Armstrong, Dustin

From: Armstrong, Dustin
Sent: Wednesday, January 19, 2022 9:15 AM
To: Timothy F. Uhler
Cc: Devan, Russ; Crooks, Joshua; Mcclennen, Bonnie; David Linahan; Jennifer O'Reilly
Subject: RE: [External] GTAC-Nockamixon TCE Site (7-1-343) - Initial POET System Evaluation and Recommendations - 65 Brennan Road

Tim,

We agree that a follow up call to discuss GES' recommendations for POET modifications would be a good idea. Here are DEP's initial thoughts and some follow up questions for GES to look into before we have a call:

- DEP agrees that AOP is not a viable option, due to safety concerns related to chemical handling/storage.
- DEP does not believe that relocating or drilling deeper residential wells is a viable option, given the locations of the 3 properties impacted by 1,4-Dx and uncertainty regarding isolation and the potential yield at intervals below the impacted water-bearing zones.
- DEP would prefer to provide a system which addresses the entire home water supply, rather than a point-of-use treatment (Reverse Osmosis). (Water from other faucets would need to have use restrictions incorporated into Institutional Controls.)
- The recommendations refer to "resin filtration". Is this a reference to Ambersorb?
- In addition to effectiveness, DEP will be considering other factors in choosing alternate treatment including: 1) Upfront cost for equipment and installation, 2) Availability of the technology (coconut carbon and Ambersorb media) for residents to perform maintenance over the long-term, and 3) Cost for residents to operate and maintain the systems. GES should prepare this information for our discussion.
- Since Ambersorb is a carbonaceous media, can it address VOCs and 1,4-Dx. (If this media is more expensive to service, perhaps pre-treatment with GAC would still be preferrable.)
- Does UV-light provide any benefit for removal of 1,4-Dx? (UV is a component of AOP treatment.) If so, addition of a UV-light and carbon upgrade could be evaluated.

When I was managing our Baghurst Drive case, I had looked at a titanium dioxide-based system that uses AOP. The system did not seem to be designed for small-scale applications, but it may be worth checking in about again. Here is a link: Photo-Cat | Purifics

Please let me know if you have any questions.

Thanks -- DA

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From: Timothy F. Uhler <TUhler@gesonline.com>
Sent: Friday, January 7, 2022 4:10 PM
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Subject: [External] GTAC-Nockamixon TCE Site (7-1-343) - Initial POET System Evaluation and Recommendations - 65 Brennan Road

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Dustin,

Per your request, GES has evaluated the breakthrough of 1,4-dioxane (1,4D) above the DEP Statewide Health Standard (SHS) through a point-of-entry treatment (POET) system at a residential property on 65 Brennan Road in Nockamixon Township, PA (the site). Based on the information provided to GES, the current system was installed in 2019 and consists of two treatment vessels filled with activated carbon. These units were installed by Culligan and are currently maintained by the property owner. The DEP SHS for 1,4D is less than 6.5 µg/l (micrograms per liter) and the latest sampling results from November 8, 2021 indicate a level of 11.2 µg/l after the two carbon treatment vessels (post-treatment).

GES conducted a screening analysis utilizing our existing experience and knowledge to identify technologies that can most effectively treat water containing 1,4D. Based on this evaluation and further discussions with vendors and suppliers, three (3) methods are considered to be effective for treating 1,4D.

1. Synthetic Adsorbent Resin (AmberSorb 560)
2. Reverse Osmosis (RO)
3. Advanced OxidationPprocesses (AOP)

In addition to these treatment methods, some types of coconut shell based carbons have a slight affinity for 1,4D. However, the adsorption capacity of these carbons does not provide adequate bed life for drinking water applications. For this reason, carbon adsorption alone is not recommended for this site. The following article link details GAC treatment for 1,4D and its limitations: https://www.canada.ca/content/dam/hc-sc/documents/programs/consultation-1-4-dioxane-drinking-water/pub-eng.pdf

Discussion of Suitable Treatment Technologies
AmberSorb 560 is an adsorbent resin that was developed by DuPont specifically to treat 1,4D in water. It is very effective for low concentrations of 1,4D and provides a reasonable service life in water treatment applications. The AmberSorb 560 resin is placed in vessels similar to those used for carbon treatment. For potable water treatment, two vessels plumbed in series is the preferred configuration because it provides adequate treatment and allows monitoring to identify breakthrough. This technology would be a good option for this site.

RO is an effective method for removing 1,4D from drinking water. One concern with RO is the disposal of the concentrated waste brine (reject water) produced by the reverse osmosis process. This reject water would contain the filtered 1,4D, and discharging it to the septic system would result in degradation of groundwater quality. In residential settings, RO is generally used as a point-of-use (POU) treatment for drinking and cooking rather than a whole-house system because of potential corrosion to metal pipes and plumbing fixtures. This concern can be addressed by remineralizing the treated water (adding calcium and magnesium). Reverse osmosis would be an effective solution for this site, but the issues of brine disposal and corrosion would have to be addressed if it is selected.

AOP is an effective treatment for 1,4D. However, it requires use of powerful oxidizers (hydrogen peroxide or ozone gas) that are dangerous, especially in a residential setting. The maintenance requirements for this technology are very high, which increases the operation, maintenance, and monitoring (OM&M) costs substantially. AOP systems require careful monitoring and adjustment to ensure proper performance; process upsets are common and result in reduced treatment efficiency. For these reasons, AOP is not recommended for this site.

Recommendations
GES is expecting additional responses and rough costs from other equipment vendors now that the holidays have passed, and can provide additional updates/information as it is received. However, based on our experience and additional information obtained during this screening evaluation of treatment options on the residential scale (POET systems), the initial recommendations are to design a POET system with multiple technologies utilized in series to maximize the efficiency of the systems capability in reducing 1,4D concentrations. This system would likely involve an initial UV treatment (for removal of naturally occurring bacteria to decrease the rate of fouling of filtration media), followed by coconut fiber GAC vessels, resin filtration, and (possibly) an RO system at the POU.

An alternative recommendation, that could be evaluated upon receipt of additional treatment option pricing, is relocation of the supply well on the property based on the previously conducted fracture trace analysis and the known dissolved-phase plume location. A new supply well could be advanced into a deeper aquifer and constructed appropriately to seal-off the currently known vertical extent of contamination on the property. GES could complete a cost analysis to compare potential long term costs of OM&M of a POET system vs. the installation of a supply well.

GES would also like to request a follow up discussion with DEP to review this evaluation and recommendations. This discussion would also aid in targeting our efforts to obtain pricing for the preferred option. Please note that additional effort will be necessary to complete the engineering design of this POET system, and in conjunction with that effort, an OM&M plan for the initial operation of the system will be recommended.

Thanks,
Tim

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