

STATE OF MISSOURI  
**DEPARTMENT OF NATURAL RESOURCES**

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

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September 27, 2016

Mr. Bradley Vann, Project Manager  
Superfund Division  
United States Environmental Protection Agency, Region 7  
11201 Renner Boulevard  
Lenexa, KS 66219

**RE: Corrective Action Measures: Inert Gas Injection Work Plan for Hot Spot Remediation**

Dear Mr. Vann:

The Missouri Department of Natural Resources' Federal Facilities Section, in coordination with the Solid Waste Management Program, has completed its review of the document titled: "Corrective Action Measures: Inert Gas Injection Work Plan for Hot Spot Remediation," revision dated August 5, 2016. Thank you for giving us the opportunity to review and comment on the work plan.

If you have any questions pertaining to these comments, please contact Mr. Seabaugh by phone at (573) 751-8628, or by written correspondence at P.O. Box 176, Jefferson City, MO 65102-0176.

Sincerely,

HAZARDOUS WASTE PROGRAM



Ryan Seabaugh, P.E.  
Federal Facilities Section

SOLID WASTE MANAGEMENT PROGRAM



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

RS:rl

Enclosures: Comments on the Corrective Action Measures: Inert Gas Injection Work Plan for Hot Spot Remediation, dated August 5, 2016

c: Mr. Chris Nagel, Director, Solid Waste Management Program

**MISSOURI DEPARTMENT OF NATURAL RESOURCES**  
**Corrective Action Measures**  
**Inert Gas Injection Work Plan for Hot Spot Remediation**  
**Comments**

**General Comment:**

1. Overall, the response to comments and draft work plan focuses on classifying an event in order to make a subjective determination on whether inert gas injection will be warranted or useful. Some examples are provided in the specific comments below. The administrative order states that the work plan will contain actions for "...use of Inert Gas Injection as a 'hot-spot' treatment option to isolate, contain, suppress, inhibit and/or extinguish any independent surface/subsurface smoldering event/fire that may occur in the "Neck" area or in the North Quarry of Bridgeton Landfill." The order also states that the Respondent shall have the necessary materials available on-Site or under agreement such that once the Work Plan has been approved by EPA, it can be implemented within seven days. All supplemental investigations or classifications are irrelevant to the scope of the order, and should not in any way interfere with the seven-day implementation of inert gas injection once triggers are exceeded.

Comment: Please re-write the document to be consistent with the order.

**Specific Comments**

**Comment to Response to Comments (Example for Comment #1)**

2. Original Comment:

*Page 2, Section 2.0: "Therefore, inert gas injection technology is not appropriate for large, deep, area-wide reactions nor for conventional landfill fires or (SSOs) deeper than approximately 40 feet."*

*EPA Comment: The work plan needs to be revised to state the maximum depth at which the inert gas injection technology will be considered for corrective action, and what technologies or actions will be implemented if a subsurface oxidation event (SSO), or other heating event is slightly or significantly deeper than this maximum effectiveness depth.*

*Other portions of the work plan suggest that inert gas injection will not be used until other methods of control are attempted and the SSO is monitored for a period of time. The EPA and the Missouri Department of Natural Resources do not agree with the inclusion of a lengthy evaluation period. Additional evaluation time may allow the SSE to substantially spread and hence potentially render inert gas injection ineffective. In accordance with the North Quarry Administrative Settlement Agreement and Order on Consent, inert gas injection should be implementable within 7-days of the identification of a trigger exceedance. The work plan must be revised to be consistent with the 7-day implementation requirement of the North Quarry Administrative Settlement Agreement and Order on Consent.*

PRP Response to Comment: The work plan has been revised to state that 40 feet is the maximum depth at which inert gas injection will be implemented. Given the requirement to implement inert gas injection within 7 days, there is not time available to evaluate the depth of the SSO. The implementation will assume an affected depth of 40 feet unless other information (e.g. TMP readings) suggests a more specific interval that is shallower than 40 feet. The work plan has been revised to describe immediate implementation of the “cover and smother” methodology and implementation of inert gas injection within 7 days. From experience, SSO’s tend to develop as a result of short-circuiting of atmospheric air up the outside of a landfill extraction well casing. SSO’s thus tend to exist between the well’s top of slots and the landfill surface. The top of slots is at or less than 40 ft below grade. Thus SSOs are typically located between the landfill surface and a maximum vertical depth of 40 feet bgs. After SSOs start, if they expand at all they expand laterally and towards the landfill surface, not deeper.

Comment to Response: Any evaluations or investigations that need to be performed should be done prior to hitting trigger values. Trigger values are to be used to implement inert gas injection within 7 days of reaching a trigger value. Please revise the work plan to be capable of implementing inert gas injection within 7 days of reaching a trigger value, as specified in the Order. (See comment #1)

## Comments to Revised Work Plan

3. Section 2.0 Inert Gas Injection Background, page 3, last two paragraphs of the section

Statement: There is a deep subsurface reaction (SSR) occurring in the south quarry portion of the Bridgeton Landfill. The SSR is a self-sustaining exothermic chemical reaction occurring at depth in saturated, anoxic waste. It is therefore and entirely different phenomenon that a typical SSO. In an SSR, the heat and pressure cause organic compounds to break down into simpler daughter products or simple carbon. Other byproducts include hydrogen gas, carbon monoxide gas, and water. Unlike the SSO, the SSR does not require free oxygen. The injection of carbon dioxide or nitrogen will not interrupt the chemical reaction.

