

**AUG 10 2015**

Mr. Brian Power  
Area Environmental Manager  
Republic Services, Inc.  
13570 St. Charles Rock Road  
Bridgeton, MO 63044

RE: Corrective Action Assessment and Plan—Neck Area and North Quarry,  
Bridgeton Sanitary Landfill, Permit Number 0118912, St. Louis County

Dear Mr. Power:

The Missouri Department of Natural Resources' Solid Waste Management Program (SWMP) has reviewed:

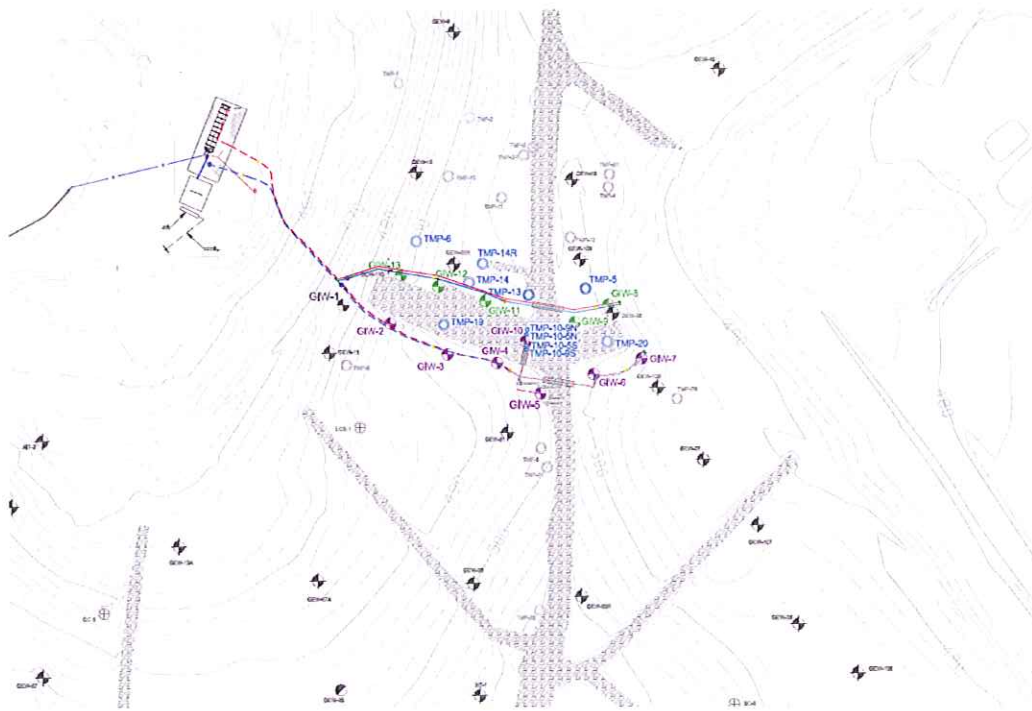
- reports submitted by Republic Services, Inc. pursuant to the First Agreed Order;
- information submitted on December 1, 2014, and Bridgeton Landfill's responses to questions from the department related to the "Expanded Heat Removal Pilot Study" for the Bridgeton Landfill, and
- a "Corrective Action Plan, Potential Northward Progression of Subsurface Smoldering Event" report prepared by Republic Services' consultant, Civil & Environmental Consultants (CEC) received on November 5, 2014. This plan provided Bridgeton Landfill's response to SWMP's October 7, 2014, letter requiring the facility to add nine (9) temperature monitoring probes (TMPs) in the North Quarry and complete a corrective action assessment and related plan.

Based upon our review of these Republic Services' submittals for Bridgeton Landfill, the SWMP is requiring submittal of work plans and schedules for previously agreed upon work set forth under the North Quarry Action Plan (NQAP) based upon the below data and referenced exceedance reports. These work plans shall include: 1) Additional corrective action measures to protect against potential progression of the subsurface fire from the South Quarry into the North Quarry and 2) Corrective measures to prevent independent fires from being generated in the North Quarry.

