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February 18, 2015

Mr. Ervin Lane
Compliance Hydrogeologist
Division of Waste Management/Solid Waste Section
1646 Mail Service Center
Raleigh, NC 27699-1646

**RE: Landfill Gas Remediation Plan
Wilkes County, Germantown Road Landfill, Permit No. 97-01
JOYCE Project No. 356.1501.11, Task No. 01**

Dear Ervin:

On behalf of Wilkes County, Joyce Engineering (JOYCE) is submitting this *Landfill Gas Remediation Plan* (LGRP) for the Wilkes County Germantown Road Landfill, Permit No. 97-01. This LGRP has been prepared in response to the Notice of Violation (NOV) issued by the North Carolina Department of Environment and Natural Resources (DENR) dated January 20, 2015.

INTRODUCTION

The Germantown Road Landfill is a closed, unlined municipal solid waste (MSW) landfill owned by Wilkes County. The landfill ceased daily operations in 1993. The landfill property is located near the town of Wilkesboro, North Carolina and currently houses the Wilkes County Fire Marshal and training grounds. The area surrounding the landfill is primarily agricultural and contains open fields and woodlands. The landfill property is bounded on the east by Moravian Creek.

The Germantown Landfill is located at the boundary of the Inner Piedmont Belt and Blue Ridge Belt in the Brevard Fault Zone. In the vicinity of the site, the Brevard Zone is a five-mile wide, east-northeast trending fault zone with a complex structural and metamorphic history. Finely interlayered gneiss and schist within the zone are amphibolite facies, with peak metamorphism as high as the kyanite zone for pelitic assemblages.

Closure of the landfill included installation of six passive gas vents around the periphery of the landfill. In 2003, four additional deep gas wells were installed in the central portion of the landfill and were fitted with Landtec wellheads. In 2004, these wells were connected to a 6" diameter below-ground HDPE pipe system designed to collect the landfill gas. In 2009, an above-ground section of 6" diameter HDPE pipe was added. In 2011, the Germantown Landfill received approval from NCDENR to construct and operate a landfill gas beneficial use project. Currently,

gas from the four active vents is being collected to generate electricity. The six passive gas vents landfill are currently capped so that they do not vent.

LANDFILL GAS MONITORING HISTORY

Gas monitoring at the Germantown Landfill has been performed throughout the post-closure care period. Through the third quarter of 2013, quarterly monitoring was conducted on the landfill property with the use of bar-hole probes around the periphery of the landfill, as well as monitoring of the three site structures near the landfill. In July 2012, the County submitted a revised Landfill Gas Monitoring Plan (LGMP) proposing the installation of four gas probes, GP-1, GP-2, GP-3, and GP-4, along the western and northern boundaries of the landfill property. No probes were required along the other sides of the landfill as the landfill property is bounded by a creek which should act as a natural barrier to gas migration. The LGMP was approved by the DENR on July 18, 2012.

Gas monitoring probes GP-1, GP-2, and GP-4 were installed on October 8, 2012. GP-3 was not installed because shallow water (< 5 feet) was encountered at the drilling location. The locations of the probes are shown on the attached Drawing 1. The probes were constructed as described below:

Gas Probe ID	Diameter of Boring	Depth of Boring	Diameter of Probe	Top of Screen	Bottom of Screen	Top of Sand Pack	Top of Seal
GP-1	6"	22'	1"	4'	22'	3'	2'
GP-2	6"	7'	1"	2'	7'	1.5'	1'
GP-4	6"	34'	1"	4'	34'	3'	2'

Depths are in feet below ground surface.

The gas probes were monitored for the first time in October 2012, and quarterly thereafter. Table 1 summarizes the historical gas monitoring results from October 2012 to present. Gas probe GP-1 has shown concentrations of methane between 5.4% and 60.0% (percent by volume) since its installation, which is in exceedance of the lower explosive limit (LEL) for methane (5% by volume at standard temperature and pressure). Neither GP-2 nor GP-4 has shown any exceedances of the LEL for methane.

PROPOSED REMEDIAITON STRATEGY

One of the passive gas vents in the landfill is located only approximately 200 feet west of GP-1. This vent is currently capped so that it is not venting the landfill. Our first proposed step in remediation the landfill gas exceedance in GP-1 will be to open the nearby gas vent and install a solar-powered turbine cap on it. This will allow gas in that part of the landfill to vent and the turbine cap will provide some additional draw on the vent to enhance its effectiveness.

