WAIMANALO GULCH SANITARY LANDFILL

LANDFILL GAS EXTRACTION ASSESSMENT

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1. INTRODUCTION

In August 2011, Waste Management of Hawaii, Inc (WMH) identified significant irregularities with the landfill gas data that had purportedly been collected and recorded by its landfill gas technician at the Waimanalo Gulch Sanitary Landfill (WGSL). Further investigation revealed that some wellhead gas parameter measurements were not actually taken and that data had been fabricated instead of collected through verifiable measurements. Based on interviews conducted during the investigation, it appears that the failure to collect data and the fabrication of replacement data began in mid-2010 and continued until August 2011 when the failure was investigated and identified. The failure to collect data and the manual entry of fabricated data into Waste Management's Landfill Gas Management System (LGMS) database is a clear violation of the company's written policy and procedures.

As a result of the discovery and initial investigation of the fabricated data, WMH has undertaken a detailed assessment of (1) the current status of the wellfield and the gas collection and control system (GCCS) to determine whether the fabricated data has concealed adverse changes in the wellfield, and (2) the past status of the wellfield based on data that conservatively excludes all data that was manually entered into LGMS by the technician. The results of this investigation are presented in this report.

Based on the analysis presented here, Environmental Information Logistics, LLC (EIL) concludes that the wellfield and GCCS at WGSL is generally performing within the expected range of monitored parameters at the facility and that there is no evidence that the wellfield has undergone any adverse changes during periods with fabricated data. The analysis also concludes that the absence of some historical wellfield data, when compared to available wellfield data, does not significantly alter the results of this evaluation: there is no indication of any adverse changes in the wellfield, including no evidence of a past subsurface oxidation event (SOE).

Existing landfill gas extraction wells were sampled between August 24th and September 2nd, 2011 by EIL personnel with additional sampling conducted from September 6th to September 14th, 2011 by experienced WM landfill gas system operations and maintenance (O&M) personnel from California. This sampling data formed the basis for this assessment report.

WMH uses a Landtec GEM2000™ analyzer (GEM) to collect, store and upload to LGMS, gas temperature, gas quality, pressures, and gas flow from each landfill gas extraction well. An Agilent Micro3000™ gas chromatograph (GC) fitted with columns to allow for the measurement of methane, CO_2, oxygen, nitrogen, hydrogen and carbon monoxide was also used to analyze grab samples from each well. The normalized results are included in Appendix A. The data collected from the GEM and GC was analyzed to establish statistical parameters useful in describing the state of landfill gas generation and GCCS operation at the site. Thermometers were replaced at all wellheads to ensure that temperature measurements were accurate. In addition, historical norms were established based on validated data within the LGMS database and compared to the August and September, 2011 sampling events to provide trend information useful in evaluating long-term changes or trends in landfill gas generation and GCCS operation at the site.

In order to enhance data integrity, and help prevent this type of issue in the future, several changes to LGMS are underway with an expected deployment date by September 29, 2011. First, a system report is being modified to allow users to easily determine which records are uploaded directly from a monitoring instrument and which are manually entered. Second, the ability for users with "Technician" level access to manually enter data is being restricted as described below for each device type.

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- <u>Wells:</u> Manual entry of primary composition and physical parameters normally measured by the GEM monitoring instrument will not be allowed by users with "Technician" level access. These users will retain the ability to manually enter comments and other gas concentrations not normally measured with a GEM instrument.

- <u>Probes:</u> Manual entry of primary composition and physical parameters normally measured by the GEM will no longer be allowed by users with "Technician" level access. These users will retain the ability to manually enter comments and other gas concentrations not normally measured with a GEM instrument.

- <u>Sample Ports:</u> Manual entry of primary composition and energy parameters normally measured by the GEM will no longer be allowed by users with "Technician" level access. These users will retain the ability to manually enter physical parameters, comments, and other gas concentrations.

WMH has also developed a draft "Monitoring and Contingency Plan for Elevated Temperatures and Subsurface Oxidation Conditions", herein referred to as the "draft Contingency Plan", that is being used to manage landfill gas extraction at the site. This draft plan establishes procedures for monitoring and operation of the GCCS in the event of elevated temperatures or evidence of a subsurface oxidation event (SOE). While this plan has not yet been finalized and approved, WMH is nonetheless implementing the procedures detailed in the Contingency Plan.

Research conducted by Dr. Morton Barlaz, of North Carolina State University in 2008 (submitted to US EPA in a report titled "Characterization of Biological Activity in Refuse Samples Excavated from the Waimanalo Gulch Sanitary Landfill") is incorporated herein by reference. This research provides a basis upon which to draw conclusions regarding gas generation at the site at elevated temperatures.

2. ANALYSIS OF THE STATE OF LANDFILL GAS GENERATION (Sept. 2011)

After discovery of the missing and fabricated data in August, 2011, WMH tasked EIL and WM's California landfill gas technician with collecting and then statistically analyzing validated landfill gas data to determine the current state of landfill gas generation and GCCS operations. The results and analysis of the August and September 2011 data are described in this section. The statistical data forming the basis of this analysis is presented in tables in Appendix B.

Based on the analysis presented here, the wellfield and GCCS at WGSL is generally performing within the expected range of monitored parameters and that there is no evidence of adverse changes in the wellfield.

2.1. Oxygen Evaluation

As recognized in the federal New Source Performance Standards (NSPS) for municipal solid waste landfills (40 CFR Part 60, Subpart WWW), a leading indicator of adverse conditions within a landfill is oxygen, for which the NSPS sets 5.0% as the maximum value [40 CFR § 60.753(c)]. The maximum oxygen concentration measured using the GEM at the site during this assessment was 0.3% by volume with an average of 0.0% (this data was excluded from the tables in Appendix B because it was predominantly zero and did not provide any statistically relevant information necessary for this analysis). SOE conditions require oxygen introduced into the landfill through ambient air intrusion. Since oxygen can be consumed during a SOE, each extraction well was sampled and analyzed for nitrogen to establish the potential or existence of this condition. The average nitrogen concentration was 3.5% which is significantly below the landfill NSPS threshold of 20%.

The data demonstrates that there is no significant oxygen or nitrogen present within the landfill waste mass, nor do the conditions present a risk of an SOE. Further, the lack of air intrusion demonstrates that no significant GCCS operational impacts have occurred at the site. WMH's installation of a vacuum controlled variable frequency drive (VFD) system on the flare system blowers in 2007 ensures that a constant vacuum is applied to the gas piping system. This system ensures stable operation of the extraction wells minimizing the potential for air intrusion.

2.2. Methane to CO2 Ratio Evaluation

Under typical anaerobic conditions, methane/carbon dioxide (CH_4/CO_2) ratios are above 1. The CH_4/CO_2 ratios observed at the site range from 0.4 to 1.5 with 60% of the wells having a ratio greater than 1 (Figure 1) and accounting for approximately 78.3% of the total collected gas from the site (Figure 2). This suggests that the biological and chemical reactions occurring within the waste are predominately anaerobic.

Research conducted by Dr. Morton Barlaz has demonstrated that, at the elevated gas temperatures found at WGSL, significant quantities of hydrogen and carbon monoxide are formed through naturally occurring biological and chemical processes and he and others have noted that the methanogenic process can be reduced by many factors including high temperatures. Further, carbohydrate fermentation will yield CO_2 and hydrogen that will accumulate in the landfill if methanogenisis is reduced producing ratios of CH_4 to CO_2 less than 1.

Figure 1 - WGSL Methane/CO2 Ratio Frequency

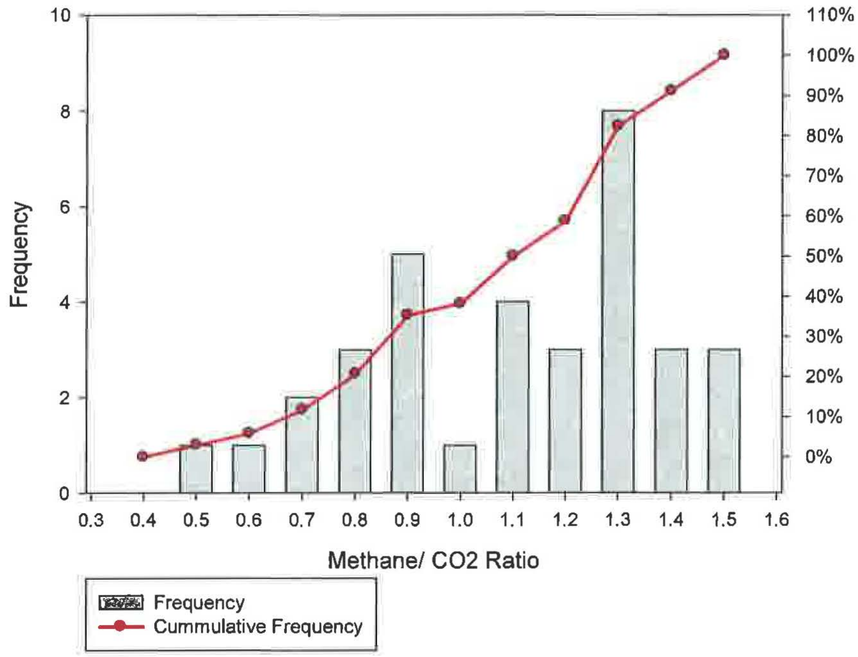
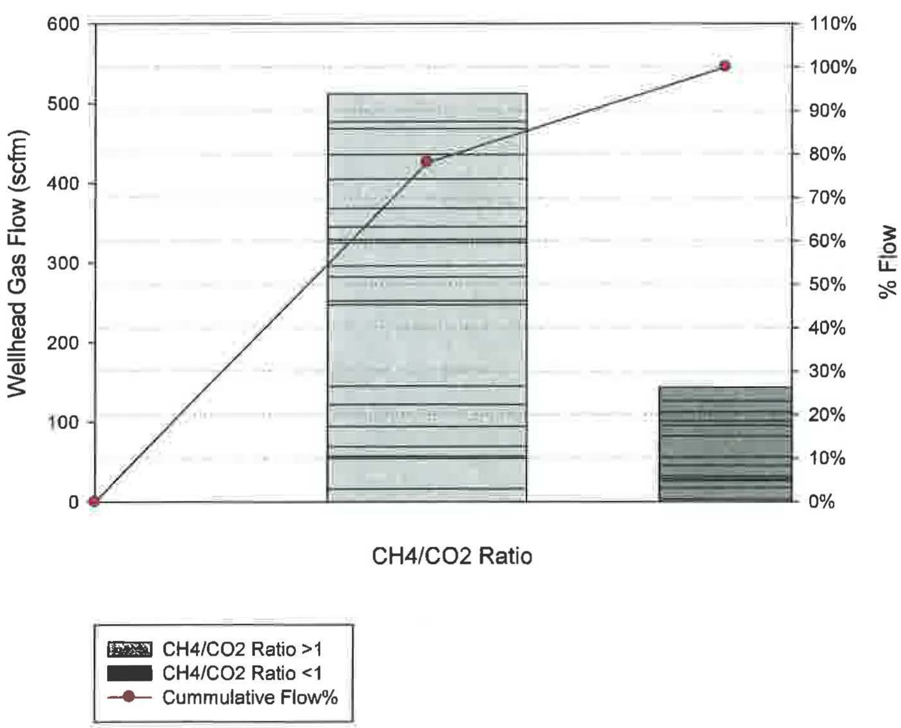


Figure 2 - Cummulative Well Flow Comparison Based on CH4/CO2 Ratio



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Of the 21 wells with CH_4/CO_2 ratios greater than 1, eleven (11) had methane concentrations above 50% (a Waste Management Best Management Practice target level), accounting for 43.8% of the average total collected gas flow (Table 1).

Table 1 – Extraction Wells > 50% Methane [1]

Statistical Analysis	Average Methane (%)	Average CH_4/CO_2 Ratio	Average Temperature (°F)	Average Flow (scfm)
GW-27	50.4	1.1	140	10
GW-38	50.6	1.2	144	16
GW-8	52.1	1.2	143	38
GW-46	52.2	1.2	130	3
GW-25	53.0	1.3	130	12
GW-35	54.4	1.3	146	25
GW-43	55.4	1.3	132	28
GW-36	56.5	1.4	147	23
GW-40	57.2	1.4	136	102
GW-39	57.4	1.4	120	5
GW-42	58.0	1.5	128	30
Well Average	54.3	1.3	136	27

[1] *Table created from data collected during August 24th and September 14th, 2011. Averages are statistical means of that data.*

The average gas flow from the wells listed in Table 1 is 27 scfm; a rate that can be used to describe good stable methanogenisis considering methane above 50% and a CH_4 to CO_2 ratio greater than 1. None of the wells in Table 1 show any indication of adverse conditions.

