



Jeremiah W. (Jay) Nixon, Governor • Sara Parker Pauley, Director

DEPARTMENT OF NATURAL RESOURCES

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SEP 17 2013

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RETURN RECEIPT REQUESTED

Mr. Brian Power
Environmental Manager
Bridgeton Landfill, LLC
13570 St. Charles Rock Road
Bridgeton, MO 63044

RE: Bridgeton Landfill, LLC, Permit Number 0118912, St. Louis County
Bridgeton Landfill North Quarry Contingency Plan – Part 1 and 2,
Subsurface Smoldering Event

Dear Mr. Power:

This letter is in response to Republic Services' (Republic's) submittals entitled "Bridgeton Landfill North Quarry, Contingency Plan – Part 2" (Part 2) dated July 26, 2013, and "Bridgeton Landfill North Quarry Contingency Plan – Part 1" (Revised Part 1) revised August 13, 2013. The submittals were provided to the Attorney General's Office through an FTP site pursuant to Sections 17. and 22.A of the First Agreed Order Case No. 13SL-CC01088 for review by the Department of Natural Resources (Department). Revised Part 1 and Part 2 were prepared by P.J. Carey & Associates, P.C., Feezor Engineering, Inc., SCS Engineers, Cornerstone Environmental Group, LLC, and Civil & Environmental Consultants, Inc. The construction plan portions of the submittal were signed and sealed by professional engineers licensed in the state of Missouri.

Based on the Department's review, the Contingency Plan – Part 2 and Revised Part 1 are not approved as written; however, several conditional approvals are being provided for specific sections to allow for ultimate finalization of contingency measures and those sections are identified and discussed further in the following comments. In addition, with this letter the Department considers the contingency plan trigger criteria and trigger lines approved as per pages two through six of this comment letter.

Due to the timing of the above referenced submittals, Republic advised the Department to disregard the trigger lines and/or trigger points contained in Part 2 and evaluate and comment upon only those trigger lines and/or trigger points detailed in the Revised Part 1, the company's latest submission. Additionally, the two submittals overlap in some areas regarding TMPs and GIWs. Therefore, consistent with Republic's request, this letter provides comments on Revised Part 1 as it supersedes the information presented in Part 2. Where information in the two

submittals does not overlap, comments on those portions of Part 2 are provided in this letter. The Department and Republic are working to re-combine Part 1 and Part 2 into a comprehensive Contingency Plan document.

Paragraph 22. of the First Agreed Order provides that, at a minimum, Part 1 of the Contingency Plan will include:

- i) Establishment of trigger criteria for installation of additional Temperature Monitoring Probes (TMP) in the North Quarry, along with a plan and schedule for such installation, if triggered;
- ii) Establishment of trigger criteria for installing Gas Interceptor Wells (GIW) within the North Quarry to control further migration of the SSE, along with a schedule for such well installation, if triggered; and
- iii) Establishment of trigger criteria for capping the North Quarry with an EVOH geomembrane cap, along with a schedule for such capping, if triggered.

With submission of Revised Part 1 and subsequent discussions, the minimum requirements for establishment of trigger lines/areas and criteria as set forth in Paragraph 22. can be agreed to along with the following comments.

COMMENTS ON TRIGGERS AND TRIGGERING OF CONTINGENCY ACTIONS

As outlined in the Department's letter dated July 24, 2013, the purpose of Part 1 is to establish trigger lines and values that allow sufficient time for completion of work plans preventing movement of the SSE into the North Quarry. Should these preventative measures fail, as a final solution, an isolation break will be installed between the North Quarry and West Lake Landfill Operable Unit 1, Area 1.

The following table, as presented in the July 24, 2013, letter, provides the Temperature and Carbon Monoxide (CO) criteria for Contingency Plan Action. The only change to this table is in Note 3 which references Trigger Line 2.

Table 1

Proposed Sentry Criteria^{1,2}

Bridgeton Sanitary Landfill, North Quarry Isolation Break

Indicator	Volume or/and Temperature	Isolation Break Required	Parameters
Carbon Monoxide (CO)			
CO levels in any gas extraction well or sentry monitoring well in the North Quarry.	>1,500 ppm	YES	CO result shall be repeatable and re-measured within 8 hours of receipt of the data. CO measurements shall be based on laboratory analysis and not field equipment. DNR and the fire authority shall be notified within 48 hours. Should any result exceed 1,500 ppm CO, the isolation break shall be constructed.
CO levels in two or more gas extraction wells and/or sentry monitoring well in the North Quarry.	>1,000 ppm	YES	Re-measure the initial CO result over 1,000 ppm within five days of receipt of the data. CO results greater than 1,000 ppm, but less than 1,500 ppm shall be re-measured 4 times for 4 weeks. DNR and the fire authority shall be notified within 5 days. Should all the retest exceed 1,000 ppm CO, the isolation break shall be constructed.
CO levels in any gas extraction well or sentry monitoring well in the North Quarry.	<1,000 ppm	No	No additional actions required. Continue monitoring per the First Agreed Order (Case No. 13SL-CC01088).
Temperature (°F)			
Any reportable temperature in a <i>TMP</i> at the sentry line or in the North Quarry ³ .	>200°F	YES	Temperature result shall be repeatable within 8 hours. DNR and the fire authority shall be notified within 48 hours. Should any temperature exceed 200°F in a <i>TMP</i> , the isolation break shall be constructed.
Any reportable temperature in a <i>gas well</i> located within the North Quarry.	>180°F	YES	Temperature result shall be repeatable within 8 hours. DNR and the fire authority shall be notified within 48 hours. Should any temperature exceed 180°F in a <i>gas well</i> , the isolation break shall be constructed.
Combination of CO + °F			
Any reportable temperature in a <i>TMP</i> or <i>gas well</i> at or past the sentry line exceeding 195°F and any <i>gas well</i> in the North Quarry exceeding 1,500 ppm CO.	>195°F + >1,500 ppm	YES	Temperature result shall be repeatable within 8 hours. DNR and the fire authority shall be notified within 48 hours. Should any temperature exceed 195°F in a <i>gas well</i> in the North Quarry and CO is detected above 1,500 ppm at the sentry line or North Quarry, the isolation break shall be constructed.
Any reportable temperature in a <i>TMP</i> less than 195°F or <i>gas well</i> located within the North Quarry or sentry line with CO less than 1,000 ppm.	<195°F + <1,500 ppm	No	Temperature(s) shall be collected weekly. Continue monitoring per the First Agreed Order (Case No. 13SL-CC01088).

