DRAFT

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ENVIRONMENT

Subject:
Revised Focused Feasibility Study
Colesville Landfill (Site No. 704010)
Broome County, New York

Date:
April 12, 2018

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Our ref:
NY000949.0028

Dear Mr. Long:

During our phone conversation on January 4, 2018 you summarized the meeting between the New York State Department of Environmental Conservation (NYSDEC) and U.S. Environmental Protection Agency (USEPA) on January 2, 2018 that involved discussions on what can be done to further restore the aquifer at the Colesville Landfill (Site) in accordance with Record of Decision (ROD) requirements. More specifically, there is an interest in revisiting currently available remedial technologies and evaluating their applicability to more effectively achieve remedial action objectives (RAOs) at the Site. It is our understanding that the USEPA was specifically interested in an evaluation of two particular in-situ groundwater treatment technologies: zero valent iron permeable reactive barrier (ZVI PRB) and injectable granulated activated carbon (GAC) – referred to by the USEPA as “carbon beds”. As requested, we have included an evaluation of these two (2) groundwater remediation technologies for site-specific conditions and revised the April 2012 Focused Feasibility Study (FFS) for the Colesville Landfill.

The changes to the enclosed Revised FFS are shown with text that is bold and underlined. In addition, since submission of the April 2012 FFS, new documents have been produced that were specifically developed to evaluate remedial progress, document the results of monitored natural attenuation (MNA) processes, and assess the need to develop a remedial alternative consistent with the following statement in the ROD:

"It may become apparent, during the operation of the groundwater extraction system that, at a certain point, contaminant levels have ceased to decline and are remaining constant at levels higher than the remediation goal. In such a case, the system performance standards and/or the remedy will be reevaluated".

The primary reports that provide data collected since 2011 and relevant technical evaluations are as follows:

- Arcadis. 2015. In-Situ Reactive Zone Discontinuation Pilot Test Report. Colesville Landfill Superfund Site, Colesville, New York. September 1, 2015.
- Arcadis 2017. Remedial System Optimization Report, Colesville Landfill, Broome County, New York. March 30, 2017,
- Arcadis 2018. 2017 Annual Monitoring Report, Colesville Landfill, Broome County, New York. January 10, 2018.

As previously noted, the ZVI PRB and injectable GAC technologies have been included in the screening of remedial technologies. The remedial evaluations that were incorporated into the 2012 FFS included the evaluation of the ZVI PRB technology. The ZVI PRB technology was determined to be unfavorable, primarily due to the need for specialized equipment/installation techniques for trenching and the very high costs. Implementation of injectable GAC was not evaluated back in 2012. However, both of these technologies were reassessed for the March 2018 Revised FFS.

In addition to the difficulty in implementing a ZVI PRB at the Site due to the depth of the zone to be addressed (i.e., approximately 50 to 80 ft below land surface (ft bls) in the area where the anaerobic in-situ reactive zone (IRZ) was implemented), the ZVI PRB technology does not provide additional benefit over the existing enhanced reductive dechlorination (ERD) technology implemented at the Site.

In order to effectively assess the implementation of an alternate remedial technology at the Site, it is important to review the background of Site conditions and the remedial progress that has been achieved to date. As described in the FFS, the ERD component of the groundwater remedy was highly successful in degrading volatile organic compound (VOC) mass within the IRZ. The Remedial System Optimization Report (Arcadis 2017), which is included as Appendix C of the Revised FFS, provides a comparison of baseline groundwater quality in July 2002 (Figure 2) with June 2016 data (Figure 3). The figures show that a significant improvement in groundwater quality occurred as a result of the IRZ and the post-IRZ natural degradation processes. The RSO Report describes the significant remedial progress that has been achieved through reductive dichlorination of volatile organic compounds (VOCs) via the anaerobic in-situ reactive zone (IRZ) and provides the basis and background information necessary to conclude that a transition to monitored natural attenuation (MNA) will be an effective alternative to the current remedy.

Although implementation of the ERD technology was highly successful in reducing contaminant mass in groundwater and ensuring protection of human health and the environment, it was no longer an efficient means of removing bulk mass from the Site. Furthermore, implementation of the IRZ Discontinuation Pilot Test ("discontinuation pilot test") activities completed at the Site from October 2012 through September 2014 (and currently ongoing) reveals that the concentration of VOCs decreased or remained stable when compared with historical data.