Even though methane concentrations were below 50% for some wells, the CH_4/CO_2 ratio still remained above 1 (Table 2).

Table 2 – Extraction Wells < 50% Methane and > 1:1 CH_4/CO_2 Ratios

Statistical Analysis	Average Methane (%)	Average CH_4/CO_2 Ratio	Average Temperature (°F)	Average Flow (scfm)
GW-12	42.3	1.0	152	14
GW-44 [2]	41.8	1.1	173	29
GW-7 [3]	37.9	1.1	169	4
GW-31	47.4	1.1	159	16
GW-14	47.7	1.2	145	23
GW-29	48.2	1.2	149	37
GW-37	46.5	1.2	141	31
GW-34	46.3	1.2	134	32
GW-26	47.5	1.2	134	9
GW-41	46.1	1.3	134	35
Well Average	45.2	1.2	149	23

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[1] *Table created from data collected during August 24th and September 14th, 2011. Averages are statistical means of that data.*

[2] *The uncharacteristically high gas temperature compared to the CH_4/CO_2 ratio may be the result of gas transport pathways from outside of this temperature zone bringing in gas generated from well established methanogenic microbial populations.*

[3] *Gas temperatures have cooled from historical highs.*

The average gas flow from the wells listed in Table 2 is 23 scfm; a slightly slower rate than the extraction wells above 50% shown in Table 1. Despite lower methane concentrations, the CH_4 to CO_2 ratio is still greater than 1 (albeit slightly lower than those found in Table 1). This is consistent with Dr. Barlaz's research indicating an increase in temperature (on average 10 degrees F above those found in wells in Table 1) starts to reduce methanogenisis. However, none of the wells in Table 2 show any indication of adverse conditions.

Dr. Barlaz's research demonstrated that as temperatures increase, methanogenic microbial populations decline yielding lower CH_4/CO_2 ratios and reduced gas flow rates as fermentation processes exceed methanogenisis allowing for accumulation of CO2 and hydrogen as noted in Table 3.

Table 3 – Extraction Wells < 50% Methane and < 1 CH_4/CO_2 Ratios [1]

Statistical Analysis	Average Methane (%)	Average CH_4/CO_2 Ratio	Average Temperature (°F)	Average Flow (scfm)	Hydrogen[2] (%)
GW-32	21.9	0.4	172	3	26.7
GW-24	29.5	0.6	165	14	22.5
GW-49	21.2	0.6	170	9	18.2
GW-13	28.6	0.7	156	2	19.9
GW-2	31.3	0.7	168	4	18.3
GW-9	35.7	0.7	164	13	21.3
GW-6	31.8	0.8	158	11	15.0
GW-30	35.7	0.8	166	26	18.3
GW-15	34.9	0.8	152	13	17.3
GW-11	30.5	0.9	146	6	5.1
GW-33	39.9	0.9	160	11	19.0
GW-47	37.6	0.9	167	14	15.9
GW-48	37.6	0.9	169	17	20.1
Well Average	32.0	0.8	163	11	18.3

[1] *Table created from data collected during August 24th and September 14th, 2011. Averages are statistical means of that data.*

[2] *Hydrogen concentrations for each well were determined by GC on 9/14 and 9/15, 2011 (Appendix A).*

Gas temperatures are elevated approximately 10 °F on average above those wells listed in Table 2 and 20 °F above those wells listed in Table 1. Methane concentrations declined as did the CH_4/CO_2 ratios all of which are consistent with Dr. Barlaz's WGSL research.

Figure 3 illustrates the direct relationship between CH_4/CO_2 ratio and gas temperature.

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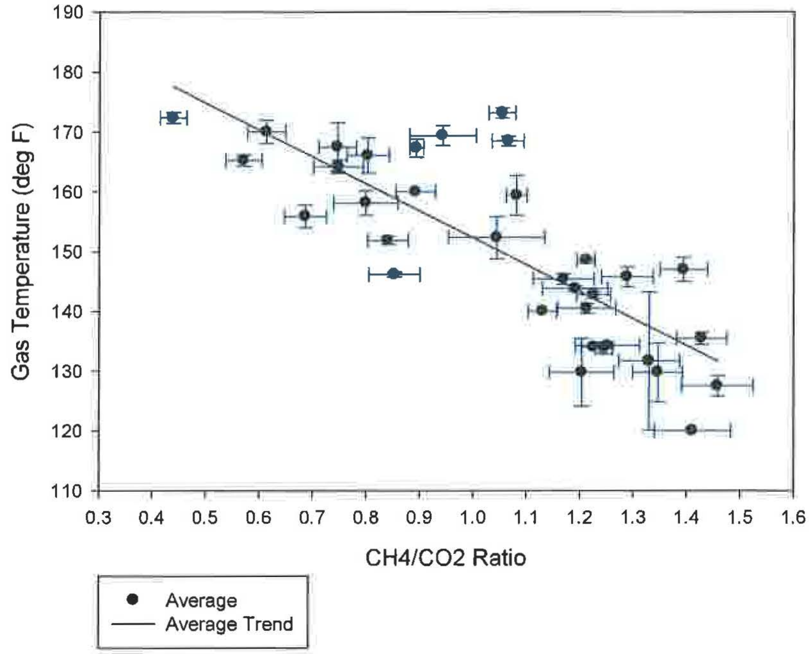
Figure 3 - WGSL
Gas Temperature vs. CH4/CO2 Ratio Trend



Blue bars represent 95% confidence interval about data mean for each parameter.

Dr. Barlaz indicated in his research that thermophilic methanogens would be expected to have a temperature optimum of 149 °F. This temperature corresponds to a CH_4/CO_2 ratio of approximately 1.1. As temperatures rise, methane production declines which alters the CH_4/CO_2 ratio as more CO_2 and hydrogen are produced. The data collected during this assessment is consistent with prior research and shows that there is no evidence of a subsurface oxidation event (SOE) which would have exponential temperature increases at lower methane to CO_2 ratios.

2.3. *Gas Temperature Evaluation*

Average gas temperatures for all gas extraction wells at WGSL ranged from 120 to 173 °F with a standard deviation of 15.2 °F. The average temperature for all wells was 150 °F.

Under the draft Contingency Plan (once approved) the following wells will be subject to enhanced monitoring because of their elevated temperatures: GW-2, GW-7, GW-30, GW-32, GW-44, GW-47, GW-48, and GW-49. Each of these wells exhibit temperatures considered as Level 1 (166 °F – 175 °F). Depending on when the draft Contingency Plan is approved, the monitoring established for this level will be formally implemented, most likely in the 4th quarter of 2011.

The draft Contingency Plan also establishes monitoring and operational procedures for wells that exhibit monthly (or from previous monitoring event) gas temperature increases greater than 5 °F or a two month increase greater than 10 °F (Table 4). Table 4 lists the 14 wells that triggered this provision.

Although the wells in Table 4 show a temperature rise from historical averages, the temperatures are not substantially higher. The data shows that temperatures rose no more than 10°F above the 95% confidence interval of the historical mean. Further, the thermometers used at each well (which were all replaced for this assessment) have a scale resolution of 2 °F which reduces the significance of small changes. In addition, the recent placement of waste and stockpiled soil in much of the landfill area surrounding these wells likely reduced heat dissipation through the landfill surface because of the insulating properties of municipal solid waste allowing for temperature increases.

Table 4 – Gas Temperature Changes > 5 °F

ID	Historical Average (°F)	Aug./Sept. 2011 Average (°F)	Change (°F)	Change Above Historical 95% Confidence Interval (°F)	Hydrogen[1] (%)	Nitrogen[1] (%)	Aug./Sept. 2011 Average CO (ppmv)[2]
GW -15	146	152	6	5	17.3	0.2	45
GW- 2	162	168	6	3	18.3	9.9	175
GW -31	153	159	6	5	8.9	0.0	32
GW -34	128	134	6	3	0.0	7.9	0
GW -29	141	149	7	7	0.0	5.8	9
GW -41	127	134	7	6	0.0	11.8	10
GW-43	124	132	8	7	0.0	0.0	0
GW- 38	136	144	8	7	1.9	0.0	40
GW- 30	158	166	8	4	18.3	0.7	117
GW- 24	157	165	8	7	22.5	0.0	208
GW-32	164	172	8	7	26.7	0.0	171
GW-42	118	128	10	8	0.0	0.0	1
GW-33	149	160	12	7	19.0	0.4	206
GW -40	122	136	13	9	0.0	0.0	3

[1] *Hydrogen and nitrogen concentrations for each well were determined by GC on 9/14 and 9/15, 2011 (Appendix A).*
[2] *The average is based on Draeger and GC data.*

WM implemented the draft Contingency Plan for the wells listed in Table 4 regardless and found no evidence of an SOE. The draft Contingency Plan actions included well inspections, gas flow reduction (if necessary/possible), thermometer replacement and gas chromatograph analysis for nitrogen, hydrogen and CO concentration. Nitrogen concentrations were significantly less than the NSPS threshold (20%) and hydrogen as well as CO was observed in wells with higher temperatures consistent with WGSL research by Dr. Barlaz. In fact, the highest measured CO concentrations were at wells with zero nitrogen indicating no ambient air intrusion into the waste mass surrounding those wells. Lastly, no other SOE indicators were observed.

Only three draft Contingency Plan Level 1 wells had temperature increases greater than 5 °F: GW-2, GW-30 and GW-32. As explained below, none of these wells exhibit conditions above what would be considered normal. No evidence of an SOE exists.

GW-2: Average well pressure is at -0.3 inches water column ("w.c.). This vacuum is considered minimal for this well so no flow reduction is possible. CO measurements were performed by Draeger tubes and showed 130 and 150 ppm CO. A GC sample showed 225 ppm CO. Zero oxygen was measured and only 9.9% nitrogen (less than the 20% landfill NSPS

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threshold) indicating that air intrusion is minimal. Further, the temperature rise is only slightly outside of historical norms and it is not unexpected that the rate of temperature dissipation will be reduced because of the insulating effect of the recently placed waste in this area. Hydrogen concentrations are as expected given the temperature. Data does not indicate a SOE.

GW-30: Well pressure is at -0.3 "w.c. Attempts to reduce gas flow were made, but no substantial change was observed. CO measurements were performed by Draeger tubes and showed 130 and 80 ppm. A GC sample showed 142 ppm. Zero oxygen was measured and only 0.8% nitrogen indicating that there is no air intrusion. Further, the temperature rise is only slightly outside of historical norms and it is not unexpected that the rate of temperature dissipation will be reduced because of the insulating effect of the recently placed waste in this area. Hydrogen concentrations are as expected given the temperature. Data does not indicate a SOE.

GW-32: Well pressure is at -0.3 "w.c. Attempts to reduce gas flow were made, but no substantial change was observed (gas flow averages less than 5 cfm). CO measurements were performed by Draeger tubes and showed 150 and 140 ppm. A GC sample showed 221 ppm. Zero oxygen was measured and only 0.8% nitrogen indicating that there is no air intrusion. Further, the temperature rise is only slightly outside of historical norms and it is not unexpected that the rate of temperature dissipation will be reduced because of the insulating effect of the recently placed waste in this area. Hydrogen concentrations are as expected given the temperature. Data does not indicate a SOE.

Therefore, conditions at these wells have been confirmed to be normal for WGSL.

Table 5 lists the results of additional monitoring undertaken to evaluate the observed temperature changes for wells that are not considered as Level 1 in the draft Contingency Plan.

