SITE CHARACTERIZATION REPORT
AND REMEDIAL ACTION PLAN
Shenango Township Municipal Building
3439 Hubbard-West Middlesex Road, West Middlesex, PA 16159
Shenango Township, Mercer County
PADEP Facility ID No. 43-04177
PAUSTIF Claim No. 2016-008
March 15, 2017

EXECUTIVE SUMMARY

A release of unleaded gasoline from an underground storage tank (UST) system was discovered at the Shenango Township Municipal Building complex (the "Site") located at 3439 Hubbard-West Middlesex Road, West Middlesex, PA 16159 (mailing address); Shenango Township, Mercer County (physical location) on December 4, 2015, during removal of an unleaded gasoline UST.

Interim remedial actions have not been necessary to prevent an imminent threat to human health or the environment. Water supplies have not been affected as supported by testing of the Township's water supply well and monitoring wells near the hydraulically down-gradient property boundary. Free product, referred to herein as separate phase liquid (SPL), has not been encountered at the Site.

Analytical results for soil, groundwater and soil vapor/indoor air quality have been evaluated according to the appropriate Statewide Health Standard (SHS), as stated in the site Characterization Report (SCR). Exceedance of a SHS (or in the case of soil vapor/indoor air quality, PADEP Indoor Air Criteria screening values) results in a need for further evaluation or remedial action to comply with *PA Code Title 25, Chapter 250* (Administration of Land Recycling Program) and *PA Code Title 25, Chapter 245* (Administration of the Storage Tank and Spill Prevention Program).

The locations of each of the soil borings, monitoring wells and soil vapor sampling locations are provided in Figures 4A and 4B. Soil samples were collected from 17 soil boring locations. The analytical results from these borings, provided in Table 3, show that samples from four locations exceeded Statewide Health Standards (SHS). The impacted soil is shallow (≤4 feet) and limited to the area immediately around the UST cavity, including the north side of the active diesel fuel UST. Soil below this depth is below the seasonal high water table and is thereby considered a groundwater issue.

Seventeen groundwater monitoring wells have been installed at the Site, four of which have well screen restricted to the upper 10 to 15 feet of bedrock. Five rounds of groundwater sampling have been completed for MW-1, MW-2, MW-3, MW-4, and MW-6. Three rounds have been completed for MW-9, MW-10, MW-11, and MW-12, which were installed in September 2016. One round has been completed for MW-18, MW-19, MW-20, MW-21, MW-22, MW-23, MW-24, and RW-1, which were installed in February 2017. The analytical results for groundwater sampling are tabulated in Table 4. MW-3, located approximately 6 feet north and down-gradient from the UST cavity, near the northern edge of the diesel tank UST, has had eight of the nine Chemicals of Concern (COC) exceed the SHS. RW-1, located approximately 5 feet north and down-gradient from the UST cavity, approximately 8 feet west of MW-3, had seven of the nine COC exceed the SHS. MW-6, located in the former gasoline UST excavation, has had five of the nine COC exceed the SHS. MW-23, a bedrock ("deep") monitoring well located approximately 25 feet north and down-gradient from the UST cavity had only MTBE exceed the SHS in the one round of groundwater sampling. The groundwater samples from MW-4, located 48 feet to the north and down-gradient from the former gasoline UST excavation, have exceeded the SHS for Benzene and MTBE during three of the five sampling events. The two most recent sample tested from MW-4 (11/1/16 and 2/17/17) showed no COC above the SHS. MW-19, installed in February 2017 on the west side of the Township Building, had two of the nine COC exceed the SHS. MW-21, installed in February 2017 in the parking lot on the west side of the Township Building, had four of the nine COC exceed the SHS. All of the exceedances at the west side of the building were from wells completed above bedrock.

The source area is the former gasoline UST cavity. The groundwater contamination plume follows the groundwater flow direction, which is to the northwest. MW-23 is the only monitoring well which is screened entirely within bedrock that has had an exceedance of a COC (MTBE). The remaining wells that have had exceedances are shallow wells screened within the glacial till. The water well on the site has been sampled two times and has not had any detection of COC. This well is currently on a monthly sampling schedule.

Soil vapor/air phase samples were collected July 11, 2016; August 2, 2016; and January 19, 2017. Test results are provided in Table 5. Soil vapor/air phase test results have exceeded Indoor Air Criteria Nonresidential screening values; therefore further testing will be performed as Additional Site Characterization, described in Section 5.0. The additional air phase sampling will include two sub-slab locations positioned along the potential COC in groundwater migration pathway.

SITE CHARACTERIZATION REPORT

1.0 INTRODUCTION

This SCR describes Site Characterization (SC) activities that took place to define the extent of hydrocarbon impacts that may have occurred to potentially impacted media, specifically soil (used herein to include all solid subsurface materials above bedrock), groundwater, and hydrocarbon vapors (soil gas/air matrix). This SCR provides conclusions regarding the horizontal and vertical extent of impacted soil and groundwater and the potential for impact to indoor air quality through testing of soil vapors/air matrix samples.

This SCR presents the results of all SC activities that have taken place at the Site since the release was discovered on December 4, 2015.

The Site is owned by the municipality of Shenango Township, Mercer County, Pennsylvania. The primary contact for the Township is Ms. Lynnett Beck (724) 528-9571.

Environmental activities are being conducted by Compliance Environmental Services (CES), David E. Siekkinen, P.G.; Project Manager. CES contact information is 2700 Kirila Boulevard, Hermitage, PA 16148; (724) 342-1990; dsiekkinen@ces-env.com.

2.0 FACILITY LOCATION AND DESCRIPTION

2.1 Location

The Shenango Township Municipal Building complex (the "Site") is located in Shenango Township, Mercer County, Pennsylvania. The mailing address of the Site is 3439 Hubbard-West Middlesex Road, West Middlesex, PA 16159. The location of the property is shown in Figure 1 (U.S.G.S. Topographic Map). Coordinates for the Site are: Latitude 41°08.45" North; Longitude 80°28'50.29" West (near the center of the former unleaded gasoline UST). The Site is located in a semi-rural area of Shenango Township, west of the Borough of West Middlesex and approximately 1.5 miles west of the intersection of PA Route 18 and Hubbard-West Middlesex Road. Land use in the area is mixed residential, agricultural, and limited commercial. An aerial view of the Site and surrounding area is provided in Figures 3 and 4B.

2.2 Facility Description

The Shenango Township Municipal Building complex property consists of one parcel of land consisting of 10 acres. The shape of the property and property boundary are shown on the Site Map / Tax Map (Figure 2) and Surveyed Site Map (Figure 2A). Site features are shown on

Figures 4A and 4B. The Site is located at the southeast corner of the intersection of Hubbard-Middlesex Road and Jackson Road. The property is somewhat irregular in shape, having approximately 668 feet fronting Jackson Road at the west side of the Site and approximately 285 feet fronting Hubbard-Middlesex Road to the north of the Site. The maximum east-west length of the Site is approximately 900 feet. The property is bordered by single family residences to the north, east, and south. A paving company is located to the northwest of the Site. Wooded property borders part of the Site to the south, and agricultural fields are located east and west of the Site.

Shenango Township utilizes the property for various Township purposes such as administrative offices, meetings, police headquarters, fire station, and as the township maintenance garage and vehicle base. Approximately 8 acres of the property to the south and east of the USTs area are utilized as the Shenango Township Community Park. The Shenango Township Community Park (the "Park) portion of the property is hydraulically up-gradient and at a higher elevation than the former unleaded gasoline UST and no impact from the release is anticipated in the Park area.

The Site and surrounding area are served by individual private "on-lot" septic systems and water supply wells. It is considered in this report that all inhabited dwelling within the area of concern from the release rely on individual water supply wells.

2.2.1 Report Base Maps

Figures 2A and 4A represent "to scale" base maps surveyed by Henry T. Welka and Associates, LLC, a professional surveying company. Figures 3 and 4B, are based on "to scale" aerial imagery provided by Google Earth and provide a "real time" image of surface features existing at the Site as of the date of the aerial imagery. To document the accuracy of the aerial imagery, the scale provided in the Figures was checked by direct measurements of distances between features at the Site and also compared with the surveyed base maps. The Figures provided in this report meet the requirements of *PA Code Title 25, Chapter 245.310, Site Characterization Report*.

2.3 Physical Setting

2.3.1 Topography and Drainage

Figure 1 shows the natural topographic contours at and surrounding the Site from the U.S.G.S. 7½ minute topographic map. Topographic contours are also provided in Figure 2A, 4A, 5A, 5B, and Figures 6A through 6R. The elevations shown by the topographic contours illustrated on the surveyed maps are based on an arbitrary bench mark of 100.0 located at the southeast corner of the fire station building. The elevation of the arbitrary bench mark relative to mean sea level is approximately 1,009 feet. A cross-section is provided in Figure 7.

The elevation of the Site property ranges from 1,128 feet above sea level (asl) at the southeast corner to 1,005 feet asl at the northwest corner. The Park portion of the property occupies the entire southern and eastern parts of the Site, with all parts of Park at a higher elevation than the USTs area.

