3 A-8
17-Jul-14	1056.5	14.18	6.30	9.85	2.54	0.62	
17-Jul-14	1057	14.26	6.12	9.55	0.53	0.61	
17-Jul-14	1057.5	15.12	5.41	8.48	0.90	1.02	
17-Jul-14	1058	14.40	6.17	9.61	3.13	1.01	
17-Jul-14	1058.5	14.41	5.92	9.43	3.07	0.94	7
17-Jul-14	1059	15.09	5.42	8.48	3.29	0.91	
17-Jul-14	1059.5	14.89	5.71	8.73	10.44	0.99	
17-Jul-14	1100	15.67	4.64	7.47	7.23	1.08	
17-Jul-14	1100.5	15.10	5.63	8.63	9.83	0.96	
17-Jul-14	1101	14.29	6.30	9.72	11.90	1.03	6
17-Jul-14	1101.5	14.34	6.29	9.69	5.14	0.79	
17-Jul-14	1102	15.28	4.76	7.70	2.04	0.70	
17-Jul-14	1102.5	15.35	5.62	8.39	7.87	0.80	
17-Jul-14	1103	14.33	6.15	9.54	8.51	1.21	
17-Jul-14	1103.5	13.85	6.84	10.50	2.04	0.72	5
17-Jul-14	1104	13.73	6.61	10.46	1.03	0.66	
17-Jul-14	1104.5	14.49	5.87	9.40	0.88	0.63	
17-Jul-14	1105	14.09	6.66	10.36	1.16	0.63	
17-Jul-14	1105.5	13.85	6.64	10.25	2.55	0.63	
17-Jul-14	1106	14.27	6.30	9.77	5.04	0.58	4

17-Jul-14	1100	14.17	6.31	9.80	5.34	0.57	
17-Jul-14	1100.5	14.30	6.27	9.66	4.55	0.59	
17-Jul-14	1101	13.57	7.01	10.82	4.94	0.52	
17-Jul-14	1101.5	13.56	6.85	10.68	0.61	0.44	
17-Jul-14	1102	13.78	6.85	10.52	0.99	0.50	3
17-Jul-14	1102.5	12.98	7.69	11.39	4.07	0.50	
17-Jul-14	1103	12.70	7.82	12.03	3.75	0.52	
17-Jul-14	1103.5	13.30	6.94	11.18	1.16	0.51	
17-Jul-14	1104	13.00	8.19	12.44	1.06	0.51	
17-Jul-14	1104.5	12.29	8.36	12.92	0.70	0.61	2
17-Jul-14	1105	11.95	8.73	13.31	0.37	0.47	
17-Jul-14	1105.5	11.58	9.05	13.88	0.21	0.42	
17-Jul-14	1106	12.03	8.53	13.27	0.08	0.43	
17-Jul-14	1106.5	13.79	6.64	10.65	0.02	0.43	
17-Jul-14	1107	13.74	6.91	10.79	0.61	0.41	1
17-Jul-14	1107.5	14.04	6.26	9.36	3.39	0.45	
17-Jul-14	1108	14.90	5.19	7.65	9.52	0.61	
17-Jul-14	1108.5	14.86	6.45	9.03	23.52	0.89	
17-Jul-14	1109	13.97	6.26	10.13	11.91	6.15	
17-Jul-14	1112.5	13.50	7.03	11.48	0.51	0.44	B-8
17-Jul-14	1113	13.06	7.39	12.41	2.25	0.44	
17-Jul-14	1113.5	14.09	6.45	10.73	2.36	0.43	
17-Jul-14	1114	14.18	6.39	10.61	2.23	0.42	
17-Jul-14	1114.5	14.04	6.45	10.32	13.17	0.26	
17-Jul-14	1115	13.09	7.61	12.36	30.10	0.37	7
17-Jul-14	1115.5	13.17	7.20	11.95	9.35	1.10	
17-Jul-14	1116	13.60	7.04	11.23	0.72	0.30	
17-Jul-14	1116.5	13.45	7.12	11.44	0.96	0.40	
17-Jul-14	1117	13.69	6.77	10.84	1.51	0.35	
17-Jul-14	1117.5	13.90	6.67	10.73	2.24	0.30	6
17-Jul-14	1118	13.50	7.16	11.14	1.74	0.33	
17-Jul-14	1118.5	13.71	6.66	10.36	1.74	0.31	
17-Jul-14	1119	13.87	6.68	10.46	8.37	0.30	
17-Jul-14	1119.5	15.46	4.78	7.81	10.79	0.35	
17-Jul-14	1120	15.01	5.64	8.84	17.93	0.58	5
17-Jul-14	1120.5	14.63	5.96	9.32	17.03	1.26	
17-Jul-14	1121	14.76	5.72	8.97	11.21	1.56	
17-Jul-14	1121.5	13.84	6.58	10.43	7.05	0.87	
17-Jul-14	1122	13.61	7.07	11.26	3.99	0.67	
17-Jul-14	1122.5	13.73	6.54	10.97	3.32	0.49	4
17-Jul-14	1123	13.89	6.93	10.93	1.77	0.47	
17-Jul-14	1123.5	13.74	6.64	10.68	0.96	0.84	
17-Jul-14	1124	13.58	7.11	10.94	0.44	0.61	
17-Jul-14	1124.5	13.52	6.94	10.74	1.03	0.55	
17-Jul-14	1125	13.74	6.85	10.62	1.89	0.43	3
17-Jul-14	1125.5	13.67	6.71	10.59	1.12	0.37	
17-Jul-14	1126	13.73	6.86	11.05	0.97	0.36	
17-Jul-14	1126.5	15.65	4.70	7.05	1.95	0.41	
17-Jul-14	1127	14.58	6.10	9.37	16.14	0.35	
17-Jul-14	1127.5	13.28	7.57	11.98	8.95	1.80	2
17-Jul-14	1128	12.69	7.79	12.39	0.42	0.45	
17-Jul-14	1128.5	12.51	8.09	12.68	-0.16	0.21	
17-Jul-14	1129	12.69	7.92	12.28	-0.23	0.23	
17-Jul-14	1129.5	12.83	7.75	12.14	-0.22	0.27	
17-Jul-14	1130	13.73	6.45	10.47	-0.16	0.22	1
17-Jul-14	1130.5	14.36	6.41	9.87	0.04	0.21	
17-Jul-14	1131	13.59	6.79	10.71	-0.05	0.22	
17-Jul-14	1131.5	14.04	6.49	10.16	-0.06	0.23	
17-Jul-14	1132	13.79	6.87	10.53	-0.02	0.23	End R3

## CARB Method 100 Performance Data

Facility: Chemical Waste Management, Inc. - Kettleman Hills L.F.  
 Source: Flare  
 Job No.: W07-084  
 Date: 7/17/2014

PRETEST CALIBRATION ERROR				
LEAK CHECK				
RANGE :	25	15	25	100
	O2	CO2	NOx	CO
ZERO				
Instrument	0.10	0.07	-0.01	0.14
Cylinder	0.00	0.00	0.00	0.00
Difference (%)	0.41	0.45	-0.02	0.14
LOW LEVEL				
Instrument				
Cylinder				
Difference (%)				
MID LEVEL				
Instrument	12.01	6.99	12.17	46.04
Cylinder	11.99	6.98	12.16	45.98
Difference (%)	0.07	0.08	-0.05	0.08
HIGH LEVEL				
Instrument	22.47	13.84	24.54	90.06
Cylinder	22.52	13.86	24.48	90.36
Difference (%)	-0.21	1.20	0.23	-0.30

PRETEST LINEARITY		
	Cylinder	Instrument
O2		
Zero	0.00	0.10
High Level	22.52	22.47
Slope	1.01	
Intercept	-0.10	Status
Predicted Value	12.01	<2
Linearity (%)	-0.01	PASS
CO2		
Zero	0.00	0.07
High Level	13.66	13.84
Slope	0.99	
Intercept	-0.07	Status
Predicted Value	7.10	<2
Linearity (%)	-0.75	PASS
NOx		
Zero	0.00	-0.01
High Level	24.48	24.54
Slope	1.00	
Intercept	0.01	Status
Predicted Value	12.21	<2
Linearity (%)	-0.15	PASS
CO		
Zero	0.00	0.14
High Level	90.36	90.06
Slope	1.00	
Intercept	-0.14	Status
Predicted Value	45.88	<2
Linearity (%)	0.16	PASS

SYSTEM RESPONSE TIME			
	#1	#2	#3
Upscale			
CO	43	43	44
NOx	28	29	29
O2	28	30	28
CO2	27	28	27
Downscale			
CO	42	41	43
NOx	28	29	30
O2	29	29	29
CO2	27	29	28

NO2 CONVERTER EFFICIENCY			
	ppm	%	status
Cylinder(C0)	19.71		
NO Mode(C1)	0.00		
NOx Mode(C2)	19.57		
D1	19.71		
D2	19.57		
D3	0.14		
CE		99.29	
CE > 90 %			PASS
D3 <1.0 ppm	0.14		PASS

POST TEST CALIBRATION ERROR				
LEAK CHECK				
	O2	CO2	NOx	CO
ZERO				
Instrument	-0.04	0.03	0.10	0.17
Cylinder	0.00	0.00	0.00	0.00
Difference (%)	-0.15	0.22	0.41	0.17
LOW LEVEL				
Instrument				
Cylinder				
Difference (%)				
MID LEVEL				
Instrument	12.02	7.06	12.10	45.95
Cylinder	11.99	6.98	12.18	45.98
Difference (%)	0.13	0.52	-0.31	-0.01
HIGH LEVEL				
Instrument	22.60	13.62	24.47	90.04
Cylinder	22.52	13.66	24.48	90.36
Difference (%)	0.32	1.08	-0.04	-0.32

POST TEST LINEARITY		
	Cylinder	Instrument
O2		
Zero	0.00	-0.04
High Level	22.52	22.60
Slope	0.99	
Intercept	0.04	Status
Predicted Value	12.01	<2
Linearity (%)	0.03	PASS
CO2		
Zero	0.00	0.03
High Level	13.66	13.82
Slope	0.99	
Intercept	-0.03	Status
Predicted Value	7.08	<2
Linearity (%)	-0.15	PASS
NOx		
Zero	0.00	0.10
High Level	24.48	24.47
Slope	1.00	
Intercept	-0.10	Status
Predicted Value	12.23	<2
Linearity (%)	-0.50	PASS
CO		
Zero	0.00	0.17
High Level	90.36	90.04
Slope	1.01	
Intercept	-0.17	Status
Predicted Value	45.88	<2
Linearity (%)	0.07	PASS

Facility: Chemical Waste Management, Inc. - Kettleman Hills L.F.  
 Source: Flare  
 Job No.: W07-084  
 Date: 7/17/2014

PRETEST CALIBRATION ERROR	
LEAK CHECK	
RANGE :	10
	CH4
ZERO	
Instrument	0.04
Cylinder	0.00
Offset (%)	0.40
LOW LEVEL	
Instrument	2.49
Cylinder	2.57
Offset (%)	-3.00
MIO LEVEL	
Instrument	5.03
Cylinder	5.02
Offset (%)	0.30
HIGH LEVEL	
Instrument	8.06
Cylinder	7.94
Difference (%)	1.52

SYSTEM RESPONSE TIME			
	#1	#2	#3
Upscale			
CH4	42	44	41
Downscale			
CH4	40	41	39

POST TEST CALIBRATION ERROR	
LEAK CHECK	
ZERO	
Instrument	-0.09
Cylinder	0.00
Offset (%)	-0.90
LOW LEVEL	
Instrument	2.51
Cylinder	2.57
Difference (%)	-0.57
MIO LEVEL	
Instrument	5.04
Cylinder	5.02
Difference (%)	0.25
HIGH LEVEL	
Instrument	7.95
Cylinder	7.94
Difference (%)	0.11

Facility: Chemical Waste Management, Inc. - Kettleman Hills L.F.  
 Source: Flare  
 Job No.: W07-084  
 Date: 07/17/14

Run No.: Raw Data  
 Fuel: LFG  
 Std. O2: 3

		O2 %	CO2 %	NOx ppm	CO ppm	THC ppm	
Range:		25	15	25	100	10.0	
Span:							
Low:							
High:							
Average:		10.15	4.10	8.19	9.51	1.37	
O2 adjust:	3.0			15.93	18.49	2.86	
Date	Time	O2	CO2	NOx	CO	THC	
17-Jul-14	740	0.11	0.07	0.05	-0.36	-0.76	
17-Jul-14	740.5	0.10	0.07	0.02	-0.01	-0.82	
17-Jul-14	741	0.10	0.07	-0.01	0.14	0.04	Zero All
17-Jul-14	741.5	0.10	0.08	-0.03	0.04	0.04	
17-Jul-14	742	0.10	0.07	-0.04	0.04	-0.14	
17-Jul-14	742.5	0.10	0.07	-0.07	0.00	-0.57	
17-Jul-14	743	0.09	0.06	-0.08	0.07	-0.66	
17-Jul-14	743.5	0.09	0.06	-0.10	0.04	-0.78	
17-Jul-14	744	0.10	0.06	-0.12	0.04	4.10	
17-Jul-14	744.5	0.09	0.06	0.09	0.04	-1.65	
17-Jul-14	745	0.10	0.08	0.17	0.04	2.23	
17-Jul-14	745.5	0.10	0.07	0.15	0.08	0.88	
17-Jul-14	746	0.09	0.06	0.13	0.04	0.06	
17-Jul-14	746.5	0.10	0.07	0.12	0.04	3.61	
17-Jul-14	747	0.09	0.06	0.10	0.04	8.42	
17-Jul-14	747.5	0.10	0.06	0.09	0.13	7.95	Cal
17-Jul-14	748	0.09	0.07	0.07	0.04	4.80	
17-Jul-14	748.5	0.09	0.06	0.05	0.15	0.09	
17-Jul-14	749	0.09	0.06	0.03	28.15	2.80	
17-Jul-14	749.5	0.09	0.07	0.02	45.13	7.81	
17-Jul-14	750	0.10	0.07	0.01	46.04	8.05	Cal
17-Jul-14	750.5	0.09	0.06	-0.01	46.14	5.03	
17-Jul-14	751	0.09	0.07	-0.03	69.06	-0.05	
17-Jul-14	751.5	0.10	0.06	-0.04	88.04	-0.18	
17-Jul-14	752	0.10	0.05	-0.06	90.06	0.25	Cal
17-Jul-14	752.5	0.09	0.06	-0.08	90.11	7.73	
17-Jul-14	753	0.10	0.06	-0.09	70.09	8.18	
17-Jul-14	753.5	0.09	0.05	-0.11	27.11	8.06	Cal
17-Jul-14	754	0.10	0.06	-0.11	0.11	5.18	
17-Jul-14	754.5	0.10	0.05	-0.13	0.16	0.14	
17-Jul-14	755	0.09	0.07	-0.15	0.13	-0.02	
17-Jul-14	755.5	0.11	0.08	-0.16	0.07	-0.15	
17-Jul-14	756	0.10	0.06	-0.16	0.10	-0.06	

17-Jul-14	756.5	0.10	0.06	-0.18	0.19	0.11	
17-Jul-14	757	0.09	0.06	-0.19	0.11	0.11	
17-Jul-14	757.5	0.10	0.07	-0.22	0.16	-0.01	
17-Jul-14	758	0.10	0.05	-0.22	0.16	2.37	
17-Jul-14	758.5	0.09	0.06	-0.23	0.16	5.99	
17-Jul-14	759	0.11	0.05	-0.25	0.16	5.05	
17-Jul-14	759.5	0.10	0.06	0.04	0.09	4.98	
17-Jul-14	800	0.11	0.06	0.14	0.16	5.03	Cal
17-Jul-14	800.5	0.10	0.06	0.13	0.16	6.89	
17-Jul-14	801	0.11	0.06	0.12	0.13	7.99	
17-Jul-14	801.5	0.11	0.05	0.10	0.12	6.57	
17-Jul-14	802	0.10	0.06	0.09	0.16	2.72	
17-Jul-14	802.5	0.11	0.06	0.08	0.23	2.41	
17-Jul-14	803	0.10	0.07	0.08	0.17	2.48	
17-Jul-14	803.5	0.11	0.07	0.06	0.13	2.49	Cal
17-Jul-14	804	0.12	0.07	0.05	0.09	2.47	
17-Jul-14	804.5	0.11	0.08	0.03	0.20	2.44	
17-Jul-14	805	0.12	0.08	0.03	0.12	2.22	
17-Jul-14	805.5	0.11	0.08	0.02	0.18	-0.35	
17-Jul-14	806	10.80	6.89	10.62	0.17	-0.45	
17-Jul-14	806.5	11.99	6.92	12.23	0.23	-0.47	
17-Jul-14	807	12.00	6.93	12.26	0.16	-0.52	
17-Jul-14	807.5	12.01	6.99	12.17	0.23	-0.27	Cal
17-Jul-14	808	14.01	9.39	12.07	0.18	-0.01	
17-Jul-14	808.5	22.39	13.18	8.10	0.16	-0.02	
17-Jul-14	809	22.43	13.86	10.42	0.22	-0.02	
17-Jul-14	809.5	22.44	13.82	22.09	0.20	-0.01	
17-Jul-14	810	22.46	13.83	24.57	0.26	-0.06	
17-Jul-14	810.5	22.47	13.84	24.54	0.20	-0.10	Cal
17-Jul-14	811	22.47	13.84	24.91	0.16	-0.14	
17-Jul-14	811.5	7.90	2.57	15.71	0.15	-0.13	
17-Jul-14	812	0.17	0.07	4.34	0.16	-0.06	
17-Jul-14	812.5	0.17	0.06	13.78	0.25	-0.06	
17-Jul-14	813	0.16	0.06	16.75	0.16	-0.08	
17-Jul-14	813.5	0.15	0.06	17.09	0.20	-0.18	
17-Jul-14	814	0.14	0.06	17.71	0.20	-0.23	
17-Jul-14	814.5	0.14	0.06	18.94	0.26	0.27	
17-Jul-14	815	0.14	0.06	19.57	0.18	0.24	NO2
17-Jul-14	815.5	0.16	0.06	4.70	0.26	0.16	
17-Jul-14	816	0.14	0.07	0.02	0.17	-0.16	
17-Jul-14	816.5	0.24	0.08	0.30	0.19	-0.19	
17-Jul-14	817	19.96	0.11	0.31	0.17	-0.23	
17-Jul-14	817.5	20.69	0.11	0.51	0.26	-0.20	
17-Jul-14	818	10.35	0.07	0.54	0.54	-0.13	
17-Jul-14	818.5	0.19	0.06	0.16	0.51	-0.03	
17-Jul-14	819	0.12	0.07	0.14	0.26	-0.07	
17-Jul-14	819.5	0.10	0.05	0.11	0.26	-0.09	
17-Jul-14	820	0.08	0.07	0.10	0.32	-0.09	
17-Jul-14	820.5	0.06	0.07	0.08	0.29	-0.12	
17-Jul-14	821	0.07	0.06	0.16	0.31	-0.17	
17-Jul-14	821.5	0.07	0.06	0.15	0.33	-0.19	
17-Jul-14	822	0.06	0.06	0.15	0.31	-0.21	
17-Jul-14	822.5	0.05	0.05	0.14	0.35	-0.01	
17-Jul-14	823	0.05	0.06	0.12	0.33	0.12	
17-Jul-14	823.5	0.05	0.06	0.12	0.35	0.10	Blas Zero
17-Jul-14	824	3.85	0.07	15.06	0.73	0.11	
17-Jul-14	824.5	0.08	0.07	33.52	24.26	0.09	
17-Jul-14	825	0.04	0.05	33.51	45.72	0.06	
17-Jul-14	825.5	0.04	0.07	33.51	46.72	0.05	
17-Jul-14	826	0.42	0.43	33.50	46.66	0.09	Blas
17-Jul-14	826.5	10.61	6.45	9.11	37.39	0.08	
17-Jul-14	827	11.70	6.72	0.30	7.82	0.02	
17-Jul-14	827.5	11.93	6.79	0.18	-0.01	0.02	
17-Jul-14	828	11.93	6.93	0.14	-0.17	0.01	Blas
17-Jul-14	828.5	11.93	6.93	0.11	-0.16	0.00	
17-Jul-14	829	6.40	2.29	7.15	-0.17	-0.02	

17-Jul-14	829.5	0.10	0.08	12.25	-0.04	-0.03	Blas
17-Jul-14	830	0.06	0.07	12.31	0.22	-0.02	
17-Jul-14	830.5	0.06	0.07	12.32	0.28	0.30	
17-Jul-14	831	9.84	0.08	6.93	0.28	1.10	
17-Jul-14	831.5	20.71	0.10	0.24	0.26	1.14	
17-Jul-14	832	20.77	0.10	0.14	0.31	1.15	
17-Jul-14	832.5	20.78	0.09	0.10	0.31	1.19	
17-Jul-14	833	20.79	0.08	0.07	0.27	1.24	
17-Jul-14	833.5	20.79	0.10	0.06	0.34	1.26	
17-Jul-14	834	20.81	0.10	0.05	0.26	1.27	
17-Jul-14	834.5	20.80	0.09	0.04	0.33	1.25	
17-Jul-14	835	20.82	0.09	0.03	0.30	1.28	
17-Jul-14	835.5	17.35	3.80	5.24	0.53	1.30	
17-Jul-14	836	15.70	4.58	7.86	8.63	1.30	
17-Jul-14	836.5	15.91	4.30	7.30	18.05	2.17	
17-Jul-14	837	18.48	3.97	6.52	26.64	2.80	
17-Jul-14	837.5	15.33	4.88	8.22	18.22	2.45	
17-Jul-14	838	18.11	4.03	6.87	8.77	2.31	
17-Jul-14	838.5	18.57	4.01	8.83	14.41	4.78	
17-Jul-14	839	18.83	3.24	5.54	28.88	1.30	
17-Jul-14	839.5	17.41	3.06	4.81	32.10	4.40	
17-Jul-14	840	18.88	3.83	5.75	48.88	9.42	
17-Jul-14	840.5	15.93	4.24	8.87	36.32	12.56	
17-Jul-14	841	17.40	2.93	4.72	32.77	10.89	
17-Jul-14	841.5	17.28	3.08	4.98	34.61	9.32	
17-Jul-14	842	17.07	3.52	5.29	43.41	10.22	
17-Jul-14	842.5	16.09	4.27	8.45	60.82	10.81	
17-Jul-14	843	18.89	3.70	5.69	51.14	11.12	
17-Jul-14	843.5	15.94	4.60	8.78	41.73	3.23	
17-Jul-14	844	14.80	5.37	8.59	46.14	7.47	
17-Jul-14	844.5	15.12	5.43	8.16	20.77	0.89	
17-Jul-14	845	14.34	5.92	8.94	18.80	4.81	
17-Jul-14	845.5	14.40	5.88	9.31	21.52	0.01	
17-Jul-14	846	14.53	5.69	9.47	7.74	0.03	
17-Jul-14	846.5	15.98	4.25	7.44	2.87	0.16	
17-Jul-14	847	15.78	4.28	7.68	13.48	0.03	
17-Jul-14	847.5	18.91	3.67	8.29	19.77	0.38	
17-Jul-14	848	17.57	2.89	4.98	26.21	-0.05	
17-Jul-14	848.5	18.71	3.93	6.73	24.35	0.04	
17-Jul-14	849	15.09	5.36	9.06	12.79	-0.01	
17-Jul-14	849.5	13.97	6.55	10.63	2.72	0.00	Zero
17-Jul-14	850	14.03	8.21	10.34	1.88	0.03	
17-Jul-14	850.5	15.81	4.43	7.81	2.30	0.05	
17-Jul-14	851	14.72	5.92	9.18	19.10	0.11	
17-Jul-14	851.5	14.05	8.28	9.84	15.97	0.13	
17-Jul-14	852	14.17	8.03	9.58	2.98	2.22	
17-Jul-14	852.5	15.09	5.10	8.29	1.47	5.04	
17-Jul-14	853	14.79	5.50	8.89	8.03	5.01	Cal
17-Jul-14	853.5	14.85	5.84	9.27	8.88	4.98	
17-Jul-14	854	13.89	8.55	10.84	1.97	5.02	
17-Jul-14	854.5	15.28	4.74	8.07	1.11	4.98	
17-Jul-14	855	15.98	4.28	7.03	8.46	1.03	
17-Jul-14	855.5	15.17	5.47	8.58	23.14	0.03	
17-Jul-14	858	14.91	5.20	8.61	13.13	0.04	
17-Jul-14	858.5	14.88	5.56	8.92	7.80	0.03	
17-Jul-14	857	14.33	5.88	9.68	5.87	1.28	Start A-8
17-Jul-14	857.5	15.83	4.49	7.64	3.20	0.71	
17-Jul-14	858	15.83	4.55	7.57	8.91	0.55	
17-Jul-14	858.5	15.29	4.98	8.22	7.99	0.44	
17-Jul-14	859	15.81	4.27	7.13	14.89	0.34	
17-Jul-14	859.5	15.86	4.58	7.24	25.41	0.53	7
17-Jul-14	900	15.71	4.57	7.48	24.25	2.99	
17-Jul-14	900.5	15.01	5.43	8.77	7.59	1.52	
17-Jul-14	901	15.43	4.85	7.54	2.63	0.18	
17-Jul-14	901.5	15.45	5.07	7.71	13.87	0.06	
17-Jul-14	902	14.73	5.37	8.72	22.00	1.07	6

17-Jul-14	902.5	14.83	5.68	8.76	9.04	0.44	
17-Jul-14	903	14.39	5.89	9.39	12.09	-0.02	
17-Jul-14	903.5	14.23	6.09	9.69	3.47	-0.10	
17-Jul-14	904	14.47	5.80	9.26	2.12	-0.01	
17-Jul-14	904.5	15.21	5.02	8.17	4.72	-0.04	5
17-Jul-14	905	15.09	5.25	8.55	9.18	-0.03	
17-Jul-14	905.5	14.00	6.46	10.32	6.88	-0.09	
17-Jul-14	906	13.90	6.31	10.14	4.53	-0.01	
17-Jul-14	906.5	14.49	5.86	9.34	9.97	-0.19	
17-Jul-14	907	15.76	4.25	7.24	9.80	-0.07	4
17-Jul-14	907.5	15.78	4.49	7.06	20.76	-0.19	
17-Jul-14	908	15.05	5.76	8.67	44.02	1.71	
17-Jul-14	908.5	13.67	6.48	10.49	27.12	6.17	
17-Jul-14	909	14.96	5.20	8.48	2.09	0.65	
17-Jul-14	909.5	14.31	5.83	8.49	6.99	-0.19	3
17-Jul-14	910	15.83	4.84	6.83	22.95	1.00	
17-Jul-14	910.5	13.20	7.33	11.37	9.02	3.13	
17-Jul-14	911	14.13	5.91	9.89	2.87	0.89	
17-Jul-14	911.5	14.23	6.43	9.67	6.56	0.76	
17-Jul-14	912	13.33	7.00	10.06	16.90	0.83	2
17-Jul-14	912.5	13.35	6.62	8.98	25.94	0.84	
17-Jul-14	913	14.48	5.94	7.37	57.24	0.80	
17-Jul-14	913.5	15.72	4.41	7.10	51.06	0.82	
17-Jul-14	914	14.60	6.06	7.74	16.60	0.85	
17-Jul-14	914.5	12.86	7.44	10.93	38.08	0.88	1
17-Jul-14	915	13.51	6.83	11.24	31.04	0.85	
17-Jul-14	915.5	13.95	6.18	10.59	5.80	0.89	
17-Jul-14	916	13.19	7.73	12.02	0.45	0.81	
17-Jul-14	916.5	11.91	8.39	13.54	0.78	2.25	
17-Jul-14	917	12.90	7.53	12.05	1.13	4.11	port
17-Jul-14	917.5	13.44	6.49	10.75	1.09	1.68	
17-Jul-14	918	19.14	0.82	1.91	0.63	0.13	
17-Jul-14	918.5	20.78	0.12	0.19	0.43	0.11	
17-Jul-14	919	20.79	0.11	0.14	0.45	-0.07	
17-Jul-14	919.5	19.72	2.08	2.47	0.40	-0.16	
17-Jul-14	920	13.29	6.86	11.82	0.58	-0.12	B-8
17-Jul-14	920.5	13.58	6.84	11.34	2.13	-0.08	
17-Jul-14	921	13.58	6.84	10.78	3.74	-0.06	
17-Jul-14	921.5	12.69	7.56	12.01	5.01	-0.06	
17-Jul-14	922	14.88	5.29	8.84	2.87	-0.08	
17-Jul-14	922.5	14.00	6.52	10.13	4.07	-0.05	7
17-Jul-14	923	13.82	6.65	10.52	2.78	-0.01	
17-Jul-14	923.5	13.75	6.49	10.42	1.76	-0.03	
17-Jul-14	924	13.69	6.66	10.74	1.12	-0.04	
17-Jul-14	924.5	13.77	6.40	10.57	2.35	-0.07	
17-Jul-14	925	14.39	5.81	9.62	3.06	-0.09	6
17-Jul-14	925.5	14.73	5.36	8.88	1.14	-0.08	
17-Jul-14	926	14.67	5.97	9.30	2.79	-0.05	
17-Jul-14	926.5	13.24	6.96	11.10	1.63	-0.05	
17-Jul-14	927	13.75	6.84	10.48	2.84	-0.15	
17-Jul-14	927.5	13.70	6.62	10.52	2.05	-0.17	5
17-Jul-14	928	14.31	5.72	9.12	1.82	-0.15	
17-Jul-14	928.5	14.45	6.02	9.28	3.69	-0.15	
17-Jul-14	929	13.49	6.99	10.73	13.23	-0.10	
17-Jul-14	929.5	13.60	6.51	10.41	7.55	0.45	
17-Jul-14	930	14.69	5.56	8.96	4.04	0.14	4
17-Jul-14	930.5	14.82	5.46	8.33	9.38	0.11	
17-Jul-14	931	13.45	6.81	10.95	5.64	0.24	
17-Jul-14	931.5	13.89	6.58	10.12	2.05	0.13	
17-Jul-14	932	13.64	6.67	10.58	3.57	-0.06	
17-Jul-14	932.5	14.08	6.19	9.75	2.86	-0.03	3
17-Jul-14	933	13.38	6.85	11.03	6.18	-0.08	
17-Jul-14	933.5	13.29	7.37	10.87	7.77	-0.03	
17-Jul-14	934	13.07	6.95	11.46	8.23	-0.13	
17-Jul-14	934.5	13.91	6.19	10.04	1.68	0.00	
17-Jul-14	935	16.23	4.03	6.18	7.30	-0.10	2

17-Jul-14	935.5	15.60	4.92	7.02	15.45	0.35	
17-Jul-14	938	14.25	6.01	9.25	25.04	0.52	
17-Jul-14	936.5	14.97	5.48	8.56	14.08	3.25	
17-Jul-14	937	12.68	7.88	12.82	8.48	0.23	
17-Jul-14	937.5	12.32	8.01	13.13	1.06	0.00	1
17-Jul-14	938	14.15	5.77	9.33	0.54	-0.19	
17-Jul-14	938.5	14.84	5.53	8.54	2.67	-0.16	
17-Jul-14	939	14.40	5.97	9.29	2.27	-0.04	
17-Jul-14	939.5	13.85	6.48	10.56	1.55	0.20	End
17-Jul-14	940	13.84	6.46	9.70	1.20	0.52	
17-Jul-14	940.5	12.82	7.58	12.15	2.60	0.11	
17-Jul-14	941	8.15	3.67	7.70	1.30	0.01	
17-Jul-14	941.5	0.24	0.08	-0.02	0.72	-0.02	
17-Jul-14	942	0.20	0.07	-0.08	0.55	0.02	
17-Jul-14	942.5	0.12	0.05	-0.10	0.62	0.02	Zero
17-Jul-14	943	0.06	0.06	-0.12	0.69	0.00	
17-Jul-14	943.5	0.05	0.08	-0.14	0.65	0.39	
17-Jul-14	944	0.92	0.26	27.81	5.10	4.89	
17-Jul-14	944.5	0.04	0.05	33.52	34.41	5.00	Cal
17-Jul-14	945	0.03	0.04	33.51	46.37	5.03	
17-Jul-14	945.5	0.02	0.06	33.51	46.28	4.98	Cal
17-Jul-14	946	0.01	0.05	33.51	46.98	2.05	
17-Jul-14	946.5	8.16	5.73	15.90	43.42	0.08	
17-Jul-14	947	11.91	6.89	0.09	12.40	0.05	
17-Jul-14	947.5	11.95	7.00	0.08	0.65	0.05	Cal
17-Jul-14	948	8.24	3.83	5.54	0.04	0.39	
17-Jul-14	948.5	0.15	0.09	12.23	0.20	0.11	Cal
17-Jul-14	949	0.00	0.05	12.18	0.35	0.31	
17-Jul-14	949.5	0.14	0.14	12.52	0.41	2.78	
17-Jul-14	950	0.36	0.07	1.13	2.08	3.43	
17-Jul-14	950.5	0.01	0.04	0.03	1.86	7.13	
17-Jul-14	951	11.37	4.95	7.42	4.41	10.67	
17-Jul-14	951.5	14.36	6.14	9.71	28.77	10.63	
17-Jul-14	952	13.59	6.87	10.97	12.05	5.18	
17-Jul-14	952.5	13.78	6.50	9.97	8.88	5.95	
17-Jul-14	953	13.57	6.88	10.81	55.47	1.49	
17-Jul-14	953.5	13.66	6.70	10.61	32.17	1.14	Start R-2 B-8
17-Jul-14	954	13.14	7.49	11.58	4.65	1.08	
17-Jul-14	954.5	12.60	7.66	11.90	0.72	1.12	
17-Jul-14	955	13.79	6.49	10.15	4.26	1.14	
17-Jul-14	955.5	14.37	5.93	9.18	19.38	1.29	
17-Jul-14	956	13.94	6.54	10.09	28.19	1.78	7
17-Jul-14	956.5	14.25	6.21	9.81	9.51	1.36	
17-Jul-14	957	14.20	6.14	9.88	6.76	1.39	
17-Jul-14	957.5	14.80	5.37	8.85	10.68	2.09	
17-Jul-14	958	15.54	5.05	7.82	7.25	2.29	
17-Jul-14	958.5	15.74	4.46	7.21	17.57	1.34	6
17-Jul-14	959	15.22	5.29	8.44	17.50	1.26	
17-Jul-14	959.5	13.88	6.82	10.55	4.82	1.22	
17-Jul-14	1000	13.55	6.73	10.76	1.51	1.20	
17-Jul-14	1000.5	14.14	6.20	9.72	1.82	1.20	
17-Jul-14	1001	14.61	5.72	9.16	5.89	1.18	5
17-Jul-14	1001.5	14.24	5.96	9.67	10.01	1.19	
17-Jul-14	1002	14.28	6.57	9.64	10.75	1.25	
17-Jul-14	1002.5	13.45	6.93	10.32	4.83	1.22	
17-Jul-14	1003	12.82	7.64	11.50	3.20	1.22	
17-Jul-14	1003.5	13.25	7.16	10.89	1.12	1.43	4
17-Jul-14	1004	13.01	7.32	11.47	0.40	1.38	
17-Jul-14	1004.5	13.89	6.59	10.38	0.54	1.21	
17-Jul-14	1005	13.24	7.21	11.28	2.09	1.11	
17-Jul-14	1005.5	13.36	7.14	10.98	1.82	0.14	
17-Jul-14	1006	13.61	6.65	9.98	1.47	-0.15	3
17-Jul-14	1008.5	13.87	8.59	9.95	5.67	-0.12	
17-Jul-14	1007	13.73	8.60	10.00	6.01	-0.09	
17-Jul-14	1007.5	13.40	7.08	10.56	4.09	-0.19	
17-Jul-14	1008	14.01	6.16	9.65	4.56	-0.20	

17-Jul-14	1006.5	14.69	5.46	7.69	5.21	-0.25	2
17-Jul-14	1009	15.27	5.06	6.69	19.69	0.26	
17-Jul-14	1009.5	15.68	4.55	5.89	37.41	0.53	
17-Jul-14	1010	15.13	5.31	7.92	42.45	0.71	
17-Jul-14	1010.5	15.53	4.69	6.69	18.16	3.55	
17-Jul-14	1011	15.69	4.76	6.52	28.66	0.36	1
17-Jul-14	1011.5	15.26	4.65	6.68	26.36	1.31	
17-Jul-14	1012	14.42	6.39	9.61	21.16	0.66	
17-Jul-14	1012.5	13.51	6.96	11.29	6.62	1.63	
17-Jul-14	1013	13.47	6.92	11.31	0.47	0.01	
17-Jul-14	1013.5	13.64	6.56	10.68	0.04	-0.10	Port
17-Jul-14	1014	17.99	1.64	3.63	0.85	-0.02	
17-Jul-14	1014.5	20.83	0.11	0.50	1.35	0.05	
17-Jul-14	1015	20.86	0.09	0.39	0.41	1.44	
17-Jul-14	1015.5	20.86	0.31	0.41	0.34	0.92	
17-Jul-14	1016	15.13	6.09	9.66	0.63	9.91	
17-Jul-14	1016.5	13.72	6.57	10.69	1.26	3.96	
17-Jul-14	1017	14.86	5.17	6.73	1.91	1.55	R-2 A-6
17-Jul-14	1017.5	16.42	3.98	6.72	7.36	1.25	
17-Jul-14	1018	16.00	4.58	7.51	25.56	1.36	
17-Jul-14	1018.5	15.04	5.37	6.84	20.73	1.40	
17-Jul-14	1019	13.94	6.49	10.52	12.52	1.34	
17-Jul-14	1019.5	14.04	6.39	10.60	2.51	1.33	7
17-Jul-14	1020	14.25	6.04	9.91	0.61	1.32	
17-Jul-14	1020.5	15.20	5.12	8.63	1.67	1.14	
17-Jul-14	1021	15.71	4.48	7.56	7.16	0.91	
17-Jul-14	1021.5	15.30	5.02	6.45	14.17	0.25	
17-Jul-14	1022	15.99	4.91	6.03	6.16	1.58	6
17-Jul-14	1022.5	14.19	6.11	10.00	13.20	1.13	
17-Jul-14	1023	15.26	4.97	6.21	7.15	1.20	
17-Jul-14	1023.5	15.46	4.97	7.98	9.99	1.14	
17-Jul-14	1024	15.18	4.94	6.30	13.78	1.29	
17-Jul-14	1024.5	15.62	4.66	7.72	9.24	1.23	5
17-Jul-14	1025	15.26	5.24	6.38	13.99	1.32	
17-Jul-14	1025.5	15.45	4.73	7.76	20.50	1.43	
17-Jul-14	1026	15.77	4.66	7.30	26.46	1.36	
17-Jul-14	1026.5	14.76	5.79	6.65	46.60	1.36	
17-Jul-14	1027	14.66	5.29	6.41	20.93	1.34	4
17-Jul-14	1027.5	14.23	6.57	9.73	12.72	1.31	
17-Jul-14	1028	12.60	7.91	12.37	13.59	1.73	
17-Jul-14	1028.5	12.50	7.96	12.55	2.23	1.65	
17-Jul-14	1029	13.01	7.46	11.90	0.40	1.57	
17-Jul-14	1029.5	12.26	8.16	13.09	0.25	1.54	3
17-Jul-14	1030	13.56	6.92	11.00	0.10	2.71	
17-Jul-14	1030.5	13.03	7.42	11.60	0.45	0.61	
17-Jul-14	1031	12.30	6.24	13.06	1.13	0.25	
17-Jul-14	1031.5	13.09	7.35	11.46	0.90	0.16	
17-Jul-14	1032	13.05	7.46	11.72	1.97	0.07	2
17-Jul-14	1032.5	13.19	6.77	11.16	2.28	0.06	
17-Jul-14	1033	13.50	7.46	11.20	0.93	-0.01	
17-Jul-14	1033.5	12.90	7.57	11.70	1.11	0.10	
17-Jul-14	1034	12.92	7.47	11.75	1.00	-0.02	
17-Jul-14	1034.5	14.41	5.73	9.01	0.64	-0.04	1
17-Jul-14	1035	14.43	6.06	9.36	1.63	-0.09	
17-Jul-14	1035.5	13.69	6.99	10.67	1.73	0.17	
17-Jul-14	1036	12.61	7.91	12.44	1.07	0.42	
17-Jul-14	1036.5	11.67	6.69	13.66	0.51	0.32	End 2
17-Jul-14	1037	11.04	5.52	9.49	0.53	0.79	
17-Jul-14	1037.5	0.70	0.13	0.41	1.11	0.26	
17-Jul-14	1036	0.06	0.07	0.20	0.36	-0.04	
17-Jul-14	1036.5	0.06	0.06	0.16	0.35	-0.01	
17-Jul-14	1039	0.05	0.05	0.17	0.37	0.01	Bias Zero
17-Jul-14	1039.5	0.04	0.04	0.16	0.37	1.23	
17-Jul-14	1040	0.56	0.31	24.60	2.72	4.66	
17-Jul-14	1040.5	0.02	0.04	33.52	30.81	5.04	
17-Jul-14	1041	0.02	0.03	33.52	45.21	5.06	Blas

17-Jul-14	1041.5	0.00	0.04	33.51	45.84	5.00	Blas
17-Jul-14	1042	-0.01	0.05	33.51	45.84	4.93	
17-Jul-14	1042.5	-0.04	0.04	0.53	0.35	0.13	
17-Jul-14	1043	-0.04	0.03	0.13	0.35	0.12	
17-Jul-14	1050	-0.03	0.04	0.13	0.29	0.10	
17-Jul-14	1050.5	0.87	0.28	4.79	0.35	0.11	
17-Jul-14	1051	-0.02	0.04	12.17	0.37	0.12	Blas
17-Jul-14	1051.5	-0.04	0.03	12.06	0.24	0.13	
17-Jul-14	1052	4.61	3.69	6.51	0.14	0.13	
17-Jul-14	1052.5	12.03	7.08	0.12	-0.07	0.13	Blas
17-Jul-14	1053	12.04	7.08	0.08	-0.23	0.08	
17-Jul-14	1053.5	8.00	3.53	0.50	-0.25	0.10	
17-Jul-14	1054	0.02	0.06	0.10	-0.07	0.25	
17-Jul-14	1054.5	4.97	2.88	3.88	0.25	0.62	
17-Jul-14	1055	15.49	5.06	7.89	4.05	1.66	
17-Jul-14	1055.5	13.79	6.71	10.43	13.45	0.76	
17-Jul-14	1056	14.94	5.60	8.83	5.02	1.20	Start R-3 A-8
17-Jul-14	1056.5	14.18	6.30	9.85	2.54	0.62	
17-Jul-14	1057	14.26	6.12	9.55	0.53	0.61	
17-Jul-14	1057.5	15.12	5.41	8.48	0.90	1.02	
17-Jul-14	1058	14.40	6.17	9.61	3.13	1.01	
17-Jul-14	1058.5	14.41	5.92	9.43	3.07	0.94	7
17-Jul-14	1059	15.09	5.42	8.48	3.29	0.91	
17-Jul-14	1059.5	14.89	5.71	8.73	10.44	0.99	
17-Jul-14	1100	15.67	4.84	7.47	7.23	1.08	
17-Jul-14	1100.5	15.10	5.63	8.63	9.83	0.96	
17-Jul-14	1101	14.29	6.30	9.72	11.90	1.03	6
17-Jul-14	1101.5	14.34	6.29	9.69	5.14	0.79	
17-Jul-14	1102	15.28	4.76	7.70	2.04	0.70	
17-Jul-14	1102.5	15.35	5.62	8.39	7.87	0.80	
17-Jul-14	1103	14.33	6.15	9.54	8.51	1.21	
17-Jul-14	1103.5	13.85	6.84	10.50	2.04	0.72	5
17-Jul-14	1104	13.73	6.61	10.46	1.03	0.66	
17-Jul-14	1104.5	14.49	5.87	9.40	0.88	0.63	
17-Jul-14	1105	14.09	6.66	10.36	1.16	0.63	
17-Jul-14	1105.5	13.85	6.64	10.25	2.55	0.63	
17-Jul-14	1106	14.27	6.30	9.77	5.04	0.58	4
17-Jul-14	1100	14.17	6.31	9.80	5.34	0.57	
17-Jul-14	1100.5	14.30	6.27	9.86	4.55	0.59	
17-Jul-14	1101	13.57	7.01	10.82	4.94	0.52	
17-Jul-14	1101.5	13.56	6.85	10.68	0.61	0.44	
17-Jul-14	1102	13.78	6.85	10.52	0.99	0.50	3
17-Jul-14	1102.5	12.98	7.69	11.39	4.07	0.50	
17-Jul-14	1103	12.70	7.82	12.03	3.75	0.52	
17-Jul-14	1103.5	13.30	6.94	11.18	1.16	0.51	
17-Jul-14	1104	13.00	8.19	12.44	1.06	0.51	
17-Jul-14	1104.5	12.29	8.36	12.92	0.70	0.61	2
17-Jul-14	1105	11.95	8.73	13.31	0.37	0.47	
17-Jul-14	1105.5	11.58	9.05	13.88	0.21	0.42	
17-Jul-14	1106	12.03	8.53	13.27	0.08	0.43	
17-Jul-14	1106.5	13.79	6.64	10.65	0.02	0.43	
17-Jul-14	1107	13.74	6.91	10.79	0.61	0.41	1
17-Jul-14	1107.5	14.04	6.26	9.36	3.39	0.45	
17-Jul-14	1108	14.90	5.19	7.65	9.52	0.61	
17-Jul-14	1108.5	14.66	6.45	9.03	23.52	0.89	
17-Jul-14	1109	13.97	6.26	10.13	11.91	6.15	
17-Jul-14	1109.5	15.60	4.30	7.17	0.69	0.74	Port
17-Jul-14	1110	20.54	0.20	0.71	0.46	0.57	
17-Jul-14	1110.5	21.04	0.10	0.44	0.45	0.73	
17-Jul-14	1111	21.06	0.11	0.34	0.25	1.44	
17-Jul-14	1111.5	21.05	0.50	0.51	0.25	1.23	
17-Jul-14	1112	14.66	6.61	10.39	0.18	0.48	
17-Jul-14	1112.5	13.50	7.03	11.48	0.51	0.44	B-8
17-Jul-14	1113	13.06	7.39	12.41	2.25	0.44	
17-Jul-14	1113.5	14.09	6.45	10.73	2.36	0.43	
17-Jul-14	1114	14.18	6.39	10.61	2.23	0.42	

17-Jul-14	1114.5	14.04	6.45	10.32	13.17	0.26	
17-Jul-14	1115	13.09	7.61	12.36	30.10	0.37	7
17-Jul-14	1115.5	13.17	7.20	11.95	9.35	1.10	
17-Jul-14	1116	13.60	7.04	11.23	0.72	0.30	
17-Jul-14	1116.5	13.45	7.12	11.44	0.96	0.40	
17-Jul-14	1117	13.69	6.77	10.84	1.51	0.35	
17-Jul-14	1117.5	13.90	6.67	10.73	2.24	0.30	6
17-Jul-14	1118	13.50	7.16	11.14	1.74	0.33	
17-Jul-14	1118.5	13.71	6.66	10.36	1.74	0.31	
17-Jul-14	1119	13.87	6.68	10.46	8.37	0.30	
17-Jul-14	1119.5	15.46	4.78	7.81	10.79	0.35	
17-Jul-14	1120	15.01	5.64	8.84	17.93	0.58	5
17-Jul-14	1120.5	14.63	5.96	9.32	17.03	1.26	
17-Jul-14	1121	14.76	5.72	8.97	11.21	1.56	
17-Jul-14	1121.5	13.84	6.58	10.43	7.05	0.87	
17-Jul-14	1122	13.61	7.07	11.26	3.99	0.67	
17-Jul-14	1122.5	13.73	6.54	10.97	3.32	0.49	4
17-Jul-14	1123	13.89	6.93	10.93	1.77	0.47	
17-Jul-14	1123.5	13.74	6.64	10.68	0.96	0.84	
17-Jul-14	1124	13.58	7.11	10.94	0.44	0.61	
17-Jul-14	1124.5	13.52	6.94	10.74	1.03	0.55	
17-Jul-14	1125	13.74	6.85	10.62	1.89	0.43	3
17-Jul-14	1125.5	13.67	6.71	10.59	1.12	0.37	
17-Jul-14	1126	13.73	6.86	11.05	0.97	0.36	
17-Jul-14	1126.5	15.65	4.70	7.05	1.95	0.41	
17-Jul-14	1127	14.58	6.10	9.37	16.14	0.35	
17-Jul-14	1127.5	13.28	7.57	11.98	8.95	1.80	2
17-Jul-14	1128	12.69	7.79	12.39	0.42	0.45	
17-Jul-14	1128.5	12.51	8.09	12.88	-0.16	0.21	
17-Jul-14	1129	12.69	7.92	12.28	-0.23	0.23	
17-Jul-14	1129.5	12.83	7.75	12.14	-0.22	0.27	
17-Jul-14	1130	13.73	6.45	10.47	-0.16	0.22	1
17-Jul-14	1130.5	14.36	6.41	9.87	0.04	0.21	
17-Jul-14	1131	13.59	6.79	10.71	-0.05	0.22	
17-Jul-14	1131.5	14.04	6.49	10.16	-0.06	0.23	
17-Jul-14	1132	13.79	6.87	10.53	-0.02	0.23	End R3
17-Jul-14	1132.5	13.51	6.44	10.63	-0.07	0.98	
17-Jul-14	1133	10.72	0.30	1.12	-0.12	1.38	
17-Jul-14	1133.5	0.15	0.07	0.41	0.14	1.31	
17-Jul-14	1134	0.12	0.06	0.40	0.25	0.59	
17-Jul-14	1134.5	0.09	0.05	0.36	0.25	0.37	
17-Jul-14	1135	0.10	0.05	0.34	0.25	-0.08	
17-Jul-14	1135.5	0.08	0.05	0.34	0.25	-0.06	
17-Jul-14	1136	0.08	0.05	0.27	0.21	-0.09	Zero Bias
17-Jul-14	1136.5	0.08	0.05	0.23	0.25	0.43	
17-Jul-14	1137	0.81	0.04	15.50	1.01	5.06	
17-Jul-14	1137.5	0.06	0.04	33.53	20.95	5.04	Bias
17-Jul-14	1138	0.05	0.05	33.52	44.24	6.75	
17-Jul-14	1138.5	0.04	0.04	33.51	45.83	7.96	Bias
17-Jul-14	1139	0.05	0.05	33.51	45.69	7.91	
17-Jul-14	1139.5	0.63	0.98	33.51	45.56	6.42	
17-Jul-14	1140	11.48	6.94	5.69	34.84	2.73	
17-Jul-14	1140.5	12.07	7.03	0.38	6.76	2.51	Bias
17-Jul-14	1141	12.08	7.02	0.29	-0.09	2.47	
17-Jul-14	1141.5	7.76	3.47	5.42	-0.33	0.97	
17-Jul-14	1142	0.09	0.08	12.00	-0.23	-0.05	
17-Jul-14	1142.5	0.05	0.06	12.05	-0.03	-0.05	
17-Jul-14	1143	0.03	0.05	12.07	0.08	-0.03	Bias
17-Jul-14	1143.5	0.03	0.05	12.08	0.15	-0.02	
17-Jul-14	1144	0.01	0.04	12.07	0.15	-0.01	
17-Jul-14	1144.5	0.94	0.09	6.31	0.17	-0.03	
17-Jul-14	1145	-0.05	0.01	0.13	0.25	-0.02	
17-Jul-14	1145.5	-0.05	0.02	0.11	0.25	-0.02	
17-Jul-14	1146	-0.04	0.01	0.10	0.25	0.00	
17-Jul-14	1146.5	-0.04	0.03	0.10	0.17	0.03	Zero All
17-Jul-14	1147	-0.04	0.04	0.11	0.21	0.09	

17-Jul-14	1147.5	-0.03	0.03	0.10	0.21	0.09	
17-Jul-14	1148	5.45	4.39	6.09	0.19	0.12	
17-Jul-14	1148.5	12.06	7.06	12.05	0.21	0.17	
17-Jul-14	1149	12.02	7.06	12.10	0.17	0.19	Cal
17-Jul-14	1149.5	15.56	10.69	12.11	0.22	0.21	
17-Jul-14	1150	22.57	13.79	16.64	0.19	0.23	
17-Jul-14	1150.5	22.60	13.82	12.07	0.21	0.24	Cal
17-Jul-14	1151	22.61	13.80	21.32	0.16	0.28	
17-Jul-14	1151.5	15.10	7.02	23.97	0.16	0.32	
17-Jul-14	1152	0.03	0.05	24.39	0.12	0.38	
17-Jul-14	1152.5	0.01	0.03	24.47	0.16	0.69	Cal
17-Jul-14	1153	0.00	0.03	24.42	0.21	1.24	
17-Jul-14	1153.5	0.00	0.03	9.11	0.15	1.52	
17-Jul-14	1154	0.00	0.04	0.17	0.15	1.80	
17-Jul-14	1154.5	0.00	0.04	0.17	6.80	2.02	
17-Jul-14	1155	-0.01	0.04	0.17	39.30	3.79	
17-Jul-14	1155.5	-0.01	0.03	0.18	45.95	3.95	Cal
17-Jul-14	1156	-0.01	0.03	0.18	45.93	4.06	
17-Jul-14	1156.5	-0.01	0.03	0.18	46.45	4.08	
17-Jul-14	1157	-0.01	0.04	0.19	68.66	4.13	
17-Jul-14	1157.5	-0.02	0.04	0.19	89.75	4.17	
17-Jul-14	1158	-0.01	0.04	0.19	90.04	4.25	Cal
17-Jul-14	1158.5	-0.01	0.03	0.19	89.65	4.28	
17-Jul-14	1159	-0.02	0.03	0.21	81.52	4.26	
17-Jul-14	1159.5	-0.02	0.04	0.20	21.89	4.24	
17-Jul-14	1200	-0.02	0.05	0.21	0.43	4.28	
17-Jul-14	1200.5	-0.02	0.03	0.21	0.16	4.36	
17-Jul-14	1201	-0.01	0.04	0.22	0.15	4.34	
17-Jul-14	1201.5	-0.02	0.03	0.22	0.10	4.34	
17-Jul-14	1202	-0.02	0.03	0.22	0.15	4.38	
17-Jul-14	1202.5	-0.01	0.05	0.22	0.15	4.41	

## **APPENDIX C - Laboratory Data**



AtmAA Inc.

23917 Craftsman Rd., Calabasas, CA 91302 • (818) 223-3277 • FAX (818) 223-8250

environmental consultants  
laboratory services

### LABORATORY ANALYSIS REPORT

Methane, Ethane, and total Gaseous Non-Methane Organics (TGNMO),  
Analysis in Steel Tank Samples

Report Date: July 28, 2014

Client: Horizon Air measurement Services, Inc.

Client Project No.: W07 - 084

Source Location : Waste Management, Kettleman City , CA.

Source ID: Flare Inlet LFG

Date Received: July 21, 2014

Date Analyzed: July 21, - 26, 2014

### ANALYSIS DESCRIPTION

Total gaseous non-methane organics (TGNMO) and ethane were measured by flame ionization detection/total combustion analysis (FID/TCA), M25. Methane was measured by thermal conductivity detection/gas chromatography (TCD/GC), EPA 3C.

AtmAA Lab No.	Sample ID	Tank Methane	Tank Ethane	Tank TGNMO	
(Concentration, ppmv)					
12024-8	Tank U Run 1 Inlet	366000	<20	7500	✓
12024-9	Tank T Run 2 Inlet	370000	<20	8120	✓ used
12024-10	Tank D Run 3 Inlet	366000	<20	6900	✓

Inlet

Report used the overall gas analysis  
for inlet methane  
instead of this analysis

TGNMO is total gaseous non-methane organics (excluding ethane), reported as ppmvC.  
Ethane is reported as ppmvC.

Michael L. Porter  
Laboratory Director

**QUALITY ASSURANCE SUMMARY**  
(Repeat Analysis)

Source Location : Waste Management, Kettleman City , CA.

Date Received: July 21, 2014

Date Analyzed: July 21, - 26, 2014

Components	Sample ID	Repeat Analysis		Mean Conc.	% Diff. From Mean
		Run #1	Run #2		
(Concentration in ppmv)					
Methane	Tank U Run 1 Inlet	365000	366000	366000	0.14
Ethane	Tank U Run 1 Inlet	<20	<20	---	---
	Tank T Run 2 Inlet	<20	<20	---	---
	Tank D Run 3 Inlet	<20	<20	---	---
TGNMO	Tank U Run 1 Inlet	7640	7360	7500 ✓	1.9
	Tank T Run 2 Inlet	8200	8030	8120 ✓	1.0
	Tank D Run 3 Inlet	7050	6740	6900 ✓	2.2

*Inlet  
TGNMO*

A set of 3 tank samples, laboratory number 12024-(8 - 10), was analyzed for methane, ethane, and total gaseous non-methane organics (TGNMO). Agreement between repeat analysis is a measure of precision and is shown in the column "% Difference from Mean". The average % Difference from Mean for 4 repeat measurements from the sample set of 3 tank samples is 1.3%.



# CHAIN OF CUSTODY RECORD

Client/Project Name <b>Waste Mng</b>		Project Location <b>Kettleman City Ca</b>		ANALYSES  <i>EPA 25C</i>	
Project No. <b>W07-084</b>		Project Manager <b>E. Swede</b>			
Sampler: (Signature) <i>[Signature]</i>		Chain of Custody Tape No. <b>_____</b>			

Sample No./Identification	Date	Lab Sample Number	Type of Sample	REMARKS LFG										
Tank U	7/17/14	12024-8	Tank 12L	X										R-1 Plan 1 <sub>2</sub>
↓ T	↓	-9	↓	X										2
↓ D	↓	-10	↓	X										3

Relinquished by: (Signature) <i>[Signature]</i>		Date 7/21/14	Time 0630	Received by: (Signature) <i>[Signature]</i>		Date 7/21/14	Time 0630
Relinquished by: (Signature) <i>[Signature]</i>		Date 7/21/14	Time 0820	Received by: (Signature) <i>[Signature]</i>		Date 7/21/14	Time 0820
Relinquished by: (Signature) <i>[Signature]</i>		Date 7/21/14	Time 1045	Received for Laboratory: (Signature) <i>[Signature]</i>		Date 7/21/14	Time 1045

Sample Disposal Method:		Disposed of by: (Signature) <i>[Signature]</i>	
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<b>SAMPLE COLLECTOR</b>  HORIZON AIR MEASUREMENT SERVICES, INC 310 Cortez Circle Camarillo, CA 93012 (805) 482-8753 Fax (805) 498-3173 www.horizonairmeasurement.com	<b>ANALYTICAL LABORATORY</b>  <div style="font-size: 2em; text-align: center;">Atm AA</div> <div style="text-align: right; font-weight: bold; font-size: 1.2em;">Nº 212661</div>
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# HORIZON AIR MEASUREMENT SERVICES, INC.