Table 5 – Gas Temperature Changes > 5 °F and Level 1 Monitoring Not Triggered [1]

Device ID	Average CO (ppmv)[2]	Average Methane (%)	Average Pressure ("w.c.)	Average CH4/CO2	Hydrogen[3] (%)	Nitrogen[3] (%)
GW-24	208	29.5	-0.7	0.6	22.5	0.0
GW-15	45	34.9	-0.2	0.8	17.3	0.2
GW-33	206	39.9	-0.7	0.9	19.0	0.4
GW-41	10	46.1	-6.6	1.3	0.0	11.8
GW-34	0	46.3	-18.6	1.2	0.0	7.9
GW-31	32	47.4	-0.6	1.1	8.9	0.0
GW-29	9	48.2	-4.9	1.2	0.0	5.8
GW-38	40	50.6	-3.7	1.2	1.9	0.0
GW-43	0	55.4	-1.7	1.3	0.0	0.0
GW-40	3	57.2	-23.5	1.4	0.0	0.0
GW-42	1	58.0	-28.6	1.5	0.0	0.0

[1] *Table created from data collected during August 24th and September 14th, 2011. Averages are statistical means of that data.*

[2] *The average is based on Draeger and GC data collected during August 24th and September 14th, 2011.*

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[3] *Hydrogen and nitrogen concentrations for each well were determined by gas chromatograph (GC) on 9/14 and 9/15, 2011.*

Methane to CO_2 ratios for all but 3 wells in Table 5 (GW-15, GW-24, and GW-33) were greater than 1. Similarly, hydrogen was measured at greater than 15% for those wells. However, zero oxygen was measured and no significant nitrogen (much less than the 20% NSPS threshold) indicating no air intrusion is occurring. Further, the temperature rises for these 3 wells are only slightly outside of historical norms (approximately 7 °F). As temperatures increase, methanogenic microbial populations decline yielding lower CH_4/CO_2 ratios and reduced gas flow rates as fermentation processes exceed methanogenisis allowing for accumulation of CO2 and hydrogen. Similarly, Dr. Barlaz has shown at WGSL that CO concentrations increase with higher gas temperatures. These wells have CO concentrations consistent with the observed temperature and elevated hydrogen content. Therefore, the data does not indicate a SOE.

For the remaining wells in Table 5, zero oxygen was measured at each well and nitrogen was measured at 0 or close to 0 in all but 3 wells (GW-29, GW-34, and GW-41). The measured nitrogen concentration in GW-29, GW-34, and GW-41was much less than the threshold established by EPA in the landfill NSPS. Further, the lack of hydrogen in any well and CH_4/CO_2 ratios greater than 1 indicate stable methanogenisis. Therefore, conditions at these wells have been confirmed to be normal for WGSL.

2.4. Balance Gas Evaluation

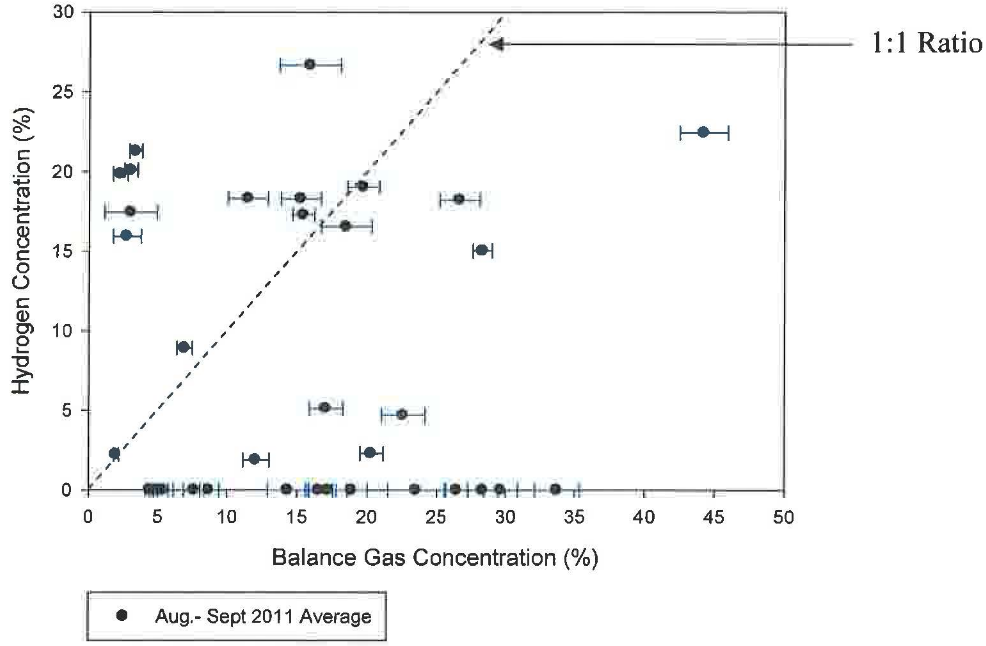
Balance gas consists of nitrogen, hydrogen, water vapor and trace gases found within landfill gas. During this assessment it ranged from 2.0% to 44.2% with an average of 15.6%. Data collected and analyzed by GC at the site on 9/14 and 9/15, 2011, illustrates that many extraction wells exhibit greater than 5% hydrogen and that it makes up the bulk of the balance gas concentration (Figure 4) in some wells. These results are similar to prior studies at the facility.

Wells falling above the 1:1 hydrogen to balance gas ratio have the preponderance of the balance gas as hydrogen while wells falling below have the bulk of the balance gas comprised of the other compounds noted above i.e. nitrogen or water vapor. This relationship is important because the field meter used at WGSL (as well as a majority of the landfills in the US) does not differentiate balance gas into its component parts. Therefore, understanding whether balance gas is comprised of hydrogen or the other compounds will assist in establishing if the GCCS are normal for the site.

Figure 5 illustrates the relationship between hydrogen and nitrogen at WGSL. There is no significant correlation suggesting two independent processes at work. Indeed, Dr. Barlaz has shown that hydrogen formation is the result of elevated temperature impacts on methanogenic microbes while nitrogen comes from ambient air intrusion into the waste mass. While both process impact methanogenisis (methanogens are anaerobic), only excessive nitrogen concentrations would indicate that oxygen has entered the landfill and as such provided one of the key components required to fuel a SOE.

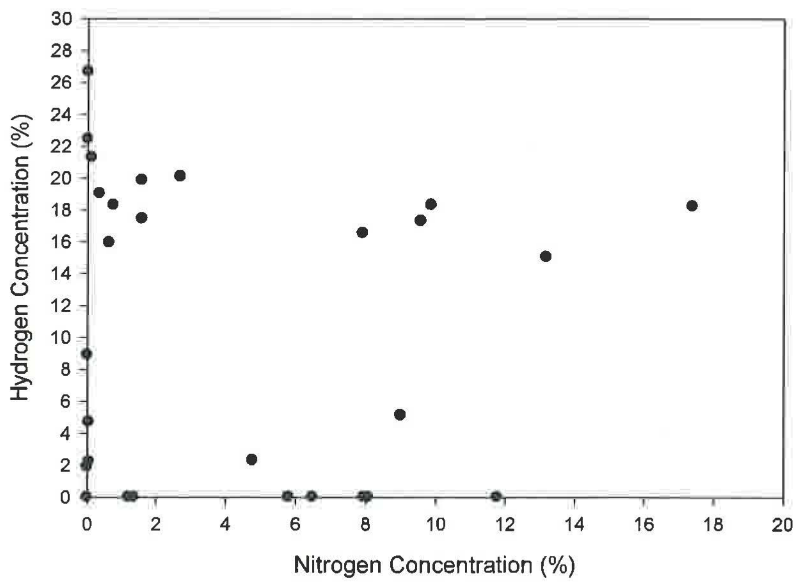
Figure 5 illustrates the fact that all of the extraction wells have nitrogen concentrations that are less than the 20% nitrogen threshold established within the landfill NSPS; evidence that conditions are <u>not</u> optimum for a SOE.

Figure 4 - WGSL Hydrogen / Balance Gas Correlation



Blue bar represent 95% confidence interval about mean.

Figure 5 - WGSL
Hydrogen vs. Nitrogen Correlation Analysis



The "draft Contingency Plan" being developed by WM is being implemented for the wells listed in Table 6 because of their balance gas concentration.

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Table 6 – Balance Gas > 10% and hydrogen <5% (non-hydrogen producing well)[1,2]

ID	Average Balance Gas (%)	Nitrogen[3] (%)	Hydrogen[3] (%)	Average CH_4/CO_2 Ratio	Average Applied Pressure ("w.c.)
GW-14	11.5	0.0	4.7	1.2	-1.6
GW-29	12.1	5.8	0.0	1.2	-4.9
GW-26	14.3	8.1	0.0	1.3	-0.4
GW-37	15.2	1.4	0.0	1.2	-1.3
GW-34	15.9	7.9	0.0	1.2	-18.6
GW-41	17.0	11.8	0.0	1.3	-6.8
GW-12	17.2	4.8	2.3	1.0	-0.3
GW-11	33.7	9.0	5.1	0.9	-0.2

[1] *Table created from data collected during August 24th and September 14th, 2011. Averages are statistical means of that data.*

[2] *Nitrogen and hydrogen may not add up to equal balance gas because water vapor, another component of balance gas, has not been measured. Further, the sum of nitrogen and hydrogen may be more or less than balance gas because they result from a single discrete measurement that is being compared to an average balance gas concentration measured over the period August 24th to September 14th, 2011.*

[3] *Hydrogen and nitrogen concentrations for each well were determined by gas chromatograph (GC) on 9/14 and 9/15, 2011.*

In accordance with the draft Contingency Plan, vacuum was reduced at each well listed in Table 6 where possible (several wells are already at the lowest vacuum without going positive with the pressure that can be maintained specific to each well). However, the CH_4/CO_2 ratio was near or above 1.0 in the wells. As noted previously, Dr. Barlaz's research indicates that CH_4/CO_2 ratios greater than 1.0 are strong indicators of stable methanogenisis, especially in light of the low hydrogen content. The methanogenic microbes are consuming the hydrogen formed during the fermentation phase causing a rise in methane formation. In addition, zero oxygen was measured and no significant nitrogen (less than the 20% landfill NSPS threshold) indicating that there is no air intrusion. Therefore, although WM has implemented the draft Contingency Plan for these wells, there is no SOE occurring and conditions are not conducive to a SOE starting.

Table 7 shows the additional wells WM is implementing the draft Contingency Plan on because balance gas concentrations are above 10%, however, hydrogen is above 5%.

Table 7 – Balance Gas > 10% and hydrogen >5% (hydrogen producing wells)[1,2]

ID	Average Balance Gas (%)	Nitrogen[3] (%)	Hydrogen[3] (%)	Average Applied Pressure ("w.c.)
GW-33	15.4	0.4	19.0	-0.7
GW-9	16.6	0.1	21.3	-0.9
GW-44	18.5	1.6	17.5	-0.4
GW-24	18.9	0.0	22.5	-0.7
GW-30	19.7	0.7	18.3	-0.3

Table 7 – Balance Gas > 10% and hydrogen >5% (hydrogen producing wells)[1,2]

ID	Average Balance Gas (%)	Nitrogen[3] (%)	Hydrogen[3] (%)	Average Applied Pressure ("w.c.)
GW-47	20.3	0.6	15.9	-0.6
GW-48	22.6	2.7	20.1	-0.8
GW-15	23.5	0.2	17.3	-0.2
GW-7	26.5	7.9	16.5	-0.5
GW-2	26.6	9.9	18.3	-0.3
GW-32	28.3	0.0	26.7	-0.9
GW-6	28.3	13.2	15.0	-0.2
GW-13	29.6	1.6	19.9	-0.2
GW-49	44.2	17.4	18.2	-0.8

[1] Table created from data collected during August 24th and September 14th, 2011. Averages are statistical means of that data.

[2] Nitrogen and hydrogen may not add up to equal balance gas because water vapor, another component of balance gas, has not been measured. Further, the sum of nitrogen and hydrogen may be more or less than balance gas because they result from a single discrete measurement that is being compared to an average balance gas concentration measured over the period August 24th to September 14th, 2011.

[3] Hydrogen and nitrogen concentrations for each well were determined by gas chromatograph (GC) on 9/14 and 9/15, 2011.

In accordance with the draft Contingency Plan, vacuum was reduced at each well in Table 7 where possible (many wells are already at the lowest vacuum that can be applied without going positive with the pressure that can be maintained specific to each well). With the exception of GW-6 and GW-49, nitrogen was less than 10%. Zero oxygen was measured at each well indicating (considering the lack of any significant nitrogen in the well) no substantial air intrusion that would be adverse to the site. Wells GW-6 and GW-49 had nitrogen concentrations of 13.2% and 17.4% respectively, which is less than the 20% landfill NSPS threshold and despite exceeding WM's balance gas trigger threshold for follow-up monitoring,

GW-49 was temporarily brought off line because of its temperature (170 °F) and a Draeger tube CO concentration measurement of 650 ppm, however, follow-up GC analysis did not confirm this level. Stain tubes are impacted by gas temperature and although a cooling tube is used at the site to minimize this impact, it is not unreasonable to expect a large variation in stain tube results because of the elevated temperatures. Stain tube results for this well have ranged from 150 ppm to 650 ppm with the GC confirmation results conducted on 9/14 and 9/15, 2011 averaging 283 ppm. EIL does not believe that the Draeger tube sample outlier is significant and has dropped it from this analysis. GW-6 had CO concentrations of 95 ppm (via GC). Neither of the GC results for GW-49 and GW-6 raises a concern given the research by Dr. Barlaz and the results of other samples collected and analyzed by a third party laboratory in 2007 and 2008. Further, the presence of hydrogen strongly correlates with the formation carbon monoxide (Figure 6).