¹These criteria are in addition to the First Agreed Order of Preliminary Injunction (Case No. 13SL-CC01088) between the State of Missouri and the Bridgeton Sanitary Landfill, LLC.

²The temperature and CO levels for this matrix are for the establishment of a trigger value and not for the confirmation of a smoldering event.

³The sentry line for these criteria is GEW-200, -42R, -54R, -204, -208 and -209. Please reference Figure 4, Plan View of Contingent Actions dated August 13, 2013 in the Revised Part 1.

Trigger Line 1

Trigger Line 1, which is formed by an arc connecting TMP-6, -14, -13 and -5 was approved in the Department’s letter dated July 24, 2013. A triggering event at Trigger Line 1 will be any temperature measurement greater than 200° F at any of the TMPs in the line. Any triggering event in Trigger Line 1 will trigger:

- installation of a new row of enhanced GIWs or an enhanced GIW system as detailed later in Appendix I, Preliminary Cooling Point Design and
- the North Phase Enhanced Gas Collection and Control System (GCCS) including the EVOH capping system over phase 1A.

Additionally, in a letter dated August 27, 2013, the Department stated, “As proposed by Republic Services in the submitted Contingency Plan – Part 2, the Department concurs that placement of TMP-26, -27, and -28 will provide improved coverage in this area.” The Department referred to these TMPs as TMP-26, -27 and -28 as detailed on the attached plan sheet which uses this numbering scheme (See Attachment 1). Republic may use any numbering scheme they find acceptable for these additional TMPs, however, the TMP locations will need to match those as shown on the plan sheet.

Data evaluation shows that TMP-13 and -5 have thermocouples or wiring that is not functioning as designed at certain depths. TMPs in Trigger Line 1 and TMP-1, -2, -3 and -4 which have components that fail from the ground’s surface to the depth or elevation detailed in Table 2 are required to be reinstalled to ensure adequate coverage of the trigger line and to assist in evaluation of the cooling points planned for installation near TMP-1, -2, -3 and -4. However, consideration may be given regarding immediate replacement of a TMP if only a single thermocouple fails. This consideration would be based on: 1) the failed thermocouple was not approaching a trigger level when it failed and 2) all remaining thermocouples within that TMP continue to function properly.

Table 2
Temperature Monitoring Probe Depth and Elevation

TMP ID	DEPTH	ELEVATION	Comments
TMP-1	138	331.2174	
TMP-2	180	308.3816	
TMP-3	190	310	
TMP-4	48	452	
TMP-5	180	322.6242	
TMP-6	195	292.2198	
TMP-13	189	310.664	
TMP-14	181	316.747	
New TMP-26			Depth of these TMPs is likely to be limited by their proximity to the quarry sidewalls.
New TMP-27			
New TMP-28			

Trigger Line 2 and Defined Trigger Areas

Republic’s initial Part 1 submission included three (3) trigger lines. The Department found Trigger Line 3 to be unacceptable as it was placed at approximately the mid-point of the

North Quarry. The Department suggested that Trigger Line 2 at the existing line formed by TMP-1, -2, -3 and -4 which is located at the northern end of the “neck” area might prove too close to the enhanced GIWs or cooling point system to provide for an accurate evaluation of effectiveness. Republic agreed to relocate Trigger Line 2. As discussed in Revised Part 1, Republic suggested the use of GEW data instead of TMPs from within a specified area using the same triggering criteria contained in Table 1. Please reference Figure 4, Plan View of Contingent Actions dated August 13, 2013, in the Revised Part 1.

Republic and the Department have discussed the placement of Trigger Line 2. As a result of this discussion, a line was drawn in the North Quarry between existing GEW-42R, -54R and proposed GEW-200, -204, -208 and -209 as currently detailed on Sheet 1 below. The trigger area lies between the line, formed by the arc of GEWs -200, -42R, -54R, -204, -208 and -209, and the proposed southern edge of the North Quarry Cap Part 1A as detailed on Sheet 1 below. Any GEW located within that area with a confirmed exceedence of the trigger criteria in Table 1 will require the following contingent actions:

