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Subject:
Remedial Injection Work Plan
Colesville Landfill (Site No. 704010)
Broome County, New York

ENVIRONMENT

Date:
August 12, 2019

Contact:
Steven M. Feldman

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Our ref:
NY000949.0028

Dear Mr. Long:

This Remedial Injection Work Plan was prepared on behalf of the Broome County Division of Solid Waste Management for the Colesville Landfill (Site), located in Broome County, New York (Figure 1) to describe the approach for performing injections to accelerate natural biodegradation processes.

STATUS OF GROUNDWATER REMEDIATION

The remedial system consisted of seventeen (17) injections wells and three (3) recovery wells that operated from September 2002 until the last anaerobic in-situ reactive zone (IRZ) injection in May 2012. Following this period of remedial system operation, an IRZ Discontinuation Pilot Test was implemented to evaluate the feasibility of relying on natural biodegradation processes to restore groundwater quality to maximum contaminant levels (MCLs). Tracking of groundwater quality trends during the period from May 2012 through June 2018 demonstrated that natural biodegradation processes were maintaining stable to decreasing volatile organic compound concentrations. The U.S. Environmental Protection Agency (USEPA) and New York State Department of Environmental Conservation (NYSDEC) believe that, at this stage in the remedial process, performing another injection will enhance and sustain further biodegradation.

INJECTION RATIONALE AND GOALS

The purpose of the anaerobic IRZ injection is to drive groundwater geochemistry to more highly anaerobic conditions to facilitate enhanced reductive

dechlorination of VOCs, particularly chlorinated ethenes, near the landfill perimeter in areas of historic higher concentrations. Chlorinated ethanes are primarily degrading further downgradient of the anaerobic IRZ because they more readily degrade in an aerobic environment, as evidenced by the decreasing trends of contaminants of concern (COCs) observed at PW-5, GMPW-5, and PW-4. The goal of the injection strategy is to enhance anaerobic conditions to assess whether reductive dechlorination processes can be accelerated at this point in the remedial lifecycle.

OVERVIEW OF APPROACH

Molasses solution will be gravity fed into the subsurface utilizing eleven (11) injection wells (PW-6, GMMW-1, and IW-1 through IW-9). Injection well construction details are provided in Table 1. The solution strength will be 4% molasses by volume. Injection wells GMMW-1, IW-4, IW-5 and IW-6 will receive higher injection volumes to target the elevated total COC concentrations at GMMW-5 (76.6 ppb) and GMMW-6 (190 ppb). Injection volumes to individual wells may be field adjusted depending on the ability of the wells to receive injections.

Methodology

Injections will be completed in the following manner:

- The injection wells will be inspected, sounded, and silt will be removed prior to the injection where piping configuration in individual wells allows.
- Delivery of water used for the injection will be from a potable source.
- Injections will be performed via gravity feed.
- The molasses solution will be mixed in a portable aboveground mixing tank.
- Injection will be conducted in up to eleven (11) wells simultaneously.
- Flow and volume into each injection will be monitored and recorded.
- Nearby monitoring wells and/or injection wells will be occasionally monitored (baseline and 2 additional measurements per day) for water level elevation, pH and conductivity.
- Once the injection event has been completed, all mixing tanks will be rinsed out with water, drained to an injection well, hoses rolled up, and equipment will be returned or stored in the treatment building.

Target Injection Volumes (4% Molasses Solution)

- PW-6: 100 gallons
- IW-3: 100 gallons
- IW-1: 100 gallons

- IW-2: 100 gallons
- GMMW-1: 650 gallons
- IW-4: 1000 gallons
- IW-5: 1000 gallons
- IW-6: 650 gallons
- IW-7: 100 gallons
- IW-8: 100 gallons
- IW-9: 100 gallons

Groundwater Monitoring

Monitoring activities have been conducted at the site pursuant to the Site Management Plan (SMP) (Broome County Division of Solid Waste Management and Arcadis 2015), which was approved by the New York State Department of Environmental Conservation (NYSDEC). Groundwater samples are collected for analysis of VOCs, field parameters and geochemical parameters as shown in Table 2.

Data Evaluation

Data collected under the SMP monitoring program will be evaluated to assess trends in VOC concentrations, inorganic parameters (i.e., electron acceptors), total organic carbon (TOC) concentrations and evidence of biodegradation end products (i.e., ethene, ethane, and methane).