EXHIBIT K160

2.5. *Analysis of Trace Carbon Monoxide*

Table 8 illustrates the comparative results of historical sampling and the recent sampling conducted by Draeger and GC between August 24th and September 14th, 2011. All of the wells were within two standard deviations of the historical mean with the exception of GW-2, GW-9, GW-24, GW-30 and GW-33.

The current average temperature for these five wells is listed in Table 9:

Table 9 – Average Temperature Comparison[1]

ID	Average Gas Temperature	Degrees Above Historical 95%Confidence Interval	Nitrogen (%)[2]	Average CH_4/ CO_2 Ratio	Historical Average
GW-2	168 °F	3 °F	9.9	0.8	0.7
GW-9	164 °F	2 °F	0.1	0.8	0.6
GW-24	165 °F	7 °F	0.0	0.6	0.6
GW-30	166 °F	4 °F	0.7	0.8	0.9
GW-33	160 °F	7 °F	0.4	0.9	0.9

[1] *Table created from data collected during August 24th and September 14th, 2011. Averages are statistical means of that data.*

[2] *Nitrogen concentrations for each well were determined by gas chromatograph (GC) on 9/14 and 9/15, 2011.*

The temperature rise above the historical 95% confidence interval for these wells is less than 7 °F. Further, the thermometers used at each well (which, as noted previously, were all replaced for this assessment) have a scale resolution of 2 °F which reduces the significance of small changes.

Further, current oxygen concentrations for these wells are zero with nitrogen concentrations indicating no significant air intrusion (much less than the 20% landfill NSPS threshold).

In addition, CH_4/ CO_2 ratios for GW-2 and GW-9 are higher than historical norms with no change in ratios observed at GW-24 or GW- 33 further confirming that no significant changes have occurred at these wells. GW-30 had a small (0.1) change, but nothing that would foster conditions sufficient to support a SOE.

Therefore, although gas temperatures are elevated compared to historical norms, conditions are not optimum for a subsurface oxidation event (SOE) and the elevated CO can be attributed to gas temperature consistent with the research conducted by Dr. Barlaz's. Figure 6 shows a comparison of gas temperature to measured CO concentrations at the wells during the August 24th – September 14th sampling.

EXHIBIT K160

Table 8 - CO (Carbon Monoxide) Concentration Data

Device ID	Draeger Tube Sampling 8/29/2011 (ppmv)	Draeger Tube Sampling 9/13/2011 (ppmv)	GC Sampling 9/14/2011 (ppmv)	Aug./Sept. 2011 Average (ppmv)	Aug./Sept. 2011 Standard Deviation (ppmv)	Aug./Sept. 2011 95% Confidence Interval (ppmv)	Historical Average (ppmv)	Historical Std. Dev. (ppmv)	95% Confidence Min. (ppmv)	95% Confidence Max. (ppmv)	Aug./Sept. 2011 Avg. Above 95% Confidence Interval (Yes or No)
WGSL0025	0		0	0	0.0	0.0	29	7	14	44	No
WGSL0026	0		0	0	0.0	0.0	37	11	15	59	No
WGSL0027	0		19	10	13.8	19.1	35	13	9	61	No
WGSL0029	0		18	9	12.5	17.4	33	11	11	54	No
WGSL0030	130	80	142	117	32.9	37.3	50	14	21	79	Yes
WGSL0031	15		49	32	23.9	33.2	73	31	11	135	No
WGSL0032	150	140	222	171	44.7	50.6	121	31	59	184	No
WGSL0033	90		322	206	164.0	227.3	61	24	14	108	Yes
WGSL0034	0		0	0	0.0	0.0	28	14	0	55	No
WGSL0035	0		0	0	0.0	0.0	21	11	0	42	No
WGSL0036	0		0	0	0.0	0.0	21	5	10	31	No
WGSL0037	0		24	12	17.2	23.8	133	181	0	495	No
WGSL0038	10		70	40	42.2	58.5	23	13	0	48	No
WGSL0039	0		0	0	0.0	0.0	51	28	0	107	No
WGSL0040	0		7	3	4.8	6.6	50				Yes
WGSL0041	0		20	10	14.2	19.7	26	25	0	76	No
WGSL0042	0		3	1	1.8	2.5	13		13	13	No
WGSL0043	0	0	0	0	0.0	0.0	24	14	0	51	No
WGSL0044	30		98	64	47.9	66.4	87	26	34	140	No
WGSL0046	5		31	18	18.1	25.1	23	25	0	73	No
WGSL0047	90	70	97	86	13.9	15.7	102	41	19	185	No
WGSL0048	80	60	92	77	16.2	18.3	68	27	14	121	No
WGSL0049	150	350	366	289	120.5	136.4	307	170	0	646	No
WGSLGW02	150	150	225	175	43.2	48.9	77	31	15	138	Yes
WGSLGW06	40	50	95	62	29.4	33.3	70	36	0	142	No
WGSLGW07	50	70	102	74	26.3	29.8	129	43	44	215	No
WGSLGW08	10		0	5	0.0	0.0	29	20	0	70	No
WGSLGW09	80	60	206	115	79.1	89.5	59	23	12	106	Yes
WGSLGW11	5		0	2.5	3.5	4.9	36	19	0	74	No
WGSLGW12	10		0	5	7.1	9.8	49	20	8	89	No
WGSLGW13	40		126	83	61.0	84.6	43	25	0	93	No
WGSLGW14	20		46	33	18.4	25.4	86	49	0	184	No
WGSLGW15	10		81	45	49.9	69.2	38	21	0	80	No
WGSLGW24	150	130	344	208	118.1	133.6	69	50	0	170	Yes

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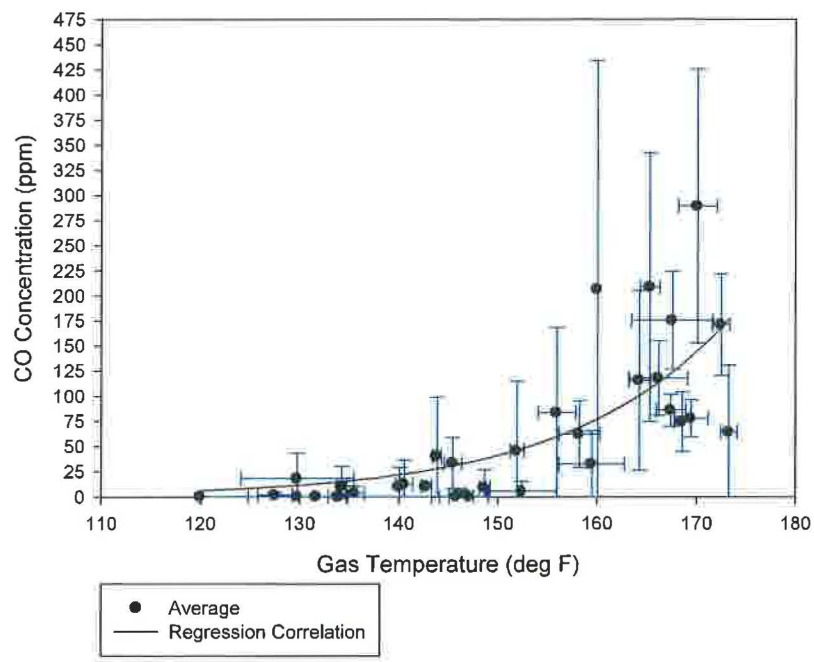
Figure 6 - WGSL
CO/ Temperature Trend

f=0.0034*exp(0.0627*x)



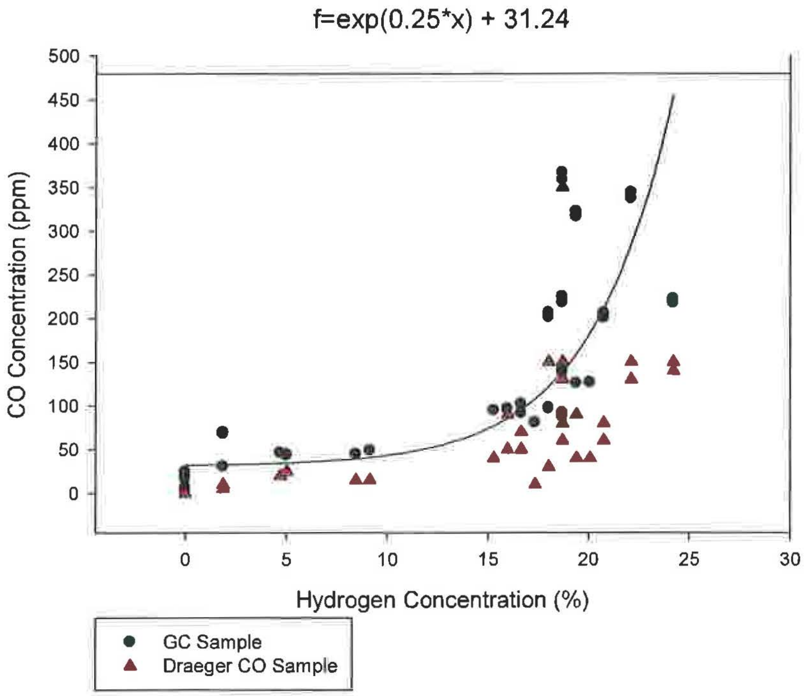
Blue bars represent 95% confidence interval about mean of each parameter.

CO data for each well for the August 24th to September 14th, 2011 assessment period ranged from 0 to 366 ppm with an average of 52 ppm. The research conducted by Dr. Barlaz shows significant CO generation from the same conditions producing hydrogen i.e. high temperatures. Dr. Barlaz attributes this to declining methanogenic microbe populations at these higher temperatures allowing both hydrogen and CO to accumulate because of lower consumption rates of those compounds by the microbes. Figure 7 shows that CO was not elevated in non-hydrogen producing wells (i.e. wells with a hydrogen concentration less than 5%) and only mildly elevated but consistent with previous readings for the hydrogen producing wells. In fact, no significant increase in CO occurs until hydrogen production exceeds 15%. As a comparison, Dr. Barlaz recorded CO concentrations of up to 893 ppm under controlled laboratory conditions with significant production of hydrogen.

None of the data analyzed in this assessment suggests any adverse conditions associated with the observed CO concentrations.

EXHIBIT K160

Figure 7 - CO Concentration vs. Hydrogen Formation



This study and previous ones have demonstrated that gas temperatures as high as 180 deg. F are normal for WGSL. Similarly, CO concentrations greater than 200 ppm have been shown to be a function of the chemical and microbial activity at these temperatures. There is low nitrogen present within the landfill (averaging 3.5% for all wells) which is significantly less than the NSPS threshold of 20% and hydrogen has been shown to be a large percentage of the balance gas calculated at each well. Therefore, conditions at WGSL have been confirmed to be normal with no adverse implications regarding landfill gas generation.

3. HISTORICAL REVIEW OF LANDFILL GAS DATA

Another aspect of this report is the analysis of historical landfill gas data to determine whether data that was previously entered manually by the former technician into the LGMS could have masked conditions indicating adverse changes in the wellfield, including evidence of a subsurface oxidation event (SOE) or conditions that materially increased the risk of a SOE.

Based on the analysis presented here, the absence of some historical wellfield data, when compared to available wellfield data, does not significantly alter the results of this evaluation; there is no indication of any adverse changes in the wellfield.