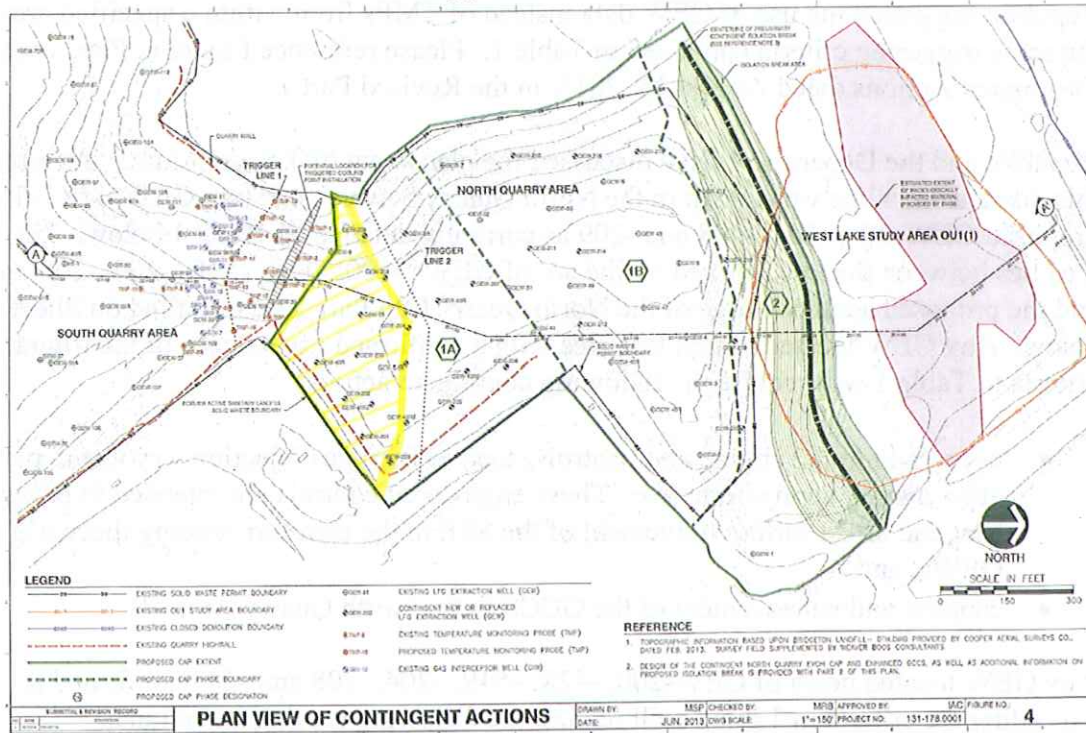
- use of additional engineered controls, such as inert gas injection, cryogenic pellets or other agreed upon alternative. These engineered controls are intended to reduce the heat and arrest further movement of the SSE in the area surrounding those triggering GEWs; and
- capping and enhancement of the GCCS in the North Quarry Area 1B.

Any GEW located north of GEW-200, -42R, -54R, -204, -208 and -209 confirmed as exceeding the criteria in Table 1 will require the following contingent actions:

- installation of the isolation barrier; and
- capping of North Quarry Area 2.

The placement of Trigger Line 2 is acceptable to the Department. Per the contingency plan requirements, additional GEWs are to be installed in the North Quarry Area 1A if trigger criteria are exceeded in Trigger Line 1. As the Area 1A GEWs help complete Trigger Line 2, it is essential that they be installed timely to provide adequate spacial coverage.

**Sheet 1
Trigger Line 2 Location**



Note: GEWs in the yellow area exceeding the criteria in Table 1 require additional engineered controls and capping and enhancement of the GCCS in the North Quarry Area - 1B. Any GEW located north of GEW-200, -42R, -54R, -204, -208 and -209 and confirmed as exceeding the criteria in Table 1 require installation of the isolation barrier and capping of North Quarry Area 2.

Please review the following comments and respond accordingly before re-submitting.

COMMENTS ON REVISED PART 1

General:

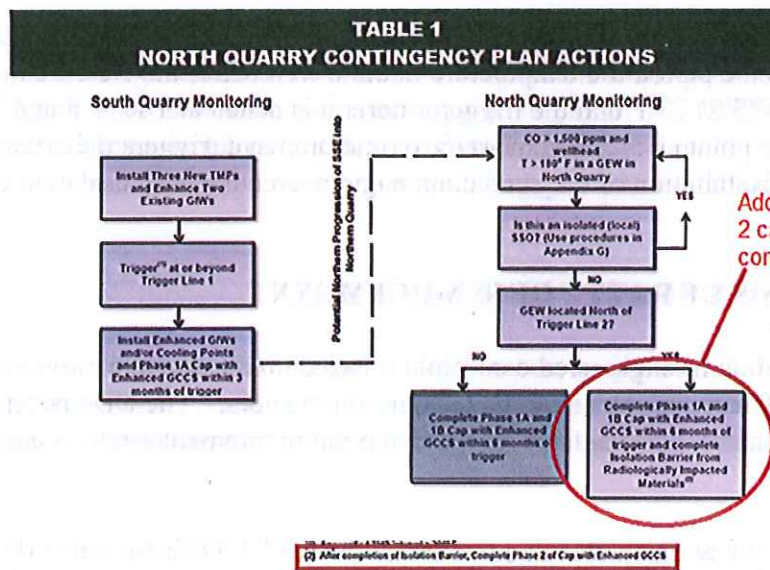
1. Republic should continue to research, evaluate and test other alternatives for mitigating the SSE heating front including, but not limited to, inert gas injection or cryogenic pellets as potential “hot” spot treatments for the North Quarry.
2. The requirements in the Department’s July 24, 2013, comment letter to contact the Engineering Section Chief is to provide the Department with sufficient time to prepare for and an opportunity to observe Republic’s confirmation and verification procedures which are set to occur within a day or so of a triggering event and to allow for the Department to conduct independent verification, if needed.
3. Section 5.3 states that conditions will be monitored in the entire North Quarry area using gas wellhead temperature and carbon monoxide (CO) values, as appropriate. If any gas extraction well exhibits a well head temperature above 145° F, then monthly CO laboratory testing and weekly Draeger Tube® testing will be performed on that gas well.