#### Current Status and Assessment

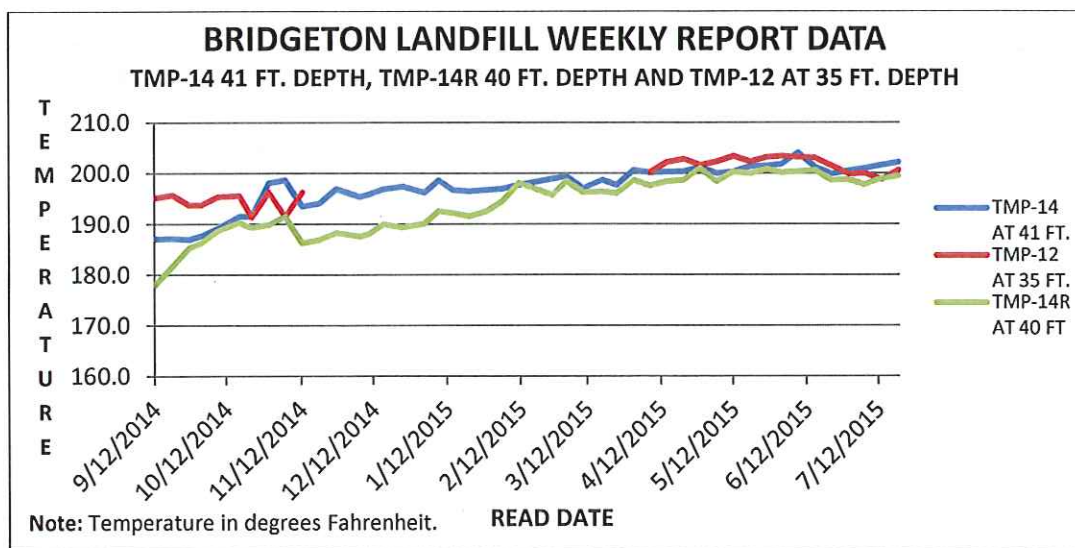
The facility's November 5, 2014, Corrective Action Plan Potential Northward Progression of Subsurface Smoldering Event document states, at the time of the submittal, the expanded heat removal pilot study was newly implemented. As of July 2015, Bridgeton Landfill expanded the Heat Extraction Pilot Study to include an additional five (5) gas interceptor wells. However, the pilot study cooling line does not

extend across the entire Neck Area, i.e., from quarry wall to quarry wall, which continues to allow an open pathway for potential progression of the subsurface smoldering fire.



Drawing from Bridgeton Landfill May 22, 2015 submittal Expanded Heat Extraction Pilot Study (Feezor Eng., Inc.).

Data reported by Bridgeton Landfill continues to show an area of concern in the Neck which seemingly is beyond the zone of influence of the Heat Extraction Pilot Study. This area is in and around TMP-12 and TMP-14, the new TMP-14R and Gas Extraction Well-110 (GEW-110). Of specific concern are the temperatures being reported around the 41 foot depth of TMP-14, the 40 foot depth of TMP-14R and the 35 foot depth of TMP-12 which have shown a slow, steady progression upwards and are now reported at or slightly above 200° F. The following chart and table show temperatures reported from TMP-12, TMP-14 and TMP-14R since TMP-14R was installed in September 2014.





