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ENERGY AND ENVIRONMENT CABINET
Department for Environmental Protection

ANTHONY R. HATTON
COMMISSIONER

300 SOWER BOULEVARD
FRANKFORT, KENTUCKY 40601

December 3, 2019

Mr. William Neuberg, President
Shamrock Technologies, Inc.
301 Community Drive
Henderson, KY 42420

Re: Approval – Draft Site Characterization Report (On-Site)
Shamrock Technologies, Inc. Site
301 Community Drive,
5233 Industrial Park Drive, and
109 N. McKinley Street
Henderson, KY 42420
Agency Interests #46709, 46707, and 38464

Dear Mr. Neuberg:

The Kentucky Department for Environmental Protection (KDEP) has received and reviewed the on-site *Site Characterization Report* (SCR) dated October 4, 2019 submitted by Environmental Resources Management (ERM) on behalf of Shamrock Technologies, Inc. This SCR scope was an initial phase developed and implemented to evaluate and characterize the nature and extent of the releases and impacts of Per- and Poly-Fluoro-Alkylated Substances (PFAS) to environmental media on-site at the three above referenced facilities. The KDEP has reviewed the technical merits of this SCR and approves of the SCR for submission as a final document for record.

KDEP has noted the following significant initial findings from this SCR and extant published geological data for the area:

- PFAS, in particular PFOA, contaminants of concern (COC) in the upper groundwater unit are significant in concentration, magnitude, and mass at all three sites. This is particular so for the central site, Community Drive, which exhibits multiple PFAS constituents impacting groundwater in excess of 300 million parts



per trillion (ppt) with PFOA in particular at 300 million ppt. PFOA concentrations at this facility are over 4 million times the U.S. EPA Health Advisory of 70 ppt.

- Based on PFAS concentration levels in the on-site groundwater at all three sites it is clear that the off-site groundwater is and continues to be impacted by PFAS COCs. However, the full magnitude, nature, and extent of these off-site impacts are unknown at this time.
- The hydraulic conductivity, and thus flow rate, horizontally and vertically in the upper and lower on-site groundwater aquifers appear to range relatively low to medium. Present data and estimates of the localized hydraulic conductivities are likely in the 1×10^{-6} to 1×10^{-2} centimeters per second (i.e. 1 x 0.001 to 10 feet per day) range with significant preferential differentials due to the extensive depositional geologic heterogeneity.
- Based on these hydraulic conductivity ranges, and without consideration of the air dispersion to groundwater fate and transport pathway, a theoretical calculation of horizontal movement and extent of PFAS from a point source release over a 10 year period can be made. This assumes the initial release(s) began only 10 years ago for an estimate. A 10 year groundwater extent estimate would range from +/- 4 feet to 36,500+ feet. If the release was +/-20 years ago this estimated range would double. It is clear from present on-site PFAS concentration data that the lower hydraulic conductivity range is not the case, and/or the effects of air dispersion to groundwater fate and transport pathways are more influential.
- U.S. EPA published physical and chemical properties data for PFOS and PFOA, PFOS has an estimated half-life of >41 years and PFOA >92 years in water (U.S. EPA 2014). General water half-life degradation rates of most chemicals are typically much faster than in groundwater. At the Henderson sites PFOA is the primary COC that is under the U.S. EPA Health Advisory—PFOS has not been detected. A half-life is an indication of the overall total mass reduction time frame and not a measure of concentration reduction. Concerning the Henderson sites, and Community Drive in particular, this means that the first millennial half-life (>>92 years) of the existing mass of PFOA in groundwater may theoretically degrade by half +/-, while still leaving a mass in exceedance of the present U.S. EPA Health Advisory of 70 ppt (or a future likely published established risk levels/MCL) that will remain multiple magnitudes above that level. I.e. the mass of PFOA COCs in exceedance of any conceivable clean-up level published to date or in the near future will remain a significant groundwater source of contamination and advance increasingly downgradient. This will potentially render the groundwater resources significantly impacted for multiple millennia. I.e. Given the long half-life of PFOA and the concentration magnitude of the releases, if the primary on-site sources are not addressed and remediated, and/or air to groundwater pathways are found to be significantly more contributive, the impact will continue to expand to greater portions of the groundwater aquifer resources in the Henderson area.
- All three sites are located along the southern edge of higher #4 hydrogeologic sensitivity region in the Ohio River Alluvium (ORA) physiographic region. The

recharge, flow, and dispersive properties of the aquifer matrix within zone #4 are higher than all other zones, and zones delineated as #4 zones are second in terms of sensitivity to impact only to #5 zones in the Commonwealth of Kentucky. Since the sites are located along the southern edge of the ORA physiographic region, this is likely a narrow transitional zone between the less sensitive #3 Western Coalfield (WC) region and the #4 groundwater sensitivity zone of ORA physiographic region. This would explain the lower on-site hydraulic conductivities in monitoring wells versus the higher conductivities in area domestic use wells and more northern municipal production wells. All three sites are within 3,000 to 5,000 +/- feet of the Ohio River. The significance of this is that the groundwater aquifer transition from the less sensitive #3 zone to the greater sensitive #4 zone—and subsequent higher hydraulic conductivity—is within a short distance downgradient or cross-gradient from all three sites. If or once PFAS COC impacts from the higher on-site source areas have arrived or do arrive in the ORA zone #4 aquifer, a much greater impact to groundwater resources exists (presently) or will exist (in the future).

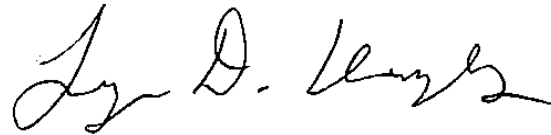
- These initial findings emphasize the urgency and necessity of addressing the significant on-site PFAS soil and groundwater source impacts, and a thorough evaluation of the air to groundwater fate and transport pathway as a potential impact.

Due to the scope of the site characterization work at the three Henderson sites it will be necessary and reasonable to perform the full scope of on- and off-site characterization in multiple phases as data needs arise and conclusions toward characterization and corrective action require. The KDEP understands that this initial SCR only represents a phase in the more comprehensive on- and off-site investigative and site characterization scope.

Mr. Neuberg
December 3, 2019
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The KDEP continues to appreciate your proactive efforts toward this environmental issue. Please contact me at (502) 782-6661 if you have any questions.

Sincerely,

A handwritten signature in black ink, appearing to read "Larry D. Hughes". The signature is fluid and cursive, with the first name "Larry" being the most prominent.

Larry D. Hughes, P.G.,
Environmental Scientist Consultant Sr.
Commissioner's Office
Kentucky Department for Environmental Protection

LDH/ldh

ec: Tony Hatton, P.G., Commissioner, Kentucky Department for Environmental Protection
Sean Alteri, Deputy Commissioner, Kentucky Department for Environmental Protection

Carolyn Brown, Dinsmore & Shohl, LLP
Chris W. Wenczel, P.G. Environmental Resources Management