GROUNDWATER CONTINGENCY PLAN

The draft Groundwater Contingency Plan is in the process of being reviewed and finalized. This Groundwater Contingency Plan will serve as a companion document to the Injection Work Plan to guide whether future injections are warranted.

We trust that this Work Plan is responsive to your request. The injections are planned to begin on August 27th, and it is anticipated that they will be completed during the week of September 2nd. Please let us know if you have any questions or comments.

Sincerely,

Arcadis of New York, Inc.



Steven M. Feldman
Associate Vice President

Copies:

George Jacob, USEPA
Laurie Haskell, Broome County

TABLES



Table 1
Injection Well Specifications
Colesville Landfill
Broome County, New York

Well Identification	Borehole Depth (ft bls)	Well Casing/Screen Diameter (inches)	Well Casing/Screen Composition	Well Total Depth (ft bls)	Screened Interval (ft bls)
Injection Wells					
PW-6	82	4/4	Sch. 40 CS/unknown	73.7	33.7 - 73.7
IW-1	70	2/2	Sch. 40 PVC/0.006 slot	70	50 - 65
IW-2	70	2/2	Sch. 40 PVC/0.006 slot	70	50 - 65
GMMW-1	68	2/2	Sch. 40 PVC/0.010 slot	63	53 - 63
IW-3	70	2/2	Sch. 40 PVC/0.010 slot	70	50 - 70
IW-4	70	2/2	Sch. 40 PVC/0.010 slot	70	50 - 70
IW-5	75	2/2	Sch. 40 PVC/0.010 slot	75	55 - 75
IW-6	75	2/2	Sch. 40 PVC/0.010 slot	75	55 - 75
IW-7	75	2/2	Sch. 40 PVC/0.010 slot	75	55 - 75
IW-8	75	2/2	Sch. 40 PVC/0.010 slot	75	55 - 75
IW-9	80	2/2	Sch. 40 PVC/0.010 slot	80	55 - 80
IW-10	80	2/2	Sch. 40 PVC/0.010 slot	80	55 - 80
IW-11	80	2/2	Sch. 40 PVC/0.010 slot	80	55 - 80
IW-12	80	2/2	Sch. 40 PVC/0.010 slot	80	55 - 80
IW-13	80	2/2	Sch. 40 PVC/0.010 slot	80	55 - 80
IW-14	80	2/2	Sch. 40 PVC/0.010 slot	80	60 - 80
IW-15	80	2/2	Sch. 40 PVC/0.010 slot	80	60 - 80

Notes and Abbreviations:

ft bls: Feet below land surface.

Sch. 40 CS: Schedule 40 carbon steel.

Sch. 40 PVC: Schedule 40 poly vinyl chloride.

Sch. 80 PVC: Schedule 80 poly vinyl chloride.

PW-6 screen slot size unknown.

Table 2
Site Management Plan Monitoring Program
Injection Work Plan
Colesville Landfill
Broome County, New York

Constituents	VOCs	Metals	Water Level	Dissolved Gases	Nitrate and Sulfate	TOC	Field Parameters	Geochemical Parameters	Frequency
Groundwater Monitoring									
GMMW-2	L	L*	F	L	L	L	F	L	5th quarter
GMMW-5	L	L*	F	L	L	L	F	L	5th quarter
GMMW-6	L	L*	F	L	L	L	F	L	5th quarter
GMMW-7	L	L*	F	L	L	L	F	L	5th quarter
PW-4	L	L*	F	L	L	L	F	L	5th quarter
PW-3	L	L*	F	L	L	L	F	L	5th quarter
PW-5	L		F				F		5th quarter
W-7	L		F				F		5th quarter
W-16S	L	L*	F	L	L	L	F		5th quarter
W-18	L	L*	F	L	L	L	F	L	5th quarter
PW-7	L	L*	F	L	L	L	F	L	5th quarter
W-17S	L		F				F		5th quarter
W-20S	L		F				F	L	5th quarter
GMPW-4	L	L*	F	L	L	L	F		5th quarter
Spring/Surface Water Monitoring									
SP-2	L	L					F*		semi-annual
SP-3	L	L					F*		semi-annual
SP-4	L	L					F*		semi-annual
SP-5 influent	L	L					F*		semi-annual
SP-5 effluent	L	L					F*		semi-annual
Spring Visual Monitoring									semi-annual
Surface Water Monitoring									
F-6	L	L					F+		semi-annual
SW-2	L	L					F+		semi-annual
SW-3	L	L					F+		semi-annual
SW-4	L	L					F+		semi-annual
Sediment Sampling									
SP-3-Sed		L							semi-annual
Cover System Monitoring									annual