GP-1 is located north (downgradient) of an old sedimentation basin on the north side of the landfill. The basin is full of water and decaying vegetative matter. The ground on

the north side of the basin near GP-1 is typically wet and sometimes saturated even though it is several tens of feet above the groundwater table, indicating that the basin leaks. GP-1 often has water filling it to within 5-10 feet of the ground surface. It is possible that some or all of the methane detected in GP-1 originates from the pond or the saturated conditions near the probe, rather than from the landfill.

If allowing the nearby gas vent to vent methane from the landfill does not prove effective in significantly reducing the methane concentrations in GP-1, we propose as a contingency draining of the old sedimentation basin. If the berm on the north side of the basin is breached and a small drainage channel is constructed to allow water in the basin, as well as future rain water entering the basin, to drain down the slope, the area around GP-1 should dry up and the decaying vegetative matter should no longer be a potential source of methane. Also, GP-1 should no longer fill up with water, allowing it to be more effective as a monitoring probe.

MONITORING AND EVALUATION

Quarterly monitoring of the three gas probes will continue in accordance with the Landfill Gas Monitoring Plan for the facility. In addition, the methane concentration in the gas vent near GP-1 will also be monitored. The monitoring data will be evaluated one year after opening the gas vent near GP-1 to determine the effectiveness of the gas vent in controlling gas migration. If, after one year, the methane concentration in gas probe GP-1 has not been substantially reduced, the contingency plan of draining the nearby sedimentation basin will be implemented.

After the basin has been drained, the quarterly monitoring will continue, and in addition, the area around GP-1 will be examined to see how well it is drying out. If after one year there has been no substantial reduction of the methane concentration in GP-1, further remedial action will be considered.

SCHEDULE OF IMPLEMENTATION

- Quarterly gas monitoring will continue on the same schedule as before.
- Within 30 calendar days of DENR approval of this LGRP, the gas vent near GP-1 will be opened and the solar-powered turbine top will be installed.
- Within 60 calendar days of performance of the fourth quarterly monitoring event after the opening of the gas vent, an evaluation of the effectiveness of the remedy will be submitted to the DENR.
- Within 60 calendar days of determining that the gas vent is not sufficiently mitigating methane migration in the vicinity of GP-1, a plan will be submitted to the DENR (and the US Army Corps of Engineers, if necessary) to proceed with draining the sedimentation basin.

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- Within 60 calendar days of DENR approval of the plan (and Corps of Engineers approval, if needed), the sedimentation basin will be drained.
- Within 60 calendar days of performance of the fourth quarterly monitoring event after the draining of the sedimentation basin, an evaluation of the effectiveness of the remedy will be submitted to the DENR.
- Within 60 calendar days of determining that the draining of the sedimentation basin has not been sufficiently effective in reducing the methane concentration is in GP-1, a new Landfill Gas Remediation Plan will be submitted to the DENR proposing the next phases of remediation.

Please feel free to contact Alex Everhart or me at (336) 323-0092 if you have any questions regarding this Plan.