The procedures for use and the accuracy range and specifications for the Draeger Tubes® need to be provided for review and comment. Below is a table of Draeger Tubes® with measuring ranges known to us. The one with an acceptable range has been highlighted in yellow and marked with a ☆.

Draeger-Tube®	Measuring Range:
Carbon Monoxide 2/a	Measuring Range: 2 - 300 ppm
Carbon Monoxide 5/c	Measuring Range: 5 - 700 ppm (SEI Certified)
Carbon Monoxide 8/a	Measuring Range: 8 - 150 ppm
☆ Carbon Monoxide 10/b	Measuring Range: 10 - 3,000 ppm
Carbon Monoxide 0.3%/b	Measuring Range: 0.3 - 7 Vol%

- Table 1 of the Revised Plan 1, needs to explicitly state in the applicable box that part 2 of the cap will be installed in addition to 1A and 1B upon completion of the isolation barrier construction.

Mark-up of Table 1 from the Revised Plan 1



- Figure 4, Resubmittal of Plan View of Contingent Actions, dated August 13, 2013, details the proposed North Quarry GCCS enhancements. During our review, it appeared the North Quarry GCCS design has areas where gaps in well coverage may exist. Republic will need to review and provide the calculations used for the proposed design to ensure spacing and radius of influence is adequate given conditions that may exist if the North Quarry is impacted by the SSE. Regarding the vertical design of GEWs, additional GEWs will need to be installed to within 15 feet of the bottom of the landfill unless justification is provided for a different depth.

APPENDIX E: DATA CORRELATIONS AND TRIGGER ASSESSMENTS

The Department has provided in Table 1 the trigger criteria acceptable for use in determining advancement of the SSE towards the North Quarry. While the information contained in Appendix E yields data useful to Bridgeton Landfill, the Department's need is to determine the northern progression of the SSE which will result in construction or installation of engineered controls. Specifically, predictive indicators of movement towards the north are being used.

APPENDIX F: VERIFICATION PROCEDURES OF TMP MEASUREMENTS

From review of data provided on a weekly and monthly basis, it appears the Omega switches used on the temperature monitoring probes (TMPs) have been problematic and may have resulted in variable readings. As some of these TMPs will serve as a triggering element, use of an enhanced system for logging temperature readings from the TMPs is needed.

APPENDIX G: STANDARD OPERATING PROCEDURES FOR MANAGEMENT OF A LOCAL SUBSURFACE OXIDATION EVENT

Pursuant to Appendix G, the facility has the opportunity to adjust the GCCS and take other mitigative actions between the period the temperature in the well reaches the New Source Performance Standard (NSPS) 131° F and the trigger criteria is reached at 180° F and 1,500 ppm carbon monoxide. At the point an isolated subsurface oxidation event triggers the criteria in Table 1, construction or installation of the agreed upon engineered controls based on the location of the event is required.

APPENDIX H: ANALYSIS OF RATE OF SSE MOVEMENT

The calculation for installation of engineered controls is based on the average movement since January 31, 2013, of 0.49 feet per day using three (3) northern vectors. The Department requires the rate of movement to be calculated on the maximum movement rate to ensure an adequate factor of safety.

A NE vector movement rate was calculated at a maximum rate of 1.77 feet per day (between March 20th and April 15th, 2013) in the South Quarry. Since the gas interceptor wells (GIWs) were activated the maximum movement rate has slowed to 0.87 feet per day (between May 13th and June 21st, 2013). Without additional settlement data being provided since June 21st and with the potential for the reaction accelerating once outside the radius of the GIWs, northward movement of the reaction could increase through the balance of the neck. The Department for planning purposes and to ensure an adequate factor of safety requires use of a reaction rate of movement of 2 feet per day, as the potential rate, once outside the confluence of the engineered controls in the 'neck' based on the data provided.

As stated in our July 24, 2013, comment letter, the Department is concerned whether adequate time exists, given landfill conditions in the neck, for installation of the cooling point system and the system becoming operational and achieving the desired temperature before the SSE reaches the system. Please provide verification and the calculations and assumptions used to show the

proposed installation and operational timeframes are achievable using the movement rate established by the Department.

APPENDIX I: PRELIMINARY COOLING POINT DESIGN

Upon review of the included information and calculations on the proposed cooling point system, we find additional details are needed before approval can be given. This system is an acceptable alternative to the Department for the additional, enhanced GIWs contemplated in the First Agreed Order.