3.1. Individual Well Data Trends - Filtered Data Set

Although interviews conducted during the investigation revealed that some manually-uploaded data from mid-2010 until August 2011 was fabricated, WMH does not have direct evidence that that earlier data (before mid-2010) was fabricated. Nonetheless, WMH has conservatively analyzed the data set from 2006 through August 2011 by excluding all data that had been manually uploaded by the technician. Using this data set, EIL determined historical data norms based on validated data within LGMS and compared it to the August 24th to September 14th, 2011 verified sampling events to evaluate changes in landfill gas generation at the site for each well. Statistical data was evaluated for 2006 through 2009, 2010 through July 2011, August 2011 data automatically uploaded to LGMS from the GEM prior to the assessment by EIL, and the August 24th to September 14th, 2011 assessment data (Appendix C). Five parameters were evaluated including gas temperature, flow, balance gas concentration, methane to CO2 ratio, and well pressure.

Table 10 provides a summary of the Appendix C data illustrating the long term trends observed at each well.

Table 10 – Trend Summary

	Temperature	Flow	CH4/CO2 Ratio	Balance Gas Concentration	Well Pressure
GW-39	Down	down	stable	stable	up
GW-26	Peaked	down	stable	plateau	stable
GW-43	Peaked	up	up	down	variable
GW-14	Plateau	up	up	down	variable
GW-32	Plateau	down	up	stable	stable
GW-33	Plateau	down	stable	peaked	stable
GW-42	Plateau	plateau	plateau	stable	up
GW-47	Plateau	stable	stable	stable	stable
GW-12	Stable	stable	stable	down	stable

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Table 10 – Trend Summary

	Temperature	Flow	CH4/CO2 Ratio	Balance Gas Concentration	Well Pressure
GW-13	Stable	stable	stable	plateau	stable
GW-27	Stable	stable	up	stable	down
GW-35	Stable	down	plateau	variable	up
GW-36	Stable	stable	plateau	stable	up
GW-44	Stable	stable	stable	stable	stable
GW-46	Stable	down	stable	up	up
GW-6	Stable	stable	up	down	stable
GW-7	Stable	stable	plateau	down	stable
GW-8	Stable	plateau	stable	variable	stable
GW-9	Stable	up	stable	stable	stable
GW-11	Up	stable	stable	plateau	stable
GW-15	Up	down	stable	plateau	stable
GW-2	Up	down	up	stable	stable
GW-24	Up	stable	stable	stable	stable
GW-25	Up	down	up	stable	variable
GW-29	Up	stable	stable	up	up
GW-30	Up	down	stable	plateau	stable
GW-31	Up	down	stable	peaked	variable
GW-34	Up	plateau	stable	up	up
GW-37	Up	stable	stable	plateau	stable
GW-38	Up	down	stable	up	down
GW-40	Up	peaked	stable	stable	up
GW-41	Up	down	down	up	up
GW-48	Up	stable	stable	stable	stable
GW-49	Up	stable	stable	stable	stable

Index: down – downward trending data, up – upward trending data, stable – no significant trend either up or down, peaked – parameter increased to a high and then has fallen, plateau – parameter increased and has stabilized at elevated value, variable – no trend can be established.

Although temperature trending data is up for many wells, this report has shown that it is only slightly elevated compared to historical norms with a maximum rise of 13 °F (Table 4). In most of these instances, CH_4/CO_2 ratios are either stable or increasing indicating improved methanogenisis. Stable or declining flows are expected over time as the decomposition process proceeds. Many of the wells have stable well pressures which can be attributed to the VFD system mentioned previously. A constant vacuum source provides for a constant applied vacuum at each well. However, since each extraction well is managed based on monitoring, wells may undergo pressure changes to reflect the results of the monitoring to maintain optimum operation of the GCCS.

Therefore, although some wells have experienced a slight temperature rise, the preponderance of information indicates that the current conditions are consistent with historical norms or in fact improved in terms of the state of methanogenisis.

3.2. Well Data Variability -All Data

In addition to evaluating statistical trends of data filtered of information manually entered into LGMS, EIL overlaid the manually input data onto a graph of the historical (filtered data – manual input data removed) averages for each well. Error bars were determined based on the 95% confidence interval of the historical filtered data set. The current average data from the August 24th to September 14th, 2011 assessment data was also included. This analysis will illustrate the data trends between historical and current conditions as well as how different, if at all, the manually input data was compared to data uploaded automatically from the GEM.

The following 12 wells have exhibited long term stability: GW-6, GW-7, GW-8, GW-9, GW-12, GW-13, GW-27, GW-35, GW-36, GW-39, GW-44, and GW-46. There is no evidence that these wells have been impacted as illustrated by small temperature changes (+/- 3 °F)[1] and small CH_4/CO_2 ratio changes and in many cases higher CH_4/CO_2 ratios indicating improving methanogenic conditions (Figures 8 and 9). Further, the charts illustrate the fact that the manual input data is not inconsistent with either the historical norms or the data collected from August 24th to September 14th. In the single instance where the manual data was above the 95% temperature confidence interval of the historical norm (GW-33), the temperature data was only 3 °F higher and would not have triggered enhanced monitoring as prescribed in the draft Contingency Plan.

This data indicates that no matter what data set is evaluated for these 12 wells, temperatures and other indicators such as CH_4/CO_2 ratios has remained constant suggesting no change in the operation of the GCCS.

[1] The thermometers used at each well have a scale interval accuracy of +/- 2 °F.

EXHIBIT K160

Figure 8 - Gas Temperature Variability

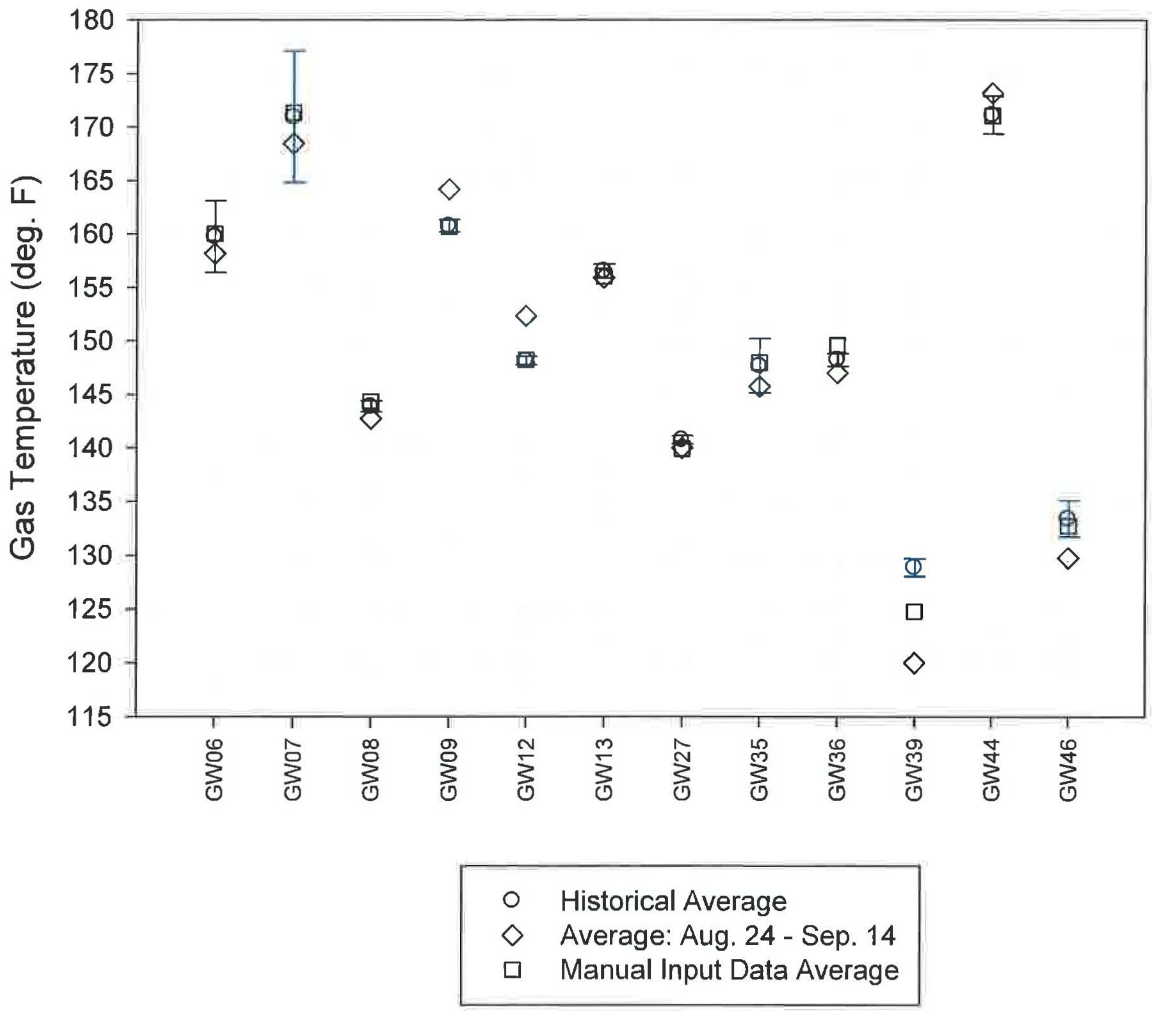

Figure 8 Notes -

[1]Blue bars represent 95% confidence interval about historical mean.
[2]The historical average is based on all data automatically uploaded from the field GEM instrument to LGMS.
[3]The manual input data average is based all data that was manually input into LGMS.

	GW06	GW07	GW08	GW09	GW12	GW13	GW27	GW35	GW36	GW39	GW44	GW46
+95% Confidence	161	173	144	161	149	157	141	149	150	130	172	135
Historical Avg.	160	171	144	161	148	156	141	148	148	129	171	133
-95% Confidence	158	168	144	160	147	156	140	147	147	127	170	132
Avg. : Aug. 24 - Sep. 14	158	169	143	164	152	156	140	146	147	120	173	130
Manual Input Data Avg.	160	171	144	161	148	156	140	148	150	125	171	133

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Figure 9 - CH4/CO2 Variability

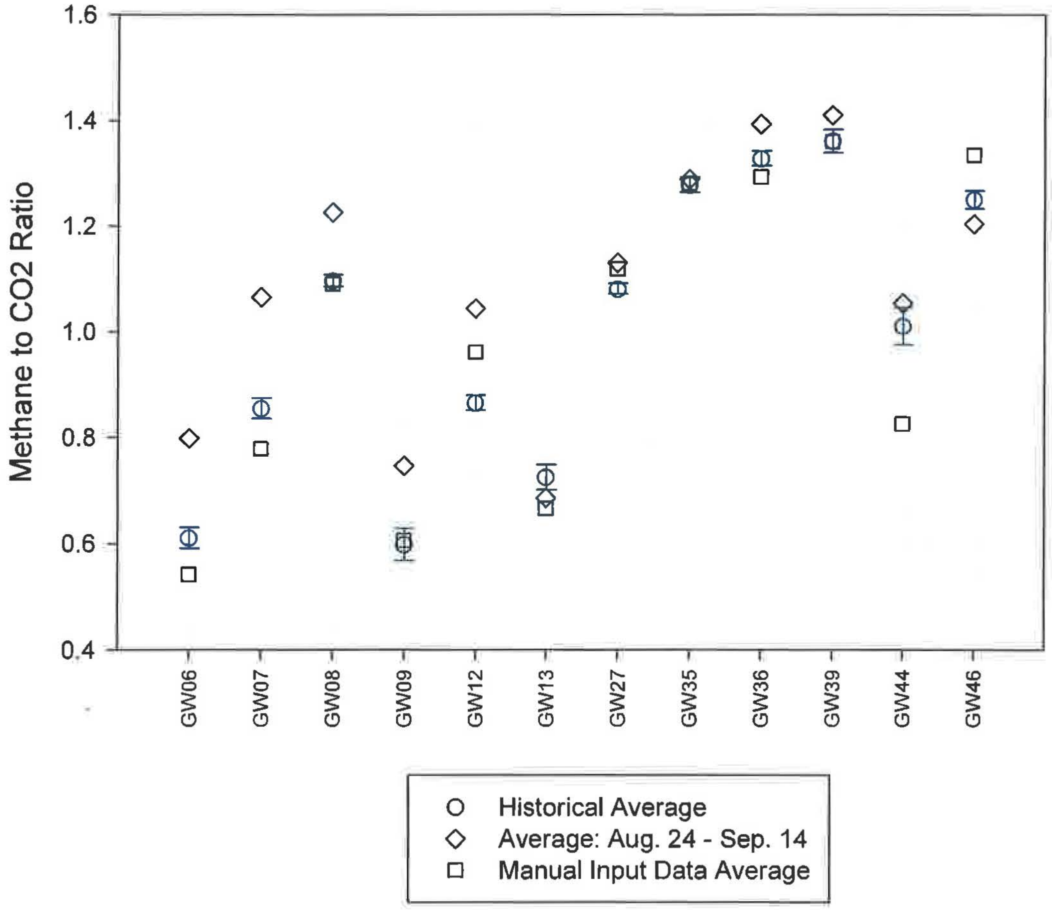

Figure 9 Notes -

[1]Blue bars represent 95% confidence interval about historical mean.
[2]The historical average is based on all data automatically uploaded from the field GEM instrument to LGMS.
[3]The manual input data average is based all data that was manually input into LGMS.