BRIDGETON LANDFILL WEEKLY REPORT  
DATA FROM TEMPERATURE MONITORING PROBES

TMP-14 at 41 Foot Depth				TMP-14R at 40 Foot Depth			
READ DATE	READING (° F)	READ DATE	READING (° F)	READ DATE	READING (° F)	READ DATE	READING (° F)
9/12/2014	187.1	2/25/2015	198.9	9/12/2014	178.1	2/23/2015	195.7
9/19/2014	187.2	3/3/2015	199.4	9/19/2014	181.7	3/4/2015	198.4
9/26/2014	187.0	3/10/2015	197.1	9/26/2014	185.3	3/11/2015	196.3
10/1/2014	187.7	3/18/2015	198.7	10/1/2014	186.3	3/18/2015	196.4
10/8/2014	189.2	3/24/2015	197.7	10/8/2014	188.7	3/24/2015	196.1
10/17/2014	191.5	3/31/2015	200.6	10/17/2014	190.3	3/31/2015	198.7
10/22/2014	191.5	4/7/2015	200.2	10/22/2014	189.3	4/7/2015	197.6
10/29/2014	198.1	4/14/2015	200.3	10/29/2014	189.9	4/14/2015	198.4
11/5/2014	198.7	4/21/2015	200.4	11/5/2014	191.5	4/21/2015	198.7
11/12/2014	193.5	4/28/2015	201.2	11/12/2014	186.3	4/28/2015	201.0
11/19/2014	194.1	5/5/2015	200.0	11/19/2014	186.9	5/5/2015	198.4
11/26/2014	196.9	5/12/2015	200.3	11/26/2014	188.3	5/12/2015	200.3
12/6/2014	195.4	5/19/15	201.4	12/6/2014	187.6	5/19/15	200.0
12/10/2014	195.9	5/26/15	201.5	12/10/2014	188.1	5/26/15	200.8
12/16/2014	196.9	6/1/15	201.8	12/15/2014	190.0	6/1/15	200.2
12/24/2014	197.4	6/8/15	204.1	12/24/2014	189.4	6/8/15	200.4
1/2/2015	196.2	6/15/15	201.3	1/2/2015	190.1	6/15/15	200.6
1/8/2015	198.6	6/22/15	199.9	1/8/2015	192.6	6/22/15	198.7
1/14/2015	196.7	6/29/15	200.5	1/14/2015	192.2	6/29/15	198.8
1/21/2015	196.5	7/6/15	201.0	1/21/2015	191.6	7/6/15	197.8
1/28/2015	196.7	7/13/15	201.6	1/28/2015	192.5	7/13/15	199.0
2/4/2015	197.0	7/20/15	202.2	2/2/2015	194.5	7/20/15	199.5
2/11/2015	197.7			2/16/2015	198.1		

Note: TMP-14R first reported as part of the Heat Extraction Pilot Study on 9/12/2014.  
Pre-pilot study, weekly data is available for TMP-14 and additional days between 9/12/2014 and 2/26/2015 are available for TMP-14R.

Additionally, on April 7, 2015, Bridgeton Landfill began reporting TMP-12 at the 35 foot depth.  
(Note: This thermocouple had previously been reported as having high or no resistivity.)

BRIDGETON LANDFILL WEEKLY REPORT  
DATA FROM TEMPERATURE MONITORING PROBES

TMP-12 at 35 Foot Depth

READ DATE	READING (° F)	READ DATE	READING (° F)
4/7/2015	200.2	6/1/15	203.4
4/14/2015	202.2	6/8/15	203.2
4/21/2015	202.8	6/15/15	203.1
4/28/2015	201.6	6/22/15	201.5
5/5/2015	202.3	6/29/15	199.9
READ DATE	READING (° F)	READ DATE	READING (° F)

5/12/2015	203.4	7/6/15	200.0
5/19/15	202.3	7/13/15	198.8
5/26/15	203.2	7/20/15	200.6

On December 29, 2014, GEW-110 had its highest to date temperature reported as 157.5° F with 0.0% by volume oxygen present in the well. January 5, 2015, GEW-110 was reported as being in need of repair with a temperature of 32.5° F with 10.8% by volume oxygen. After flow was restored, GEW-110's temperature was reported with a new maximum temperature of 175.7° F with 0.0% by volume oxygen on February 14, 2015, and was reported as 166.0° F with 4.0% by volume oxygen on May 15, 2015. The upward trend in temperature in this gas extraction well is apparent when the well is fully operational.