Please provide the following:

1. The current plan indicates the design of the cooling points has yet to be finalized. We understand Republic will be implementing the cooling point strategy in two phases:
 - Phase 1 – involves short term enhancements to existing infrastructure, basically two to three GIWs or GEWs and installation of a few of the stand-alone cooling pipe units to allow for data collection and a determination of the most effective use of the components.
 - Phase 2 – will be a shelf-ready plan for installation, should Trigger Line 1 be triggered. For Contingency Planning purposes, the plan needs to be a detailed cooling point design for uniform implementation that has already been reviewed and approved by the Department before a triggering event occurs. Our review noted the balance of the submittal does not provide a specific number of wells and spacing, radius of influence, and heat extraction, but rather provides a theoretical spacing and number of wells to be used. Republic should complete the design plan by identifying the numbers and types of wells or points to be used or a combination of the two types, spacing of the wells/points, amount of heat to be extracted, radius of influence, construction details for both, and the theoretical calculations proposed for the design as a whole to be readily implementable.
 - Upon conclusion of Phase 1 and completion of data analysis, should any changes need to be made to the detailed cooling design plan (Phase 2) in the North Quarry Contingency Plan, these changes may be completed through the routine modification process. This process allows the Department an opportunity to review and approve changes in the Phase 2 design based upon the data analysis provided.
 - We understand the design plan for the wells and the cooling points may be further developed. In your plan, you explain this design may be used in additional applications where it may prove more effective, such as to mitigate localized hot spots. Once a decision is made for use in other applications, please notify the Department through the routine modification process of these additional applications.
 - Should Phase 2 require implementation prior to completion of Phase 1, the Department understands that field modifications may be necessary to allow for adjustments in the amount of space between cooling points and the total number of cooling points installed. Should such implementation be required, the Department's expectation is that documentation will be submitted within 60 days of completion and will include as-built drawings and explanations for the field modifications.

2. Cooling point designs

(1. Cooling points – hammered/drilled coaxial pipe and 2. U-tube style in GIWs/GEWs)

- While there are two distinct designs for cooling points, only one equation was provided for determining heat conduction for both systems. Given the similarity to geothermal energy wells and differences in the cooling point designs, please explain why an adjustment/modification would not be needed in the equation for the two systems. Additionally, please explain how thermal resistivity of the pipe and U-tube is being accounted for in the equation(s).
- The submittal provides only the equation and results. Please provide detailed supporting calculations, assumptions, and hand-calculations, references, equations, etc. used to obtain the results and related designs.
- The Department does not believe that assumed steady state conditions are present, at a minimum, in the area of the landfill near the SSE. Please explain how transient heat transfer from the SSE is accounted for in the equation used for determining the amount of heat extracted by the cooling point.
- The proposed GIW/GEW U-tube enhanced design assumes saturated conditions within the well casing will act as a better conductor of heat transfer. Explain how the system will continue to operate effectively if saturated conditions are not maintained, e.g., the liquid begins to evaporate or the waste density becomes altered due to the advancement of the heat front/reaction. Also, provide calculations on the reduction in gas flow if the liquid level rises in the GIW to submerge the U-tube.
- As stated, the temperature gradient calculation is determined by the warmest 60 feet of each TMP (three consecutive thermocouples) in March. Using data from March 12, 2013, TMP-8 and 7R averaged 259.6° F (243.3° F [100'], 249.8° F [120'], 285.7° F [140']) and 176.5° F (174.6° F [80'], 177.3° F [100'], 177.6° F [120']), respectively. The change in temperature over the distance as noted is 42 feet and equals a gradient of approximately 1.98° F/foot. Explain how the stated heat gradient of 0.84° F/foot was obtained and provide the supporting work and hand calculations to show the determination.
- Please explain and provide the supporting calculations for the radius of influence on each of the cooling point designs. We noted the 4" diameter cooling point is shown with a radius of influence of 6 feet while the 6" diameter cooling point is shown with a radius of influence of 6½ feet. Please explain and provide the work and calculations that were used to produce these radiuses of influence. Is the heat extraction assumed to be constant and uniform over each radius of influence?
- State if the heat flux evaluation is dependent on the existing temperatures of the heat front or the temperatures of the reaction. In addition, please explain if the flux is the average temperatures across the reaction or the maximum potential of the reaction.
- In our review, we did not see a clear explanation as to the amount of time it will take for the full radius of influence to develop once the cooling point system becomes operational. Please provide the equation, result and associated work and calculations used to determine the number of days from the system becoming operational until the radius of influence stated in the submitted plan is achieved and the amount of heat extracted over the radius of influence.

- Although Attachment C includes manufacturer's specifications for certain types of cooling systems, it is important that the system have a large enough capacity and flow rate to allow for additional cooling points should the proposed design not be as efficient as designed or the SSE becomes larger and hotter than currently assumed. Please provide information on the number of cooling points planned and the number that can be supported by the cooling system planned to be purchased.
- While confirmatory data is not available from use of this system at another facility experiencing an SSE, Republic is approved to install the U-tube cooling mechanism in GIW-9, -10 and -11 and some of the hammered coaxial pipe mechanisms between the referenced GIWs. This will allow for evaluation of the effectiveness of the cooling point system. Please explicitly state how the short term enhancements will be evaluated (i.e. existing infrastructure, etc.) and what measurements will be used to demonstrate the system's effectiveness.
- Please quantify the heat removal capacity of the GIWs and how much enhancement is made through the cooling point design.

CONTINGENCY PLAN -- PART 2

Section 17 of the First Agreed Order requires the following in regard to Part 2:

- i.) Future work plans will be reviewed and signed by a professional engineer licensed in the State of Missouri, or other qualified professionals, as detailed in Exhibit B of the First Agreed Order;
- ii.) Bridgeton Landfill will not undertake any of the work proposed in the work plan or any other future work plans until approved by the Department;
- iii.) The "North Quarry Contingency Plan," will be submitted to the Department in two parts in accordance with the timing set forth in Section 22; and
- iv.) The plan will, at a minimum, address those items referenced in Section 22 of the First Agreed Order.