	GW06	GW07	GW08	GW09	GW12	GW13	GW27	GW35	GW36	GW39	GW44	GW46
+95% Confidence	0.6	0.9	1.1	0.8	0.9	0.8	1.1	1.3	1.4	1.4	1.0	1.3
Historical Avg.	0.6	0.9	1.1	0.6	0.9	0.7	1.1	1.3	1.3	1.4	1.0	1.2
-95% Confidence	0.6	0.8	1.1	0.4	0.8	0.7	1.1	1.3	1.3	1.3	1.0	1.2
Avg. : Aug. 24 - Sep. 14	0.8	1.1	1.2	0.7	1.0	0.7	1.1	1.3	1.4	1.4	1.1	1.2
Manual Input Data Avg.	0.5	0.8	1.1	0.6	1.0	0.7	1.1	1.3	1.3	1.4	0.8	1.3

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The following 7 wells have exhibited temperature increases over the historical norm (Figure 10), but have peaked or stabilized at a higher operating temperature: GW-14, GW-26, GW-32, GW-33, GW-42, GW-43, and GW-47. In each case, the CH_4/ CO_2 ratio (Figure 11) has either increased or remained stable. As noted previously, an increase in this ratio indicates increasing methanogenisis.

In addition, balance gas (Figure 12) has either remained stable (+/- 3.5% or less) or declined for all of these wells except for GW-33 which saw concentrations rise to approximately 15%. Table 11 shows that hydrogen is present in some of the wells and that the nitrogen fraction (that which would be attributed to air intrusion) is not significant. As discussed previously, balance gas is comprised predominantly of hydrogen, nitrogen, or water vapor or a combination of the three. Any variance between balance gas and the sum of hydrogen and nitrogen is likely water vapor. In addition, the analysis of hydrogen and nitrogen represents a single point in time sample whereas the balance data is averaged over a period of time.

Table 11 – Hydrogen and Nitrogen Concentration of Select Wells Analyzed by GC (9/14 and 9/15, 2011)

Sample ID	Hydrogen (%)	Nitrogen (%)
GW-14	4.7	0.0
GW-26	0.0	8.1
GW-32	26.7	0.0
GW-33	19.0	0.4
GW-42	0.0	0.0
GW-43	0.0	0.0
GW-47	15.9	0.6

Although the draft Contingency Plan has been implemented for these wells as a result of the balance gas concentration and vacuum reduced at each well where possible (many wells are already at the lowest vacuum), the CH_4/CO_2 ratio indicates no detrimental conditions or changes at these wells.

Further, Figures 10, 11, and 12 illustrate the fact that the manual input data is not inconsistent with either the historical norms or the data collected from August 24th to September 14th. Where manual input CH_4/CO_2 ratios are lower, it is an under representation of the actual condition of the landfill suggesting that the state of methanogenisis is better than reported.

This data indicates that temperatures and other indicators such as CH_4/CO_2 ratios has remained consistent suggesting no change in the operation of the GCCS.

EXHIBIT K160

Figure 10 - Gas Temperature Variability

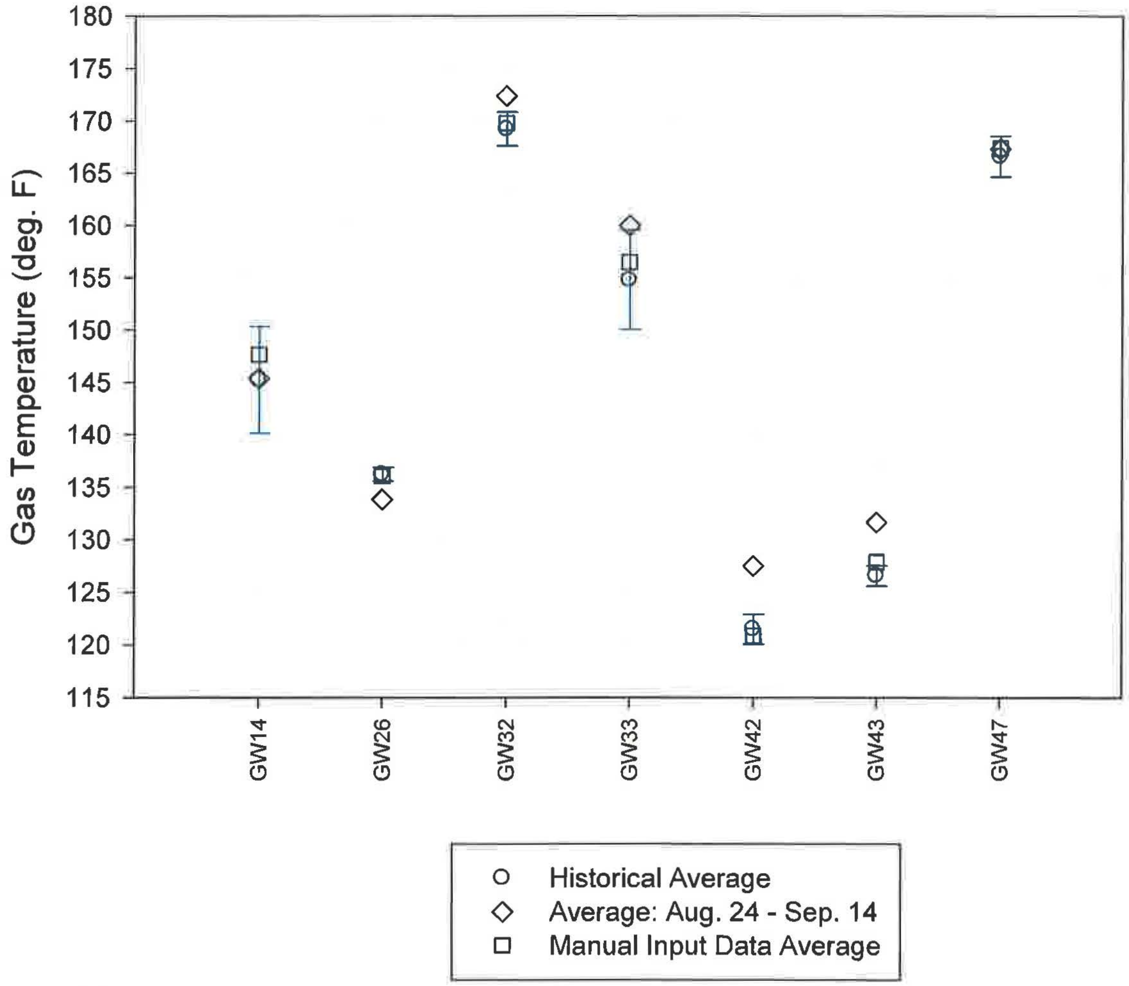

Figure 10 Notes -

[1]Blue bars represent 95% confidence interval about historical mean.
[2]The historical average is based on all data automatically uploaded from the field GEM instrument to LGMS.
[3]The manual input data average is based all data that was manually input into LGMS.

	GW14	GW26	GW32	GW33	GW42	GW43	GW47
+95% Confidence	147	137	170	157	122	128	167
Historical Avg.	145	136	169	155	121	127	167
-95% Confidence	143	136	168	153	121	125	166
Avg. : Aug. 24 - Sep. 14	145	134	172	160	128	132	167
Manual Input Data Avg.	148	136	170	157	121	128	167

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Figure 11 - CH4/CO2 Variability

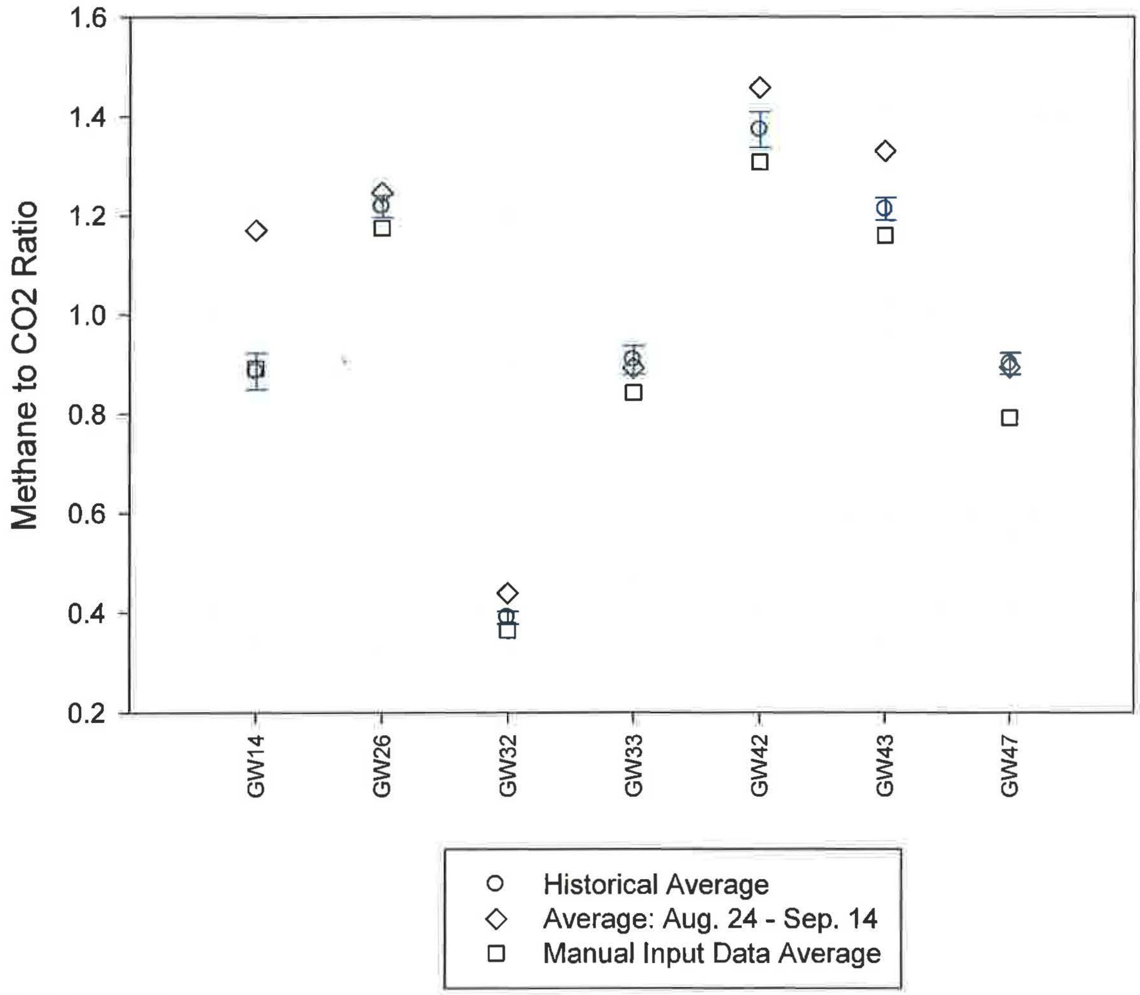

Figure 11 Notes -

[1]Blue bars represent 95% confidence interval about historical mean.
[2]The historical average is based on all data automatically uploaded from the field GEM instrument to LGMS.
[3]The manual input data average is based all data that was manually input into LGMS.