Bridgeton Landfill Weekly Report  
Data from Neck Area GEW-110

GEW ID#	Reading Date	CH4 (% Vol.)	CO2 (% Vol.)	Oxygen (% Vol.)	Balance (% Vol.)	Wellhead Temp. (°F)	Initial Static Pressure (In W.C.)
GEW-110	10/17/14	1.4	19.6	14.7	64.3	66.0	-21.6
GEW-110	10/17/14	1.4	19.6	14.7	64.3	66.0	-21.6
GEW-110	10/20/14	0.8	17.0	14.0	68.2	67.0	-21.6
GEW-110	10/20/14	0.9	18.3	14.6	66.2	67.0	-21.7
GEW-110	10/27/14	0.4	21.3	14.2	64.1	88.0	-22.9
GEW-110	11/07/14	1.2	13.1	17.9	67.8	61.0	-21.1
GEW-110	11/07/14	0.8	7.7	19.9	71.6	62.0	-21.1
GEW-110	11/17/14	0.5	11.5	19.2	68.8	28.0	-21.1
GEW-110	11/24/14	3.8	32.4	8.0	55.8	42.5	-22.89
GEW-110	11/24/14	2.8	37.6	7.0	52.6	43.1	-22.77
GEW-110	12/04/14	3.1	38.3	10.2	48.4	45.2	-18.25
GEW-110	12/04/14	1.8	34.8	10.3	53.1	42.8	-18.13
GEW-110	12/08/14	2.1	31.8	10.5	55.6	65.4	-19.84
GEW-110	12/08/14	1.8	29.4	11.1	57.7	66.2	-19.9
GEW-110	12/15/14	3.6	57.6	0.0	38.8	75.7	-0.29
GEW-110	12/22/14	2.0	69.0	0.6	28.4	109.0	-19.1
GEW-110	12/29/14	3.5	56.3	0.0	40.2	157.5	-23.02
GEW-110	12/29/14	2.7	57.0	0.1	40.2	157.0	-23.02
GEW-110	01/05/15	2.5	28.1	11.0	58.4	32.1	-23.93
GEW-110	01/05/15	1.7	27.2	10.8	60.3	32.5	-23.99
GEW-110	01/13/15	6.0	37.8	10.2	46.0	32.5	-24.88
GEW-110	01/13/15	3.2	33.2	10.4	53.2	34.4	-24.45
GEW-110	01/26/15	2.2	20.0	14.2	63.6	60.2	-23.81
GEW-110	01/26/15	2.2	20.1	13.6	64.1	63.5	-23.44
GEW-110	02/02/15	4.8	29.7	12.4	53.1	46.9	-13.84
GEW-110	02/14/15	13.7	53.5	0.0	32.8	175.7	-23.44
GEW-110	02/14/15	13.4	54.9	0.0	31.7	172.7	-12.76
GEW-110	02/20/15	16.1	48.4	1.3	34.2	172.7	-12.21
GEW-110	02/20/15	15.8	48.7	1.3	34.2	172.2	-12.09
GEW ID#	Reading Date	CH4 (% Vol.)	CO2 (% Vol.)	Oxygen (% Vol.)	Balance (% Vol.)	Wellhead Temp. (°F)	Initial Static Pressure (In W.C.)



GEW-110	02/26/15	23.2	51.0	0.1	25.7	156.6	-22.44
GEW-110	02/26/15	22.5	51.8	0.2	25.5	156.0	-20.98
GEW-110	03/02/15	26.5	49.9	0.0	23.6	168.3	-19.05
GEW-110	03/02/15	25.9	51.1	0.0	23.0	169.0	-23.87
GEW-110	03/09/15	2.1	54.8	1.4	41.7	126.3	-14.16
GEW-110	03/09/15	0.7	55.6	2.2	41.5	129.6	-17.03
GEW-110	03/16/15	1.2	15.7	13.9	69.2	92.4	-18.68
GEW-110	03/16/15	1.2	16.1	13.6	69.1	93.2	-18.62
GEW-110	03/23/15	1.5	15.9	16.9	65.7	70.9	-23.5
GEW-110	03/23/15	1.3	14.7	16.6	67.4	71.2	-23.08
GEW-110	04/01/15	8.3	54.5	0.8	36.4	146.0	-24.42
GEW-110	04/01/15	7.1	56.8	0.9	35.2	146.6	-23.99
GEW-110	04/10/15	16.7	44.8	1.8	36.7	166.9	-22.41
GEW-110	04/10/15	17.1	42.1	2.0	38.8	167.3	-22.47
GEW-110	04/16/15	24.3	54.3	0.4	21.0	160.0	-24.1
GEW-110	04/16/15	24.2	54.5	0.4	20.9	160.0	-24.0
GEW-110	04/22/15	7.6	33.6	4.6	54.2	168.3	-19.45
GEW-110	04/22/15	9.4	35.4	4.6	50.6	168.3	-19.51
GEW-110	04/28/15	5.8	30.6	8.1	55.5	168.3	-15.08
GEW-110	04/28/15	5.9	30.2	7.9	56.0	168.3	-15.57
GEW-110	05/07/15	11.7	34.9	4.3	49.1	169.7	-16.59
GEW-110	05/07/15	12.1	32.0	4.5	51.4	169.3	-17.13
GEW-110	05/15/15	12.7	36.3	4.0	47.0	166.0	-14.1
GEW-110	05/20/15	19.4	36.5	4.0	40.1	165.0	-15.6
GEW-110	05/28/15	12.4	35.1	3.6	48.9	170.0	-19.7
GEW-110	06/01/15	12.2	40.6	3.9	43.3	166.6	-21.8
GEW-110	06/01/15	12.3	40.5	4.0	43.2	166.6	-21.8
GEW-110	06/08/15	2.4	24.4	9.6	63.6	148.0	-26.1
GEW-110	06/15/15	15.8	48.3	1.2	34.7	163.5	-21.7
GEW-110	06/23/15	17.2	51.3	1.1	30.4	170.0	-21.9
GEW-110	07/02/15	7.9	26.3	12.1	53.7	129.3	-11.0
GEW-110	07/02/15	7.9	25.8	12.2	54.1	131.6	-3.5
GEW-110	07/09/15	Well not able to be read due to excessive moisture.					
GEW-110	07/16/15	Well not able to be read due to excessive moisture.					