Section 22.A. of the First Agreed Order states the following will be addressed in Part 2:

Within seventy-five days of entry of this Agreed Order, Bridgeton Landfill shall submit Part 2 which shall include:

- i) Construction Plans for the installation of additional interceptor wells in the North Quarry, if triggered;
- ii) Construction Plans for installation of an EVOH geomembrane cap over the North Quarry, if triggered;
- iii) Establishment of trigger criteria for an isolation break between the North Quarry and the radiological materials contained in West Lake Landfill Site OU-1, along with a schedule for such break, if triggered.

Please review the following comments and respond accordingly before re-submitting.

CONTINGENT GAS INTERCEPTOR WELLS (GIWs)

APPENDIX A: INSTALLATION PLAN FOR CONTINGENT GAS INTERCEPTOR WELLS (GIWs)

The use of a proposed third line of GIWs has been replaced in Revised Part 1 to incorporate use of a cooling point system. (See above for comments on this system). Appendix A will need to be revised to reflect the modifications as described in the Revised Part 1 or as discussed with the Department.

TEMPERATURE MONITORING PROBES (TMPs)

APPENDIX B: INSTALLATION PLAN FOR CONTINGENT TEMPERATURE MONITORING PROBES (TMPs)

TMPs planned for installation along Trigger Line 2 have been eliminated. Please revise to reflect the most up to date information. Appendix B will need to be revised to reflect the modifications as described in the Revised Part 1 or as discussed with Department staff. The balance of the comments on this Appendix B will relate to technical aspects of the probes.

1. Republic staff and contractors have stated that Temperature Monitoring Probes (TMPs) have a limited operational lifetime.
2. Any TMPs incorporated into Trigger Line 1 as well as TMP-1, -2, -3 and -4 which have components that fail from the ground's surface to the depth or elevation shown in Table 2 are required to be reinstalled to ensure adequate coverage of the trigger line and for evaluation of the cooling points planned for installation near TMP-1, -2, -3 and -4.
3. Due to operational issues with TMPs and given the value of the data provided by the TMPs, Republic should reconsider the construction design based on site specific conditions and experience gained at other landfills experiencing SSEs. We suggest incorporating alternating sand layers between the grouted thermocouple layers to help with durability and limit wire stress to extend the operational life cycle of the TMP.
4. Explain what steps are planned for installation of all future TMPs to minimize resistance. Resistance has been given as the reason for the majority of the readings not being provided on certain thermocouples or an entire TMP.
5. Section 1.3 indicates the thermocouples will be installed as the casing is removed, while Section 1.4 appears to imply that the thermocouples will be installed as the drill rod is removed. Please clarify the procedure and whether the drill tip is sacrificed during the installation.

**APPENDIX C: CONSTRUCTION PLAN FOR CONTINGENT NORTH QUARRY
TEMPORARY CAP AND ENHANCED GAS MANAGEMENT
SYSTEM**

**Appendix B - Construction Plans for North Quarry – EVOH Geomembrane Cap and
Cap Integrity System**

1. The “Installation schedule” for this Appendix C is missing from the submittal and needs to be submitted to the Department for review. Also, note the Table of Contents for Appendix C lists section 4 and 4.1 as the “Installation schedule” and shows an “Error! Bookmark not defined” related to the section. As a result of Section 4 being missing, Sections 5 and 6 have moved forward one section and are misnumbered when compared to the Table of Contents.
2. As stated in our July 24, 2013, comment letter in order to address public nuisance issues, the Department has the right to require installation of the North Quarry cap sooner should odors again increase and be attributable to landfill fugitive emissions coming from the existing earthen cap.
3. The approved South Quarry Capping Plan Construction Quality Control and Surveying Section (the equivalent of Section 4) provided settlement in the South Quarry is to be monitored on a monthly basis. Section 4 of the North Quarry Cap Integrity System omitted this provision. The monthly monitoring method is to be used in the North Quarry. Additionally, gas well temperature monitoring is required on at least a monthly basis and carbon monoxide readings as agreed to with the Department to track the advancement of the SSE.
4. The Department’s request in Comment 4 from the July 24, 2013, letter as follows requires response “Due to the continuing nature of the SSE, Republic Services must provide an evaluation of the current on-site soil resources and the logistical plans that are in place to ensure timely application of those soils to an SSE outbreak, if one were to occur.” Work on the site during the South Quarry capping was stated as using a significant amount of soil. The Department needs to know that sufficient soil resources remain on-site and available should an SSE outbreak occur. Given the characteristics of an SSE, we need to know that an area containing soil and the volume immediately available is identified to allow the facility to take appropriate mitigative actions should an incident occur without delay and that such information is kept up-to-date as part of the Contingency Plan.
5. Section 4.1 states that a “detailed construction quality assurance/quality control” plan has been prepared in a separate document. However, that document was not a part of the submittal. The QA/QC plan needs to be submitted for Department review.
6. Section 5.1 states an Operations Maintenance & Monitoring Plan will be prepared under a separate cover. As a reminder, the "Final Operations Maintenance and Monitoring Plan Manual" pursuant to Section 17.C of the First Agreed Order is required to be

submitted within forty-five days (i.e., September 20) of completion of the work under the "Ethylene Vinyl Alcohol (EVOH) Capping Plan for South Quarry." Should the North Quarry Capping System and GCCS enhancement be triggered the Operations Maintenance & Monitoring Plan sections specific to the North Quarry will need to be updated to include any additional site specific issues such as items related to construction and maintenance of the isolation barrier, etc.