## AIR ANALYSIS LABORATORY

COMPANY : Waste Management - Kettleman City  
 PROJECT : W07-084  
 LAB ID : FG140225-01  
 CHEMIST : Drew Picard

SAMPLED : 07/17/14  
 RECEIVED : 07/21/14  
 ANALYZED : 07/23/14  
 REPORTED: 07/23/14

### LANDFILL GAS ANALYSIS

CONSTITUENT	MOLE %	WT. %	CHONS Wt. %	
CARBON DIOXIDE	34.989	53.180	CARBON	31.32
OXYGEN	2.302	2.544	HYDROGEN	5.61
NITROGEN	22.596	21.862	OXYGEN	41.21
CARBON MONOXIDE	0.000	0.000	NITROGEN	21.86
			SULFUR	0.00
METHANE	40.005 ✓	22.165	H/C	0.179
ETHANE	0.004	0.005		
PROPANE	0.015	0.022		
ISOBUTANE	0.006	0.012		
N-BUTANE	0.034	0.069		
ISOPENTANE	0.006	0.014		
N-PENTANE	0.001	0.002		
HEXANES+	0.042	0.126		
TOTALS :	100.000	100.000		

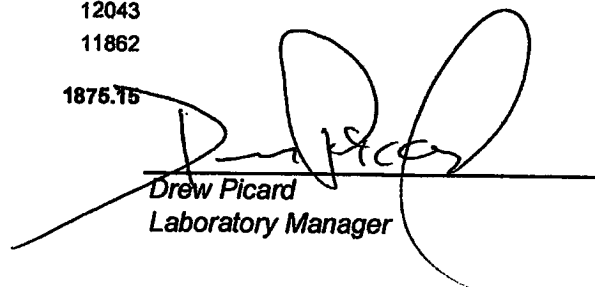
SPECIFIC GRAVITY (AIR = 1) 0.9998  
 SPECIFIC VOLUME, cu.ft./lb. 13.11  
 GROSS CALORIFIC VALUE (DRY), BTU/cu.ft. 409.06 ✓  
 GROSS CALORIFIC VALUE (WET), BTU/cu.ft. 400.96  
 GROSS CALORIFIC VALUE (DRY), BTU/lb. 5360.80  
 NET CALORIFIC VALUE (DRY), BTU/cu.ft. 368.41  
 NET CALORIFIC VALUE (WET), BTU/cu.ft. 361.12  
 COMPRESSABILITY FACTOR "Z" @ 60° F, 1 ATM 0.9976  
 EXPANSION FACTOR (DSCF/CF) 3.94

EPA "F" FACTOR @ 68° F (DSCF/MM BTU) 9784 ✓  
 EPA "F" FACTOR @ 60° F (DSCF/MM BTU) 9637

EPA "F" FACTOR WET BASIS @ 68° F (WSCF/MM BTU) 12043  
 EPA "F" FACTOR WET BASIS @ 60° F (WSCF/MM BTU) 11862

EPA "F<sub>c</sub>" FACTOR @ 68° F (SCF CO<sub>2</sub>/MMBTU) 1875.75

ASTM METHODS D-1945-96 & D-3588-98

  
 Drew Picard  
 Laboratory Manager

**HORIZON AIR MEASUREMENT SERVICES, INC.**  
**AIR ANALYSIS LABORATORY**

COMPANY : Waste Management - Kettleman City  
 PROJECT : W07-084  
 LAB ID : FG140226-01  
 CHEMIST : Drew Picard

SAMPLED : 07/17/14  
 RECEIVED : 07/21/14  
 ANALYZED : 07/23/14  
 REPORTED: 07/23/14

**LANDFILL GAS ANALYSIS**

CONSTITUENT	MOLE %	WT. %	CHONS Wt. %	
CARBON DIOXIDE	35.170	53.445	CARBON	31.46
OXYGEN	2.188	2.418	HYDROGEN	5.64
NITROGEN	22.360	21.629	OXYGEN	41.28
CARBON MONOXIDE	0.000	0.000	NITROGEN	21.63
			SULFUR	0.00
METHANE	40.172	22.254	H/C	0.179
ETHANE	0.004	0.004		
PROPANE	0.013	0.020		
ISOBUTANE	0.005	0.010		
N-BUTANE	0.031	0.062		
ISOPENTANE	0.010	0.025		
N-PENTANE	0.008	0.020		
HEXANES+	0.038	0.113		
TOTALS :	100.000	100.000		

SPECIFIC GRAVITY (AIR = 1)	1.0000
SPECIFIC VOLUME, cu.ft./lb.	13.10
GROSS CALORIFIC VALUE (DRY), BTU/cu.ft.	410.83 ✓
GROSS CALORIFIC VALUE (WET), BTU/cu.ft.	402.70
GROSS CALORIFIC VALUE (DRY), BTU/lb.	5383.06
NET CALORIFIC VALUE (DRY), BTU/cu.ft.	370.01
NET CALORIFIC VALUE (WET), BTU/cu.ft.	362.68
COMPRESSABILITY FACTOR "Z" @ 60° F, 1 ATM	0.9976
EXPANSION FACTOR (DSCF/CF)	3.96

EPA "F" FACTOR @ 68° F (DSCF/MM BTU)	9788 ✓
EPA "F" FACTOR @ 60° F (DSCF/MM BTU)	9641

EPA "F" FACTOR WET BASIS @ 68° F (WSCF/MM BTU)	12047
EPA "F" FACTOR WET BASIS @ 60° F (WSCF/MM BTU)	11866

EPA "F <sub>c</sub> " FACTOR @ 68° F (SCF CO <sub>2</sub> /MMBTU)	1875.91
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ASTM METHODS D-1945-96 & D-3588-98

  
 Drew Picard  
 Laboratory Manager

**HORIZON AIR MEASUREMENT SERVICES, INC.**  
**AIR ANALYSIS LABORATORY**

COMPANY : Waste Management - Kettleman City  
 PROJECT : W07-084  
 LAB ID : FG140227-01  
 CHEMIST : Drew Picard

SAMPLED : 07/17/14  
 RECEIVED : 07/21/14  
 ANALYZED : 07/23/14  
 REPORTED: 07/23/14

**LANDFILL GAS ANALYSIS**

CONSTITUENT	MOLE %	WT. %	CHONS Wt. %	
CARBON DIOXIDE	35.122	53.402	CARBON	31.46
OXYGEN	2.222	2.457	HYDROGEN	5.64
NITROGEN	22.328	21.610	OXYGEN	41.28
CARBON MONOXIDE	0.000	0.000	NITROGEN	21.61
			SULFUR	0.00
METHANE	40.227	22.297	H/C	0.179
ETHANE	0.004	0.004		
PROPANE	0.012	0.019		
ISOBUTANE	0.004	0.008		
N-BUTANE	0.029	0.059		
ISOPENTANE	0.009	0.023		
N-PENTANE	0.008	0.019		
HEXANES+	0.034	0.102		
TOTALS :	100.000	100.000		

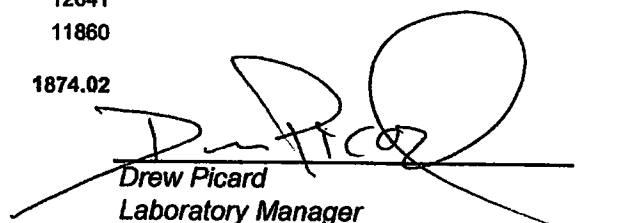
SPECIFIC GRAVITY (AIR = 1) 0.9994  
 SPECIFIC VOLUME, cu.ft./lb. 13.11  
 GROSS CALORIFIC VALUE (DRY), BTU/cu.ft. 411.06 ✓  
 GROSS CALORIFIC VALUE (WET), BTU/cu.ft. 402.92  
 GROSS CALORIFIC VALUE (DRY), BTU/lb. 5389.12  
 NET CALORIFIC VALUE (DRY), BTU/cu.ft. 370.20  
 NET CALORIFIC VALUE (WET), BTU/cu.ft. 362.87  
 COMPRESSABILITY FACTOR "Z" @ 60° F, 1 ATM 0.9976  
 EXPANSION FACTOR (DSCF/CF) 3.96

EPA "F" FACTOR @ 68° F (DSCF/MM BTU) 9782 ✓  
 EPA "F" FACTOR @ 60° F (DSCF/MM BTU) 9635

EPA "F" FACTOR WET BASIS @ 68° F (WSCF/MM BTU) 12041  
 EPA "F" FACTOR WET BASIS @ 60° F (WSCF/MM BTU) 11860

EPA "F<sub>c</sub>" FACTOR @ 68° F (SCF CO<sub>2</sub>/MMBTU) 1874.02

ASTM METHODS D-1945-96 & D-3588-98

  
 Drew Picard  
 Laboratory Manager

# CHAIN OF CUSTODY RECORD

Client/Project Name <i>Water Mng</i>		Project Location <i>Kettleman City Ca</i>		ANALYSES <i>EPA 18 CH 4 only</i> <i>ASTM D 3588 HHV</i>	
Project No. <i>W07-084</i>		Project Manager <i>E. Swick</i>			
Sampler: (Signature) <i>E. L. Swick</i>		Chain of Custody Tape No. _____			

Sample No./Identification	Date	Lab Sample Number	Type of Sample									REMARKS
<i>FlrO-CH4-1</i>	<i>7/17/14</i>	<i>FG 140 221-01</i>	<i>5L kblar</i>	<i>X</i>								<i>Oct. 1</i>
<i>FlrO-CH4-2</i>		<i>222-01</i>		<i>X</i>								<i>" 2</i>
<i>FlrO-CH4-3</i>		<i>223-01</i>		<i>X</i>								<i>" 3</i>
<i>FlrO BCU</i>		<i>224-01</i>										<i>Hold BCU</i>
<i>LFG-HHV-R1</i>		<i>225-01</i>				<i>X</i>						<i>LFG 1</i>
<i>LFG-HHV-R2</i>		<i>226-01</i>				<i>X</i>						<i>2</i>
<i>LFG-HHV-R3</i>		<i>227-01</i>				<i>X</i>						<i>3</i>
<i>LFG-BCU</i>		<i>228-01</i>										<i>Hold BCU</i>

Relinquished by: (Signature) <i>E. L. Swick</i>	Date <i>7/24/14</i>	Time <i>0640</i>	Received by: (Signature) <i>[Signature]</i>	Date	Time
Relinquished by: (Signature)	Date	Time	Received by: (Signature)	Date	Time
Relinquished by: (Signature)	Date	Time	Received for Laboratory: (Signature) <i>[Signature]</i>	Date <i>7/24/14</i>	Time <i>0640</i>
Sample Disposal Method:	Disposed of by: (Signature) <i>[Signature]</i>			Date	Time

<b>SAMPLE COLLECTOR</b>  HORIZON AIR MEASUREMENT SERVICES, INC 310 Cortez Circle Camarillo, CA 93012 (805) 482-8753 Fax (805) 498-3173 www.horizonairmeasurement.com	<b>ANALYTICAL LABORATORY</b>  <i>Horizon</i>
	<b>Nº 212660</b>

# HORIZON AIR MEASUREMENT SERVICES, INC

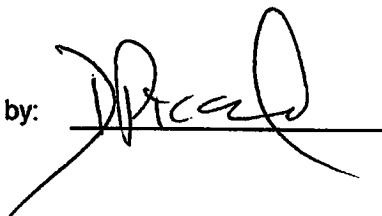
## AIR ANALYSIS LABORATORY

COMPANY : Waste Management - Kettleman City      DATE SAMPLED : 07/17/14  
PROJECT : W07-084      DATE ANALYZED : 07/21/14  
SAMPLE # : Flare Outlet Run 1&2      DATE REPORTED: 07/21/14  
LAB ID # : FG140221-01, FG140222-01

### EPA METHOD 18 HYDROCARBON ANALYSIS REPORT

	CONSTITUENT	Run 1 ppm(v/v)	Run 1-Dup ppm(v/v)	Run 2 ppm(v/v)	Run 2-Dup ppm(v/v)
C1	METHANE	0.64 ✓	0.66	0.79 ✓	0.81

Analyzed by:



Date:

7-21-14

# HORIZON AIR MEASUREMENT SERVICES, INC

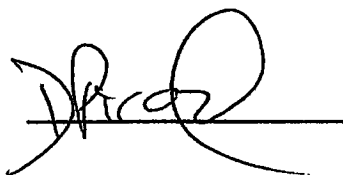
## AIR ANALYSIS LABORATORY

COMPANY : Waste Management - Kettleman City      DATE SAMPLED : 07/17/14  
PROJECT : W07-084      DATE ANALYZED : 07/21/14  
SAMPLE # : Flare Outlet Run 3 & MB      DATE REPORTED: 07/21/14  
LAB ID # : FG140223-01

### EPA METHOD 18 HYDROCARBON ANALYSIS REPORT

	CONSTITUENT	Run 3 ppm(v/v)	Run 3-Dup ppm(v/v)	M-Blank ppm(v/v)	Run 2-Dup ppm(v/v)
C1	METHANE	0.42 ✓	0.45	< 0.07	< 0.07

Analyzed by:



Date:

7-21-14

## CHAIN OF CUSTODY RECORD

Client/Project Name <i>Water Mng</i>		Project Location <i>Kettleman City Ca</i>		ANALYSES <i>EPA 18 CH4 only ASTM D 3588 HHV</i>	
Project No. <i>W07-084</i>		Project Manager <i>E. Swick</i>			
Sampler: (Signature) <i>E. L. Swick</i>		Chain of Custody Tape No. _____			
Sample No./Identification	Date	Lab Sample Number	Type of Sample	REMARKS	
<i>Flr O-CH4-1</i>	<i>7/17/14</i>	<i>FG 140 221-01</i>	<i>5L Kellar</i>	<i>X</i>	<i>Oct. 1</i>
<i>Flr O-CH4-2</i>		<i>222-01</i>		<i>X</i>	<i>" 2</i>
<i>Flr O-CH4-3</i>		<i>223-01</i>		<i>X</i>	<i>" 3</i>
<i>Flr O BCU</i>		<i>224-01</i>			<i>Hold BCU</i>
<i>LFG-HMV-R1</i>		<i>225-01</i>		<i>X</i>	<i>LFG 1</i>
<i>LFG-HMV-R2</i>		<i>226-01</i>		<i>X</i>	<i>2</i>
<i>LFG-HMV-R3</i>		<i>227-01</i>		<i>X</i>	<i>3</i>
<i>LFG-BCU</i>		<i>228-01</i>			<i>Hold BCU</i>
Relinquished by: (Signature) <i>E. L. Swick</i>			Date <i>7/24/14</i>	Time <i>0640</i>	Received by: (Signature) <i>[Signature]</i>
Relinquished by: (Signature)			Date	Time	Received by: (Signature)
Relinquished by: (Signature)			Date	Time	Received for Laboratory: (Signature) <i>[Signature]</i>
Sample Disposal Method:			Disposed of by: (Signature) <i>[Signature]</i>		Date <i>7/24/14</i>
SAMPLE COLLECTOR HORIZON AIR MEASUREMENT SERVICES, INC 310 Cortez Circle Camarillo, CA 93012 (805) 482-8753 Fax (805) 498-3173 www.horizonairmeasurement.com			ANALYTICAL LABORATORY <i>Horizon</i>		No 212660

## **APPENDIX D - Field Data Sheets**

## VELOCITY DATA SHEET - METHOD 2

Facility: WM Kettleman  
Source: Elare  
Job #: W07-084  
Date: 07/17/14  
Operator: MM

Baro. Press: 28.77  
Static Press: \_\_\_\_\_  
Pitot Tube #: \_\_\_\_\_  
Pitot Tube Type: \_\_\_\_\_  
Magnahelic: \_\_\_\_\_

**D<sub>1</sub> upstream:** 0.6  
**D<sub>1</sub> downstream:** 2.5  
**Stack Diameter:** 120"

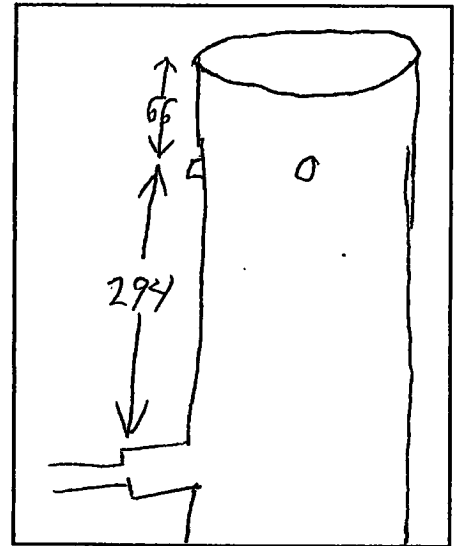
**Leak Check**

**Initial:** **Final:**

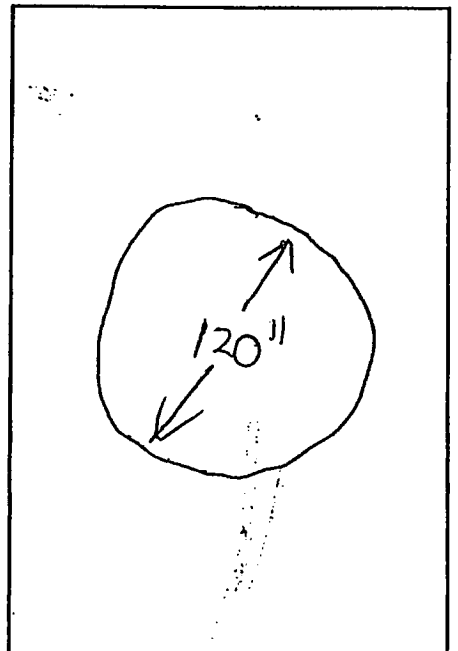
Run #: PRE

Point #	Position In.	Velocity Head in. H <sub>2</sub> O	Stack Temp °F	Cyclonic Flow Angle
A 8	116.2			
7	107.4			
6	96.7			
5	81.2			
4	38.8			
3	23.3			
2	12.5			
1	3.8			
B 8				
7				
6				
5				
4				
3				
2				
1				
Average		$\sqrt{\Delta P} =$	$T_s =$	$L =$

### Side View



### Top View



**TOTAL COMBUSTION ANALYSIS  
SCAQMD METHOD 25  
FIELD SAMPLING DATA SHEET**

Job #: W07-084  
Facility: Kettlemann  
Location: Kettlemann City  
Date: 7/17/14  
Operator: ES

Control Device: Flare Inlet  
Sample Location: Inlet  
Ambient Temp.: 74  
Baro. Pressure: 28.77

**SAMPLE A** R-1

Tank #: V Trap #: -  
Roto # 2B Probe # -  
Initial Vacuum: 2.0  
Final Vacuum: 12"  
Start Time: 857-937

**SAMPLE B** R-2

Tank #: T Trap #: -  
Roto # 2B Probe # -  
Initial Vacuum: 2.0  
Final Vacuum: 12"  
End Time: 953-1033

TIME (min.)	VACUUM ("Hg)	FLOW (cc/min)
00	30	200
05	28	200
10	25	200
15	22	200
20	20	200
25	17	200
30	15	200
35	13	200
40	12	200
45		
50		
55		
60		

TIME (min.)	VACUUM ("Hg)	FLOW (cc/min)
00	30	200
05	28	200
10	25	200
15	22	200
20	20	200
25	18	200
30	15	200
35	13	200
40	12	200
45		
50		
55		
60		

**LEAK RATE**

Pre Test : ✓  
Post Test: ✓

Pre Test : ✓  
Post Test: ✓

**TOTAL COMBUSTION ANALYSIS  
SCAQMD METHOD 25  
FIELD SAMPLING DATA SHEET**

Job #: W07-084  
Facility: WM Landfill  
Location: Kettlem  
Date: 7/17/14  
Operator: ES

Control Device: Flare  
Sample Location: Inlet  
Ambient Temp.: 87  
Baro. Pressure: 28.77

R-3  
**SAMPLE A**

Tank #: D Trap #: -  
Roto # 213 Probe # -  
Initial Vacuum: 2.0  
Final Vacuum: 12"  
Start Time: 1056 - 1136

**SAMPLE B**

Tank #: \_\_\_\_\_ Trap #: \_\_\_\_\_  
Roto # \_\_\_\_\_ Probe # \_\_\_\_\_  
Initial Vacuum: \_\_\_\_\_  
Final Vacuum: \_\_\_\_\_  
End Time: \_\_\_\_\_

TIME (min.)	VACUUM ("Hg)	FLOW (cc/min)
00	30	200
05	28	200
10	25	200
15	22	200
20	20	200
25	18	200
30	16	200
35	14	200
40	12	200
45	-	-
50		
55		
60		

TIME (min.)	VACUUM ("Hg)	FLOW (cc/min)
00		
05		
10		
15		
20		
25		
30		
35		
40		
45		
50		
55		
60		

**LEAK RATE**

Pre Test : ✓  
Post Test: ✓

Pre Test : \_\_\_\_\_  
Post Test: \_\_\_\_\_

## INTEGRATED BAG SAMPLING DATA FORM

Run Number: 1  
Date: 7/17/14 Plant: Waste Mng Kettleman  
Sampling Location: Flare Out  
Barometric Pressure: 28.77  
Ambient Temp. °C: F 74 Stack Temp. °C: F ~1500  
Operator: MM

Time		Traverse Point	Rate Meter Flow Rate (Q), cm <sup>3</sup> /min.	% Dev. <sup>a</sup>
0857	0	Singh	100	0
	10		100	0
	20		100	0
	30		100	0
945	40		100	0
			Avg. =	0

$$\% \text{ Dev.} = \left( \frac{Q - Q_{avg}}{Q_{avg}} \right) 100; \text{ must be } \leq 10\%$$

# INTEGRATED BAG SAMPLING DATA FORM

Date: 7/17/14 Run Number: 2  
 Plant: Waste Mng Keffleman  
 Sampling Location: Flare Out  
 Barometric Pressure: 29.79  
 Ambient Temp. °F: 82 Stack Temp. °F: ~1500  
 Operator: MM

Time		Traverse Point	Rate Meter Flow Rate (Q), cm <sup>3</sup> /min.	% Dev. <sup>a</sup>
0953	0	Single ↓	100	0
	10		100	0
	20		100	0
	30		100	0
1038	40		100	0
			Avg. =	0

$$\% \text{ Dev.} = \left( \frac{Q - Q_{avg}}{Q_{avg}} \right) 100; \text{ must be } \leq 10\%$$

# INTEGRATED BAG SAMPLING DATA FORM

Date: 7/17/14 Run Number: 3  
 Plant: Waste Mng Kettleman  
 Sampling Location: Flare Out  
 Barometric Pressure: 28.77  
 Ambient Temp. °F: 87 Stack Temp. °F: ~ 1500 F  
 Operator: MM

Time	Traverse Point	Rate Meter Flow Rate (Q), cm <sup>3</sup> /min.	% Dev. <sup>a</sup>
1056 0	single	100	0
10	↓	100	0
20		100	0
30		100	0
1140 40	↓	100	0
Avg. =			0

$$\% \text{ Dev.} = \left( \frac{Q - Q_{avg}}{Q_{avg}} \right) 100; \text{ must be } \leq 10\%$$

## **APPENDIX E - Process Data**

**Facility:** Chemical Waste Management, Inc. - Kettleman Hills L.F.  
**Source:** Flare  
**Job No.:** W07-084  
**Test Date:** 7/17/14

Time	LFG Flow, scfm	Flare Temp, deg F	Condensate Flow, gph
0	629	1544	
10	641	1547	
20	646	1548	
30	644	1546	
40	643	1547	

640.6

1546.4

Averages

Time	LFG Flow, scfm	Flare Temp, deg F	Condensate Flow, gph
0	653	1549	
10	650	1543	
20	656	1546	
30	645	1552	
40	654	1549	

651.6

1547.8

Averages

Time	LFG Flow, scfm	Flare Temp, deg F	Condensate Flow, gph
0	666	1561	
10	654	1554	
20	658	1556	
30	662	1556	
40	658	1554	

659.6

1556.2

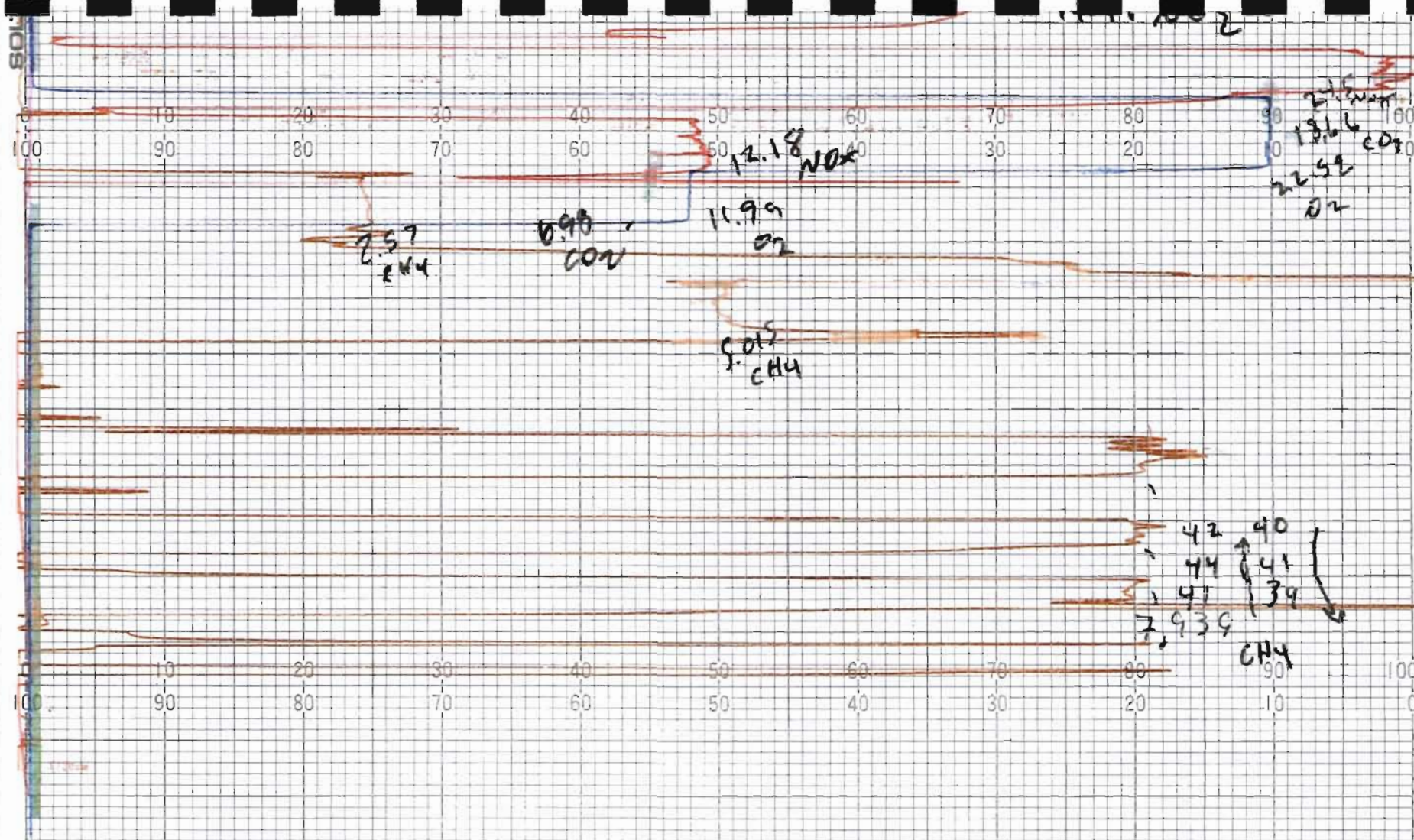
Averages

# FLARE OPERATING DATA

Client: <i>Waste Management</i>	Date: <i>7/17/14</i>
Facility: <i>Kettleman Hills</i>	Job No.: <i>607-084</i>
Location: <i>Kettleman</i>	Fuel: <i>LF6</i>
Meter Make/Model: <i>Thermal last Co. 62-2/9900</i>	Source: <i>Flare</i>
Meter Serial No.: <i>2010078</i>	Recorded By: <i>E.S.</i>

Time	Fuel Gas Flow Rate (SCFM)	Fuel Gas Totalizer ( )	Condensate Injection ( )	Flare Temp (°F) <i>SP 1550</i>	Fuel Pressure ( )	Fuel Temp (°F)
R-1 0	1629			1544		
10	1641			1547		
20	1646			1548		
30	1644			1546		
40	1643			1547		
R-2 0	653			1549		
10	650			1543		
20	656			1546		
30	645			1552		
40	654			1549		
R-3 0	666			1561		
10	654			1554		
20	658			1556		
30	662			1556		
40	658			1554		

## **APPENDIX F - Strip Charts**



7/17/14 W07-084 Waste Mng  
 CC277907 6.981 CO<sub>2</sub> / 11.99 O<sub>2</sub>  
 CC288129 13.66 CO<sub>2</sub> / 22.52 O<sub>2</sub>  
 CC300815 12.18 NO<sub>x</sub>  
 CC330987 14.48 NO<sub>x</sub>  
 CC208326 19.71 NO<sub>2</sub>

Kettlemann City CO by ES  
 CC78434 45.79 NO<sub>x</sub> / 45.96 CO  
 CC195528 89.92 NO<sub>x</sub> / 90.36 CO  
 CC420412 5.015 CH<sub>4</sub>  
 CC217078 7.939 CH<sub>4</sub>  
 CC37353 2.567 CH<sub>4</sub>

-89-

(20521)

CHART NO. ZR1-01-25-20M

SOLTEC

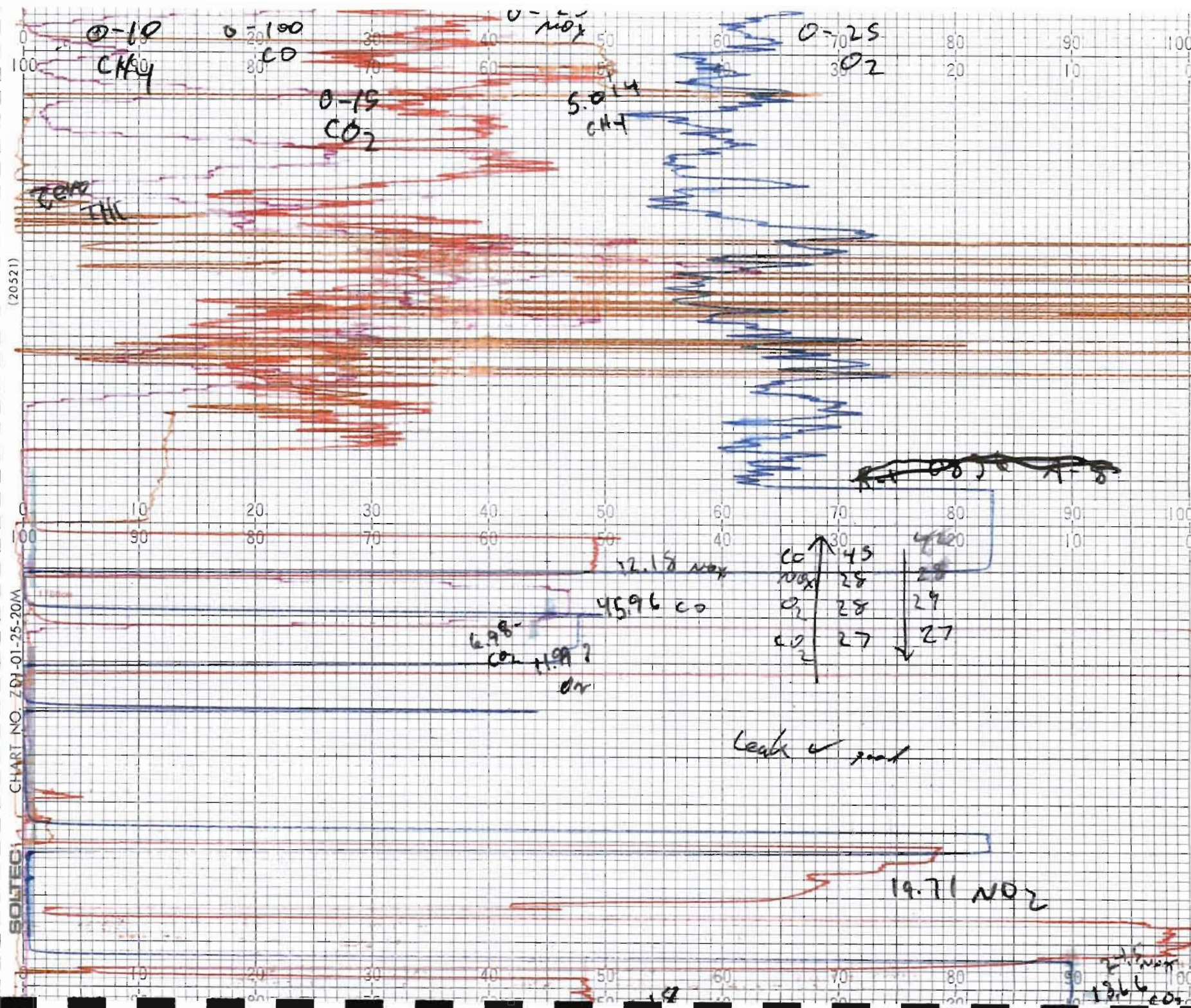


CHART NO. ZD1-01-25-20M

501105

~~Zeved~~ ~~Shab~~

0940  
end 1

② ~~25~~ NOx

0, 0, 2, 2, 1

B-6

123456

A-8 857

0-10  
C/K<sub>90</sub>

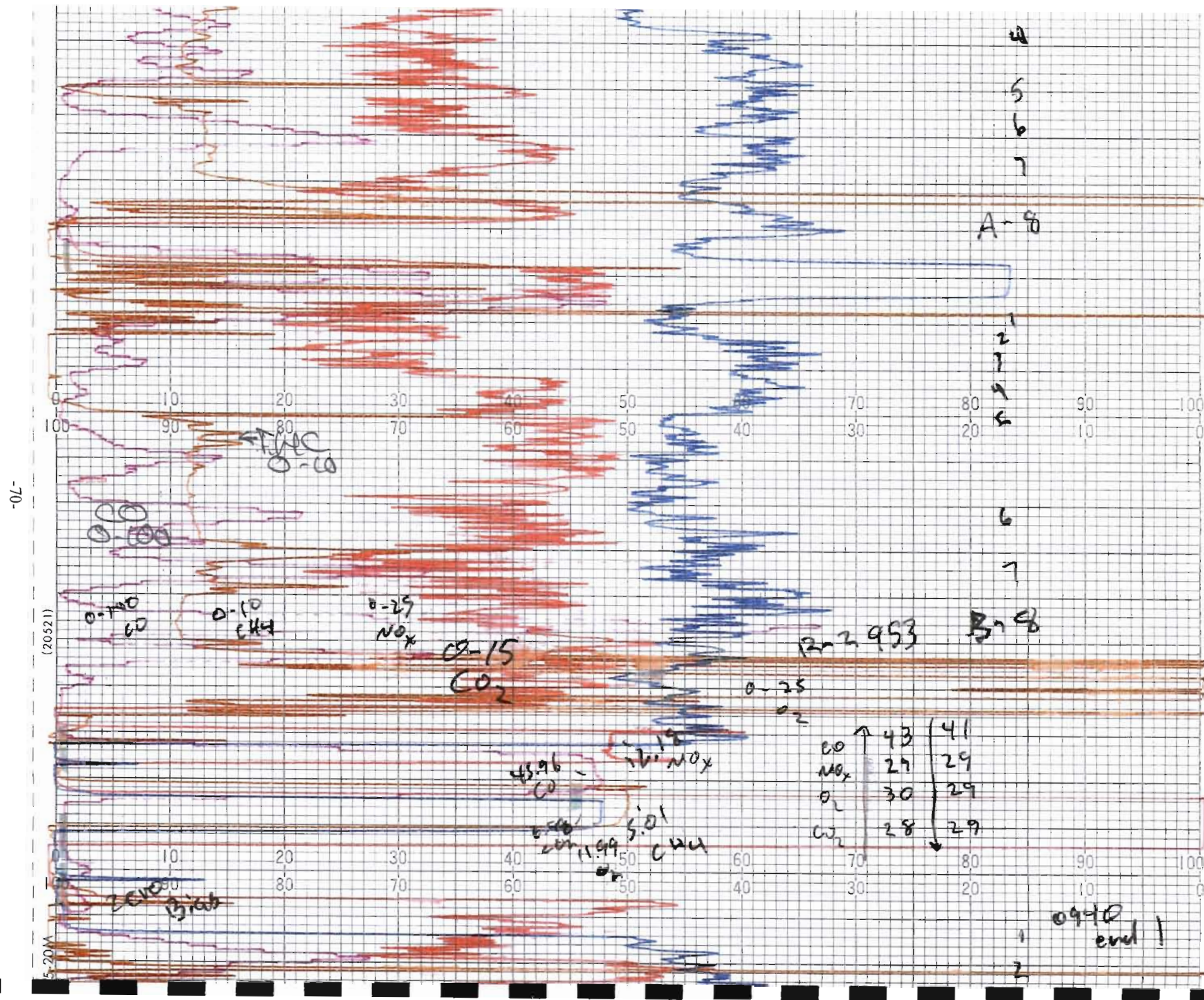
$$\begin{array}{r} 100 \\ 20 \\ \hline 80 \end{array}$$

$\phi = 25^\circ$   
max

0-25  
70  
307

0-15

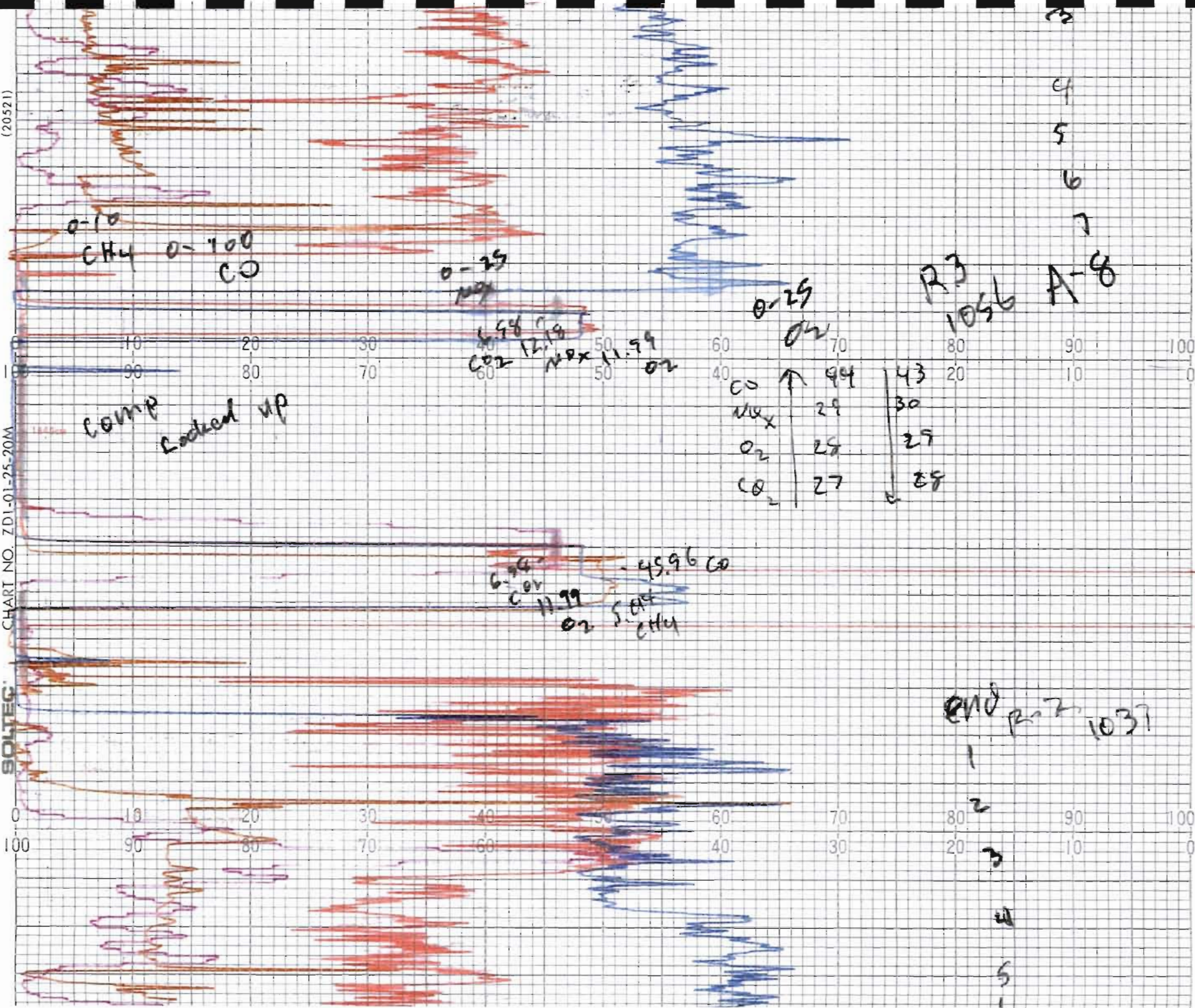
5.014



(20521)

CHART NO. ZD1-01-25-20M

SOLTEC



0-10  
CH4 0-100  
CO

0-25  
max

6.94 CO2  
12.19 max  
11.99 O2

comp  
locked up

0-25  
O2

R3  
1056 A-8

CO	↑ 94	43
max	29	30
O2	28	29
CO2	27	28

6.94 CO2  
11.99 O2  
5.04 CH4  
45.96 CO

END R2 1037

CHART NO. 7

SOLTEG

0 10 20 30 40 50 60 70 80 90 100

100 90 80 70 60 50 40 30 20 10 0

0 10 20 30 40 50 60 70 80 90 100

100 90 80 70 60 50 40 30 20 10 0

21)

2.56x  
CHK

1.99  
COR

4.996  
CO

12.18 NOX  
14.99 D2

5.04  
CHN

Leah ✓  
good

7.95  
CHK

end 1132

803

1

2

3

4

5

6

7

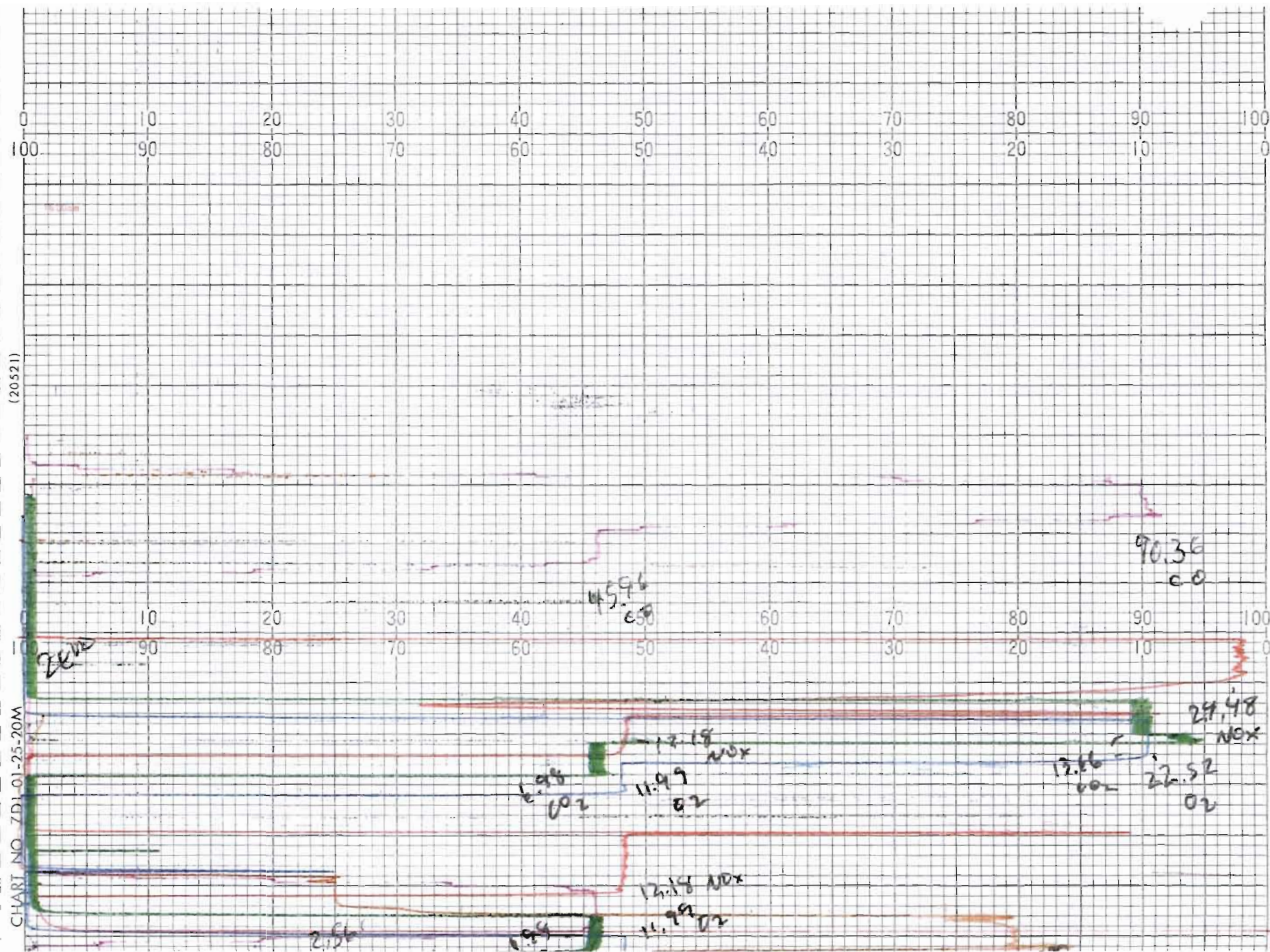
B-8

1

2

3

4



## **APPENDIX G - Calibration Data**

## CERTIFICATE OF ANALYSIS

### Grade of Product: EPA Protocol

#### Airgas Specialty Gases

11711 S. Alameda Street  
Los Angeles, CA 90059  
(323) 568-2208 Fax: (323) 567-3686  
www.airgas.com

Part Number: E03NI81E15A0006  
Cylinder Number: CC277907  
Laboratory: ASG - Los Angeles - CA  
PGVP Number: B32014  
Gas Code: CO2,O2,BALN

Reference Number: 48-124429942-2  
Cylinder Volume: 149.3 CF  
Cylinder Pressure: 2015 PSIG  
Valve Outlet: 590  
Certification Date: Apr 21, 2014

Expiration Date: Apr 21, 2022

*Trailer #3  
(ES)*

Certification performed in accordance with "EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards (May 2012)" document EPA 600/R-12/531, using the assay procedures listed. Analytical Methodology does not require correction for analytical interference. This cylinder has a total analytical uncertainty as stated below with a confidence level of 95%. There are no significant impurities which affect the use of this calibration mixture. All concentrations are on a volume/volume basis unless otherwise noted.

Do Not Use This Cylinder below 100 psig, i.e. 0.7 megapascals.

#### ANALYTICAL RESULTS

Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty	Assay Dates
CARBON DIOXIDE	7.000 %	6.981 %	G1	+/- 0.6% NIST Traceable	04/21/2014
OXYGEN	12.00 %	11.99 %	G1	+/- 0.4% NIST Traceable	04/21/2014
NITROGEN	Balance				

#### CALIBRATION STANDARDS

Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
NTRM	12061346	CC360804	11.002 % CARBON DIOXIDE/NITROGEN	+/- 0.6%	Jan 11, 2018
NTRM	09060206	CC262089	9.961 % OXYGEN/NITROGEN	+/- 0.3%	Nov 08, 2018

#### ANALYTICAL EQUIPMENT

Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
SIEMENS 6E CO2	NDIR	Mar 27, 2014
SIEMENS OXYMAT 6	PARAMAGNETIC	Apr 04, 2014

Triad Data Available Upon Request

Notes:

Approved for Release

## CERTIFICATE OF ANALYSIS

### Grade of Product: EPA Protocol

Airgas Specialty Gases  
11711 South Alameda Street  
Los Angeles, CA 90059  
(323) 568-2203 Fax: (323) 567-3686  
www.airgas.com

Part Number: E03NI64E15A0001  
Cylinder Number: CC288129  
Laboratory: ASG - Los Angeles - CA  
PGVP Number: B32012

Reference Number: 48-124317320-7  
Cylinder Volume: 155 Cu.Ft.  
Cylinder Pressure: 2015 PSIG  
Valve Outlet: 590  
Analysis Date: Jun 05, 2012

Expiration Date: Jun 05, 2015

Certification performed in accordance with "EPA Traceability Protocol (Sept. 1997)" using the assay procedures listed. Analytical Methodology does not require correction for analytical interferences. This cylinder has a total analytical uncertainty as stated below with a confidence level of 95%. There are no significant impurities which affect the use of this calibration mixture. All concentrations are on a volume/volume basis unless otherwise noted.  
Do Not Use This Cylinder below 150 psig.i.e. 1 Mega Pascal

#### ANALYTICAL RESULTS

Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty
CARBON DIOXIDE	13.50 %	13.66 %	G1	+/- 1% NIST Traceable
OXYGEN	22.50 %	22.52 %	G1	+/- 1% NIST Traceable
NITROGEN	Balance			

#### CALIBRATION STANDARDS

Type	Lot ID	Cylinder No	Concentration	Expiration Date
NTRM	090614	CC273756	22.53% OXYGEN/NITROGEN	Aug 01, 2013
NTRM	970512	SG9168443	15.862% CARBON DIOXIDE/NITROGEN	May 01, 2016

#### ANALYTICAL EQUIPMENT

Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
SIEMENS % CO2	NDIR	May 14, 2012
Siemens %O2	PARAMAGNETIC	May 29, 2012

Triad Data Available Upon Request

Notes:

Approved for Release

## CERTIFICATE OF ANALYSIS

### Grade of Product: EPA Protocol

**Airgas Specialty Gases**

11711 South Alameda Street

Los Angeles, CA 90059

(323) 568-2203 Fax: (323) 567-3686

www.airgas.com

Part Number: E02AI99E15AC232  
Cylinder Number: CC37353  
Laboratory: ASG - Los Angeles - CA  
PGVP Number: B32012  
Gas Code: APPVD

Reference Number: 48-124299630-1  
Cylinder Volume: 146 Cu.Ft.  
Cylinder Pressure: 2015 PSIG  
Valve Outlet: 590  
Analysis Date: Jan 26, 2012

Expiration Date: Jan 26, 2015

Certification performed in accordance with "EPA Traceability Protocol (Sept. 1997)" using the assay procedures listed. Analytical Methodology does not require correction for analytical interferences. This cylinder has a total analytical uncertainty as stated below with a confidence level of 95%. There are no significant impurities which affect the use of this calibration mixture. All concentrations are on a volume/volume basis unless otherwise noted.  
Do Not Use This Cylinder below 150 psig, i.e. 1 Mega Pascal

#### ANALYTICAL RESULTS

Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty
METHANE	2.500 PPM	2.567 PPM	G1	+/- 1% NIST Traceable
Air	Balance			

#### CALIBRATION STANDARDS

Type	Lot ID	Cylinder No	Concentration	Expiration Date
NTRM	070604	CC207862	4.495PPM METHANE/AIR	Apr 19, 2017

#### ANALYTICAL EQUIPMENT

Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
Nicolet 8700 AHR0801551 CH4	FTIR	Jan 25, 2012

Triad Data Available Upon Request

Notes:

Approved for Release

## CERTIFICATE OF ANALYSIS

### Grade of Product: EPA Protocol

Part Number: E02AI99E15A0448      Reference Number: 48-124389663-1  
Cylinder Number: CC420412      Cylinder Volume: 146.2 CF  
Laboratory: ASG - Los Angeles - CA      Cylinder Pressure: 2015 PSIG  
PGVP Number: B32013      Valve Outlet: 590  
Gas Code: CH4,BALA      Certification Date: Aug 22, 2013

Expiration Date: Aug 22, 2021

Certification performed in accordance with "EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards (May 2012)" document EPA 600/R-12/531, using the assay procedures listed. Analytical Methodology does not require correction for analytical interference. This cylinder has a total analytical uncertainty as stated below with a confidence level of 95%. There are no significant impurities which affect the use of this calibration mixture. All concentrations are on a volume/volume basis unless otherwise noted.

Do Not Use This Cylinder below 100 psig, i.e. 0.7 megapascals.

#### ANALYTICAL RESULTS

Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty	Assay Dates
METHANE	5.000 PPM	5.015 PPM	G1	+/- 1.0% NIST Traceable	08/22/2013
AIR	Balance				

#### CALIBRATION STANDARDS

Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
NTRM	07060420	CC207959	4.495 PPM METHANE/AIR	+/- 1.0%	Apr 19, 2017

#### ANALYTICAL EQUIPMENT

Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
Nicolet 6700 AHR0801551 CH4	FTIR	Aug 12, 2013

Triad Data Available Upon Request

Notes:

Approved for Release

## CERTIFICATE OF ANALYSIS

### Grade of Product: EPA Protocol

#### Airgas Specialty Gases

11711 South Alameda Street  
Los Angeles, CA 90059  
(323) 568-2203 Fax: (323) 567-3686  
www.airgas.com

Part Number: E02AI99E15A1569  
Cylinder Number: CC217078  
Laboratory: ASG - Los Angeles - CA  
PGVP Number: B32013  
Gas Code: CH4,BALA

Reference Number: 48-124389662-1  
Cylinder Volume: 146.2 CF  
Cylinder Pressure: 2015 PSIG  
Valve Outlet: 590  
Certification Date: Aug 22, 2013

Expiration Date: Aug 22, 2021

*mtsu #1  
(25A)*

Certification performed in accordance with "EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards (May 2012)" document EPA 600/R-12/531, using the assay procedures listed. Analytical Methodology does not require correction for analytical interference. This cylinder has a total analytical uncertainty as stated below with a confidence level of 95%. There are no significant impurities which affect the use of this calibration mixture. All concentrations are on a volume/volume basis unless otherwise noted.

Do Not Use This Cylinder below 100 psig, i.e. 0.7 megapascals.

#### ANALYTICAL RESULTS

Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty	Assay Dates
METHANE	8.000 PPM	7.939 PPM	G1	+/- 1.0% NIST Traceable	08/22/2013
AIR	Balance				

#### CALIBRATION STANDARDS

Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
NTRM	07060501	CC207776	10.00 PPM METHANE/AIR	+/- 0.8%	Apr 27, 2017

#### ANALYTICAL EQUIPMENT

Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
Nicolet 6700 AHR0801551 CH4	FTIR	Aug 12, 2013

Triad Data Available Upon Request

Notes:

Approved for Release

## CERTIFICATE OF ANALYSIS

### Grade of Product: EPA Protocol

**Airgas Specialty Gases**  
 11711 South Alameda Street  
 Los Angeles, CA 90059  
 (323) 568-2203 Fax: (323) 567-3886  
 www.airgas.com

Part Number: E02NI99E15AC4A8 Reference Number: 48-124366696-1  
 Cylinder Number: CC300815 Cylinder Volume: 144.3 CF  
 Laboratory: ASG - Los Angeles - CA Cylinder Pressure: 2015 PSIG  
 PGVP Number: B32013 Valve Outlet: 660  
 Gas Code: NO Certification Date: Apr 09, 2013

Expiration Date: Apr 09, 2016

*Traceable #3 (ES)*

Certification performed in accordance with "EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards (May 2012)" document EPA 600/R-12/531, using the assay procedures listed. Analytical Methodology does not require correction for analytical interference. This cylinder has a total analytical uncertainty as stated below with a confidence level of 95%. There are no significant impurities which affect the use of this calibration mixture. All concentrations are on a volume/volume basis unless otherwise noted.

Do Not Use This Cylinder below 100 psig, i.e. 0.7 megapascals.

#### ANALYTICAL RESULTS

Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty	Assay Dates
NOX	12.50 PPM	12.18 PPM	G1	+/- 1.4% NIST Traceable	04/02/2013, 04/09/2013
NITRIC OXIDE	12.50 PPM	12.10 PPM	G1	+/- 1.4% NIST Traceable	04/02/2013, 04/09/2013
NITROGEN	Balance				

#### CALIBRATION STANDARDS

Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
NTRM	12061102	CC280987	9.76 PPM NITRIC OXIDE/NITROGEN	+/- 1.4%	Jan 30, 2015
NTRM	12061102NOx	CC280987-NOx	9.79 PPM NOx/NITROGEN	+/- 1.4%	Jan 30, 2015

#### ANALYTICAL EQUIPMENT

Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
Thermo 42-ILS 1115848421 NO	Chemiluminescence	Mar 14, 2013
Thermo 42-ILS 1115848421 NOx	Chemiluminescence	Mar 14, 2013

Triad Data Available Upon

Request

Notes:

*[Signature]*

Approved for Release

## CERTIFICATE OF ANALYSIS

### Grade of Product: EPA Protocol

#### Airgas Specialty Gases

11711 S. Alameda Street  
Los Angeles, CA 90059  
(323) 668-2208 Fax: (323) 567-3686  
www.airgas.com

Part Number: E02NI99E15A0529 Reference Number: 48-124308893-1  
Cylinder Number: CC230887 Cylinder Volume: 144 Cu.Ft.  
Laboratory: ASG - Los Angeles - CA Cylinder Pressure: 2015 PSIG  
PGVP Number: B32012 Valve Outlet: 350  
Gas Code: NO Analysis Date: Mar 28, 2012

Expiration Date: Mar 28, 2015

*Transfer #3  
(E5)*

Certification performed in accordance with "EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards (May 2012)" document EPA 600/R-12/531, using the assay procedures listed. Analytical Methodology does not require correction for analytical interference. This cylinder has a total analytical uncertainty as stated below with a confidence level of 95%. There are no significant impurities which affect the use of this calibration mixture. All concentrations are on a volume/volume basis unless otherwise noted.

Do Not Use This Cylinder below 100 psig, i.e. 0.7 megapascals.

#### ANALYTICAL RESULTS

Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty
NOx	24.00 PPM	24.48 PPM	G1	+/- 1% NIST Traceable
NITRIC OXIDE	24.00 PPM	24.41 PPM	G1	+/- 1% NIST Traceable
NITROGEN	Balance			

#### CALIBRATION STANDARDS

Type	Lot ID	Cylinder No	Concentration	Expiration Date
NTRM	100603	CC281041	20.34PPM NITRIC OXIDE/NITROGEN	Feb 01, 2013
NTRM	100603	CC281041-NOx	20.36PPM NOx/NITROGEN	Feb 01, 2013

#### ANALYTICAL EQUIPMENT

Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
Thermo 42-ILS 1115848421 NO	Chemiluminescence	Mar 14, 2012
Thermo 42-ILS 1115848421 NOx	Chemiluminescence	Mar 14, 2012

Triad Data Available Upon Request

Notes:



Approved for Release

## CERTIFICATE OF ANALYSIS

### Grade of Product: EPA Protocol

Part Number:	E02NI99E15A00F7	Reference Number:	48-124317140-3
Cylinder Number:	CC208326	Cylinder Volume:	CF
Laboratory:	ASG - Los Angeles - CA	Cylinder Pressure:	
PGVP Number:	B32012	Valve Outlet:	660
Gas Code:	NO2,BALN	Certification Date:	May 31, 2012

**Expiration Date: May 31, 2015**

Certification performed in accordance with "EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards (May 2012)" document EPA 600/R-12/531, using the assay procedures listed. Analytical Methodology does not require correction for analytical interference. This cylinder has a total analytical uncertainty as stated below with a confidence level of 95%. There are no significant impurities which affect the use of this calibration mixture. All concentrations are on a volume/volume basis unless otherwise noted.

Do Not Use This Cylinder below 100 psig, i.e. 0.7 megapascals.

ANALYTICAL RESULTS					
Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty	Assay Dates
NITROGEN DIOXIDE	19.00 PPM	19.71 PPM	G1	+/- 2% NIST Traceable	05/24/2012, 05/31/2012
NITROGEN	Balance				

CALIBRATION STANDARDS					
Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
GMIS	124199110107	CC323269	15.37 PPM NITROGEN DIOXIDE/NITROGEN		Mar 07, 2013

ANALYTICAL EQUIPMENT		
Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
Nicolet 6700 AHR0801551 NO2	FTIR	May 29, 2012

Triad Data Available Upon Request

Permanent Notes: OXYGEN ADDED  
TO MAINTAIN STABILITY

Notes:



**Approved for Release**

## CERTIFICATE OF ANALYSIS

### Grade of Product: EPA Protocol

Part Number: E03NI99E15A0259  
Cylinder Number: CC78934  
Laboratory: ASG - Los Angeles - CA  
PGVP Number: B32013  
Gas Code: CO,NO,BALN

Reference Number: 48-124381858-4  
Cylinder Volume: 144.3 CF  
Cylinder Pressure: 2015 PSIG  
Valve Outlet: 660  
Certification Date: Jul 03, 2013

Expiration Date: Jul 03, 2016

*Transfer #3 (E5)*

Certification performed in accordance with "EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards (May 2012)" document EPA 600/R-12/531, using the assay procedures listed. Analytical Methodology does not require correction for analytical interference. This cylinder has a total analytical uncertainty as stated below with a confidence level of 95%. There are no significant impurities which affect the use of this calibration mixture. All concentrations are on a volume/volume basis unless otherwise noted.

Do Not Use This Cylinder below 100 psig, i.e. 0.7 megapascals.

ANALYTICAL RESULTS					
Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty	Assay Dates
NOX	45.00 PPM	45.79 PPM	G1	+/- 1.0% NIST Traceable	06/26/2013, 07/03/2013
CARBON MONOXIDE	45.00 PPM	45.96 PPM	G1	+/- 0.7% NIST Traceable	06/26/2013
NITRIC OXIDE	45.00 PPM	45.50 PPM	G1	+/- 1.0% NIST Traceable	06/26/2013, 07/03/2013
NITROGEN	Balance				

CALIBRATION STANDARDS					
Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
NTRM	12060507	CC353899	49.53 PPM CARBON MONOXIDE/NITROGEN	+/- 0.6%	Dec 20, 2017
PRM	12312	680179	10.01 PPM NITROGEN DIOXIDE/NITROGEN	+/- 2.0%	Feb 14, 2012
NTRM	12060808	CC281021	49.95 PPM NITRIC OXIDE/NITROGEN	+/- 0.8%	Dec 16, 2017
GMIS	124208889129	CC323206	4.835 PPM NITROGEN DIOXIDE/NITROGEN	+/-2.0%	Oct 11, 2013

The SRM or PRM noted above is only in reference to the GMIS used in the assay and not part of the analysis.

