

Bridgeton Landfill, LLC

13570 St. Charles Rock Road
Bridgeton, Missouri 63044

Mr. Aaron Schmidt
Missouri Department of Natural Resources
1738 East Elm Street
Jefferson City, Missouri 65101

July 30, 2013

Dear Mr. Schmidt:

**Gas Wellfield Management, Oxygen Control Measures
Bridgeton Landfill, Bridgeton, Missouri
Permit No. 0118912**

On June 24, 2013 we submitted a letter that addressed Mr. Thalhamer's concerns regarding what he describes as "overpull" of the wellfield at the Bridgeton Landfill. Our letter pointed to the general conditions that can occur in a wellfield that appear to be overpull (oxygen at the wellhead at levels higher than 5%), but, in fact, are operational conditions that do not necessarily mean that oxygen is being pulled into the waste mass.

In response, on July 3, 2013, you replied with a letter that re-emphasized Mr. Thalhamer's concerns and included a list of gas wells that, during one or more weekly monitoring events in May 2013, indicated oxygen greater than 4% at the wellhead. During subsequent discussions, we agreed to follow up on the wells listed in your letter and to provide a protocol for immediately addressing the presence of oxygen at a wellhead to assure that oxygen is not present in the waste mass due to overpull.

May 2013 Gas Wells with Oxygen Greater than 5% at the Wellhead

The attached table presents a list of thirteen gas extraction wells that were identified in your letter as having oxygen at levels 4% or higher at some point during the weekly monitoring in May 2013. The table shows the initial oxygen content identified in your letter, subsequent readings taken in June through mid-July, and notations regarding the assessment, evaluation, and corrective actions taken (where needed). Of the original 13 wells, only one still has oxygen greater than 5% (and that well is compromised and will need to be replaced). The paragraphs below present discussions of the identified wells grouped by common issues.

GEW-33R, -34, -35, -36, -56R, and -62R – Wellhead Repair Required

In the elevated temperature conditions that exist in the South Quarry area, the above-grade wellhead features are subject to accelerated wear and deterioration. Wellheads are inspected for issues during each monitoring event, but sometimes the issue is a very small hole in a sample port cover, or perforation in a boot or coupling and not readily visible.

Elevated oxygen can be detected in these wells as a result of vacuum conditions in the wellhead pulling air through the defects. In some cases, wellheads were replaced, in others, temporary repairs have been made while awaiting full wellhead replacement. See Table 1 for well-specific details.

In all cases, oxygen appears to have been coming through the wellhead and was not present in the waste mass.

GEW-1, 14A, -18R, and -20 – Watered-In Well Condition

A common reason that oxygen appears elevated at a wellhead at the Bridgeton Landfill is due to a “watered-in” condition. In the South Quarry area, the SSE pushes steam into the slots of a gas extraction well where it cools and condenses and, at times, completely fills the perforated portion of the below-grade gas well. When this occurs, the well is “deadheaded” and the vacuum applied at the above-grade wellhead is no longer pulling gas from the waste mass (and, hence, cannot pull oxygen from the ground surface or perimeter area into the waste mass). Instead, the vacuum can pull very small amounts of ambient air through the myriad of fittings, connections, and boots that exist above grade at the wellhead, even in an intact non-compromised wellhead. Such small quantities of air are never in contact with the waste in the landfill.

A “deadheaded” well is not a desirable condition as it means that the well is not serving the purpose of gas removal from the landfill. Therefore, when this situation is identified, the well is designated for pump installation, pump repair, or well replacement if the well cannot support a pump in its present condition. It may take several weeks after pump installation before gas well perforations are exposed, the waste in the zone de-saturated, and good gas flow resumes; when this occurs, we see oxygen content decrease as the volume of gas extracted by the gas well overwhelms the very small amount of air that may come into the wellhead from other sources.

Pumps were repaired in GEW-18R and GEW-20 allowing gas to flow and bringing these wells into compliant oxygen levels. A pump is scheduled to be installed in GEW-14A; until that time this well has been tuned-down (vacuum decreased to a low level) decreasing the oxygen level to acceptable levels. In all cases, oxygen appears to have been coming through the wellhead and was not present in the waste mass.