The main municipal building, located at the northwest portion of the Site, consists of interconnected structures housing the township offices, garage, fire station, and police station. A parking canopy and an equipment garage are located east of the main municipal building. A 10,000-gallon diesel UST and dispenser pump are located near the southeast corner of the garage section of the main municipal building. The diesel UST is oriented in an east west direction. The former 10,000-gallon gasoline UST was located parallel and south of the diesel UST, as shown in Figures 2A, 4A and 4B. The former gasoline dispenser was located adjacent and south of the diesel dispenser ("diesel pump") shown in Figure 4A (and others) at the east side of the garage. A gasoline aboveground storage tank (tank is brand new and unused as of the date of this report) is currently located at the edge of the driveway area southeast of the municipal building complex. The northwest portion of the Site encompassing the Shenango Township Municipal Building complex is relatively level, with an elevation relief of approximately 6 feet between MW-1 and lower area at the northwest corner of the Site around MW-9 and MW-10.

Surface water at the Site drains to drainage swales and catch basins which are present along the north, west and south sides of the area of concern, all of which drain into a catch basin at the northwest corner of the property (Photograph # 7). Drainage from the northwest catch basin then drains beneath Route 318 by means of a culvert pipe that discharges at the north side of Route 318. The ephemeral stream that begins at this location has an elevation of approximately 1,103 feet asl and has a well defined channel flowing in a north-northwesterly direction (before turning north-northeasterly). This ephemeral stream becomes part of an unnamed perennial stream that is a tributary of Shenango River, entering the river approximately 1.5 miles from the Site. No other surface bodies of water are a concern for SC. Paved parking areas are located to the west and north of the municipal building complex. The driveway area south and east of the municipal building complex is hard packed gravel. The northwest portion of the Site is covered by grass and trees as is evident in Figures 3 and 4B.

No other man made features have been recognized that could have a bearing on SC. Underground and above ground utilities and piping are shown in Figures 2A and 4A. A 1-inch underground natural gas line enters the west side of the building in the office area and an underground electric line enters the south side of the building in the garage area. No other underground features have been identified that could act as a conduit for accelerated migration of contaminants.

Photographs of the Site are provided in Appendix J.

2.3.2 Soil, Stratigraphy and Geology

The soil type occupying the entire area of concern for SC is listed in Soil Survey of Mercer County, PA *(U.S.D.A Soil Conservation Service, 1971)* as RaB2, Ravenna silt loam, 3-8% slopes, moderately eroded; and CdB2, Canfield silt loam, 3-8% slopes, moderately eroded. Both soil types are very similar. For both soil types, it is described that because of erosion the upper soil layer now consists partly of brighter colored subsoil but originally had a dark grayish-brown silt loam surface layer and mottled firm silt loam yellowish-brown subsoil. The water table is seasonally high with slow permeability. Both soil types are developed on firm glacial till that normally occurs at a depth of 6 to 9 feet, as has been documented by drilling. Much of the area containing both soil types is or has been cultivated in the area. A soils map of the Site and surrounding area is provided as Figure 9.

Glacial Geology of Northwestern Pennsylvania (*Bulletin G-32, Pennsylvania Topographic and Geologic Survey, 1959*) shows that beneath the soil column the entire area is underlain by glacial till belonging to the Pleistocene Age Kent End Moraine system. This silt loam till is very dense in part and of low permeability. Where the till contains more sand and gravel, permeability can be moderately good within thin discontinuous lenses, as found at MW-4. In general, contaminants coming into contact with these lenses can migrate, mostly horizontally and typically only for short distances. Based on the writer's knowledge of the area, glacial till typically varies from 8 to 25 feet thick, with the bottom several feet containing a substantial percentage of weathered bedrock. This weathered bedrock zone can also display higher permeability and conductivity. The top of bedrock was found to occur at a depth of approximately 6.9 to 9.5 feet. A geologic map that describes the bedrock units is provided as Figure 8.

There are no geologic structures in the area that would have a bearing on the migration of any hydrocarbons. There are no significant karst features in shallow bedrock strata. Bedrock over a short distance is relatively flat, having local dips of variable direction and typically less than 2 degrees. The regional dip is approximately 90 feet/mile or less to the south-southeast. The very limited potential for migration of liquids within bedrock is dependent on the orientation, continuity and frequency of horizontal partings and vertical joint sets. It appears unlikely that hydrocarbon impacts have significantly impacted bedrock even though the bottom of the UST cavity appears to be have encountered the top of bedrock. MW-9, MW-18, MW-20 and MW-23 are screened solely within bedrock and will serve as a means of evaluating any potential hydrocarbon impact within bedrock. The one sample tested to date from MW-23, located just north of the hydrocarbon impacted area showed MTBE to be above the SHS. Additional testing will show whether or not this is cause for concern or just minor cross contamination introducted during the well installation process.

The thickness of unconsolidated materials above bedrock, as determined by direct observation during drilling, ranges from approximately 6.9 to 11.5 feet.

2.3.3 Hydrogeology / Hydrology / Aquifers

Drilling evidence, information provided in various geologic publications and the writer's experience in the area indicates that groundwater impacts above SHSs from dissolved phase hydrocarbons are present within the fill material of the USTs cavity and extend to the north approximately 50 feet and northwest approximately 140 feet (as far as MW-21) within the unconsolidated deposits, hydraulically down-gradient from the location of the release, beneath the Township Building and into the parking area to the west of the building (as shown in Figures 6K through 6M. The majority of the detected dissolved hydrocarbons are limited to the sequence of subsurface materials overlying the dense glacial till at the top of bedrock; with the exception of MTBE detected in the deeper bedrock monitoring wells MW-23, MW-18, and MW-20 (only MW-23 exceeded the SHS for MTBE in the deeper wells).

As described in section 2.4.3, most of the water wells identified in the Pennsylvania Groundwater Information System (PAGWIS) database within 0.5 mile of the Site are completed in sandstone bedrock units. Where unconsolidated glacial deposits are thick, such as between moraines and buried valleys, high yield wells are common but these conditions are not present within a 1 mile radius of the Site. Wells completed in sandstone bedrock aquifers within 0.5 mile radius of the Site reportedly yield from 5 to 20 gallons per minute (gpm) as reported in the PAGWIS database.

There is no municipal water supply serving the area around the Site. The Shenango Township Municipal Building and local residences utilize water wells. Aqua Pennsylvania, Inc., the municipal water provider to the east (2,600 feet away) and west (3,400 feet away) of the Site, obtains its water supply from the Shenango River,

Based on observations during groundwater sampling, most monitoring wells at the Site show fairly low groundwater recharge capability (estimated $\leq$ 1 gpm) within the subsurface interval of concern, above bedrock, with the exception of occasional discontinuous sand/gravel lenses, such as in MW-4 or fractured bedrock lenses as found at RW-1. From monitoring wells that intersect one of these lenses, the recharge was still 2 gpm based on aquifer testing. Based on observations from drilling, sampling, and aquifer testing, permeability and hydraulic conductivity at the Site is moderately low throughout the Site.

As previously stated, the entire area of concern for SC is served by residential private water supply wells. The primary source aquifers in the area are bedrock sandstone units of the Pottsville Group (lowermost Pennsylvanian System) or the Shenango Formation (uppermost Mississippian System). Most water wells in the area have a total depth of between 65 to 215

feet. It is possible to have shallow water supply wells in the unconsolidated glacial till deposits above bedrock where the till has an abundance of sand and gravel lenses, however, none are reported in the PAGWIS database within 0.5 mile of the Site. Wells completed within the unconsolidated deposits are of greatest concern for hydrocarbon impacts. The topography does not show any nearby features that appear suitable to contain sufficient sand and gravel deposits for a water source.

At the Site, groundwater level fluctuation at individual monitoring wells is a maximum of 3.50 feet, based on data provided in Table 4. Amongst all of the monitoring wells at the Site, depth to groundwater has ranged from 1.84 foot to 12.11 feet. Depth to groundwater for individual monitoring wells is provided in Table 4.

Groundwater flow at the Site is shown in Figures 5A through 5D to flow in a northwesterly direction in both the shallow and the deeper monitoring wells.

Water wells within 0.5 mile of the Site that are restricted to the bedrock aquifer report static water levels from 10 to 40 feet BGL (Table 1). The static water levels of the wells reported within 1 mile of the Site average 50 feet BGL.

2.3.4 Regional Groundwater Flow

Most water wells in the area utilize sandstone members of the Pottsville Group (lowermost Pennsylvanian System) or the Shenango Formation (uppermost Mississippian System). These are the most important groundwater aquifers within the regional area but yield is generally too low for use as municipal wells. The Shenango River is mainly the source of the area-wide municipal supplies. A review of the 112 water well entries listed within a 2-mile radius of the Site in the PAGWIS database shows that most well are less than 150 feet deep and likely utilize sandstones near the bottom of the Pottsville Group bedrock sequence. These wells typically yield 5 to 25 gpm. There is one industrial well identified within a 2-mile radius which has a reported capacity of 225 gpm located 1.9 miles away from the Site. No evidence was found of the existence any local shallow or dug wells having a water source within the vertical sequence of concern for SC. If groundwater testing shows that contaminants are migrating toward potentially susceptible off-site water wells, CES will perform a door-to-door survey to further evaluate local water supply wells and collect water samples upon request.