ANALYTICAL EQUIPMENT		
Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
Nicolet 6700 AHR0801551 CO	FTIR	Jun 06, 2013
Nicolet 6700 AHR0801551 NO	FTIR	Jun 19, 2013
Nicolet 6700 AHR0801551 NO2	FTIR	Jun 26, 2013

Triad Data Available Upon Request

Notes:



Approved for Release

## CERTIFICATE OF ANALYSIS

### Grade of Product: EPA Protocol

Part Number:	E03NI99E15A0260	Reference Number:	48-124374361-2
Cylinder Number:	CC198528	Cylinder Volume:	144.3 CF
Laboratory:	ASG - Los Angeles - CA	Cylinder Pressure:	2015 PSIG
PGVP Number:	B32013	Valve Outlet:	660
Gas Code:	CO,NO,BALN	Certification Date:	May 20, 2013

**Expiration Date: May 20, 2021**

TRAILER #3  
(ES)

Certification performed in accordance with "EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards (May 2012)" document EPA 600/R-12/531, using the assay procedures listed. Analytical Methodology does not require correction for analytical interference. This cylinder has a total analytical uncertainty as stated below with a confidence level of 95%. There are no significant impurities which affect the use of this calibration mixture. All concentrations are on a volume/volume basis unless otherwise noted.

Do Not Use This Cylinder below 100 psig, i.e. 0.7 megapascals.

#### ANALYTICAL RESULTS

Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty	Assay Dates
NOX	90.00 PPM	89.92 PPM	G1	+/- 0.8% NIST Traceable	05/13/2013, 05/20/2013
CARBON MONOXIDE	90.00 PPM	90.36 PPM	G1	+/- 0.7% NIST Traceable	05/13/2013
NITRIC OXIDE	90.00 PPM	89.54 PPM	G1	+/- 0.8% NIST Traceable	05/13/2013, 05/20/2013
NITROGEN	Balance				

#### CALIBRATION STANDARDS

Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
NTRM	12062218	CC326928	97.56 PPM CARBON MONOXIDE/NITROGEN	+/- 0.6%	May 25, 2018
PRM	12312	680179	10.01 PPM NITROGEN DIOXIDE/NITROGEN	+/- 2.0%	Feb 14, 2012
NTRM	11060542	CC331957	101.2 PPM NITRIC OXIDE/NITROGEN	+/- 0.6%	Feb 16, 2017
GMIS	124208889129	CC323206	4.835 PPM NITROGEN DIOXIDE/NITROGEN	+/-2.0%	Oct 11, 2013

The SRM or PRM noted above is only in reference to the GMIS used in the assay and not part of the analysis.

#### ANALYTICAL EQUIPMENT

Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
Nicolet 6700 AHR0801551 CO	FTIR	Apr 22, 2013
Nicolet 6700 AHR0801551 NO	FTIR	May 18, 2013
Nicolet 6700 AHR0801551 NO2	FTIR	May 20, 2013

Triad Data Available Upon  
Request

Notes:



**Approved for Release**

## **APPENDIX H - Permit to Operate**

# San Joaquin Valley Air Pollution Control District

PERMIT UNIT: C-283-22-17

EXPIRATION DATE: 08/31/2016

## EQUIPMENT DESCRIPTION:

MUNICIPAL SOLID WASTE BIOREACTOR LANDFILL, CLASS II AND III (B-19), 4.2 MILLION CUBIC YARD CAPACITY (40.4 ACRES) WITH GAS COLLECTION AND CONTROL SYSTEM SERVED BY A 2,500 SCFM (EQUIVALENT TO 83.6 MMBTU/HR) PARNEL BIOGAS ENCLOSED FLARE SHARED WITH C-283-25

## PERMIT UNIT REQUIREMENTS

1. No air contaminant shall be discharged into the atmosphere for a period or periods aggregating more than three minutes in any one hour which is as dark as, or darker than, Ringelmann 1/4 or 5% opacity. [District Rules 2201 and 4101] Federally Enforceable Through Title V Permit
2. All equipment shall be maintained in good operating condition and shall be operated in a manner to minimize emissions of air contaminants into the atmosphere. [District Rule 2201] Federally Enforceable Through Title V Permit
3. Each owner or operator shall keep for at least 5 years up-to-date, readily accessible, on-site records of the maximum design capacity, the current amount of solid waste in-place, and the year-by-year waste acceptance rate. Off-site records may be maintained if they are retrievable within 4 hours. [40 CFR 60.758(a)] Federally Enforceable Through Title V Permit
4. This operating permit may be cancelled with APCO approval when the landfill is closed, pursuant to the requirements of this permit, if the landfill is not otherwise subject to the requirements of either 40 CFR part 70 or part 71 and if either 1) it was never subject to the requirement for a control system under 40 CFR 60.752(b)(2); or 2) the owner or operator meets the conditions for control system removal specified in 40 CFR 60.752(b)(2)(v). [40 CFR 60.752(d)] Federally Enforceable Through Title V Permit
5. If the landfill is permanently closed, a closure notification shall be submitted to the APCO within 30 days of waste disposal cessation. A permanent closure must take place in accordance with 40 CFR 258.60. If a closure report has been submitted, no additional waste may be placed in the landfill without filing a notification of modification to the APCO, pursuant to 40 CFR 60.7(a)(4). [40 CFR 60.752(b)(1)(ii)(B), 60.757(d)] Federally Enforceable Through Title V Permit
6. An active collection system shall be designed to handle the maximum expected gas flow rate from the entire area of the landfill that warrants control over the intended use period of the gas control or treatment system equipment, collect gas from each area, cell, or group of cells in the landfill in which the initial solid waste has been placed for a period of 5 years or more if active; or 2 years or more if closed or at final grade, collect gas at a sufficient extraction rate, and be designed to minimize off-site migration of subsurface gas. [40 CFR 60.752(b)(2)(ii)(A)] Federally Enforceable Through Title V Permit
7. Each owner or operator seeking to comply with 40 CFR 60.752(b)(2)(i) shall site active collection wells, horizontal collectors, surface collectors, or other extraction devices at a sufficient density throughout all gas producing areas using the procedures in 60.759(a)(1), (2), and (3) unless alternative procedures have been approved by the APCO as provided in 60.752(b)(2)(i)(C) and (D). [40 CFR 60.759(a)] Federally Enforceable Through Title V Permit
8. For the purposes of calculating the maximum expected gas generation flow rate from the landfill to determine compliance with 60.752(b)(2)(ii)(A)(1), one of the equations in Section 60.755(a)(1)(i) or (ii) or (iii) shall be used. [40 CFR 60.755(a)(1)] Federally Enforceable Through Title V Permit

PERMIT UNIT REQUIREMENTS CONTINUE ON NEXT PAGE

These terms and conditions are part of the Facility-wide Permit to Operate.

Facility Name: CHEMICAL WASTE MANAGEMENT, INC  
Location: 35251 OLD SKYLINE ROAD, KETTLEMAN CITY, CA 93239  
C-283-22-17 - Mar 8 2014 4:26PM - KLEVARD

9. For the purposes of determining sufficient density of gas collectors for compliance with 60.752(b)(2)(ii)(A)(2), the owner or operator shall design a system of vertical wells, horizontal collectors, or other collection devices, satisfactory to the APCO, capable of controlling and extracting gas from all portions of the landfill sufficient to meet all operational and performance standards. [40 CFR 60.755(a)(2)] Federally Enforceable Through Title V Permit
10. For the purpose of demonstrating whether the gas collection system flow rate is sufficient to determine compliance with 60.752(b)(2)(ii)(A)(3), the owner or operator shall measure gauge pressure in the gas collection header at each individual well, monthly. If a positive pressure exists, action shall be initiated to correct the exceedance within 5 calendar days, except for the three conditions allowed under 60.753(b). If negative pressure cannot be achieved without excess air infiltration within 15 calendar days of the first measurement, the gas collection system shall be expanded to correct the exceedance within 120 days of the initial measurement of positive pressure. Any attempted corrective measure shall not cause exceedances of other operational or performance standards. An alternative timeline for correcting the exceedance may be submitted to the APCO for approval. [40 CFR 60.755(a)(3)] Federally Enforceable Through Title V Permit
11. Owners or operators are not required to expand the system as required in paragraph 60.755(a)(3) during the first 180 days after gas collection system startup. [40 CFR 60.755(a)(4)] Federally Enforceable Through Title V Permit
12. For the purpose of identifying whether excess air infiltration into the landfill is occurring, the owner or operator shall monitor each well monthly for temperature and nitrogen or oxygen as provided in 60.753(c). If a well exceeds one of these operating parameters, action shall be initiated to correct the exceedance within 5 calendar days. If correction of the exceedance cannot be achieved within 15 calendar days of the first measurement, the gas collection system shall be expanded to correct the exceedance within 120 days of the initial exceedance. Any attempted corrective measure shall not cause exceedance of other operational or performance standards. An alternative timeline for corrected in the exceedance may be submitted to the APCO for approval. [40 CFR 60.755(a)(5)] Federally Enforceable Through Title V Permit
13. The provisions of this subpart apply at all times, except during periods of start-up, shutdown, or malfunction, provided that the duration of start-up, shutdown, or malfunction shall not exceed 5 days for collection systems and shall not exceed 1 hour for treatment or control devices. [40 CFR 60.755(e)] Federally Enforceable Through Title V Permit
14. Surface testing to measure the methane concentration at the surface of the landfill shall be conducted around the perimeter of the collection area and along a pattern that traverses the landfill at 30 meter intervals and where visual observations indicate elevated concentrations of landfill gas, such as distressed vegetation and cracks or seeps in the cover. The owner or operator may establish an alternative traversing pattern that ensures equivalent coverage. A surface monitoring design plan shall be developed that includes a topographical map with the monitoring route and the rationale for any site-specific deviations from the 30 meter intervals. Areas with steep slopes or other dangerous areas may be excluded from the surface testing. [District Rule 2201, 40 CFR 60.753(d), and 40 CFR 60.755(c)(1)] Federally Enforceable Through Title V Permit
15. Surface testing to measure the methane concentration at the surface of the landfill shall be conducted on a quarterly basis using an organic vapor analyzer, flame ionization detector, or other portable monitor meeting the specifications provided in 40 CFR 60.755(d). [40 CFR 60.755(c)(1)] Federally Enforceable Through Title V Permit
16. The collection system shall be operated such that the methane concentration is less than 500 parts per million above background at the surface of the landfill. Compliance with this surface methane operational standard shall be demonstrated using the procedures outlined in 40 CFR 60.755(c) within 180 days of installation and startup of the collection and control system and quarterly thereafter. [District Rule 2201, 40 CFR 60.753(d), 40 CFR 60.755(c), and 40 CFR 60.8] Federally Enforceable Through Title V Permit
17. Permittee shall calculate the NMOC emission rate for purposes of determining when the collection and control system can be removed as provided in 40 CFR 60.752(b)(2)(v) by using the equation found in 40 CFR 60.754(b). [40 CFR 60.754(b)] Federally Enforceable Through Title V Permit
18. Permittee shall operate the enclosed flare at all times when the collected gas is routed to it. [40 CFR 60.753(f)] Federally Enforceable Through Title V Permit

PERMIT UNIT REQUIREMENTS CONTINUE ON NEXT PAGE  
These terms and conditions are part of the Facility-wide Permit to Operate.

19. Permittee shall operate the landfill gas collection system such that gas is collected from each area, cell, or group of cells in the MSW landfill in which solid waste has been in place for: (1) five years or more if active; or (2) two years or more if closed or at final grade. [40 CFR 60.753(a)] Federally Enforceable Through Title V Permit
20. Permittee shall operate the landfill gas collection system with negative pressure at each wellhead except under the following conditions: (1) A fire or increased well temperature. The owner or operator shall record instances when positive pressure occurs in efforts to avoid a fire. These records shall be submitted with the annual reports as provided in 60.757(f)(1); (2) Use of a geomembrane or synthetic cover. The owner or operator shall develop acceptable pressure limits in the design plan; (3) A decommissioned well. A well may experience a static positive pressure after shut down to accommodate for declining flows. All design changes shall be approved by the APCO. [40 CFR 60.753(b)] Federally Enforceable Through Title V Permit
21. Permittee shall operate each interior wellhead in the collection system with a landfill gas temperature less than 55 C and with either a nitrogen level less than 20 percent or an oxygen level less than 5 percent. The owner or operator may establish a higher operating temperature, nitrogen, or oxygen value at a particular well. A higher operating value demonstration shall show supporting data that the elevated parameter does not cause fires or significantly inhibit anaerobic decompositions by killing methanogens. [40 CFR 60.753(c)] Federally Enforceable Through Title V Permit
22. If monitoring demonstrates that the operational requirements in paragraphs (b), (c), or (d) of section 60.753 are not met, corrective action shall be taken as specified in 40 CFR 60.755(a)(3 - 5) or (c). If corrective actions are taken as specified in 60.755, the monitored exceedance is not a violation of the operational requirements in this section. [40 CFR 60.753(g)] Federally Enforceable Through Title V Permit
23. Each wellhead shall have a sampling port and a thermometer, other temperature-measuring device, or an access port for temperature measurements. [40 CFR 60.756(a)] Federally Enforceable Through Title V Permit
24. When monitoring interior wellheads for operation for a nitrogen level, the nitrogen level shall be determined using Method 3C, unless an alternative test method is established as allowed by 60.752(b)(2)(i) of this subpart. [40 CFR 60.753(c)(1)] Federally Enforceable Through Title V Permit
25. For each interior wellhead, unless an alternative test method is established as allowed by 60.752(b)(2)(i) of this subpart, the oxygen shall be determined by an oxygen meter using Method 3A or 3C except that: (i) The span shall be set so that the regulatory limit is between 20 and 50 percent of the span; (ii) A data recorder is not required; (iii) Only two calibration gases are required, a zero and span, and ambient air may be used as the span; (iv) A calibration error check is not required; (v) The allowable sample bias, zero drift, and calibration drift are  $\pm 10$  percent. [40 CFR 60.753(c)(2)] Federally Enforceable Through Title V Permit
26. The background concentration shall be determined by moving the probe inlet upwind and downwind outside the boundary of the landfill at a distance of at least 30 meters from the perimeter wells. [40 CFR 60.755(c)(2)] Federally Enforceable Through Title V Permit
27. Surface emission monitoring shall be performed in accordance with section 4.3.1 of Method 21 of appendix A, except that the probe inlet shall be placed within 5 to 10 centimeters of the ground. Monitoring shall be performed during typical meteorological conditions. Any reading of 500 parts per million or more above background at any location shall be recorded as a monitored exceedance and the actions specified in 40 CFR 60.755(c)(4)(i-v) shall be taken. As long as the specified actions are taken, the exceedance is not a violation of the operational requirements of 60.753(d). [40 CFR 60.755(c)(3), (4)] Federally Enforceable Through Title V Permit
28. For the performance test required in 60.752(b)(2)(iii)(B), Method 25, 25C, or Method 18 of Appendix A must be used to determine compliance with the 98 weight percent efficiency or the 20 ppmv outlet concentration level, unless another method to demonstrate compliance has been approved by the APCO as provided by 60.752(b)(2)(i)(B). Method 3 or 3A shall be used to determine oxygen for correcting the NMOC concentration as hexane to 3 percent. In cases where the outlet concentration is less than 50 ppm NMOC as carbon (8 ppm NMOC as hexane), Method 25A should be used in place of Method 25. If using Method 18 of appendix A, the minimum list of compounds to be tested shall be those published in the most recent Compilation of Air Pollutant Emission Factors (AP-42). The following equation shall be used to calculate efficiency:  $(\text{NMOC}_{\text{in}} - \text{NMOC}_{\text{out}}) / \text{NMOC}_{\text{in}}$ . The District must be notified at least 30 days prior to any compliance source test, and a source test plan must be submitted for approval at least 15 days prior to testing. [District Rule 1081; 40 CFR 60.754(d)] Federally Enforceable Through Title V Permit

PERMIT UNIT REQUIREMENTS CONTINUE ON NEXT PAGE

These terms and conditions are part of the Facility-wide Permit to Operate.

29. Permittee shall implement a program to monitor for cover integrity and implement cover repairs as necessary on a monthly basis. [40 CFR 60.755(c)(5)] Federally Enforceable Through Title V Permit
30. The portable analyzer shall meet the instrument specifications of Method 21, section 3 (except that "methane" shall replace all references to VOC). The calibration gas shall be methane, diluted to a nominal concentration of 500 parts per million in air. To meet the performance evaluation requirements of Method 21, section 3.1.3, the instrument evaluation procedures of Method 21, section 4.4. The calibration procedures provided in Method 21, section 4.2 shall be followed immediately before commencing a surface monitoring survey. The provisions of this condition apply at all times, except during periods of start-up, shutdown, or malfunction (as defined in 40 CFR 60.755(e)). [40 CFR 60.755(d), (e)] Federally Enforceable Through Title V Permit
31. The provisions of this subpart apply at all times, except during periods of start-up, shutdown, or malfunction, provided that the duration of start-up, shutdown, or malfunction shall not exceed 5 days for collections systems and shall not exceed 1 hour for treatment or control devices. [40 CFR 60.755(e)] Federally Enforceable Through Title V Permit
32. Operator shall measure the gauge pressure in the gas collection header on a monthly basis as provided in 40 CFR 60.755(a)(3); and monitor nitrogen or oxygen concentration in the landfill gas on a monthly basis as provided in 40 CFR 60.755(a)(5); and monitor temperature of the landfill gas on a monthly basis as provided in 40 CFR 60.755(a)(5). [40 CFR 60.756(a)] Federally Enforceable Through Title V Permit
33. Permittee shall submit an equipment removal report to the District 30 days prior to removal or cessation of operation of the control equipment. The report shall conform to the requirements of 40 CFR 60.757(e)(1). [40 CFR 60.757(e)] Federally Enforceable Through Title V Permit
34. Permittee shall submit to the District semiannual reports of the recorded information in 40 CFR 60.757(f)(1-6). The initial report shall be submitted within 180 days of installation and start-up of the collection and control system, and shall include the initial performance test report required under 40 CFR 60.8. [40 CFR 60.757(f), 40 CFR 63.1980(a)] Federally Enforceable Through Title V Permit
35. Each owner or operator seeking to comply with 40 CFR 60.752(b)(2)(iii) shall include information specified in 40 CFR 60.757(g)(1-6) with the initial performance test report required under 40 CFR Part 60.8. [40 CFR 60.757(g)] Federally Enforceable Through Title V Permit
36. The following constitute exceedances that also shall be recorded and reported under 40 CFR 60.757(f): all 3-hour periods of operation during which the average combustion temperature was more than 28 C below the average combustion temperature during the most recent performance test (flare source test). [40 CFR 60.758(c)] Federally Enforceable Through Title V Permit
37. Except as provided in 60.752(b)(2)(i)(B), each owner or operator of a controlled landfill shall keep up-to-date, readily accessible records for the life of the control equipment of the data listed in paragraphs 60.758(b)(1) through (b)(4) as measured during the initial performance test or compliance determination. Records of subsequent tests or monitoring shall be maintained for a minimum of 5 years. Records of the control device vendor specifications shall be maintained until removal. [40 CFR 60.758(b)] Federally Enforceable Through Title V Permit
38. Permittee shall keep the following records: (1)(i) the maximum expected gas generation flow rate as calculated in 60.755(a)(1). The owner or operator may use another method to determine the maximum gas generation flow rate, if the method has been approved by the APCO; (ii) the density of wells, horizontal collectors, surface collectors, or other gas extraction devices determined using the procedures specified in 60.759(a)(1); (2)(i) the average combustion temperature measured at least every 15 minutes and averaged over the same time period of the performance test; (ii) the percent reduction of NMOC determined as specified in 60.752(b)(2)(iii)(B) achieved by the control device. [40 CFR 60.758(b)(1) and (2)] Federally Enforceable Through Title V Permit
39. Except as provided in 60.752(b)(2)(i)(B), permittee shall keep, for the life of the collection system, an up-to-date, readily accessible plot map showing each existing and planned collector in the system and providing a unique identification location label for each collector. Permittee shall keep readily accessible documentation of the nature, date of deposition, amount, and location of asbestos-containing or nondegradable waste excluded from collection as well as any nonproductive areas excluded from collection. [40 CFR 60.758(d)] Federally Enforceable Through Title V Permit

PERMIT UNIT REQUIREMENTS CONTINUE ON NEXT PAGE  
These terms and conditions are part of the Facility-wide Permit to Operate.

40. Except as provided in 60.752(b)(2)(i)(B), permittee shall keep for at least 5 years up-to-date, readily accessible records of all collection and control system exceedances of the operational standards in 60.753, the reading in the subsequent month whether or not the second reading is an exceedance, and the location of each exceedance. [40 CFR 60.758(e)] Federally Enforceable Through Title V Permit
41. VOC emissions from the flare and landfill shall not exceed 339.5 lb-VOC/day. [District Rule 2201] Federally Enforceable Through Title V Permit
42. Emissions from the flare shall not exceed any of the following limits: 0.06 lb-NOx/MMBtu, 91.1 lb-SOx/day, 13,146 lb-SOx/year, 0.008 lb-PM10/MMBtu, 0.22 lb-CO/MMBtu, or 0.063 lb-VOC/MMBtu. [District Rule 2201] Federally Enforceable Through Title V Permit
43. The combined heat input of collected B-17 and B-19 landfill gas into the flare shall not exceed any of the following: 83.6 MMBtu/hr or 398,333 MMBtu/year. Heat input shall be calculated daily using monthly methane measurements (%), landfill gas flow into the flare (cubic feet per minute), and the annually tested landfill gas heat content (Btu/cubic foot). [District Rule 2201] Federally Enforceable Through Title V Permit
44. Enclosed flare shall reduce the inlet NMOC emissions by at least 98% by weight or to no more than 20 ppmvd @ 3% O2 as methane. [District Rule 2201] Federally Enforceable Through Title V Permit
45. The methane destruction efficiency for the enclosed flares shall be at least 99% by weight. [17 CCR 95464 (b)(2)(A)(1)]
46. Emissions from the flare LPG-fired pilot shall not exceed any of the following limits: 0.15 lb-NOx/MMBtu, 0.0164 lb-SOx/MMBtu, 0.0044 lb-PM10/MMBtu, 0.021 lb-CO/MMBtu, or 0.0055 lb-VOC/MMBtu. [District Rule 2201] Federally Enforceable Through Title V Permit
47. A non-resettable, totalizing mass or volumetric landfill gas fuel flow meter to measure the amount of gas combusted in the enclosed flare shall be installed, utilized and maintained. [District Rule 2201] Federally Enforceable Through Title V Permit
48. Sampling ports adequate for sulfur testing shall be provided in the landfill gas manifold line to the flare. [District Rule 1081] Federally Enforceable Through Title V Permit
49. SOx emissions shall be determined by measuring the sulfur concentration in the landfill gas and calculating the correlated SOx emission rate based on the correlation between landfill gas sulfur concentration and associated SOx emission rate demonstrated during startup. [District Rule 1081] Federally Enforceable Through Title V Permit
50. Testing to demonstrate compliance with the daily and annual SOx emission limit shall be conducted weekly. Once eight (8) consecutive weekly tests show compliance, the frequency of monitoring sulfur content, and associated SOx emissions, may be reduced to monthly. If a monthly test shows violation of the SOx emission limit, then weekly testing shall resume and continue until eight (8) consecutive tests show compliance. Once compliance is shown on eight (8) consecutive weekly tests, then testing may return to monthly. [District Rule 2201] Federally Enforceable Through Title V Permit
51. Sulfur content of the landfill gas being combusted in the flare shall be determined using ASTM D 1072, D 3031, D 4084, D 3246 or double GC for H2S and mercaptans, or draeger tubes for H2S, or an equivalent method approved by the District. [District Rule 1081] Federally Enforceable Through Title V Permit
52. Total combined Class II/III waste material and Class II soil acceptance rate of C-283-22 and '-25 shall not exceed 2000 tons per day. [District Rule 2201] Federally Enforceable Through Title V Permit
53. Total combined Class II/III waste material acceptance rate of C-283-22 and '-25 shall not exceed 620,000 tons per year. [District Rule 2201] Federally Enforceable Through Title V Permit
54. Total combined Class II soil acceptance rate of C-283-22 and '-25 shall not exceed 800 tons per day. [District Rule 2201] Federally Enforceable Through Title V Permit
55. Total combined clean (<50 ppm by weight VOC) soil cover usage rate of C-283-22 and '-25 shall not exceed 6000 tons per day. [District Rule 2201] Federally Enforceable Through Title V Permit

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56. Total PM10 emissions from handling of Class II/III waste material and soil cover shall not exceed 0.000454 pounds per ton material handled. [District Rule 2201] Federally Enforceable Through Title V Permit
57. Source testing on the flare shall be performed to demonstrate compliance with the flare NOx and CO limits, and the NMOC destruction efficiency of 98%, or no more than 20 ppmvd @ 3% O2 as methane, as required by this permit shall be conducted annually. [District Rule 2201] Federally Enforceable Through Title V Permit
58. Source testing for flare NOx emissions shall be conducted using CARB Method 7 or Method 20. [District Rule 1081] Federally Enforceable Through Title V Permit
59. Source testing for flare CO emissions shall be conducted using EPA Method 10 or 10B, CARB Methods 1 through 5 with 10, or CARB Method 100. [District Rule 1081] Federally Enforceable Through Title V Permit
60. Operator shall determine landfill gas fuel higher heating value annually by ASTM D 1826 or D 1945 in conjunction with ASTM D 3588 for gaseous fuels. [District Rule 2201] Federally Enforceable Through Title V Permit
61. The results of each landfill gas sulfur content test shall be submitted to the District within 60 days thereafter. [District Rule 1081] Federally Enforceable Through Title V Permit
62. Gas collection system shall be operated in a manner which maximizes the amount of landfill gas extracted while preventing overdraw that can cause fires or damage the gas collection system. [District Rule 2201] Federally Enforceable Through Title V Permit
63. During maintenance of the gas collection system or incineration device, emissions of landfill gas shall be minimized during shutdown. [District Rule 2201] Federally Enforceable Through Title V Permit
64. Maintenance is defined as work performed on a gas collection system and/or control device in order to ensure continued compliance with District rules, regulations, and/or Permits to Operate, and to prevent its failure or malfunction. [District Rule 2201] Federally Enforceable Through Title V Permit
65. The permittee shall notify the APCO by telephone at least 24 hours before performing any maintenance work that requires the system to be shutdown. The notification shall include a description of work, the date work will be performed and the amount of time needed to complete the maintenance work. [District Rule 2201] Federally Enforceable Through Title V Permit
66. Permittee shall maintain records of system inspections including: date, time and inspection results. [District Rule 1070] Federally Enforceable Through Title V Permit
67. Permittee shall maintain records of maintenance related or other collection system and control device downtime, including individual well shutdown. [District Rule 1070] Federally Enforceable Through Title V Permit
68. The operator shall record emission control device source tests (emissions of CO, NOx, and VOC) in pounds per MMBtu heat input. Operator shall also record VOC destruction/treatment efficiency. [District Rule 1081] Federally Enforceable Through Title V Permit
69. Daily records of the weight of materials received (tons) - including Class II/III waste material, Class II soil cover, and clean soil cover - and daily records of all soil organic content test results and certifications, shall be maintained, kept on site for a period of five years, and made available to District staff upon request. [District Rule 2201] Federally Enforceable Through Title V Permit
70. The District shall be notified in writing ten days prior to the acceptance of new types of waste streams, or waste streams with significant malodorous qualities. [District Rules 2201 and 4102] Federally Enforceable Through Title V Permit
71. A District approved anemometer shall be continuously operated on site with permanent data available to the District. [District Rule 2201] Federally Enforceable Through Title V Permit
72. Wastes with the potential to release hazardous gases, mists, or vapors in excess of existing air quality standards shall not be exposed to the atmosphere, and combustion of flammable wastes in the landfill shall be prevented. [District Rule 2201] Federally Enforceable Through Title V Permit

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73. A record of continuous flare combustion temperature, continuous volumetric gas flow rate, net heating value of landfill gas being combusted, daily landfill gas fuel consumption, and daily heat input shall be maintained, retained on the premises for a period of at least five years and made readily available for District inspection upon request. [District Rule 2201] Federally Enforceable Through Title V Permit
74. Records of daily and annual landfill gas flow rate, annual test results of higher heating value of landfill gas, and calculated daily and annual SOx emissions shall be maintained. [District Rule 2201] Federally Enforceable Through Title V Permit
75. The collection devices within the interior and along the perimeter areas shall be certified to achieve comprehensive control of surface gas emissions by a professional engineer. The following issues shall be addressed in the design: depths of refuse, refuse gas generation rates and flow characteristics, cover properties, gas system expandability, leachate and condensate management, accessibility, compatibility with filling operations, integration with closure end use, air intrusion control, corrosion resistance, fill settlement, and resistance to the refuse decomposition heat. [40 CFR 60.759(a)(1)] Federally Enforceable Through Title V Permit
76. The placement of gas collection devices determined in paragraph 60.759(a)(1) shall control all gas producing areas, except as provided by paragraphs 60.759(a)(3)(i) and (a)(3)(ii). [40 CFR 60.759(a)(3)] Federally Enforceable Through Title V Permit
77. The sufficient density of gas collection devices determined in paragraph 60.759(a)(1) shall address landfill gas migration issues and augmentation of the collection system through the use of active or passive systems at the landfill perimeter or exterior. [40 CFR 60.759(a)(2)] Federally Enforceable Through Title V Permit
78. Any segregated area of asbestos or nondegradable material may be excluded from collection if documented as provided under 60.758(d). The documentation shall provide the nature, date of deposition, location and amount of asbestos or nondegradable material deposited in the area, and shall be provided to the Administrator upon request. [40 CFR 60.759(a)(3)(i)] Federally Enforceable Through Title V Permit
79. Any nonproductive area of the landfill may be excluded from control provided that the total of all excluded areas can be shown to contribute less than 1 percent of the total amount of NMOC emissions from the landfill. The amount, location, and age of the material shall be documented and provided to the Administrator upon request. A separate NMOC emissions estimate shall be made for each section proposed for exclusion, and the sum of all such sections shall be compared to the NMOC emissions estimate for the entire landfill. Emissions from each section shall be computed using the equation in Section 60.759(a)(3)(ii). [40 CFR 60.759(a)(3)(ii)] Federally Enforceable Through Title V Permit
80. The values for k and CNMOC in equation in Section 60.759(a)(3)(ii) determined in field testing shall be used if field testing has been performed in determining the NMOC emission rate or the radii of influence (this distance from the well center to a point in the landfill where the pressure gradient applied by the blower or compressor approaches zero). If field testing has not been performed, the default values for k, Lo, and CNMOC provided in 60.754(a)(1) or the alternative values from 60.754(a)(5) shall be used. The mass of nondegradable solid waste contained within the given section may be subtracted from the total mass of the section when estimating emissions provided the nature, location, age, and amount of the nondegradable material is documented as provided in paragraph 60.759(a)(3)(i). [40 CFR 60.759(a)(3)(iii)] Federally Enforceable Through Title V Permit

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81. Each owner or operator seeking to comply with 60.752(b)(2)(i)(A) shall construct the gas collection devices using the following equipment or procedures: (1) The landfill gas extraction components shall be constructed of polyvinyl chloride (PVC), high density polyethylene (HDPE) pipe, fiberglass, stainless steel, or other nonporous corrosion resistant material of suitable dimensions to: convey projected amounts of gases; withstand installation, static, and settlement forces; and withstand planned overburden or traffic loads. The collection system shall extend as necessary to comply with emission and migration standards. Collection devices such as wells and horizontal collectors shall be perforated to allow gas entry without head loss sufficient to impair performance across the intended extent of control. Perforations shall be situated with regard to the need to prevent excessive air infiltration; (2) Vertical wells shall be placed so as not to endanger underlying liners and shall address the occurrence of water within the landfill. Holes and trenches constructed for piped wells and horizontal collectors shall be of sufficient cross-section so as to allow for their proper construction and completion including, for example, centering of pipes and placement of gravel backfill. Collection devices shall be designed so as not to allow indirect short circuiting of air into the cover or refuse into the collection system or gas into the air. Any gravel used around pipe perforations should be of a dimension so as not to penetrate or block perforations; (3) Collection devices may be connected to the collection header pipes below or above the landfill surface. The connector assembly shall include a positive closing throttle valve, any necessary seals and couplings, access couplings and at least one sampling port. The collection devices shall be constructed of PVC, HDPE, fiberglass, stainless steel, or other nonporous material of suitable thickness. [40 CFR 60.759(b)] Federally Enforceable Through Title V Permit
82. Each owner or operator seeking to comply with 60.752(b)(2)(i)(A) shall convey the landfill gas to a control system in compliance with 60.752(b)(2)(iii) through the collection header pipe(s). The gas mover equipment shall be sized to handle the maximum gas generation flow rate expected over the intended use period of the gas moving equipment using the following procedures: (1) For existing collection systems, the flow data shall be used to project the maximum flow rate. If no flow data exists, the procedures in paragraph 60.759(c)(2) shall be used; (2) For new collection systems, the maximum flow rate shall be in accordance with 60.755(a)(1). [40 CFR 60.759(c)] Federally Enforceable Through Title V Permit
83. The permittee is no longer required to comply with the requirements of 40 CFR Part 63 Subpart AAAA for the bioreactor provided the conditions in paragraphs (a) or (b) are met: (a) the affected source meets the control system removal criteria in 40 CFR 60.752(b)(2)(v) of part 60, subpart WWW or the bioreactor meets the criteria for a nonproductive area of the landfill in 40 CFR 60.759(a)(3)(ii) of part 60, subpart WWW; (b) the bioreactor portion of the landfill is a closed landfill as defined in 40 CFR 60.751, subpart WWW and has permanently ceased adding liquids to the bioreactor, and have not added liquids to the bioreactor for at least 1 year. A closure report for the bioreactor must be submitted to the APCO as provided in 40 CFR 60.757(d) of subpart WWW. [40 CFR 63.1952(a) and (b)] Federally Enforceable Through Title V Permit
84. For the bioreactor portions, the permittee shall comply with the general provisions specified in Table 1 of 40 CFR Part 63 Subpart AAAA and 63.1960 through 63.1985 starting on the date required to install the gas collection and control system and must extend the collection and control system into each new cell or area of the bioreactor prior to initiating liquids addition in that area. [40 CFR 63.1955(b) and (d)(2)] Federally Enforceable Through Title V Permit
85. Continuous parameter monitoring data, collected under 40 CFR 60.756(b)(1), (c)(1), and (d), are used to demonstrate compliance with the operating conditions for control systems. If a deviation occurs, the permittee has failed to meet the control device operation conditions described in this subpart and has deviated from the requirements of this subpart. The permittee shall develop a written SSM plan according to the provisions in 40 CFR 63.6(e)(3). A copy of the SSM plan must be maintained on site. Failure to write or maintain a copy of the SSM plan is a deviation from the requirements of this subpart. [40 CFR 63.1960] Federally Enforceable Through Title V Permit
86. The permittee shall maintain records as specified in the general provisions of 40 CFR part 60 and this part as shown in Table 1 of this subpart. Applicable records in the general provisions include items such as SSM plans and the SSM plan reports. [40 CFR 63.1980(b)] Federally Enforceable Through Title V Permit
87. The permittee shall submit the initial semiannual compliance report and performance tests results described in 40 CFR 60.757(f) within 180 days after the date required to being operating the gas collection and control system by 63.1947(c) of this subpart. [40 CFR 63.1980(e)] Federally Enforceable Through Title V Permit

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88. If a semiannual compliance report for the bioreactor is required as well as a semiannual compliance report for the conventional portion of the same landfill, submittal may be delayed of a subsequent semiannual compliance report for the bioreactor according to the following so that the reports may be submitted on the same schedule: (1) After submittal of the initial semiannual compliance report and performance test results for the bioreactor, the permittee may delay of the submittal of the subsequent semiannual compliance report for the bioreactor until the date of the initial or subsequent semiannual compliance report is due for the conventional portion of the landfill; (2) The permittee may delay submittal of the subsequent semiannual compliance report by no more than 12 months after the due date for submitting the initial semiannual compliance report and performance test results described in 40 CFR 60.757(f) for the bioreactor. The report shall cover the time period since the previous semiannual report for the bioreactor, which would be a period of at least 6 months and no more than 12 months; (3) After the delayed semiannual report, all subsequent semiannual reports for the bioreactor must be submitted every 6 months on the same date the semiannual report for the conventional portion of the landfill is due. [40 CFR 63.1980(f)] Federally Enforceable Through Title V Permit
89. All records shall be maintained and retained on-site for a period of at least 5 years and shall be made available for District inspection upon request. [District Rule 1070] Federally Enforceable Through Title V Permit
90. The landfill surface shall be monitored quarterly. If there are any exceedances during a quarterly event, monitoring will be required monthly until three consecutive months without exceedances, which would allow a return to quarterly monitoring. [District Rule 2201] Federally Enforceable Through Title V Permit
91. After an exceedance, the permittee shall initiate correction action within five days and conduct remonitoring within ten days from the initial exceedance. If compliance is shown, an additional remonitoring event is required within one month of the initial exceedance. If the ten day event shows an exceedance, the permittee shall initiate correction action within five days and conduct remonitoring within ten days from the second exceedance. If compliance is shown, an additional remonitoring is required within one month of the initial exceedance. If the second ten day event shows an exceedance, the permittee shall permit and install additional landfill gas wells to correct the problem within 120 days of the initial exceedance. [District Rule 2201] Federally Enforceable Through Title V Permit
92. The gas collection and control system shall comply with the operational standards of 40 CFR 60.753, the compliance provisions of 40 CFR 60.755, the monitoring provisions of 40 CFR 60.756, the reporting and record keeping requirements of 40 CFR 60.757 and 60.758, and the requirements of 40 CFR 60.759 (for active collection systems). [40 CFR 60.752(b)(2)(ii), 60.753, 60.755, 60.756, 60.757, 60.758 and 60.759] Federally Enforceable Through Title V Permit
93. In the event that the collection or control system becomes inoperable, the gas mover equipment (as defined in 40 CFR 60.751) shall be shut down and all valves in the collection and control system contributing to venting of the landfill gas to the atmosphere shall be closed within one hour. [40 CFR 60.753(e)] Federally Enforceable Through Title V Permit
94. The owner/operator shall install, calibrate, maintain, and operate a meter that measures and records the landfill gas flow rate into the flare at least once every 15 minutes. This meter shall also be capable of measuring the landfill gas flow rate that might bypass the flare in the event of equipment malfunction or maintenance. [40 CFR 60.756(c)(2)] Federally Enforceable Through Title V Permit
95. The flare shall be operated with a flame present at all times while gas is being vented to it. The presence of a flame shall be continuously monitored using a thermocouple, ultraviolet sensor, or any other equivalent device located at the pilot light or the flame itself. The flame's presence shall be recorded at least once every 15 minutes. [40 CFR 60.18(c)(2) and 40 CFR 60.756(c)(1)] Federally Enforceable Through Title V Permit
96. The enclosed flare shall be equipped with an accurate temperature indicator/recorder that continuously measures and records the operating temperature. [District Rule 2201; 40 CFR 60.756(b)(1)] Federally Enforceable Through Title V Permit
97. The enclosed flare shall be equipped with either a device that records flow to the control device at least every 15 minutes; or secure the bypass line valve in the closed position with a car-seal or a lock-and-key type configuration of the control device. [40 CFR 60.756(b)(2)] Federally Enforceable Through Title V Permit
98. Any closed landfill that has demonstrated compliance in three consecutive quarterly monitoring periods may perform annual monitoring. Quarterly monitoring shall resume if any methane readings of 500 ppm or more above background are detected during annual monitoring. [40 CFR 60.756(f)] Federally Enforceable Through Title V Permit

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99. Permittee shall keep up-to-date, readily accessible continuous records of the indication of flow to the enclosed flare, or the indication of bypass flow, or records of monthly inspections of car-seals or lock-and-key configurations used to seal bypass lines. [40 CFR 60.758(c) and 60.34c] Federally Enforceable Through Title V Permit
100. The non-bioreactor portion of the landfill is no longer required to comply with the requirements of 40 CFR Part 63 Subpart AAAA when it is no longer required to apply controls as specified in 40 CFR 60.752(b)(2)(v) of subpart WWW. [40 CFR 63.1950] Federally Enforceable Through Title V Permit
101. Except for the spreading of landfill cover, when handling bulk materials outside an enclosed structure or building, water or chemical/organic stabilizers/suppressants shall be applied as required to limit Visible Dust Emissions to a maximum of 20% opacity. When necessary to achieve this opacity limitation, wind barriers with less than 50% porosity shall also be used. [District Rules 8011 and 8031] Federally Enforceable Through Title V Permit
102. Except for the spreading of landfill cover, when transporting bulk materials outside an enclosed structure or building, all bulk material transport vehicles shall limit Visible Dust Emissions to 20% opacity by either limiting vehicular speed, maintaining sufficient freeboard on the load, applying water to the top of the load, or covering the load with a tarp or other suitable cover. [District Rules 8011 and 8031] Federally Enforceable Through Title V Permit
103. Records and other supporting documentation shall be maintained as required to demonstrate compliance with the requirements of the rules under Regulation VIII only for those days that a control measure was implemented. Such records shall include the type of control measure(s) used, the location and extent of coverage, and the date, amount, and frequency of application of dust suppressant, manufacturer's dust suppressant product information sheet that identifies the name of the dust suppressant and application instructions. Records shall be kept for one year following project completion that results in the termination of all dust generating activities. [District Rules 8031, 8071, and 8011] Federally Enforceable Through Title V Permit
104. An owner/operator shall prevent or cleanup any carryout or trackout in accordance with the requirements of District Rule 8041 Section 5.0, unless specifically exempted under Rule 8041 or Rule 8011. [District Rules 8041 and 8011] Federally Enforceable Through Title V Permit
105. One or more of the following control measures shall be implemented on each day that 50 or more VDT (Vehicle Daily Trips), or 25 or more VDT with 3 or more axles, originates from within and remains exclusively within an unpaved vehicle/equipment traffic area: water, gravel, roadmix, or chemical/organic dust stabilizers/suppressants, vegetative materials, or other District-approved control measure shall be applied to unpaved vehicle travel areas as required to limit Visible Dust Emissions to 20% opacity and comply with the requirements for a stabilized unpaved road as defined in District Rule 8011. [District Rule 8071 and 8011] Federally Enforceable Through Title V Permit
106. On each day that 50 or more VDT (Vehicle Daily Trips), or 25 or more VDT with 3 or more axles, originates from within and remains exclusively within an unpaved vehicle/equipment traffic area, dusting materials accumulated on paved surfaces shall be removed daily or water and/or chemical/organic dust stabilizers/suppressants shall be applied to the paved surface as required to maintain continuous compliance with the requirements for a stabilized unpaved road as defined in District Rule 8011 and limit Visible Dust Emissions (VDE) to 20% opacity. [District Rule 8011 and 8071] Federally Enforceable Through Title V Permit
107. Whenever any portion of the site becomes inactive, permittee shall restrict access and periodically stabilize any disturbed surface to comply with the conditions for a stabilized surface as defined in Section 3.58 of District Rule 8011. [District Rules 8071 and 8011] Federally Enforceable Through Title V Permit
108. The flare and gas collection system may be shut down when there is an insufficient amount of landfill gas to operate on. During the shutdown period, all gas collection system vents shall be closed and no emissions shall occur through the gas collection system. [District Rule 2201] Federally Enforceable Through Title V Permit
109. During the shutdown of the gas collection system, surface testing to measure the methane concentration at the surface of the landfill shall be conducted at least once every week using an organic vapor analyzer, flame ionization detector, or other portable monitor meeting the specifications provided in 40 CFR 60.755(d). After demonstrating compliance on four consecutive tests, the testing frequency shall be at least once every month. [District Rule 2201] Federally Enforceable Through Title V Permit

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110. During the shutdown of the gas collection system, if the methane concentration measured during weekly or monthly surface testing exceeds 500 parts per million above background at the surface of the landfill, the testing frequency shall be at least once every other day. After demonstrating compliance on four consecutive tests, the testing frequency shall revert to at least once every week. [District Rule 2201] Federally Enforceable Through Title V Permit
111. During operation of the enclosed flare, the permittee shall continuously monitor and record combustion chamber temperature. The temperature readings shall not be less than 28 degree C (50 degree F) below the average combustion temperature determined during the most recent flare source test, averaged over a 3-hour period. Upon detecting any temperature excursion lower than 28 degree C (50 degree F) below the source test average combustion temperature, averaged over a 3-hour period, the permittee shall investigate the excursion and take corrective action to minimize excessive emissions and prevent recurrence of the excursion as expeditiously as practicable. [40 CFR part 64] Federally Enforceable Through Title V Permit
112. The temperature monitoring device shall be calibrated, maintained, and operated according to the manufacturer's specifications. [40 CFR part 64] Federally Enforceable Through Title V Permit
113. The enclosed flare burner and its associated components and the vapor collection system shall be inspected on an annual basis. The records of inspection shall at least contain date and time of inspection, identification of the person performing an inspection, parts replacement and repairs, and all maintenance actions taken. The records shall be kept and maintained for compliance inspection upon request. [40 CFR part 64] Federally Enforceable Through Title V Permit
114. The permittee shall comply with the compliance assurance monitoring operation and maintenance requirements of 40 CFR part 64.7. [40 CFR part 64] Federally Enforceable Through Title V Permit
115. The permittee shall comply with the recordkeeping and reporting requirements of 40 CFR part 64.9. [40 CFR part 64] Federally Enforceable Through Title V Permit
116. If the District or EPA determine that a Quality Improvement Plan is required under 40 CFR 64.7(d)(2), the permittee shall develop and implement the Quality Improvement Plan in accordance with 40 CFR part 64.8. [40 CFR part 64] Federally Enforceable Through Title V Permit
117. Landfill gas collection system components downstream of blower have a leak limit of 500 ppmv as methane. Components must be checked quarterly. [17 CCR 95464 (b)(1)(B), 17 CCR 95469 (b)(3)]
118. Landfill gas collection system wellheads must be operated under vacuum. Monthly monitoring of wellheads is required. Landfill gas collection system wellheads may be operated under neutral or positive pressure except as allowed in sections 95464(c), 95464(d), and 95464(e) [17 CCR 95464(b)(1)(C)]
119. Landfill gas collection and control system must be operated such that landfill surface methane emissions shall not exceed instantaneous surface emission limit of 500 ppmv as methane or integrated surface emission limit of 25 ppmv as methane. [17 CCR 95465]
120. Instantaneous and integrated landfill surface emissions measurements shall be done quarterly. The landfill may monitor annually provided they comply with requirements of 17 CCR 95469 (a)(3). [17 CCR 95469(a)]
121. Permittee shall keep records of all gas collection system downtime exceeding five days, including individual well shutdown and disconnection times and the reason for downtime. [17 CCR 95470(a)(1)(A)]
122. Permittee shall keep records of all gas control system downtime in excess of one hour, the reason for the downtime and the length of time the gas control system was shutdown. [17 CCR 95470(a)(1)(B)]
123. Permittee shall keep records of the expected gas generation flow rate calculated pursuant to section 95471(e). [17 CCR 95470(a)(1)(C)]
124. Permittee shall keep records of all instantaneous surface readings of 200 ppmv or greater; all exceedances of the limits in sections 95464(b)(1)(B) or 95465, including the location of the leak (or affected grid), leak concentration in ppmv, date and time of measurement, the action taken to repair the leak, date of repair, any required re-monitoring and the re-monitored concentration in ppmv, and wind speed during surface sampling; and the installation date and location of each well installed as part of a gas collection system expansion. [17 CCR 95470(a)(1)(D)]

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125. Permittee shall keep records of any positive wellhead gauge pressure measurements, the date of the measurements, the well identification number, and the corrective action taken. [17 CCR 95470(a)(1)(E)]
126. Permittee shall conduct surface emission monitoring using either the procedures specified in section 95471(c) or the Los Angeles County Sanitation District monitoring procedure. Permittee shall keep records of which procedure was used. [17 CCR 95468]
127. Permittee shall keep records of delays encountered during repair of leaks or repair of positive wellhead readings. Documentation of delays shall be submitted with the annual report. [17 CCR 95468(a)(2)]
128. Permittee shall keep records of alternate landfill gas collection system modifications being implemented to correct an exceedance in the landfill gas surface emissions or wellhead pressure. Any alternative to installing a new well shall be documented and submitted with the annual report. [17 CCR 95468]
129. Permittee shall identify areas which are dangerous and unable to be inspected or contain only inert, non-decomposing waste. Areas shall be clearly identified on a map of the facility. A copy of the map shall be kept onsite as well as submitted with the annual report. [17 CCR 95468(a)(5)]
130. Permittee shall conduct monitoring of the landfill surface within 3 inches of the surface. The facility may monitor surface emissions with the probe tip at the height of the vegetation if there is vegetation and it is impractical to monitor at 3 inches from the landfill surface. [17 CCR 95468]
131. Permittee shall terminate surface emission testing when the measured average wind speed is over 10 mph or the instantaneous wind speed is over 20 mph. [17 CCR 95468(a)(3), 17 CCR 95471(c)(1)(C)]
132. Permittee shall only conduct surface emission testing when precipitation has met the following requirements. It has been 24 hours since measured precipitation of 0.01 to 0.15 inches. It has been 48 hours since measured precipitation of 0.16 to 0.24 inches. It has been 72 hours since measured precipitation of 0.25 or more inches. [17 CCR 95468]
133. Permittee shall keep records of the annual solid waste acceptance rate and the current amount of waste-in-place. [17 CCR 95470(a)(1)(F)]
134. Permittee shall keep records of the nature, location, amount, and date of deposition of non-degradable waste for any landfill areas excluded from the collection system. [17 CCR 95470(a)(1)(G)]
135. Permittee shall keep records of any source tests conducted pursuant to section 95464(b)(4). [17 CCR 95470(a)(1)(H)]
136. The flare must be source tested annually for methane destruction efficiency of at least 99% by weight. If the flare is in compliance after three consecutive source tests, the facility may move to source testing the flare every three years. If subsequent tests show the flare out of compliance, the test frequency shall revert to annual testing. [17 CCR 95464(b)(4)]
137. The flare must have automatic dampers, an automatic shutdown device, a flame arrester, and continuous recording temperature sensors. [17 CCR 95464(b)(2)(A)(2)]
138. The flare must operate within the parameter ranges established during the initial or most recent source test. [17 CCR 95464(b)(2)(A)(4)]
139. Permittee shall keep records describing the mitigation measures taken to prevent the release of methane or other emissions into the atmosphere during the following activities: 1. When solid waste was brought to the surface during the installation or preparation of wells, piping, or other equipment; 2. During repairs or the temporary shutdown of gas collection system components; or, 3. When solid waste was excavated and moved. [17 CCR 95470(a)(1)(I)]
140. Permittee shall keep records of any construction activities pursuant to section 95466. The records must contain the following information: 1. A description of the actions being taken, the areas of the MSW landfill that will be affected by these actions, the reason the actions are required, and any landfill gas collection system components that will be affected by these actions. 2. Construction start and finish dates, projected equipment installation dates, and projected shut down times for individual gas collection system components. 3. A description of the mitigation measures taken to minimize methane emissions and other potential air quality impacts. [17 CCR 95470(a)(1)(J)]

PERMIT UNIT REQUIREMENTS CONTINUE ON NEXT PAGE

These terms and conditions are part of the Facility-wide Permit to Operate.

141. Permittee shall keep records of the equipment operating parameters specified to be monitored under section 95469(b)(1) as well as records for periods of operation during which the parameter boundaries established during the most recent source test are exceeded. The records must include the following information: 1. For enclosed flares, all 3-hour periods of operation during which the average temperature difference was more than 28 degrees Celsius (or 50 degrees Fahrenheit) below the average combustion temperature during the most recent source test at which compliance with sections 95464(b)(2) was determined and a gas flow rate device which must record the flow to the control device at least every 15 minutes. [17 CCR 95470(a)(1)(K), 17 CCR 95469(b)(1)(B)]
142. Permittee shall submit the following reports as required in section 95470(b): Closure notification, Equipment removal report and Annual report. All reports must be accompanied by a certification of truth, accuracy, and completeness signed by a responsible official. [17 CCR 95470(b)]
143. Permittee may request alternatives to the compliance measures, monitoring requirements, test methods and procedures of sections 95464, 95469, and 95471. Any requests must be submitted in writing. [17 CCR 95468]

These terms and conditions are part of the Facility-wide Permit to Operate.

# San Joaquin Valley Air Pollution Control District

PERMIT UNIT: C-283-25-3

EXPIRATION DATE: 08/31/2016

## EQUIPMENT DESCRIPTION:

MUNICIPAL SOLID WASTE LANDFILL, CLASS II AND III (B-17), 18.4 MILLION CUBIC YARD CAPACITY (62 ACRES) WITH GAS COLLECTION AND CONTROL SYSTEM SERVED BY A 2,500 SCFM (EQUIVALENT TO 83.6 MMBTU/HR) PARNEL BIOGAS ENCLOSED FLARE SHARED WITH C-283-22

## PERMIT UNIT REQUIREMENTS

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1. No air contaminant shall be discharged into the atmosphere for a period or periods aggregating more than three minutes in any one hour which is as dark as, or darker than, Ringelmann 1/4 or 5% opacity. [District Rules 2201 and 4101] Federally Enforceable Through Title V Permit
2. All equipment shall be maintained in good operating condition and shall be operated in a manner to minimize emissions of air contaminants into the atmosphere. [District Rule 2201] Federally Enforceable Through Title V Permit
3. Each owner or operator shall keep for at least 5 years up-to-date, readily accessible, on-site records of the maximum design capacity, the current amount of solid waste in-place, and the year-by-year waste acceptance rate. Off-site records may be maintained if they are retrievable within 4 hours. [40 CFR 60.758(a)] Federally Enforceable Through Title V Permit
4. This operating permit may be cancelled with APCO approval when the landfill is closed, pursuant to the requirements of this permit, if the landfill is not otherwise subject to the requirements of either 40 CFR part 70 or part 71 and if either 1) it was never subject to the requirement for a control system under 40 CFR 60.752(b)(2); or 2) the owner or operator meets the conditions for control system removal specified in 40 CFR 60.752(b)(2)(v). [40 CFR 60.752(d)] Federally Enforceable Through Title V Permit
5. If the landfill is permanently closed, a closure notification shall be submitted to the APCO within 30 days of waste disposal cessation. A permanent closure must take place in accordance with 40 CFR 258.60. If a closure report has been submitted, no additional waste may be placed in the landfill without filing a notification of modification to the APCO, pursuant to 40 CFR 60.7(a)(4). [40 CFR 60.752(b)(1)(ii)(B), 60.757(d)] Federally Enforceable Through Title V Permit
6. An active collection system shall be designed to handle the maximum expected gas flow rate from the entire area of the landfill that warrants control over the intended use period of the gas control or treatment system equipment, collect gas from each area, cell, or group of cells in the landfill in which the initial solid waste has been placed for a period of 5 years or more if active; or 2 years or more if closed or at final grade, collect gas at a sufficient extraction rate, and be designed to minimize off-site migration of subsurface gas. [40 CFR 60.752(b)(2)(ii)(A)] Federally Enforceable Through Title V Permit
7. Each owner or operator seeking to comply with 40 CFR 60.752(b)(2)(i) shall site active collection wells, horizontal collectors, surface collectors, or other extraction devices at a sufficient density throughout all gas producing areas using the procedures in 60.759(a)(1), (2), and (3) unless alternative procedures have been approved by the APCO as provided in 60.752(b)(2)(i)(C) and (D). [40 CFR 60.759(a)] Federally Enforceable Through Title V Permit
8. For the purposes of calculating the maximum expected gas generation flow rate from the landfill to determine compliance with 60.752(b)(2)(ii)(A)(1), one of the equations in Section 60.755(a)(1)(i) or (ii) or (iii) shall be used. [40 CFR 60.755(a)(1)] Federally Enforceable Through Title V Permit

PERMIT UNIT REQUIREMENTS CONTINUE ON NEXT PAGE

These terms and conditions are part of the Facility-wide Permit to Operate.

Facility Name: CHEMICAL WASTE MANAGEMENT, INC  
Location: 35251 OLD SKYLINE ROAD, KETTLEMAN CITY, CA 93239  
C-283-25-3; Mar 9 2014 4:28PM - RLEVANNI

9. For the purposes of determining sufficient density of gas collectors for compliance with 60.752(b)(2)(ii)(A)(2), the owner or operator shall design a system of vertical wells, horizontal collectors, or other collection devices, satisfactory to the APCO, capable of controlling and extracting gas from all portions of the landfill sufficient to meet all operational and performance standards. [40 CFR 60.755(a)(2)] Federally Enforceable Through Title V Permit
10. For the purpose of demonstrating whether the gas collection system flow rate is sufficient to determine compliance with 60.752(b)(2)(ii)(A)(3), the owner or operator shall measure gauge pressure in the gas collection header at each individual well, monthly. If a positive pressure exists, action shall be initiated to correct the exceedance within 5 calendar days, except for the three conditions allowed under 60.753(b). If negative pressure cannot be achieved without excess air infiltration within 15 calendar days of the first measurement, the gas collection system shall be expanded to correct the exceedance within 120 days of the initial measurement of positive pressure. Any attempted corrective measure shall not cause exceedances of other operational or performance standards. An alternative timeline for correcting the exceedance may be submitted to the APCO for approval. [40 CFR 60.755(a)(3)] Federally Enforceable Through Title V Permit
11. Owners or operators are not required to expand the system as required in paragraph 60.755(a)(3) during the first 180 days after gas collection system startup. [40 CFR 60.755(a)(4)] Federally Enforceable Through Title V Permit
12. For the purpose of identifying whether excess air infiltration into the landfill is occurring, the owner or operator shall monitor each well monthly for temperature and nitrogen or oxygen as provided in 60.753(c). If a well exceeds one of these operating parameters, action shall be initiated to correct the exceedance within 5 calendar days. If correction of the exceedance cannot be achieved within 15 calendar days of the first measurement, the gas collection system shall be expanded to correct the exceedance within 120 days of the initial exceedance. Any attempted corrective measure shall not cause exceedance of other operational or performance standards. An alternative timeline for corrected in the exceedance may be submitted to the APCO for approval. [40 CFR 60.755(a)(5)] Federally Enforceable Through Title V Permit
13. The provisions of this subpart apply at all times, except during periods of start-up, shutdown, or malfunction, provided that the duration of start-up, shutdown, or malfunction shall not exceed 5 days for collection systems and shall not exceed 1 hour for treatment or control devices. [40 CFR 60.755(e)] Federally Enforceable Through Title V Permit
14. Surface testing to measure the methane concentration at the surface of the landfill shall be conducted around the perimeter of the collection area and along a pattern that traverses the landfill at 30 meter intervals and where visual observations indicate elevated concentrations of landfill gas, such as distressed vegetation and cracks or seeps in the cover. The owner or operator may establish an alternative traversing pattern that ensures equivalent coverage. A surface monitoring design plan shall be developed that includes a topographical map with the monitoring route and the rationale for any site-specific deviations from the 30 meter intervals. Areas with steep slopes or other dangerous areas may be excluded from the surface testing. [District Rule 2201, 40 CFR 60.753(d), and 40 CFR 60.755(c)(1)] Federally Enforceable Through Title V Permit
15. Surface testing to measure the methane concentration at the surface of the landfill shall be conducted on a quarterly basis using an organic vapor analyzer, flame ionization detector, or other portable monitor meeting the specifications provided in 40 CFR 60.755(d). [40 CFR 60.755(c)(1)] Federally Enforceable Through Title V Permit
16. The collection system shall be operated such that the methane concentration is less than 500 parts per million above background at the surface of the landfill. Compliance with this surface methane operational standard shall be demonstrated using the procedures outlined in 40 CFR 60.755(c) within 180 days of installation and startup of the collection and control system and quarterly thereafter. [District Rule 2201, 40 CFR 60.753(d), 40 CFR 60.755(c), and 40 CFR 60.8] Federally Enforceable Through Title V Permit
17. Permittee shall calculate the NMOC emission rate for purposes of determining when the collection and control system can be removed as provided in 40 CFR 60.752(b)(2)(v) by using the equation found in 40 CFR 60.754(b). [40 CFR 60.754(b)] Federally Enforceable Through Title V Permit
18. Permittee shall operate the enclosed flare at all times when the collected gas is routed to it. [40 CFR 60.753(f)] Federally Enforceable Through Title V Permit

PERMIT UNIT REQUIREMENTS CONTINUE ON NEXT PAGE

These terms and conditions are part of the Facility-wide Permit to Operate.