GEW-1 is the only North Quarry gas extraction well that exhibited elevated oxygen. This well is located outside the limit of Permit No.118912 and beyond the location of a perimeter extraction well. Nevertheless, it is believed that this gas well is installed through some waste material. A camera was inserted into this well and it was determined that it is pinched at a depth of 20 feet. No perforations are visible above the pinch point, and it was determined that no gas is flowing in the well. It is believed that the well is watered in below the pinch point. Therefore, the oxygen detected at this wellhead is not from the waste mass. This well has been shut down and will be scheduled for replacement.

GEW-10, 23A, and 91 – Compromised Laboratory Sample

A field GEM reading is taken just prior to obtaining a summa canister sample during monthly gas sampling. At each of these wells, a GEM reading taken moments prior to the summa canister sampling indicated 0.0% oxygen. In fact, the prior and subsequent weeks of field readings at these wells also indicated no more than 0.1% oxygen.

Therefore, it is apparent that oxygen was introduced into the summa canister in a manner other than presence in the well gas. It is likely that oxygen was introduced through a small leak in the sample train or during shipping, unpacking, and preparation of the canisters in the field. Follow up monthly lab testing should confirm this assessment.

None of the detected oxygen is believed to have originated or been present in the waste mass.

Overdraw

There are other explanations for elevated oxygen content at a wellhead. One of those is "overdraw" of a gas well wherein excessive vacuum is applied which could, if sustained high enough and long enough, pull oxygen in through the landfill cover or surrounding geology.

Based on the well-by-well assessments included in this letter, it is not believed that an overdraw condition resulted in oxygen being pulled into the waste mass at any of these wells. However, since it is not always possible to immediately determine if elevated oxygen at a wellhead is, or is not, from overdraw, it is important to have rigorous procedures to quickly identify the source and attempt to address elevated oxygen. Such a procedure is described below.

Procedures for Assessment and Remediation of Oxygen

Bridgeton Landfill is required to maintain a compliance threshold oxygen level of 5% per the facility's air operating permit and regulations such as the federal New Source Performance Standards (NSPS). However, as an internal operating goal, site personnel employ a maximum target level for oxygen of 2%.

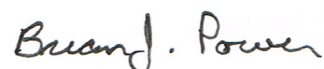
To meet these goals, a DRAFT protocol for addressing elevated oxygen detections at gas wellheads has been implemented. The protocol includes assessment of a wide array of potential causes including loose fittings, cracked well casing, and watered-in conditions, etc. The procedure is included as Attachment A to this letter.

We believe that implementation of this protocol will allow early identification of gas wells with slightly elevated oxygen, and a rapid, systematic method for identifying and remediating the cause. This DRAFT protocol will be used until a final protocol is approved in the forthcoming Operation, Maintenance and Monitoring (OM&M) Plan.

If you need additional information, please contact me at (618) 410-0157.