The shallowest groundwater flow at the Site, based on data from monitoring wells, is to the north-northwest at a hydraulic gradient of 2 to 3 percent, as shown in Figures 5C (for shallow overburden wells) and 5B (for deeper/bedrock wells). Regional groundwater flow varies greatly and typically is in the direction of the regional and local surface water drainage systems. Deep groundwater movement (below the level of the major surface water drainage systems) has not been evaluated but would be expected to be to the south-southeast, the regional dip direction of

bedrock. The Shenango River, the major regional discharge surface water, is located within 2 miles to the north, east, and southeast of the Site. Shallow groundwater flow is typically toward the most local surface water drainage system where discharge of groundwater to surface water would be expected. The nearest surface water to the Site is an ephemeral stream that begins at the north side of Route 318 at an elevation of approximately 1,103 feet asl and has a well defined channel flowing in a north-northwesterly direction (before turning north-northeasterly). This ephemeral stream becomes part of an unnamed perennial stream that is a tributary of Shenango River, entering the river approximately 1.5 miles from the Site.

2.4 Sensitive Receptor Analysis

2.4.1 On-Site Water Well

One water supply well is present on the Shenango Township Municipal Building complex property. This well is located west of the office section of the main building, down-gradient from the UST cavity (Figure 4B and Photograph #9). This well has a reported total depth of 125 feet with surface casing extending to 27 feet. This Township water supply well was sampled on July 26, 2016, and on February 24, 2017; no detectable COC concentrations were found (Table 4). The Township water supply well is not used for consumption purposes and signs have been posted at sinks advising not to drink the water. A water cooler is provided for drinking water. The Township water well will be sampled monthly beginning in February 2017.

2.4.2 Impact to Water Supplies

There is no municipal water supply serving the area around the Site. The Shenango Township Municipal Building and local residences utilize water wells. Aqua Pennsylvania, Inc., the municipal water provider to the east (2,600 feet away) and west (3,400 feet away) of the Site obtains its water supply from the Shenango River, as specified in the 2014 Water Quality Report for PWSID # PA6430054. This document is supplied annually to PADEP by public water systems. The PAGWIS was also checked for wells located within ½ mile radius and 1 mile radius of the Site. A walking site reconnaissance was also performed of the area and water wells not shown in the PAGWIS database were observed. This SCR considers that all inhabited properties within the area of concern have water supply wells.

The closest water supply well is the Shenango Township water well, which is located directly down-gradient from the former gasoline UST location. This well has not been impacted by the release. Shallow monitoring wells have been installed to the south, west and north of the Township water well, and deeper bedrock wells have been installed to the south and west of the Township well. The shallow wells MW-19 and MW-21 have COC exceedances. The deeper bedrock monitoring wells (MW-18 and MW-20; both screened from 20 to 25 feet) had detections of MTBE from the initial groundwater sampling event on 2/17/17, but these values were below SHS. This situation will be further documented by ongoing groundwater testing. There has been

no indication of any impact to surface water bodies or off-site water supply wells from the released unleaded gasoline at the Site.

2.4.3 Well Search

A search was performed on December 9, 2016 of the Pennsylvania Department of Conservation and Natural Resources (DCNR), Bureau of Topographic and Geologic Survey, PAGWIS to identify water wells within 0.5 mile of the Site. Results of the search are provided in Table 1 and approximate well locations are illustrated on Figure 3. The PAGWIS search shows 10 wells are located within a 0.5 mile search radius. Four of the wells are monitoring wells at the Site (MW-9, MW-10, MW-11, and MW-12). There is no public water supply or industrial water well listed in the PGWIS database within 1.0 mile of the Site. This SCR considers that all inhabited properties within the area of concern have water supply wells.

Excluding the four Site monitoring wells on the list, the reported yield of wells within 0.5 mile of the Site range from 5 to 20 gallons per minute, with well depths ranging from 65 to 215 feet, which are completed into bedrock, as shown in Table 1. The PAGWIS database indicates that wells within 1 mile of the Site yield 4 to 50 gpm.

A review of the PAGWIS database on December 9, 2016 shows one high capacity well located within 2 miles of the Site. This well, listed as owned by Wheatland Tube, reportedly has a capacity of 225 gallons per minute and is located 1.9 miles away from the Site.

2.4.4 Potential Sensitive Receptors

There are no recognized "geologically susceptible or sensitive areas". There are no geologic conditions such as karst dissolution, faults, or fracture zones that would result in accelerated migration of contaminants. Permeability and hydraulic conductivity at the Site are moderately low, as previously described in Sections 2.3.3.

There are no "socially susceptible or sensitive areas" within the potential maximum extent of the COC plumes in groundwater. Approximately 8 acres of the property to the south and east of the USTs area are utilized as the Shenango Township Community Park. The Park portion of the property is hydraulically up-gradient and at a higher elevation than the former unleaded gasoline UST. The park has restrooms which utilize the Shenango Township water well and the picnic shelter has a water spigot. Each of the water sources at the Park (restroom sinks and shelter spigot) have signs posted stating that the water is non-potable. There are no other parks, schools, or hospitals within a 0.5 mile radius of the Site.

2.4.5 Potential Ecological Receptors

Potentially Affected Flora and Fauna – The only potential impact to flora or fauna resulting from the gasoline release is speculated be to (no observed affect) burrowing micro-fauna

(predominately microorganisms, insects and worms) by direct contact with contaminated soil at the tank cavity or with impacted groundwater within the contaminant plumes mainly encompassing MW-3, MW-6, MW-19, MW-21, MW-23 and RW-1 (illustrated in Figures 6A through 6R). The entire area being referred to is within the Shenango Township property, beneath the hard packed gravel driveway area, beneath the garage area of the main building, and beneath the paved parking lot to the west of the main building and at a depth of 2 feet or more. With these considerations there is only minimal potential impact to micro-fauna. There is no flora present within the area impacted by the unleaded gasoline release. A 30-year Bioscreen F&T Model, prepared prior to the February 2017 installation and testing of additional monitoring wells, showed the potential migration distance of Benzene (the main COC) in groundwater above the SHS is 50 feet, which is well within the property boundary. Considering that only one round of groundwater data is available for the newly installed wells, a meaningful Fate and Transport computer model is not applicable at this time. Migration of COC will be continually evaluated by groundwater level monitoring and testing. As of this report, the outer margin and depth of the dissolved hydrocarbon plume has been identified.

Potentially Affected Flora and Fauna on Endangered Species List – A Pennsylvania Natural Diversity Inventory (PNDI) search conducted on December 15, 2016 was performed to evaluate potential impact to listed or protected flora and fauna species. The PNDI search includes four agencies: PA Game Commission; PA Department of Conservation and Natural Resources; PA Fish and Boat Commission; and U.S. Fish and Wildlife Service. Each of the four agencies concluded that there was "no known impact" and "no further review required" was listed as the response. With the information provided by these database searches and the conditions at the Site described in this report, it is easily concluded that there is no potential threat to any flora and fauna on the endangered species list from the unleaded gasoline release.

Potential or Observed Effects of Contamination on Vegetation or Wildlife – There are no potential or observed effects of contamination on vegetation or wildlife at the Site. The affected area is within the graveled driveways, east and west of the maintenance garage.

The only potential impact to flora or fauna resulting from the unleaded gasoline release is speculated be to (no observed affect) burrowing micro-fauna (predominately microorganisms, insects and worms) by direct contact with, and only within the area where dissolved COC in groundwater are above the SHS, as shown in Figures 6A through 6R. This potential impact would be minimal at best. The top of the saturated zone within the plume occurs at a depth of 2 to 7 feet. There is no observable impact to flora within or outside of the property resulting from the release of unleaded gasoline that was discovered on December 4, 2015. There is minimal vegetation within the hydrocarbon impacted area.

This SCR concludes that there are no potential or observed effects of contamination on vegetation, wildlife or other ecological receptors at the Site as a result of the unleaded gasoline release and no effects are expected in the future.

2.4.6 Potential Migration Pathways

No preferential migration pathways have been recognized that would have a bearing on groundwater flow. Figures 2A and 4A show underground and aboveground utility locations, which include an underground natural gas line west of the building and an underground electrical line near the southeast corner of the building. The potential for preferential migration along the underground electrical line near the southeast corner of the building will be further evaluated as remediation progresses.

2.5 Current and Future Land Use

The Site has been used by Shenango Township for their municipal headquarters since 1968, and is currently being used for that purpose. The Township utilizes the property for administrative offices, meetings, police headquarters, fire station, and as the township maintenance garage and vehicle base. The portion of the building closest to the USTs area is used as a maintenance garage. Approximately 8 acres of the property to the south and east of the USTs area are utilized as the Shenango Township Community Park.

Land use in the area is mixed residential, agricultural, and limited commercial. An aerial view of the Site and surrounding area is provided in Figures 3 and 4B. The property is bordered by single family residences to the north, east, and south. A paving company is located to the northwest of the Site. Wooded property borders part of the Site to the south and north, and agricultural fields are located east and west of the Site. The Site and surrounding area are served by individual private "on-lot" septic systems and water supply wells.

There is no sign or knowledge of future changes in land use in the area.