As noted above given the density of the waste at depth and its saturated condition, the injected inert gas will not travel substantially beyond the injection point. There are very few open interconnected pore spaces at the depth at which the SSR is occurring in the Bridgeton Landfill. Inert gas injection is not a feasible remedial action for an SSR.

Comment: The statements contained in these two paragraphs are outside the scope of the order and should be deleted. (See comment #1)

4. Previous Work Plan Statement, Section 3.0 Response to Trigger Value Exceedances/ Determining the Type of Event, page 3:

*“These trigger values are not, in and of themselves, sufficient to determine whether an SSO is present in the vicinity of the gas extraction well or TMP where they were recorded. As described below, inert gas injection is not appropriate as an initial remedial action for an SSO. The following protocol will be followed to determine whether an SSO is present. If an SSO is present, the*

*initial remedial measures will be implemented. If the initial remedial measures are not effective, inert gas injection will be implemented.*

*Previous DNR Comment: The bulleted list should be part of daily physical monitoring, and remedial measures should be taken prior to exceeding the trigger values. The basis for the conclusions drawn in this statement is questionable, and the action steps do not match the intent of implementation of inert gas injection. The administrative order requires inert gas injection to begin within 7 days of the exceedance of the triggers. Please revise the document to be consistent with the order.*

Revised work plan statement, Section 3.0, page 3: These trigger values are not, in and of themselves, sufficient to determine whether an SSO is present in the vicinity of the gas extraction well or TMP where they were recorded. The protocol below will be followed to determine whether an SSO is present. If an SSO is present, the initial remedial measures will be implemented immediately. The process to implement inert gas injection will start within 7 days.

Comment: Daily physical monitoring and remedial measures should be taken prior to exceeding the trigger values. Classifying the event is outside the scope of the order, and should not interfere with the action steps to begin inert gas injection within seven days of a trigger exceedance. (See comment #1)

5. Section 3.0 Response to Trigger Value Exceedances/ Determining the Type of Event, page 3: “The protocol below will be followed to determine whether an SSO is present.”

Comment: Determining the type of event is outside the scope of the order (See comment #1). Delete or cite a direct reference.

6. Section 3.0 Response to Trigger Value Exceedances/ Determining the Type of Event, Page 3 and 4:

Statement: “If an SSO is present, the initial remedial measures will be implemented immediately. The process to implement inert gas injection will start within 7 days.”

Statement: “If symptoms of an SSO are present, the process of inert gas injection will be implemented.”

Comment: These comments are vague and appear inconsistent with each other, and classification of an event is outside of the order. All verbiage describing implementation of the work plan should be reviewed and revised to be clear and consistent with both the Order, and an appropriate Decision Tree. (See comment 1)

7. Section 4.1 Identification of Affected Area, Page 4: “The affected area must be delineated in order to design an effective injection plan. The Bridgeton Landfill, LLC Environmental Manager, the MDNR, and US EPA will actively collaborate to verify that the trigger exceedance(s) and/or symptoms are the result of an SSO event. Such determination will be made within seven days of the notification of the MDNR and US EPA or a trigger value

exceedance. Bridgeton Landfill, LLC will immediately begin to implement its standard procedures to remediate an SSO as described in Appendix A, Bridgeton Landfill SOP, Section 17, Subsurface Oxidation Events.”

Comment: Classification of an event is outside the scope of the order, and should not interfere with action steps needed to inject inert gas within seven days of a trigger exceedance. Please revise this statement to be consistent with the order (see comment #1)

8. Section 4.1 Identification of Affected Area, Page 4: “The affected area must be delineated in order to design an effective injection plan. The Bridgeton Landfill, LLC Environmental Manager, the MDNR, and US EPA will actively collaborate to verify that the trigger exceedance(s) and/or symptoms are the result of an SSO event. Such determination will be made within seven days of the notification of the MDNR and US EPA or a trigger value exceedance. Bridgeton Landfill, LLC will immediately begin to implement its standard procedures to remediate an SSO as described in Appendix A, Bridgeton Landfill SOP, Section 17, Subsurface Oxidation Events.”

Comment: Please clarify whether the cited “Bridgeton Landfill SOP” is part of a regulatory approved document or an internal document, or delete the sentence that the reference is contained in (See comment #1).

9. Section 4.1.1. Surface Observations, page 4: The bulleted list is inconsistent with the referenced SOP in section 17.1

Comment: Please revise for consistency, and add SOPs for symptoms below EVOH cover, or delete.

10. Section 4.3 Injection of Inert Gas, page 7: “A health and Safety Plan will be prepared to cover inert gas injection activities and will be attached to this work plan prior to implementation.”

Comment: Please cite an existing, valid health and safety plan.

11. Section 5.0 Schedule, page 9: “Once Bridgeton decides to implement inert gas injection to remediate an SSO, ...”

Comment: Delete

12. Figure 1. Decision Tree:

Comment: The Decision Tree is not consistent with the order (see comment #1) Please revise to be consistent with the order.

13. Appendix A, Section 17: “GCCS”

Comment: Please identify what a GCCS is prior to introducing the abbreviation or acronym.

14. Appendix A, Section 17.7: “Site personnel or the OM&M Provider should visually monitor the area of the suspected SSO at least once per day...”

Comment: Please explain “OM&M Provider”

15. Appendix A, Section 17.7 Continued Monitoring, page 17-5: “The wells in the SSO area and the adjacent wells should be monitored once per week for at least 4 months before returning to a normal monitoring schedule.

Comment: The normal monitoring schedule is daily. All wells should be monitored daily, or more as necessary.