Sincerely,

Bridgeton Landfill, LLC



Brian Power
Environmental Manager

cc: Mr. Chris Nagel, Chief, MDNR-SWMP

TABLE

Table 1
Bridgeton Landfill
June - July 2013 Oxygen Levels

Point Name	Date	CH ₄ %	CO ₂ %	O ₂ %	Balance %	Init Temp °F	Comments
GEW-01	6/7/2013 11:58	0.5	3.5	19.1	76.9	89	May 29, 2013 Maximum O ₂ = 19.1% GEM.
GEW-01	6/7/2013 12:04	0.3	0.4	19.8	79.5	91	
GEW-01	6/14/2013 10:56	18.5	11.4	13.7	56.4	96	Well was inspected by camera and determined to be pinched at 20' depth which is above the top of perforations. Therefore, this well is not drawing landfill gas and the GEM readings are virtually all ambient air coming through fittings at surface.
GEW-01	6/14/2013 10:57	18.3	11.3	13.8	56.6	99	
GEW-01	6/18/2013 10:18	26.9	15.2	11.4	46.5	100	
GEW-01	6/18/2013 16:00	19.5	13.8	12.4	54.3	92	
GEW-01	7/2/2013 15:26	36.4	24.3	5.9	33.4	63	It is recommended that this well be redrilled and has been closed off until it can be replaced.
GEW-01	7/2/2013 15:28	36	23.3	6.1	34.6	63	
GEW-01	7/17/2013 15:51	48.2	27.7	2.6	21.5	110	
GEW-01	7/24/2013 15:40	26.5	14.8	10.6	48.1	91	
GEW-01	7/24/2013 15:41	28.2	15	10.3	46.5	94	
GEW-10	6/4/2013 14:11	33.2	54.4	0.1	12.3	118	May 14, 2013 Maximum O ₂ = 8.0% Lab.
GEW-10	6/12/2013 16:57	31.7	46.7	0	21.6	120	
GEW-10	6/12/2013 17:02	31.9	46.4	0	21.7	120	A reading taken with the field GEM immediately prior to taking the summa cannister sample for laboratory analyses indicated 0.0% oxygen. Therefore, it is believed that no oxygen was present in this wellhead, rather, that oxygen was introduced into the cannister through the sample train during sampling, or during shipping, or at the laboratory.
GEW-10	6/19/2013 8:49	28.9	41.6	1.3	28.2	112	
GEW-10	6/24/2013 14:22	44.8	44.9	0	10.3	116	
GEW-10	7/1/2013 9:57	44.5	47.2	0.2	8.1	110	
GEW-10	7/11/2013 10:36	56.2	42.6	0	1.2	102	
GEW-10	7/11/2013 10:42	56.5	41.8	0	1.7	102	
GEW-10	7/15/2013 8:00	48.7	51.2	0	0.1	98	
GEW-10	7/23/2013 9:15	54.6	45.3	0	0.1	90	
GEW-14A	6/13/2013 12:20	10	35.5	9.2	45.3	82	May 14, 2013 Maximum O ₂ = 11.5% GEM, 5.0% Lab.
GEW-14A	6/13/2013 12:30	12.7	43	6.9	37.4	82	
GEW-14A	7/1/2013 11:01	6.3	57.4	3.5	32.8	85	Well is watered-in. Scheduled for pump installation. Decreased vacuum as temporary adjustment.
GEW-14A	7/11/2013 11:33	4.4	70.2	0	25.4	85	
GEW-14A	7/11/2013 11:39	4.3	70.5	0	25.2	85	
GEW-14A	7/15/2013 9:27	2.4	62.5	3.1	32	92	
GEW-14A	7/23/2013 10:06	0.7	72.9	2.4	24	90	

Table 1
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Point Name	Date	CH ₄ %	CO ₂ %	O ₂ %	Balance %	Init Temp °F	Comments
GEW-18R	6/4/2013 9:02	1.5	19.3	15.5	63.7	72	May 30, 2013 Maximum O ₂ = 19.6% GEM.
GEW-18R	6/19/2013 13:48	3.4	2.7	18.6	75.3	90	
GEW-18R	6/19/2013 13:50	3.1	0.9	19.3	76.7	90	Pump was repaired in June allowing gas flow to resume and bringing well into acceptable oxygen range.
GEW-18R	6/24/2013 8:52	18.6	71	0	10.4	92	
GEW-18R	7/11/2013 14:14	17.4	75.6	0	7	95	
GEW-18R	7/11/2013 14:19	17.6	75.2	0	7.2	95	
GEW-18R	7/17/2013 12:54	11.7	77.9	0	10.4	105	
GEW-18R	7/23/2013 13:46	7.3	82.2	0	10.5	100	
GEW-20A	6/4/2013 9:17	8	80.7	0	11.3	76	May 14, 2013 Maximum O ₂ = 11.0% Lab.
GEW-20A	6/11/2013 14:27	16	77.7	1.9	4.4	102	
GEW-20A	6/11/2013 14:34	17.3	78.4	1.8	2.5	100	Pump was repaired in June allowing gas flow to resume and bringing well into acceptable oxygen range.
GEW-20A	6/19/2013 14:19	3.6	79.2	0	17.2	122	
GEW-20A	6/24/2013 9:20	3.2	77.9	0.5	18.4	114	
GEW-20A	7/3/2013 11:37	3.5	80.4	0	16.1	114	
GEW-20A	7/11/2013 14:48	5.3	81	0	13.7	110	
GEW-20A	7/11/2013 14:58	5.7	80.4	0	13.9	110	
GEW-20A	7/17/2013 13:19	9.4	81.9	0	8.7	128	
GEW-20A	7/23/2013 13:58	8.2	83.7	0	8.1	152	
GEW-23A	6/4/2013 9:28	13.8	76.2	0	10	128	May 14, 2013 Maximum O ₂ = 4.0% Lab.
GEW-23A	6/11/2013 13:30	20.2	78.5	0	1.3	124	
GEW-23A	6/11/2013 13:35	20.6	79.3	0	0.1	124	A reading taken with the field GEM immediately prior to taking the summa cannister sample for laboratory analyses indicated 0.0% oxygen. Therefore, it is believed that no oxygen was present in this wellhead, rather, that oxygen was introduced into the cannister through the sample train during sampling, or during shipping, or at the laboratory.
GEW-23A	6/19/2013 14:30	14.6	72.3	0	13.1	124	
GEW-23A	6/24/2013 9:34	18.6	74.6	0	6.8	120	
GEW-23A	7/3/2013 11:44	17.4	75.8	0	6.8	124	
GEW-23A	7/10/2013 15:46	15.4	76.4	0	8.2	126	
GEW-23A	7/10/2013 15:52	16.2	76.1	0	7.7	126	
GEW-23A	7/17/2013 13:30	23.2	76.7	0	0.1	125	
GEW-23A	7/23/2013 14:08	19.4	80.5	0	0.1	124	