3.0 FACILITY BACKGROUND

3.1 Site History

Shenango Township, the current owner of the property, utilizes the property for various Township purposes such as administrative offices, meetings, police headquarters, and as the township maintenance garage and vehicle base. The current size of the property is 10 acres, as shown in Figure 2 as parcel number 131 (Mercer County Tax Map 27 184 131). Approximately 8 acres of the property to the south and east of the USTs area are utilized as the Shenango

Township Community Park. The Park portion of the property is hydraulically up-gradient and at a higher elevation than the former unleaded gasoline UST and no impact from the release is anticipated in the Park area.

The USTs are/were used to fuel Township vehicles. A 10,000-gallon coated steel diesel fuel UST located north and adjacent to the former gasoline UST shown is still in use. Only the 10,000-gallon "StiP3" coated steel unleaded gasoline tank was removed on December 4, 2015 (location illustrated in Figure 4A). Both tanks were located in the same excavation when installed in 1979.

The property in which the former unleaded gasoline USTs was located was purchased by Shenango Township on May 14, 1966 from Betty Mason Hofmeister and Walter S. Hofmeister (Mercer County Deed Record No. 1031). Prior to being purchased by Shenango Township, the property appears to have been used for agricultural purposes, as evident in aerial photographs provided in *Sheet Number 43 of Soil Survey, Mercer County, PA; U.S.D.A., Soil Conservation Service (1971)* dating back to the 1960s. Construction of the current Township Municipal Building was completed in 1968. The property has been used for Shenango Township municipal purposes since that time. The two underground storage tank (UST) systems were installed in August 1979. Underground fiberglass piping extended/extends a short distance from the top of the tanks to the gasoline and diesel fuel dispensers that are/were located at the southeast corner of the municipal building, as shown in Figure 4A and Photographs #4. Underground piping and the dispenser serving the former unleaded gasoline UST have been removed. The diesel fuel tank system is still active.

The aerial photograph of the Site found in *Soil Survey, Mercer County, PA, U.S.D.A. (1971)*, shows the subject property and surrounding properties to be mostly cropland divided by forested plots (at that time). Currently, part of the cropland has reverted to forest. Only a few rural residential dwellings along the main road bordering the north side of the property, PA Route 318, were present within 1,000 feet of the Site in 1971. Currently, there are more residential dwellings within 1,000 feet of the USTs but not many more on the north side of Route 318, the area that could potentially have groundwater impacts resulting from the release. The only noteworthy property use within 1,000 feet is the Davano Paving business located approximately 400 feet to the west of the northwest corner of the subject property, on the north side of Route 318. It appears that the Davano Paving property is used mainly for vehicle and equipment storage. No asphalt processing facilities were evident.

Since being installed in 1979, Township personnel indicated that only routine maintenance has occurred to the tank systems. The UST systems were/are equipped with spill and overfill protection and a "Veeder-Root" leak detection system. The Veeder Root system automatically prints out leak detection reports that are retained by Township personnel. No leaks have been

identified by the Veeder-Root system to date. According to Township personnel, the removed UST "looked perfect" when removed from the ground, as supported by Photograph #8 located in Appendix J.

No evidence of any other release was discovered on the Shenango Township property or at any other property within an area of concern for potential impacts. An aboveground storage tank (AST) is currently located along the gravel driveway area southeast of the UST (Photographs #2 and 3). This AST is brand new and unused, having never contained any petroleum product or hazardous substance. No other fueling systems are known to exist within at least 1,000 feet of the Shenango Township UST systems. No other site investigations for a fuel release are known to exist or have existed within the area of concern for SC.

3.2 Description and Type of Regulated Substances

The only regulated substance of concern is "virgin" unleaded gasoline. A Material Safety Data Sheet (MSDS) describing the characteristics of unleaded gasoline and health and safety concerns is provided in Appendix D. Unleaded gasoline can contaminate surface water, groundwater and soil and has a high potential for impacting indoor air quality by means of volatilization from underground media, both soil and groundwater, due to its high volatility. It is believed that the origin of the released substance was a "swing joint" at the top of the UST that connected the unleaded gasoline tank with fiberglass piping leading to the dispenser. It has been reported that discolored soil was evident at this location during removal of the UST on December 4, 2015.

Compounds that are being tested to evaluate the presence and concentration of unleaded gasoline in soil and groundwater, using the PADEP "New Short List" of unleaded gasoline constituents, include Benzene; Toluene; Ethylbenzene; Total Xylenes; MTBE; Naphthalene; Cumene (Isopropylbenzene); 1,2,4-Trimethylbenzene (1,2,4-TMB); and 1,3,5-Trimethylbenzene (1,3,5-TMB).

No separate phase liquid (SPL) was observed during the UST removal. Discoloration of soil and analytical results from soil and groundwater samples above PADEP statewide health standards (SHS), collected by the tank remover A. Graziani and Company, Inc. upon removal of the UST, were the reasons for PADEP to request that a site characterization (SC) be performed. PADEP representative Andrew Sepos was on-site during the removal of the tank and a Storage System Report Form was prepared (12/4/15) that stated: "heavy dark staining and odors to 12' depth. Observed staining across top of tank on west end". A copy of this report, which addresses fire, explosion, and safety hazards, is provided in Appendix K. The Notification of Reportable Release, verbally provided to PADEP on December 4, 2015 (written submittal 12/7/15), estimated that 30 gallons of product were released. The period of time over which this release

occurred is not known. No SPL has been observed during any of the activities at the Site and leak test reports have not indicated any loss of product.

Analytical results and the location of soil and groundwater samples collected in conjunction with the UST removal on December 4, 2015 are provided in the January 7, 2016 Underground Storage Tank System Closure Report Form (Appendix K). Soil values exceeded SHS for 1,3,5-Trimethylbenzene; 1,2,5-Trimethylbenzene; and Naphthalene in the Tank West (#38); Tank East (#39); and Tank Backfill (#40) samples. Soil samples from under the "Pump" (Dispenser) and Piping showed no exceedances of SHSs. The two groundwater samples from the tank pit were above the SHS for all parameters tested (MTBE; Benzene; Toluene; Ethylbenzene; Xylenes; 1,3,5-Trimethylbenzene; 1,2,4-Trimethylbenzene; and Naphthalene).

Soil removed from the tank cavity, as was necessary to remove the UST, was placed back into the tank pit. No soil was disposed off-site.

The gasoline UST was emptied of product by Shenango Township prior to removal. The only disposal associated with closure of the UST system was one 55-gallon drum of tank liquids derived from the cleanout of the tank. The waste was listed as 565 pounds on the waste manifest prepared by the licensed disposal/treatment company Environmental Specialists, Inc. of Youngstown, OH. Shenango Township is listed as a USEPA conditionally exempt small quantity generator (CESQG). No waste disposal manifest has been provided by A. Graziani and Company, Inc., the tank removal company.

No conduits have been identified that would enable the released unleaded gasoline to selectively migrate beyond the confines of the USTs area so it is likely that hydrocarbon impacts migrated to the northwest, under the Township building and beneath a portion of the parking lot at the west side of the building during periods of high groundwater levels and groundwater contact with shallow subsurface materials with increased permeability resulting from construction activities. The extent of hydrocarbons can best be observed in Figures 6K through 6M. The presence of hydrocarbons beneath the parking lot at the west side of the building was just discovered during installation of monitoring wells in February 2017. It appears that hydrocarbons have migrated beneath the Township building in order to be present beneath the parking lot to the west. It is advised that the proposed remedial actions are initiated as soon as possible to alleviate the potential for further migration and potential impact to water supply wells.

There has been no need for interim SPL recovery (no SPL reported) or other remedial action at the Site.

3.2.1 Regulated Substances In Soil

The first round of soil samples was collected on May 18 and 19, 2016. A second round of soil samples was collected on September 13 and 14, 2016, associated with the second round of drilling. A third round of soil samples was collected on February 3 through 10, 2017, associated with the third round of drilling. Table 3 provides the laboratory analytical results for soil. Certificates-of-analysis for soil are provided in Appendix C. Benzene exceeded the SHS in samples collected from MW-3, SB-8, and SB-14; 1,2,4-Trimethylbenzene and 1,3,5-Trimethylbenzene exceeded SHSs in the sample collected from SB-6. Soil samples were collected from above the water table from the interval that showed the most impact based on field observations and photoionization detector readings. The borings that had soil samples exceeding SHS are all located in the immediate area of the UST cavity, as seen on Figure 4B.

3.2.2 Regulated Substances In Groundwater

As part of SC activities, five rounds of groundwater sampling have been completed for MW-1, MW-2, MW-3, MW-4, and MW-6; three rounds have been completed for MW-9, MW-10, MW-11, and MW-12; two rounds have been completed for the Township's water well; and one round has been completed for MW-18, MW-19, MW-20, MW-21, MW-22, MW-23, MW-24, and RW-1. The analytical results for groundwater sampling are provided in Table 4. MW-3, located approximately 6 feet north and down-gradient from the UST cavity, near the northern edge of the diesel tank UST, has had eight of the nine COC exceed the SHS. RW-1, located approximately 5 feet north and down-gradient from the UST cavity, approximately 8 feet west of MW-3, had seven of the nine COC exceed the SHS. MW-6, located in the former gasoline UST excavation, has had five of the nine COC exceed the SHS. MW-23, a bedrock/"deep" monitoring well located approximately 25 feet north and down-gradient from the UST cavity had only MTBE exceed the SHS in the one round of groundwater sampling. Additional testing will show whether or not the MTBE is a result of cross-contamination resulting from the drilling procees. The groundwater samples from MW-4, located 48 feet to the north and down-gradient from the former gasoline UST excavation, have exceeded the SHS for Benzene and MTBE during three of the five sampling events. The two most recent sample tested from MW-4 (11/1/16 and 2/17/17) showed no COC above the SHS. MW-19, installed in February 2017 on the west side of the Township Building, had two of the nine COC exceed the SHS. MW-21, installed in February 2017 in the parking lot on the west side of the Township Building, had four of the nine COC exceed the SHS.