7. Plan sheet 1 indicates a proposed relocation of Outfall 001. Any outfall modifications need to be submitted and approved by the Department's Water Protection Program.
8. Plan sheet 1 shows the solid waste boundary. As clarification, please be aware that the identified boundary is the solid waste boundary for permit number 0118912. Permit number 0118906 was issued on January 22, 1979, and encompasses part of the North Quarry as well as the area to the northwest of the 0118912 permit.
9. Plan sheet 1a does not indicate existing "black" HDPE layer locations within the South Quarry. Due to the recent decision to cap these areas with EVOH liner, please indicate the proposed locations of the new liner on all applicable sheets.
10. Plan sheets 3 and 4B do not indicate subgrade strip drains for the area on 1B adjoining phase 2. Explain why this location is not incorporated into the proposed design or include these features on the applicable plan sheets.
11. On plan sheet 6, please clarify if Note 3 references the "North" or "South" Quarry and verify the amount of wellhead risers stated in the legend. In addition, include an explanation as to why the Air & Force Main (A&FM) is not connected to PS-27 or CS-1, or include these features on the applicable plan sheets.
12. Plan sheet 7 shows the existing channel of the proposed northeast detention pond will discharge to and reach Outfall 004. In addition, explain why the channels within N1B-N2 and N1B-E only have 0.08% and 0.02% channel slopes, respectively. Additionally, the subarea naming on the map requires review to ensure the naming is consistent with the subareas listed on the table. As needed, please revise any discrepancies, such as including Subarea NW-NW2, which does not currently appear to be listed on the map.
13. The Perimeter Sump Schedule for the North Quarry is missing from the submittal. Plan sheet 8 appears to include the Perimeter Sump Schedule for the South Quarry.
14. Plan sheet 11, detail 7, states a portion of the isolation barrier backfill will be re-compacted spoil initially excavated during the trenching process. All excavated spoil material must be managed properly by an active permitted facility unless demonstrated to be uncontaminated clean-fill.

Appendix C: Landfill Gas Collection and Control System (GCCS) Evaluation

1. The Table of Contents does not include an Appendix D, however a title page for Appendix D: Proposed Wellfield Modifications is included between Appendices B and C,

but does not contain any information. Modify to either include any wellfield modifications or this page may be removed from future submittals.

2. Section 5 recommends if the SSE moves into the North Quarry, that the GCCS be enhanced, in part by, replacing well pumps, header lines, flare modifications, etc. or adding new GEWs. It appears these replacements and modifications would be triggered by Trigger Line 1. However, some of these replacements and modifications appear to be routine maintenance that should be occurring (i.e., replacements of GEWs 8, 40-43, 53-55). Which replacements and modifications fall outside the category of routine maintenance and are properly categorized as enhancements to the GCCS?
3. Section 3.2.2 describes how the estimate for gas production in the North Quarry when impacted by the SSE was developed using a ratio for the current condition in the South Quarry. Please state and provide a professional opinion that the current production and/or collection of gas in the South Quarry is either at or already past its peak generation. This explanation must include, at a minimum, the reasons why gas production will not continue to increase in the South Quarry.

Appendix A: Wellfield Data

1. There appear to be differences between the as-builts provided and the proposed design plans. Can you provide clarification on the wellfield table data presented in the submittal explaining how these results were calculated or determined and why, in principle, the measured existing conditions of these wells differ from the approved construction detail documents (e.g., wells measure refuse depths farther than the recorded boring depths, measured more perforated pipe than installed, etc.). Additionally, provide the status of each well -- whether any of the wells have already been impacted or compromised by effects of the SSE, e.g., steam, pressure, increased leachate, etc., and establish a schedule for repair or replacement, if deemed necessary.
2. Due to concerns related to the overdraw of the GCCS during an SSE and given well issues have been noted and/or resolved, the SWMP must be immediately notified when higher oxygen values (> 5% by volume) are determined to exist within the North Quarry wellfield. Our July 3, 2013, letter, set forth that due to the ongoing SSE, the oxygen levels in all the GEWs must be minimized (less than one percent by volume). In addition, please revise your color coordination system to reflect the values submitted (i.e., oxygen column) which does not appear to be consistent.
3. Section 3.2.1 states that the wellfield data indicates typical LFG constituent concentrations and does not indicate the presence of an SSE. Over the past 2 years periodically, seven wells in the North Quarry have exceeded the NSPS reporting limits (GEW-1, -40, -41R, -43R, -53, -54, and -55). Additionally, there are two wells (GEW-47R and -49) that have a methane concentration less than 40%, with balance gas above 30%. These percentages are not typical and require careful monitoring.

4. Table 1 indicates that GEW-3 and GEW-46R have a water column within the well greater than 50% of the perforated screen. Please indicate when additional pumps will be installed into these two wells.
5. Please clarify why only some wells' flow data was provided for the May and June 2013 periods. Republic should provide for all wells not included in the May and June 2013 data, a listing of when the well flows were last taken and a specific date for future reporting.