Facility Name: CHEMICAL WASTE MANAGEMENT, INC  
Location: 38251 OLD SKYLINE ROAD, KETTLEMAN CITY, CA 93239  
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19. Permittee shall operate the landfill gas collection system such that gas is collected from each area, cell, or group of cells in the MSW landfill in which solid waste has been in place for: (1) five years or more if active; or (2) two years or more if closed or at final grade. [40 CFR 60.753(a)] Federally Enforceable Through Title V Permit
20. Permittee shall operate the landfill gas collection system with negative pressure at each wellhead except under the following conditions: (1) A fire or increased well temperature. The owner or operator shall record instances when positive pressure occurs in efforts to avoid a fire. These records shall be submitted with the annual reports as provided in 60.757(f)(1); (2) Use of a geomembrane or synthetic cover. The owner or operator shall develop acceptable pressure limits in the design plan; (3) A decommissioned well. A well may experience a static positive pressure after shut down to accommodate for declining flows. All design changes shall be approved by the APCO. [40 CFR 60.753(b)] Federally Enforceable Through Title V Permit
21. Permittee shall operate each interior wellhead in the collection system with a landfill gas temperature less than 55 C and with either a nitrogen level less than 20 percent or an oxygen level less than 5 percent. The owner or operator may establish a higher operating temperature, nitrogen, or oxygen value at a particular well. A higher operating value demonstration shall show supporting data that the elevated parameter does not cause fires or significantly inhibit anaerobic decompositions by killing methanogens. [40 CFR 60.753(c)] Federally Enforceable Through Title V Permit
22. If monitoring demonstrates that the operational requirements in paragraphs (b), (c), or (d) of section 60.753 are not met, corrective action shall be taken as specified in 40 CFR 60.755(a)(3 - 5) or (c). If corrective actions are taken as specified in 60.755, the monitored exceedance is not a violation of the operational requirements in this section. [40 CFR 60.753(g)] Federally Enforceable Through Title V Permit
23. Each wellhead shall have a sampling port and a thermometer, other temperature-measuring device, or an access port for temperature measurements. [40 CFR 60.756(a)] Federally Enforceable Through Title V Permit
24. When monitoring interior wellheads for operation for a nitrogen level, the nitrogen level shall be determined using Method 3C, unless an alternative test method is established as allowed by 60.752(b)(2)(i) of this subpart. [40 CFR 60.753(c)(1)] Federally Enforceable Through Title V Permit
25. For each interior wellhead, unless an alternative test method is established as allowed by 60.752(b)(2)(i) of this subpart, the oxygen shall be determined by an oxygen meter using Method 3A or 3C except that: (i) The span shall be set so that the regulatory limit is between 20 and 50 percent of the span; (ii) A data recorder is not required; (iii) Only two calibration gases are required, a zero and span, and ambient air may be used as the span; (iv) A calibration error check is not required; (v) The allowable sample bias, zero drift, and calibration drift are  $\pm 10$  percent. [40 CFR 60.753(c)(2)] Federally Enforceable Through Title V Permit
26. The background concentration shall be determined by moving the probe inlet upwind and downwind outside the boundary of the landfill at a distance of at least 30 meters from the perimeter wells. [40 CFR 60.755(c)(2)] Federally Enforceable Through Title V Permit
27. Surface emission monitoring shall be performed in accordance with section 4.3.1 of Method 21 of appendix A, except that the probe inlet shall be placed within 5 to 10 centimeters of the ground. Monitoring shall be performed during typical meteorological conditions. Any reading of 500 parts per million or more above background at any location shall be recorded as a monitored exceedance and the actions specified in 40 CFR 60.755(c)(4)(i-v) shall be taken. As long as the specified actions are taken, the exceedance is not a violation of the operational requirements of 60.753(d). [40 CFR 60.755(c)(3), (4)] Federally Enforceable Through Title V Permit
28. For the performance test required in 60.752(b)(2)(iii)(B), Method 25, 25C, or Method 18 of Appendix A must be used to determine compliance with the 98 weight percent efficiency or the 20 ppmv outlet concentration level, unless another method to demonstrate compliance has been approved by the APCO as provided by 60.752(b)(2)(i)(B). Method 3 or 3A shall be used to determine oxygen for correcting the NMOC concentration as hexane to 3 percent. In cases where the outlet concentration is less than 50 ppm NMOC as carbon (8 ppm NMOC as hexane), Method 25A should be used in place of Method 25. If using Method 18 of appendix A, the minimum list of compounds to be tested shall be those published in the most recent Compilation of Air Pollutant Emission Factors (AP-42). The following equation shall be used to calculate efficiency:  $(\text{NMOC}_{\text{in}} - \text{NMOC}_{\text{out}}) / \text{NMOC}_{\text{in}}$ . The District must be notified at least 30 days prior to any compliance source test, and a source test plan must be submitted for approval at least 15 days prior to testing. [District Rule 1081; 40 CFR 60.754(d)] Federally Enforceable Through Title V Permit

PERMIT UNIT REQUIREMENTS CONTINUE ON NEXT PAGE

These terms and conditions are part of the Facility-wide Permit to Operate.

Facility Name: CHEMICAL WASTE MANAGEMENT, INC  
Location: 35251 OLD SKYLINE ROAD, KETTLEMAN CITY, CA 93239  
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29. Permittee shall implement a program to monitor for cover integrity and implement cover repairs as necessary on a monthly basis. [40 CFR 60.755(c)(5)] Federally Enforceable Through Title V Permit
30. The portable analyzer shall meet the instrument specifications of Method 21, section 3 (except that "methane" shall replace all references to VOC). The calibration gas shall be methane, diluted to a nominal concentration of 500 parts per million in air. To meet the performance evaluation requirements of Method 21, section 3.1.3, the instrument evaluation procedures of Method 21, section 4.4. The calibration procedures provided in Method 21, section 4.2 shall be followed immediately before commencing a surface monitoring survey. The provisions of this condition apply at all times, except during periods of start-up, shutdown, or malfunction (as defined in 40 CFR 60.755(e)). [40 CFR 60.755(d), (e)] Federally Enforceable Through Title V Permit
31. The provisions of this subpart apply at all times, except during periods of start-up, shutdown, or malfunction, provided that the duration of start-up, shutdown, or malfunction shall not exceed 5 days for collections systems and shall not exceed 1 hour for treatment or control devices. [40 CFR 60.755(e)] Federally Enforceable Through Title V Permit
32. Operator shall measure the gauge pressure in the gas collection header on a monthly basis as provided in 40 CFR 60.755(a)(3); and monitor nitrogen or oxygen concentration in the landfill gas on a monthly basis as provided in 40 CFR 60.755(a)(5); and monitor temperature of the landfill gas on a monthly basis as provided in 40 CFR 60.755(a)(5). [40 CFR 60.756(a)] Federally Enforceable Through Title V Permit
33. Permittee shall submit an equipment removal report to the District 30 days prior to removal or cessation of operation of the control equipment. The report shall conform to the requirements of 40 CFR 60.757(e)(1). [40 CFR 60.757(e)] Federally Enforceable Through Title V Permit
34. Permittee shall submit to the District semiannual reports of the recorded information in 40 CFR 60.757(f)(1-6). The initial report shall be submitted within 180 days of installation and start-up of the collection and control system, and shall include the initial performance test report required under 40 CFR 60.8. [40 CFR 60.757(f), 40 CFR 63.1980(a)] Federally Enforceable Through Title V Permit
35. Each owner or operator seeking to comply with 40 CFR 60.752(b)(2)(iii) shall include information specified in 40 CFR 60.757(g)(1-6) with the initial performance test report required under 40 CFR Part 60.8. [40 CFR 60.757(g)] Federally Enforceable Through Title V Permit
36. The following constitute exceedances that also shall be recorded and reported under 40 CFR 60.757(f): all 3-hour periods of operation during which the average combustion temperature was more than 28 C below the average combustion temperature during the most recent performance test (flare source test). [40 CFR 60.758(c)] Federally Enforceable Through Title V Permit
37. Except as provided in 60.752(b)(2)(i)(B), each owner or operator of a controlled landfill shall keep up-to-date, readily accessible records for the life of the control equipment of the data listed in paragraphs 60.758(b)(1) through (b)(4) as measured during the initial performance test or compliance determination. Records of subsequent tests or monitoring shall be maintained for a minimum of 5 years. Records of the control device vendor specifications shall be maintained until removal. [40 CFR 60.758(b)] Federally Enforceable Through Title V Permit
38. Permittee shall keep the following records: (1)(i) the maximum expected gas generation flow rate as calculated in 60.755(a)(1). The owner or operator may use another method to determine the maximum gas generation flow rate, if the method has been approved by the APCO; (ii) the density of wells, horizontal collectors, surface collectors, or other gas extraction devices determined using the procedures specified in 60.759(a)(1); (2)(i) the average combustion temperature measured at least every 15 minutes and averaged over the same time period of the performance test; (ii) the percent reduction of NMOC determined as specified in 60.752(b)(2)(iii)(B) achieved by the control device. [40 CFR 60.758(b)(1) and (2)] Federally Enforceable Through Title V Permit
39. Except as provided in 60.752(b)(2)(i)(B), permittee shall keep, for the life of the collection system, an up-to-date, readily accessible plot map showing each existing and planned collector in the system and providing a unique identification location label for each collector. Permittee shall keep readily accessible documentation of the nature, date of deposition, amount, and location of asbestos-containing or nondegradable waste excluded from collection as well as any nonproductive areas excluded from collection. [40 CFR 60.758(d)] Federally Enforceable Through Title V Permit

PERMIT UNIT REQUIREMENTS CONTINUE ON NEXT PAGE

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Facility Name: CHEMICAL WASTE MANAGEMENT, INC  
Location: 35251 OLD SKYLINE ROAD, KETTLEMAN CITY, CA 93239  
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40. Except as provided in 60.752(b)(2)(i)(B), permittee shall keep for at least 5 years up-to-date, readily accessible records of all collection and control system exceedances of the operational standards in 60.753, the reading in the subsequent month whether or not the second reading is an exceedance, and the location of each exceedance. [40 CFR 60.758(e)] Federally Enforceable Through Title V Permit
41. VOC emissions from the flare and landfill shall not exceed 240.7 lb-VOC/day. [District Rule 2201] Federally Enforceable Through Title V Permit
42. Emissions from the flare shall not exceed any of the following limits: 0.06 lb-NOx/MMBtu, 91.1 lb-SOx/day, 13,146 lb-SOx/year, 0.008 lb-PM10/MMBtu, 0.22 lb-CO/MMBtu, or 0.063 lb-VOC/MMBtu. [District Rule 2201] Federally Enforceable Through Title V Permit
43. The combined heat input of collected B-17 and B-19 landfill gas into the flare shall not exceed any of the following: 83.6 MMBtu/hr or 398,333 MMBtu/year. Heat input shall be calculated daily using monthly methane measurements (%), landfill gas flow into the flare (cubic feet per minute), and the annually tested landfill gas heat content (Btu/cubic foot). [District Rule 2201] Federally Enforceable Through Title V Permit
44. Enclosed flare shall reduce the inlet NMOC emissions by at least 98% by weight or to no more than 20 ppmvd @ 3% O2 as methane. [District Rule 2201] Federally Enforceable Through Title V Permit
45. The methane destruction efficiency for the enclosed flares shall be at least 99% by weight. [17 CCR 95464(b)(2)(A)(1)]
46. Emissions from the flare LPG-fired pilot shall not exceed any of the following limits: 0.15 lb-NOx/MMBtu, 0.0164 lb-SOx/MMBtu, 0.0044 lb-PM10/MMBtu, 0.021 lb-CO/MMBtu, or 0.0055 lb-VOC/MMBtu. [District Rule 2201] Federally Enforceable Through Title V Permit
47. A non-resettable, totalizing mass or volumetric landfill gas fuel flow meter to measure the amount of gas combusted in the enclosed flare shall be installed, utilized and maintained. [District Rule 2201] Federally Enforceable Through Title V Permit
48. Sampling ports adequate for sulfur testing shall be provided in the landfill gas manifold line to the flare. [District Rule 1081] Federally Enforceable Through Title V Permit
49. SOx emissions shall be determined by measuring the sulfur concentration in the landfill gas and calculating the correlated SOx emission rate based on the correlation between landfill gas sulfur concentration and associated SOx emission rate demonstrated during startup. [District Rule 1081] Federally Enforceable Through Title V Permit
50. Testing to demonstrate compliance with the daily and annual SOx emission limit shall be conducted weekly. Once eight (8) consecutive weekly tests show compliance, the frequency of monitoring sulfur content, and associated SOx emissions, may be reduced to monthly. If a monthly test shows violation of the SOx emission limit, then weekly testing shall resume and continue until eight (8) consecutive tests show compliance. Once compliance is shown on eight (8) consecutive weekly tests, then testing may return to monthly. [District Rule 2201] Federally Enforceable Through Title V Permit
51. Sulfur content of the landfill gas being combusted in the flare shall be determined using ASTM D 1072, D 3031, D 4084, D 3246 or double GC for H2S and mercaptans, or draeger tubes for H2S, or an equivalent method approved by the District. [District Rule 1081] Federally Enforceable Through Title V Permit
52. Total combined Class II/III waste material and Class II soil acceptance rate of C-283-22 and '-25 shall not exceed 2000 tons per day. [District Rule 2201] Federally Enforceable Through Title V Permit
53. Total combined Class II/III waste material acceptance rate of C-283-22 and '-25 shall not exceed 620,000 tons per year. [District Rule 2201] Federally Enforceable Through Title V Permit
54. Total combined Class II soil acceptance rate of C-283-22 and '-25 shall not exceed 800 tons per day. [District Rule 2201] Federally Enforceable Through Title V Permit
55. Total combined clean (<50 ppm by weight VOC) soil cover usage rate of C-283-22 and '-25 shall not exceed 6000 tons per day. [District Rule 2201] Federally Enforceable Through Title V Permit

PERMIT UNIT REQUIREMENTS CONTINUE ON NEXT PAGE

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Facility Name: CHEMICAL WASTE MANAGEMENT, INC  
Location: 35251 OLD SKYLINE ROAD, KETTLEMAN CITY, CA 93239  
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56. Total PM10 emissions from handling of Class II/III waste material and soil cover shall not exceed 0.000454 pounds per ton material handled. [District Rule 2201] Federally Enforceable Through Title V Permit
57. Source testing on the flare shall be performed to demonstrate compliance with the flare NOx and CO limits, and the NMOC destruction efficiency of 98%, or no more than 20 ppmvd @ 3% O2 as methane, as required by this permit shall be conducted within 60 days of startup and annually thereafter. [District Rule 2201] Federally Enforceable Through Title V Permit
58. Source testing for flare NOx emissions shall be conducted using CARB Method 7 or Method 20. [District Rule 1081] Federally Enforceable Through Title V Permit
59. Source testing for flare CO emissions shall be conducted using EPA Method 10 or 10B, CARB Methods I through 5 with 10, or CARB Method 100. [District Rule 1081] Federally Enforceable Through Title V Permit
60. Operator shall determine landfill gas fuel higher heating value annually by ASTM D 1826 or D 1945 in conjunction with ASTM D 3588 for gaseous fuels. [District Rule 2201] Federally Enforceable Through Title V Permit
61. The results of each landfill gas sulfur content test shall be submitted to the District within 60 days thereafter. [District Rule 1081] Federally Enforceable Through Title V Permit
62. Gas collection system shall be operated in a manner which maximizes the amount of landfill gas extracted while preventing overdraw that can cause fires or damage the gas collection system. [District Rule 2201] Federally Enforceable Through Title V Permit
63. During maintenance of the gas collection system or incineration device, emissions of landfill gas shall be minimized during shutdown. [District Rule 2201] Federally Enforceable Through Title V Permit
64. Maintenance is defined as work performed on a gas collection system and/or control device in order to ensure continued compliance with District rules, regulations, and/or Permits to Operate, and to prevent its failure or malfunction. [District Rule 2201] Federally Enforceable Through Title V Permit
65. The permittee shall notify the APCO by telephone at least 24 hours before performing any maintenance work that requires the system to be shutdown. The notification shall include a description of work, the date work will be performed and the amount of time needed to complete the maintenance work. [District Rule 2201] Federally Enforceable Through Title V Permit
66. Permittee shall maintain records of system inspections including: date, time and inspection results. [District Rule 1070] Federally Enforceable Through Title V Permit
67. Permittee shall maintain records of maintenance related or other collection system and control device downtime, including individual well shutdown. [District Rule 1070] Federally Enforceable Through Title V Permit
68. The operator shall record emission control device source tests (emissions of CO, NOx, and VOC) in pounds per MMbtu heat input. Operator shall also record VOC destruction/treatment efficiency. [District Rule 1081] Federally Enforceable Through Title V Permit
69. Daily records of the weight of materials received (tons) - including Class II/III waste material, Class II soil cover, and clean soil cover - and daily records of all soil organic content test results and certifications, shall be maintained, kept on site for a period of five years, and made available to District staff upon request. [District Rule 2201] Federally Enforceable Through Title V Permit
70. The District shall be notified in writing ten days prior to the acceptance of new types of waste streams, or waste streams with significant malodorous qualities. [District Rules 2201 and 4102] Federally Enforceable Through Title V Permit
71. A District approved anemometer shall be continuously operated on site with permanent data available to the District. [District Rule 2201] Federally Enforceable Through Title V Permit
72. Wastes with the potential to release hazardous gases, mists, or vapors in excess of existing air quality standards shall not be exposed to the atmosphere, and combustion of flammable wastes in the landfill shall be prevented. [District Rule 2201] Federally Enforceable Through Title V Permit

PERMIT UNIT REQUIREMENTS CONTINUE ON NEXT PAGE

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Facility Name: CHEMICAL WASTE MANAGEMENT, INC  
Location: 35251 OLD SKYLINE ROAD, KETTLEMAN CITY, CA 93239  
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73. A record of continuous flare combustion temperature, continuous volumetric gas flow rate, net heating value of landfill gas being combusted, daily landfill gas fuel consumption, and daily heat input shall be maintained, retained on the premises for a period of at least five years and made readily available for District inspection upon request. [District Rule 2201] Federally Enforceable Through Title V Permit
74. Records of daily and annual landfill gas flow rate, annual test results of higher heating value of landfill gas, and calculated daily and annual SOx emissions shall be maintained. [District Rule 2201] Federally Enforceable Through Title V Permit
75. The collection devices within the interior and along the perimeter areas shall be certified to achieve comprehensive control of surface gas emissions by a professional engineer. The following issues shall be addressed in the design: depths of refuse, refuse gas generation rates and flow characteristics, cover properties, gas system expandability, leachate and condensate management, accessibility, compatibility with filling operations, integration with closure end use, air intrusion control, corrosion resistance, fill settlement, and resistance to the refuse decomposition heat. [40 CFR 60.759(a)(1)] Federally Enforceable Through Title V Permit
76. The placement of gas collection devices determined in paragraph 60.759(a)(1) shall control all gas producing areas, except as provided by paragraphs 60.759(a)(3)(i) and (a)(3)(ii). [40 CFR 60.759(a)(3)] Federally Enforceable Through Title V Permit
77. The sufficient density of gas collection devices determined in paragraph 60.759(a)(1) shall address landfill gas migration issues and augmentation of the collection system through the use of active or passive systems at the landfill perimeter or exterior. [40 CFR 60.759(a)(2)] Federally Enforceable Through Title V Permit
78. Any segregated area of asbestos or nondegradable material may be excluded from collection if documented as provided under 60.758(d). The documentation shall provide the nature, date of deposition, location and amount of asbestos or nondegradable material deposited in the area, and shall be provided to the Administrator upon request. [40 CFR 60.759(a)(3)(i)] Federally Enforceable Through Title V Permit
79. Any nonproductive area of the landfill may be excluded from control provided that the total of all excluded areas can be shown to contribute less than 1 percent of the total amount of NMOC emissions from the landfill. The amount, location, and age of the material shall be documented and provided to the Administrator upon request. A separate NMOC emissions estimate shall be made for each section proposed for exclusion, and the sum of all such sections shall be compared to the NMOC emissions estimate for the entire landfill. Emissions from each section shall be computed using the equation in Section 60.759(a)(3)(ii). [40 CFR 60.759(a)(3)(ii)] Federally Enforceable Through Title V Permit
80. The values for k and CNMOC in equation in Section 60.759(a)(3)(ii) determined in field testing shall be used if field testing has been performed in determining the NMOC emission rate or the radii of influence (this distance from the well center to a point in the landfill where the pressure gradient applied by the blower or compressor approaches zero). If field testing has not been performed, the default values for k, L<sub>o</sub>, and CNMOC provided in 60.754(a)(1) or the alternative values from 60.754(a)(5) shall be used. The mass of nondegradable solid waste contained within the given section may be subtracted from the total mass of the section when estimating emissions provided the nature, location, age, and amount of the nondegradable material is documented as provided in paragraph 60.759(a)(3)(i). [40 CFR 60.759(a)(3)(iii)] Federally Enforceable Through Title V Permit

PERMIT UNIT REQUIREMENTS CONTINUE ON NEXT PAGE

These terms and conditions are part of the Facility-wide Permit to Operate.

Facility Name: CHEMICAL WASTE MANAGEMENT, INC  
Location: 35251 OLD SKYLINE ROAD, KETTLEMAN CITY, CA 93239  
C-283-25-3 : Mar 6 2014 4:25PM - KLEVANNO

81. Each owner or operator seeking to comply with 60.752(b)(2)(i)(A) shall construct the gas collection devices using the following equipment or procedures: (1) The landfill gas extraction components shall be constructed of polyvinyl chloride (PVC), high density polyethylene (HDPE) pipe, fiberglass, stainless steel, or other nonporous corrosion resistant material of suitable dimensions to: convey projected amounts of gases; withstand installation, static, and settlement forces; and withstand planned overburden or traffic loads. The collection system shall extend as necessary to comply with emission and migration standards. Collection devices such as wells and horizontal collectors shall be perforated to allow gas entry without head loss sufficient to impair performance across the intended extent of control. Perforations shall be situated with regard to the need to prevent excessive air infiltration; (2) Vertical wells shall be placed so as not to endanger underlying liners and shall address the occurrence of water within the landfill. Holes and trenches constructed for piped wells and horizontal collectors shall be of sufficient cross-section so as to allow for their proper construction and completion including, for example, centering of pipes and placement of gravel backfill. Collection devices shall be designed so as not to allow indirect short circuiting of air into the cover or refuse into the collection system or gas into the air. Any gravel used around pipe perforations should be of a dimension so as not to penetrate or block perforations; (3) Collection devices may be connected to the collection header pipes below or above the landfill surface. The connector assembly shall include a positive closing throttle valve, any necessary seals and couplings, access couplings and at least one sampling port. The collection devices shall be constructed of PVC, HDPE, fiberglass, stainless steel, or other nonporous material of suitable thickness. [40 CFR 60.759(b)] Federally Enforceable Through Title V Permit
82. Each owner or operator seeking to comply with 60.752(b)(2)(i)(A) shall convey the landfill gas to a control system in compliance with 60.752(b)(2)(iii) through the collection header pipe(s). The gas mover equipment shall be sized to handle the maximum gas generation flow rate expected over the intended use period of the gas moving equipment using the following procedures: (1) For existing collection systems, the flow data shall be used to project the maximum flow rate. If no flow data exists, the procedures in paragraph 60.759(c)(2) shall be used; (2) For new collection systems, the maximum flow rate shall be in accordance with 60.755(a)(1). [40 CFR 60.759(c)] Federally Enforceable Through Title V Permit
83. Continuous parameter monitoring data, collected under 40 CFR 60.756(b)(1), (c)(1), and (d), are used to demonstrate compliance with the operating conditions for control systems. If a deviation occurs, the permittee has failed to meet the control device operation conditions described in this subpart and has deviated from the requirements of this subpart. The permittee shall develop a written SSM plan according to the provisions in 40 CFR 63.6(e)(3). A copy of the SSM plan must be maintained on site. Failure to write or maintain a copy of the SSM plan is a deviation from the requirements of this subpart. [40 CFR 63.1960] Federally Enforceable Through Title V Permit
84. The permittee shall maintain records as specified in the general provisions of 40 CFR part 60 and this part as shown in Table 1 of this subpart. Applicable records in the general provisions include items such as SSM plans and the SSM plan reports. [40 CFR 63.1980(b)] Federally Enforceable Through Title V Permit
85. The permittee shall submit the initial semiannual compliance report and performance tests results described in 40 CFR 60.757(f) within 180 days after the date required to being operating the gas collection and control system by 63.1947(c) of this subpart. [40 CFR 63.1980(e)] Federally Enforceable Through Title V Permit
86. All records shall be maintained and retained on-site for a period of at least 5 years and shall be made available for District inspection upon request. [District Rule 1070] Federally Enforceable Through Title V Permit
87. The landfill surface shall be monitored quarterly. If there are any exceedances during a quarterly event, monitoring will be required monthly until three consecutive months without exceedances, which would allow a return to quarterly monitoring. [District Rule 2201] Federally Enforceable Through Title V Permit
88. After an exceedance, the permittee shall initiate correction action within five days and conduct remonitoring within ten days from the initial exceedance. If compliance is shown, an additional remonitoring event is required within one month of the initial exceedance. If the ten day event shows an exceedance, the permittee shall initiate correction action within five days and conduct remonitoring within ten days from the second exceedance. If compliance is shown, an additional remonitoring is required within one month of the initial exceedance. If the second ten day event shows an exceedance, the permittee shall permit and install additional landfill gas wells to correct the problem within 120 days of the initial exceedance. [District Rule 2201] Federally Enforceable Through Title V Permit

PERMIT UNIT REQUIREMENTS CONTINUE ON NEXT PAGE

These terms and conditions are part of the Facility-wide Permit to Operate.

Facility Name: CHEMICAL WASTE MANAGEMENT, INC  
Location: 35251 OLD SKYLINE ROAD, KETTLEMAN CITY, CA 93239  
C-283-25-3: Mar 6 2014 4:26PM - KLEVANN

89. The gas collection and control system shall comply with the operational standards of 40 CFR 60.753, the compliance provisions of 40 CFR 60.755, the monitoring provisions of 40 CFR 60.756, the reporting and record keeping requirements of 40 CFR 60.757 and 60.758, and the requirements of 40 CFR 60.759 (for active collection systems). [40 CFR 60.752(b)(2)(ii), 60.753, 60.755, 60.756, 60.757, 60.758 and 60.759] Federally Enforceable Through Title V Permit
90. In the event that the collection or control system becomes inoperable, the gas mover equipment (as defined in 40 CFR 60.751) shall be shut down and all valves in the collection and control system contributing to venting of the landfill gas to the atmosphere shall be closed within one hour. [40 CFR 60.753(e)] Federally Enforceable Through Title V Permit
91. The owner/operator shall install, calibrate, maintain, and operate a meter that measures and records the landfill gas flow rate into the flare at least once every 15 minutes. This meter shall also be capable of measuring the landfill gas flow rate that might bypass the flare in the event of equipment malfunction or maintenance. [40 CFR 60.756(c)(2)] Federally Enforceable Through Title V Permit
92. The flare shall be operated with a flame present at all times while gas is being vented to it. The presence of a flame shall be continuously monitored using a thermocouple, ultraviolet sensor, or any other equivalent device located at the pilot light or the flame itself. The flame's presence shall be recorded at least once every 15 minutes. [40 CFR 60.18(c)(2) and 40 CFR 60.756(c)(1)] Federally Enforceable Through Title V Permit
93. The enclosed flare shall be equipped with an accurate temperature indicator/recorder that continuously measures and records the operating temperature. [District Rule 2201; 40 CFR 60.756(b)(1)] Federally Enforceable Through Title V Permit
94. The enclosed flare shall be equipped with either a device that records flow to the control device at least every 15 minutes; or secure the bypass line valve in the closed position with a car-seal or a lock-and-key type configuration of the control device. [40 CFR 60.756(b)(2)] Federally Enforceable Through Title V Permit
95. Any closed landfill that has demonstrated compliance in three consecutive quarterly monitoring periods may perform annual monitoring. Quarterly monitoring shall resume if any methane readings of 500 ppm or more above background are detected during annual monitoring. [40 CFR 60.756(f)] Federally Enforceable Through Title V Permit
96. Permittee shall keep up-to-date, readily accessible continuous records of the indication of flow to the enclosed flare, or the indication of bypass flow, or records of monthly inspections of car-seals or lock-and-key configurations used to seal bypass lines. [40 CFR 60.758(c) and 60.34c] Federally Enforceable Through Title V Permit
97. The landfill is no longer required to comply with the requirements of 40 CFR Part 63 Subpart AAAA when it is no longer required to apply controls as specified in 40 CFR 60.752(b)(2)(v) of subpart WWW. [40 CFR 63.1950] Federally Enforceable Through Title V Permit
98. Except for the spreading of landfill cover, when handling bulk materials outside an enclosed structure or building, water or chemical/organic stabilizers/suppressants shall be applied as required to limit Visible Dust Emissions to a maximum of 20% opacity. When necessary to achieve this opacity limitation, wind barriers with less than 50% porosity shall also be used. [District Rules 8011 and 8031] Federally Enforceable Through Title V Permit
99. Except for the spreading of landfill cover, when transporting bulk materials outside an enclosed structure or building, all bulk material transport vehicles shall limit Visible Dust Emissions to 20% opacity by either limiting vehicular speed, maintaining sufficient freeboard on the load, applying water to the top of the load, or covering the load with a tarp or other suitable cover. [District Rules 8011 and 8031] Federally Enforceable Through Title V Permit
100. Records and other supporting documentation shall be maintained as required to demonstrate compliance with the requirements of the rules under Regulation VIII only for those days that a control measure was implemented. Such records shall include the type of control measure(s) used, the location and extent of coverage, and the date, amount, and frequency of application of dust suppressant, manufacturer's dust suppressant product information sheet that identifies the name of the dust suppressant and application instructions. Records shall be kept for one year following project completion that results in the termination of all dust generating activities. [District Rules 8031, 8071, and 8011] Federally Enforceable Through Title V Permit

PERMIT UNIT REQUIREMENTS CONTINUE ON NEXT PAGE

These terms and conditions are part of the Facility-wide Permit to Operate.

101. An owner/operator shall prevent or cleanup any carryout or trackout in accordance with the requirements of District Rule 8041 Section 5.0, unless specifically exempted under Rule 8041 or Rule 8011. [District Rules 8041 and 8011] Federally Enforceable Through Title V Permit
102. One or more of the following control measures shall be implemented on each day that 50 or more VDT (Vehicle Daily Trips), or 25 or more VDT with 3 or more axles, originates from within and remains exclusively within an unpaved vehicle/equipment traffic area: water, gravel, roadmix, or chemical/organic dust stabilizers/suppressants, vegetative materials, or other District-approved control measure shall be applied to unpaved vehicle travel areas as required to limit Visible Dust Emissions to 20% opacity and comply with the requirements for a stabilized unpaved road as defined in District Rule 8011. [District Rule 8071 and 8011] Federally Enforceable Through Title V Permit
103. On each day that 50 or more VDT (Vehicle Daily Trips), or 25 or more VDT with 3 or more axles, originates from within and remains exclusively within an unpaved vehicle/equipment traffic area, dusting materials accumulated on paved surfaces shall be removed daily or water and/or chemical/organic dust stabilizers/suppressants shall be applied to the paved surface as required to maintain continuous compliance with the requirements for a stabilized unpaved road as defined in District Rule 8011 and limit Visible Dust Emissions (VDE) to 20% opacity. [District Rule 8011 and 8071] Federally Enforceable Through Title V Permit
104. Whenever any portion of the site becomes inactive, Permittee shall restrict access and periodically stabilize any disturbed surface to comply with the conditions for a stabilized surface as defined in Section 3.58 of District Rule 8011. [District Rules 8071 and 8011] Federally Enforceable Through Title V Permit
105. The flare and gas collection system may be shut down when there is an insufficient amount of landfill gas to operate on. During the shutdown period, all gas collection system vents shall be closed and no emissions shall occur through the gas collection system. [District Rule 2201] Federally Enforceable Through Title V Permit
106. During the shutdown of the gas collection system, surface testing to measure the methane concentration at the surface of the landfill shall be conducted at least once every week using an organic vapor analyzer, flame ionization detector, or other portable monitor meeting the specifications provided in 40 CFR 60.755(d). After demonstrating compliance on four consecutive tests, the testing frequency shall be at least once every month. [District Rule 2201] Federally Enforceable Through Title V Permit
107. During the shutdown of the gas collection system, if the methane concentration measured during weekly or monthly surface testing exceeds 500 parts per million above background at the surface of the landfill, the testing frequency shall be at least once every other day. After demonstrating compliance on four consecutive tests, the testing frequency shall revert to at least once every week. [District Rule 2201] Federally Enforceable Through Title V Permit
108. During operation of the enclosed flare, the permittee shall continuously monitor and record combustion chamber temperature. The temperature readings shall not be less than 28 degree C (50 degree F) below the average combustion temperature determined during the most recent flare source test, averaged over a 3-hour period. Upon detecting any temperature excursion lower than 28 degree C (50 degree F) below the source test average combustion temperature, averaged over a 3-hour period, the permittee shall investigate the excursion and take corrective action to minimize excessive emissions and prevent recurrence of the excursion as expeditiously as practicable. [40 CFR part 64] Federally Enforceable Through Title V Permit
109. The temperature monitoring device shall be calibrated, maintained, and operated according to the manufacturer's specifications. [40 CFR part 64] Federally Enforceable Through Title V Permit
110. The enclosed flare burner and its associated components and the vapor collection system shall be inspected on an annual basis. The records of inspection shall at least contain date and time of inspection, identification of the person performing an inspection, parts replacement and repairs, and all maintenance actions taken. The records shall be kept and maintained for compliance inspection upon request. [40 CFR part 64] Federally Enforceable Through Title V Permit
111. The permittee shall comply with the compliance assurance monitoring operation and maintenance requirements of 40 CFR part 64.7. [40 CFR part 64] Federally Enforceable Through Title V Permit
112. The permittee shall comply with the recordkeeping and reporting requirements of 40 CFR part 64.9. [40 CFR part 64] Federally Enforceable Through Title V Permit

PERMIT UNIT REQUIREMENTS CONTINUE ON NEXT PAGE

These terms and conditions are part of the Facility-wide Permit to Operate.

113. If the District or EPA determine that a Quality Improvement Plan is required under 40 CFR 64.7(d)(2), the permittee shall develop and implement the Quality Improvement Plan in accordance with 40 CFR part 64.8. [40 CFR part 64] Federally Enforceable Through Title V Permit
114. Landfill gas collection system components downstream of blower have a leak limit of 500 ppmv as methane. Components must be checked quarterly. [17 CCR 95464(b)(1)(B), 17CCR 95469(b)(3)]
115. Landfill gas collection system wellheads must be operated under vacuum. Monthly monitoring of wellheads is required. Landfill gas collection system wellheads may be operated under neutral or positive pressure except as allowed in sections 95464(c), 95464(d), and 95464(e) [17 CCR 95464(b)(1)(C)]
116. Landfill gas collection and control system must be operated such that landfill surface methane emissions shall not exceed instantaneous surface emission limit of 500 ppmv as methane or integrated surface emission limit of 25 ppmv as methane. [17 CCR 95465]
117. Instantaneous and integrated landfill surface emissions measurements shall be done quarterly. The landfill may monitor annually provided they comply with requirements of 17 CCR 95469 (a)(3). [17 CCR 95469(a)]
118. Permittee shall keep records of all gas collection system downtime exceeding five days, including individual well shutdown and disconnection times and the reason for downtime. [17 CCR 95470(a)(1)(A)]
119. Permittee shall keep records of all gas control system downtime in excess of one hour, the reason for the downtime and the length of time the gas control system was shutdown. [17 CCR 95470(a)(1)(B)]
120. Permittee shall keep records of the expected gas generation flow rate calculated pursuant to section 95471(e). [17 CCR 95470(a)(1)(C)]
121. Permittee shall keep records of all instantaneous surface readings of 200 ppmv or greater; all exceedances of the limits in sections 95464(b)(1)(B) or 95465, including the location of the leak (or affected grid), leak concentration in ppmv, date and time of measurement, the action taken to repair the leak, date of repair, any required re-monitoring and the re-monitored concentration in ppmv, and wind speed during surface sampling; and the installation date and location of each well installed as part of a gas collection system expansion. [17 CCR 95470(a)(1)(D)]
122. Permittee shall keep records of any positive wellhead gauge pressure measurements, the date of the measurements, the well identification number, and the corrective action taken. [17 CCR 95470(a)(1)(E)]
123. Permittee shall conduct surface emission monitoring using either the procedures specified in section 95471(c) or the Los Angeles County Sanitation District monitoring procedure. Permittee shall keep records of which procedure was used. [17 CCR 95468]
124. Permittee shall keep records of delays encountered during repair of leaks or repair of positive wellhead readings. Documentation of delays shall be submitted with the annual report. [17 CCR 95468(a)(2)]
125. Permittee shall keep records of alternate landfill gas collection system modifications being implemented to correct an exceedance in the landfill gas surface emissions or wellhead pressure. Any alternative to installing a new well shall be documented and submitted with the annual report. [17 CCR 95468]
126. Permittee shall identify areas which are dangerous and unable to be inspected or contain only inert, non-decomposing waste. Areas shall be clearly identified on a map of the facility. A copy of the map shall be kept onsite as well as submitted with the annual report. [17 CCR 95468(a)(5)]
127. Permittee shall conduct monitoring of the landfill surface within 3 inches of the surface. The facility may monitor surface emissions with the probe tip at the height of the vegetation if there is vegetation and it is impractical to monitor at 3 inches from the landfill surface. [17 CCR 95468]
128. Permittee shall terminate surface emission testing when the measured average wind speed is over 10 mph or the instantaneous wind speed is over 20 mph. [17 CCR 95468(a)(3), 17 CCR 95471(c)(1)(C)]
129. Permittee shall only conduct surface emission testing when precipitation has met the following requirements. It has been 24 hours since measured precipitation of 0.01 to 0.15 inches. It has been 48 hours since measured precipitation of 0.16 to 0.24 inches. It has been 72 hours since measured precipitation of 0.25 or more inches. [17 CCR 95468]

PERMIT UNIT REQUIREMENTS CONTINUE ON NEXT PAGE

These terms and conditions are part of the Facility-wide Permit to Operate.

130. Permittee shall keep records of the annual solid waste acceptance rate and the current amount of waste-in-place. [17 CCR 95470(a)(1)(F)]
131. Permittee shall keep records of the nature, location, amount, and date of deposition of non-degradable waste for any landfill areas excluded from the collection system. [17 CCR 95470(a)(1)(G)]
132. Permittee shall keep records of any source tests conducted pursuant to section 95464(b)(4). [17 CCR 95470(a)(1)(H)]
133. The flare must be source tested annually for methane destruction efficiency of at least 99% by weight. If the flare is in compliance after three consecutive source tests, the facility may move to source testing the flare every three years. If subsequent tests show the flare out of compliance, the test frequency shall revert to annual testing. [17 CCR 95464(b)(4)(A)]
134. The flare must have automatic dampers, an automatic shutdown device, a flame arrester, and continuous recording temperature sensors. [17 CCR 95464(b)(2)(A)(2)]
135. The flare must operate within the parameter ranges established during the initial or most recent source test. [17 CCR 95464(b)(2)(A)(4)]
136. Permittee shall keep records describing the mitigation measures taken to prevent the release of methane or other emissions into the atmosphere during the following activities: 1. When solid waste was brought to the surface during the installation or preparation of wells, piping, or other equipment; 2. During repairs or the temporary shutdown of gas collection system components; or, 3. When solid waste was excavated and moved. [17 CCR 95470(a)(1)(I)]
137. Permittee shall keep records of any construction activities pursuant to section 95466. The records must contain the following information: 1. A description of the actions being taken, the areas of the MSW landfill that will be affected by these actions, the reason the actions are required, and any landfill gas collection system components that will be affected by these actions. 2. Construction start and finish dates, projected equipment installation dates, and projected shut down times for individual gas collection system components. 3. A description of the mitigation measures taken to minimize methane emissions and other potential air quality impacts. [17 CCR 95470(a)(1)(J)]
138. Permittee shall keep records of the equipment operating parameters specified to be monitored under section 95469(b)(1) as well as records for periods of operation during which the parameter boundaries established during the most recent source test are exceeded. The records must include the following information: 1. For enclosed flares, all 3-hour periods of operation during which the average temperature difference was more than 28 degrees Celsius (or 50 degrees Fahrenheit) below the average combustion temperature during the most recent source test at which compliance with sections 95464(b)(2) was determined and a gas flow rate device which must record the flow to the control device at least every 15 minutes. [17 CCR 95470(a)(1)(K), 17 CCR 95469(b)(1)(B)]
139. Permittee shall submit the following reports as required in section 95470(b): Closure notification, Equipment removal report and Annual report. All reports must be accompanied by a certification of truth, accuracy, and completeness signed by a responsible official. [17 CCR 95470(b)]
140. Permittee may request alternatives to the compliance measures, monitoring requirements, test methods and procedures of sections 95464, 95469, and 95471. Any requests must be submitted in writing. [17 CCR 95468]

These terms and conditions are part of the Facility-wide Permit to Operate.

## **APPENDIX I - Correspondences**



# San Joaquin Valley

## AIR POLLUTION CONTROL DISTRICT



June 30, 2014

Horizon Air Measurement Services, Inc.  
Attn: Mr. Richard Vacherot  
310 Cortez Circle  
Camarillo, CA 93012

**RE: Approval of Test Protocol**  
Chemical Waste Management, Inc.  
July 17, 2014  
Permit to Operate: C-283-22-17

District staff has completed the review of the test protocol submitted for the testing of a municipal solid waste bioreactor landfill served by a biogas enclosed flare. Staff finds the protocol will meet the District's requirements. Should the test date or test methods change from the approved protocol, then a modified protocol shall be submitted for review no later than seven (7) days prior to the scheduled test date. Submittal of the modified protocol after this date may result in test cancellation by District staff.

Standard conditions include the following:

- 1) All data must be recorded by a data logger and shall be submitted to the District in hard copy and in electronic form on disk.
- 2) A colored copy of the original 110% strip chart must be submitted with the report.
- 3) If at any time during a test run the measured concentration exceeds the span, the test run shall be considered invalid for determining compliance (in some cases, two recorders or a dual-range recorder may be necessary). The emission standard shall not be less than 30% of the monitoring range.
- 4) Source test is being performed in accordance with the most recent PTO/ATC.
- 5) All testing must be done during normal District business hours unless otherwise approved.

If the equipment to be tested is being operated under a District issued Authority to Construct, it is the operator's responsibility to contact the District and schedule a start-up inspection prior to the scheduled source test date. Failure to do so may result in cancellation of the scheduled source test. If you have any questions, please contact Mr. Joe Avila at (559) 230-5951.

Sincerely,

Lupe Jauregui  
Supervising Air Quality Inspector

Joe Avila  
Air Quality Inspector II

## **APPENDIX J - Certifications**



# South Coast Air Quality Management District

21865 Copley Drive, Diamond Bar, CA 91765-4178  
(909) 396-2000 • [www.aqmd.gov](http://www.aqmd.gov)

April 16, 2014

Mr. Richard Vacherot  
Horizon Air Measurement Services, Inc.  
310 Cortez Circle  
Camarillo, CA 93012

Subject: LAP Approval Notice  
Reference # 94LA0211

Dear Mr. Vacherot:

We completed our review of the renewal application you submitted for approval under the South Coast Air Quality Management District's Laboratory Approval Program (SCAQMD LAP). We are pleased to inform you that your firm is approved for the period beginning May 31, 2014, and ending May 31, 2015 for the following methods:

- SCAQMD Methods 1-4
- SCAQMD Method 100.1
- SCAQMD Method 25.1 (Sampling & Trap Burning)
- SCAQMD Method 25.3 (Sampling)
- SCAQMD Methods 5.1, 5.2, 5.3, and 6.1 (Sampling & Analysis)
- SCAQMD Rule 462 Testing
- SCAQMD Rule 1174 Protocol
- SCAQMD Rule 1420/ 1420.1 – Source Sampling

Thank you for participating in the SCAQMD LAP. Your cooperation helps us to achieve the goal of the LAP: to maintain high standards of quality in the sampling and analysis of source emissions. You may direct any questions or information to LAP Coordinator, Glenn Kasai. He may be reached by telephone at (909) 396-2271, or via e-mail at [gkasai@aqmd.gov](mailto:gkasai@aqmd.gov).

Sincerely,

Rudy Eden, Senior Manager  
Laboratory Services &  
Source Test Engineering

RE:GK/gk

cc: Dipankar Sarkar


140416 LapRenewal.doc

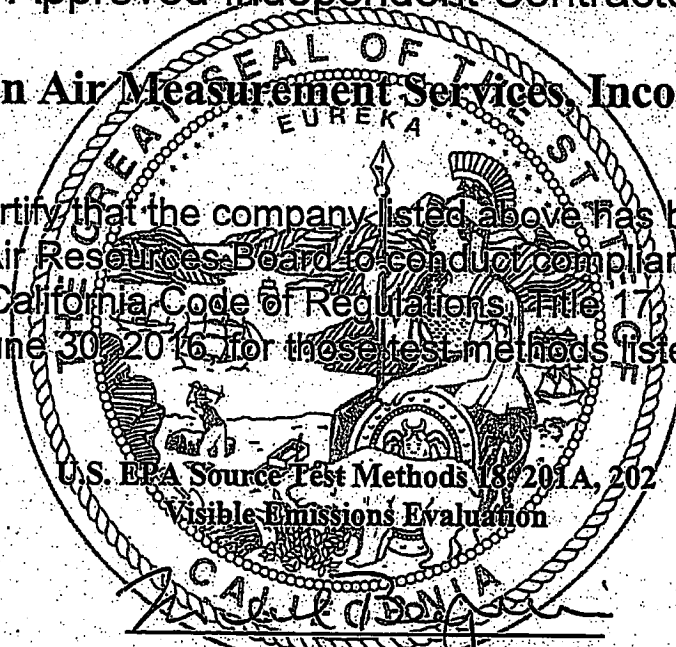
State of California  
Air Resources Board  
Approved Independent Contractor

**Horizon Air Measurement Services, Incorporated**

This is to certify that the company listed above has been approved  
by the Air Resources Board to conduct compliance testing  
pursuant to California Code of Regulations, Title 17, Section 91207,  
until June 30, 2016, for those test methods listed below:

U.S. EPA Source Test Methods 18, 201A, 202  
Visible Emissions Evaluation

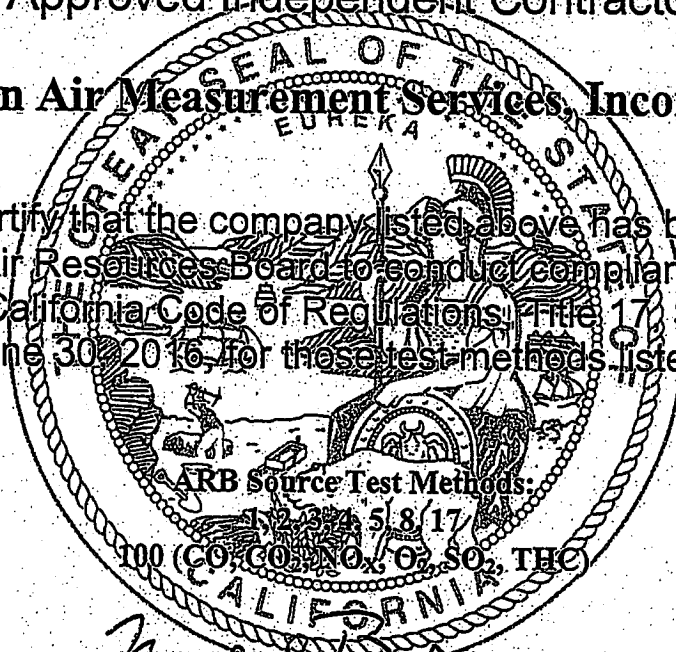
  
Dr. Michael T. Benjamin, Chief  
Monitoring and Laboratory Division



State of California  
**Air Resources Board**  
Approved Independent Contractor

**Horizon Air Measurement Services, Incorporated**

This is to certify that the company listed above has been approved  
by the Air Resources Board to conduct compliance testing  
pursuant to California Code of Regulations, Title 17, Section 91207,  
until June 30, 2016, for those test methods listed below:



ARB Source Test Methods:

1, 2, 3, 4, 5, 8, 17

100 (CO, CO<sub>2</sub>, NO<sub>x</sub>, O<sub>2</sub>, SO<sub>2</sub>, THC)

Dr. Michael T. Benjamin, Chief  
Monitoring and Laboratory Division

**THIS IS THE LAST PAGE  
OF THIS DOCUMENT**



# San Joaquin Valley

AIR POLLUTION CONTROL DISTRICT



June 30, 2014

Horizon Air Measurement Services, Inc.  
Attn: Mr. Richard Vacherot  
310 Cortez Circle  
Camarillo, CA 93012

**RE: Approval of Test Protocol**  
Chemical Waste Management, Inc.  
July 17, 2014  
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- 1) All data must be recorded by a data logger and shall be submitted to the District in hard copy and in electronic form on disk.
- 2) A colored copy of the original 110% strip chart must be submitted with the report.
- 3) If at any time during a test run the measured concentration exceeds the span, the test run shall be considered invalid for determining compliance (in some cases, two recorders or a dual-range recorder may be necessary). The emission standard shall not be less than 30% of the monitoring range.
- 4) Source test is being performed in accordance with the most recent PTO/ATC.
- 5) All testing must be done during normal District business hours unless otherwise approved.

If the equipment to be tested is being operated under a District issued Authority to Construct, it is the operator's responsibility to contact the District and schedule a start-up inspection prior to the scheduled source test date. Failure to do so may result in cancellation of the scheduled source test. If you have any questions, please contact Mr. Joe Avila at (559) 230-5951.

Sincerely,

Lupe Jauregui  
Supervising Air Quality Inspector



Joe Avila  
Air Quality Inspector II



**San Joaquin Valley**  
**AIR POLLUTION CONTROL DISTRICT**



June 30, 2014

Chemical Waste Management, Inc  
Attn: Mr. Paul Turek  
PO Box 471  
Kettleman City, CA 93239-0471

**RE: Approval of Test Protocol**  
Chemical Waste Management, Inc.  
July 17, 2014  
Permit to Operate: C-283-22-17

District staff has completed the review of the test protocol submitted for the testing of a municipal solid waste bioreactor landfill served by a biogas enclosed flare. Staff finds the protocol will meet the District's requirements. Should the test date or test methods change from the approved protocol, then a modified protocol shall be submitted for review no later than seven (7) days prior to the scheduled test date. Submittal of the modified protocol after this date may result in test cancellation by District staff.

Standard conditions include the following:

- 1) All data must be recorded by a data logger and shall be submitted to the District in hard copy and in electronic form on disk.
- 2) A colored copy of the original 110% strip chart must be submitted with the report.
- 3) If at any time during a test run the measured concentration exceeds the span, the test run shall be considered invalid for determining compliance (in some cases, two recorders or a dual-range recorder may be necessary). The emission standard shall not be less than 30% of the monitoring range.
- 4) Source test is being performed in accordance with the most recent PTO/ATC.
- 5) All testing must be done during normal District business hours unless otherwise approved.

If the equipment to be tested is being operated under a District issued Authority to Construct, it is the operator's responsibility to contact the District and schedule a start-up inspection prior to the scheduled source test date. Failure to do so may result in cancellation of the scheduled source test. If you have any questions, please contact Mr. Joe Avila at (559) 230-5951.

Sincerely,

Lupe Jauregui  
Supervising Air Quality Inspector

Joe Avila  
Air Quality Inspector II



Received

JUN 26 2014

SJVAPCD

**WASTE MANAGEMENT**

35251 Old Skyline Road  
P.O. Box 471  
Kettleman City, CA 93239

June 24, 2014

CERTIFIED MAIL (7011 3500 0003 1588 6383)

John Copp  
San Joaquin Valley Air Pollution Control District  
1990 E. Gettysburg Avenue  
Fresno, California 93726-0244

**RE: CHEMICAL WASTE MANAGEMENT, INC. - KETTLEMAN HILLS FACILITY  
15-DAY SUBMISSION OF SOURCE TEST PROTOCOL – B-19 & B-17 GCCS FLARE**

Dear Mr. Copp,

As you'll recall, in a letter titled 30-Day Notice of Source Test – Landfills B-19 & B-17 GCCS Flare, dated June 12, 2014, the Chemical Waste Management, Inc. – Kettleman Hill Facility (KHF) provided the San Joaquin Valley Air Pollution Control District (SJVAPCD) a 30-day notice that KHF will be source testing the KHF landfills B-19 & B-17 gas collection and control system (GCCS) flare, permitted under PTOs C-283-22-17 and C-283-25-3, on **Thursday, July 17, 2014**.

Attached is the Test Plan to Conduct an Emission Compliance Test on a Landfill Gas Flare, prepared by Horizon Air Measurement Services, Inc., for that source test event.

PTOs C-283-22-17 and C-283-25-3 condition # 28 requires submittal of the source test protocol "at least 15 days prior to testing".

The source testing requirements can be found under PTO C-283-22-17 conditions 28, 42 - 45, 57 - 60, 68, and 136; and C-283-25-3 conditions 28, 42 - 45, 57 - 60, 68, and 133.

Please contact me at (559) 386-6151 if further information or clarification is needed.

Sincerely,  
CHEMICAL WASTE MANAGEMENT, INC.

A handwritten signature in black ink that reads "Paul Turek". The signature is written in a cursive, flowing style.

Paul Turek  
Environmental Manager

Attachment

cc: Jim Swaney, SJVAPCD (w/o attachment)  
Lupe Jauregui, SJVAPCD

***From everyday collection to environmental protection, Think Green® Think Waste Management.***





**Horizon Test No.: W07-084-TP**

**Date Submitted: June 19, 2014**

**Received**

**JUN 26 2014**

**SJVUAPCD**

**TEST PLAN TO  
CONDUCT AN EMISSION COMPLIANCE TEST  
ON A LANDFILL GAS FLARE**

**Permit to Operate C283-22-17 and C-283-25-3**

*Facility:*

**Chemical Waste Management, Inc.  
35251 Old Skyline Road  
Kettleman City, California 93239**

*Prepared for:*

**Chemical Waste Management, Inc.  
P.O. Box 471  
35251 Old Skyline Road  
Kettleman City, California 93239**

*Prepared by:*

**Horizon Air Measurement Services, Inc.  
310 Cortez Circle  
Camarillo, California 93012**

*Regulatory Agency:*

**San Joaquin Valley Air Pollution Control District  
1990 E. Gettysburg Avenue  
Fresno, California 93726**

A handwritten signature in black ink, appearing to read "Ed Swede", written over a horizontal line.

**Edward S. Swede  
Sr. Project Manager**

A handwritten signature in black ink, appearing to read "Richard J. Vacherot", written over a horizontal line.

**Richard J. Vacherot  
Technical Director**



June 19, 2014

Via: Email & UPS

Mr. Paul Turek  
Environmental Manager  
Chemical Waste Management, Inc.  
35251 Old Skyline Road  
Kettleman City, California 93239

Dear Mr. Turek:

Please find enclosed three (3) copies of the Test Plan entitled "Test Plan to Conduct an Emission Compliance Test on a Landfill Gas Flare" for your submittal to SJVAPCD.

If you have any questions, please call me at (805) 482-8753.

Sincerely,

HORIZON AIR MEASUREMENT SERVICES, INC.

A handwritten signature in black ink, appearing to read "Ed Swede", written over a horizontal line.

Edward S. Swede  
Sr. Project Manager

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## **1. INTRODUCTION**

Under San Joaquin Valley Air Pollution Control District (SJVAPCD) Permit to Operate Nos. C283-22-17 and C-283-25-3, Chemical Waste Management, Inc. is required to conduct an annual source test on the landfill gas flare at the Kettleman Hills Facility located in Kettleman City, California. Horizon Air Measurement Services, Inc. (Horizon) has been retained for this purpose. The compounds of interest to be quantified and the associated test methods are provided in Table 1-1. The emission limits for the subject flare are provided in Table 1-2.

A brief description of the flare and anticipated flare operating conditions during testing is provided in Section 2. Samples will be taken for each parameter of interest in accordance with the sampling/analytical procedures in Section 3. Final report format is provided in Section 4.

**Table 1-1**  
**Compounds of Interest**  
**Chemical Waste Management, Inc.**  
**Kettleman Hills Facility Flare**

<b><u>Parameter</u></b>	<b><u>Location</u></b>	<b><u>Method</u></b>	<b><u>No. of Samples Per Source</u></b>
Oxides of Nitrogen	Outlet	CARB 100 *	3
Carbon Monoxide	Outlet	CARB 100	3
Nitrogen	Outlet	CARB 100 (by difference)	3
Oxygen	Outlet	CARB 100	3
Carbon Dioxide	Outlet	CARB 100	3
Flow Rate	Inlet	Fuel Gas Meter (Calibrated)	3
	Outlet	EPA Method 19	3
Higher Heating Value	Inlet	ASTM D-3588/D1945	3
Reactive Organic Compounds, as Non-Methane Hydrocarbons	Inlet	EPA 25C	3
	Outlet	EPA 25A	3
Methane	Inlet	EPA 25C	3
	Outlet	EPA 18	3

\* See Section 3.3 for discussion.

**Table 1-2**  
**Emission Limits - Flare**  
**Chemical Waste Management, Inc.**  
**Kettleman Hills Facility Flare**

	<b><u>lb/hr</u></b>	<b><u>lb/day</u></b>	<b><u>lb/MMBtu</u></b>
Oxides of Nitrogen	NA	NA	0.06
Carbon Monoxide	NA	NA	0.22
Reactive Organic Compounds (ROC)	NA	240.7	0.063
ROC Concentration Limit:	20 ppm as Methane @ 3% O <sub>2</sub>		
Alternative ROC Limit:	98% Destruction Efficiency		
Methane Limit:	99% Destruction Efficiency		

## **2. FLARE DESCRIPTION AND OPERATION**

### **2.1 Process Description**

The subject landfill is a municipal solid waste bioreactor landfill (B19), Class II and III, with a 4.2 million yard capacity (40.4 acres) and a municipal solid waste landfill (B17), Class II and III with 18.4 million yard capacity (62 acres). A gas collection system directs landfill gas from both B17 and B19 to a 2,500 scfm (83.6 MMBtu/hr) Parnel Biogas enclosed flare.

### **2.2 Flare Description**

The flare is a Parnel Biogas enclosed ground flare with a heat rate capacity of 83.6 MMBtu/hr.

### **2.3 Operating Conditions**

The following parameters will be monitored and recorded during the source test:

- Landfill Gas Flow Rate, scfm
- Flare Temperature, F

Process parameters will be recorded at a minimum of 15-minute intervals during testing.

### **3. SAMPLING/ANALYSES**

The sampling/analytical program has been designed to quantify the parameters of interest outlined in Table 1-1. Three, 40-minute test runs will be conducted for NO<sub>x</sub>, ROC, CO and O<sub>2</sub> concentration and emission rate determination. Additionally, three landfill gas samples will be collected and analyzed for higher heating value.

#### **3.1 Sample Location**

##### **3.1.1 Flare Exhaust**

At the flare exhaust 16 sample points (8 per diameter), determined in accordance with Method 1.1, will be utilized for the determination of the following parameters:

- NO<sub>x</sub>
- CO
- O<sub>2</sub>/CO<sub>2</sub>
- Flow Rate

A single sample point at the flare exhaust will be utilized for the collection and determination of the following parameters:

- ROC
- Methane

##### **3.1.3 Landfill Gas Supply Line**

Flow rate will be determined using the existing landfill gas flow meter. A single sample port will be utilized for the collection of the following compounds:

- higher heating value
- ROC

#### **3.2 Flow Rate**

##### **3.2.1 Inlet**

Landfill gas flow rate will be recorded from the facility in-line flow monitor.