3.2.3 Soil Vapor / Indoor Air Quality Evaluation

Soil vapor/air phase samples were collected on July 11, 2016; August 2, 2016; and January 19, 2017 (results provided in Table 5) to determine potential impact to indoor air quality at the Shenango Township Building. Samples have been collected from an unoccupied hallway inside the main building [SV/AP- #1 (Indoor)]; outside the main building [SV/AP- #2 (Outdoor)]; Soil Vapor Point 1 [SV/AP- #3 (SV-1)]; Soil Vapor Point 2 [SV/AP- #4 (SV-2)]; an occupied office inside the main building [SV/AP- #5 (Indoor-office)]; and inside the garage office [SV/AP- #6

(Indoor-garage)]. The analytical results are compared with PADEP Indoor Air Vapor Intrusion Nonresidential screening values.

The SV/AP- #1 (Indoor) sample, collected from a hallway between the men's and women's restrooms near the garage and fire station sections, has been sampled three times. Benzene, 1,2,4-Trimethylbenzene, and Naphthalene exceeded the screening values for each round, but have decreased with each sample. 1,3,5-Trimethylbenzene exceeded the screening value from only the first round.

The SV/AP- #2 (Outdoor) sample, collected from outside the east side of the main building, has been sampled three times. Naphthalene exceeded the screening value from only the first round.

The SV/AP- #3 (SV-1) sample, collected from a soil vapor monitoring point located south of the main building and west of the former gasoline UST cavity, has been sampled two times. Ethylbenzene exceeded the screening values in both samples. Total Xylenes and Naphthalene exceeded the screening values from the July 11, 2016 sample. Concentrations have declined in these samples between the two rounds of testing. This location was not tested during the most recent sampling event on 1/19/2017 due to high groundwater levels.

The SV/AP- #4 (SV-2) sample, collected from a soil vapor monitoring point located east of the main building and directly downgradient from the former gasoline UST cavity, has been sampled two times. Eight of the nine COC exceeded the screening values (or had detection limits above the screening values) from both rounds of sampling. As with SV-1, SV-2 was not sampled on 1/19/2017 due to high groundwater levels.

The SV/AP- #5 (Indoor-office) sample, collected from the Township Secretary's office located at the northwest section of the main building, has been sampled one time on 1/19/2017. The detection limit for Naphthalene was above the screening value. All other COC were below the screening values.

The SV/AP- #6 (Indoor-garage) sample, collected from the garage office/break room located at the northwest section of the garage area inside main building, has been sampled one time on 1/19/2017. Naphthalene exceeded the screening value. All other COC were below the screening values.

Sub-slab (beneath the concrete floor) vapor samples will be collected from two locations within the garage area of the main building and a second round of air phase samples will be collected from the two office areas in April 2017. Air phase sampling locations are shown in Figure 4B.

Further testing is required to satisfy the requirements of *PADEP's Land Recycling Program Technical Guidance Manual, Section IV.A.4. Vapor Intrusion into Buildings from Groundwater and Soil under the Act 2 Statewide Health Standard* in order to demonstrate that there is no potential impact to indoor air quality. It should be noted that maintenance and other Township vehicles are commonly started and idled within the Shenango Township municipal complex buildings and may be the reason for exceedances of PADEP indoor air criteria from the indoor air samples. Further testing will evaluate this potential exposure pathway.

3.3 Aquifer Testing – Hydraulic Conductivity

An aquifer test was performed on September 23, 2016, using MW-4 as an extraction well. MW-3 and MW-6 were not used due to their location within backfill material or at the edge of the tank cavity, making them non-representative of natural site conditions. MW-4 contains a discontinuous gravel/sand lens that is not found in other monitoring wells, and as a result hydraulic conductivity determined by the pumping test data, using the Aqtesolv Model, should be considered a localized maximum value compared with the Site as a whole. The saturated thickness of 8 feet considers the area at and around the former UST, with the water table at 4 to 5 ft within the weathered glacial till and extending downward through the dense glacial till and into the top few feet of bedrock. The Dense Glacial Till and the top portion of bedrock are considered to have similar hydraulic conductivity. The greatest conductivity will be found within the weathered glacial till and contact boundaries with the dense till and at the boundary of the dense till and bedrock. All other input data used in the Aqtesolv Model are based on measurements from the Pump Test and monitoring well construction data. The hydraulic conductivity as determined by the Aqtesolv Model (6.35×10^{-2} cm/sec) should be considered a maximum value as mentioned above. Appendix E contains the aquifer testing and Aqtesolv Model information. The cover page for Appendix E describes why a (Bioscreen) Fate and Transport Model was not included with this report (as was discussed with PADEP during a meeting at the Site on 1/30/2017).

4.0 SITE CHARACTERIZATION ACTIVITIES

4.1 Parameters Analyzed

Parameters analyzed in association with the SC are those included in PADEP's New Short List of Petroleum Products for Unleaded Gasoline (*Page IV-9, PADEP's Land Recycling Program Technical Guidance Manual, Document Number 253-0300-100, March 15, 2008*), including Benzene; Toluene; Ethylbenzene; Xylenes, (total); Cumene (Isopropylbenzene); MTBE; Naphthalene; 1,2,4-Trimethylbenzene; and 1,3,5-Trimethylbenzene. Medium Specific

Concentration (MSC) values used for evaluating attainment of SHSs reflect the revisions effective as of August 27, 2016. The analytical method used for soil (solids) is EPA Method 5035/8260B; for groundwater 5030B/8260B; and for soil vapors/air matrix samples EPA Method TO15 (Short List). Reportable levels for each parameter are provided in the Certificates-of-Analysis in Appendix C.

4.2 Soil Borings and Monitoring Well Installations

Soil boring and monitoring well logs are provided in Appendix B. Installations of soil borings/monitoring wells were completed in three mobilizations (May 2016, September 2016, and February 2017). MW-1 was installed as an upgradient monitoring point. MW-2, MW-3, MW-6, SB-7, SB-8, SB-13, SB-14, SB-15, SB-16, SB-17, and RW-1 were installed in the area immediately around the UST cavity. MW-4 was installed approximately 48 feet to the north and down-gradient from the former gasoline UST excavation. MW-23 was installed approximately 25 feet to the north and down-gradient from the former gasoline UST excavation and is screened entirely in bedrock. MW-10, installed approximately 200 feet northwest and down-gradient from the former gasoline UST excavation, is screened in unconsolidated materials and the top 2.6 feet of bedrock. MW-18 ("deep" monitoring well) and MW-19 were installed downgradient from the former gasoline UST excavation just west of the main building. MW-20 ("deep" monitoring well) and MW-21 were installed downgradient from the former gasoline UST excavation west of the main building in the middle of the parking area. MW-22 was installed 20 feet northwest of the northwest corner of the main building. MW-24 was installed 75 feet west of the main building just off the edge of the parking lot. MW-9, installed approximately 220 feet north-northwest and down-gradient from the former gasoline UST excavation, is screened entirely in bedrock. MW-11, installed approximately 220 feet north-northeast and cross-gradient from the former gasoline UST excavation, is screened in unconsolidated materials. SB-5 and MW-12 were both installed near the southeast corner of the fire station section of the main building approximately 90 feet cross-gradient from the former gasoline UST excavation.

Two soil vapor sampling points (SV) were installed at the Site. SV-1 is located west of the former gasoline UST excavation, next to the exterior wall at the south side of the garage section of the main building. SV-2 is located north-northwest of the former gasoline UST excavation, next to the exterior wall at the east side of the garage section of the main building. Boring/well logs are located in Appendix B.

The "deep" monitoring wells that are screened entirely within bedrock are MW-9, MW-18, MW-20, and MW-23.

4.3 Soil Sampling and Analysis

All soil testing results from samples collected by CES are provided in Tables 3. Laboratory Certificates-of-Analysis for soil analyses are provided in Appendix C. Sample locations are provided in Figures 4A and 4B. Samples were collected according to CES's soil sampling protocol described in Appendix D, Policies and Procedures, D through F. Immediately after field screening, soil samples were placed into laboratory sealed pre-weighed vials containing the proper preservative, placed on ice and delivered to the PADEP accredited testing laboratory under normal chain-of-custody protocol. Samples were tested according to EPA Method 5035/8260B. It should be noted that the SB number corresponds with the monitoring well (MW) number for soil sample locations where monitoring wells were installed.

4.4 Groundwater Sampling and Analysis

Groundwater analytical results are tabulated in Table 4 and copies of the laboratory Certificates-of-Analysis are provided in Appendix C. The cover page for Appendix C lists the date of all sampling events that are included (for all media). Groundwater sampling by CES has been performed according to its Policies and Procedures provided in Appendix D and also in accordance with PADEP's *Groundwater Monitoring Guidance Manual, Chapter 6, Document 383-3000-001*. Analytical testing has been performed by a PADEP accredited laboratory according to EPA Method 8260B.