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Point Name	Date	CH ₄ %	CO ₂ %	O ₂ %	Balance %	Init Temp °F	Comments
GEW-33R	6/4/2013 10:23	0.1	44.5	6.8	48.6	196	May 14, 2013 O ₂ = Maximum 8.0% Lab.
GEW-33R	6/13/2013 10:13	7	70	0	23	200	
GEW-33R	6/13/2013 10:18	19.8	69.1	0	11.1	200	A hole was discovered in a Fernco connection strap on the wellhead and repaired on June 12, 2013. Well has returned to complaint oxygen levels.
GEW-33R	6/18/2013 10:41	1.6	66.4	0	32	200	
GEW-33R	6/24/2013 10:44	3.9	66.7	0	29.4	202	
GEW-33R	7/1/2013 14:05	3	67.5	0	29.5	196	
GEW-33R	7/9/2013 14:19	0.2	68.6	0	31.2	202	
GEW-33R	7/9/2013 14:26	0.3	67.2	0	32.5	202	
GEW-33R	7/17/2013 16:36	0.5	70.9	0	28.6	205	
GEW-33R	7/23/2013 14:37	0.4	73.2	0	26.4	202	
GEW-34	6/4/2013 10:30	0.5	11.1	16.9	71.5	82	May 14, 2013 Maximum O ₂ = 20 .0% Lab.
GEW-34	6/13/2013 10:01	4.5	57.3	3.6	34.6	106	
GEW-34	6/13/2013 10:09	8.6	42.3	7.6	41.5	106	A sample port was repaired with a temporary fix on June 10 returning the well to compliant oxygen levels. The entire wellhead assembly is scheduled to be replaced.
GEW-34	6/18/2013 10:53	19.8	62.6	0.9	16.7	104	
GEW-34	6/24/2013 10:54	2	65.8	0	32.2	130	
GEW-34	7/1/2013 14:12	12	67.6	0.1	20.3	110	
GEW-34	7/10/2013 13:20	5.2	68.2	0.3	26.3	120	
GEW-34	7/10/2013 13:25	5.4	67.9	0.1	26.6	120	
GEW-34	7/18/2013 8:28	4.8	74.4	1.4	19.4	120	
GEW-34	7/23/2013 14:43	4.4	71.8	0	23.8	130	