### 3.2.2 Outlet

Since it is expected that the flare exhaust velocity is below the applicable limit (0.05 in. WG  $\Delta P$ ) of CARB Method 2, the exhaust flow rate will be calculated stoichiometrically, using EPA Method 19, based upon the landfill gas flow rate, landfill gas composition and stack dilution.

### 3.3 Oxides of Nitrogen, Carbon Monoxide, Carbon Dioxide, Oxygen (Continuous Emissions Monitoring)

Three, 40-minute test runs will be conducted at the flare exhaust. Sixteen sample points will be utilized. All sampling will be performed using Horizon's mobile CEMS in accordance with CARB Method 100, as detailed in Appendix A.

Condition 58 of PTO C-283-25-3 and PTO C-283-22-17 states "Source testing for flare  $NO_x$  emissions shall be conducted using CARB Method 7 or Method 20". However, Method 20 applies specifically to gas turbines and Method 7 is an antiquated, wet chemical method which does not provide real-time data; thus, CARB Method 100 is more applicable for  $NO_x$  concentration determination for this source.

### 3.4 Higher Heating Value

The higher heating value of the landfill gas will be determined from three samples analyzed in accordance with ASTM D-3588 as described in appendix A.

### 3.5 Reactive Organic Carbon (ROC) as Total Non-Methane Hydrocarbons (TNMHC)

#### 3.5.1 Inlet

Three, 40-minute test runs will be conducted at the flare inlet in accordance with EPA Method 25C as described in Appendix A to determine ROC concentration, as TNMHC. A description of EPA Method 25C is provided in Appendix A.

#### 3.5.2 Outlet

Three, 40-minute test runs will be conducted at the flare exhaust in accordance with EPA Method 25A, as described in Appendix A, to determine total hydrocarbon concentration. A Tedlar bag sample will also be obtained during each test run. Each Tedlar bag will be analyzed using EPA

Method 18 for methane and ethane concentration. The subsequent methane and ethane concentrations will be subtracted from the total hydrocarbon concentration to calculate the resulting ROC concentration. Additionally, the methane concentration will be used to calculate methane destruction efficiency.

#### **4. FINAL REPORT FORMAT**

Within 30 days of the final day of testing, Horizon will prepare a draft Final Report documenting the results of the testing program. The report will contain the following sections:

- Introduction
- Summary of Results
- Process and Operation Description
- Sampling and Analytical Procedures (including QA/QC summary)
- Results and Discussion
- Appendices

Appendices will contain calibration data, field data sheets, analytical results, calculation formulas and any pertinent process operating information. The presentation of results will include the following parameters from each test run at each location.

##### **Flare Stack**

- fixed gas composition (CO<sub>2</sub>, O<sub>2</sub>, N<sub>2</sub>)
- volumetric flow rate, (dscfm)
- oxides of nitrogen, (ppm, lb/hour, lb/MMBtu)
- carbon monoxide, (ppm, lb/hour, lb/MMBtu)
- reactive organic compounds, (ppm, lb/hour, lb/day, lb/MMBtu)
- methane (ppm, lb/hr)

##### **Landfill Gas**

- flow rate, (scfm)
- higher heating value, (MMBtu/dscf)
- reactive organic compounds, (ppm, lb/hr)
- methane (ppm, lb/hr)

## **APPENDIX A - Methods Description**

**Method:** **Sample Velocity Traverses for Stationary Sources**

**Applicable for Methods:** EPA Method 1, SCAQMD Method 1.1, CARB Method 1

**Principle:** To aid in the representative measurements of pollutant emissions and/or total volumetric flow rate from a stationary source, a measurement site where the effluent stream is flowing in a known direction is selected, and the cross section of the stack is divided into a number of equal areas. A traverse point is then located within these equal areas. The method cannot be used when, 1) flow is cyclonic or swirling, 2) stack is small than about 0.30 meter (12 inches) in diameter or 3) the measurement of the site is less than two stack or duct diameters downstream or less than a half diameter upstream from the flow disturbance.

<b>Method:</b>	<b>Stack Gas Velocity and Volumetric Flow Rate</b>
<b>Applicable for Methods:</b>	EPA Method 2, CARB 2, SCAQMD Method 2.1
<b>Principle:</b>	The average gas velocity in a stack gas is determined from the gas density and from measurement of the average velocity head with a type S or standard pitot tube.
<b>Sampling Procedure:</b>	Set up the apparatus as shown in the figure. Measure the velocity head and temperature at the traverse points specified by EPA Method 2, CARB Method 2 or SCAQMD Method 2.1. Measure the static pressure in the stack and determine the atmospheric pressure. The stack gas molecular weight is determined from independent measurements of O <sub>2</sub> , CO <sub>2</sub> and H <sub>2</sub> O concentrations.
<b>Sample Recovery: and Analyses:</b>	The stack gas velocity is determined from the measured average velocity head, the measured dry concentrations of O <sub>2</sub> and CO <sub>2</sub> and the measured concentration of H <sub>2</sub> O. The velocity is determined from the following set of equations:

Where,

$\Delta P$  = velocity head, inches in H<sub>2</sub>O

$T_s$  = gas/temperature, degrees R

$P_s$  = absolute static pressure

$M_{wd}$  = dry molecular weight

$M_w$  = molecular weight

$C_p$  = pitot flow coefficient

**Dry molecular weight of stack gas**

$$M_{wd} = 0.44 (\%CO_2) + 0.32 (\%O_2) + 0.28 (\%N_2 + \%CO)$$

**Molecular weight of stack gas, wet basis**

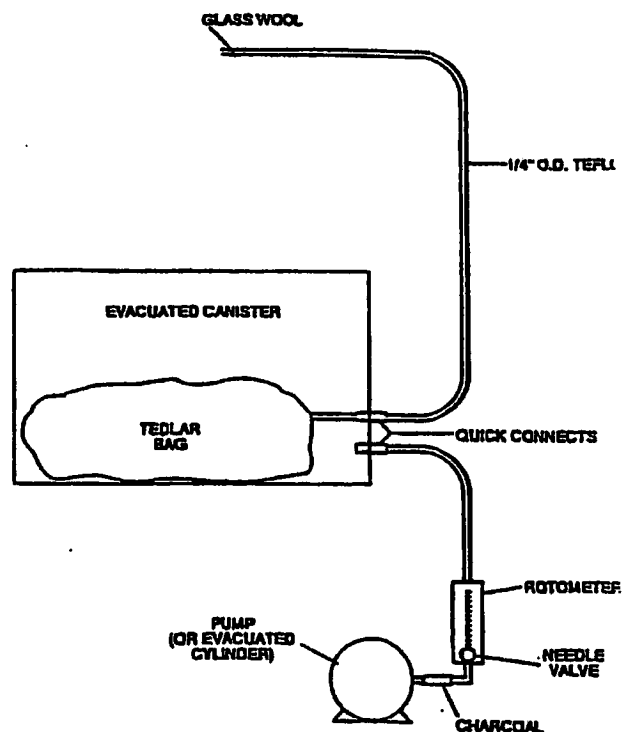
$$M_w = (M_{wd} \times M_d) + 18 (1 - M_d)$$

$$\text{Where, } M_d = \frac{100 - Bws}{100}$$

**Stack gas velocity**

$$(V_s)_{avg.} = (5130) C_p \times \sqrt{\Delta P_{avg.}} \times \sqrt{T_s} \times \left( \frac{1}{P_s \times M_w} \right)^{1/2}$$

<b>Method:</b>	<b>Measurement of Gaseous Organic Compound Emissions by Gas Chromatography</b>
<b>Reference:</b>	<b>EPA Method 18 (Tedlar Bag)</b>
<b>Principle:</b>	A Tedlar bag is filled with flue gas at a constant rate. The gas contents are analyzed by gas chromatography for speciated organic compounds.
<b>Sampling Procedure:</b>	<p>Exhaust samples are collected in Tedlar bags using the evacuated container sampling system which is capable of collecting an integrated, representative sample while ensuring sample integrity (diagram is included on the following page). The system consists of a 1/4" stainless steel probe followed by a 1/4" Teflon sample line and a non-reactive 10-liter Tedlar bag contained within a leak-free evacuation container. All system components coming in contact with the sample are constructed of Teflon or stainless steel. The probe is maintained at the stack temperature, while the sample line is maintained at 250 °F.</p> <p>Samples are collected by evacuating the canister at a constant rate over each test run using a rotameter/needle valve and a diaphragm pump. Prior to each sampling run, the evacuated canister (containing the Tedlar bag) is leak checked at 2 inches Hg vacuum. At the conclusion of each test run, each Tedlar bag sample is sealed and stored in an opaque container pending analysis.</p>
<b>Analytical Procedure:</b>	Samples are analyzed for speciated organic compounds using the appropriate gas chromatograph column and detector configurations.



**Method:** Determination of Total Gaseous Organic Concentration Using a Flame Ionization Analyzer

**Reference:** EPA Method 25A

**Principle:** A gas sample is extracted from the source through a heated sample line into a flame ionization detector.

**Analyzer:** Ratfisch Instruments Model 55 CA High Temperature Total Hydrocarbon Analyzer

**Measurement Principle:** Flame Ionization Detection

**Accuracy:** 1% of full scale

**Ranges:** 0-10, 100, 1000, 10,000 and 100,000 ppm

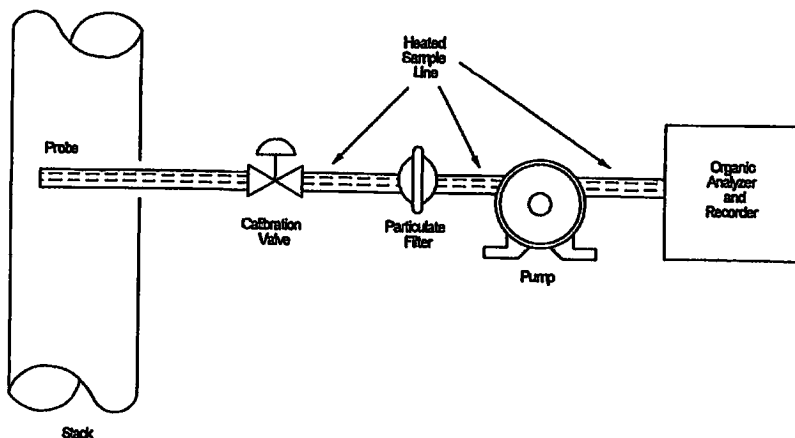
**Output:** 0-1 V

**Interferences:** None

**Response Time:** <5 seconds

**Sampling/Analytical Procedure:** The sampling extraction system is depicted in the figure. Sample is withdrawn through a heated sample probe and Teflon sample line, if necessary, into the flame ionization analyzer. Total gaseous organic concentration is continuously recorded on a strip chart recorder.

The sample interface (1/4" stainless steel probe and heated Teflon tubing) is assembled and the measurement system operated according to the manufacturers instructions. After spanning the instrument, linearity is checked on site using zero ( $\leq \pm 1\%$  of span value), high level, low level and mid level calibration gases. The mid level calibration gas is then introduced at the probe tip to determine sampling system bias. The sampling system is deemed acceptable for testing if the recorded value is within 5% of the span gas value. At the conclusion of each test a drift determination is made using zero and mid level gases. Prior to and at the conclusion of the test period a leak check, sample system bias and linearity check is performed. Calibration drift is checked and the instruments are recalibrated between each sub-test.



<b>Method:</b>	<b>Methane and Total Non-Methane Hydrocarbons by Total Carbon Analyses</b>
<b>Reference:</b>	<b>EPA Method 25C</b>
<b>Principle:</b>	Gaseous samples are collected in stainless steel canisters. The canisters are then pressurized with nitrogen and analyzed for methane and total non methane hydrocarbons (TNMHC) using a TCA/FID.
<b>Sampling Procedure:</b>	<p>Samples are collected, in duplicate, using stainless steel canisters which are evacuated to less than 10 mm Hg absolute. The tanks are pressurized and evacuated three times with ultrapure nitrogen and leak checked prior to use. A gas flow metering device and stainless steel shutoff valve is located just upstream of the canister. Representative, integrated samples are collected through a heat conditioned 1/4" stainless steel probe. The gas samples are metered into the canisters through the vacuum regulator maintaining a constant flow rate throughout each sampling period.</p> <p>The sampling apparatus is checked for leaks prior to the sampling program by attaching the probe end to an absolute pressure gauge and vacuum pump in series. The sample lines were evacuated to less than 10 mm Hg and the gauge shutoff valve is then closed. The sample lines are deemed to be leak-free if no loss of vacuum occurs as indicated by the vacuum gauge. During sampling the tank pressures are monitored with a 0-30 inch vacuum gauge to ensure integrated sampling.</p>
<b>Analytical Procedure:</b>	Samples are analyzed for methane and total non methane hydrocarbons (TNMHC) by total combustion analyses (TCA)/flame ionization detection (FID).

## CONTINUOUS EMISSIONS MONITORING SYSTEM - Trailer No. 3

### CARB Method 100

The continuous emissions monitoring system consists of a Thermo Electron Model 10 chemiluminescence NO/NO<sub>x</sub> analyzer, a Servomex Paramagnetic O<sub>2</sub> analyzer, a Thermo Electron Model 48C CO gas filter correlation analyzer and a Horiba PIR 2000 non dispersive infrared CO<sub>2</sub> analyzer. All analyzer specifications are provided in Table 1. All concentrations are determined on a dry basis. Concentrations of NO<sub>x</sub>, CO, O<sub>2</sub> and CO<sub>2</sub> are continuously recorded on a 10-inch strip chart recorder and a Daq View Data Acquisition System (DAS). The extractive monitoring system conforms with the requirements of CARB Method 100.

The sampling probe (heated to 250°F), constructed of 1/2 inch-diameter 316 stainless steel, is connected to a condenser with a six foot length of 3/8 inch Teflon line (heated to 250°F). A Nupro stainless steel filter (10 micron) is connected at the tip of the probe and maintained at stack temperature.

The condenser consists of a series of two stainless steel moisture knock-out bottles immersed in an ice water bath. The system is designed to minimize contact between the sample and the condensate. Condensate is continuously removed from the knock-out bottles via a peristaltic pump. The condenser outlet temperature is monitored either manually at 10-minute intervals or on a strip chart recorder/DAS system. The sample exiting the condenser is then transported through a filter, housed in a stainless steel holder, followed by 3/8 inch O.D. Teflon tubing and a Teflon coated (or stainless steel/viton) diaphragm pump to the sample manifold. The sample manifold is constructed of stainless steel tubing and directs the sample through each of four rotameters to the NO<sub>x</sub> monitor, O<sub>2</sub> monitor, CO monitor, CO<sub>2</sub> monitor and excess sample exhaust line, respectively. Sample flow through each channel is controlled by a back pressure regulator and by stainless steel needle valves on each rotameter. All components of the sampling system that contact the sample are composed of stainless steel, Teflon or glass.

Immediately upstream of the NO<sub>x</sub> analyzer(s) is an ammonia scrubber which removes all ammonia from the sample gas stream prior to introduction to the NO<sub>x</sub> analyzer to avoid interference. The ammonia scrubber consists of a stainless steel or other nonreactive cylindrical housing which contains 135cc of Perma Pure ammonia scrubbing Media A and 65cc of scrubbing Media B.

The calibration system is comprised of two parts: the analyzer calibration and the system bias check. The calibration gases are, at a minimum, certified to  $\pm 1\%$  by the manufacturer. Where necessary to comply with the reference method requirements, EPA Protocol 1 gases are used. The cylinders are equipped with pressure regulators which supply the calibration gas to the analyzers at the same pressure and flow rate as the sample. The selection of zero, span or sample gas directed to each analyzer is accomplished by operation of the zero, calibration or sample selector knobs located on the main flow control panel.

For CARB Method 100 testing, the following procedures are conducted before and after each series of test runs:

#### Leak Check:

The leak check is performed by plugging the end of the sampling probe, evacuating the system to at least 20 inches of Hg. The leak check is deemed satisfactory if the system holds 20 inches of Hg vacuum for five minutes with less than one inch Hg loss.

#### Linearity Check:

The NO<sub>x</sub>, CO, CO<sub>2</sub> and O<sub>2</sub> analyzers linearity check is performed by introducing, at a minimum, zero gas, mid range calibration gas (40-60% scale) and high range calibration gas (80-100% scale). Instrument span value is set on each instrument with the mid range gas. The high range calibration gas (80-100% scale) is then introduced into each instrument without any calibration adjustments. Linearity is confirmed, if all values agree with the calibration gas value to within 1% of the range.

### Stratification Check:

A stack stratification check is performed (pre-test only) by traversing the stack with the appropriate number of traverse alternately with the reference point (center). If the gas composition is homogenous, <10% variation between any traverse points in the gas stream and the normalized average point, single point gas sampling is performed at the reference point. If stratification exceeds the 10% criteria, then the stack cross section is traversed during sampling.

### System Bias Check:

The system bias check is accomplished by transporting the same gases used to zero and span the analyzers to the sample system as close as practical to the probe inlet. This is accomplished by opening a valve located on the probe, allowing the gas to flow to the probe and back through the moisture knockout and sample line to the analyzers. During this check the system is operated at the normal sampling rate with no adjustments. The system bias check is considered valid if the difference between the gas concentration exhibited by the measurement system which a known concentration gas is introduced at the sampling probe tip and when the sample gas is introduced directly to the analyzer, does not exceed  $\pm 5\%$  of the analyzer range.

### Response Time:

Response time (upscale and downscale) for each analyzer is recorded during the system bias check. Upscale response time is defined as the time it takes the subject analyzer gas to reach 95% of the calibration gas value after introducing the upscale gas to the sample bias calibration system. Downscale response time is defined as the time it takes the subject analyzer to return to zero after the zero gas is introduced into the sample system bias calibration system.

### NO<sub>x</sub> Conversion Efficiency

The NO<sub>x</sub> analyzer NO<sub>2</sub> conversion efficiency is determined by injecting a NO<sub>2</sub> gas standard directly into the NO<sub>x</sub> analyzer (after initial calibration). The analyzer response must be a least 90% of the NO<sub>2</sub> standard gas value.

In between each sampling run the following procedures are conducted:

### Zero and Calibration Drift Check:

Upon the completion of each test run, the zero and calibration drift check is performed by introducing zero and mid range calibration gases to the instruments, with no adjustments (with the exception of flow to instruments) after each test run. The analyzer response must be within  $\pm 3\%$  of the actual calibration gas value.

### Analyzer Calibration:

Upon completion of the drift test, the analyzer calibration is performed by introducing the zero and mid range gases to each analyzer prior to the upcoming test run and adjusting the instrument calibration as necessary.

### System Bias Check

(same as above)

A schematic of the sample system and specific information of the analytical equipment is provided in the following pages.

**TABLE 1**

**CONTINUOUS EMISSIONS MONITORING LABORATORY - Trailer No. 3**

**NO<sub>x</sub> CHEMILUMINESCENT ANALYZER -- THERMO ELECTRON MODEL 10 A**

Response Time (0-90%)	1.5 sec -- NO mode/1.7 sec -- NO <sub>x</sub> mode
Zero Drift	Negligible after 1/2 hour warmup
Linearity	± 1% of full scale
Accuracy	Derived from the NO or NO <sub>2</sub> calibration gas, ± 1% of full scale
Operating Ranges (ppm)	2.5, 10, 25, 100, 250, 1000, 2500, 10000
Output	0-1 volt

**O<sub>2</sub> ANALYZER, PARAMAGNETIC -- SERVOMEX MODEL 1400B**

Response Time (0-90%)	15 seconds
Accuracy	0.1% oxygen
Linearity	± 1% scale
Operating Ranges (%)	0-25, 0-100
Output	0-1 volt

**CO GAS FILTER CORRELATION -- THERMO ELECTRON MODEL 48C**

Response Time (0-95%)	1 minute
Zero Drift	± 0.2 ppm CO
Span Drift	Less than 1% full scale in 24 hours
Linearity	± 1% full scale, all ranges
Accuracy	± 0.1 ppm CO
Operating Ranges (ppm)	10, 100, 200, 500, 1,000, 2,000, 5,000, 10,000
Output	0-1 volt

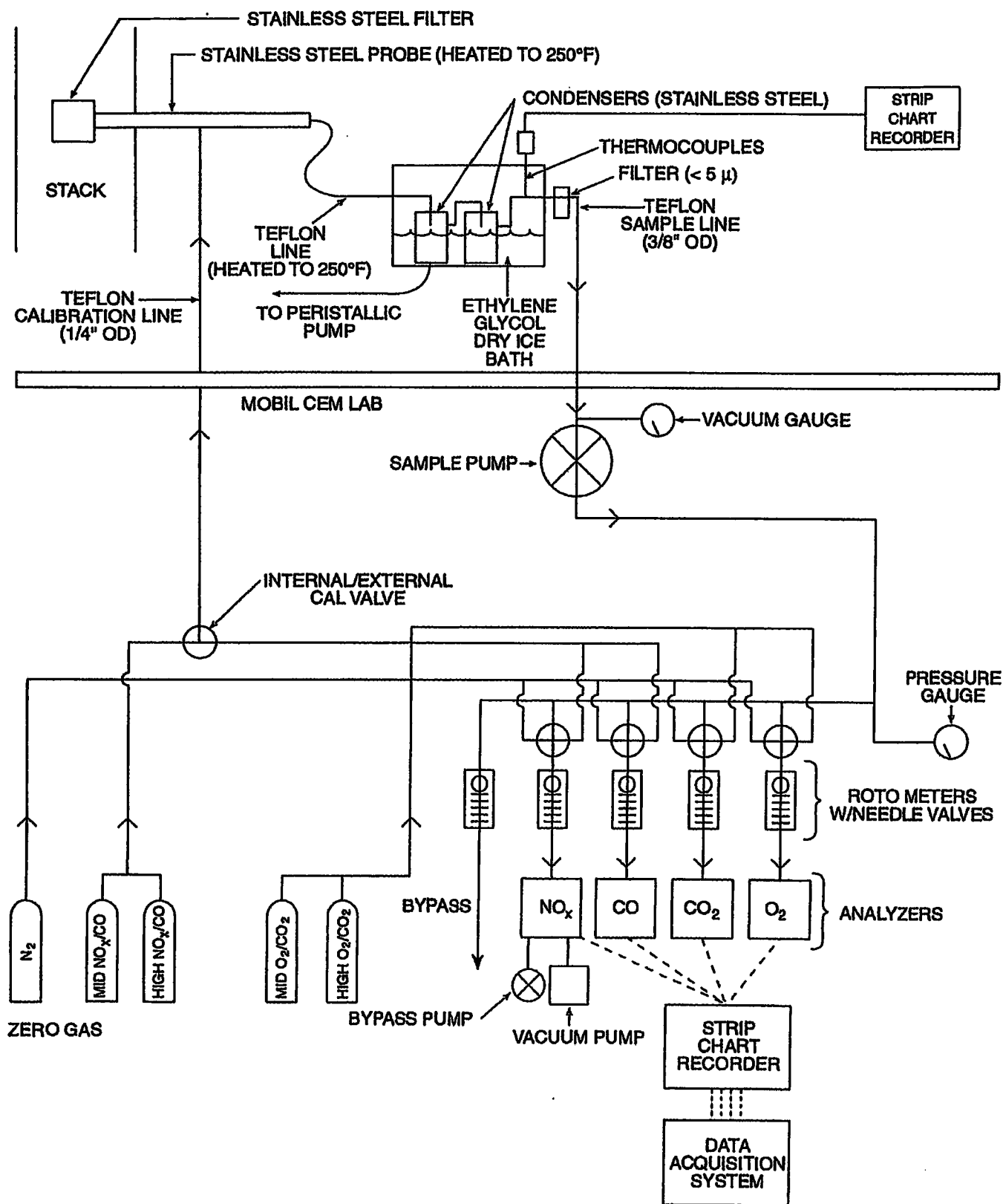
**CO<sub>2</sub> INFRARED GAS ANALYZER -- HORIBA- PIR 2000**

Response Time (0-90%)	5 seconds
Zero Drift	± 1% of full scale in 24 hours
Span Drift	± 1% of full scale in 24 hours
Linearity	± 2% of full scale
Resolution	Less than 1% of full scale
Operating Ranges (%)	0-5, 0-20
Output	0-1 volt

**TABLE 1 (Cont.)**

**YOKOGAWA MODEL LR8100 SIX PEN STRIP CHART RECORDER**

Pen Speed	up to 120 cm/min
Measuring Response	0-20 volts
Linearity Error	0.25%
Accuracy	0.3%
Zero Suppression	Manual (from 1 to 10X full scale)



**CEM System Schematic**

Method:	<b>NO/NO<sub>x</sub> by Continuous Analyzer</b>
Applicable Reference Methods:	EPA 7E, EPA 20; CARB 100, BAAQMD ST-13A, SCAQMD 100.1
Principle:	A sample is continuously withdrawn from the flue gas stream, conditioned and conveyed to the instrument for direct readout of NO or NO <sub>x</sub> .
Analyzer:	TECO Model 10A
Measurement Principle:	Chemiluminescence
Accuracy:	1% of full scale
Ranges:	0-2.5, 0-10, 0-25, 0-100, 0-250, 0-1000, 0-2500, 0-10,000 ppm
Output:	0-1 V or 0-10 V
Interferences:	Compounds containing nitrogen (other than ammonia) may cause interference.
Response Time:	90%, 1.5 seconds (NO mode) and 1.7 seconds (NO <sub>x</sub> mode)
Sampling Procedure:	A representative flue gas sample is collected and conditioned using the CEM system described previously. If EPA Method 20 is used, that method's specific procedures for selecting sample points are used.
Analytical Procedure:	<p>The oxides of nitrogen monitoring instrument is a chemiluminescent nitric oxide analyzer. the operational basis of the instrument is the chemiluminescent reaction of NO and ozone (O<sub>3</sub>) to form NO<sub>2</sub> in an excited state. Light emission results chemiluminescence is monitored through an optical filter by a high sensitivity photomultiplier tube, the output of which is electronically processed so it is linearly proportional to the NO concentration. The output of the instrument is in ppmV.</p> <p>When NO<sub>2</sub> is expected to be present in the flue gas, a supercooled water dropout flask will be placed in the sample line to avoid loss of NO<sub>2</sub>. Since NO<sub>2</sub> is highly soluble in water, "freezing out" the water will allow the NO<sub>2</sub> to reach the analyzers for analysis. The analyzer measures NO only. In the NO<sub>x</sub> mode, the gas is passed through a moly converter which converts NO<sub>2</sub> to NO and a total NO<sub>x</sub> measurement is obtained. NO<sub>2</sub> is determined as the difference between NO and NO<sub>x</sub>. Use of a moly converter instead of a stainless steel converter eliminates NH<sub>3</sub> interference; NH<sub>3</sub> is converted to NO with a stainless converter, but not with a moly converter.</p>

<b>Method:</b>	<b>Oxygen (O<sub>2</sub>) by Continuous Analyzer</b>
<b>Applicable Reference Methods:</b>	EPA 3A, EPA 20, CARB 100, BAAQMD ST-14, SCAQMD 100.1
<b>Principle:</b>	A sample is continuously withdrawn from the flue gas stream, conditioned and conveyed to the instrument for direct readout of O <sub>2</sub> concentration.
<b>Analyzer:</b>	Servo Mex
<b>Measurement Principle:</b>	Paramagnetic
<b>Ranges:</b>	0-25% 0-100%
<b>Accuracy:</b>	1% of full scale
<b>Output:</b>	0-1 V
<b>Interferences:</b>	Halogens and halogenated compounds will cause a positive interference. Acid gases will consume the fuel cell and cause a slow calibration drift.
<b>Response Time:</b>	90% <60 seconds
<b>Sampling Procedure:</b>	A representative flue gas sample is collected and conditioned using the CEM system described previously. If Method 20 is used, that method's specific procedures for selecting sample points are used. Otherwise, stratification checks are performed at the start of a test program to select single or multiple-point sample locations.
<b>Analytical Procedure:</b>	An electrochemical cell is used to measure O <sub>2</sub> concentration. Oxygen in the flue gas diffuses through a Teflon membrane and is reduced on the surface of the cathode. A corresponding oxidation occurs at the anode internally and an electric current is produced that is proportional to the concentration of oxygen. This current is measured and conditioned by the instrument's electronic circuitry to give an output in percent O <sub>2</sub> by volume.

<b>Method:</b>	<b>Carbon Dioxide (CO<sub>2</sub>) by Continuous Analyzer</b>
<b>Applicable Reference</b>	EPA 3A, CARB 100, BAAQMD ST-5, SCAQMD 100.1
<b>Principle:</b>	A sample is continuously drawn from the flue gas stream, conditioned and conveyed to the instrument for direct readout of CO <sub>2</sub> concentration.
<b>Analyzer:</b>	Horiba PIR 2000
<b>Measurement Principle:</b>	Non-dispersive infrared (NDIR)
<b>Accuracy:</b>	1% of full scale
<b>Ranges:</b>	0-5%, 0-15%, 0-25%
<b>Output:</b>	0-1 V
<b>Interferences:</b>	A possible interference includes water. Since the instrument receives dried sample gas, this interference is not significant.
<b>Response Time:</b>	5 seconds
<b>Sampling Procedure:</b>	A representative flue gas sample is collected and conditioned using the CEM system described previously.
<b>Analytical Procedure:</b>	Carbon dioxide concentrations are measured by short path length non-dispersive infrared analyzers. These instruments measure the differential in infrared energy absorbed from energy beams passed through a reference cell (containing a gas selected to have minimal absorption of infrared energy in the wavelength absorbed by the gas component of interest) and a sample cell through which the sample gas flows continuously. The differential absorption appears as a reading on a scale of 0-100%.

<b>Method:</b>	<b>Carbon Monoxide (CO) by NDIR/Gas Filter Correlation</b>
<b>Applicable Reference Methods:</b>	<b>EPA 10; CARB 1-100; BAAQMD ST-6, SCAQMD 100.1</b>
<b>Principle:</b>	<b>A sample is continuously drawn from the flue gas stream, conditioned and conveyed to the instrument for direct readout of CO concentration.</b>
<b>Analyzer:</b>	<b>TECO, Model 48C</b>
<b>Measurement Principle:</b>	<b>NDIR/Gas Filter Correlation</b>
<b>Precision:</b>	<b>0.1% ppm</b>
<b>Ranges:</b>	<b>0-10, 0-100, 0-200, 0-500, 0-1,000, 0-2,000, 0-5,000, 0-10,000</b>
<b>Output:</b>	<b>0-1 V</b>
<b>Interferences:</b>	<b>Negligible interference from water and CO<sub>2</sub></b>
<b>Rise/Fall times (0-95%)</b>	<b>1 minute @ 1 lpm flow, 30 second integration time</b>
<b>Sampling Procedure:</b>	<b>A representative flue gas sample is collected and conditioned using the CEM system described previously. Sample point selection has been described previously.</b>
<b>Analytical Procedure:</b>	<b>Radiation from an infrared source is chopped and then passed through a gas filter which alternates between CO and N<sub>2</sub> due to rotation of a filter wheel. The radiation then passes through a narrow band-pass filter and a multiple optical pass sample cell where absorption by the sample gas occurs. The IR radiation exits the sample cell and falls on a solid state IR detector.</b>

<b>Method:</b>	<b>Sulfur Dioxide (SO<sub>2</sub>) by Pulsed Fluorescent</b>
<b>Applicable Reference Methods:</b>	EPA 6C; CARB 1-100; BAAQMD ST-6, SCAQMD 100.1
<b>Principle:</b>	A sample is continuously drawn from the flue gas stream, conditioned and conveyed to the instrument for direct readout of SO <sub>2</sub> concentration.
<b>Analyzer:</b>	TECO, Model 43C-HL
<b>Measurement Principle:</b>	Pulsed fluorescence SO <sub>2</sub> analyzer
<b>Precision:</b>	0.1% ppm
<b>Ranges:</b>	5, 10, 20, 50, 100, 200, 500, 1,000, 2,000, 5,000 ppm
<b>Output:</b>	0-10 V
<b>Interferences:</b>	Less than lower detectable limit except for the following: NO <3 ppb, m-xylene <2 ppm, H <sub>2</sub> O <2% of reading.
<b>Response Time:</b>	80 seconds
<b>Sampling Procedure:</b>	A representative flue gas sample is collected and conditioned using the CEM system described previously. Sample point selection has been described previously.
<b>Analytical Procedure:</b>	The sample flows into the fluorescent chamber, where pulsating UV light excites the SO <sub>2</sub> molecules. The condensing lens focuses the pulsating UV light into the mirror assembly. The mirror assembly contains four selecting mirrors that reflect only the wavelengths which excite SO <sub>2</sub> molecules. As excited SO <sub>2</sub> molecules decay to lower energy states they emit UV light that is proportional to the SO <sub>2</sub> concentration. The PMT (photomultiplier tube) detects UV light emission from decaying SO <sub>2</sub> molecules. The PMT continuously monitors pulsating UV light source and is connected to a circuit that compensates for fluctuating in the light.



## Standard Practice for Calculating Heat Value, Compressibility Factor, and Relative Density of Gaseous Fuels<sup>1</sup>

This standard is issued under the fixed designation D 3588; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon ( $\epsilon$ ) indicates an editorial change since the last revision or reapproval.

### 1. Scope

1.1 This practice covers procedures for calculating heating value, relative density, and compressibility factor at base conditions (14.696 psia and 60°F (15.6°C)) for natural gas mixtures from compositional analysis.<sup>2</sup> It applies to all common types of utility gaseous fuels, for example, dry natural gas, reformed gas, oil gas (both high and low Btu), propane-air, carbureted water gas, coke oven gas, and retort coal gas, for which suitable methods of analysis as described in Section 6 are available. Calculation procedures for other base conditions are given.

1.2 The values stated in inch-pound units are to be regarded as the standard. The SI units given in parentheses are for information only.

1.3 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

### 2. Referenced Documents

#### 2.1 ASTM Standards:

- D 1717 Method for Analysis of Commercial Butane-Butene Mixtures and Isobutylene by Gas Chromatography<sup>3</sup>
- D 1945 Test Method for Analysis of Natural Gas by Gas Chromatography<sup>4</sup>
- D 1946 Practice for Analysis of Reformed Gas by Gas Chromatography<sup>4</sup>
- D 2163 Test Method for Analysis of Liquefied Petroleum (LP) Gases and Propane Concentrates by Gas Chromatography<sup>5</sup>

D 2650 Test Method for Chemical Composition of Gases by Mass Spectrometry<sup>5</sup>

#### 2.2 GPA Standards:

- GPA 2145 Physical Constants for the Paraffin Hydrocarbons and Other Components in Natural Gas<sup>6</sup>
- GPA Standard 2166 Methods of Obtaining Natural Gas Samples for Analysis by Gas Chromatography<sup>6</sup>
- GPA 2172 Calculation of Gross Heating Value, Relative Density, and Compressibility Factor for Natural Gas Mixtures from Compositional Analysis<sup>6,7</sup>
- GPA Standard 2261 Method of Analysis for Natural Gas and Similar Gaseous Mixtures by Gas Chromatography<sup>6</sup>
- GPA Technical Publication TP-17 Table of Physical Properties of Hydrocarbons for Extended Analysis of Natural Gases<sup>6</sup>

GPSA Data Book, Fig. 23-2, Physical Constants<sup>6</sup>

#### 2.3 TRC Document:

TRC Thermodynamic Tables—Hydrocarbons<sup>8</sup>

#### 2.4 ANSI Standard:

ANSI Z 132.1-1969: Base Conditions of Pressure and Temperature for the Volumetric Measurement of Natural Gas<sup>9,10</sup>

### 3. Terminology

#### 3.1 Definitions:

3.1.1 *British thermal unit*—the defined International Tables British thermal unit (Btu).

3.1.1.1 *Discussion*—The defining relationships are:

$$1 \text{ Btu} \cdot \text{lb}^{-1} = 2.326 \text{ J} \cdot \text{g}^{-1} \text{ (exact)}$$

$$1 \text{ lb} = 453.59237 \text{ g (exact)}$$

<sup>1</sup> This practice is under the jurisdiction of ASTM Committee D03 on Gaseous Fuels and is the direct responsibility of Subcommittee D03.03 on Determination of Heating Value and Relative Density of Gaseous Fuels.

Current edition approved May 10, 2003. Published May 2003. Originally approved in 1998. Last previous edition approved in 1998 as D 3588 – 98.

<sup>2</sup> A more rigorous calculation of  $Z(T,P)$  at both base conditions and higher pressures can be made using the calculation procedures in "Compressibility and Super Compressibility for Natural Gas and Other Hydrocarbon Gases," American Gas Association Transmission Measurement Committee Report 8, AGA Cal. No. XQ1285, 1985, AGA, 1515 Wilson Blvd., Arlington, VA 22209.

<sup>3</sup> Discontinued. See 1981 *Annual Book of ASTM Standards*, Vol 05.01.

<sup>4</sup> *Annual Book of ASTM Standards*, Vol 05.06.

<sup>5</sup> *Annual Book of ASTM Standards*, Vol 05.01.

<sup>6</sup> Available from Gas Processors Association, 6526 E. 60th, Tulsa, OK 74145.

<sup>7</sup> The sole source of supply of the program in either BASIC or FORTRAN suitable for running on computers known to the committee at this time is the Gas Processors Association. If you are aware of alternative suppliers, please provide this information to ASTM International Headquarters. Your comments will receive careful consideration at a meeting of the responsible technical committee<sup>1</sup>, which you may attend.

<sup>8</sup> Available from Thermodynamics Research Center, The Texas A&M University, College Station, TX 77843-3111.

<sup>9</sup> Available from the American National Standards Institute, 25 W. 43rd St., 4th Floor, New York, NY 10036.

<sup>10</sup> Supporting data have been filed at ASTM International Headquarters and may be obtained by requesting Research Report RR: D03-1007.

By these relationships, 1 Btu = 1 055.055 852 62 J (exact). For most purposes, the value (rounded) 1 Btu = 1055.056 J is adequate.

3.1.2 *compressibility factor* ( $z$ )—the ratio of the actual volume of a given mass of gas at a specified temperature and pressure to its volume calculated from the ideal gas law under the same conditions.

3.1.3 *gross heating value*—the amount of energy transferred as heat from the complete, ideal combustion of the gas with air, at standard temperature, in which all the water formed by the reaction condenses to liquid. The values for the pure gases appear in GPA Standard 2145, which is revised annually. If the gross heating value has a volumetric rather than a mass or molar basis, a base pressure must also be specified.

3.1.4 *net heating value*—the amount of energy transferred as heat from the total, ideal combustion of the gas at standard temperature in which all the water formed by the reaction remains in the vapor state. Condensation of any "spectator" water does not contribute to the net heating value. If the net heating value has a volumetric rather than a mass or molar basis, a base pressure must also be specified.

3.1.5 *relative density*—the ratio of the density of the gaseous fuel, under observed conditions of temperature and pressure, to the density of dry air (of normal carbon dioxide content) at the same temperature and pressure.

3.1.6 *standard cubic foot of gas*—the amount of gas that occupies 1 ft<sup>3</sup> (0.028 m<sup>3</sup>) at a temperature of 60°F (15.6°C) under a given base pressure and either saturated with water vapor (wet) or free of water vapor (dry) as specified (see ANSI Z 132.1). In this practice, calculations have been made at 14.696 psia and 60°F (15.6°C), because the yearly update of GPA 2145 by the Thermodynamics Research Center, on which these calculations are based, are given for this base pressure. Conversions to other base conditions should be made at the end of the calculation to reduce roundoff errors.

3.1.7 *standard temperature (USA)*—60°F (15.6°C).

## 3.2 Symbols:

### 3.2.1 Nomenclature:

3.2.1.1  $B$ —second virial coefficient for gas mixture

3.2.1.2  $\sqrt{\beta_{ij}}$ —summation factor for calculating real gas correction (alternate method)

3.2.1.3 (cor)—corrected for water content

3.2.1.4 (dry)—value on water-free basis

3.2.1.5  $d$ —density for gas relative to the density of air.

3.2.1.6  $d^{id}$ —ideal relative density or relative molar mass, that is, molar mass of gas relative to molar mass of air

3.2.1.7  $G^{id}$ —molar mass ratio

3.2.1.8  $H_{ij}^{id}$ —gross heating value per unit mass

3.2.1.9  $H_v^{id}$ —gross heating value per unit volume

3.2.1.10  $H_n^{id}$ —gross heating value per unit mole

3.2.1.11  $h_{ij}^{id}$ —net heating value per unit mass

3.2.1.12  $h_v^{id}$ —net heating value per unit volume

3.2.1.13  $h_n^{id}$ —net heating value per unit mole

3.2.1.14  $a, b, c$ —in Eq 1, integers required to balance the equation: C, carbon; H, hydrogen; S, sulfur; O, oxygen

3.2.1.15 ( $id$ )—ideal gas state

3.2.1.16 ( $l$ )—liquid phase

3.2.1.17  $M$ —molar mass

3.2.1.18  $m$ —mass flow rate

3.2.1.19  $n$ —number of components

3.2.1.20  $P$ —pressure in absolute units (psia)

3.2.1.21  $Q^{id}$ —ideal energy per unit time released as heat upon combustion

3.2.1.22  $R$ —gas constant, 10.7316 psia.ft<sup>3</sup>/(lb mol·R) in this practice (based upon  $R = 8.31448$  J/(mol·K))

3.2.1.23 (sat)—denotes saturation value

3.2.1.24  $T$ —absolute temperature, °R = °F + 459.67 or K = °C + 273.15

3.2.1.25 ( $T, P$ )—value dependent upon temperature and pressure

3.2.1.26  $V$ —gas volumetric flow rate

3.2.1.27  $x$ —mole fraction

3.2.1.28  $Z$ —gas compressibility factor repeatability of property

3.2.1.29  $\delta$ —repeatability of property

3.2.1.30  $\rho$ —density in mass per unit volume

3.2.1.31  $\sum_{j=1}^n$ —property summed for Components 1 through  $n$ , where  $n$  represents the total number of components in the mixture

## 3.2.2 Superscripts:

3.2.2.1  $id$ —ideal gas value

3.2.2.2  $l$ —liquid

3.2.2.3  $\sigma$ —value at saturation (vapor pressure)

3.2.2.4  $'$ —reproducibility

## 3.2.3 Subscripts:

3.2.3.1  $a$ —value for air

3.2.3.2  $a$ —relative number of atoms of carbon in Eq 1

3.2.3.3  $b$ —relative number of atoms of hydrogen in Eq 1

3.2.3.4  $c$ —relative number of atoms of sulfur in Eq 1

3.2.3.5  $j$ —property for component  $j$

3.2.3.6  $ii$ —non-ideal gas property for component  $i$

3.2.3.7  $ij$ —non-ideal gas property for mixture of  $i$  and  $j$

3.2.3.8  $jj$ —non-ideal gas property for component  $j$

3.2.3.9  $w$ —value for water

3.2.3.10 1—property for Component 1

3.2.3.11 2—property for Component 2

## 4. Summary of Practice

4.1 The ideal gas heating value and ideal gas relative density at base conditions (14.696 psia and 60°F (15.6°C)) are calculated from the molar composition and the respective ideal gas values for the components; these values are then adjusted by means of a calculated compressibility factor.

## 5. Significance and Use

5.1 The heating value is a measure of the suitability of a pure gas or a gas mixture for use as a fuel; it indicates the amount of energy that can be obtained as heat by burning a unit of gas. For use as heating agents, the relative merits of gases from different sources and having different compositions can be compared readily on the basis of their heating values. Therefore, the heating value is used as a parameter for determining the price of gas in custody transfer. It is also an essential factor in calculating the efficiencies of energy conversion devices such as gas-fired turbines. The heating values of a gas depend not only upon the temperature and pressure, but also upon the degree of saturation with water vapor.

However, some calorimetric methods for measuring heating values are based upon the gas being saturated with water at the specified conditions.

5.2 The relative density (specific gravity) of a gas quantifies the density of the gas as compared with that of air under the same conditions.

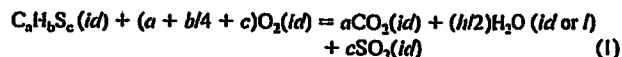
## 6. Methods of Analysis

6.1 Determine the molar composition of the gas in accordance with any ASTM or GPA method that yields the complete composition, exclusive of water, but including all other components present in amounts of 0.1 % or more, in terms of components or groups of components listed in Table 1. At least 98 % of the sample must be reported as individual components (that is, not more than a total of 2 % reported as groups of components such as butanes, pentanes, hexanes, butenes, and

so forth). Any group used must be one of those listed in Table 1 for which average values appear. The following test methods are applicable to this practice when appropriate for the sample under test: Test Methods D 1717, D 1945, D 2163, and D 2650.

## 7. Calculation—Ideal Gas Values; Ideal Heating Value

7.1 An ideal combustion reaction in general terms for fuel and air in the ideal gas state is:



where *id* denotes the ideal gas state and *l* denotes liquid phase. The ideal net heating value results when all the water remains in the ideal gas state. The ideal gross heating value results when all the water formed by the reaction condenses to liquid. For water, the reduction from  $H_2O(id)$  to  $H_2O(l)$  is  $H_{11}^{id}$

TABLE 1 Properties of Natural Gas Components at 60°F and 14.696 psia<sup>A</sup>

Compound	Formula	Molar Mass, lb·lbmol <sup>-1B</sup>	Molar Mass, Ratio, <i>G</i> <sup>nc</sup>	Ideal Gross Heating Value <sup>D</sup>			Ideal Net Heating Value			Summation Factor, <i>b<sub>s</sub></i> psia <sup>-1</sup>
				<i>H<sub>11</sub><sup>id</sup></i> , kJ·mol <sup>-1</sup>	<i>H<sub>11</sub><sup>id</sup></i> , Btu·lbm <sup>-1</sup>	<i>H<sub>11</sub><sup>id</sup></i> , Btu·ft <sup>-3</sup>	<i>H<sub>11</sub><sup>id</sup></i> , kJ·mol <sup>-1</sup>	<i>H<sub>11</sub><sup>id</sup></i> , Btu·lbm <sup>-1</sup>	<i>H<sub>11</sub><sup>id</sup></i> , Btu·ft <sup>-3</sup>	
Hydrogen	H <sub>2</sub>	2.0159	0.069 60	286.20	6 1022	324.2	241.79	51 566	273.93	0
Helium	He	4.0026	0.138 20	0	0	0	0	0	0	0
Water	H <sub>2</sub> O	18.0153	0.622 02	44.409	1059.8	50.312	0	0	0	0.0823
Carbon monoxide	CO	28.010	0.967 11	282.9	4342	320.5	282.9	4 342	320.5	0.0053
Nitrogen	N <sub>2</sub>	28.0134	0.967 23	0	0	0	0	0	0	0.0044
Oxygen	O <sub>2</sub>	31.9988	1.104 8	0	0	0	0	0	0	0.0073
Hydrogen sulfide	H <sub>2</sub> S	34.08	1.176 7	582.4	7 094.2	637.1	517.99	6 534	586.8	0.0253
Argon	Ar	39.948	1.379 3	0	0	0	0	0	0	0.0071
Carbon dioxide	CO <sub>2</sub>	44.010	1.519 6	0	0	0	0	0	0	0.0197
Air	<sup>E</sup>	28.9625	1.000 0	0	0	0	0	0	0	0.0050
Methane	CH <sub>4</sub>	16.043	0.553 92	891.63	23 891	1010.0	802.71	21 511	909.4	0.0118
Ethane	C <sub>2</sub> H <sub>6</sub>	30.070	1.038 2	1562.06	22 333	1769.7	1428.83	20 429	1618.7	0.0239
Propane	C <sub>3</sub> H <sub>8</sub>	44.097	1.522 6	2220.99	21 853	2516.1	2043.3	19 922	2314.9	0.0344
i-Butane	C <sub>4</sub> H <sub>10</sub>	58.123	2.006 8	2870.45	21 232	3251.9	2646.4	19 590	3000.4	0.0458
n-Butane	C <sub>4</sub> H <sub>10</sub>	58.123	2.006 8	2879.63	21 300	3282.3	2657.6	19 658	3010.8	0.0478
i-Pentane	C <sub>5</sub> H <sub>12</sub>	72.150	2.491 2	3531.5	21 043	4000.9	3265.0	19 456	3699.0	0.0581
n-Pentane	C <sub>5</sub> H <sub>12</sub>	72.150	2.491 2	3535.8	21 085	4008.9	3269.3	19 481	3703.9	0.0631
n-Hexane	C <sub>6</sub> H <sub>14</sub>	86.177	2.975 5	4198.1	20 943	4755.9	3887.2	19 393	4403.9	0.0802
n-Heptane	C <sub>7</sub> H <sub>16</sub>	100.204	3.459 8	4857.2	20 839	5502.6	4501.9	19 315	5100.3	0.0944
n-Octane	C <sub>8</sub> H <sub>18</sub>	114.231	3.944 1	5515.9	20 759	6248.9	5116.2	19 256	5796.2	0.1137
n-Nonane	C <sub>9</sub> H <sub>20</sub>	128.258	4.428 4	6175.9	20 701	6996.6	5731.8	19 213	6493.6	0.1331
n-Decane	C <sub>10</sub> H <sub>22</sub>	142.285	4.912 7	6834.9	20 651	7742.9	6346.4	19 176	7189.9	0.1538
Neopentane	C <sub>5</sub> H <sub>12</sub>	72.015	2.491 2	3517.27	20 958	3985	3250.8	19 371	3683	
2-Methylpentane	C <sub>6</sub> H <sub>14</sub>	86.177	2.975 5	4190.43	20 905	4747	3879.6	19 366	4395	0.080
3-Methylpentane	C <sub>6</sub> H <sub>14</sub>	86.177	2.975 5	4193.03	20 918	4750	3882.2	19 367	4398	0.080
2,2-Dimethylbutane	C <sub>6</sub> H <sub>14</sub>	86.177	2.975 5	4180.63	20 858	4736	3869.8	19 306	4364	0.080
2,3-Dimethylbutane	C <sub>6</sub> H <sub>14</sub>	86.177	2.975 5	4188.41	20 895	4745	3877.5	19 344	4393	0.080
Cyclopropane	C <sub>3</sub> H <sub>6</sub>	42.081	1.452 9	2092.78	21 381	2371	1959.8	20 020	2220	...
Cyclobutane	C <sub>4</sub> H <sub>8</sub>	58.108	1.937 3	2747.08	21 049	2747	2569.4	19 688	2911	...
Cyclopentane	C <sub>5</sub> H <sub>10</sub>	70.134	2.421 5	3322.04	20 364	3764	3100.0	19 003	3512	...
Cyclohexane	C <sub>6</sub> H <sub>12</sub>	84.161	2.905 9	3955.84	20 208	4482	3689.4	18 847	4180	...
Ethyne (acetylene)	C <sub>2</sub> H <sub>2</sub>	26.038	0.899 0	1301.32	21 487	1474	1256.9	20 753	1424	0.021
Ethene (ethylene)	C <sub>2</sub> H <sub>4</sub>	28.054	0.968 6	1412.06	21 640	1600	1323.2	20 278	1489	0.020
Propene (propylene)	C <sub>3</sub> H <sub>6</sub>	42.081	1.452 9	2059.35	21 039	2333	1926.1	19 678	2182	0.033
Benzene	C <sub>6</sub> H <sub>6</sub>	78.114	2.697 1	3202.74	18 177	3742	3169.5	17 444	3591	0.069
Butanes (ave)	C <sub>4</sub> H <sub>10</sub>	58.123	2.006 8	2875	21 268	3257	2653	19 623	3006	0.048
Pentanes (ave)	C <sub>5</sub> H <sub>12</sub>	72.150	2.491 2	3534	21 058	4003	3287	19 469	3702	0.062
Hexanes (ave)	C <sub>6</sub> H <sub>14</sub>	86.177	2.975 5	4180	20 904	4747	3879	19 353	4395	0.080
Butenes (ave)	C <sub>4</sub> H <sub>8</sub>	56.108	1.937 2	2716	20 811	3077	2538	19 450	2876	0.046
Penlenes (ave)	C <sub>5</sub> H <sub>10</sub>	70.134	2.421 5	3375	20 691	3824	3153	19 328	3572	0.080

<sup>A</sup> This table is consistent with GPA 2145-89, but it is necessary to use the values from the most recent edition of GPA 2145 for custody transfer calculations.

<sup>B</sup> 1984 Atomic Weights: C = 12.011, H = 1.00794, O = 15.9994, N = 14.0067, S = 32.06.

<sup>C</sup> Molar mass ratio is the ratio of the molar mass of the gas to that of air.

<sup>D</sup> Based upon ideal reaction; the entry for water represents the total enthalpy of vaporization.

<sup>E</sup> Composition from: F. E. Jones, *J. Res. Nat. Bur. Stand.*, Vol. 83, 419, 1978.

–  $H_w^I$ , the ideal enthalpy of vaporization, which is somewhat larger than the enthalpy of vaporization  $H_w^v - H_w^l$ .

7.1.1 Because the gross heating value results from an ideal combustion reaction, ideal gas relationships apply. The ideal gross heating value per unit mass for a mixture,  $H_m^{id}$ , is:

$$H_m^{id} = \sum_{j=1}^n x_j M_j H_{m,j}^{id} / \sum_{j=1}^n x_j M_j \quad (2)$$

where:  $x_j$  is the mole fraction of Component  $j$ ,  $M_j$  is the molar mass of Component  $j$  from Table 1, and  $n$  is the total number of components.

7.1.2  $H_{m,j}^{id}$  is the pure component, ideal gross heating value per unit mass for Component  $j$  (at 60°F (15.6°C) in Table 1). Values of  $H_{m,j}^{id}$  are independent of pressure, but they vary with temperature.

## 7.2 Ideal Gas Density

7.2.1 The ideal gas density,  $\rho^{id}$ , is:

$$\rho^{id} = (P/RT) \sum_{j=1}^n x_j M_j = MP/RT \quad (3)$$

where:  $M$  is the molar mass of the mixture,

$$M = \sum_{j=1}^n x_j M_j \quad (4)$$

$P$  is the base pressure in absolute units (psia),  $R$  is the gas constant, 10.7316 psia.ft<sup>3</sup>/(lb mol•°R) in this practice, based upon  $R = 8.31448$  J/(mol•K),  $T$  is the base temperature in absolute units (°R = °F + 459.67). Values of the ideal gas density at 60°F (15.6°C) and 14.696 psia are in GPA Standard 2145.

## 7.3 Ideal Relative Density:

7.3.1 The ideal relative density  $d^{id}$  is:

$$d^{id} = \sum_{j=1}^n x_j d_j = \sum_{j=1}^n x_j M_j / M_a = M/M_a \quad (5)$$

where:  $M_a$  is the molar mass of air. The ideal relative density is the molar mass ratio.

## 7.4 Gross Heating Value per Unit Volume:

7.4.1 Multiplication of the gross heating value per unit mass by the ideal gas density provides the gross heating value per unit volume,  $H_v^{id}$ :

$$H_v^{id} = \rho^{id} H_m^{id} = \sum_{j=1}^n x_j H_{v,j}^{id} \quad (6)$$

$H_{v,j}^{id}$  is the pure component gross heating value per unit volume for Component  $j$  at specified temperature and pressure (60°F (15.6°C) and 14.696 psia in Table 1, ideal gas values).

7.4.2 Conversion of values in Table 1 to different pressure bases results from multiplying by the pressure ratio:

$$H_v^{id}(P) = H_v^{id}(P = 14.696) \times P/14.696 \quad (7)$$

## 7.5 Real Gas Values—Compressibility Factor:

7.5.1 The compressibility factor is:

$$Z(T,P) = \rho^{id}/\rho = (MP/RT)/\rho \quad (8)$$

where  $\rho$  is the real gas density in mass per unit volume. At conditions near ambient, the truncated virial equation of state satisfactorily represents the volumetric behavior of natural gas:

$$Z(T,P) = 1 + BP/RT \quad (9)$$

where  $B$  is the second virial coefficient for the gas mixture. The second virial coefficient for a mixture is:

$$B = x_1^2 B_{11} + x_2^2 B_{22} + \dots + x_n^2 B_{nn} + 2x_1 x_2 B_{12} + \dots + 2x_{n-1} x_n B_{n-1,n} \\ = \sum_{j=1}^n \sum_{l=1}^n x_j x_l B_{jl} \quad (10)$$

where  $B_{jj}$  is the second virial coefficient for Component  $j$  and  $B_{jl}$  is the second cross virial coefficient for Components  $l$  and  $j$ . The second virial coefficients are functions of temperature. Eq 9 can be used with Eq 10 for calculation of the compressibility factor for the various pressure bases, but it is not accurate at pressures greater than two atmospheres. Special treatment is not required for H<sub>2</sub> and He at mole fractions up to 0.01. Calculations can be made with  $B_{jj} = 0$  for hydrogen and helium.

7.5.2 Eq 9 and Eq 10 for calculation of  $Z(T,P)$  for a gas mixture are rigorous but require considerable calculations and information that is not always available. An alternative, approximate expression for  $Z(T,P)$  that is more convenient for hand calculations is:

$$Z(T,P) = 1 - P \left[ \sum_{j=1}^n x_j \sqrt{\beta_{jj}} \right]^2 \quad (11)$$

where  $\beta_{jj} = B_{jj}/RT$  and  $\sqrt{\beta_{jj}}$  is the summation factor for Component  $j$ . Values of  $\sqrt{\beta_{jj}}$  at 60°F (15.6°C) appear in Table 2. The method based upon Eq 11 has been adopted for this practice.

## 7.6 Real Gas Density:

7.6.1 The real gas density  $\rho$  at a specific temperature and pressure is:

$$\rho = \rho^{id}/Z \quad (12)$$

where:  $\rho^{id}$  and  $Z$  are evaluated at the same temperature and pressure.

## 7.7 Real Relative Density:

7.7.1 The real relative density  $d$  is:

$$d = \rho/\rho_a = MZ_a/M_a Z \quad (13)$$

7.8 Real Heating Value—The real heating value is not given by division of the ideal heating value by the compressibility factor. Real gas heating values differ from the ideal gas values by less than one part in 10<sup>4</sup> at 14.696 psia, which is of the order of the accuracy of the heating values.

## 7.9 Gross Heating Value of Water Wet Gas:

7.9.1 If the gas contains water as a component but the compositional analysis is on a dry basis, it is necessary to adjust the mole fractions to reflect the presence of water. The corrected mole fractions are:

$$x_j(\text{cor}) = x_j(1 - x_w) \quad (14)$$

The mole fraction of water can range from zero up to the saturated value. The saturated value for  $x_w$  is, assuming Raoult's Law:

$$x_w(\text{sat}) = P_w^v/P \quad (15)$$

where:  $P_w^v$  is the vapor pressure of water (0.256 36 psia at 60°F (15.6°C)).

7.9.2 Technically, water has a gross heating value, the ideal enthalpy of condensation. If only the water that is formed

TABLE 2 Example Calculations of Gas Properties at 60°F and 14.696 psia (Gas Analysis on Dry Basis)<sup>a</sup>

NOTE—Division of  $H_v^{id}$  by  $Z$  does not give a real gas heating value but rather an ideal gas heating value per real cubic foot. Any digits carried beyond 1 part in 1000 are not significant but only alleviate roundoff error. Although CO<sub>2</sub> has a carbon atom, its  $\alpha = 0$  because it is not part of the fuel formula  $C_\alpha H_\beta S_\gamma$ .