4.5 Soil Vapor / Air Matrix Sampling and Analysis

Soil vapor/air matrix analytical results are provided in Table 5 and copies of the laboratory Certificates-of-Analysis are provided in Appendix C. Sample locations SV-1, SV-2 and Indoor Air are provided in Figure 4B. Soil vapor testing was performed on July 11, 2016 August 2, 2016, and January 19, 2017, and tested according to EPA Method TO-15. The Indoor air samples were collected from an unoccupied hallway located between the garage and fire station sections of the main building, an occupied office located near the northwest corner of the main building, and an office area inside the garage area of the main building. The Outdoor air samples were collected from the open air adjacent to SV-2. All air samples were collected using laboratory provided and pre-measured vacuum "summa" canisters. The chain-of-custody provided to the testing laboratory indicated the pre-sampling and post-sampling vacuum reading and the time at the start and completion of sampling, which lasted a period of 30 minutes. Additional information on soil vapor sampling and conclusions is provided in Sections 3.2.3. CES's soil vapor/air phase sampling procedure is provided in Appendix D.

4.6 Site Specific Health and Safety Plan and Policies

The Health and Safety Plan (H&S Plan), which has been provided to CES's drilling contractors and all other on-site personnel, is provided in Appendix D. The H&S Plan along with the MSDS (Appendix D) was discussed with all on-site personnel prior to the beginning of any work. It is CES's policy to conduct all field work in a safe and careful manner, recognizing and conveying to all site workers any potential hazards that may be present in the physical environment (such as heat, cold, lightning, insect bites, etc.) and associated with the chemicals that are anticipated to be encountered. CES's on-site supervisor is typically a PG (or other qualified person) experienced with field activities and safety considerations.

The MSDS included in Appendix D that describes the hazards associated with virgin unleaded gasoline was maintained on-site during field activities.

4.7 Geophysical Surveys

No Geophysical Surveys were conducted in associated with SC activities and none are anticipated to be needed at this stage of the project. The locations of aboveground and underground utilities are shown on Figures 2A and 4A.

4.8 Waste Disposal

All waste materials have been handled according to appropriate regulations and approvals applicable to Pennsylvania regulations. Cuttings generated during soil sampling and well installation were containerized in 55-gallon drums and staged on-site. Purge and sampling water that does not show any indication of contamination is placed in a portable granular activated carbon filter drum and allowed to slowly discharge to the gravel driveway in the area of the tank cavity. Suspected contaminated purge water was containerized in 55-gallon drums. There is no SPL present at the Site. Eight drums of the environmental investigation derived waste were transported from the Site for proper disposal by Environmental Specialists, Inc. on January 20, 2017. A copy of the waste manifest is included in Appendix G. One drum of tank cleaning liquids was generated during removal of the UST, as described in Section 3.2. Nine drums of drill cuttings and purge water generated from the February 2017 SC activities are currently staged on-site awaiting proper disposal. As a result of CES's environmental policies, environmental investigation derived waste generation has been minimized.

Soil associated with removal of the gasoline UST was placed back into the tank cavity at the time of UST closure.

5.0 ADDITIONAL SITE CHARACTERIZATION

The extent of soil contamination has been well defined to be above the water table within the area of the UST cavity that contained the former gasoline UST and currently contains the diesel fuel UST. The monitoring well network is well placed to define and monitor the groundwater plume. The groundwater within shallow bedrock wells (often referred to as "deep" wells in this report) is monitored from MW-9, MW-18, MW-20, and MW-23, which are "deeper" wells screened entirely in bedrock. Multiple rounds of indoor, outdoor, and soil air phase sampling have been completed.

The groundwater monitoring network will continue to be sampled once each quarter. Additional soil sampling will be performed to demonstrate attainment of SHSs following the completion of remediation at the Site. The Township's water supply well located at the Site will be sampled monthly. This well is not used for potable purposes and signs have been posted at water faucets advising against drinking the water. A pumping test of the Township water supply well will be conducted within 60 days of the date of this report in order to assess possible influence to monitoring wells from pumping of the water well.

Additional testing is needed to evaluate indoor air quality. CES will collect additional rounds of indoor air samples from two occupied (office) areas of the main Shenango Township building to further evaluate the indoor air quality. Sub-slab vapor samples will be collected from two locations within the garage area of the main building and a second round of air phase samples will be collected from the two office areas in April 2017 (locations shown in Figure 4B). Additional air phase sampling will take place once the source removal event has been completed.

No other additional SC activities other than those discussed in this section are needed.

6.0 REMEDIAL ACTIONS

Interim remedial actions have not been necessary to prevent an immediate threat to human health or the environment. Water supplies have not been affected (even though water supply wells remain as potential receptors as discussed in Table 6). Free product / separate phase liquid (SPL), has not been encountered at the Site.

Proposed remedial actions are discussed in the Remedial Action Plan (RAP) portion of this report.

7.0 CONCEPTUAL SITE MODEL (CSM)

A Conceptual Site Model spreadsheet is provided in Table 6, which includes an evaluation of primary (SPL) and secondary (impacted media) sources; transport mechanisms (wind, volatilization, direct contact, soil to groundwater migration and groundwater transport); exposure routes (soil ingestion/adsorption, inhalation, ingestion/dermal contact, and diffuse flow); receptors (on-site and off-site workers, construction workers, residents, flora and fauna, and surface and groundwater supplies). Conclusions in Table 6 indicate that the following potential complete exposure pathways exist:

Surficial Soil (0-2 feet)
Direct contact with surficial soil by on-site workers and construction workers by excavation within the USTs area: There is no evidence of soil impacts at the surface (discoloration or odor). No soil samples from the "surficial zone" (0-2 feet) were tested. Of the 8 soil samples tested from a depth of 2 to 4 feet, only one sample showed an exceedance of SHSs and that was Benzene at SB-14, within the USTs area. Exposure from contact with surficial soil appears to be insignificant.

Subsurface Soil (>2 feet)
Inhalation of vapors from contaminated subsurface soil: Air phase testing has shown indoor air results exceed PADEP Indoor Air Criteria. Elevated indoor air results are likely attributed mainly to vehicles running combustion engines within multiple area of the main building. This potential exposure pathway will be further evaluated by additional air phase testing described in Section 5.

Subsurface soil poses a potential exposure pathway through "volatilization" as it may affect indoor air by means of inhalation. Also, there exists a potential "soil to groundwater" transport mechanism that could impact groundwater supplies by means of ingestion/dermal contact. Subsurface soil below approximately 4 feet is at or below the seasonal high water table and will therefore be handled as a groundwater issue and will be further evaluated as such. Groundwater testing has shown that several of the COC are above SHS, Used Aquifer, Residential, Soil to Groundwater MSCs from within and in close proximity to the UST cavity. Table 6 provides further description of potential receptors. Attainment of SHSs for soil will be demonstrated following attainment of SHSs for groundwater.

Direct contact with subsurface soil by on-site workers and construction workers by excavation within and immediately adjacent the USTs area is a possible exposure route. This potential exposure pathway will be addressed through the use of worker safety plans which will be in place at the time of excavation.

Groundwater (Dissolved)

Dissolved COC in groundwater: Groundwater from the area of the USTs can potentially be of concern through direct contact, volatilization and groundwater transport, by means of ingestion/dermal contact, indoor inhalation and groundwater transport (as a potential threat to groundwater supplies). Potential receptors are shown in Table 6. Testing of the monitoring well network has shown no potential discharge of groundwater to the surface. Although no impact has been detected in the Township's on-site water well, potential impact to water wells on or off-site cannot be ruled out.

Inhalation of vapors from groundwater volatilization can potentially occur during excavation within the UST area and could possibly affect indoor air quality. This potential exposure pathway will be further evaluated by on-going groundwater testing of monitoring wells installed within the unconsolidated materials above bedrock and the four wells (MW-9, MW-18, MW-20, and MW-23) restricted to the bedrock zone, as well as additional air phase testing as described in Section 5. The Township's on-site water well will be sampled monthly beginning in February 2017, in order to monitor this potential exposure route.

7.1 Chemicals of Concern (COC) and Hazards for All Media

COC are constituents of virgin unleaded gasoline, the substance released at the Site. Specific chemicals evaluated by SC, as applicable to the year of the release (post March 2008 list), include those listed in PADEP's Land Recycling Program Technical Guidance Manual Table IV-9, *Document Number 253-0300-100 (March 15, 2008)*, as Short List of Petroleum Products for Unleaded Gasoline ("New Short List"). MSCs of the "Short List" compounds that were updated as of August 27, 2016 are used in the tables in this report. The following chemicals were tested in all media: Benzene; Toluene; Ethylbenzene; Total Xylenes; Cumene (Isopropylbenzene); MTBE; Naphthalene; 1,2,4-Trimethylbenzene; and 1,3,5-Trimethylbenzene.