From CEC's report, your consultant appears to believe these slow increases are due to conduction and convection of heat that was left in the area after the subsurface smoldering event was active in the vicinity. Then, the report further states CEC and Bridgeton believe the optimum condition in the Neck Area would be to observe declining temperature profiles. The SWMP agrees the optimum condition is consistently declining temperatures through the subsurface smoldering event impacted areas of the landfill, especially in the Neck Area. The Bridgeton Landfill's Neck Area must be closely monitored and maintenance promptly conducted.

## Development of Additional Corrective Measures and Preparedness for Implementation

### *Supplementary Engineering Controls in the Neck:*

Given the uncertainties regarding installation of an isolation barrier near the West Lake Landfill Area 1 and the information presented above, the SWMP is requiring submittal of work plans and schedules for supplementary corrective measures. These plans must be submitted for review and approval by SWMP to ensure Bridgeton Landfill has immediately, implementable measures at hand. With installation of the expanded heat extraction pilot study which has yet to be proven, Bridgeton Landfill has no additional measures approved and immediately, implementable.

- Within 30 days of this letter, Republic Services shall submit a work plan and schedule identifying a technology or technologies that may be used to halt any potential movement of the South Quarry smoldering fire identified to be occurring in the neck north of the gas interceptor wells. The schedule must identify specifically the time needed for mobilization through project completion, whether required by SWMP or initiated by Bridgeton Landfill.

Industrial waste materials were accepted by Bridgeton Landfill prior to enactment of 40 CFR Part 258, Subtitle D of the Resource Conservation and Recovery Act. The exact types and volumes of industrial waste material accepted are not known. These materials were accepted during the period the North Quarry was being filled and are likely present in the North Quarry. A 1992-1994 fire at the North Quarry's east wall reached temperatures of 800° F to 1,000° F according to a report filed by SCS Engineers for Laidlaw Waste Systems, the "then" landfill owner. At a minimum, Republic Services must have a corrective measure using inert gas injection or other available technology for "hot spot" treatment in the North Quarry to contain any independent fire(s) that might be generated.

- Within 30 days of this letter, Bridgeton Landfill shall submit a corrective measures work plan and schedule with a control line specified within the corrective action zone identified in the SWMP's October 7, 2014, letter and, at a minimum, a corrective action measure using inert gas injection as a "hot spot" treatment.

### *Connection of Previously Installed North Quarry Gas Wells:*

During the original North Quarry Contingency Plan development process, Republic Services' engineers stated Bridgeton Landfill would be better positioned to minimize movement of the South Quarry smoldering event into the North Quarry, should movement occur, if the landfill had additional GEWs to assist in managing reaction constituents, i.e., heat, pressure and gases, in those areas. While many new North Quarry GEWs were drilled, the GEWs were not connected to the gas collection and control system (GCCS). To be in a better position to delay or stop any forward progression of the South Quarry smoldering fire, the new North Quarry GEWs to the south of the sentry line of TMPs (TMP-16, -17, -21, -22, -23, -25, -27, -28 and -29) must be connected to the GCCS.

- The SWMP is requiring Republic Services to complete connection of the previously drilled North Quarry GEWs located to the south of the sentry line of North Quarry TMPs to the GCCS.