Compound	$x_i$	$\alpha_i$	$\beta_i$	$\gamma_i$	$H_v^{id}$	$G_i^{id}$	$b_i$	$x_i p_i$	$x_i \beta_i$	$x_i \gamma_i$	$x_i H_v^{id}$	$x_i G_i^{id}$	$x_i b_i$
Methane	0.8302	1	4	0	1010.0	0.553 92	0.0116	0.8302	3.3208	0	838.5	0.4599	0.009 63
Ethane	0.0745	2	6	0	1769.7	1.038 20	0.0239	0.1490	0.4470	0	131.8	0.0773	0.001 78
Propane	0.0439	3	8	0	2516.1	1.522 60	0.0344	0.1317	0.3512	0	110.5	0.0668	0.001 51
<i>i</i> -Butane	0.0083	4	10	0	3251.9	2.008 80	0.0458	0.0332	0.0830	0	27.0	0.0167	0.000 38
<i>n</i> -Butane	0.0108	4	10	0	3262.3	2.006 80	0.0478	0.0432	0.1080	0	35.2	0.0217	0.000 52
<i>i</i> -Pentane	0.0031	5	12	0	4000.9	2.481 20	0.0581	0.0155	0.0372	0	12.4	0.0077	0.000 18
<i>n</i> -Pentane	0.0025	5	12	0	4008.9	2.481 20	0.0631	0.0125	0.03	0	10.0	0.0062	0.000 16
Hexane	0.0030	6	14	0	4755.9	2.975 50	0.0802	0.0180	0.0420	0	14.3	0.0089	0.000 24
Helium	0.0003	0	0	0	0	0.138 20	0	0	0	0	0	0.0000	0.000 00
Nitrogen	0.0032	0	0	0	0	0.967 23	0.0044	0	0	0	0	0.0031	0.000 01
Carbon dioxide	0.0202	0	0	0	0	1.519 60	0.0197	0	0	0	0	0.0307	0.000 40
Summation	1.0000	...	...	...	...	...	...	1.2333	4.4192	0	1179.7	0.6991	0.014 81

$\alpha_{x_w} = (0.256\ 36)/14.696 = 0.0174$   
 $G^{id}(\text{dry gas}) = 0.6991$   
 $Z(\text{dry gas}) = 1 - [0.014\ 81]^2(14.696) = 0.9968$   
 $Z(\text{dry air}) = 1 - [0.0050]^2(14.696) = 0.9996$   
 $G(\text{dry gas, dry air}) = 0.6991(0.9996)/0.9968 = 0.7011$   
 $G(\text{dry gas, sat air}) = 0.6991(0.9995)/0.9968 = 0.7010$   
 $H_v^{id}(\text{dry gas, dry air}) = 1179.7\ \text{Btu}\cdot\text{ft}^{-3}$   
 $H_v^{id}(\text{sat gas, dry air}) = 1179.7(0.9826) = 1159.1\ \text{Btu}\cdot\text{ft}^{-3}$   
 $1 - x_w = 0.9826$   
 $G^{id}(\text{sat gas}) = 0.6991(0.9826) + 0.0174(0.622\ 02) = 0.6978$   
 $Z(\text{sat gas}) = 1 - [0.9826(0.014\ 81) + 0.0174(0.0623)]^2(14.696) = 0.9964$   
 $Z(\text{sat air}) = 1 - [0.9826(0.0050) + 0.0174(0.0623)]^2(14.696) = 0.9995$   
 $G(\text{sat gas, dry air}) = 0.6978(0.9996)/0.9964 = 0.7001$   
 $G(\text{sat gas, sat air}) = 0.6978(0.9995)/0.9964 = 0.7000$   
 $(H_v^{id}/Z)(\text{dry gas, dry air}) = 1179.7/0.9968 = 1183.5\ \text{Btu}\cdot\text{ft}^{-3}$   
 $(H_v^{id}/Z)(\text{sat gas, dry air}) = 1159.1/(0.9964) = 1163.3\ \text{Btu}\cdot\text{ft}^{-3}$

during the combustion condenses, then the heat released upon combustion of a wet gas with dry air becomes:

$$H_v^{id}(\text{wet gas}) = (1 - x_w)H_v^{id}(\text{dry gas}) \quad (16)$$

For water-saturated gas,  $x_w$ , at 60° F (15.6° C) is 0.256 36/ $P_b$ , where  $P_b$  is the base pressure. Eq 16 is adequate for custody transfer applications as a matter of definition. However, this equation does not accurately describe the effect of water upon the heating value. Appendix X1 contains a rigorous examination of the effect of water.

#### 7.10 Calculation of the Ideal Energy Released as Heat:

7.10.1 When multiplied by the gas flow rate, the ideal gross heating value provides the ideal energy released as heat upon combustion,  $\dot{Q}^{id}$ , an ideal gas property:

$$\dot{Q}^{id} = \dot{m} H_v^{id} \quad (17)$$

where  $\dot{m}$  is the mass flow rate. For an ideal gas, the mass flow rate is related to the volumetric flow rate,  $\dot{V}^{id}$ , by:

$$\dot{m} = \dot{V}^{id} \rho^{id} \quad (18)$$

and

$$\dot{Q}^{id} = \dot{V}^{id} H_v^{id} \quad (19)$$

7.10.2 The ideal gas flow rate is related to the real gas flow rate by:

$$\dot{V}^{id} = \dot{V}/Z \quad (20)$$

where  $\dot{V}$  is the real gas volumetric flow rate and  $Z(T, P)$  is the real gas compressibility factor at the same  $T$  and  $P$ . Hence, combining Eq 19 and Eq 20 gives:

$$\dot{Q}^{id} = H_v^{id} \dot{V}/Z(T, P) \quad (21)$$

NOTE 1—The ideal energy released per unit time as heat upon combustion,  $\dot{Q}^{id}$ , can be calculated using the mass flow rate (Eq 17), the ideal gas flow rate (Eq 19), or the real gas flow rate (Eq 21), but is always an ideal gas property. Division of  $H_v^{id}$  by the gas compressibility factor  $Z(T, P)$  does not produce a real gas heating value but only allows calculation of  $\dot{Q}^{id}$  using the real gas flow rate rather than the ideal gas flow rate.

## 8. Precision

8.1 The properties reported in this practice derive from experimental enthalpy of combustion measurements which, in general, are accurate to 1 part in 1000. The extra digits that appear in the accompanying tables alleviate problems associated with roundoff errors and internal consistency, but they are not significant. Table 3

8.2 The values of properties in this practice are those that appear in GPA Standard 2172-97, Fig. 23-2 of the GPSA Engineering Data Book, GPA TP-17, and the TRC Thermodynamic Tables—Hydrocarbons. GPA Standard 2145 is updated annually and the values in that standard should be used in all calculations.

NOTE 2—Three sources of error must be considered: errors in heating values of the components, errors in the calculated compressibility factor, and errors in the composition. The uncertainty (twice the standard deviation) of the ideal gas heating values for components should be 0.03 %. Such errors affect the bias and the agreement between calculated and measured heating values, but they do not affect the precision. Error in the calculated compressibility factor varies with the composition of the gas, but for natural gas, this error should be less than 0.03 % and

TABLE 3 Example Calculations of Gas Properties at 60°F and 14.696 psia (Gas Analysis on Wet Basis)<sup>A</sup>

Note—Division of  $H_v^{H^d}$  by  $Z$  does not give a real gas heating value but rather an ideal gas heating value per real cubic foot. Any digits carried beyond 1 part in 1000 are not significant but only alleviate roundoff error. Although  $\text{CO}_2$  has a carbon atom, its  $\alpha = 0$  because it is not part of the fuel formula  $\text{C}_x\text{H}_y\text{S}_z$ .

Compound	$x_i$	$\alpha_i$	$\beta_i$	$\gamma_i$	$H_v^{H^d}$	$G_i^{H^d}$	$b_i$	$x_i \rho_i$	$x_i \beta_i$	$x_i \gamma_i$	$x_i H_v^{H^d}$	$x_i G_i^{H^d}$	$x_i b_i$
Methane	0.8167	1	4	0	1010.0	0.553 92	0.0116	0.8157	3.2629	0	823.9	0.4518	0.009 46
Ethane	0.0732	2	6	0	1769.7	1.038 20	0.0239	0.1464	0.4392	0	129.5	0.0760	0.001 75
Propane	0.0431	3	8	0	2516.1	1.522 60	0.0344	0.1294	0.3451	0	108.5	0.0657	0.001 48
i-Butane	0.0082	4	10	0	3251.9	2.006 80	0.0458	0.0326	0.0818	0	26.5	0.0184	0.000 37
n-Butane	0.0106	4	10	0	3262.3	2.006 80	0.0478	0.0424	0.1061	0	34.8	0.0213	0.000 51
i-Pentane	0.0030	5	12	0	4000.9	2.491 20	0.0581	0.0152	0.0366	0	12.2	0.0076	0.000 18
n-Pentane	0.0025	5	12	0	4008.9	2.491 20	0.0631	0.0123	0.0295	0	9.8	0.0061	0.000 15
Hexane	0.0029	6	14	0	4755.9	2.975 50	0.0802	0.0177	0.0413	0	14.0	0.0088	0.000 24
Helium	0.0003	0	0	0	0	0.138 20	0	0	0	0	0	0	0
Nitrogen	0.0031	0	0	0	0	0.967 23	0.0044	0	0	0	0	0.0030	0
Carbon dioxide	0.0198	0	0	0	0	1.519 60	0.0197	0	0	0	0	0.0302	0.000 39
Water	0.0174	0	0	0	50.3	0.622 02	0.0623	0	0	0	0.9	0.0108	0.001 09
Summation	1.0000	...	...	...	...	...	...	1.2118	4.3421	0	1160.0	0.6977	0.015 64

$$^A G^{H^d}(\text{sat gas}) = 0.6977$$

$$Z(\text{sat gas}) = 1 - [0.015 64]^2(14.696) = 0.9964$$

$$Z(\text{dry air}) = 1 - [0.0050]^2(14.696) = 0.9996$$

$$G(\text{sat gas, dry air}) = 0.6977(0.9996)/0.9964 = 0.6999$$

$$H_v^{H^d}(\text{sat gas, dry air}) = 1160.0 - 0.9 = 1159.1 \text{ Btu}\cdot\text{ft}^{-3}$$

$$Z(\text{sat air}) = 1 - [0.9826(0.050) + 0.0174(0.0623)]^2(14.696) = 0.9985$$

$$G(\text{sat gas, sat air}) = 0.6977(0.9985)/0.9964 = 0.6999$$

$$(H_v^{H^d}/Z)(\text{sat gas, dry air}) = 1159.1/(0.9964) = 1163.3 \text{ Btu}\cdot\text{ft}^{-3}$$

negligible compared to errors arising from uncertainty in composition. In this practice, the errors in the heating values of the components and the calculated compressibility factor,  $Z$ , are neglected. The precision of the method is related to the repeatability and reproducibility of the analysis. An example appears in .

Note 3—It is essential to include all components in the gas sample that appear with mole fractions greater than or equal to 0.001 in the analysis. Some routine analyses do not determine compounds such as He and  $\text{H}_2\text{S}$ , but these compounds are important to the calculations.

### 8.3 Repeatability:

8.3.1 If all the components are analyzed and the results are normalized, then the repeatability of the heating value,  $\delta H$  is:

$$\frac{\delta H}{H^{H^d}} = \sqrt{\frac{1}{(H^{H^d})^2} \sum_{j=1}^n [(H^{H^d} - H_j^{H^d}) \delta x_j]^2} \quad (22)$$

8.3.2 If the results of the analysis are made to sum to 1.0 by calculating the methane mole fraction as the difference between 1.0 and the sum of the mole fractions of the other components, then

$$\frac{\delta H}{H^{H^d}} = \sqrt{\frac{1}{(H^{H^d})^2} \sum_{j=1}^n [H_j^{H^d} \delta x_j]^2} \quad (23)$$

where  $\delta x_j$  is the repeatability of the method of analysis for Component  $j$ . The differences between heating values calculated from successive pairs of analysis performed by the same operator using the same sample of gas and the same instrument should exceed  $2\delta H$  in only 5 % of the tests when  $\delta H$  is taken as one standard deviation.

8.4 Reproducibility—The reproducibility  $\delta H'$  is calculated from Eq 22 and Eq 23 using  $\delta x'_j$ , the reproducibility of the method of analysis for Component  $j$ . The difference between heating values calculated from analysis obtained in different laboratories is expected to exceed  $\delta H'$  for only 5 % of the analyses.

## APPENDIXES

### (Nonmandatory Information)

#### X1. EFFECT OF WATER UPON THE HEATING VALUE

X1.1 Custody transfer of natural gas uses a simple pricing equation that states that the cost of gas is the rate of energy released upon combustion multiplied by the price of gas per energy unit multiplied by the time or accounting period. The rate of energy released upon combustion is the product of the heating value of the gas and the flow rate of the gas. The flow rate of the gas requires knowledge of the compressibility factor and the relative density of the gas. All three custody transfer properties (heating value, compressibility factor, and relative

density) can be calculated from the composition given pure component property tables. The equations for calculating the properties of dry natural gas are well known, but this appendix also presents an account of the effects of water contained in the gas and in the air used to burn the gas.

X1.2 The heating value of a natural gas is the absolute value of its enthalpy of combustion in an ideal combustion reaction. The heating value is, therefore, an ideal gas property

that can be calculated unambiguously from tables of pure component values and it has no pressure dependence.

X1.3 An ideal combustion reaction with fuel and air in the ideal gas state and the possibility of water in the fuel and air is:

$$\begin{aligned} & C_n H_p S_r (id) + (\alpha + \beta/4 + \gamma)(1 + \epsilon) O_2 (id) \\ & + 0.043\ 83(\alpha + \beta/4 + \gamma)(1 + \epsilon) Ar (id) \quad (X1.1) \\ & + [0.001\ 62(\alpha + \beta/4 + \gamma)(1 + \epsilon) + x_c/(1 - x_N - x_C)] CO_2 (id) \\ & + [3.728\ 73(\alpha + \beta/4 + \gamma)(1 + \epsilon) + x_N/(1 - x_N - x_C)] N_2 (id) + (n_w^g \\ & + n_w^l) H_2O (id) \\ & = [\alpha + 0.001\ 62(\alpha + \beta/4 + \gamma)(1 + \epsilon) + x_c/(1 - x_N - x_C)] CO_2 (id) \\ & + n_w^g H_2O (id) + n_w^l H_2O (l) + \gamma SO_2 (id) \\ & + [3.728\ 73(\alpha + \beta/4 + \gamma)(1 + \epsilon) \\ & + x_N/(1 - x_N - x_C)] N_2 (id) \\ & + 0.043\ 83(\alpha + \beta/4 + \gamma)(1 + \epsilon) Ar (id) + (\alpha + \beta/4 + \gamma)\epsilon O_2 (id) \end{aligned}$$

where:  $\alpha$ ,  $\beta$ , and  $\gamma$  are stoichiometric coefficients,  $\epsilon$  is the fraction excess air, the composition of air is assumed to be that of Table X1.1,  $n_w^g$  and the moles of water contained in the gas,  $n_w^l$  are the moles of water contained in the air;  $n_w^g$  are the moles of water contained in the product gas mixture,  $n_w^l$  are the moles of gas that actually condense,  $X_c$  is the mole fraction of  $CO_2$  in the gas, and  $x_N$  is the mole fraction of  $N_2$  in the gas. If air has been injected into the gas, it is assumed that the effect is accounted for in the excess fraction  $\epsilon$ . Fuel gas mixtures would have non-integer values of  $\alpha$ ,  $\beta$  and  $\gamma$ .

X1.4 It is customary to define hypothetical reference states for the water formed by the reaction denoted by Eq 1 (as opposed to "spectator" water that enters the reaction carried by the gas or air). If we assume that the water formed in the reaction remains in the ideal gas state, the heating value is termed "net." If we assume that the water formed in the reaction condenses totally to the liquid state, the heating value is termed "gross." The gross heating value is greater than the net heating value by the ideal enthalpy of vaporization for water:

$$\text{heating value (gross)} - \text{heating value (net)} = H_w(lid) - H_w(l) \quad (X1.2)$$

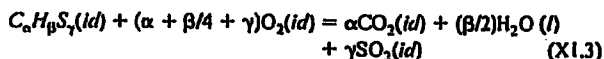
where:

$H$  = enthalpy,  
 $l$  = liquid state, and  
 $w$  = water.

The quantity  $H_w(lid) - H_w(l)$  is the ideal enthalpy of vaporization for water.

X1.5 It is possible to calculate a real gas heating value rather than using a hypothetical state, but the calculations are tedious, the numerical values are negligibly different, and the mathematical simplicity of the defining equation is lost. It is customary in the gas industry to use gross heating value for most calculations, so for the remainder of this appendix, the term "heating value" refers to the gross value.

X1.6 Eq 7 in Section 7 provides the recipe to convert the heating value from one base pressure to another. Note that when using Eq 7,  $H_v^{id}$  should be calculated using the values from Table 1 before converting the pressure; the individual values in Table 1 should not be converted. Conversion to another temperature is more complicated. Heating value data exist at 25°C based upon the reaction:



X1.7 The experiments use pure oxygen and are corrected to stoichiometric proportions. It is necessary to correct the sensible heat effects to arrive at a different temperature:

$$H_{in}^{id}(T) = H_{in}^{id}(25) + \int_{25}^T \sum_r C_p^{id} - \sum_r C_p^{id} dT \quad (X1.4)$$

where:

$$\sum_r C_p^{id} = \alpha C_{p,CO_2}^{id} + (\beta/2) C_{p,H_2O}^{id} + \gamma C_{p,SO_2}^{id} \quad (X1.5)$$

$$\sum_r C_p^{id} = C_{p,C_n H_p S_r}^{id} + (\alpha + \beta/4 + \gamma) C_{p,O_2}^{id} \quad (X1.6)$$

and:  $C_p^{id}$  is the ideal specific heat at constant pressure,  $r$  denotes reactants and  $r'$  denotes products.

TABLE X1.1 Example Calculation of Precision

Compound	Composition, $x_j$	$H_p^g - H_p^l$ Btu·lb <sup>-1</sup>	Repeatability		Reproducibility	
			$\delta x_j$	$[(H_p^g - H_p^l) \delta x_j]^2$ (Btu·lb <sup>-1</sup> ) <sup>2</sup>	$\delta x_{j'}$	$[(H_p^g - H_p^l) \delta x_{j'}]^2$ (Btu·lb <sup>-1</sup> ) <sup>2</sup>
Methane	0.8302	169.7	0.0010	0.029	0.0020	0.115
Ethane	0.0745	-590.0	0.0002	0.014	0.0004	0.056
Propane	0.0439	-1336.4	0.0002	0.071	0.0004	0.286
Isobutane	0.0083	-2072.2	0.0001	0.043	0.0002	0.171
Butane	0.0108	-2082.6	0.0002	0.173	0.0004	0.694
Isopentane	0.0031	-2821.2	0.0001	0.080	0.0002	0.318
Pentane	0.0025	-2829.2	0.0001	0.080	0.0002	0.320
Hexane	0.0030	-3576.2	0.0001	0.128	0.0002	0.512
Helium	0.0003	1179.7	0.0001	0.014	0.0002	0.056
Nitrogen	0.0032	1179.7	0.0001	0.014	0.0002	0.056
Carbon dioxide	0.0202	1179.7	0.0002	0.056	0.0004	0.223
Total	1.0000			0.702		2.807

## X2. ACCOUNTING FOR WATER

X2.1 If the gas contains water (or must be assumed to be saturated) but the compositional analysis is on a dry basis, it is necessary to adjust the mole fractions to account for the fact that water has displaced some gas, thus lowering the heating value. The mole fraction of water in the gas results from the definition of relative humidity:

$$x_w = h^s P_w^s / P = n_w / (1 + n_w) \quad (X2.1)$$

(Based upon one mole of the fuel  $C_\alpha H_\beta S_\gamma$ ) where  $h^s$  is the relative humidity of the gas,  $P_w^s$  is the vapor pressure of water, and  $n_w$  denotes moles of water. For saturated gas  $h^s$  is unity. Rearranging Eq X2.1 gives the moles of water:

$$n_w = x_w / (1 - x_w) \quad (X2.2)$$

The corrected mole fractions then become:

$$x_i(\text{cor}) = x_i \left[ \frac{1}{1 + n_w} \right] = x_i \left[ \frac{1}{1 + x_w / (1 - x_w)} \right] = (1 - x_w) x_i \quad (X2.3)$$

and the heating value becomes:

$$H_v^{hd} = (1 - x_w) \sum_{i=1}^N x_i^{hd} H_{vi}^{hd} \quad (X2.4)$$

where water is not included in the  $N$  components of the summation. If the compositional analysis determines  $x_w$  and water is included in the  $N$  components of the summation:

$$H_v^{hd} = \sum_{i=1}^N x_i^{hd} H_{vi}^{hd} - x_w H_{vw}^{hd} \quad (X2.5)$$

X2.2 It is necessary to remove the effect of water because, although water has a heating value, it is only a condensation effect. Water carried by wet gas (spectator water) does not actually condense, and only water formed in the reaction contributes to heating value.

X2.3 Accounting for water in the above manner is sufficient for defined custody transfer conditions, but when trying to model actual situations, the question becomes much more complicated. It is obvious that all of the reaction water actually cannot condense because in a situation in which both gas and air are dry some of the reaction water saturates the product gases and the remainder condenses. It is possible to account for these effects in a general manner. To do so, it is necessary to calculate  $n_w^s$ ,  $n_w^a$ ,  $n_w^p$ , and  $n_w^c$ .

$$n_w^s / [1 + (x_N + x_C) / (1 - x_N - x_C) + n_w^s] = h^s P_w^s / P \quad (X2.6)$$

$$n_w^s = (h^s P_w^s / P) / [(1 - x_N - x_C) / (1 - h^s P_w^s / P)]$$

$$n_w^a [4.774 \ 18(\alpha + \beta/4 + \gamma)(1 + \epsilon) + n_w^a] = h^a P_w^a / P \quad (X2.7)$$

$$n_w^a = 4.774 \ 18(\alpha + \beta/4 + \gamma)(1 + \epsilon) / (h^a P_w^a / P - 1)$$

$$n_w^p / \{ \alpha + \gamma + (x_N + x_C) / (1 - x_N - x_C) + (\alpha + \beta/4 + \gamma) [0.001 \ 62(1 + \epsilon) \quad (X2.8)$$

$$+ 3.728 \ 73(1 + \epsilon) + 0.043 \ 83(1 + \epsilon) + \epsilon] + n_w^p \} = P_w^p / P$$

$$n_w^p = \{ \alpha + \gamma + (x_N + x_C) / (1 - x_N - x_C) + (\alpha + \beta/4 + \gamma) [0.001 \ 62(1 + \epsilon) \quad (X2.9)$$

$$+ 3.728 \ 73(1 + \epsilon) + 0.043 \ 83(1 + \epsilon) + \epsilon] \} (P_w^p / P) / (1 - P_w^p / P)$$

$$n_w^c = \beta/2 + n_w^s + n_w^a - n_w^p \quad (X2.9)$$

where:  $h_a$  is the relative humidity of the air, Eq X2.6 and Eq X2.7 are reformulations of Eq X2.1 to reflect inlet conditions. Eq X2.8 reflects Eq X2.1 for the saturated product gas (it must be saturated before any water can condense). Eq X2.9 is a water balance:  $\beta/2$  are the moles of water formed by the reaction,  $n_w^s$  and  $n_w^a$  are the moles of water that enter with the gas and air,  $n_w^p$  are the moles of water that saturate the product gas, and  $n_w^c$  are the moles of water that condense. Therefore, the complete correction for the effect of water on heating value is:

$$H_v^{hd} = H_v^{hd} (\text{Eq X2.4 or Eq X2.5}) + (h^s P_w^s / P) / (1 - x_w - x_w^s) (1 - h^a P_w^a / P) \quad (X2.10)$$

$$+ 4.774 \ 18(\alpha + \beta/4 + \gamma)(1 + \epsilon) / (h^a P_w^a / P) / (1 - h^a P_w^a / P) - [\alpha + \gamma + (x_N - x_C) + (\alpha + \beta/4 + \gamma)(3.774 \ 18 + 4.774 \ 18 \epsilon)] \times (P_w^p / P) / (1 - P_w^p / P) H_{vw}^{hd}$$

X2.4 Depending upon the relative humidities of the gas and air, the observed heating value can be greater or smaller than that calculated using Eq X2.4 or Eq X2.5. A humidity of air exists for each gas above which  $H_v^{hd}$  is greater than that calculated by Eq X2.4 or Eq X2.5. That critical value depends upon the gas composition, the humidity of the gas, and the amount of excess air. For pure, dry methane with no excess air,  $h_a = 0.793 \ 45$ .

## X3. REAL GAS PROPERTIES

X3.1 In principal, we have enough information to convert the heating value to a real gas property (it is not necessary to do so for relative density because the molar mass ratio,  $G^{hd}$ , is

the desired property). This is simply a matter of evaluating the integral:

$$H_{II} - H_{II}^{id} = \int_0^P \left\{ \left[ \left( \frac{\partial H}{\partial P} \right)_{T,P} \right] - \left[ \left( \frac{\partial H}{\partial P} \right)_{T,P} \right] \right\} dP \quad (X3.1)$$

where:

$$\left( \frac{\partial H}{\partial P} \right)_T = V - T \left( \frac{\partial V}{\partial T} \right)_P = B - T \frac{dB}{dT} = 2 RT^2 b \frac{db}{dT} \quad (X3.2)$$

where  $V$  is the molar volume. The temperature dependence of  $b$  must be defined, but in the custody transfer region it is easy to do so. The products and reactants again correspond to Eq X1.3.

**X3.2** While it is obviously possible to make the required calculations to convert the heating value into a real gas

property, it serves no custody transfer purpose to do so. As we have seen, the cost equation is unchanged; the calculations while obvious are tedious.  $H_v$  is slightly different from  $H_v^{id}$  because the base pressure is low; the likelihood of having all the information required to use Eq X3.1 is remote. The heating value is defined in a hypothetical state. It is not possible, at base conditions, to have all the water formed in the reaction be either all gas or all liquid; some of the water formed is in each state. Thus, if the definition is of a hypothetical state, using a hypothetical real gas rather than an ideal gas state adds nothing but complexity.

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## **APPENDIX B - Certifications**



# South Coast Air Quality Management District

21865 Copley Drive, Diamond Bar, CA 91765-4178  
(909) 396-2000 • [www.aqmd.gov](http://www.aqmd.gov)

April 16, 2014

Mr. Richard Vacherot  
Horizon Air Measurement Services, Inc.  
310 Cortez Circle  
Camarillo, CA 93012

Subject: LAP Approval Notice  
Reference # 94LA0211

Dear Mr. Vacherot:

We completed our review of the renewal application you submitted for approval under the South Coast Air Quality Management District's Laboratory Approval Program (SCAQMD LAP). We are pleased to inform you that your firm is approved for the period beginning May 31, 2014, and ending May 31, 2015 for the following methods:

- SCAQMD Methods 1-4
- SCAQMD Method 100.1
- SCAQMD Method 25.1 (Sampling & Trap Burning)
- SCAQMD Method 25.3 (Sampling)
- SCAQMD Methods 5.1, 5.2, 5.3, and 6.1 (Sampling & Analysis)
- SCAQMD Rule 462 Testing
- SCAQMD Rule 1174 Protocol
- SCAQMD Rule 1420/ 1420.1 – Source Sampling

Thank you for participating in the SCAQMD LAP. Your cooperation helps us to achieve the goal of the LAP: to maintain high standards of quality in the sampling and analysis of source emissions. You may direct any questions or information to LAP Coordinator, Glenn Kasai. He may be reached by telephone at (909) 396-2271, or via e-mail at [gkasai@aqmd.gov](mailto:gkasai@aqmd.gov).

Sincerely,

A handwritten signature in black ink, appearing to read "Rudy Eden", is positioned above the typed name.

Rudy Eden, Senior Manager  
Laboratory Services &  
Source Test Engineering

RE:GK/gk

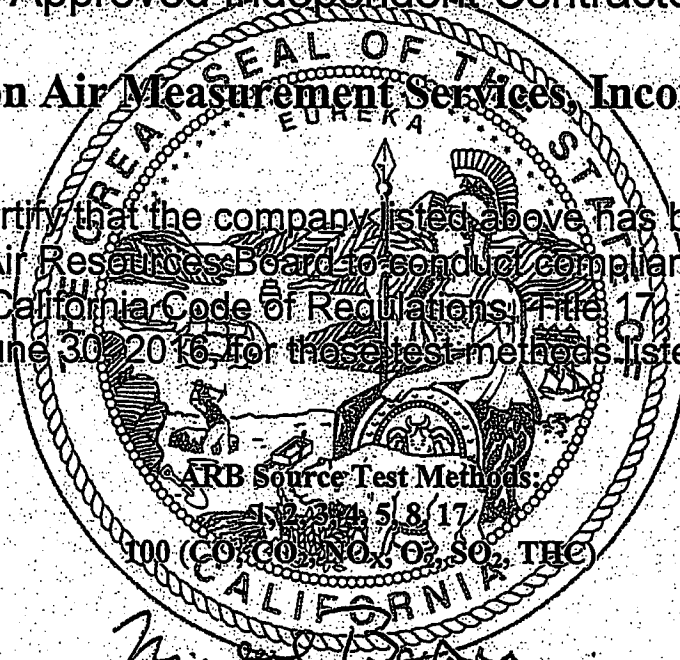
cc: Dipankar Sarkar

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State of California  
**Air Resources Board**  
Approved Independent Contractor

**Horizon Air Measurement Services, Incorporated**

This is to certify that the company listed above has been approved  
by the Air Resources Board to conduct compliance testing  
pursuant to California Code of Regulations, Title 17, Section 91207,  
until June 30, 2016, for those test methods listed below:




*Michael T. Benjamin*  
Dr. Michael T. Benjamin, Chief  
Monitoring and Laboratory Division

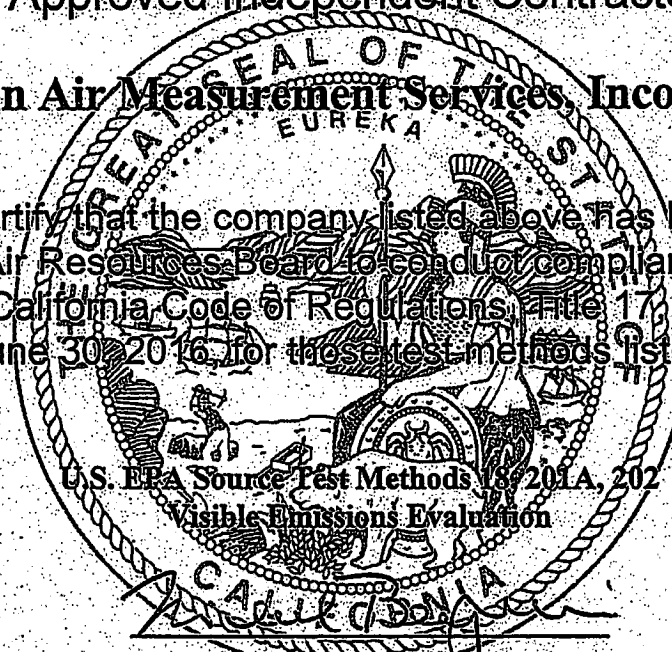
State of California  
Air Resources Board  
Approved Independent Contractor

**Horizon Air Measurement Services, Incorporated**

This is to certify that the company listed above has been approved  
by the Air Resources Board to conduct compliance testing  
pursuant to California Code of Regulations, Title 17, Section 91207,  
until June 30, 2016, for those test methods listed below:

U.S. EPA Source Test Methods 18, 201A, 202  
Visible Emissions Evaluation

  
Dr. Michael T. Benjamin, Chief  
Monitoring and Laboratory Division



## **APPENDIX C - Permits to Operate**

# San Joaquin Valley Air Pollution Control District

**PERMIT UNIT:** C-283-22-17

**EXPIRATION DATE:** 08/31/2016

**EQUIPMENT DESCRIPTION:**

MUNICIPAL SOLID WASTE BIOREACTOR LANDFILL, CLASS II AND III (B-19), 4.2 MILLION CUBIC YARD CAPACITY (40.4 ACRES) WITH GAS COLLECTION AND CONTROL SYSTEM SERVED BY A 2,500 SCFM (EQUIVALENT TO 83.6 MMBTU/HR) PARNEL BIOGAS ENCLOSED FLARE SHARED WITH C-283-25

## PERMIT UNIT REQUIREMENTS

---

1. No air contaminant shall be discharged into the atmosphere for a period or periods aggregating more than three minutes in any one hour which is as dark as, or darker than, Ringelmann 1/4 or 5% opacity. [District Rules 2201 and 4101] Federally Enforceable Through Title V Permit
2. All equipment shall be maintained in good operating condition and shall be operated in a manner to minimize emissions of air contaminants into the atmosphere. [District Rule 2201] Federally Enforceable Through Title V Permit
3. Each owner or operator shall keep for at least 5 years up-to-date, readily accessible, on-site records of the maximum design capacity, the current amount of solid waste in-place, and the year-by-year waste acceptance rate. Off-site records may be maintained if they are retrievable within 4 hours. [40 CFR 60.758(a)] Federally Enforceable Through Title V Permit
4. This operating permit may be cancelled with APCO approval when the landfill is closed, pursuant to the requirements of this permit, if the landfill is not otherwise subject to the requirements of either 40 CFR part 70 or part 71 and if either 1) it was never subject to the requirement for a control system under 40 CFR 60.752(b)(2); or 2) the owner or operator meets the conditions for control system removal specified in 40 CFR 60.752(b)(2)(v). [40 CFR 60.752(d)] Federally Enforceable Through Title V Permit
5. If the landfill is permanently closed, a closure notification shall be submitted to the APCO within 30 days of waste disposal cessation. A permanent closure must take place in accordance with 40 CFR 258.60. If a closure report has been submitted, no additional waste may be placed in the landfill without filing a notification of modification to the APCO, pursuant to 40 CFR 60.7(a)(4). [40 CFR 60.752(b)(1)(ii)(B), 60.757(d)] Federally Enforceable Through Title V Permit
6. An active collection system shall be designed to handle the maximum expected gas flow rate from the entire area of the landfill that warrants control over the intended use period of the gas control or treatment system equipment, collect gas from each area, cell, or group of cells in the landfill in which the initial solid waste has been placed for a period of 5 years or more if active; or 2 years or more if closed or at final grade, collect gas at a sufficient extraction rate, and be designed to minimize off-site migration of subsurface gas. [40 CFR 60.752(b)(2)(ii)(A)] Federally Enforceable Through Title V Permit
7. Each owner or operator seeking to comply with 40 CFR 60.752(b)(2)(i) shall site active collection wells, horizontal collectors, surface collectors, or other extraction devices at a sufficient density throughout all gas producing areas using the procedures in 60.759(a)(1), (2), and (3) unless alternative procedures have been approved by the APCO as provided in 60.752(b)(2)(i)(C) and (D). [40 CFR 60.759(a)] Federally Enforceable Through Title V Permit
8. For the purposes of calculating the maximum expected gas generation flow rate from the landfill to determine compliance with 60.752(b)(2)(ii)(A)(1), one of the equations in Section 60.755(a)(1)(i) or (ii) or (iii) shall be used. [40 CFR 60.755(a)(1)] Federally Enforceable Through Title V Permit

PERMIT UNIT REQUIREMENTS CONTINUE ON NEXT PAGE

These terms and conditions are part of the Facility-wide Permit to Operate.

Facility Name: CHEMICAL WASTE MANAGEMENT, INC  
Location: 35251 OLD SKYLINE ROAD, KETTLEMAN CITY, CA 93239  
C-283-22-17 : Mar 6 2014 4:28PM - KLEVANN

9. For the purposes of determining sufficient density of gas collectors for compliance with 60.752(b)(2)(ii)(A)(2), the owner or operator shall design a system of vertical wells, horizontal collectors, or other collection devices, satisfactory to the APCO, capable of controlling and extracting gas from all portions of the landfill sufficient to meet all operational and performance standards. [40 CFR 60.755(a)(2)] Federally Enforceable Through Title V Permit
10. For the purpose of demonstrating whether the gas collection system flow rate is sufficient to determine compliance with 60.752(b)(2)(ii)(A)(3), the owner or operator shall measure gauge pressure in the gas collection header at each individual well, monthly. If a positive pressure exists, action shall be initiated to correct the exceedance within 5 calendar days, except for the three conditions allowed under 60.753(b). If negative pressure cannot be achieved without excess air infiltration within 15 calendar days of the first measurement, the gas collection system shall be expanded to correct the exceedance within 120 days of the initial measurement of positive pressure. Any attempted corrective measure shall not cause exceedances of other operational or performance standards. An alternative timeline for correcting the exceedance may be submitted to the APCO for approval. [40 CFR 60.755(a)(3)] Federally Enforceable Through Title V Permit
11. Owners or operators are not required to expand the system as required in paragraph 60.755(a)(3) during the first 180 days after gas collection system startup. [40 CFR 60.755(a)(4)] Federally Enforceable Through Title V Permit
12. For the purpose of identifying whether excess air infiltration into the landfill is occurring, the owner or operator shall monitor each well monthly for temperature and nitrogen or oxygen as provided in 60.753(c). If a well exceeds one of these operating parameters, action shall be initiated to correct the exceedance within 5 calendar days. If correction of the exceedance cannot be achieved within 15 calendar days of the first measurement, the gas collection system shall be expanded to correct the exceedance within 120 days of the initial exceedance. Any attempted corrective measure shall not cause exceedance of other operational or performance standards. An alternative timeline for corrected in the exceedance may be submitted to the APCO for approval. [40 CFR 60.755(a)(5)] Federally Enforceable Through Title V Permit
13. The provisions of this subpart apply at all times, except during periods of start-up, shutdown, or malfunction, provided that the duration of start-up, shutdown, or malfunction shall not exceed 5 days for collection systems and shall not exceed 1 hour for treatment or control devices. [40 CFR 60.755(e)] Federally Enforceable Through Title V Permit
14. Surface testing to measure the methane concentration at the surface of the landfill shall be conducted around the perimeter of the collection area and along a pattern that traverses the landfill at 30 meter intervals and where visual observations indicate elevated concentrations of landfill gas, such as distressed vegetation and cracks or seeps in the cover. The owner or operator may establish an alternative traversing pattern that ensures equivalent coverage. A surface monitoring design plan shall be developed that includes a topographical map with the monitoring route and the rationale for any site-specific deviations from the 30 meter intervals. Areas with steep slopes or other dangerous areas may be excluded from the surface testing. [District Rule 2201, 40 CFR 60.753(d), and 40 CFR 60.755(c)(1)] Federally Enforceable Through Title V Permit
15. Surface testing to measure the methane concentration at the surface of the landfill shall be conducted on a quarterly basis using an organic vapor analyzer, flame ionization detector, or other portable monitor meeting the specifications provided in 40 CFR 60.755(d). [40 CFR 60.755(c)(1)] Federally Enforceable Through Title V Permit
16. The collection system shall be operated such that the methane concentration is less than 500 parts per million above background at the surface of the landfill. Compliance with this surface methane operational standard shall be demonstrated using the procedures outlined in 40 CFR 60.755(c) within 180 days of installation and startup of the collection and control system and quarterly thereafter. [District Rule 2201, 40 CFR 60.753(d), 40 CFR 60.755(c), and 40 CFR 60.8] Federally Enforceable Through Title V Permit
17. Permittee shall calculate the NMOC emission rate for purposes of determining when the collection and control system can be removed as provided in 40 CFR 60.752(b)(2)(v) by using the equation found in 40 CFR 60.754(b). [40 CFR 60.754(b)] Federally Enforceable Through Title V Permit
18. Permittee shall operate the enclosed flare at all times when the collected gas is routed to it. [40 CFR 60.753(f)] Federally Enforceable Through Title V Permit

PERMIT UNIT REQUIREMENTS CONTINUE ON NEXT PAGE

These terms and conditions are part of the Facility-wide Permit to Operate.

19. Permittee shall operate the landfill gas collection system such that gas is collected from each area, cell, or group of cells in the MSW landfill in which solid waste has been in place for: (1) five years or more if active; or (2) two years or more if closed or at final grade. [40 CFR 60.753(a)] Federally Enforceable Through Title V Permit
20. Permittee shall operate the landfill gas collection system with negative pressure at each wellhead except under the following conditions: (1) A fire or increased well temperature. The owner or operator shall record instances when positive pressure occurs in efforts to avoid a fire. These records shall be submitted with the annual reports as provided in 60.757(f)(1); (2) Use of a geomembrane or synthetic cover. The owner or operator shall develop acceptable pressure limits in the design plan; (3) A decommissioned well. A well may experience a static positive pressure after shut down to accommodate for declining flows. All design changes shall be approved by the APCO. [40 CFR 60.753(b)] Federally Enforceable Through Title V Permit
21. Permittee shall operate each interior wellhead in the collection system with a landfill gas temperature less than 55 C and with either a nitrogen level less than 20 percent or an oxygen level less than 5 percent. The owner or operator may establish a higher operating temperature, nitrogen, or oxygen value at a particular well. A higher operating value demonstration shall show supporting data that the elevated parameter does not cause fires or significantly inhibit anaerobic decompositions by killing methanogens. [40 CFR 60.753(c)] Federally Enforceable Through Title V Permit
22. If monitoring demonstrates that the operational requirements in paragraphs (b), (c), or (d) of section 60.753 are not met, corrective action shall be taken as specified in 40 CFR 60.755(a)(3 - 5) or (c). If corrective actions are taken as specified in 60.755, the monitored exceedance is not a violation of the operational requirements in this section. [40 CFR 60.753(g)] Federally Enforceable Through Title V Permit
23. Each wellhead shall have a sampling port and a thermometer, other temperature-measuring device, or an access port for temperature measurements. [40 CFR 60.756(a)] Federally Enforceable Through Title V Permit
24. When monitoring interior wellheads for operation for a nitrogen level, the nitrogen level shall be determined using Method 3C, unless an alternative test method is established as allowed by 60.752(b)(2)(i) of this subpart. [40 CFR 60.753(c)(1)] Federally Enforceable Through Title V Permit
25. For each interior wellhead, unless an alternative test method is established as allowed by 60.752(b)(2)(i) of this subpart, the oxygen shall be determined by an oxygen meter using Method 3A or 3C except that: (i) The span shall be set so that the regulatory limit is between 20 and 50 percent of the span; (ii) A data recorder is not required; (iii) Only two calibration gases are required, a zero and span, and ambient air may be used as the span; (iv) A calibration error check is not required; (v) The allowable sample bias, zero drift, and calibration drift are  $\pm 10$  percent. [40 CFR 60.753(c)(2)] Federally Enforceable Through Title V Permit
26. The background concentration shall be determined by moving the probe inlet upwind and downwind outside the boundary of the landfill at a distance of at least 30 meters from the perimeter wells. [40 CFR 60.755(c)(2)] Federally Enforceable Through Title V Permit
27. Surface emission monitoring shall be performed in accordance with section 4.3.1 of Method 21 of appendix A, except that the probe inlet shall be placed within 5 to 10 centimeters of the ground. Monitoring shall be performed during typical meteorological conditions. Any reading of 500 parts per million or more above background at any location shall be recorded as a monitored exceedance and the actions specified in 40 CFR 60.755(c)(4)(i-v) shall be taken. As long as the specified actions are taken, the exceedance is not a violation of the operational requirements of 60.753(d). [40 CFR 60.755(c)(3), (4)] Federally Enforceable Through Title V Permit
28. For the performance test required in 60.752(b)(2)(iii)(B), Method 25, 25C, or Method 18 of Appendix A must be used to determine compliance with the 98 weight percent efficiency or the 20 ppmv outlet concentration level, unless another method to demonstrate compliance has been approved by the APCO as provided by 60.752(b)(2)(i)(B). Method 3 or 3A shall be used to determine oxygen for correcting the NMOC concentration as hexane to 3 percent. In cases where the outlet concentration is less than 50 ppm NMOC as carbon (8 ppm NMOC as hexane), Method 25A should be used in place of Method 25. If using Method 18 of appendix A, the minimum list of compounds to be tested shall be those published in the most recent Compilation of Air Pollutant Emission Factors (AP-42). The following equation shall be used to calculate efficiency:  $(\text{NMOC}_{\text{in}} - \text{NMOC}_{\text{out}}) / \text{NMOC}_{\text{in}}$ . The District must be notified at least 30 days prior to any compliance source test, and a source test plan must be submitted for approval at least 15 days prior to testing. [District Rule 1081; 40 CFR 60.754(d)] Federally Enforceable Through Title V Permit

PERMIT UNIT REQUIREMENTS CONTINUE ON NEXT PAGE

These terms and conditions are part of the Facility-wide Permit to Operate.

29. Permittee shall implement a program to monitor for cover integrity and implement cover repairs as necessary on a monthly basis. [40 CFR 60.755(c)(5)] Federally Enforceable Through Title V Permit
30. The portable analyzer shall meet the instrument specifications of Method 21, section 3 (except that "methane" shall replace all references to VOC). The calibration gas shall be methane, diluted to a nominal concentration of 500 parts per million in air. To meet the performance evaluation requirements of Method 21, section 3.1.3, the instrument evaluation procedures of Method 21, section 4.4. The calibration procedures provided in Method 21, section 4.2 shall be followed immediately before commencing a surface monitoring survey. The provisions of this condition apply at all times, except during periods of start-up, shutdown, or malfunction (as defined in 40 CFR 60.755(e)). [40 CFR 60.755(d), (e)] Federally Enforceable Through Title V Permit
31. The provisions of this subpart apply at all times, except during periods of start-up, shutdown, or malfunction, provided that the duration of start-up, shutdown, or malfunction shall not exceed 5 days for collections systems and shall not exceed 1 hour for treatment or control devices. [40 CFR 60.755(e)] Federally Enforceable Through Title V Permit
32. Operator shall measure the gauge pressure in the gas collection header on a monthly basis as provided in 40 CFR 60.755(a)(3); and monitor nitrogen or oxygen concentration in the landfill gas on a monthly basis as provided in 40 CFR 60.755(a)(5); and monitor temperature of the landfill gas on a monthly basis as provided in 40 CFR 60.755(a)(5). [40 CFR 60.756(a)] Federally Enforceable Through Title V Permit
33. Permittee shall submit an equipment removal report to the District 30 days prior to removal or cessation of operation of the control equipment. The report shall conform to the requirements of 40 CFR 60.757(e)(1). [40 CFR 60.757(e)] Federally Enforceable Through Title V Permit
34. Permittee shall submit to the District semiannual reports of the recorded information in 40 CFR 60.757(f)(1-6). The initial report shall be submitted within 180 days of installation and start-up of the collection and control system, and shall include the initial performance test report required under 40 CFR 60.8. [40 CFR 60.757(f), 40 CFR 63.1980(a)] Federally Enforceable Through Title V Permit
35. Each owner or operator seeking to comply with 40 CFR 60.752(b)(2)(iii) shall include information specified in 40 CFR 60.757(g)(1-6) with the initial performance test report required under 40 CFR Part 60.8. [40 CFR 60.757(g)] Federally Enforceable Through Title V Permit
36. The following constitute exceedances that also shall be recorded and reported under 40 CFR 60.757(f): all 3-hour periods of operation during which the average combustion temperature was more than 28 C below the average combustion temperature during the most recent performance test (flare source test). [40 CFR 60.758(c)] Federally Enforceable Through Title V Permit
37. Except as provided in 60.752(b)(2)(i)(B), each owner or operator of a controlled landfill shall keep up-to-date, readily accessible records for the life of the control equipment of the data listed in paragraphs 60.758(b)(1) through (b)(4) as measured during the initial performance test or compliance determination. Records of subsequent tests or monitoring shall be maintained for a minimum of 5 years. Records of the control device vendor specifications shall be maintained until removal. [40 CFR 60.758(b)] Federally Enforceable Through Title V Permit
38. Permittee shall keep the following records: (1)(i) the maximum expected gas generation flow rate as calculated in 60.755(a)(1). The owner or operator may use another method to determine the maximum gas generation flow rate, if the method has been approved by the APCO; (ii) the density of wells, horizontal collectors, surface collectors, or other gas extraction devices determined using the procedures specified in 60.759(a)(1); (2)(i) the average combustion temperature measured at least every 15 minutes and averaged over the same time period of the performance test; (ii) the percent reduction of NMOC determined as specified in 60.752(b)(2)(iii)(B) achieved by the control device. [40 CFR 60.758(b)(1) and (2)] Federally Enforceable Through Title V Permit
39. Except as provided in 60.752(b)(2)(i)(B), permittee shall keep, for the life of the collection system, an up-to-date, readily accessible plot map showing each existing and planned collector in the system and providing a unique identification location label for each collector. Permittee shall keep readily accessible documentation of the nature, date of deposition, amount, and location of asbestos-containing or nondegradable waste excluded from collection as well as any nonproductive areas excluded from collection. [40 CFR 60.758(d)] Federally Enforceable Through Title V Permit

PERMIT UNIT REQUIREMENTS CONTINUE ON NEXT PAGE

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40. Except as provided in 60.752(b)(2)(i)(B), permittee shall keep for at least 5 years up-to-date, readily accessible records of all collection and control system exceedances of the operational standards in 60.753, the reading in the subsequent month whether or not the second reading is an exceedance, and the location of each exceedance. [40 CFR 60.758(e)] Federally Enforceable Through Title V Permit
41. VOC emissions from the flare and landfill shall not exceed 339.5 lb-VOC/day. [District Rule 2201] Federally Enforceable Through Title V Permit
42. Emissions from the flare shall not exceed any of the following limits: 0.06 lb-NOx/MMBtu, 91.1 lb-SOx/day, 13,146 lb-SOx/year, 0.008 lb-PM10/MMBtu, 0.22 lb-CO/MMBtu, or 0.063 lb-VOC/MMBtu. [District Rule 2201] Federally Enforceable Through Title V Permit
43. The combined heat input of collected B-17 and B-19 landfill gas into the flare shall not exceed any of the following: 83.6 MMBtu/hr or 398,333 MMBtu/year. Heat input shall be calculated daily using monthly methane measurements (%), landfill gas flow into the flare (cubic feet per minute), and the annually tested landfill gas heat content (Btu/cubic foot). [District Rule 2201] Federally Enforceable Through Title V Permit
44. Enclosed flare shall reduce the inlet NMOC emissions by at least 98% by weight or to no more than 20 ppmvd @ 3% O<sub>2</sub> as methane. [District Rule 2201] Federally Enforceable Through Title V Permit
45. The methane destruction efficiency for the enclosed flares shall be at least 99% by weight. [17 CCR 95464 (b)(2)(A)(1)]
46. Emissions from the flare LPG-fired pilot shall not exceed any of the following limits: 0.15 lb-NOx/MMBtu, 0.0164 lb-SOx/MMBtu, 0.0044 lb-PM10/MMBtu, 0.021 lb-CO/MMBtu, or 0.0055 lb-VOC/MMBtu. [District Rule 2201] Federally Enforceable Through Title V Permit
47. A non-resettable, totalizing mass or volumetric landfill gas fuel flow meter to measure the amount of gas combusted in the enclosed flare shall be installed, utilized and maintained. [District Rule 2201] Federally Enforceable Through Title V Permit
48. Sampling ports adequate for sulfur testing shall be provided in the landfill gas manifold line to the flare. [District Rule 1081] Federally Enforceable Through Title V Permit
49. SOx emissions shall be determined by measuring the sulfur concentration in the landfill gas and calculating the correlated SOx emission rate based on the correlation between landfill gas sulfur concentration and associated SOx emission rate demonstrated during startup. [District Rule 1081] Federally Enforceable Through Title V Permit
50. Testing to demonstrate compliance with the daily and annual SOx emission limit shall be conducted weekly. Once eight (8) consecutive weekly tests show compliance, the frequency of monitoring sulfur content, and associated SOx emissions, may be reduced to monthly. If a monthly test shows violation of the SOx emission limit, then weekly testing shall resume and continue until eight (8) consecutive tests show compliance. Once compliance is shown on eight (8) consecutive weekly tests, then testing may return to monthly. [District Rule 2201] Federally Enforceable Through Title V Permit
51. Sulfur content of the landfill gas being combusted in the flare shall be determined using ASTM D 1072, D 3031, D 4084, D 3246 or double GC for H<sub>2</sub>S and mercaptans, or draeger tubes for H<sub>2</sub>S, or an equivalent method approved by the District. [District Rule 1081] Federally Enforceable Through Title V Permit
52. Total combined Class II/III waste material and Class II soil acceptance rate of C-283-22 and '-25 shall not exceed 2000 tons per day. [District Rule 2201] Federally Enforceable Through Title V Permit
53. Total combined Class II/III waste material acceptance rate of C-283-22 and '-25 shall not exceed 620,000 tons per year. [District Rule 2201] Federally Enforceable Through Title V Permit
54. Total combined Class II soil acceptance rate of C-283-22 and '-25 shall not exceed 800 tons per day. [District Rule 2201] Federally Enforceable Through Title V Permit
55. Total combined clean (<50 ppm by weight VOC) soil cover usage rate of C-283-22 and '-25 shall not exceed 6000 tons per day. [District Rule 2201] Federally Enforceable Through Title V Permit

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These terms and conditions are part of the Facility-wide Permit to Operate.

Facility Name: CHEMICAL WASTE MANAGEMENT, INC  
Location: 35251 OLD SKYLINE ROAD, KETTLEMAN CITY, CA 93239  
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56. Total PM10 emissions from handling of Class II/III waste material and soil cover shall not exceed 0.000454 pounds per ton material handled. [District Rule 2201] Federally Enforceable Through Title V Permit
57. Source testing on the flare shall be performed to demonstrate compliance with the flare NOx and CO limits, and the NMOC destruction efficiency of 98%, or no more than 20 ppmvd @ 3% O2 as methane, as required by this permit shall be conducted annually. [District Rule 2201] Federally Enforceable Through Title V Permit
58. Source testing for flare NOx emissions shall be conducted using CARB Method 7 or Method 20. [District Rule 1081] Federally Enforceable Through Title V Permit
59. Source testing for flare CO emissions shall be conducted using EPA Method 10 or 10B, CARB Methods 1 through 5 with 10, or CARB Method 100. [District Rule 1081] Federally Enforceable Through Title V Permit
60. Operator shall determine landfill gas fuel higher heating value annually by ASTM D 1826 or D 1945 in conjunction with ASTM D 3588 for gaseous fuels. [District Rule 2201] Federally Enforceable Through Title V Permit
61. The results of each landfill gas sulfur content test shall be submitted to the District within 60 days thereafter. [District Rule 1081] Federally Enforceable Through Title V Permit
62. Gas collection system shall be operated in a manner which maximizes the amount of landfill gas extracted while preventing overdraw that can cause fires or damage the gas collection system. [District Rule 2201] Federally Enforceable Through Title V Permit
63. During maintenance of the gas collection system or incineration device, emissions of landfill gas shall be minimized during shutdown. [District Rule 2201] Federally Enforceable Through Title V Permit
64. Maintenance is defined as work performed on a gas collection system and/or control device in order to ensure continued compliance with District rules, regulations, and/or Permits to Operate, and to prevent its failure or malfunction. [District Rule 2201] Federally Enforceable Through Title V Permit
65. The permittee shall notify the APCO by telephone at least 24 hours before performing any maintenance work that requires the system to be shutdown. The notification shall include a description of work, the date work will be performed and the amount of time needed to complete the maintenance work. [District Rule 2201] Federally Enforceable Through Title V Permit
66. Permittee shall maintain records of system inspections including: date, time and inspection results. [District Rule 1070] Federally Enforceable Through Title V Permit
67. Permittee shall maintain records of maintenance related or other collection system and control device downtime, including individual well shutdown. [District Rule 1070] Federally Enforceable Through Title V Permit
68. The operator shall record emission control device source tests (emissions of CO, NOx, and VOC) in pounds per MMbtu heat input. Operator shall also record VOC destruction/treatment efficiency. [District Rule 1081] Federally Enforceable Through Title V Permit
69. Daily records of the weight of materials received (tons) - including Class II/III waste material, Class II soil cover, and clean soil cover - and daily records of all soil organic content test results and certifications, shall be maintained, kept on site for a period of five years, and made available to District staff upon request. [District Rule 2201] Federally Enforceable Through Title V Permit
70. The District shall be notified in writing ten days prior to the acceptance of new types of waste streams, or waste streams with significant malodorous qualities. [District Rules 2201 and 4102] Federally Enforceable Through Title V Permit
71. A District approved anemometer shall be continuously operated on site with permanent data available to the District. [District Rule 2201] Federally Enforceable Through Title V Permit
72. Wastes with the potential to release hazardous gases, mists, or vapors in excess of existing air quality standards shall not be exposed to the atmosphere, and combustion of flammable wastes in the landfill shall be prevented. [District Rule 2201] Federally Enforceable Through Title V Permit

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These terms and conditions are part of the Facility-wide Permit to Operate.

73. A record of continuous flare combustion temperature, continuous volumetric gas flow rate, net heating value of landfill gas being combusted, daily landfill gas fuel consumption, and daily heat input shall be maintained, retained on the premises for a period of at least five years and made readily available for District inspection upon request. [District Rule 2201] Federally Enforceable Through Title V Permit
74. Records of daily and annual landfill gas flow rate, annual test results of higher heating value of landfill gas, and calculated daily and annual SO<sub>x</sub> emissions shall be maintained. [District Rule 2201] Federally Enforceable Through Title V Permit
75. The collection devices within the interior and along the perimeter areas shall be certified to achieve comprehensive control of surface gas emissions by a professional engineer. The following issues shall be addressed in the design: depths of refuse, refuse gas generation rates and flow characteristics, cover properties, gas system expandability, leachate and condensate management, accessibility, compatibility with filling operations, integration with closure end use, air intrusion control, corrosion resistance, fill settlement, and resistance to the refuse decomposition heat. [40 CFR 60.759(a)(1)] Federally Enforceable Through Title V Permit
76. The placement of gas collection devices determined in paragraph 60.759(a)(1) shall control all gas producing areas, except as provided by paragraphs 60.759(a)(3)(i) and (a)(3)(ii). [40 CFR 60.759(a)(3)] Federally Enforceable Through Title V Permit
77. The sufficient density of gas collection devices determined in paragraph 60.759(a)(1) shall address landfill gas migration issues and augmentation of the collection system through the use of active or passive systems at the landfill perimeter or exterior. [40 CFR 60.759(a)(2)] Federally Enforceable Through Title V Permit
78. Any segregated area of asbestos or nondegradable material may be excluded from collection if documented as provided under 60.758(d). The documentation shall provide the nature, date of deposition, location and amount of asbestos or nondegradable material deposited in the area, and shall be provided to the Administrator upon request. [40 CFR 60.759(a)(3)(i)] Federally Enforceable Through Title V Permit
79. Any nonproductive area of the landfill may be excluded from control provided that the total of all excluded areas can be shown to contribute less than 1 percent of the total amount of NMOC emissions from the landfill. The amount, location, and age of the material shall be documented and provided to the Administrator upon request. A separate NMOC emissions estimate shall be made for each section proposed for exclusion, and the sum of all such sections shall be compared to the NMOC emissions estimate for the entire landfill. Emissions from each section shall be computed using the equation in Section 60.759(a)(3)(ii). [40 CFR 60.759(a)(3)(ii)] Federally Enforceable Through Title V Permit
80. The values for k and CNMOC in equation in Section 60.759(a)(3)(ii) determined in field testing shall be used if field testing has been performed in determining the NMOC emission rate or the radii of influence (this distance from the well center to a point in the landfill where the pressure gradient applied by the blower or compressor approaches zero). If field testing has not been performed, the default values for k, L<sub>o</sub>, and CNMOC provided in 60.754(a)(1) or the alternative values from 60.754(a)(5) shall be used. The mass of nondegradable solid waste contained within the given section may be subtracted from the total mass of the section when estimating emissions provided the nature, location, age, and amount of the nondegradable material is documented as provided in paragraph 60.759(a)(3)(i). [40 CFR 60.759(a)(3)(iii)] Federally Enforceable Through Title V Permit

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These terms and conditions are part of the Facility-wide Permit to Operate.