As part of SC activities, soil samples were collected at 17 boring locations (17 samples total). Benzene exceeded the SHS in soil samples collected from SB-3, SB-8, and SB-14; 1,2,4-Trimethylbenzene and 1,3,5-Trimethylbenzene exceeded SHS in the sample collected from SB-6. Soil samples were collected from above the water table from the interval that showed the most impact based on field observations and photoionization detector readings. The borings that had soil samples exceeding SHS are all located in the immediate area of the UST cavity, as seen on Figure 4. The interval where COC were found to be above SHS is from 2 to 4 feet below the ground surface. Soil analytical results are provided in Table 3.

As part of SC activities, 5 rounds of groundwater sampling were completed for MW-1, MW-2, MW-3, MW-4, and MW-6; 3 rounds were completed for MW-9, MW-10, MW-11, and MW-12; 2 rounds have been completed at the Township's water supply well; and one round has been

performed at newly installed wells MW-18, MW-19, MW-20, MW-21, MW-22, MW-23, MW-24 and RW-1. Locations having exceedances of SHSs in groundwater are illustrated in Figures 6A through 6R, which show COC values for several sampling events and the aerial extent of impacts. Groundwater analytical results are provided in Table 4 and laboratory certificates-of-analysis are provided in Appendix C. Analytical testing has shown that dissolved impacts of COC in groundwater are limited to the Shenango Township property.

Indoor air quality was evaluated by means of indoor, outdoor, and soil vapor testing. Table 5 shows all soil vapor/air phase testing conducted to date. Three rounds of air sampling were completed from an unoccupied hallway inside the main building [SV/AP- #1 (Indoor)], outside the main building [SV/AP- #2 (Outdoor)]. Two rounds of sampling was performed at Soil Vapor Point 1 [SV/AP- #3 (SV-1)], and Soil Vapor Point 2 [SV/AP- #4 (SV-2)]. Groundwater levels were too high to collect an air phase sample at these locations on 1/19/2017. One round of air phase sampling was performed at two other indoor locations, the office and garage break room, as previous testing showed a need to expand indoor air testing. The analytical results are compared to PADEP Indoor Air Criteria Nonresidential screening values. The SV/AP- #1 (Indoor) samples from both rounds of testing exceeded the screening values for Benzene, 1,2,4-Trimethylbenzene, 1,3,5-Trimethylbenzene, and Naphthalene. The SV/AP- #3 (SV-1) samples from July 11, 2016, exceeded the screening values for Ethylbenzene, Total Xylenes, and Naphthalene but only for Ethylbenzene on August 2, 2016. The SV/AP- #4 (SV-2) samples from July 11 and August 2, 2016, exceeded the screening value for several COC. Only Naphthalene slightly exceeded the screening value at the indoor-office and indoor-garage break room locations on January 19, 2017, the only sample collected to date from these locations. Additional testing is required to satisfy the requirements of *PADEP's Land Recycling Program Technical Guidance Manual, Section IV.A.4. Vapor Intrusion into Buildings from Groundwater and Soil under the Act 2 Statewide Health Standard* in order to demonstrate that there is no potential impact to indoor air quality. Soil vapor analytical results are provided in Table 5. Additional soil vapor/air phase testing is discussed in Section 5.

Analytical results for soil are provided in Tables 3; for groundwater, Table 4; and for Soil Vapor/Air Matrix, Table 5. Certificates-of-analysis for testing of soil, groundwater and soil vapor/air phase are provided in Appendix C.

7.2 Separate Phase Liquid (SPL)

No SPL has been encountered at the Site.

7.3 COC in Soil

The status of COC in soil is described in detail in Section 3.2.1 and 7.1 (For Soil). Twenty-two (22) soil samples were collected from soil borings installed at the Site and four of the samples showed exceedances of SHSs for at least one compound, including Benzene, 1,2,4-Trimethylbenzene, and 1,3,5-Trimethylbenzene (Table 3). Sampling locations for all the soil samples tested, provided in Figures 2A through 4B, show the impacted soil above SHSs is limited to the UST area. No other areas have been identified where additional soil testing may be applicable above the seasonal high water table. Sampling to demonstrate attainment of SHSs for soil will be conducted upon completion of remedial actions. Benzene, 1,2,4-Trimethylbenzene, and 1,3,5-Trimethylbenzene are the only COC that have been recognized for soil.

7.4 COC in Groundwater

The analytical results for groundwater sampling are tabulated in Table 4. Seventeen groundwater monitoring wells have been installed at the Site. Five rounds of groundwater sampling have been completed for MW-1, MW-2, MW-3, MW-4, and MW-6. Three rounds have been completed for MW-9, MW-10, MW-11, and MW-12, which were installed in September 2016. One round has been completed for MW-18, MW-19, MW-20, MW-21, MW-22, MW-23, MW-24, and RW-1, which were installed in February 2017. The Township's water supply well has been tested twice.

MW-3, located approximately 6 feet north and down-gradient from the UST cavity, near the northern edge of the diesel tank UST, has had eight of the nine Chemicals of Concern (COC) exceed the SHS. RW-1, located approximately 5 feet north and down-gradient from the UST cavity, approximately 8 feet west of MW-3, had seven of the nine COC exceed the SHS. MW-6, located in the former gasoline UST excavation, has had five of the nine COC exceed the SHS. MW-23, a deep monitoring well located approximately 25 feet north and down-gradient from the UST cavity had only MTBE exceed the SHS in the one round of groundwater sampling. Additional testing will determine whether or not the MTBE at MW-23 is a result of cross contamination during will installation, as suspected. Groundwater samples from MW-4, located 48 feet to the north and down-gradient from the former gasoline UST excavation, have exceeded the SHS for Benzene and MTBE during three of the five sampling events. The two most recent sample tested from MW-4 (11/1/16 and 2/17/17) showed no COC above the SHS. MW-19, installed in February 2017 on the west side of the Township Building, had two of the nine COC exceed the SHS. MW-21, installed in February 2017 in the parking lot on the west side of the Township Building, had four of the nine COC exceed the SHS.

Quarterly testing of monitoring wells will continue until point-of-compliance locations demonstrate attainment of SHS, Used Aquifer, Residential criteria.

7.5 Soil Vapor / Indoor Air Quality

Soil vapor/air phase test results have exceeded PADEP Indoor Air Criteria Nonresidential screening values (*PADEP Land Recycling Program Technical Guidance Manual for Vapor Intrusion into Buildings from Groundwater and Soil under Act 2 - Document Number 261-0300-101; Table 5; January 18, 2017*) for the indoor samples and from both soil vapor points. Test results are provided in Table 5. Indoor air phase samples (locations shown in Figure 4B) were collected from an unoccupied hallway situated between the maintenance garage and fire station sections of the main building, the Township Secretary's office near the northwest corner of the main building, and the office/break room located at the northwest corner of the garage section of the main building. Indoor air quality at the location where samples were collected is possibly impacted by the motor vehicles and equipment which are parked and maintained inside multiple areas of the main building. Further sampling will be conducted in occupied sections of the building, as well as from two sub-slab vapor sample locations from below the concrete floor of the garage area, as described in Section 5. Sub-slab sample locations, as well as indoor air locations, are shown in Figure 4B. Air phase samples will be collected as necessary to satisfy the requirements of the PADEP guidance document described previously in this paragraph.

7.6 Fate and Transport (F&T) Analysis

Five rounds of groundwater sampling were completed from the original monitoring wells around the UST cavity (MW-1, MW-2, MW-3, MW-4, and MW-6). Three rounds have been completed for MW-9, MW-10, MW-11, and MW-12, which were installed in September 2016. One round has been completed for MW-18, MW-19, MW-20, MW-21, MW-22, MW-23, MW-24, and RW-1, which were installed in February 2017. The Township's water supply well has been tested twice to date. Groundwater testing from the entire monitoring well network and the on-site water well shows that dissolved impacts in groundwater above SHSs are limited to the area around and down-gradient of the UST cavity, which extends under the building and to the west of the building, as illustrated in Figures 6K through 6M.

Aquifer testing was completed using MW-4 as an extraction well, as previously described in Section 3.3. Hydraulic conductivity was determined using the Aqtesolv Model. Prior to the most recent round of monitoring well installation in February 2017, a 30-year Bioscreen F&T Model showed that the potential migration distance of Benzene (the main COC) in groundwater above the SHS is 50 feet from the north edge of the former gasoline UST excavation, which is well within the property boundary. The Bioscreen F&T Model showed that the greatest potential migration distance is from the 6-year model, resulting in a potential distance of 130 feet from the edge of the former gasoline UST excavation. Considering data collected from the newly installed monitoring wells, the former Bioscreen Model appears to be invalid and not enough data has been collected to perform a meaningful Bioscreen (or equivalent) F&T Model at this

time (as was discussed with PADEP during our on-site meeting on January 30, 3017). As a result, a F&T computer model is not included in this report. Based on groundwater and soil testing data, hydrocarbon impacts from the UST release are confined to the Shenango Township property.

The collection of groundwater analytical data will continue in order to monitor the stability of the groundwater plumes and to refine the fate and transport analysis. Trend line graphs will be provided in remedial action progress reports (RAPRs).