Notes and abbreviations:

L Laboratory Analysis

L* Laboratory analysis is limited to dissolved and total iron analysis using USEPA Method 6010C

Dissolved gases include ethene, ethane and methane analysis using USEPA Method RSK-175

Nitrate and Sulfate analysis using USEPA Method 300.

TOC analysis using Method 5310C

TOC Total Organic Carbon

Field Parameters include ORP, Temperature, pH, Conductivity, Turbidity

F* Field parameters excluding ORP

F+ Field parameters including dissolved oxygen

MNA Parameters include Nitrate, Iron (total, dissolved), Sulfate, Methane/Ethene/Ethane, and TOC

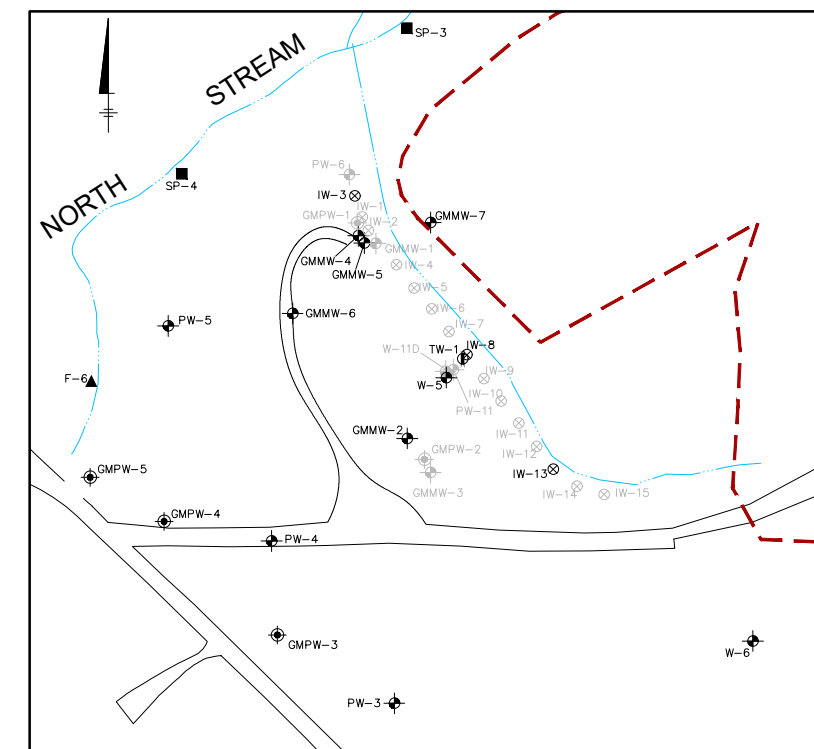
FIGURES



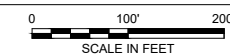


EXPLANATION

- | BOLD | | IN-SITU REACTIVE ZONE (IRZ) DISCONTINUATION PILOT TEST MONITORING WELL |
|----------------|--|--|
| W-24
GMMW-7 | | LOCATION AND DESIGNATION OF MONITORING WELL |
| SCOTT | | LOCATION AND DESIGNATION OF EXISTING HOMEOWNER WELL |
| IW-2 | | LOCATION AND DESIGNATION OF INJECTION WELL |
| GMPW-3 | | LOCATION AND DESIGNATION OF PRODUCTION WELL |
| TW-1 | | LOCATION AND DESIGNATION OF TEST MONITORING WELL |
| F-6 | | LOCATION AND DESIGNATION OF SURFACE WATER SAMPLE |
| SP-2 | | LOCATION AND DESIGNATION OF SPRING SAMPLE AND CO-LOCATED SEDIMENT SAMPLE |



SITE PLAN SHOWING PROJECT AREA



COLESVILLE LANDFILL
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SITE PLAN