Facility Name: CHEMICAL WASTE MANAGEMENT, INC  
Location: 35251 OLD SKYLINE ROAD, KETTLEMAN CITY, CA 93239  
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81. Each owner or operator seeking to comply with 60.752(b)(2)(i)(A) shall construct the gas collection devices using the following equipment or procedures: (1) The landfill gas extraction components shall be constructed of polyvinyl chloride (PVC), high density polyethylene (HDPE) pipe, fiberglass, stainless steel, or other nonporous corrosion resistant material of suitable dimensions to: convey projected amounts of gases; withstand installation, static, and settlement forces; and withstand planned overburden or traffic loads. The collection system shall extend as necessary to comply with emission and migration standards. Collection devices such as wells and horizontal collectors shall be perforated to allow gas entry without head loss sufficient to impair performance across the intended extent of control. Perforations shall be situated with regard to the need to prevent excessive air infiltration; (2) Vertical wells shall be placed so as not to endanger underlying liners and shall address the occurrence of water within the landfill. Holes and trenches constructed for piped wells and horizontal collectors shall be of sufficient cross-section so as to allow for their proper construction and completion including, for example, centering of pipes and placement of gravel backfill. Collection devices shall be designed so as not to allow indirect short circuiting of air into the cover or refuse into the collection system or gas into the air. Any gravel used around pipe perforations should be of a dimension so as not to penetrate or block perforations; (3) Collection devices may be connected to the collection header pipes below or above the landfill surface. The connector assembly shall include a positive closing throttle valve, any necessary seals and couplings, access couplings and at least one sampling port. The collection devices shall be constructed of PVC, HDPE, fiberglass, stainless steel, or other nonporous material of suitable thickness. [40 CFR 60.759(b)] Federally Enforceable Through Title V Permit
82. Each owner or operator seeking to comply with 60.752(b)(2)(i)(A) shall convey the landfill gas to a control system in compliance with 60.752(b)(2)(iii) through the collection header pipe(s). The gas mover equipment shall be sized to handle the maximum gas generation flow rate expected over the intended use period of the gas moving equipment using the following procedures: (1) For existing collection systems, the flow data shall be used to project the maximum flow rate. If no flow data exists, the procedures in paragraph 60.759(c)(2) shall be used; (2) For new collection systems, the maximum flow rate shall be in accordance with 60.755(a)(1). [40 CFR 60.759(c)] Federally Enforceable Through Title V Permit
83. The permittee is no longer required to comply with the requirements of 40 CFR Part 63 Subpart AAAA for the bioreactor provided the conditions in paragraphs (a) or (b) are met: (a) the affected source meets the control system removal criteria in 40 CFR 60.752(b)(2)(v) of part 60, subpart WWW or the bioreactor meets the criteria for a nonproductive area of the landfill in 40 CFR 60.759(a)(3)(ii) of part 60, subpart WWW; (b) the bioreactor portion of the landfill is a closed landfill as defined in 40 CFR 60.751, subpart WWW and has permanently ceased adding liquids to the bioreactor, and have not added liquids to the bioreactor for at least 1 year. A closure report for the bioreactor must be submitted to the APCO as provided in 40 CFR 60.757(d) of subpart WWW. [40 CFR 63.1952(a) and (b)] Federally Enforceable Through Title V Permit
84. For the bioreactor portions, the permittee shall comply with the general provisions specified in Table 1 of 40 CFR Part 63 Subpart AAAA and 63.1960 through 63.1985 starting on the date required to install the gas collection and control system and must extend the collection and control system into each new cell or area of the bioreactor prior to initiating liquids addition in that area. [40 CFR 63.1955(b) and (d)(2)] Federally Enforceable Through Title V Permit
85. Continuous parameter monitoring data, collected under 40 CFR 60.756(b)(1), (c)(1), and (d), are used to demonstrate compliance with the operating conditions for control systems. If a deviation occurs, the permittee has failed to meet the control device operation conditions described in this subpart and has deviated from the requirements of this subpart. The permittee shall develop a written SSM plan according to the provisions in 40 CFR 63.6(e)(3). A copy of the SSM plan must be maintained on site. Failure to write or maintain a copy of the SSM plan is a deviation from the requirements of this subpart. [40 CFR 63.1960] Federally Enforceable Through Title V Permit
86. The permittee shall maintain records as specified in the general provisions of 40 CFR part 60 and this part as shown in Table 1 of this subpart. Applicable records in the general provisions include items such as SSM plans and the SSM plan reports. [40 CFR 63.1980(b)] Federally Enforceable Through Title V Permit
87. The permittee shall submit the initial semiannual compliance report and performance tests results described in 40 CFR 60.757(f) within 180 days after the date required to being operating the gas collection and control system by 63.1947(c) of this subpart. [40 CFR 63.1980(e)] Federally Enforceable Through Title V Permit

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Facility Name: CHEMICAL WASTE MANAGEMENT, INC  
Location: 35251 OLD SKYLINE ROAD, KETTLEMAN CITY, CA 93239  
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88. If a semiannual compliance report for the bioreactor is required as well as a semiannual compliance report for the conventional portion of the same landfill, submittal may be delayed of a subsequent semiannual compliance report for the bioreactor according to the following so that the reports may be submitted on the same schedule: (1) After submittal of the initial semiannual compliance report and performance test results for the bioreactor, the permittee may delay of the submittal of the subsequent semiannual compliance report for the bioreactor until the date of the initial or subsequent semiannual compliance report is due for the conventional portion of the landfill; (2) The permittee may delay submittal of the subsequent semiannual compliance report by no more than 12 months after the due date for submitting the initial semiannual compliance report and performance test results described in 40 CFR 60.757(f) for the bioreactor. The report shall cover the time period since the previous semiannual report for the bioreactor, which would be a period of at least 6 months and no more than 12 months; (3) After the delayed semiannual report, all subsequent semiannual reports for the bioreactor must be submitted every 6 months on the same date the semiannual report for the conventional portion of the landfill is due. [40 CFR 63.1980(f)] Federally Enforceable Through Title V Permit
89. All records shall be maintained and retained on-site for a period of at least 5 years and shall be made available for District inspection upon request. [District Rule 1070] Federally Enforceable Through Title V Permit
90. The landfill surface shall be monitored quarterly. If there are any exceedances during a quarterly event, monitoring will be required monthly until three consecutive months without exceedances, which would allow a return to quarterly monitoring. [District Rule 2201] Federally Enforceable Through Title V Permit
91. After an exceedance, the permittee shall initiate correction action within five days and conduct remonitoring within ten days from the initial exceedance. If compliance is shown, an additional remonitoring event is required within one month of the initial exceedance. If the ten day event shows an exceedance, the permittee shall initiate correction action within five days and conduct remonitoring within ten days from the second exceedance. If compliance is shown, an additional remonitoring is required within one month of the initial exceedance. If the second ten day event shows an exceedance, the permittee shall permit and install additional landfill gas wells to correct the problem within 120 days of the initial exceedance. [District Rule 2201] Federally Enforceable Through Title V Permit
92. The gas collection and control system shall comply with the operational standards of 40 CFR 60.753, the compliance provisions of 40 CFR 60.755, the monitoring provisions of 40 CFR 60.756, the reporting and record keeping requirements of 40 CFR 60.757 and 60.758, and the requirements of 40 CFR 60.759 (for active collection systems). [40 CFR 60.752(b)(2)(ii), 60.753, 60.755, 60.756, 60.757, 60.758 and 60.759] Federally Enforceable Through Title V Permit
93. In the event that the collection or control system becomes inoperable, the gas mover equipment (as defined in 40 CFR 60.751) shall be shut down and all valves in the collection and control system contributing to venting of the landfill gas to the atmosphere shall be closed within one hour. [40 CFR 60.753(e)] Federally Enforceable Through Title V Permit
94. The owner/operator shall install, calibrate, maintain, and operate a meter that measures and records the landfill gas flow rate into the flare at least once every 15 minutes. This meter shall also be capable of measuring the landfill gas flow rate that might bypass the flare in the event of equipment malfunction or maintenance. [40 CFR 60.756(c)(2)] Federally Enforceable Through Title V Permit
95. The flare shall be operated with a flame present at all times while gas is being vented to it. The presence of a flame shall be continuously monitored using a thermocouple, ultraviolet sensor, or any other equivalent device located at the pilot light or the flame itself. The flame's presence shall be recorded at least once every 15 minutes. [40 CFR 60.18(c)(2) and 40 CFR 60.756(c)(1)] Federally Enforceable Through Title V Permit
96. The enclosed flare shall be equipped with an accurate temperature indicator/recorder that continuously measures and records the operating temperature. [District Rule 2201; 40 CFR 60.756(b)(1)] Federally Enforceable Through Title V Permit
97. The enclosed flare shall be equipped with either a device that records flow to the control device at least every 15 minutes; or secure the bypass line valve in the closed position with a car-seal or a lock-and-key type configuration of the control device. [40 CFR 60.756(b)(2)] Federally Enforceable Through Title V Permit
98. Any closed landfill that has demonstrated compliance in three consecutive quarterly monitoring periods may perform annual monitoring. Quarterly monitoring shall resume if any methane readings of 500 ppm or more above background are detected during annual monitoring. [40 CFR 60.756(f)] Federally Enforceable Through Title V Permit

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99. Permittee shall keep up-to-date, readily accessible continuous records of the indication of flow to the enclosed flare, or the indication of bypass flow, or records of monthly inspections of car-seals or lock-and-key configurations used to seal bypass lines. [40 CFR 60.758(c) and 60.34c] Federally Enforceable Through Title V Permit
100. The non-bioreactor portion of the landfill is no longer required to comply with the requirements of 40 CFR Part 63 Subpart AAAA when it is no longer required to apply controls as specified in 40 CFR 60.752(b)(2)(v) of subpart WWW. [40 CFR 63.1950] Federally Enforceable Through Title V Permit
101. Except for the spreading of landfill cover, when handling bulk materials outside an enclosed structure or building, water or chemical/organic stabilizers/suppressants shall be applied as required to limit Visible Dust Emissions to a maximum of 20% opacity. When necessary to achieve this opacity limitation, wind barriers with less than 50% porosity shall also be used. [District Rules 8011 and 8031] Federally Enforceable Through Title V Permit
102. Except for the spreading of landfill cover, when transporting bulk materials outside an enclosed structure or building, all bulk material transport vehicles shall limit Visible Dust Emissions to 20% opacity by either limiting vehicular speed, maintaining sufficient freeboard on the load, applying water to the top of the load, or covering the load with a tarp or other suitable cover. [District Rules 8011 and 8031] Federally Enforceable Through Title V Permit
103. Records and other supporting documentation shall be maintained as required to demonstrate compliance with the requirements of the rules under Regulation VIII only for those days that a control measure was implemented. Such records shall include the type of control measure(s) used, the location and extent of coverage, and the date, amount, and frequency of application of dust suppressant, manufacturer's dust suppressant product information sheet that identifies the name of the dust suppressant and application instructions. Records shall be kept for one year following project completion that results in the termination of all dust generating activities. [District Rules 8031, 8071, and 8011] Federally Enforceable Through Title V Permit
104. An owner/operator shall prevent or cleanup any carryout or trackout in accordance with the requirements of District Rule 8041 Section 5.0, unless specifically exempted under Rule 8041 or Rule 8011. [District Rules 8041 and 8011] Federally Enforceable Through Title V Permit
105. One or more of the following control measures shall be implemented on each day that 50 or more VDT (Vehicle Daily Trips), or 25 or more VDT with 3 or more axles, originates from within and remains exclusively within an unpaved vehicle/equipment traffic area: water, gravel, roadmix, or chemical/organic dust stabilizers/suppressants, vegetative materials, or other District-approved control measure shall be applied to unpaved vehicle travel areas as required to limit Visible Dust Emissions to 20% opacity and comply with the requirements for a stabilized unpaved road as defined in District Rule 8011. [District Rule 8071 and 8011] Federally Enforceable Through Title V Permit
106. On each day that 50 or more VDT (Vehicle Daily Trips), or 25 or more VDT with 3 or more axles, originates from within and remains exclusively within an unpaved vehicle/equipment traffic area, dusting materials accumulated on paved surfaces shall be removed daily or water and/or chemical/organic dust stabilizers/suppressants shall be applied to the paved surface as required to maintain continuous compliance with the requirements for a stabilized unpaved road as defined in District Rule 8011 and limit Visible Dust Emissions (VDE) to 20% opacity. [District Rule 8011 and 8071] Federally Enforceable Through Title V Permit
107. Whenever any portion of the site becomes inactive, permittee shall restrict access and periodically stabilize any disturbed surface to comply with the conditions for a stabilized surface as defined in Section 3.58 of District Rule 8011. [District Rules 8071 and 8011] Federally Enforceable Through Title V Permit
108. The flare and gas collection system may be shut down when there is an insufficient amount of landfill gas to operate on. During the shutdown period, all gas collection system vents shall be closed and no emissions shall occur through the gas collection system. [District Rule 2201] Federally Enforceable Through Title V Permit
109. During the shutdown of the gas collection system, surface testing to measure the methane concentration at the surface of the landfill shall be conducted at least once every week using an organic vapor analyzer, flame ionization detector, or other portable monitor meeting the specifications provided in 40 CFR 60.755(d). After demonstrating compliance on four consecutive tests, the testing frequency shall be at least once every month. [District Rule 2201] Federally Enforceable Through Title V Permit

PERMIT UNIT REQUIREMENTS CONTINUE ON NEXT PAGE

These terms and conditions are part of the Facility-wide Permit to Operate.

Facility Name: CHEMICAL WASTE MANAGEMENT, INC  
Location: 35251 OLO SKYLINE ROAD, KETTLEMAN CITY, CA 93238  
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110. During the shutdown of the gas collection system, if the methane concentration measured during weekly or monthly surface testing exceeds 500 parts per million above background at the surface of the landfill, the testing frequency shall be at least once every other day. After demonstrating compliance on four consecutive tests, the testing frequency shall revert to at least once every week. [District Rule 2201] Federally Enforceable Through Title V Permit
111. During operation of the enclosed flare, the permittee shall continuously monitor and record combustion chamber temperature. The temperature readings shall not be less than 28 degree C (50 degree F) below the average combustion temperature determined during the most recent flare source test, averaged over a 3-hour period. Upon detecting any temperature excursion lower than 28 degree C (50 degree F) below the source test average combustion temperature, averaged over a 3-hour period, the permittee shall investigate the excursion and take corrective action to minimize excessive emissions and prevent recurrence of the excursion as expeditiously as practicable. [40 CFR part 64] Federally Enforceable Through Title V Permit
112. The temperature monitoring device shall be calibrated, maintained, and operated according to the manufacturer's specifications. [40 CFR part 64] Federally Enforceable Through Title V Permit
113. The enclosed flare burner and its associated components and the vapor collection system shall be inspected on an annual basis. The records of inspection shall at least contain date and time of inspection, identification of the person performing an inspection, parts replacement and repairs, and all maintenance actions taken. The records shall be kept and maintained for compliance inspection upon request. [40 CFR part 64] Federally Enforceable Through Title V Permit
114. The permittee shall comply with the compliance assurance monitoring operation and maintenance requirements of 40 CFR part 64.7. [40 CFR part 64] Federally Enforceable Through Title V Permit
115. The permittee shall comply with the recordkeeping and reporting requirements of 40 CFR part 64.9. [40 CFR part 64] Federally Enforceable Through Title V Permit
116. If the District or EPA determine that a Quality Improvement Plan is required under 40 CFR 64.7(d)(2), the permittee shall develop and implement the Quality Improvement Plan in accordance with 40 CFR part 64.8. [40 CFR part 64] Federally Enforceable Through Title V Permit
117. Landfill gas collection system components downstream of blower have a leak limit of 500 ppmv as methane. Components must be checked quarterly. [17 CCR 95464 (b)(1)(B), 17 CCR 95469 (b)(3)]
118. Landfill gas collection system wellheads must be operated under vacuum. Monthly monitoring of wellheads is required. Landfill gas collection system wellheads may be operated under neutral or positive pressure except as allowed in sections 95464(c), 95464(d), and 95464(e) [17 CCR 95464(b)(1)(C)]
119. Landfill gas collection and control system must be operated such that landfill surface methane emissions shall not exceed instantaneous surface emission limit of 500 ppmv as methane or integrated surface emission limit of 25 ppmv as methane. [17 CCR 95465]
120. Instantaneous and integrated landfill surface emissions measurements shall be done quarterly. The landfill may monitor annually provided they comply with requirements of 17 CCR 95469 (a)(3). [17 CCR 95469(a)]
121. Permittee shall keep records of all gas collection system downtime exceeding five days, including individual well shutdown and disconnection times and the reason for downtime. [17 CCR 95470(a)(1)(A)]
122. Permittee shall keep records of all gas control system downtime in excess of one hour, the reason for the downtime and the length of time the gas control system was shutdown. [17 CCR 95470(a)(1)(B)]
123. Permittee shall keep records of the expected gas generation flow rate calculated pursuant to section 95471(e). [17 CCR 95470(a)(1)(C)]
124. Permittee shall keep records of all instantaneous surface readings of 200 ppmv or greater; all exceedances of the limits in sections 95464(b)(1)(B) or 95465, including the location of the leak (or affected grid), leak concentration in ppmv, date and time of measurement, the action taken to repair the leak, date of repair, any required re-monitoring and the re-monitored concentration in ppmv, and wind speed during surface sampling; and the installation date and location of each well installed as part of a gas collection system expansion. [17 CCR 95470(a)(1)(D)]

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125. Permittee shall keep records of any positive wellhead gauge pressure measurements, the date of the measurements, the well identification number, and the corrective action taken. [17 CCR 95470(a)(1)(E)]
126. Permittee shall conduct surface emission monitoring using either the procedures specified in section 95471(c) or the Los Angeles County Sanitation District monitoring procedure. Permittee shall keep records of which procedure was used. [17 CCR 95468]
127. Permittee shall keep records of delays encountered during repair of leaks or repair of positive wellhead readings. Documentation of delays shall be submitted with the annual report. [17 CCR 95468(a)(2)]
128. Permittee shall keep records of alternate landfill gas collection system modifications being implemented to correct an exceedance in the landfill gas surface emissions or wellhead pressure. Any alternative to installing a new well shall be documented and submitted with the annual report. [17 CCR 95468]
129. Permittee shall identify areas which are dangerous and unable to be inspected or contain only inert, non-decomposing waste. Areas shall be clearly identified on a map of the facility. A copy of the map shall be kept onsite as well as submitted with the annual report. [17 CCR 95468(a)(5)]
130. Permittee shall conduct monitoring of the landfill surface within 3 inches of the surface. The facility may monitor surface emissions with the probe tip at the height of the vegetation if there is vegetation and it is impractical to monitor at 3 inches from the landfill surface. [17 CCR 95468]
131. Permittee shall terminate surface emission testing when the measured average wind speed is over 10 mph or the instantaneous wind speed is over 20 mph. [17 CCR 95468(a)(3), 17 CCR 95471(c)(1)(C)]
132. Permittee shall only conduct surface emission testing when precipitation has met the following requirements. It has been 24 hours since measured precipitation of 0.01 to 0.15 inches. It has been 48 hours since measured precipitation of 0.16 to 0.24 inches. It has been 72 hours since measured precipitation of 0.25 or more inches. [17 CCR 95468]
133. Permittee shall keep records of the annual solid waste acceptance rate and the current amount of waste-in-place. [17 CCR 95470(a)(1)(F)]
134. Permittee shall keep records of the nature, location, amount, and date of deposition of non-degradable waste for any landfill areas excluded from the collection system. [17 CCR 95470(a)(1)(G)]
135. Permittee shall keep records of any source tests conducted pursuant to section 95464(b)(4). [17 CCR 95470(a)(1)(H)]
136. The flare must be source tested annually for methane destruction efficiency of at least 99% by weight. If the flare is in compliance after three consecutive source tests, the facility may move to source testing the flare every three years. If subsequent tests show the flare out of compliance, the test frequency shall revert to annual testing. [17 CCR 95464(b)(4)]
137. The flare must have automatic dampers, an automatic shutdown device, a flame arrester, and continuous recording temperature sensors. [17 CCR 95464(b)(2)(A)(2)]
138. The flare must operate within the parameter ranges established during the initial or most recent source test. [17 CCR 95464(b)(2)(A)(4)]
139. Permittee shall keep records describing the mitigation measures taken to prevent the release of methane or other emissions into the atmosphere during the following activities: 1. When solid waste was brought to the surface during the installation or preparation of wells, piping, or other equipment; 2. During repairs or the temporary shutdown of gas collection system components; or, 3. When solid waste was excavated and moved. [17 CCR 95470(a)(1)(I)]
140. Permittee shall keep records of any construction activities pursuant to section 95466. The records must contain the following information: 1. A description of the actions being taken, the areas of the MSW landfill that will be affected by these actions, the reason the actions are required, and any landfill gas collection system components that will be affected by these actions. 2. Construction start and finish dates, projected equipment installation dates, and projected shut down times for individual gas collection system components. 3. A description of the mitigation measures taken to minimize methane emissions and other potential air quality impacts. [17 CCR 95470(a)(1)(J)]

PERMIT UNIT REQUIREMENTS CONTINUE ON NEXT PAGE

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141. Permittee shall keep records of the equipment operating parameters specified to be monitored under section 95469(b)(1) as well as records for periods of operation during which the parameter boundaries established during the most recent source test are exceeded. The records must include the following information: 1. For enclosed flares, all 3-hour periods of operation during which the average temperature difference was more than 28 degrees Celsius (or 50 degrees Fahrenheit) below the average combustion temperature during the most recent source test at which compliance with sections 95464(b)(2) was determined and a gas flow rate device which must record the flow to the control device at least every 15 minutes. [17 CCR 95470(a)(1)(K), 17 CCR 95469(b)(1)(B)]
142. Permittee shall submit the following reports as required in section 95470(b): Closure notification, Equipment removal report and Annual report. All reports must be accompanied by a certification of truth, accuracy, and completeness signed by a responsible official. [17 CCR 95470(b)]
143. Permittee may request alternatives to the compliance measures, monitoring requirements, test methods and procedures of sections 95464, 95469, and 95471. Any requests must be submitted in writing. [17 CCR 95468]

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# San Joaquin Valley Air Pollution Control District

**PERMIT UNIT:** C-283-25-3

**EXPIRATION DATE:** 08/31/2016

**EQUIPMENT DESCRIPTION:**

MUNICIPAL SOLID WASTE LANDFILL, CLASS II AND III (B-17), 18.4 MILLION CUBIC YARD CAPACITY (62 ACRES) WITH GAS COLLECTION AND CONTROL SYSTEM SERVED BY A 2,500 SCFM (EQUIVALENT TO 83.6 MMBTU/HR) PARNEL BIOGAS ENCLOSED FLARE SHARED WITH C-283-22

## PERMIT UNIT REQUIREMENTS

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1. No air contaminant shall be discharged into the atmosphere for a period or periods aggregating more than three minutes in any one hour which is as dark as, or darker than, Ringelmann 1/4 or 5% opacity. [District Rules 2201 and 4101] Federally Enforceable Through Title V Permit
2. All equipment shall be maintained in good operating condition and shall be operated in a manner to minimize emissions of air contaminants into the atmosphere. [District Rule 2201] Federally Enforceable Through Title V Permit
3. Each owner or operator shall keep for at least 5 years up-to-date, readily accessible, on-site records of the maximum design capacity, the current amount of solid waste in-place, and the year-by-year waste acceptance rate. Off-site records may be maintained if they are retrievable within 4 hours. [40 CFR 60.758(a)] Federally Enforceable Through Title V Permit
4. This operating permit may be cancelled with APCO approval when the landfill is closed, pursuant to the requirements of this permit, if the landfill is not otherwise subject to the requirements of either 40 CFR part 70 or part 71 and if either 1) it was never subject to the requirement for a control system under 40 CFR 60.752(b)(2); or 2) the owner or operator meets the conditions for control system removal specified in 40 CFR 60.752(b)(2)(v). [40 CFR 60.752(d)] Federally Enforceable Through Title V Permit
5. If the landfill is permanently closed, a closure notification shall be submitted to the APCO within 30 days of waste disposal cessation. A permanent closure must take place in accordance with 40 CFR 258.60. If a closure report has been submitted, no additional waste may be placed in the landfill without filing a notification of modification to the APCO, pursuant to 40 CFR 60.7(a)(4). [40 CFR 60.752(b)(1)(ii)(B), 60.757(d)] Federally Enforceable Through Title V Permit
6. An active collection system shall be designed to handle the maximum expected gas flow rate from the entire area of the landfill that warrants control over the intended use period of the gas control or treatment system equipment, collect gas from each area, cell, or group of cells in the landfill in which the initial solid waste has been placed for a period of 5 years or more if active; or 2 years or more if closed or at final grade, collect gas at a sufficient extraction rate, and be designed to minimize off-site migration of subsurface gas. [40 CFR 60.752(b)(2)(ii)(A)] Federally Enforceable Through Title V Permit
7. Each owner or operator seeking to comply with 40 CFR 60.752(b)(2)(i) shall site active collection wells, horizontal collectors, surface collectors, or other extraction devices at a sufficient density throughout all gas producing areas using the procedures in 60.759(a)(1), (2), and (3) unless alternative procedures have been approved by the APCO as provided in 60.752(b)(2)(i)(C) and (D). [40 CFR 60.759(a)] Federally Enforceable Through Title V Permit
8. For the purposes of calculating the maximum expected gas generation flow rate from the landfill to determine compliance with 60.752(b)(2)(ii)(A)(1), one of the equations in Section 60.755(a)(1)(i) or (ii) or (iii) shall be used. [40 CFR 60.755(a)(1)] Federally Enforceable Through Title V Permit

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These terms and conditions are part of the Facility-wide Permit to Operate.

Facility Name: CHEMICAL WASTE MANAGEMENT, INC  
Location: 35251 OLD SKYLINE ROAD, KETTLEMAN CITY, CA 93239  
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9. For the purposes of determining sufficient density of gas collectors for compliance with 60.752(b)(2)(ii)(A)(2), the owner or operator shall design a system of vertical wells, horizontal collectors, or other collection devices, satisfactory to the APCO, capable of controlling and extracting gas from all portions of the landfill sufficient to meet all operational and performance standards. [40 CFR 60.755(a)(2)] Federally Enforceable Through Title V Permit
10. For the purpose of demonstrating whether the gas collection system flow rate is sufficient to determine compliance with 60.752(b)(2)(ii)(A)(3), the owner or operator shall measure gauge pressure in the gas collection header at each individual well, monthly. If a positive pressure exists, action shall be initiated to correct the exceedance within 5 calendar days, except for the three conditions allowed under 60.753(b). If negative pressure cannot be achieved without excess air infiltration within 15 calendar days of the first measurement, the gas collection system shall be expanded to correct the exceedance within 120 days of the initial measurement of positive pressure. Any attempted corrective measure shall not cause exceedances of other operational or performance standards. An alternative timeline for correcting the exceedance may be submitted to the APCO for approval. [40 CFR 60.755(a)(3)] Federally Enforceable Through Title V Permit
11. Owners or operators are not required to expand the system as required in paragraph 60.755(a)(3) during the first 180 days after gas collection system startup. [40 CFR 60.755(a)(4)] Federally Enforceable Through Title V Permit
12. For the purpose of identifying whether excess air infiltration into the landfill is occurring, the owner or operator shall monitor each well monthly for temperature and nitrogen or oxygen as provided in 60.753(c). If a well exceeds one of these operating parameters, action shall be initiated to correct the exceedance within 5 calendar days. If correction of the exceedance cannot be achieved within 15 calendar days of the first measurement, the gas collection system shall be expanded to correct the exceedance within 120 days of the initial exceedance. Any attempted corrective measure shall not cause exceedance of other operational or performance standards. An alternative timeline for corrected in the exceedance may be submitted to the APCO for approval. [40 CFR 60.755(a)(5)] Federally Enforceable Through Title V Permit
13. The provisions of this subpart apply at all times, except during periods of start-up, shutdown, or malfunction, provided that the duration of start-up, shutdown, or malfunction shall not exceed 5 days for collection systems and shall not exceed 1 hour for treatment or control devices. [40 CFR 60.755(e)] Federally Enforceable Through Title V Permit
14. Surface testing to measure the methane concentration at the surface of the landfill shall be conducted around the perimeter of the collection area and along a pattern that traverses the landfill at 30 meter intervals and where visual observations indicate elevated concentrations of landfill gas, such as distressed vegetation and cracks or seeps in the cover. The owner or operator may establish an alternative traversing pattern that ensures equivalent coverage. A surface monitoring design plan shall be developed that includes a topographical map with the monitoring route and the rationale for any site-specific deviations from the 30 meter intervals. Areas with steep slopes or other dangerous areas may be excluded from the surface testing. [District Rule 2201, 40 CFR 60.753(d), and 40 CFR 60.755(c)(1)] Federally Enforceable Through Title V Permit
15. Surface testing to measure the methane concentration at the surface of the landfill shall be conducted on a quarterly basis using an organic vapor analyzer, flame ionization detector, or other portable monitor meeting the specifications provided in 40 CFR 60.755(d). [40 CFR 60.755(c)(1)] Federally Enforceable Through Title V Permit
16. The collection system shall be operated such that the methane concentration is less than 500 parts per million above background at the surface of the landfill. Compliance with this surface methane operational standard shall be demonstrated using the procedures outlined in 40 CFR 60.755(c) within 180 days of installation and startup of the collection and control system and quarterly thereafter. [District Rule 2201, 40 CFR 60.753(d), 40 CFR 60.755(c), and 40 CFR 60.8] Federally Enforceable Through Title V Permit
17. Permittee shall calculate the NMOC emission rate for purposes of determining when the collection and control system can be removed as provided in 40 CFR 60.752(b)(2)(v) by using the equation found in 40 CFR 60.754(b). [40 CFR 60.754(b)] Federally Enforceable Through Title V Permit
18. Permittee shall operate the enclosed flare at all times when the collected gas is routed to it. [40 CFR 60.753(f)] Federally Enforceable Through Title V Permit

PERMIT UNIT REQUIREMENTS CONTINUE ON NEXT PAGE

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19. Permittee shall operate the landfill gas collection system such that gas is collected from each area, cell, or group of cells in the MSW landfill in which solid waste has been in place for: (1) five years or more if active; or (2) two years or more if closed or at final grade. [40 CFR 60.753(a)] Federally Enforceable Through Title V Permit
20. Permittee shall operate the landfill gas collection system with negative pressure at each wellhead except under the following conditions: (1) A fire or increased well temperature. The owner or operator shall record instances when positive pressure occurs in efforts to avoid a fire. These records shall be submitted with the annual reports as provided in 60.757(f)(1); (2) Use of a geomembrane or synthetic cover. The owner or operator shall develop acceptable pressure limits in the design plan; (3) A decommissioned well. A well may experience a static positive pressure after shut down to accommodate for declining flows. All design changes shall be approved by the APCO. [40 CFR 60.753(b)] Federally Enforceable Through Title V Permit
21. Permittee shall operate each interior wellhead in the collection system with a landfill gas temperature less than 55 C and with either a nitrogen level less than 20 percent or an oxygen level less than 5 percent. The owner or operator may establish a higher operating temperature, nitrogen, or oxygen value at a particular well. A higher operating value demonstration shall show supporting data that the elevated parameter does not cause fires or significantly inhibit anaerobic decompositions by killing methanogens. [40 CFR 60.753(c)] Federally Enforceable Through Title V Permit
22. If monitoring demonstrates that the operational requirements in paragraphs (b), (c), or (d) of section 60.753 are not met, corrective action shall be taken as specified in 40 CFR 60.755(a)(3 - 5) or (c). If corrective actions are taken as specified in 60.755, the monitored exceedance is not a violation of the operational requirements in this section. [40 CFR 60.753(g)] Federally Enforceable Through Title V Permit
23. Each wellhead shall have a sampling port and a thermometer, other temperature-measuring device, or an access port for temperature measurements. [40 CFR 60.756(a)] Federally Enforceable Through Title V Permit
24. When monitoring interior wellheads for operation for a nitrogen level, the nitrogen level shall be determined using Method 3C, unless an alternative test method is established as allowed by 60.752(b)(2)(i) of this subpart. [40 CFR 60.753(c)(1)] Federally Enforceable Through Title V Permit
25. For each interior wellhead, unless an alternative test method is established as allowed by 60.752(b)(2)(i) of this subpart, the oxygen shall be determined by an oxygen meter using Method 3A or 3C except that: (i) The span shall be set so that the regulatory limit is between 20 and 50 percent of the span; (ii) A data recorder is not required; (iii) Only two calibration gases are required, a zero and span, and ambient air may be used as the span; (iv) A calibration error check is not required; (v) The allowable sample bias, zero drift, and calibration drift are  $\pm 10$  percent. [40 CFR 60.753(c)(2)] Federally Enforceable Through Title V Permit
26. The background concentration shall be determined by moving the probe inlet upwind and downwind outside the boundary of the landfill at a distance of at least 30 meters from the perimeter wells. [40 CFR 60.755(c)(2)] Federally Enforceable Through Title V Permit
27. Surface emission monitoring shall be performed in accordance with section 4.3.1 of Method 21 of appendix A, except that the probe inlet shall be placed within 5 to 10 centimeters of the ground. Monitoring shall be performed during typical meteorological conditions. Any reading of 500 parts per million or more above background at any location shall be recorded as a monitored exceedance and the actions specified in 40 CFR 60.755(c)(4)(i-v) shall be taken. As long as the specified actions are taken, the exceedance is not a violation of the operational requirements of 60.753(d). [40 CFR 60.755(c)(3), (4)] Federally Enforceable Through Title V Permit
28. For the performance test required in 60.752(b)(2)(iii)(B), Method 25, 25C, or Method 18 of Appendix A must be used to determine compliance with the 98 weight percent efficiency or the 20 ppmv outlet concentration level, unless another method to demonstrate compliance has been approved by the APCO as provided by 60.752(b)(2)(i)(B). Method 3 or 3A shall be used to determine oxygen for correcting the NMOC concentration as hexane to 3 percent. In cases where the outlet concentration is less than 50 ppm NMOC as carbon (8 ppm NMOC as hexane), Method 25A should be used in place of Method 25. If using Method 18 of appendix A, the minimum list of compounds to be tested shall be those published in the most recent Compilation of Air Pollutant Emission Factors (AP-42). The following equation shall be used to calculate efficiency:  $(\text{NMOC}_{\text{in}} - \text{NMOC}_{\text{out}}) / \text{NMOC}_{\text{in}}$ . The District must be notified at least 30 days prior to any compliance source test, and a source test plan must be submitted for approval at least 15 days prior to testing. [District Rule 1081; 40 CFR 60.754(d)] Federally Enforceable Through Title V Permit

PERMIT UNIT REQUIREMENTS CONTINUE ON NEXT PAGE

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29. Permittee shall implement a program to monitor for cover integrity and implement cover repairs as necessary on a monthly basis. [40 CFR 60.755(c)(5)] Federally Enforceable Through Title V Permit
30. The portable analyzer shall meet the instrument specifications of Method 21, section 3 (except that "methane" shall replace all references to VOC). The calibration gas shall be methane, diluted to a nominal concentration of 500 parts per million in air. To meet the performance evaluation requirements of Method 21, section 3.1.3, the instrument evaluation procedures of Method 21, section 4.4. The calibration procedures provided in Method 21, section 4.2 shall be followed immediately before commencing a surface monitoring survey. The provisions of this condition apply at all times, except during periods of start-up, shutdown, or malfunction (as defined in 40 CFR 60.755(e)). [40 CFR 60.755(d), (e)] Federally Enforceable Through Title V Permit
31. The provisions of this subpart apply at all times, except during periods of start-up, shutdown, or malfunction, provided that the duration of start-up, shutdown, or malfunction shall not exceed 5 days for collections systems and shall not exceed 1 hour for treatment or control devices. [40 CFR 60.755(e)] Federally Enforceable Through Title V Permit
32. Operator shall measure the gauge pressure in the gas collection header on a monthly basis as provided in 40 CFR 60.755(a)(3); and monitor nitrogen or oxygen concentration in the landfill gas on a monthly basis as provided in 40 CFR 60.755(a)(5); and monitor temperature of the landfill gas on a monthly basis as provided in 40 CFR 60.755(a)(5). [40 CFR 60.756(a)] Federally Enforceable Through Title V Permit
33. Permittee shall submit an equipment removal report to the District 30 days prior to removal or cessation of operation of the control equipment. The report shall conform to the requirements of 40 CFR 60.757(e)(1). [40 CFR 60.757(e)] Federally Enforceable Through Title V Permit
34. Permittee shall submit to the District semiannual reports of the recorded information in 40 CFR 60.757(f)(1-6). The initial report shall be submitted within 180 days of installation and start-up of the collection and control system, and shall include the initial performance test report required under 40 CFR 60.8. [40 CFR 60.757(f), 40 CFR 63.1980(a)] Federally Enforceable Through Title V Permit
35. Each owner or operator seeking to comply with 40 CFR 60.752(b)(2)(iii) shall include information specified in 40 CFR 60.757(g)(1-6) with the initial performance test report required under 40 CFR Part 60.8. [40 CFR 60.757(g)] Federally Enforceable Through Title V Permit
36. The following constitute exceedances that also shall be recorded and reported under 40 CFR 60.757(f): all 3-hour periods of operation during which the average combustion temperature was more than 28 C below the average combustion temperature during the most recent performance test (flare source test). [40 CFR 60.758(c)] Federally Enforceable Through Title V Permit
37. Except as provided in 60.752(b)(2)(i)(B), each owner or operator of a controlled landfill shall keep up-to-date, readily accessible records for the life of the control equipment of the data listed in paragraphs 60.758(b)(1) through (b)(4) as measured during the initial performance test or compliance determination. Records of subsequent tests or monitoring shall be maintained for a minimum of 5 years. Records of the control device vendor specifications shall be maintained until removal. [40 CFR 60.758(b)] Federally Enforceable Through Title V Permit
38. Permittee shall keep the following records: (1)(i) the maximum expected gas generation flow rate as calculated in 60.755(a)(1). The owner or operator may use another method to determine the maximum gas generation flow rate, if the method has been approved by the APCO; (ii) the density of wells, horizontal collectors, surface collectors, or other gas extraction devices determined using the procedures specified in 60.759(a)(1); (2)(i) the average combustion temperature measured at least every 15 minutes and averaged over the same time period of the performance test; (ii) the percent reduction of NMOC determined as specified in 60.752(b)(2)(iii)(B) achieved by the control device. [40 CFR 60.758(b)(1) and (2)] Federally Enforceable Through Title V Permit
39. Except as provided in 60.752(b)(2)(i)(B), permittee shall keep, for the life of the collection system, an up-to-date, readily accessible plot map showing each existing and planned collector in the system and providing a unique identification location label for each collector. Permittee shall keep readily accessible documentation of the nature, date of deposition, amount, and location of asbestos-containing or nondegradable waste excluded from collection as well as any nonproductive areas excluded from collection. [40 CFR 60.758(d)] Federally Enforceable Through Title V Permit

PERMIT UNIT REQUIREMENTS CONTINUE ON NEXT PAGE

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40. Except as provided in 60.752(b)(2)(i)(B), permittee shall keep for at least 5 years up-to-date, readily accessible records of all collection and control system exceedances of the operational standards in 60.753, the reading in the subsequent month whether or not the second reading is an exceedance, and the location of each exceedance. [40 CFR 60.758(e)] Federally Enforceable Through Title V Permit
41. VOC emissions from the flare and landfill shall not exceed 240.7 lb-VOC/day. [District Rule 2201] Federally Enforceable Through Title V Permit
42. Emissions from the flare shall not exceed any of the following limits: 0.06 lb-NOx/MMBtu, 91.1 lb-SOx/day, 13,146 lb-SOx/year, 0.008 lb-PM10/MMBtu, 0.22 lb-CO/MMBtu, or 0.063 lb-VOC/MMBtu. [District Rule 2201] Federally Enforceable Through Title V Permit
43. The combined heat input of collected B-17 and B-19 landfill gas into the flare shall not exceed any of the following: 83.6 MMBtu/hr or 398,333 MMBtu/year. Heat input shall be calculated daily using monthly methane measurements (%), landfill gas flow into the flare (cubic feet per minute), and the annually tested landfill gas heat content (Btu/cubic foot). [District Rule 2201] Federally Enforceable Through Title V Permit
44. Enclosed flare shall reduce the inlet NMOC emissions by at least 98% by weight or to no more than 20 ppmvd @ 3% O2 as methane. [District Rule 2201] Federally Enforceable Through Title V Permit
45. The methane destruction efficiency for the enclosed flares shall be at least 99% by weight. [17 CCR 95464(b)(2)(A)(1)]
46. Emissions from the flare LPG-fired pilot shall not exceed any of the following limits: 0.15 lb-NOx/MMBtu, 0.0164 lb-SOx/MMBtu, 0.0044 lb-PM10/MMBtu, 0.021 lb-CO/MMBtu, or 0.0055 lb-VOC/MMBtu. [District Rule 2201] Federally Enforceable Through Title V Permit
47. A non-resettable, totalizing mass or volumetric landfill gas fuel flow meter to measure the amount of gas combusted in the enclosed flare shall be installed, utilized and maintained. [District Rule 2201] Federally Enforceable Through Title V Permit
48. Sampling ports adequate for sulfur testing shall be provided in the landfill gas manifold line to the flare. [District Rule 1081] Federally Enforceable Through Title V Permit
49. SOx emissions shall be determined by measuring the sulfur concentration in the landfill gas and calculating the correlated SOx emission rate based on the correlation between landfill gas sulfur concentration and associated SOx emission rate demonstrated during startup. [District Rule 1081] Federally Enforceable Through Title V Permit
50. Testing to demonstrate compliance with the daily and annual SOx emission limit shall be conducted weekly. Once eight (8) consecutive weekly tests show compliance, the frequency of monitoring sulfur content, and associated SOx emissions, may be reduced to monthly. If a monthly test shows violation of the SOx emission limit, then weekly testing shall resume and continue until eight (8) consecutive tests show compliance. Once compliance is shown on eight (8) consecutive weekly tests, then testing may return to monthly. [District Rule 2201] Federally Enforceable Through Title V Permit
51. Sulfur content of the landfill gas being combusted in the flare shall be determined using ASTM D 1072, D 3031, D 4084, D 3246 or double GC for H2S and mercaptans, or draeger tubes for H2S, or an equivalent method approved by the District. [District Rule 1081] Federally Enforceable Through Title V Permit
52. Total combined Class II/III waste material and Class II soil acceptance rate of C-283-22 and '-25 shall not exceed 2000 tons per day. [District Rule 2201] Federally Enforceable Through Title V Permit
53. Total combined Class II/III waste material acceptance rate of C-283-22 and '-25 shall not exceed 620,000 tons per year. [District Rule 2201] Federally Enforceable Through Title V Permit
54. Total combined Class II soil acceptance rate of C-283-22 and '-25 shall not exceed 800 tons per day. [District Rule 2201] Federally Enforceable Through Title V Permit
55. Total combined clean (<50 ppm by weight VOC) soil cover usage rate of C-283-22 and '-25 shall not exceed 6000 tons per day. [District Rule 2201] Federally Enforceable Through Title V Permit

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56. Total PM10 emissions from handling of Class II/III waste material and soil cover shall not exceed 0.000454 pounds per ton material handled. [District Rule 2201] Federally Enforceable Through Title V Permit
57. Source testing on the flare shall be performed to demonstrate compliance with the flare NOx and CO limits, and the NMOC destruction efficiency of 98%, or no more than 20 ppmvd @ 3% O2 as methane, as required by this permit shall be conducted within 60 days of startup and annually thereafter. [District Rule 2201] Federally Enforceable Through Title V Permit
58. Source testing for flare NOx emissions shall be conducted using CARB Method 7 or Method 20. [District Rule 1081] Federally Enforceable Through Title V Permit
59. Source testing for flare CO emissions shall be conducted using EPA Method 10 or 10B, CARB Methods 1 through 5 with 10, or CARB Method 100. [District Rule 1081] Federally Enforceable Through Title V Permit
60. Operator shall determine landfill gas fuel higher heating value annually by ASTM D 1826 or D 1945 in conjunction with ASTM D 3588 for gaseous fuels. [District Rule 2201] Federally Enforceable Through Title V Permit
61. The results of each landfill gas sulfur content test shall be submitted to the District within 60 days thereafter. [District Rule 1081] Federally Enforceable Through Title V Permit
62. Gas collection system shall be operated in a manner which maximizes the amount of landfill gas extracted while preventing overdraw that can cause fires or damage the gas collection system. [District Rule 2201] Federally Enforceable Through Title V Permit
63. During maintenance of the gas collection system or incineration device, emissions of landfill gas shall be minimized during shutdown. [District Rule 2201] Federally Enforceable Through Title V Permit
64. Maintenance is defined as work performed on a gas collection system and/or control device in order to ensure continued compliance with District rules, regulations, and/or Permits to Operate, and to prevent its failure or malfunction. [District Rule 2201] Federally Enforceable Through Title V Permit
65. The permittee shall notify the APCO by telephone at least 24 hours before performing any maintenance work that requires the system to be shutdown. The notification shall include a description of work, the date work will be performed and the amount of time needed to complete the maintenance work. [District Rule 2201] Federally Enforceable Through Title V Permit
66. Permittee shall maintain records of system inspections including: date, time and inspection results. [District Rule 1070] Federally Enforceable Through Title V Permit
67. Permittee shall maintain records of maintenance related or other collection system and control device downtime, including individual well shutdown. [District Rule 1070] Federally Enforceable Through Title V Permit
68. The operator shall record emission control device source tests (emissions of CO, NOx, and VOC) in pounds per MMBtu heat input. Operator shall also record VOC destruction/treatment efficiency. [District Rule 1081] Federally Enforceable Through Title V Permit
69. Daily records of the weight of materials received (tons) - including Class II/III waste material, Class II soil cover, and clean soil cover - and daily records of all soil organic content test results and certifications, shall be maintained, kept on site for a period of five years, and made available to District staff upon request. [District Rule 2201] Federally Enforceable Through Title V Permit
70. The District shall be notified in writing ten days prior to the acceptance of new types of waste streams, or waste streams with significant malodorous qualities. [District Rules 2201 and 4102] Federally Enforceable Through Title V Permit
71. A District approved anemometer shall be continuously operated on site with permanent data available to the District. [District Rule 2201] Federally Enforceable Through Title V Permit
72. Wastes with the potential to release hazardous gases, mists, or vapors in excess of existing air quality standards shall not be exposed to the atmosphere, and combustion of flammable wastes in the landfill shall be prevented. [District Rule 2201] Federally Enforceable Through Title V Permit

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73. A record of continuous flare combustion temperature, continuous volumetric gas flow rate, net heating value of landfill gas being combusted, daily landfill gas fuel consumption, and daily heat input shall be maintained, retained on the premises for a period of at least five years and made readily available for District inspection upon request. [District Rule 2201] Federally Enforceable Through Title V Permit
74. Records of daily and annual landfill gas flow rate, annual test results of higher heating value of landfill gas, and calculated daily and annual SOx emissions shall be maintained. [District Rule 2201] Federally Enforceable Through Title V Permit
75. The collection devices within the interior and along the perimeter areas shall be certified to achieve comprehensive control of surface gas emissions by a professional engineer. The following issues shall be addressed in the design: depths of refuse, refuse gas generation rates and flow characteristics, cover properties, gas system expandability, leachate and condensate management, accessibility, compatibility with filling operations, integration with closure end use, air intrusion control, corrosion resistance, fill settlement, and resistance to the refuse decomposition heat. [40 CFR 60.759(a)(1)] Federally Enforceable Through Title V Permit
76. The placement of gas collection devices determined in paragraph 60.759(a)(1) shall control all gas producing areas, except as provided by paragraphs 60.759(a)(3)(i) and (a)(3)(ii). [40 CFR 60.759(a)(3)] Federally Enforceable Through Title V Permit
77. The sufficient density of gas collection devices determined in paragraph 60.759(a)(1) shall address landfill gas migration issues and augmentation of the collection system through the use of active or passive systems at the landfill perimeter or exterior. [40 CFR 60.759(a)(2)] Federally Enforceable Through Title V Permit
78. Any segregated area of asbestos or nondegradable material may be excluded from collection if documented as provided under 60.758(d). The documentation shall provide the nature, date of deposition, location and amount of asbestos or nondegradable material deposited in the area, and shall be provided to the Administrator upon request. [40 CFR 60.759(a)(3)(i)] Federally Enforceable Through Title V Permit
79. Any nonproductive area of the landfill may be excluded from control provided that the total of all excluded areas can be shown to contribute less than 1 percent of the total amount of NMOC emissions from the landfill. The amount, location, and age of the material shall be documented and provided to the Administrator upon request. A separate NMOC emissions estimate shall be made for each section proposed for exclusion, and the sum of all such sections shall be compared to the NMOC emissions estimate for the entire landfill. Emissions from each section shall be computed using the equation in Section 60.759(a)(3)(ii). [40 CFR 60.759(a)(3)(ii)] Federally Enforceable Through Title V Permit
80. The values for k and CNMOC in equation in Section 60.759(a)(3)(ii) determined in field testing shall be used if field testing has been performed in determining the NMOC emission rate or the radii of influence (this distance from the well center to a point in the landfill where the pressure gradient applied by the blower or compressor approaches zero). If field testing has not been performed, the default values for k, Lo, and CNMOC provided in 60.754(a)(1) or the alternative values from 60.754(a)(5) shall be used. The mass of nondegradable solid waste contained within the given section may be subtracted from the total mass of the section when estimating emissions provided the nature, location, age, and amount of the nondegradable material is documented as provided in paragraph 60.759(a)(3)(i). [40 CFR 60.759(a)(3)(ii)] Federally Enforceable Through Title V Permit

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81. Each owner or operator seeking to comply with 60.752(b)(2)(i)(A) shall construct the gas collection devices using the following equipment or procedures: (1) The landfill gas extraction components shall be constructed of polyvinyl chloride (PVC), high density polyethylene (HDPE) pipe, fiberglass, stainless steel, or other nonporous corrosion resistant material of suitable dimensions to: convey projected amounts of gases; withstand installation, static, and settlement forces; and withstand planned overburden or traffic loads. The collection system shall extend as necessary to comply with emission and migration standards. Collection devices such as wells and horizontal collectors shall be perforated to allow gas entry without head loss sufficient to impair performance across the intended extent of control. Perforations shall be situated with regard to the need to prevent excessive air infiltration; (2) Vertical wells shall be placed so as not to endanger underlying liners and shall address the occurrence of water within the landfill. Holes and trenches constructed for piped wells and horizontal collectors shall be of sufficient cross-section so as to allow for their proper construction and completion including, for example, centering of pipes and placement of gravel backfill. Collection devices shall be designed so as not to allow indirect short circuiting of air into the cover or refuse into the collection system or gas into the air. Any gravel used around pipe perforations should be of a dimension so as not to penetrate or block perforations; (3) Collection devices may be connected to the collection header pipes below or above the landfill surface. The connector assembly shall include a positive closing throttle valve, any necessary seals and couplings, access couplings and at least one sampling port. The collection devices shall be constructed of PVC, HDPE, fiberglass, stainless steel, or other nonporous material of suitable thickness. [40 CFR 60.759(b)] Federally Enforceable Through Title V Permit
82. Each owner or operator seeking to comply with 60.752(b)(2)(i)(A) shall convey the landfill gas to a control system in compliance with 60.752(b)(2)(iii) through the collection header pipe(s). The gas mover equipment shall be sized to handle the maximum gas generation flow rate expected over the intended use period of the gas moving equipment using the following procedures: (1) For existing collection systems, the flow data shall be used to project the maximum flow rate. If no flow data exists, the procedures in paragraph 60.759(c)(2) shall be used; (2) For new collection systems, the maximum flow rate shall be in accordance with 60.755(a)(1). [40 CFR 60.759(c)] Federally Enforceable Through Title V Permit
83. Continuous parameter monitoring data, collected under 40 CFR 60.756(b)(1), (c)(1), and (d), are used to demonstrate compliance with the operating conditions for control systems. If a deviation occurs, the permittee has failed to meet the control device operation conditions described in this subpart and has deviated from the requirements of this subpart. The permittee shall develop a written SSM plan according to the provisions in 40 CFR 63.6(e)(3). A copy of the SSM plan must be maintained on site. Failure to write or maintain a copy of the SSM plan is a deviation from the requirements of this subpart. [40 CFR 63.1960] Federally Enforceable Through Title V Permit
84. The permittee shall maintain records as specified in the general provisions of 40 CFR part 60 and this part as shown in Table 1 of this subpart. Applicable records in the general provisions include items such as SSM plans and the SSM plan reports. [40 CFR 63.1980(b)] Federally Enforceable Through Title V Permit
85. The permittee shall submit the initial semiannual compliance report and performance tests results described in 40 CFR 60.757(f) within 180 days after the date required to being operating the gas collection and control system by 63.1947(c) of this subpart. [40 CFR 63.1980(e)] Federally Enforceable Through Title V Permit
86. All records shall be maintained and retained on-site for a period of at least 5 years and shall be made available for District inspection upon request. [District Rule 1070] Federally Enforceable Through Title V Permit
87. The landfill surface shall be monitored quarterly. If there are any exceedances during a quarterly event, monitoring will be required monthly until three consecutive months without exceedances, which would allow a return to quarterly monitoring. [District Rule 2201] Federally Enforceable Through Title V Permit
88. After an exceedance, the permittee shall initiate correction action within five days and conduct remonitoring within ten days from the initial exceedance. If compliance is shown, an additional remonitoring event is required within one month of the initial exceedance. If the ten day event shows an exceedance, the permittee shall initiate correction action within five days and conduct remonitoring within ten days from the second exceedance. If compliance is shown, an additional remonitoring is required within one month of the initial exceedance. If the second ten day event shows an exceedance, the permittee shall permit and install additional landfill gas wells to correct the problem within 120 days of the initial exceedance. [District Rule 2201] Federally Enforceable Through Title V Permit

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89. The gas collection and control system shall comply with the operational standards of 40 CFR 60.753, the compliance provisions of 40 CFR 60.755, the monitoring provisions of 40 CFR 60.756, the reporting and record keeping requirements of 40 CFR 60.757 and 60.758, and the requirements of 40 CFR 60.759 (for active collection systems). [40 CFR 60.752(b)(2)(ii), 60.753, 60.755, 60.756, 60.757, 60.758 and 60.759] Federally Enforceable Through Title V Permit
90. In the event that the collection or control system becomes inoperable, the gas mover equipment (as defined in 40 CFR 60.751) shall be shut down and all valves in the collection and control system contributing to venting of the landfill gas to the atmosphere shall be closed within one hour. [40 CFR 60.753(e)] Federally Enforceable Through Title V Permit
91. The owner/operator shall install, calibrate, maintain, and operate a meter that measures and records the landfill gas flow rate into the flare at least once every 15 minutes. This meter shall also be capable of measuring the landfill gas flow rate that might bypass the flare in the event of equipment malfunction or maintenance. [40 CFR 60.756(c)(2)] Federally Enforceable Through Title V Permit
92. The flare shall be operated with a flame present at all times while gas is being vented to it. The presence of a flame shall be continuously monitored using a thermocouple, ultraviolet sensor, or any other equivalent device located at the pilot light or the flame itself. The flame's presence shall be recorded at least once every 15 minutes. [40 CFR 60.18(c)(2) and 40 CFR 60.756(c)(1)] Federally Enforceable Through Title V Permit
93. The enclosed flare shall be equipped with an accurate temperature indicator/recorder that continuously measures and records the operating temperature. [District Rule 2201; 40 CFR 60.756(b)(1)] Federally Enforceable Through Title V Permit
94. The enclosed flare shall be equipped with either a device that records flow to the control device at least every 15 minutes; or secure the bypass line valve in the closed position with a car-seal or a lock-and-key type configuration of the control device. [40 CFR 60.756(b)(2)] Federally Enforceable Through Title V Permit
95. Any closed landfill that has demonstrated compliance in three consecutive quarterly monitoring periods may perform annual monitoring. Quarterly monitoring shall resume if any methane readings of 500 ppm or more above background are detected during annual monitoring. [40 CFR 60.756(f)] Federally Enforceable Through Title V Permit
96. Permittee shall keep up-to-date, readily accessible continuous records of the indication of flow to the enclosed flare, or the indication of bypass flow, or records of monthly inspections of car-seals or lock-and-key configurations used to seal bypass lines. [40 CFR 60.758(c) and 60.34c] Federally Enforceable Through Title V Permit
97. The landfill is no longer required to comply with the requirements of 40 CFR Part 63 Subpart AAAA when it is no longer required to apply controls as specified in 40 CFR 60.752(b)(2)(v) of subpart WWW. [40 CFR 63.1950] Federally Enforceable Through Title V Permit
98. Except for the spreading of landfill cover, when handling bulk materials outside an enclosed structure or building, water or chemical/organic stabilizers/suppressants shall be applied as required to limit Visible Dust Emissions to a maximum of 20% opacity. When necessary to achieve this opacity limitation, wind barriers with less than 50% porosity shall also be used. [District Rules 8011 and 8031] Federally Enforceable Through Title V Permit
99. Except for the spreading of landfill cover, when transporting bulk materials outside an enclosed structure or building, all bulk material transport vehicles shall limit Visible Dust Emissions to 20% opacity by either limiting vehicular speed, maintaining sufficient freeboard on the load, applying water to the top of the load, or covering the load with a tarp or other suitable cover. [District Rules 8011 and 8031] Federally Enforceable Through Title V Permit
100. Records and other supporting documentation shall be maintained as required to demonstrate compliance with the requirements of the rules under Regulation VIII only for those days that a control measure was implemented. Such records shall include the type of control measure(s) used, the location and extent of coverage, and the date, amount, and frequency of application of dust suppressant, manufacturer's dust suppressant product information sheet that identifies the name of the dust suppressant and application instructions. Records shall be kept for one year following project completion that results in the termination of all dust generating activities. [District Rules 8031, 8071, and 8011] Federally Enforceable Through Title V Permit

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101. An owner/operator shall prevent or cleanup any carryout or trackout in accordance with the requirements of District Rule 8041 Section 5.0, unless specifically exempted under Rule 8041 or Rule 8011. [District Rules 8041 and 8011] Federally Enforceable Through Title V Permit
102. One or more of the following control measures shall be implemented on each day that 50 or more VDT (Vehicle Daily Trips), or 25 or more VDT with 3 or more axles, originates from within and remains exclusively within an unpaved vehicle/equipment traffic area: water, gravel, roadmix, or chemical/organic dust stabilizers/suppressants, vegetative materials, or other District-approved control measure shall be applied to unpaved vehicle travel areas as required to limit Visible Dust Emissions to 20% opacity and comply with the requirements for a stabilized unpaved road as defined in District Rule 8011. [District Rule 8071 and 8011] Federally Enforceable Through Title V Permit
103. On each day that 50 or more VDT (Vehicle Daily Trips), or 25 or more VDT with 3 or more axles, originates from within and remains exclusively within an unpaved vehicle/equipment traffic area, dusting materials accumulated on paved surfaces shall be removed daily or water and/or chemical/organic dust stabilizers/suppressants shall be applied to the paved surface as required to maintain continuous compliance with the requirements for a stabilized unpaved road as defined in District Rule 8011 and limit Visible Dust Emissions (VDE) to 20% opacity. [District Rule 8011 and 8071] Federally Enforceable Through Title V Permit
104. Whenever any portion of the site becomes inactive, Permittee shall restrict access and periodically stabilize any disturbed surface to comply with the conditions for a stabilized surface as defined in Section 3.58 of District Rule 8011. [District Rules 8071 and 8011] Federally Enforceable Through Title V Permit
105. The flare and gas collection system may be shut down when there is an insufficient amount of landfill gas to operate on. During the shutdown period, all gas collection system vents shall be closed and no emissions shall occur through the gas collection system. [District Rule 2201] Federally Enforceable Through Title V Permit
106. During the shutdown of the gas collection system, surface testing to measure the methane concentration at the surface of the landfill shall be conducted at least once every week using an organic vapor analyzer, flame ionization detector, or other portable monitor meeting the specifications provided in 40 CFR 60.755(d). After demonstrating compliance on four consecutive tests, the testing frequency shall be at least once every month. [District Rule 2201] Federally Enforceable Through Title V Permit
107. During the shutdown of the gas collection system, if the methane concentration measured during weekly or monthly surface testing exceeds 500 parts per million above background at the surface of the landfill, the testing frequency shall be at least once every other day. After demonstrating compliance on four consecutive tests, the testing frequency shall revert to at least once every week. [District Rule 2201] Federally Enforceable Through Title V Permit
108. During operation of the enclosed flare, the permittee shall continuously monitor and record combustion chamber temperature. The temperature readings shall not be less than 28 degree C (50 degree F) below the average combustion temperature determined during the most recent flare source test, averaged over a 3-hour period. Upon detecting any temperature excursion lower than 28 degree C (50 degree F) below the source test average combustion temperature, averaged over a 3-hour period, the permittee shall investigate the excursion and take corrective action to minimize excessive emissions and prevent recurrence of the excursion as expeditiously as practicable. [40 CFR part 64] Federally Enforceable Through Title V Permit
109. The temperature monitoring device shall be calibrated, maintained, and operated according to the manufacturer's specifications. [40 CFR part 64] Federally Enforceable Through Title V Permit
110. The enclosed flare burner and its associated components and the vapor collection system shall be inspected on an annual basis. The records of inspection shall at least contain date and time of inspection, identification of the person performing an inspection, parts replacement and repairs, and all maintenance actions taken. The records shall be kept and maintained for compliance inspection upon request. [40 CFR part 64] Federally Enforceable Through Title V Permit
111. The permittee shall comply with the compliance assurance monitoring operation and maintenance requirements of 40 CFR part 64.7. [40 CFR part 64] Federally Enforceable Through Title V Permit
112. The permittee shall comply with the recordkeeping and reporting requirements of 40 CFR part 64.9. [40 CFR part 64] Federally Enforceable Through Title V Permit

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113. If the District or EPA determine that a Quality Improvement Plan is required under 40 CFR 64.7(d)(2), the permittee shall develop and implement the Quality Improvement Plan in accordance with 40 CFR part 64.8. [40 CFR part 64] Federally Enforceable Through Title V Permit
114. Landfill gas collection system components downstream of blower have a leak limit of 500 ppmv as methane. Components must be checked quarterly. [17 CCR 95464(b)(1)(B), 17CCR 95469(b)(3)]
115. Landfill gas collection system wellheads must be operated under vacuum. Monthly monitoring of wellheads is required. Landfill gas collection system wellheads may be operated under neutral or positive pressure except as allowed in sections 95464(c), 95464(d), and 95464(e) [17 CCR 95464(b)(1)(C)]
116. Landfill gas collection and control system must be operated such that landfill surface methane emissions shall not exceed instantaneous surface emission limit of 500 ppmv as methane or integrated surface emission limit of 25 ppmv as methane. [17 CCR 95465]
117. Instantaneous and integrated landfill surface emissions measurements shall be done quarterly. The landfill may monitor annually provided they comply with requirements of 17 CCR 95469 (a)(3). [17 CCR 95469(a)]
118. Permittee shall keep records of all gas collection system downtime exceeding five days, including individual well shutdown and disconnection times and the reason for downtime. [17 CCR 95470(a)(1)(A)]
119. Permittee shall keep records of all gas control system downtime in excess of one hour, the reason for the downtime and the length of time the gas control system was shutdown. [17 CCR 95470(a)(1)(B)]
120. Permittee shall keep records of the expected gas generation flow rate calculated pursuant to section 95471(e). [17 CCR 95470(a)(1)(C)]
121. Permittee shall keep records of all instantaneous surface readings of 200 ppmv or greater; all exceedances of the limits in sections 95464(b)(1)(B) or 95465, including the location of the leak (or affected grid), leak concentration in ppmv, date and time of measurement, the action taken to repair the leak, date of repair, any required re-monitoring and the re-monitored concentration in ppmv, and wind speed during surface sampling; and the installation date and location of each well installed as part of a gas collection system expansion. [17 CCR 95470(a)(1)(D)]
122. Permittee shall keep records of any positive wellhead gauge pressure measurements, the date of the measurements, the well identification number, and the corrective action taken. [17 CCR 95470(a)(1)(E)]
123. Permittee shall conduct surface emission monitoring using either the procedures specified in section 95471(c) or the Los Angeles County Sanitation District monitoring procedure. Permittee shall keep records of which procedure was used. [17 CCR 95468]
124. Permittee shall keep records of delays encountered during repair of leaks or repair of positive wellhead readings. Documentation of delays shall be submitted with the annual report. [17 CCR 95468(a)(2)]
125. Permittee shall keep records of alternate landfill gas collection system modifications being implemented to correct an exceedance in the landfill gas surface emissions or wellhead pressure. Any alternative to installing a new well shall be documented and submitted with the annual report. [17 CCR 95468]
126. Permittee shall identify areas which are dangerous and unable to be inspected or contain only inert, non-decomposing waste. Areas shall be clearly identified on a map of the facility. A copy of the map shall be kept onsite as well as submitted with the annual report. [17 CCR 95468(a)(5)]
127. Permittee shall conduct monitoring of the landfill surface within 3 inches of the surface. The facility may monitor surface emissions with the probe tip at the height of the vegetation if there is vegetation and it is impractical to monitor at 3 inches from the landfill surface. [17 CCR 95468]
128. Permittee shall terminate surface emission testing when the measured average wind speed is over 10 mph or the instantaneous wind speed is over 20 mph. [17 CCR 95468(a)(3), 17 CCR 95471(c)(1)(C)]
129. Permittee shall only conduct surface emission testing when precipitation has met the following requirements. It has been 24 hours since measured precipitation of 0.01 to 0.15 inches. It has been 48 hours since measured precipitation of 0.16 to 0.24 inches. It has been 72 hours since measured precipitation of 0.25 or more inches. [17 CCR 95468]

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130. Permittee shall keep records of the annual solid waste acceptance rate and the current amount of waste-in-place. [17 CCR 95470(a)(1)(F)]
131. Permittee shall keep records of the nature, location, amount, and date of deposition of non-degradable waste for any landfill areas excluded from the collection system. [17 CCR 95470(a)(1)(G)]
132. Permittee shall keep records of any source tests conducted pursuant to section 95464(b)(4). [17 CCR 95470(a)(1)(H)]
133. The flare must be source tested annually for methane destruction efficiency of at least 99% by weight. If the flare is in compliance after three consecutive source tests, the facility may move to source testing the flare every three years. If subsequent tests show the flare out of compliance, the test frequency shall revert to annual testing. [17 CCR 95464(b)(4)(A)]
134. The flare must have automatic dampers, an automatic shutdown device, a flame arrester, and continuous recording temperature sensors. [17 CCR 95464(b)(2)(A)(2)]
135. The flare must operate within the parameter ranges established during the initial or most recent source test. [17 CCR 95464(b)(2)(A)(4)]
136. Permittee shall keep records describing the mitigation measures taken to prevent the release of methane or other emissions into the atmosphere during the following activities: 1. When solid waste was brought to the surface during the installation or preparation of wells, piping, or other equipment; 2. During repairs or the temporary shutdown of gas collection system components; or, 3. When solid waste was excavated and moved. [17 CCR 95470(a)(1)(I)]
137. Permittee shall keep records of any construction activities pursuant to section 95466. The records must contain the following information: 1. A description of the actions being taken, the areas of the MSW landfill that will be affected by these actions, the reason the actions are required, and any landfill gas collection system components that will be affected by these actions. 2. Construction start and finish dates, projected equipment installation dates, and projected shut down times for individual gas collection system components. 3. A description of the mitigation measures taken to minimize methane emissions and other potential air quality impacts. [17 CCR 95470(a)(1)(J)]
138. Permittee shall keep records of the equipment operating parameters specified to be monitored under section 95469(b)(1) as well as records for periods of operation during which the parameter boundaries established during the most recent source test are exceeded. The records must include the following information: 1. For enclosed flares, all 3-hour periods of operation during which the average temperature difference was more than 28 degrees Celsius (or 50 degrees Fahrenheit) below the average combustion temperature during the most recent source test at which compliance with sections 95464(b)(2) was determined and a gas flow rate device which must record the flow to the control device at least every 15 minutes. [17 CCR 95470(a)(1)(K), 17 CCR 95469(b)(1)(B)]
139. Permittee shall submit the following reports as required in section 95470(b): Closure notification, Equipment removal report and Annual report. All reports must be accompanied by a certification of truth, accuracy, and completeness signed by a responsible official. [17 CCR 95470(b)]
140. Permittee may request alternatives to the compliance measures, monitoring requirements, test methods and procedures of sections 95464, 95469, and 95471. Any requests must be submitted in writing. [17 CCR 95468]

These terms and conditions are part of the Facility-wide Permit to Operate.