	GW14	GW26	GW32	GW33	GW42	GW43	GW47
+95% Confidence	0.9	1.2	0.4	0.9	1.4	1.3	0.9
Historical Avg.	0.9	1.2	0.4	0.9	1.4	1.2	0.9
-95% Confidence	0.8	1.2	0.4	0.9	1.3	1.2	0.9
Avg. : Aug. 24 - Sep. 14	1.2	1.2	0.4	0.9	1.5	1.3	0.9
Manual Input Data Avg.	0.9	1.2	0.4	0.8	1.3	1.2	0.8

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Figure 12 - Balance Gas Variability

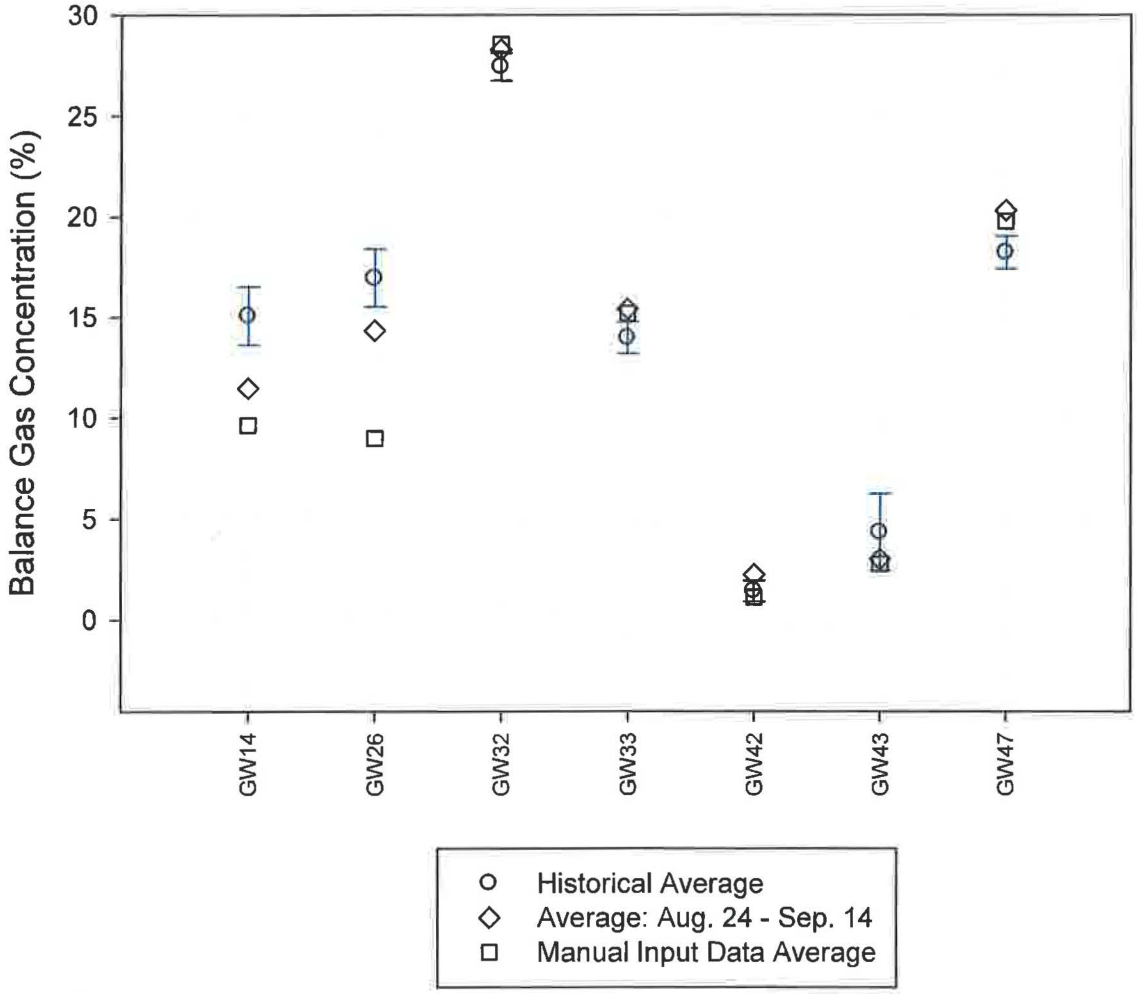

Figure 12 Notes -

[1]Blue bars represent 95% confidence interval about historical mean.
[2]The historical average is based on all data automatically uploaded from the field GEM instrument to LGMS.
[3]The manual input data average is based all data that was manually input into LGMS.

	GW14	GW26	GW32	GW33	GW42	GW43	GW47
+95% Confidence	16.9	19.2	28.7	16.2	1.9	7.0	19.3
Historical Avg.	15.1	16.9	27.4	14.0	1.4	4.3	18.2
-95% Confidence	13.2	14.6	26.2	11.7	1.0	1.6	17.1
Avg. : Aug. 24 - Sep. 14	11.5	14.3	28.3	15.4	2.2	3.0	20.3
Manual Input Data Avg.	9.6	9.0	28.5	15.2	1.1	2.8	19.8

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The remaining 15 wells have exhibited temperature increases over the historical norm (Figure 13): GW-2, GW-11, GW-15, GW-24, GW-25, GW-29, GW-30, GW-31, GW-34, GW-37, GW-38, GW-40, GW-41, GW-48, and GW-49. In each case, the methane to CO2 ratio (Figure 14) has remained stable primarily within the range considered to represent stable methanogenesis.

In addition, balance gas (Figure 15) has either remained stable (+/- 3.5% or less) or declined for GW-2, GW-24, GW-25, GW-31, GW-40, GW-48, and GW-49 suggesting that no significant change in the landfill has occurred despite the rise in temperature.

Table 12 shows that hydrogen is present in some of the wells and that the nitrogen fraction (that which would be attributed to air intrusion) is less than the allowable concentration under the landfill NSPS. Balance gas is comprised predominantly of hydrogen, nitrogen, or water vapor or a combination of the three. Any variance between balance gas and the sum of hydrogen and nitrogen is likely water vapor. In addition, the analysis of hydrogen and nitrogen represents a single point in time sample whereas the balance data is averaged over a period of time.

Table 12 – Hydrogen and Nitrogen Concentration of Select Wells Analyzed by GC (9/14 and 9/15, 2011)

Sample ID	Hydrogen (%)	Nitrogen (%)
GW-2	18.3	9.9
GW-24	22.5	0.0
GW-25	0.0	6.5
GW-31	8.9	0.0
GW-40	0.0	0.0
GW-48	20.1	2.7
GW-49	18.2	17.4

The remaining wells (GW-11, GW-15, GW-29, GW-30, GW-34, GW-37, GW-38, and GW-41) had balance gas increases from 4 – 10% above historical ranges.

Table 13 shows that hydrogen is present in some of the wells and that the nitrogen fraction (that which would be attributed to air intrusion) is less than the threshold concentration under the landfill NSPS. Balance gas is comprised predominantly of hydrogen, nitrogen, or water vapor or a combination of the three. Any variance between balance gas and the sum of hydrogen and nitrogen is likely water vapor. In addition, the analysis of hydrogen and nitrogen represents a single point in time sample whereas the balance data is averaged over a period of time.

Table 13 – Hydrogen and Nitrogen Concentration of Select Wells Analyzed by GC (9/14 and 9/15, 2011)

Sample ID	Hydrogen (%)	Nitrogen (%)
GW-11	5.1	9.0
GW-15	17.3	0.2

Sample ID	Hydrogen (%)	Nitrogen (%)
GW-29	0.0	5.8
GW-30	18.3	0.7
GW-34	0.0	7.9
GW-37	0.0	1.4
GW-38	1.9	0.0
GW-41	0.0	11.8

GW-41 had the largest increase in balance gas, however, the current concentration is only slightly higher than the draft Contingency Plan target level for non-hydrogen producing wells (17% versus 10%) and CO concentrations are currently less than 25 ppm. GW-11, GW-15 and GW-49 all have significant hydrogen concentrations that make up much of the balance gas determined. There is no evidence, despite the rise in temperature, that these wells have been impacted (See Figures 13, 14 and 15).

Although the draft Contingency Plan has been implemented for these wells as a result of the balance gas concentration and vacuum reduced at each well where possible (many wells are already at the lowest vacuum), the CH_4/CO_2 ratio indicates no detrimental conditions or significant changes at these wells.

Further, Figures 13, 14, and 15 illustrate the fact that the manual input data is not inconsistent with either the historical norms or the data collected from August 24th to September 14th. Where manual input CH_4/CO_2 ratios are lower, it is an under representation of the actual condition of the landfill suggesting that the state of methanogenisis is better than reported.

This data indicates that temperatures and other indicators such as CH_4/CO_2 ratios has remained consistent suggesting no change in the operation of the GCCS.

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Figure 13 - Gas Temperature Variability

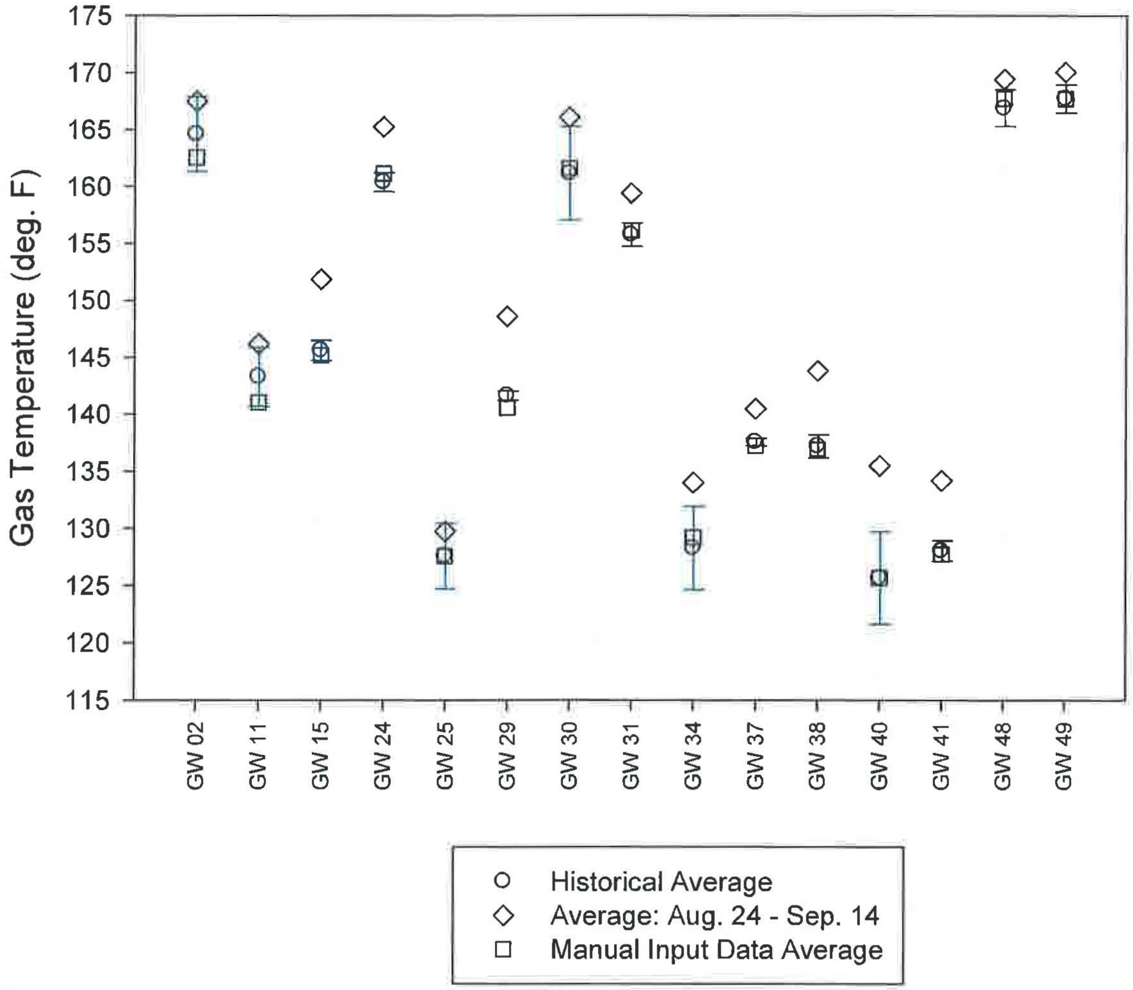

Figure 13 Notes -

[1]Blue bars represent 95% confidence interval about historical mean.
[2]The historical average is based on all data automatically uploaded from the field GEM instrument to LGMS.
[3]The manual input data average is based all data that was manually input into LGMS.