Based on several years of tracking remedial progress and development of a refined conceptual site model (CSM) that includes a more complete understanding of contaminant mass transport at the Site, it became evident that the inability to achieve MCLs in a reasonable timeframe was not a function of the remedial technology, but rather a function of site-specific factors. Specifically, it is now well understood that for sites such as the Colesville Landfill where the aquifer is characterized by low permeability deposits with a high percentage of silts and clays, mass transport is primarily governed by diffusion and the complex interaction between aquifer mass storage zones (e.g., immobile porosity/secondary porosity and low aquifer hydraulic conductivity architecture) and aquifer mass transport zones (e.g., mobile porosity and high hydraulic conductivity architecture).

Performance monitoring data collected during implementation of the anaerobic IRZ provided invaluable insight into the mass transport behavior at the Site. Specifically, the monitoring of total organic carbon (TOC) introduced into the aquifer as part of ongoing anaerobic IRZ implementation and the monitoring of the inert tracer bromide as part of the Alternate Electron Donor Pilot Test (ARCADIS G&M, Inc. 2006) were used to estimate the rate of advective groundwater velocity and estimate the rate of overall mass transport. TOC and bromide monitoring data support an advective groundwater transport velocity in the range of 0.3 ft/day to 0.5 ft/day, which is consistent with previous hydrogeologic data. However, these data also support an average mass transport rate of approximately 0.03 ft/day to 0.05 ft/day.

As a general rule, the initial observation of an injected solute at relatively low concentration at nearby downgradient monitoring locations corresponds to the advective groundwater velocity because the solute has not had an opportunity to transfer into mass storage zones. The long-term behavior of solute mass, or the time to reach the center of solute mass at a location downgradient from the injection point, represents the overall mass transport rate as it accounts for the processes that drive mass retardation. The data indicate that groundwater cleanup times will be significant and will be dictated by the rate of mass transfer from the mass storage zones to the mass transfer zones, irrespective of remedial technology implemented. The CSM provides insight into the significant challenge to expediting groundwater remediation within a reasonable timeframe.

Despite these challenges, Arcadis conducted an evaluation of the feasibility of alternative in-situ remedies based on use of a ZVI PRB and injectable GAC. A description of the technology along with a discussion of its effectiveness, implementability, relative cost, and favorability of retaining the technology for the assembly and analysis of remedial alternatives is provided in Table 4-1 of the Revised FFS.

For the ZVI PRB evaluation, based on an average mass transport rate of 0.035 ft/day, the theoretical ZVI thickness for treatment would be 0.3 ft. The flow-through thickness, which is dependent on the required residence time for treatment, will influence the selection of the construction method. Given the average depth of 76 ft (average total depth of the IW wells), the most likely method for PRB installation would be a biopolymer slurry wall for trench stabilization with a long reach excavator with a bucket width (trench width) of 2.5 ft. Where the minimum practical excavation thickness is wider than the required flow-through thickness, sand is typically used as a bulking material and mixed with the ZVI. The sand used would have uniform porosity and significantly higher hydraulic conductivity than the native geologic material to enhance flow through the PRB and accommodate porosity reductions due to mineral precipitation and hydrogen gas accumulation over the PRB lifetime. In order for the COCs to make contact with a ZVI particle, a minimum "rule of thumb" of 20 percent by volume ZVI in the iron/sand mixture is normally used. Therefore, for a trench width that is 2.5 ft wide, a ZVI thickness of 0.5 ft would be implemented. Although implementable, a ZVI PRB would be difficult to implement, would not treat chloroethane, would not expedite the overall timeframe to achieve MCLs, and would be cost prohibitive.

Therefore, a ZVI PRB was not a retained technology for the development and analysis of remedial alternatives.

Injectable GAC can be implemented by either emplacing it via pressurized injection using direct push tooling or injected as a fine-grained slurry through permanent injection or monitoring wells. The emplaced GAC sorbs contaminants passing through the in-situ media. Supplemental organic carbon dosing is required to enhance dechlorination of sorbed VOCs and sustain the long-term GAC sorption capacity. While implementable, it will require additional infrastructure or injection wells for GAC delivery and will require use of existing injection wells to provide organic carbon for long-term sorption capacity. While injectable GAC will provide an equivalent means of barrier-based VOC treatment that is comparable to the ERD remedy that was implemented at the Site, it will not expedite cleanup of VOC concentrations faster than the ERD remedy and would involve a high additional cost. Therefore, injectable GAC was not a retained technology for the development and analysis of remedial alternatives.

We look forward to further discussions once you have had a chance to consider the information provided in this letter and review the Revised FFS. Please do not hesitate to contact Laurie Haskell or myself if you have any questions.

Sincerely,

Arcadis of New York, Inc.

Steven M. Feldman
Associate Vice President

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