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Point Name	Date	CH ₄ %	CO ₂ %	O ₂ %	Balance %	Init Temp °F	Comments
GEW-35	6/4/2013 10:37	0.3	66.7	0.1	32.9	180	May 14, 2013 Maximum O ₂ = 11 .0% Lab.
GEW-35	6/12/2013 13:44	0.2	72.7	0	27.1	190	
GEW-35	6/12/2013 13:49	1.2	72	0	26.8	190	This well has a PVC Landtec wellhead which is not ideal for the elevated temperatures exhibited by the well conditions. The wellhead will be replaced with a steel unit very soon. Decreased vacuum as temporary adjustment. Well has returned to acceptable oxygen levels.
GEW-35	6/18/2013 11:11	8.9	64.2	0	26.9	196	
GEW-35	6/24/2013 11:00	0.2	66.2	0	33.6	198	
GEW-35	7/1/2013 14:17	2.7	66.8	0	30.5	196	
GEW-35	7/10/2013 13:28	0.3	67.2	0	32.5	198	
GEW-35	7/10/2013 13:34	0.4	66.2	0	33.4	198	
GEW-35	7/18/2013 8:36	0.2	72.2	0	27.6	185	
GEW-35	7/23/2013 14:50	0.1	67.3	0	32.6	196	
GEW-36	6/12/2013 13:29	5.3	70.6	0.1	24	104	May 14, 2013 Maximum O ₂ = 18 .0% Lab.
GEW-36	6/12/2013 13:36	23.8	68.6	0.1	7.5	104	
GEW-36	6/18/2013 11:15	12.9	62	0.2	24.9	102	Wellhead was determined to be compromised and then was replaced on May 27, 2013.
GEW-36	6/24/2013 11:04	0	64.4	0.3	35.3	116	
GEW-36	7/1/2013 14:21	3.9	65.7	0	30.4	98	
GEW-36	7/10/2013 13:39	0.6	65.5	0.1	33.8	100	
GEW-36	7/10/2013 13:45	0.9	64.6	0.2	34.3	100	
GEW-36	7/18/2013 8:39	0	67.3	0	32.7	120	
GEW-36	7/23/2013 14:54	0.1	68	0	31.9	110	

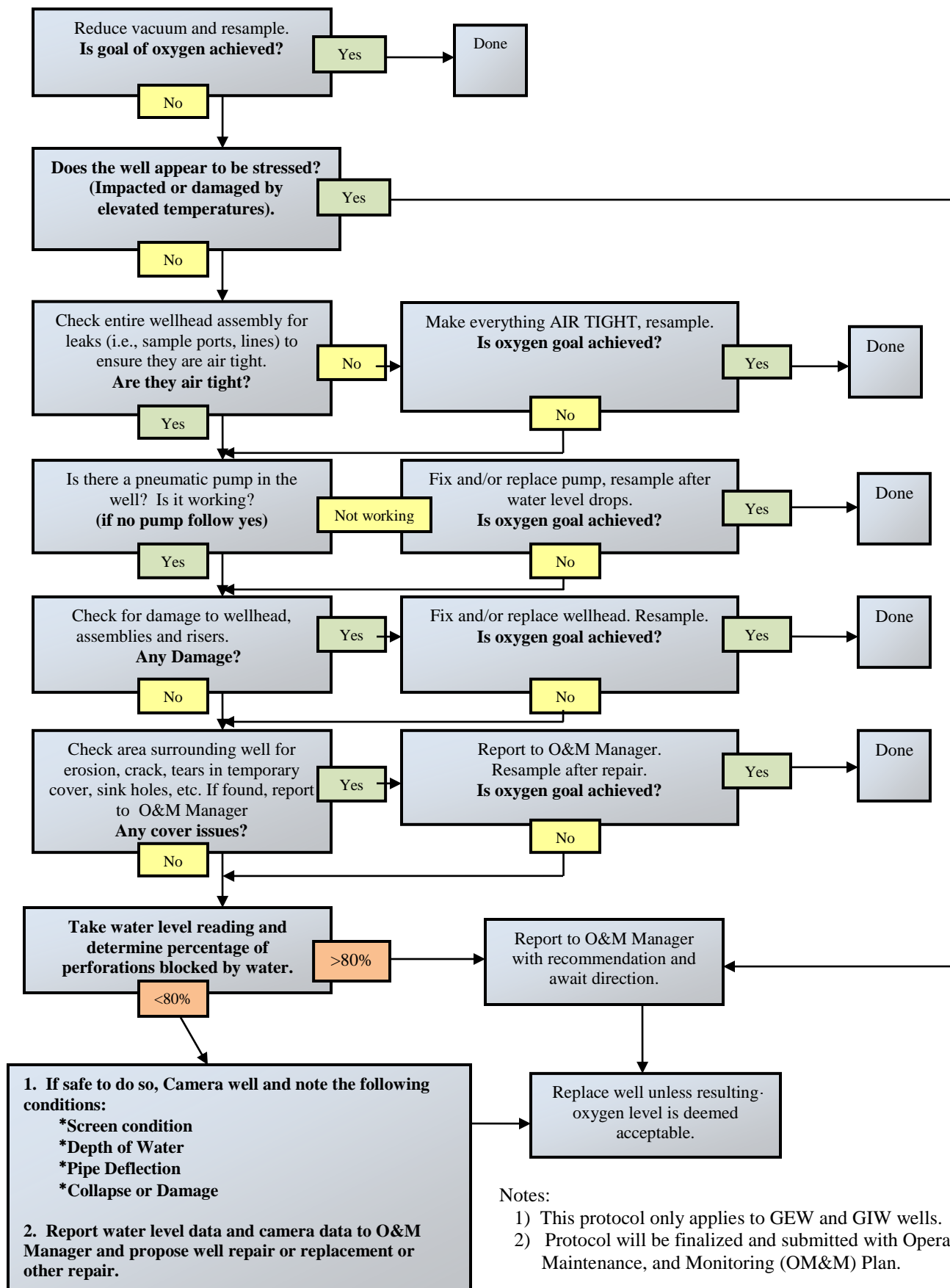
Table 1
Bridgeton Landfill
June - July 2013 Oxygen Levels