	GW 02	GW 11	GW 15	GW 24	GW 25	GW 29	GW 30	GW 31	GW 34	GW 37	GW 38	GW 40	GW 41	GW 48	GW 49
+95% Confidence	166	144	148	161	129	143	163	157	130	138	138	127	129	168	168
Historical Avg.	165	143	146	160	128	142	161	156	128	138	137	126	128	167	168
-95% Confidence	163	142	143	160	126	140	160	155	127	137	136	124	127	166	167
Avg. : Aug. 24 - Sep. 14	168	146	152	165	130	149	166	159	134	141	144	136	134	169	170
Manual Input Data Avg.	163	141	145	161	128	141	162	156	129	137	137	126	128	168	168

EXHIBIT K160

Figure 14 - CH4/CO2 Variability

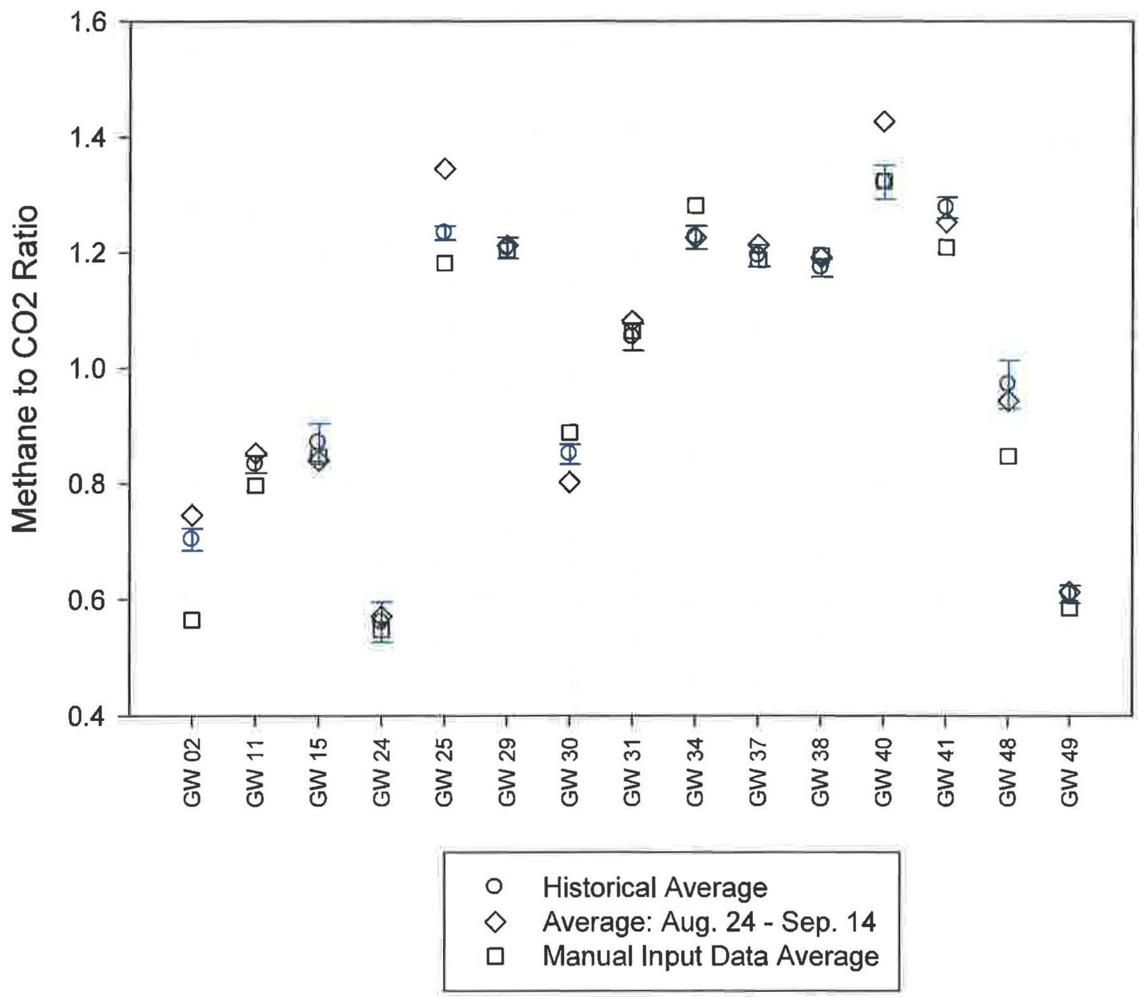

Figure 14 Notes -

[1]Blue bars represent 95% confidence interval about historical mean.
[2]The historical average is based on all data automatically uploaded from the field GEM instrument to LGMS.
[3]The manual input data average is based all data that was manually input into LGMS.

	GW 02	GW 11	GW 15	GW 24	GW 25	GW 29	GW 30	GW 31	GW 34	GW 37	GW 38	GW 40	GW 41	GW 48	GW 49
+95% Confidence	0.8	0.9	0.9	0.6	1.3	1.2	0.9	1.1	1.3	1.2	1.2	1.3	1.3	1.0	0.7
Historical Avg.	0.7	0.8	0.9	0.6	1.2	1.2	0.9	1.1	1.2	1.2	1.2	1.3	1.3	1.0	0.6
-95% Confidence	0.6	0.8	0.8	0.5	1.2	1.2	0.8	1.0	1.2	1.2	1.1	1.3	1.3	0.9	0.6
Avg. : Aug. 24 - Sep. 14	0.7	0.9	0.8	0.6	1.3	1.2	0.8	1.1	1.2	1.2	1.2	1.4	1.3	0.9	0.6
Manual Input Data Avg.	0.6	0.8	0.8	0.5	1.2	1.2	0.9	1.1	1.3	1.2	1.2	1.3	1.2	0.8	0.6

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Figure 15 - Balance Gas Variability

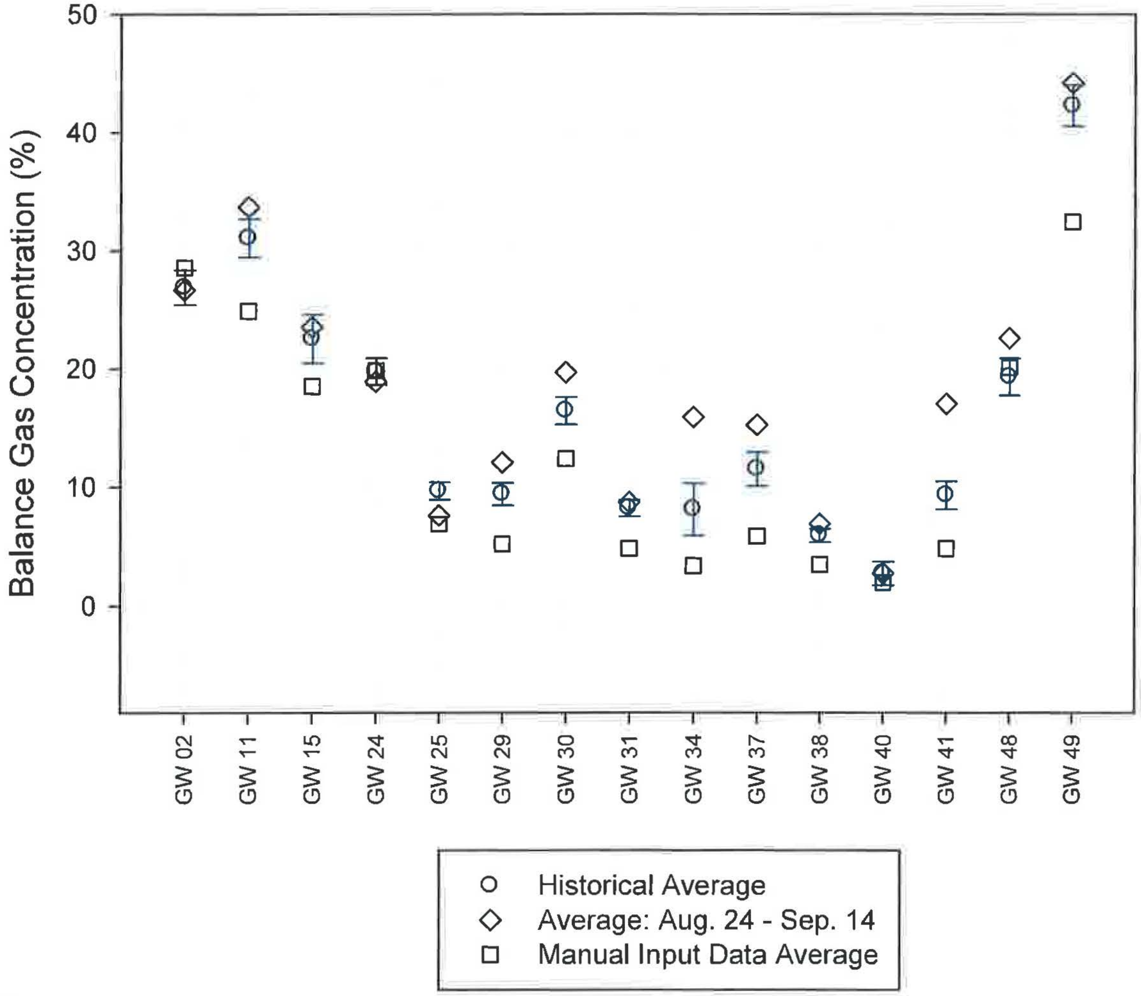

Figure 15 Notes -

[1]Blue bars represent 95% confidence interval about historical mean.
[2]The historical average is based on all data automatically uploaded from the field GEM instrument to LGMS.
[3]The manual input data average is based all data that was manually input into LGMS.

	GW 02	GW 11	GW 15	GW 24	GW 25	GW 29	GW 30	GW 31	GW 34	GW 37	GW 38	GW 40	GW 41	GW 48	GW 49
+95% Confidence	28.4	32.5	24.4	20.6	11.1	10.9	17.5	9.0	9.8	13.2	7.1	3.2	10.9	21.6	45.5
Historical Avg.	26.9	31.0	22.5	19.8	9.7	9.4	16.4	8.2	8.1	11.5	5.9	2.7	9.3	19.3	42.3
-95% Confidence	25.4	29.6	20.6	18.9	8.3	7.9	15.3	7.4	6.4	9.8	4.8	2.2	7.8	17.0	39.1
Avg. : Aug. 24 - Sep. 14	26.6	33.7	23.5	18.9	7.6	12.1	19.7	8.7	15.9	15.2	6.9	2.7	17.0	22.6	44.2
Manual Input Data Avg.	28.6	24.9	18.5	19.8	6.9	5.2	12.4	4.8	3.4	5.9	3.5	1.9	4.8	20.1	32.4

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4. CONCLUSIONS

The newly collected data demonstrates that current conditions at WGSL appear to be consistent with no adverse impacts on landfill gas generation arising from the data integrity incident. Further, although gas temperatures have risen over the period in some wells, they have not exceeded expected levels based on their proximity to other wells with similar temperatures and can be explained by changes in fill elevations. Carbon monoxide concentrations are historically consistent and do not indicate any condition considered abnormal at the facility. There is no evidence that there have been adverse changes in the wellfield.

While the wells listed in Table 4 show a temperature rise from historical averages, they are not substantially higher. The data shows that temperatures rose no more than 10°F above the 95% confidence interval of the historical mean. In addition, the thermometers used at each well have a scale resolution of 2 °F which further reduces the significance of the observed increase. Further, added fill was placed in much of the landfill area surrounding these wells reducing heat flux and dissipation through the landfill surface. This is expected to cause some of the observed well temperatures to increase. Even though the temperature increases are not significant, WM has implemented the draft Contingency Plan and has not found any cause for corrective actions at any well.

In accordance with the draft Contingency Plan, vacuum was reduced at each well listed in Table 6 and Table 7 where possible (many wells are already at the lowest vacuum). However, the CH_4/CO_2 ratio indicates no detrimental conditions at these wells. With the exception of GW-6 and GW-49, the residual fraction of balance gas after accounting for hydrogen (primarily nitrogen) was less than 10% indicating no substantial air intrusion that would be adverse to the site. GW-49 was temporarily brought off line while additional CO sampling was conducted. GW-6 had CO concentrations of 95 ppm (via GC) while GW-49 had concentrations averaging 283 ppm (via GC) neither of which raises a concern given the research conducted by Dr. Barlaz.

There is no evidence of adverse changes in the condition of the wellfield. In particular, there is no evidence of any SOE, no smoke, no odor, no localized subsidence adjacent to any well. Therefore, despite the absence of some data during the time period in question, the available data shows no wild swings and no adverse changes in the condition of the wellfield. In particular, there is no evidence of an SOE or even conditions that would present a risk of an SOE. Further, the data indicates, even if the manual data was included in any evaluation, it would not significantly alter any of the conclusions or materially skew the data.

EXHIBIT K160