Appendix B: LandGem Models

1. The narrative indicated the North Quarry began accepting waste in 1955 and this date was used in the LandGEM for calculations; however, Appendix E, Gamma Cone Penetration Test Health and Safety Plan stated the North Quarry area began filling in 1974, contradicting the models. The 1974 estimation is supported by the earliest permitted waste areas near the North Quarry which began in 1976. In addition, the South Quarry would have begun accepting waste around 1985, not 1955 as used in the models.
2. The LandGEM Emissions Models for the North and South Quarries do not accurately portray actual conditions. The mean average of waste accepted appears to be incorrect, which is supported by the Waste Tonnage reports submitted to the SWMP for the South Quarry which documented that waste accepted consistently increased from 1996 through 2001, which eclipsed 1.1 million tons in 2001. A linear progression model would be more accurate.
3. Revise the LandGEM Emissions Model graphs (Cubic Meters per Year and User Specified Unit) to show methane curves for the North and South Quarries.
4. The LandGEM models will need to be recalculated in order to verify the current and proposed North Quarry GCCS and facility flare capacity is sufficient to maintain current and future conditions, with and without the presence of an SSE in the North Quarry.

Appendix C: Construction Plan for Contingent North Quarry Enhanced GCCS

1. The plan sheet legends and symbols need to be modified to clearly differentiate landfill infrastructure, such as PEWs, GEWs, and PEW and/or GEW Combo.
2. A Well Schedule for the proposed extraction wells for the Enhanced North Quarry GCCS, as noted in Detail 1 on Sheet 3 was provided. Well depths were limited to 100 feet while the North Quarry is much deeper. GCCS wells are routinely installed to within 15 feet of the bottom of the landfill, please explain why the depth of the wells is limited to 100 feet.

Appendix D: Stormwater Management Design Report

1. Please clarify by explaining how the basin detention times were calculated within the narrative's Tables. The Department is under the impression the indicated detention times represent the time span between peak inflow and peak outflow, and not the time elapsed for a basin to discharge when it is at the event calculated peak capacity.
2. Section 3 states that contingency plans for on-site management of stormwater which comes in contact with waste are available. These plans need to be provided for review by the Department. Additional stormwater management plan(s) will need to be submitted to the Department for review to accommodate the potential time span that waste may be uncovered due to the excavation of the isolation barrier.
3. The North Quarry south drainage area incorporates the previously approved and capped South Quarry north drainage area within the calculations as they both discharge to the existing North Detention Basin. Please explain why the South Quarry north drainage area decreased from 5.76 acres in the South Quarry plan to 3.95 acres in the North Quarry plan. In addition, please explain why the southwest detention basin increased in capacity.
4. The North Quarry west drainage area will discharge in the southwest detention basin and Outfall 003. However, the calculations did not show the added runoff from the west drainage area flowing through the existing South Quarry west area channels. Please verify that the increased runoff will not overflow these existing channels.
5. Please review the entire plan (i.e., narrative, plan sheets, calculation results) and revise minor discrepancies, such as incorrect naming of areas and nodes, reaches or culverts shown on the plan sheets that are not used in HydroCAD or vice versa, etc.

APPENDICES D AND E: ISOLATION BARRIER SCHEDULE AND GCPT WORK PLAN AND GCPT HEALTH AND SAFETY PLAN

Section 4.0 Preliminary Plan for Contingent Isolation Barrier and Appendices D and E of Part 2 were commented on separately in the letter dated August 20, 2013. This information was separated from the Contingency Plan for the expedited review, approval and start of the GCPT Work Plan.

APPENDIX F: BIRD MITIGATION PLAN

1. As stated, a specific bird hazard and mitigation plan will be prepared and submitted for review in conjunction with the design and construction details of the Isolation Break Design Plan. The existing measures and plan provided are adequate for the potential of installing the GCCS expansion and cap related activities in the North Quarry, if triggered.

2. A separate review and comments were provided on the bird hazard and mitigation plan on August 28, 2013, by officials of Lambert-St. Louis International Airport and their concerns, if any, will need to be addressed to allow for approval of this plan.

OVERALL COMMENTS

1. This submittal was posted on an FTP site. When downloaded and printed, numerous sections had alpha and special characters missing; this makes review and reading the documents difficult. For future submissions, the Department is requiring 2 hard copies be submitted as well as an electronic copy on an FTP site. The hard copies will need to be in our office within 3 working days of the submittal/resubmittal being posted on the FTP site. In addition, for resubmittals, please provide a red lined version showing all changes clearly marked within the document to expedite the review process.
2. Please ensure all your engineering consultants are provided with the same information detailing the locations of the wells, TMPS and GIWs, as well as any other infrastructure on site. Currently, wells and other landfill infrastructure at the facility appear to move from one consultant's submittal to the next making review unnecessarily difficult.

Please resubmit a revised Contingency Plan - Part 1 and 2 signed and sealed by a professional engineer registered in the state of Missouri within 20 days of receipt of this comment letter per Section 11 of the First Agreed Order. If the revised Contingency Plan is submitted using an FTP site, please provide an original sealed document, a complete copy, and an unsealed redlined version sent to the Department's Solid Waste Management Program at P.O. Box 176, Jefferson City, Missouri 65102-0176.

If you have any questions or comments regarding this letter, please contact me at (573) 526-3940.

Sincerely,

SOLID WASTE MANAGEMENT PROGRAM



Charlene S. Fitch, P.E.
Chief, Engineering Section

CSF:brjbl

Attachments

- c: Peter Carey, P.E., P.J. Carey & Associates, P.C
Michael Beaudoin, P.E., Civil & Environmental Consultants, Inc.
Ms. Laura Yates, St. Louis County Department of Health
Mr. Larry Lehman, Chief, Compliance/Enforcement Section, SWMP
Ms. Brenda Ardrey, Chief, Operations Section, SWMP
St. Louis Regional Office via Electronic Shared File