Point Name	Date	CH ₄ %	CO ₂ %	O ₂ %	Balance %	Init Temp °F	Comments
GEW-56R	6/4/2013 14:07	24.8	60.1	0	15.1	136	May 29, 2013 Maximum O ₂ = 18 .6% GEM. Wellhead was determined to be slightly compromised and was equipped with a temporary fix on June 3. The wellhead will be assessed for potential full replacement.
GEW-56R	6/12/2013 16:42	24.2	52	0	23.8	140	
GEW-56R	6/12/2013 16:48	25.3	41.4	0	33.3	142	
GEW-56R	6/19/2013 8:35	22.8	67.6	0	9.6	80	
GEW-56R	6/24/2013 14:18	19.7	69.1	0	11.2	102	
GEW-56R	7/1/2013 9:53	20.1	70.2	0	9.7	74	
GEW-56R	7/11/2013 10:02	21.4	70	0	8.6	80	
GEW-56R	7/11/2013 10:09	22.7	68.9	0	8.4	80	
GEW-56R	7/15/2013 7:57	21.8	72.2	0	6	85	
GEW-56R	7/23/2013 9:11	22.7	70.4	0	6.9	94	
GEW-62R	6/4/2013 11:29	0.6	67	0	32.4	184	May 14, 2013 Maximum O ₂ = 4.0% Lab.
GEW-62R	6/13/2013 9:03	1.7	66.8	0	31.5	110	Decreased vacuum as temporary adjustment. Well has returned to acceptable oxygen levles but needs additional assessment. It is likely that this well will be recommended to be replaced.
GEW-62R	6/13/2013 9:08	1.7	67.5	0	30.8	110	
GEW-62R	7/17/2013 9:41	3.3	65.1	1.6	30	180	
GEW-91	6/19/2013 8:30	0.2	74.8	0	25	194	May 14, 2013 Maximum O ₂ = 4.0% Lab.
GEW-91	6/25/2013 10:11	2.3	73.1	0	24.6	194	A reading taken with the field GEM immediately prior to taking the summa cannister sample for laboratory analyses indicated 0.0% oxygen. Therefore, it is believed that no oxygen was present in this wellhead, rather, that oxygen was introduced into the cannister through the sample train during sampling, or during shipping, or at the laboratory.
GEW-91	6/25/2013 10:11	2.3	73.1	0	24.6	194	
GEW-91	7/1/2013 9:49	0.2	73.1	0	26.7	194	
GEW-91	7/11/2013 9:47	0.2	74.7	0	25.1	198	
GEW-91	7/11/2013 9:57	0.2	75.1	0	24.7	198	
GEW-91	7/18/2013 9:01	0.2	81.4	0	18.4	100	

ATTACHMENT A

LANDFILL GAS EXTRACTION WELL ASSESSMENT PROTOCOL-OXYGEN

Bridgeton Landfill Gas Extraction Well Assessment Protocol-Oxygen⁽¹⁾



Notes:

- 1) This protocol only applies to GEW and GIW wells.
- 2) Protocol will be finalized and submitted with Operation, Maintenance, and Monitoring (OM&M) Plan.