### *Enhancement of North Quarry Cap:*

Reinforced concrete pipes (RCPs) in the South Quarry allowed intrusion of oxygen and emission of landfill gases to ambient air thereby creating substantial odors and a public nuisance. RCPs in the North Quarry may be contributing to localized oxygen intrusion as these North Quarry RCPs have not been



properly abandoned. Republic Services must prepare a work plan and schedule for abandonment of the RCPs in the North Quarry.

In October and November 2014, Bridgeton Landfill's applied vacuum was reported as having been increased to gas extraction wells in the North Quarry leading to a rise in some well temperatures from an increase in oxygen. Recent surface emission monitoring reports, including the June 9, 2015, report, identify areas of the North Quarry cap where methane emissions exceeded 500 parts per millions (ppm), i.e. 700-1,500 ppm in seven (7) areas of the North Quarry. Department staff observed leachate outbreaks along the north slope of the North Quarry in three (3) areas in June 2015. Movement of the smoldering fire has historically been preceded by a steam front which saturates the waste mass. Further, visual observations show the beginning of movement of waste materials from the "high" North Quarry towards the now "lower" Neck Area.



*Photo taken from South Quarry looking across Neck Area to North Quarry (grassy area).*

The cap must be enhanced to minimize oxygen intrusion into the underlying waste mass that may allow for increased risk of a new fire, capture of landfill gases that would otherwise be released as fugitive emissions including odors, prevention of leachate outbreaks that could contaminate ground and surface waters and monitoring for uneven settlement in the waste mass requiring fill.

- Oxygen levels are to be maintained in the North Quarry GEWs at no greater than 1.5% by volume to further reduce the likelihood of oxygen intrusion and creation of an independent fire.
  - If corrective measures fail to lower the oxygen to the required 1.5% level, Republic Services must submit a written demonstration to the SWMP no later than 14 days from initial discovery explaining why a given well or wells did not meet the 1.5% level and include the steps taken to return the well to the required level.
- To allow for adequate management of the North Quarry, Bridgeton Landfill will need to place survey pins in the North Quarry and along the North Quarry's slopes to assist the SWMP and Bridgeton Landfill in monitoring for any rapid waste reduction that could indicate the presence and/or movement of a subsurface smoldering fire in the North Quarry or the need for additional fill material for stabilization.

- Republic Services must submit a work plan and schedule for completion of a cap enhancement project including the abandonment of North Quarry RCPs and connection of the GEWs listed above in the *Connection of Previously Installed North Quarry Gas Controls*.
- These enhancements to the North Quarry must be complete no later than December 1, 2015.

*Integrity of Gas Collection and Control System Operation:*

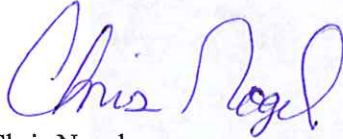
Recent, Monthly Reports show the level of methane at the flare inlet and available for combustion of landfill gasses continues to decrease. In the May Monthly report, methane is reported at only 5.4%, this is the lowest methane level that has been reported since reporting began to the SWMP in August 2012. The remaining components of the landfill gas were reported in the May report as nitrogen 50%, oxygen 13%, hydrogen 7.6%, carbon dioxide 24% and carbon monoxide 0.08%.

- With the reduction in available methane and hydrogen for combusting landfill gases, Republic Services will need to ensure Bridgeton Landfill complies with the requirements of the Clean Air Act, Missouri Clean Air Law and Missouri Solid Waste Management Law and implementing regulations with regards to utilization of natural gas as a supplemental fuel.

If you have any questions or comments, please feel free to contact me or Brenda Ardrey at (573) 751-5401 or at P.O. Box 176, Jefferson City, MO 65102-0176.

Sincerely,

SOLID WASTE MANAGEMENT PROGRAM



Chris Nagel  
Director

CN/bam

Enclosures

- c: Jim Getting, P.E., Bridgeton Landfill, LLC  
Ms. Laura Yates, St. Louis County Department of Health  
Mr. Tom Phillips, Attorney General's Office  
Mr. Larry Lehman, Compliance/Enforcement Section SWMP  
Charlene Fitch, P.E., Engineering Section, SWMP  
Ms. Brenda Ardrey, Operations Section, SWMP  
Mr. Joe Trunko, St. Louis Regional Office