**THIS IS THE LAST PAGE  
OF THIS DOCUMENT**

CONDITIONS FOR PERMIT C-283-22-17

LEGAL OWNER OR OPERATOR:  
MAILING ADDRESS:

LOCATION:

INSPECT PROGRAM PARTICIPANT: NO

EQUIPMENT DESCRIPTION:

MUNICIPAL SOLID WASTE BIOREACTOR LANDFILL, CLASS II AND III (B-19), 4.2 MILLION CUBIC YARD CAPACITY (40.4 ACRES) WITH GAS COLLECTION AND CONTROL SYSTEM SERVED BY A 2,500 SCFM (EQUIVALENT TO 83.6 MMBTU/HR) PARNEL BIOGAS ENCLOSED FLARE SHARED WITH C-283-25

## CONDITIONS

1. No air contaminant shall be discharged into the atmosphere for a period or periods aggregating more than three minutes in any one hour which is as dark as, or darker than, Ringelmann 1/4 or 5% opacity. [District Rules 2201 and 4101] Federally Enforceable Through Title V Permit
2. All equipment shall be maintained in good operating condition and shall be operated in a manner to minimize emissions of air contaminants into the atmosphere. [District Rule 2201] Federally Enforceable Through Title V Permit
3. Each owner or operator shall keep for at least 5 years up-to-date, readily accessible, on-site records of the maximum design capacity, the current amount of solid waste in-place, and the year-by-year waste acceptance rate. Off-site records may be maintained if they are retrievable within 4 hours. [40 CFR 60.758(a)] Federally Enforceable Through Title V Permit
4. This operating permit may be cancelled with APCO approval when the landfill is closed, pursuant to the requirements of this permit, if the landfill is not otherwise subject to the requirements of either 40 CFR part 70 or part 71 and if either 1) it was never subject to the requirement for a control system under 40 CFR 60.752(b)(2); or 2) the owner or operator meets the conditions for control system removal specified in 40 CFR 60.752(b)(2)(v). [40 CFR 60.752(d)] Federally Enforceable Through Title V Permit
5. If the landfill is permanently closed, a closure notification shall be submitted to the APCO within 30 days of waste disposal cessation. A permanent closure must take place in accordance with 40 CFR 258.60. If a closure report has been submitted, no additional waste may be placed in the landfill without filing a notification of modification to the APCO, pursuant to 40 CFR 60.7(a)(4). [40 CFR 60.752(b)(1)(ii)(B), 60.757(d)] Federally Enforceable Through Title V Permit
6. An active collection system shall be designed to handle the maximum expected gas flow rate from the entire area of the landfill that warrants control over the intended use period of the gas control or treatment system equipment, collect gas from each area, cell, or group of cells in the landfill in which the initial solid waste has been placed for a period of 5 years or more if active; or 2 years or more if closed or at final grade, collect gas at a sufficient extraction rate, and be designed to minimize off-site migration of subsurface gas. [40 CFR 60.752(b)(2)(ii)(A)] Federally Enforceable Through Title V Permit
7. Each owner or operator seeking to comply with 40 CFR 60.752(b)(2)(i) shall site active collection wells, horizontal collectors, surface collectors, or other extraction devices at a sufficient density throughout all gas producing areas using the procedures in 60.759(a)(1), (2), and (3) unless alternative procedures have been approved by the APCO as provided in 60.752(b)(2)(i)(C) and (D). [40 CFR 60.759(a)] Federally Enforceable Through Title V Permit
8. For the purposes of calculating the maximum expected gas generation flow rate from the landfill to determine compliance with 60.752(b)(2)(ii)(A)(1), one of the equations in Section 60.755(a)(1)(i) or (ii) or (iii) shall be used. [40 CFR 60.755(a)(1)] Federally Enforceable Through Title V Permit
9. For the purposes of determining sufficient density of gas collectors for compliance with 60.752(b)(2)(ii)(A)(2), the owner or operator shall design a system of vertical wells, horizontal collectors, or other collection devices, satisfactory to the APCO, capable of controlling and extracting gas from all portions of the landfill sufficient to meet all operational and performance standards. [40 CFR 60.755(a)(2)] Federally Enforceable Through Title V Permit

10. For the purpose of demonstrating whether the gas collection system flow rate is sufficient to determine compliance with 60.752(b)(2)(ii)(A)(3), the owner or operator shall measure gauge pressure in the gas collection header at each individual well, monthly. If a positive pressure exists, action shall be initiated to correct the exceedance within 5 calendar days, except for the three conditions allowed under 60.753(b). If negative pressure cannot be achieved without excess air infiltration within 15 calendar days of the first measurement, the gas collection system shall be expanded to correct the exceedance within 120 days of the initial measurement of positive pressure. Any attempted corrective measure shall not cause exceedances of other operational or performance standards. An alternative timeline for correcting the exceedance may be submitted to the APCO for approval. [40 CFR 60.755(a)(3)] Federally Enforceable Through Title V Permit
11. Owners or operators are not required to expand the system as required in paragraph 60.755(a)(3) during the first 180 days after gas collection system startup. [40 CFR 60.755(a)(4)] Federally Enforceable Through Title V Permit
12. For the purpose of identifying whether excess air infiltration into the landfill is occurring, the owner or operator shall monitor each well monthly for temperature and nitrogen or oxygen as provided in 60.753(c). If a well exceeds one of these operating parameters, action shall be initiated to correct the exceedance within 5 calendar days. If correction of the exceedance cannot be achieved within 15 calendar days of the first measurement, the gas collection system shall be expanded to correct the exceedance within 120 days of the initial exceedance. Any attempted corrective measure shall not cause exceedance of other operational or performance standards. An alternative timeline for corrected in the exceedance may be submitted to the APCO for approval. [40 CFR 60.755(a)(5)] Federally Enforceable Through Title V Permit
13. The provisions of this subpart apply at all times, except during periods of start-up, shutdown, or malfunction, provided that the duration of start-up, shutdown, or malfunction shall not exceed 5 days for collection systems and shall not exceed 1 hour for treatment or control devices. [40 CFR 60.755(e)] Federally Enforceable Through Title V Permit
14. Surface testing to measure the methane concentration at the surface of the landfill shall be conducted around the perimeter of the collection area and along a pattern that traverses the landfill at 30 meter intervals and where visual observations indicate elevated concentrations of landfill gas, such as distressed vegetation and cracks or seeps in the cover. The owner or operator may establish an alternative traversing pattern that ensures equivalent coverage. A surface monitoring design plan shall be developed that includes a topographical map with the monitoring route and the rationale for any site-specific deviations from the 30 meter intervals. Areas with steep slopes or other dangerous areas may be excluded from the surface testing. [District Rule 2201, 40 CFR 60.753(d), and 40 CFR 60.755(c)(1)] Federally Enforceable Through Title V Permit
15. Surface testing to measure the methane concentration at the surface of the landfill shall be conducted on a quarterly basis using an organic vapor analyzer, flame ionization detector, or other portable monitor meeting the specifications provided in 40 CFR 60.755(d). [40 CFR 60.755(c)(1)] Federally Enforceable Through Title V Permit
16. The collection system shall be operated such that the methane concentration is less than 500 parts per million above background at the surface of the landfill. Compliance with this surface methane operational standard shall be demonstrated using the procedures outlined in 40 CFR 60.755(c) within 180 days of installation and startup of the collection and control system and quarterly thereafter. [District Rule 2201, 40 CFR 60.753(d), 40 CFR 60.755(c), and 40 CFR 60.8] Federally Enforceable Through Title V Permit
17. Permittee shall calculate the NMOC emission rate for purposes of determining when the collection and control system can be removed as provided in 40 CFR 60.752(b)(2)(v) by using the equation found in 40 CFR 60.754(b). [40 CFR 60.754(b)] Federally Enforceable Through Title V Permit
18. Permittee shall operate the enclosed flare at all times when the collected gas is routed to it. [40 CFR 60.753(f)] Federally Enforceable Through Title V Permit
19. Permittee shall operate the landfill gas collection system such that gas is collected from each area, cell, or group of cells in the MSW landfill in which solid waste has been in place for: (1) five years or more if active; or (2) two years or more if closed or at final grade. [40 CFR 60.753(a)] Federally Enforceable Through Title V Permit

20. Permittee shall operate the landfill gas collection system with negative pressure at each wellhead except under the following conditions: (1) A fire or increased well temperature. The owner or operator shall record instances when positive pressure occurs in efforts to avoid a fire. These records shall be submitted with the annual reports as provided in 60.757(f)(1); (2) Use of a geomembrane or synthetic cover. The owner or operator shall develop acceptable pressure limits in the design plan; (3) A decommissioned well. A well may experience a static positive pressure after shut down to accommodate for declining flows. All design changes shall be approved by the APCO. [40 CFR 60.753(b)] Federally Enforceable Through Title V Permit
21. Permittee shall operate each interior wellhead in the collection system with a landfill gas temperature less than 55 C and with either a nitrogen level less than 20 percent or an oxygen level less than 5 percent. The owner or operator may establish a higher operating temperature, nitrogen, or oxygen value at a particular well. A higher operating value demonstration shall show supporting data that the elevated parameter does not cause fires or significantly inhibit anaerobic decompositions by killing methanogens. [40 CFR 60.753(c)] Federally Enforceable Through Title V Permit
22. If monitoring demonstrates that the operational requirements in paragraphs (b), (c), or (d) of section 60.753 are not met, corrective action shall be taken as specified in 40 CFR 60.755(a)(3 - 5) or (c). If corrective actions are taken as specified in 60.755, the monitored exceedance is not a violation of the operational requirements in this section. [40 CFR 60.753(g)] Federally Enforceable Through Title V Permit
23. Each wellhead shall have a sampling port and a thermometer, other temperature-measuring device, or an access port for temperature measurements. [40 CFR 60.756(a)] Federally Enforceable Through Title V Permit
24. When monitoring interior wellheads for operation for a nitrogen level, the nitrogen level shall be determined using Method 3C, unless an alternative test method is established as allowed by 60.752(b)(2)(i) of this subpart. [40 CFR 60.753(c)(1)] Federally Enforceable Through Title V Permit
25. For each interior wellhead, unless an alternative test method is established as allowed by 60.752(b)(2)(i) of this subpart, the oxygen shall be determined by an oxygen meter using Method 3A or 3C except that: (i) The span shall be set so that the regulatory limit is between 20 and 50 percent of the span; (ii) A data recorder is not required; (iii) Only two calibration gases are required, a zero and span, and ambient air may be used as the span; (iv) A calibration error check is not required; (v) The allowable sample bias, zero drift, and calibration drift are  $\pm 10$  percent. [40 CFR 60.753(c)(2)] Federally Enforceable Through Title V Permit
26. The background concentration shall be determined by moving the probe inlet upwind and downwind outside the boundary of the landfill at a distance of at least 30 meters from the perimeter wells. [40 CFR 60.755(c)(2)] Federally Enforceable Through Title V Permit
27. Surface emission monitoring shall be performed in accordance with section 4.3.1 of Method 21 of appendix A, except that the probe inlet shall be placed within 5 to 10 centimeters of the ground. Monitoring shall be performed during typical meteorological conditions. Any reading of 500 parts per million or more above background at any location shall be recorded as a monitored exceedance and the actions specified in 40 CFR 60.755(c)(4)(i-v) shall be taken. As long as the specified actions are taken, the exceedance is not a violation of the operational requirements of 60.753(d). [40 CFR 60.755(c)(3), (4)] Federally Enforceable Through Title V Permit
28. For the performance test required in 60.752(b)(2)(iii)(B), Method 25, 25C, or Method 18 of Appendix A must be used to determine compliance with the 98 weight percent efficiency or the 20 ppmv outlet concentration level, unless another method to demonstrate compliance has been approved by the APCO as provided by 60.752(b)(2)(i)(B). Method 3 or 3A shall be used to determine oxygen for correcting the NMOC concentration as hexane to 3 percent. In cases where the outlet concentration is less than 50 ppm NMOC as carbon (8 ppm NMOC as hexane), Method 25A should be used in place of Method 25. If using Method 18 of appendix A, the minimum list of compounds to be tested shall be those published in the most recent Compilation of Air Pollutant Emission Factors (AP-42). The following equation shall be used to calculate efficiency:  $(\text{NMOC}_{\text{in}} - \text{NMOC}_{\text{out}}) / \text{NMOC}_{\text{in}}$ . The District must be notified at least 30 days prior to any compliance source test, and a source test plan must be submitted for approval at least 15 days prior to testing. [District Rule 1081; 40 CFR 60.754(d)] Federally Enforceable Through Title V Permit
29. Permittee shall implement a program to monitor for cover integrity and implement cover repairs as necessary on a monthly basis. [40 CFR 60.755(c)(5)] Federally Enforceable Through Title V Permit

30. The portable analyzer shall meet the instrument specifications of Method 21, section 3 (except that "methane" shall replace all references to VOC). The calibration gas shall be methane, diluted to a nominal concentration of 500 parts per million in air. To meet the performance evaluation requirements of Method 21, section 3.1.3, the instrument evaluation procedures of Method 21, section 4.4. The calibration procedures provided in Method 21, section 4.2 shall be followed immediately before commencing a surface monitoring survey. The provisions of this condition apply at all times, except during periods of start-up, shutdown, or malfunction (as defined in 40 CFR 60.755(e)). [40 CFR 60.755(d), (e)] Federally Enforceable Through Title V Permit
31. The provisions of this subpart apply at all times, except during periods of start-up, shutdown, or malfunction, provided that the duration of start-up, shutdown, or malfunction shall not exceed 5 days for collections systems and shall not exceed 1 hour for treatment or control devices. [40 CFR 60.755(e)] Federally Enforceable Through Title V Permit
32. Operator shall measure the gauge pressure in the gas collection header on a monthly basis as provided in 40 CFR 60.755(a)(3); and monitor nitrogen or oxygen concentration in the landfill gas on a monthly basis as provided in 40 CFR 60.755(a)(5); and monitor temperature of the landfill gas on a monthly basis as provided in 40 CFR 60.755(a)(5). [40 CFR 60.756(a)] Federally Enforceable Through Title V Permit
33. Permittee shall submit an equipment removal report to the District 30 days prior to removal or cessation of operation of the control equipment. The report shall conform to the requirements of 40 CFR 60.757(e)(1). [40 CFR 60.757(e)] Federally Enforceable Through Title V Permit
34. Permittee shall submit to the District semiannual reports of the recorded information in 40 CFR 60.757(f)(1-6). The initial report shall be submitted within 180 days of installation and start-up of the collection and control system, and shall include the initial performance test report required under 40 CFR 60.8. [40 CFR 60.757(f), 40 CFR 63.1980(a)] Federally Enforceable Through Title V Permit
35. Each owner or operator seeking to comply with 40 CFR 60.752(b)(2)(iii) shall include information specified in 40 CFR 60.757(g)(1-6) with the initial performance test report required under 40 CFR Part 60.8. [40 CFR 60.757(g)] Federally Enforceable Through Title V Permit
36. The following constitute exceedances that also shall be recorded and reported under 40 CFR 60.757(f): all 3-hour periods of operation during which the average combustion temperature was more than 28 C below the average combustion temperature during the most recent performance test (flare source test). [40 CFR 60.758(c)] Federally Enforceable Through Title V Permit
37. Except as provided in 60.752(b)(2)(i)(B), each owner or operator of a controlled landfill shall keep up-to-date, readily accessible records for the life of the control equipment of the data listed in paragraphs 60.758(b)(1) through (b)(4) as measured during the initial performance test or compliance determination. Records of subsequent tests or monitoring shall be maintained for a minimum of 5 years. Records of the control device vendor specifications shall be maintained until removal. [40 CFR 60.758(b)] Federally Enforceable Through Title V Permit
38. Permittee shall keep the following records: (1)(i) the maximum expected gas generation flow rate as calculated in 60.755(a)(1). The owner or operator may use another method to determine the maximum gas generation flow rate, if the method has been approved by the APCO; (ii) the density of wells, horizontal collectors, surface collectors, or other gas extraction devices determined using the procedures specified in 60.759(a)(1); (2)(i) the average combustion temperature measured at least every 15 minutes and averaged over the same time period of the performance test; (ii) the percent reduction of NMOC determined as specified in 60.752(b)(2)(iii)(B) achieved by the control device. [40 CFR 60.758(b)(1) and (2)] Federally Enforceable Through Title V Permit
39. Except as provided in 60.752(b)(2)(i)(B), permittee shall keep, for the life of the collection system, an up-to-date, readily accessible plot map showing each existing and planned collector in the system and providing a unique identification location label for each collector. Permittee shall keep readily accessible documentation of the nature, date of deposition, amount, and location of asbestos-containing or nondegradable waste excluded from collection as well as any nonproductive areas excluded from collection. [40 CFR 60.758(d)] Federally Enforceable Through Title V Permit
40. Except as provided in 60.752(b)(2)(i)(B), permittee shall keep for at least 5 years up-to-date, readily accessible records of all collection and control system exceedances of the operational standards in 60.753, the reading in the subsequent month whether or not the second reading is an exceedance, and the location of each exceedance. [40 CFR 60.758(e)] Federally Enforceable Through Title V Permit

- INSPECTION WORKSHEET
41. VOC emissions from the flare and landfill shall not exceed 339.5 lb-VOC/day. [District Rule 2201] Federally Enforceable Through Title V Permit
  42. Emissions from the flare shall not exceed any of the following limits: 0.06 lb-NOx/MMBtu, 91.1 lb-SOx/day, 13,146 lb-SOx/year, 0.008 lb-PM10/MMBtu, 0.22 lb-CO/MMBtu, or 0.063 lb-VOC/MMBtu. [District Rule 2201] Federally Enforceable Through Title V Permit
  43. The combined heat input of collected B-17 and B-19 landfill gas into the flare shall not exceed any of the following: 83.6 MMBtu/hr or 398,333 MMBtu/year. Heat input shall be calculated daily using monthly methane measurements (%), landfill gas flow into the flare (cubic feet per minute), and the annually tested landfill gas heat content (Btu/cubic foot). [District Rule 2201] Federally Enforceable Through Title V Permit
  44. Enclosed flare shall reduce the inlet NMOC emissions by at least 98% by weight or to no more than 20 ppmvd @ 3% O2 as methane. [District Rule 2201] Federally Enforceable Through Title V Permit
  45. The methane destruction efficiency for the enclosed flares shall be at least 99% by weight. [17 CCR 95464 (b)(2)(A)(1)]
  46. Emissions from the flare LPG-fired pilot shall not exceed any of the following limits: 0.15 lb-NOx/MMBtu, 0.0164 lb-SOx/MMBtu, 0.0044 lb-PM10/MMBtu, 0.021 lb-CO/MMBtu, or 0.0055 lb-VOC/MMBtu. [District Rule 2201] Federally Enforceable Through Title V Permit
  47. A non-resettable, totalizing mass or volumetric landfill gas fuel flow meter to measure the amount of gas combusted in the enclosed flare shall be installed, utilized and maintained. [District Rule 2201] Federally Enforceable Through Title V Permit
  48. Sampling ports adequate for sulfur testing shall be provided in the landfill gas manifold line to the flare. [District Rule 1081] Federally Enforceable Through Title V Permit
  49. SOx emissions shall be determined by measuring the sulfur concentration in the landfill gas and calculating the correlated SOx emission rate based on the correlation between landfill gas sulfur concentration and associated SOx emission rate demonstrated during startup. [District Rule 1081] Federally Enforceable Through Title V Permit
  50. Testing to demonstrate compliance with the daily and annual SOx emission limit shall be conducted weekly. Once eight (8) consecutive weekly tests show compliance, the frequency of monitoring sulfur content, and associated SOx emissions, may be reduced to monthly. If a monthly test shows violation of the SOx emission limit, then weekly testing shall resume and continue until eight (8) consecutive tests show compliance. Once compliance is shown on eight (8) consecutive weekly tests, then testing may return to monthly. [District Rule 2201] Federally Enforceable Through Title V Permit
  51. Sulfur content of the landfill gas being combusted in the flare shall be determined using ASTM D 1072, D 3031, D 4084, D 3246 or double GC for H2S and mercaptans, or draeger tubes for H2S, or an equivalent method approved by the District. [District Rule 1081] Federally Enforceable Through Title V Permit
  52. Total combined Class II/III waste material and Class II soil acceptance rate of C-283-22 and '-25 shall not exceed 2000 tons per day. [District Rule 2201] Federally Enforceable Through Title V Permit
  53. Total combined Class II/III waste material acceptance rate of C-283-22 and '-25 shall not exceed 620,000 tons per year. [District Rule 2201] Federally Enforceable Through Title V Permit
  54. Total combined Class II soil acceptance rate of C-283-22 and '-25 shall not exceed 800 tons per day. [District Rule 2201] Federally Enforceable Through Title V Permit
  55. Total combined clean (<50 ppm by weight VOC) soil cover usage rate of C-283-22 and '-25 shall not exceed 6000 tons per day. [District Rule 2201] Federally Enforceable Through Title V Permit
  56. Total PM10 emissions from handling of Class II/III waste material and soil cover shall not exceed 0.000454 pounds per ton material handled. [District Rule 2201] Federally Enforceable Through Title V Permit
  57. Source testing on the flare shall be performed to demonstrate compliance with the flare NOx and CO limits, and the NMOC destruction efficiency of 98%, or no more than 20 ppmvd @ 3% O2 as methane, as required by this permit shall be conducted annually. [District Rule 2201] Federally Enforceable Through Title V Permit

58. Source testing for flare NOx emissions shall be conducted using CARB Method 7 or Method 20. [District Rule 1081] Federally Enforceable Through Title V Permit
59. Source testing for flare CO emissions shall be conducted using EPA Method 10 or 10B, CARB Methods 1 through 5 with 10, or CARB Method 100. [District Rule 1081] Federally Enforceable Through Title V Permit
60. Operator shall determine landfill gas fuel higher heating value annually by ASTM D 1826 or D 1945 in conjunction with ASTM D 3588 for gaseous fuels. [District Rule 2201] Federally Enforceable Through Title V Permit
61. The results of each landfill gas sulfur content test shall be submitted to the District within 60 days thereafter. [District Rule 1081] Federally Enforceable Through Title V Permit
62. Gas collection system shall be operated in a manner which maximizes the amount of landfill gas extracted while preventing overdraw that can cause fires or damage the gas collection system. [District Rule 2201] Federally Enforceable Through Title V Permit
63. During maintenance of the gas collection system or incineration device, emissions of landfill gas shall be minimized during shutdown. [District Rule 2201] Federally Enforceable Through Title V Permit
64. Maintenance is defined as work performed on a gas collection system and/or control device in order to ensure continued compliance with District rules, regulations, and/or Permits to Operate, and to prevent its failure or malfunction. [District Rule 2201] Federally Enforceable Through Title V Permit
65. The permittee shall notify the APCO by telephone at least 24 hours before performing any maintenance work that requires the system to be shutdown. The notification shall include a description of work, the date work will be performed and the amount of time needed to complete the maintenance work. [District Rule 2201] Federally Enforceable Through Title V Permit
66. Permittee shall maintain records of system inspections including: date, time and inspection results. [District Rule 1070] Federally Enforceable Through Title V Permit
67. Permittee shall maintain records of maintenance related or other collection system and control device downtime, including individual well shutdown. [District Rule 1070] Federally Enforceable Through Title V Permit
68. The operator shall record emission control device source tests (emissions of CO, NOx, and VOC) in pounds per MMBtu heat input. Operator shall also record VOC destruction/treatment efficiency. [District Rule 1081] Federally Enforceable Through Title V Permit
69. Daily records of the weight of materials received (tons) - including Class II/III waste material, Class II soil cover, and clean soil cover - and daily records of all soil organic content test results and certifications, shall be maintained, kept on site for a period of five years, and made available to District staff upon request. [District Rule 2201] Federally Enforceable Through Title V Permit
70. The District shall be notified in writing ten days prior to the acceptance of new types of waste streams, or waste streams with significant malodorous qualities. [District Rules 2201 and 4102] Federally Enforceable Through Title V Permit
71. A District approved anemometer shall be continuously operated on site with permanent data available to the District. [District Rule 2201] Federally Enforceable Through Title V Permit
72. Wastes with the potential to release hazardous gases, mists, or vapors in excess of existing air quality standards shall not be exposed to the atmosphere, and combustion of flammable wastes in the landfill shall be prevented. [District Rule 2201] Federally Enforceable Through Title V Permit
73. A record of continuous flare combustion temperature, continuous volumetric gas flow rate, net heating value of landfill gas being combusted, daily landfill gas fuel consumption, and daily heat input shall be maintained, retained on the premises for a period of at least five years and made readily available for District inspection upon request. [District Rule 2201] Federally Enforceable Through Title V Permit
74. Records of daily and annual landfill gas flow rate, annual test results of higher heating value of landfill gas, and calculated daily and annual SOx emissions shall be maintained. [District Rule 2201] Federally Enforceable Through Title V Permit

75. The collection devices within the interior and along the perimeter areas shall be certified to achieve comprehensive control of surface gas emissions by a professional engineer. The following issues shall be addressed in the design: depths of refuse, refuse gas generation rates and flow characteristics, cover properties, gas system expandability, leachate and condensate management, accessibility, compatibility with filling operations, integration with closure end use, air intrusion control, corrosion resistance, fill settlement, and resistance to the refuse decomposition heat. [40 CFR 60.759(a)(1)] Federally Enforceable Through Title V Permit
76. The placement of gas collection devices determined in paragraph 60.759(a)(1) shall control all gas producing areas, except as provided by paragraphs 60.759(a)(3)(i) and (a)(3)(ii). [40 CFR 60.759(a)(3)] Federally Enforceable Through Title V Permit
77. The sufficient density of gas collection devices determined in paragraph 60.759(a)(1) shall address landfill gas migration issues and augmentation of the collection system through the use of active or passive systems at the landfill perimeter or exterior. [40 CFR 60.759(a)(2)] Federally Enforceable Through Title V Permit
78. Any segregated area of asbestos or nondegradable material may be excluded from collection if documented as provided under 60.758(d). The documentation shall provide the nature, date of deposition, location and amount of asbestos or nondegradable material deposited in the area, and shall be provided to the Administrator upon request. [40 CFR 60.759(a)(3)(i)] Federally Enforceable Through Title V Permit
79. Any nonproductive area of the landfill may be excluded from control provided that the total of all excluded areas can be shown to contribute less than 1 percent of the total amount of NMOC emissions from the landfill. The amount, location, and age of the material shall be documented and provided to the Administrator upon request. A separate NMOC emissions estimate shall be made for each section proposed for exclusion, and the sum of all such sections shall be compared to the NMOC emissions estimate for the entire landfill. Emissions from each section shall be computed using the equation in Section 60.759(a)(3)(ii). [40 CFR 60.759(a)(3)(ii)] Federally Enforceable Through Title V Permit
80. The values for k and CNMOC in equation in Section 60.759(a)(3)(ii) determined in field testing shall be used if field testing has been performed in determining the NMOC emission rate or the radii of influence (this distance from the well center to a point in the landfill where the pressure gradient applied by the blower or compressor approaches zero). If field testing has not been performed, the default values for k, Lo, and CNMOC provided in 60.754(a)(1) or the alternative values from 60.754(a)(5) shall be used. The mass of nondegradable solid waste contained within the given section may be subtracted from the total mass of the section when estimating emissions provided the nature, location, age, and amount of the nondegradable material is documented as provided in paragraph 60.759(a)(3)(i). [40 CFR 60.759(a)(3)(iii)] Federally Enforceable Through Title V Permit
81. Each owner or operator seeking to comply with 60.752(b)(2)(i)(A) shall construct the gas collection devices using the following equipment or procedures: (1) The landfill gas extraction components shall be constructed of polyvinyl chloride (PVC), high density polyethylene (HDPE) pipe, fiberglass, stainless steel, or other nonporous corrosion resistant material of suitable dimensions to: convey projected amounts of gases; withstand installation, static, and settlement forces; and withstand planned overburden or traffic loads. The collection system shall extend as necessary to comply with emission and migration standards. Collection devices such as wells and horizontal collectors shall be perforated to allow gas entry without head loss sufficient to impair performance across the intended extent of control. Perforations shall be situated with regard to the need to prevent excessive air infiltration; (2) Vertical wells shall be placed so as not to endanger underlying liners and shall address the occurrence of water within the landfill. Holes and trenches constructed for piped wells and horizontal collectors shall be of sufficient cross-section so as to allow for their proper construction and completion including, for example, centering of pipes and placement of gravel backfill. Collection devices shall be designed so as not to allow indirect short circuiting of air into the cover or refuse into the collection system or gas into the air. Any gravel used around pipe perforations should be of a dimension so as not to penetrate or block perforations; (3) Collection devices may be connected to the collection header pipes below or above the landfill surface. The connector assembly shall include a positive closing throttle valve, any necessary seals and couplings, access couplings and at least one sampling port. The collection devices shall be constructed of PVC, HDPE, fiberglass, stainless steel, or other nonporous material of suitable thickness. [40 CFR 60.759(b)] Federally Enforceable Through Title V Permit

- 82.** Each owner or operator seeking to comply with 60.752(b)(2)(i)(A) shall convey the landfill gas to a control system in compliance with 60.752(b)(2)(iii) through the collection header pipe(s). The gas mover equipment shall be sized to handle the maximum gas generation flow rate expected over the intended use period of the gas moving equipment using the following procedures: (1) For existing collection systems, the flow data shall be used to project the maximum flow rate. If no flow data exists, the procedures in paragraph 60.759(c)(2) shall be used; (2) For new collection systems, the maximum flow rate shall be in accordance with 60.755(a)(1). [40 CFR 60.759(c)] Federally Enforceable Through Title V Permit
- 83.** The permittee is no longer required to comply with the requirements of 40 CFR Part 63 Subpart AAAA for the bioreactor provided the conditions in paragraphs (a) or (b) are met: (a) the affected source meets the control system removal criteria in 40 CFR 60.752(b)(2)(v) of part 60, subpart WWW or the bioreactor meets the criteria for a nonproductive area of the landfill in 40 CFR 60.759(a)(3)(ii) of part 60, subpart WWW; (b) the bioreactor portion of the landfill is a closed landfill as defined in 40 CFR 60.751, subpart WWW and has permanently ceased adding liquids to the bioreactor, and have not added liquids to the bioreactor for at least 1 year. A closure report for the bioreactor must be submitted to the APCO as provided in 40 CFR 60.757(d) of subpart WWW. [40 CFR 63.1952(a) and (b)] Federally Enforceable Through Title V Permit
- 84.** For the bioreactor portions, the permittee shall comply with the general provisions specified in Table 1 of 40 CFR Part 63 Subpart AAAA and 63.1960 through 63.1985 starting on the date required to install the gas collection and control system and must extend the collection and control system into each new cell or area of the bioreactor prior to initiating liquids addition in that area. [40 CFR 63.1955(b) and (d)(2)] Federally Enforceable Through Title V Permit
- 85.** Continuous parameter monitoring data, collected under 40 CFR 60.756(b)(1), (c)(1), and (d), are used to demonstrate compliance with the operating conditions for control systems. If a deviation occurs, the permittee has failed to meet the control device operation conditions described in this subpart and has deviated from the requirements of this subpart. The permittee shall develop a written SSM plan according to the provisions in 40 CFR 63.6(e)(3). A copy of the SSM plan must be maintained on site. Failure to write or maintain a copy of the SSM plan is a deviation from the requirements of this subpart. [40 CFR 63.1960] Federally Enforceable Through Title V Permit
- 86.** The permittee shall maintain records as specified in the general provisions of 40 CFR part 60 and this part as shown in Table 1 of this subpart. Applicable records in the general provisions include items such as SSM plans and the SSM plan reports. [40 CFR 63.1980(b)] Federally Enforceable Through Title V Permit
- 87.** The permittee shall submit the initial semiannual compliance report and performance tests results described in 40 CFR 60.757(f) within 180 days after the date required to being operating the gas collection and control system by 63.1947(c) of this subpart. [40 CFR 63.1980(e)] Federally Enforceable Through Title V Permit
- 88.** If a semiannual compliance report for the bioreactor is required as well as a semiannual compliance report for the conventional portion of the same landfill, submittal may be delayed of a subsequent semiannual compliance report for the bioreactor according to the following so that the reports may be submitted on the same schedule: (1) After submittal of the initial semiannual compliance report and performance test results for the bioreactor, the permittee may delay of the submittal of the subsequent semiannual compliance report for the bioreactor until the date of the initial or subsequent semiannual compliance report is due for the conventional portion of the landfill; (2) The permittee may delay submittal of the subsequent semiannual compliance report by no more than 12 months after the due date for submitting the initial semiannual compliance report and performance test results described in 40 CFR 60.757(f) for the bioreactor. The report shall cover the time period since the previous semiannual report for the bioreactor, which would be a period of at least 6 months and no more than 12 months; (3) After the delayed semiannual report, all subsequent semiannual reports for the bioreactor must be submitted every 6 months on the same date the semiannual report for the conventional portion of the landfill is due. [40 CFR 63.1980(f)] Federally Enforceable Through Title V Permit
- 89.** All records shall be maintained and retained on-site for a period of at least 5 years and shall be made available for District inspection upon request. [District Rule 1070] Federally Enforceable Through Title V Permit
- 90.** The landfill surface shall be monitored quarterly. If there are any exceedances during a quarterly event, monitoring will be required monthly until three consecutive months without exceedances, which would allow a return to quarterly monitoring. [District Rule 2201] Federally Enforceable Through Title V Permit

91. After an exceedance, the permittee shall initiate correction action within five days and conduct remonitoring within ten days from the initial exceedance. If compliance is shown, an additional remonitoring event is required within one month of the initial exceedance. If the ten day event shows an exceedance, the permittee shall initiate correction action within five days and conduct remonitoring within ten days from the second exceedance. If compliance is shown, an additional remonitoring is required within one month of the initial exceedance. If the second ten-day event shows an exceedance, the permittee shall permit and install additional landfill gas wells to correct the problem within 120 days of the initial exceedance. [District Rule 2201] Federally Enforceable Through Title V Permit
92. The gas collection and control system shall comply with the operational standards of 40 CFR 60.753, the compliance provisions of 40 CFR 60.755, the monitoring provisions of 40 CFR 60.756, the reporting and record keeping requirements of 40 CFR 60.757 and 60.758, and the requirements of 40 CFR 60.759 (for active collection systems). [40 CFR 60.752(b)(2)(ii), 60.753, 60.755, 60.756, 60.757, 60.758 and 60.759] Federally Enforceable Through Title V Permit
93. In the event that the collection or control system becomes inoperable, the gas mover equipment (as defined in 40 CFR 60.751) shall be shut down and all valves in the collection and control system contributing to venting of the landfill gas to the atmosphere shall be closed within one hour. [40 CFR 60.753(e)] Federally Enforceable Through Title V Permit
94. The owner/operator shall install, calibrate, maintain, and operate a meter that measures and records the landfill gas flow rate into the flare at least once every 15 minutes. This meter shall also be capable of measuring the landfill gas flow rate that might bypass the flare in the event of equipment malfunction or maintenance. [40 CFR 60.756(c)(2)] Federally Enforceable Through Title V Permit
95. The flare shall be operated with a flame present at all times while gas is being vented to it. The presence of a flame shall be continuously monitored using a thermocouple, ultraviolet sensor, or any other equivalent device located at the pilot light or the flame itself. The flame's presence shall be recorded at least once every 15 minutes. [40 CFR 60.18(c)(2) and 40 CFR 60.756(c)(1)] Federally Enforceable Through Title V Permit
96. The enclosed flare shall be equipped with an accurate temperature indicator/recorder that continuously measures and records the operating temperature. [District Rule 2201; 40 CFR 60.756(b)(1)] Federally Enforceable Through Title V Permit
97. The enclosed flare shall be equipped with either a device that records flow to the control device at least every 15 minutes; or secure the bypass line valve in the closed position with a car-seal or a lock-and-key type configuration of the control device. [40 CFR 60.756(b)(2)] Federally Enforceable Through Title V Permit
98. Any closed landfill that has demonstrated compliance in three consecutive quarterly monitoring periods may perform annual monitoring. Quarterly monitoring shall resume if any methane readings of 500 ppm or more above background are detected during annual monitoring. [40 CFR 60.756(f)] Federally Enforceable Through Title V Permit
99. Permittee shall keep up-to-date, readily accessible continuous records of the indication of flow to the enclosed flare, or the indication of bypass flow, or records of monthly inspections of car-seals or lock-and-key configurations used to seal bypass lines. [40 CFR 60.758(c) and 60.34c] Federally Enforceable Through Title V Permit
100. The non-bioreactor portion of the landfill is no longer required to comply with the requirements of 40 CFR Part 63 Subpart AAAA when it is no longer required to apply controls as specified in 40 CFR 60.752(b)(2)(v) of subpart WWW. [40 CFR 63.1950] Federally Enforceable Through Title V Permit
101. Except for the spreading of landfill cover, when handling bulk materials outside an enclosed structure or building, water or chemical/organic stabilizers/suppressants shall be applied as required to limit Visible Dust Emissions to a maximum of 20% opacity. When necessary to achieve this opacity limitation, wind barriers with less than 50% porosity shall also be used. [District Rules 8011 and 8031] Federally Enforceable Through Title V Permit
102. Except for the spreading of landfill cover, when transporting bulk materials outside an enclosed structure or building, all bulk material transport vehicles shall limit Visible Dust Emissions to 20% opacity by either limiting vehicular speed, maintaining sufficient freeboard on the load, applying water to the top of the load, or covering the load with a tarp or other suitable cover. [District Rules 8011 and 8031] Federally Enforceable Through Title V Permit

103. Records and other supporting documentation shall be maintained as required to demonstrate compliance with the requirements of the rules under Regulation VIII only for those days that a control measure was implemented. Such records shall include the type of control measure(s) used, the location and extent of coverage, and the date, amount, and frequency of application of dust suppressant, manufacturer's dust suppressant product information sheet that identifies the name of the dust suppressant and application instructions. Records shall be kept for one year following project completion that results in the termination of all dust generating activities. [District Rules 8031, 8071, and 8011] Federally Enforceable Through Title V Permit
104. An owner/operator shall prevent or cleanup any carryout or trackout in accordance with the requirements of District Rule 8041 Section 5.0, unless specifically exempted under Rule 8041 or Rule 8011. [District Rules 8041 and 8011] Federally Enforceable Through Title V Permit
105. One or more of the following control measures shall be implemented on each day that 50 or more VDT (Vehicle Daily Trips), or 25 or more VDT with 3 or more axles, originates from within and remains exclusively within an unpaved vehicle/equipment traffic area: water, gravel, roadmix, or chemical/organic dust stabilizers/suppressants, vegetative materials, or other District-approved control measure shall be applied to unpaved vehicle travel areas as required to limit Visible Dust Emissions to 20% opacity and comply with the requirements for a stabilized unpaved road as defined in District Rule 8011. [District Rule 8071 and 8011] Federally Enforceable Through Title V Permit
106. On each day that 50 or more VDT (Vehicle Daily Trips), or 25 or more VDT with 3 or more axles, originates from within and remains exclusively within an unpaved vehicle/equipment traffic area, dusting materials accumulated on paved surfaces shall be removed daily or water and/or chemical/organic dust stabilizers/suppressants shall be applied to the paved surface as required to maintain continuous compliance with the requirements for a stabilized unpaved road as defined in District Rule 8011 and limit Visible Dust Emissions (VDE) to 20% opacity. [District Rule 8011 and 8071] Federally Enforceable Through Title V Permit
107. Whenever any portion of the site becomes inactive, permittee shall restrict access and periodically stabilize any disturbed surface to comply with the conditions for a stabilized surface as defined in Section 3.58 of District Rule 8011. [District Rules 8071 and 8011] Federally Enforceable Through Title V Permit
108. The flare and gas collection system may be shut down when there is an insufficient amount of landfill gas to operate on. During the shutdown period, all gas collection system vents shall be closed and no emissions shall occur through the gas collection system. [District Rule 2201] Federally Enforceable Through Title V Permit
109. During the shutdown of the gas collection system, surface testing to measure the methane concentration at the surface of the landfill shall be conducted at least once every week using an organic vapor analyzer, flame ionization detector, or other portable monitor meeting the specifications provided in 40 CFR 60.755(d). After demonstrating compliance on four consecutive tests, the testing frequency shall be at least once every month. [District Rule 2201] Federally Enforceable Through Title V Permit
110. During the shutdown of the gas collection system, if the methane concentration measured during weekly or monthly surface testing exceeds 500 parts per million above background at the surface of the landfill, the testing frequency shall be at least once every other day. After demonstrating compliance on four consecutive tests, the testing frequency shall revert to at least once every week. [District Rule 2201] Federally Enforceable Through Title V Permit
111. During operation of the enclosed flare, the permittee shall continuously monitor and record combustion chamber temperature. The temperature readings shall not be less than 28 degree C (50 degree F) below the average combustion temperature determined during the most recent flare source test, averaged over a 3-hour period. Upon detecting any temperature excursion lower than 28 degree C (50 degree F) below the source test average combustion temperature, averaged over a 3-hour period, the permittee shall investigate the excursion and take corrective action to minimize excessive emissions and prevent recurrence of the excursion as expeditiously as practicable. [40 CFR part 64] Federally Enforceable Through Title V Permit
112. The temperature monitoring device shall be calibrated, maintained, and operated according to the manufacturer's specifications. [40 CFR part 64] Federally Enforceable Through Title V Permit
113. The enclosed flare burner and its associated components and the vapor collection system shall be inspected on an annual basis. The records of inspection shall at least contain date and time of inspection, identification of the person performing an inspection, parts replacement and repairs, and all maintenance actions taken. The records shall be kept and maintained for compliance inspection upon request. [40 CFR part 64] Federally Enforceable Through Title V Permit

- 114.** The permittee shall comply with the compliance assurance monitoring operation and maintenance requirements of 40 CFR part 64.7. [40 CFR part 64] Federally Enforceable Through Title V Permit
- 115.** The permittee shall comply with the recordkeeping and reporting requirements of 40 CFR part 64.9. [40 CFR part 64] Federally Enforceable Through Title V Permit
- 116.** If the District or EPA determine that a Quality Improvement Plan is required under 40 CFR 64.7(d)(2), the permittee shall develop and implement the Quality Improvement Plan in accordance with 40 CFR part 64.8. [40 CFR part 64] Federally Enforceable Through Title V Permit
- 117.** Landfill gas collection system components downstream of blower have a leak limit of 500 ppmv as methane. Components must be checked quarterly. [17 CCR 95464 (b)(1)(B), 17 CCR 95469 (b)(3)]
- 118.** Landfill gas collection system wellheads must be operated under vacuum. Monthly monitoring of wellheads is required. Landfill gas collection system wellheads may be operated under neutral or positive pressure except as allowed in sections 95464(c), 95464(d), and 95464(e) [17 CCR 95464(b)(1)(C)]
- 119.** Landfill gas collection and control system must be operated such that landfill surface methane emissions shall not exceed instantaneous surface emission limit of 500 ppmv as methane or integrated surface emission limit of 25 ppmv as methane. [17 CCR 95465]
- 120.** Instantaneous and integrated landfill surface emissions measurements shall be done quarterly. The landfill may monitor annually provided they comply with requirements of 17 CCR 95469 (a)(3). [17 CCR 95469(a)]
- 121.** Permittee shall keep records of all gas collection system downtime exceeding five days, including individual well shutdown and disconnection times and the reason for downtime. [17 CCR 95470(a)(1)(A)]
- 122.** Permittee shall keep records of all gas control system downtime in excess of one hour, the reason for the downtime and the length of time the gas control system was shutdown. [17 CCR 95470(a)(1)(B)]
- 123.** Permittee shall keep records of the expected gas generation flow rate calculated pursuant to section 95471(e). [17 CCR 95470(a)(1)(C)]
- 124.** Permittee shall keep records of all instantaneous surface readings of 200 ppmv or greater; all exceedances of the limits in sections 95464(b)(1)(B) or 95465, including the location of the leak (or affected grid), leak concentration in ppmv, date and time of measurement, the action taken to repair the leak, date of repair, any required re-monitoring and the re-monitored concentration in ppmv, and wind speed during surface sampling; and the installation date and location of each well installed as part of a gas collection system expansion. [17 CCR 95470(a)(1)(D)]
- 125.** Permittee shall keep records of any positive wellhead gauge pressure measurements, the date of the measurements, the well identification number, and the corrective action taken. [17 CCR 95470(a)(1)(E)]
- 126.** Permittee shall conduct surface emission monitoring using either the procedures specified in section 95471(c) or the Los Angeles County Sanitation District monitoring procedure. Permittee shall keep records of which procedure was used. [17 CCR 95468]
- 127.** Permittee shall keep records of delays encountered during repair of leaks or repair of positive wellhead readings. Documentation of delays shall be submitted with the annual report. [17 CCR 95468(a)(2)]
- 128.** Permittee shall keep records of alternate landfill gas collection system modifications being implemented to correct an exceedance in the landfill gas surface emissions or wellhead pressure. Any alternative to installing a new well shall be documented and submitted with the annual report. [17 CCR 95468]
- 129.** Permittee shall identify areas which are dangerous and unable to be inspected or contain only inert, non-decomposing waste. Areas shall be clearly identified on a map of the facility. A copy of the map shall be kept onsite as well as submitted with the annual report. [17 CCR 95468(a)(5)]
- 130.** Permittee shall conduct monitoring of the landfill surface within 3 inches of the surface. The facility may monitor surface emissions with the probe tip at the height of the vegetation if there is vegetation and it is impractical to monitor at 3 inches from the landfill surface. [17 CCR 95468]
- 131.** Permittee shall terminate surface emission testing when the measured average wind speed is over 10 mph or the instantaneous wind speed is over 20 mph. [17 CCR 95468(a)(3), 17 CCR 95471(c)(1)(C)]

- 132.** Permittee shall only conduct surface emission testing when precipitation has met the following requirements. It has been 24 hours since measured precipitation of 0.01 to 0.15 inches. It has been 48 hours since measured precipitation of 0.16 to 0.24 inches. It has been 72 hours since measured precipitation of 0.25 or more inches. [17 CCR 95468]
- 133.** Permittee shall keep records of the annual solid waste acceptance rate and the current amount of waste-in-place. [17 CCR 95470(a)(1)(F)]
- 134.** Permittee shall keep records of the nature, location, amount, and date of deposition of non-degradable waste for any landfill areas excluded from the collection system. [17 CCR 95470(a)(1)(G)]
- 135.** Permittee shall keep records of any source tests conducted pursuant to section 95464(b)(4). [17 CCR 95470(a)(1)(H)]
- 136.** The flare must be source tested annually for methane destruction efficiency of at least 99% by weight. If the flare is in compliance after three consecutive source tests, the facility may move to source testing the flare every three years. If subsequent tests show the flare out of compliance, the test frequency shall revert to annual testing. [17 CCR 95464(b)(4)]
- 137.** The flare must have automatic dampers, an automatic shutdown device, a flame arrester, and continuous recording temperature sensors. [17 CCR 95464(b)(2)(A)(2)]
- 138.** The flare must operate within the parameter ranges established during the initial or most recent source test. [17 CCR 95464(b)(2)(A)(4)]
- 139.** Permittee shall keep records describing the mitigation measures taken to prevent the release of methane or other emissions into the atmosphere during the following activities: 1. When solid waste was brought to the surface during the installation or preparation of wells, piping, or other equipment; 2. During repairs or the temporary shutdown of gas collection system components; or, 3. When solid waste was excavated and moved. [17 CCR 95470(a)(1)(I)]
- 140.** Permittee shall keep records of any construction activities pursuant to section 95466. The records must contain the following information: 1. A description of the actions being taken, the areas of the MSW landfill that will be affected by these actions, the reason the actions are required, and any landfill gas collection system components that will be affected by these actions. 2. Construction start and finish dates, projected equipment installation dates, and projected shut down times for individual gas collection system components. 3. A description of the mitigation measures taken to minimize methane emissions and other potential air quality impacts. [17 CCR 95470(a)(1)(J)]
- 141.** Permittee shall keep records of the equipment operating parameters specified to be monitored under section 95469(b)(1) as well as records for periods of operation during which the parameter boundaries established during the most recent source test are exceeded. The records must include the following information: 1. For enclosed flares, all 3-hour periods of operation during which the average temperature difference was more than 28 degrees Celsius (or 50 degrees Fahrenheit) below the average combustion temperature during the most recent source test at which compliance with sections 95464(b)(2) was determined and a gas flow rate device which must record the flow to the control device at least every 15 minutes. [17 CCR 95470(a)(1)(K), 17 CCR 95469(b)(1)(B)]
- 142.** Permittee shall submit the following reports as required in section 95470(b): Closure notification, Equipment removal report and Annual report. All reports must be accompanied by a certification of truth, accuracy, and completeness signed by a responsible official. [17 CCR 95470(b)]
- 143.** Permittee may request alternatives to the compliance measures, monitoring requirements, test methods and procedures of sections 95464, 95469, and 95471. Any requests must be submitted in writing. [17 CCR 95468]

**SAN JOAQUIN VALLEY UNIFIED  
AIR POLLUTION CONTROL DISTRICT**

**MEMORANDUM**

**DATE:** November 7, 2014  
**TO:** Aleah Zapf  
**C:** Source Test File  
**FROM:** John Copp

**SUBJECT:** Review of Source Test for Chemical Waste Management, Inc.  
July 17, 2014  
PTO #C-283-22-17

Horizon Air Measurement Services, Inc. (Horizon) was retained by Chemical Waste Management, Inc. to conduct a compliance emission test of an 83.6 MMBtu/hr Parnel enclosed biogas flare. The flare unit was fired on landfill gas under a normal operating load of 12.7 MMBtu/hr. The source test measured NO<sub>x</sub>, CO, TNMHC, and O<sub>2</sub>. A fuel samples was taken for CHONS and fuel gas sulfur analysis and determination of fuel HHV and F-factor.

District compliance staff found notification, reporting, and source test protocols employed during this test to be satisfactory.

The data and calculations included in the report submittal were evaluated to ensure accuracy.

A review of the report submitted by Horizon on behalf of Chemical Waste Management indicated that the flare unit was successful in demonstrating compliance with the emission limits specified in the permit.

**PTO C-283-22-17 Enclosed landfill gas flare**

Outlet NO <sub>x</sub>	9.9 ppmv	0.57 lb/hr	<b>0.036 lb/MMBtu (limit 0.06)</b>
Outlet CO	7.6 ppmv	0.27 lb/hr	<b>0.017 lb/MMBtu (limit 0.22)</b>
Outlet Methane	0.6 ppmv	0.012 lb/hr	
Outlet TNMHC <sup>1</sup> @ 3% O <sub>2</sub>	2.6 ppmv (limit 20)	0.02 lb/hr	<b>0.002 lb/MMBtu (limit 0.063)</b>
Outlet O <sub>2</sub>	14.1%		
Outlet CO <sub>2</sub>	6.26%		
Outlet Flow	8064 dscfm		
Flare Temp.	1550 F		
Inlet TNMHC <sup>1</sup>	7507 ppmv	12.2 lb/hr	
Inlet CH <sub>4</sub>	367,000 ppmv	595 lb/hr	
Inlet Flow	651 dscfm		

TNMHC %DE<sup>2</sup> by weight: **99.8%** (limit >98 or VOC <20 ppm @ 3% O<sub>2</sub>, as methane)

CH<sub>4</sub> %DE<sup>2</sup> by weight: **100.0%** (limit >99%)

<sup>1</sup> As methane, CH<sub>4</sub>.

<sup>2</sup> DE % = ((Inlet lb/hr – Outlet lb/hr)/Inlet lb/hr)\*100

### **Fuel Analysis**

#### **Run 1**

- HHV – 409.1 Btu/cf @ 68 F
- F-Factor – 9784 dscf/MMBtuhr @ 68 F
- CHONS Wt. % - 31.32% C, 5.61% H, 41.21 % O, 21.86% N, 0.00% S

#### **Run 2**

- HHV – 410.8 Btu/cf @ 68 F
- F-Factor – 9788 dscf/MMBtuhr @ 68 F
- CHONS Wt. % - 31.46% C, 5.64% H, 41.28 % O, 21.63% N, 0.00% S

#### **Run 3**

- HHV – 411.1 Btu/cf @ 68 F
- F-Factor – 9782 dscf/MMBtuhr @ 68 F
- CHONS Wt. % - 31.46% C, 5.64% H, 41.28 % O, 21.61% N, 0.00% S



**San Joaquin Valley**  
AIR POLLUTION CONTROL DISTRICT



November 7, 2014

Paul Turek, Environmental Manager  
Chemical Waste Management, Inc.  
PO Box 471  
Kettleman City, CA 93239

**Re: DETERMINATION OF COMPLIANCE EMISSION TESTING**

Dear Mr. Turek,

District staff has received the retest report for the permitted equipment listed below, submitted for compliance determination with permitted emission limits. Review of the retest result(s) reveal the equipment to be operating in compliance with permitted NOx, CO, and VOC emission limits and CH4 and VOC destruction efficiency.

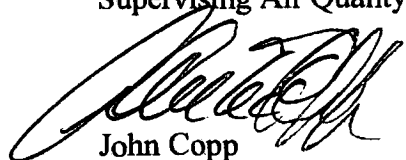
If the permitted equipment has annual source testing requirements, then the next annual test must be conducted within thirty days (+/- 30) of the next test date as shown below. If an ATC has been issued for modifications to the permitted equipment, then the testing requirements must follow the ATC.

<u>Permit Number</u>	<u>Unit</u>	<u>Test Date</u>	<u>Next Test Date</u>
C-283-22-17	Enclosed Landfill Glass Flare	7/17/14	7/19/15

If you have any questions please call this office at (559) 230-6000.

Sincerely,

Lupe Jauregui  
Supervising Air Quality Inspector



John Copp  
Air Quality Inspector II