Sincerely,
JOYCE ENGINEERING



Van Burbach, Ph.D., P.G.
Senior Technical Consultant

Attachments: Table 1, Drawing 1

C: Kent Brandon - Wilkes County, Solid Waste Director

TABLE 1: Historical Landfill Gas Monitoring Data

Date	Location	Instrument Purged?	Time	Probe Pressure (InWg)	Time Pumped (sec.)	CH ₄ (% Vol)	CH ₄ (% LEL)
16-Oct-12	GP-1	yes	12:44	0.000	20	15.2	304
16-Oct-12	GP-2	yes	12:49	0.000	20	0.0	0
16-Oct-12	GP-3	yes	12:27	0.000	20	0.0	0
16-Oct-12	Barn	yes	12:40	-	Continuous	0.0	0
16-Oct-12	Garage	yes	12:35	-	Continuous	0.0	0
16-Oct-12	Office	yes	12:29	-	Continuous	0.0	0
14-Jan-13	GP-1	yes	14:41	0.100	30	5.4	108
14-Jan-13	GP-2	yes	14:18	0.000	30	0.0	0
14-Jan-13	GP-4	yes	14:35	0.000	30	0.0	0
14-Jan-13	BH-1A	yes	14:44	-	30	0.0	0
14-Jan-13	Barn	yes	14:20	-	Continuous	0.0	0
14-Jan-13	Garage	yes	14:24	-	Continuous	0.0	0
14-Jan-13	Office	yes	14:30	-	Continuous	0.0	0
16-Apr-13	GP-1	yes	16:33	0.445	30	38.0	760
16-Apr-13	GP-2	yes	13:00	0.001	30	0.0	0
16-Apr-13	GP-4	yes	16:23	0.010	30	0.0	0
16-Apr-13	BH-1A	yes	16:36	-	30	0.0	0
16-Apr-13	Barn	yes	16:29	-	Continuous	0.0	0
16-Apr-13	Garage	yes	16:27	-	Continuous	0.0	0
16-Apr-13	Office	yes	16:25	-	Continuous	0.0	0
22-Jul-13	GP-1	yes	12:04	0.000	30	41.0	820
2-Jul-13	GP-2	yes	11:54	0.000	30	0.0	0
22-Jul-13	GP-4	yes	12:25	0.140	30	0.0	0
22-Jul-13	BH-1A	yes	12:06	-	30	0.0	0
22-Jul-13	Barn	yes	12:53	-	Continuous	0.0	0
22-Jul-13	Garage	yes	12:47	-	Continuous	0.0	0
22-Jul-13	Office	yes	12:39	-	Continuous	0.0	0
7-Oct-13	GP-1	yes	12:11	0.000	30	0.4	8
7-Oct-13	GP-2	yes	12:06	0.030	30	0.0	0
7-Oct-13	GP-4	yes	12:15	0.000	30	0.0	0
7-Oct-13	Barn	yes	-	-	Continuous	0.0	0
7-Oct-13	Garage	yes	-	-	Continuous	0.0	0
7-Oct-13	Office	yes	-	-	Continuous	0.0	0
8-Jan-14	GP-1	yes	12:43	0.200	30	42.7	854
8-Jan-14	GP-2	yes	12:50	0.000	30	0.0	0
8-Jan-14	GP-4	yes	12:56	0.160	30	0.0	0
8-Jan-14	Barn	yes	13:09	-	Continuous	0.0	0
8-Jan-14	Garage	yes	13:06	-	Continuous	0.0	0
8-Jan-14	Office	yes	12:59	-	Continuous	0.0	0
29-Apr-14	GP-1	yes	12:20	-0.040	45	3.0	60
29-Apr-14	GP-2	yes	11:50	0.040	45	0.0	0
29-Apr-14	GP-4	yes	12:05	0.070	45	0.0	0
29-Apr-14	Barn	yes	11:53	-	Continuous	0.0	0
29-Apr-14	Garage	yes	11:55	-	Continuous	0.0	0
29-Apr-14	Office	yes	12:10	-	Continuous	0.0	0
30-Jul-14	GP-1	yes	12:52	0.000	60	31.6	632
30-Jul-14	GP-2	yes	12:30	0.000	60	0.0	0
30-Jul-14	GP-4	yes	12:45	0.000	60	0.0	0
30-Jul-14	Barn	yes	12:40	-	Continuous	0.0	0
30-Jul-14	Garage	yes	13:10	-	Continuous	0.0	0
30-Jul-14	Office	yes	13:15	-	Continuous	0.0	0
14-Oct-14	GP-1	yes	12:14	0.310	60	56.3	1126
14-Oct-14	GP-2	yes	11:56	0.100	60	0.0	0
14-Oct-14	GP-4	yes	12:04	0.020	60	0.0	0
14-Oct-14	Barn	yes	11:58	-	Continuous	0.0	0
14-Oct-14	Garage	yes	12:00	-	Continuous	0.0	0
14-Oct-14	Office	yes	12:12	-	Continuous	0.0	0
20-Jan-15	GP-1	yes	12:55	0.220	60	40.0	800
20-Jan-15	GP-2	yes	12:45	0.000	60	0.0	0
20-Jan-15	GP-4	yes	13:05	0.150	60	0.0	0
20-Jan-15	BHP-1A	yes	13:00	-	60	0.0	0
20-Jan-15	Barn	yes	12:38	-	Continuous	0.0	0
20-Jan-15	Garage	yes	13:11	-	Continuous	0.0	0
20-Jan-15	Office	yes	13:09	-	Continuous	0.0	0

BH-1A = Barhole probe approximately 50 feet from GP-1 toward the property boundary.