7.7 Preliminary Analysis of Potential Exposure Pathways and Sensitive Receptors

A discussion of sensitive receptors and potential exposure pathways is provided in Sections 2.4 and 7.0. Conclusions relative to the release of unleaded gasoline that have occurred at the Site are as follows:

A potential exposure pathway exists through direct contact with subsurface soil by onsite workers and construction workers during digging below a depth of 2 feet. This potential exposure pathway is minor except in the immediate area of the former UST and existing UST. There are no indications (no staining or odor) that surficial soil (0-2 feet) is impacted by the release, but it has not been tested (only soil tested from 2 to 4 feet in the UST area has shown impacts above SHSs).

A potential exposure pathway exists through inhalation of volatilized COC from impacted subsurface soil and groundwater. Laboratory analysis of soil vapor samples and air phase samples from inside the main building exceeded Indoor Air Criteria Nonresidential MSC screening values. The possibility that indoor air is affected by vehicles and equipment inside the building will be further evaluated by additional testing as described in Section 5, which will include sub-slab testing.

The only potential exposure by direct contact with impacted subsurface soil is to workers during excavation within and immediately adjacent to the USTs cavity (including the former gasoline UST and active diesel UST). This is considered an incomplete pathway, as worker safety will be addressed during any excavation activities of the affected area.

A potential exposure pathway exists through subsurface soil, soil to groundwater, ingestion/dermal contact. Groundwater sampling has shown that several of the COC are above SHSs, Used Aquifer, Residential, Soil to Groundwater MSCs from within and down-gradient of the UST cavity, as best illustrated in Figures 6K through 6M.

A potential exposure pathway exists through groundwater transport of impacted groundwater to water supply wells (ingestion/dermal contact). The extent of the dissolved groundwater plume containing COC above SHS has been defined and is limited to the area surrounding the USTs cavity and extending down-gradient as shown in Figures 6K through 6M. This exposure will be continually evaluated by quarterly sampling of the monitoring well network, including monthly sampling of the Township water supply well. This is the most important potential exposure recognized at this time from the release. No potential impact to off-site water supply wells is evident at this time. A potential exposure route by means of ingestion/dermal contact also exists to on-site construction workers during excavation in the vicinity of the USTs.

There are no complete exposure pathways for surface water. The depth to groundwater and the analytical results from groundwater monitoring network show no potential impact to surface water.

Table 6, Conceptual Site Model, provides more discussion on potential exposure pathways and receptors.

8.0 SELECTION OF CLEANUP STANDARDS AND RATIONALE

8.1 Statewide Health Standard (SHS)

8.1.1 Soil Medium Specific Concentrations (MSCs)

The Site is located in an area that has residential properties. Soil is being evaluated according to both SHSs Direct Contact Residential MSCs and SHSs Soil to Groundwater MSCs as provided in *PA Code Title 25, Chapter 250 Appendix A, Table 3A and Table 3B*, respectively. The lowest value provided for each constituent being tested, considering both categories, is considered the attainment value. Individual constituents being tested are those contained in PADEPs New Short List of Petroleum Products for Unleaded Gasoline (March 2008 list) that includes Benzene; Toluene; Ethylbenzene; Total Xylenes; Isopropylbenzene (Cumene); Methyl Tert-Butyl Ether (MTBE); Naphthalene; 1,2,4-Trimethylbenzene; and 1,3,5-Trimethylbenzene. MSC values as revised on August 27, 2016 are used in this report.

8.1.2 Groundwater MSCs

The Site utilizes groundwater through the use of Shenango Township's water supply well located at the west side of the main building. Residential properties in the area are served by individual private "on-lot" groundwater wells, as municipal water is not available. This report considers that all inhabited residences within the area of concern utilize a groundwater supply well. Groundwater is being evaluated according to SHSs Used Aquifers, Residential MSCs as provided in *PA Code Title 25, Chapter 250 Appendix A, Table 1*. The value provided for each

constituent being tested, using values that were revised as of 8/27/2016, is considered the attainment value. Individual constituents being tested are those contained in PADEPs New Short List of Petroleum Products for Unleaded Gasoline (March 2008 list) that includes Benzene; Toluene; Ethylbenzene; Total Xylenes; Isopropylbenzene (Cumene); MTBE; Naphthalene; 1,2,4-Trimethylbenzene; and 1,3,5-Trimethylbenzene.

8.1.3 Soil Vapor / Indoor Air Quality MSCs

No residential structures are located within 300 feet of the impacted soil and groundwater. Soil Vapor / Indoor Air Quality is being evaluated according to *PADEP Land Recycling Program Technical Guidance Manual – Section IV.A.4 (Vapor Intrusion into Buildings from Groundwater and Soil) – Document Number 261-0300-101, Table 5.* The Indoor Air Criteria Nonresidential MSC for each constituent being tested is considered the screening value. Individual constituents being tested are those contained in PADEPs New Short List of Petroleum Products for Unleaded Gasoline (March 2008 list) that includes Benzene; Toluene; Ethylbenzene; Total Xylenes; Isopropylbenzene (Cumene); MTBE; Naphthalene; 1,2,4-Trimethylbenzene; and 1,3,5-Trimethylbenzene. Screening values that became effective on 1/18/2017 are used in this report. Applicable screening values (PADEP Indoor Air Criteria Nonresidential) are provided in Table 5.

REMEDIAL ACTION PLAN

9.0 REMEDIAL OPTIONS EVALUATION

Remedial options considered to further remediate the dissolved COC plume in groundwater include the following:

- Air Sparging (AS): This option would utilize air injection into the saturated zone, within the zone of water table fluctuation and below the water table. Air injection wells (AIWs) would be installed within the area of the dissolved groundwater plume. The AIWs would be installed at adequate spacing so that the injected air would affect the entire area of the dissolved plume. Air sparging would stimulate oxygenation and increased biological degradation of the contaminants. A major problem with this method appears to be its questionable effectiveness due to the tightness (low permeability) of the subsurface materials, making it difficult to establish a significant radius of influence around each well (the injected air would not be able to be distributed very far away from the injection well). Air sparging would also be a very costly option for equipment, operation and maintenance and could potentially cause increased vapor intrusion issues into the main

building. Soil vapor extraction should be used in conjunction with AS, but the shallow groundwater limits the size of the unsaturated zone, making the capture of liberated vapors challenging. The negative factors greatly outweigh the positive for this method and as a result *the AS method is not recommended*.

- Soil Vapor Extraction (SVE): The SV method is most applicable to removing contaminants from the vadose (unsaturated zone) by means of an applied vacuum. Considering the high seasonal water table, SVE would not be an affective remedial option. For this reason, along with the relatively high cost of installation and maintenance, *SVE is not recommended*.

- Dual Phase Extraction (DPE): The DPE method is similar to SVE in that it removes contaminants in soil vapors and groundwater by means of an applied vacuum. DPE would employ a stronger vacuum than SVE and is designed to remove not only soil vapors but also SPL from the capillary fringe. This method also removes a substantial amount of groundwater. Considering that there is currently no SPL and considering the high cost associated with installation and maintenance of the remedial system, *DPE is not recommended as a remedial option at this time*. The low and variable permeability of the subsurface materials also makes this method unattractive.

- Pump and Treat (P&T): P&T would involve pumping impacted groundwater from recovery wells, then treating the groundwater for re-injection or discharge under a PADEP general permit. This method is very effective in preventing plume migration. In order to implement P&T, recovery wells would need to be installed. RW-1 was installed during the February 2017 drilling in order to facilitate this remedial option if needed. When the former gasoline UST cavity is excavated to remove the source (as proposed in this RAP), an additional groundwater recovery point will be installed. This method could take a lot of time to lower dissolved components in groundwater to SHSs. Also, there is a high cost for equipment and operation. *P&T is a viable remedial option* for conditions present at the Site but *it is only considered as a secondary option if Source Removal fails* to show progress in containing and diminishing the dissolved COC plume.

- Enhanced Bioremediation (EB): EB is an in-situ method that would involve stimulating naturally occurring micro-organisms in the soil and groundwater that utilize hydrocarbons as a food supply by optimizing nutrients and oxygen levels. This process destroys the mass of contaminants in-situ. The EB option would require installing approximately 4 to 8 injection wells within the plume for oxygen and nutrient injection. This method would utilize the natural movement of groundwater, both horizontally and vertically, to transport the nutrients and oxygen to contaminants to stimulate biodegradation. The injections would be periodic at each injection well and would not

require permanent equipment on-site that could interfere with operations at the facility. Prior to implementing EB a laboratory treatability study should be performed to determine if the natural microbial population is suitable for degrading the contaminants, or if the addition of micro-organisms would be needed. A treatability study would also determine the best mixture of nutrients to accelerate microbial decay of the contaminants. The advantage of the EB method is that the initial equipment cost and ongoing operating cost would be low compared with other options (except PR). Also, no discharge permits would be required. The only permit that would be required is the Federal UIC injection permit which is relatively easy to obtain for this type of application. This option would be well suited as a secondary remedial method if additional remedial action for groundwater is necessary following the source removal. This will likely be the case as source removal may not completely address dissolved contaminants from within the existing diesel fuel UST cavity. For the reasons presented above, *EB is a viable remedial option* if additional remedial action is necessary following source removal. *EB is recommended as a second option* to contain and diminish the dissolved COC plume. The EB option should be considered if after 4 to 5 quarterly groundwater sampling events following source removal there is no evidence that attenuation is occurring or the plume is expanding. If there are signs that the plume is expanding EB should be implemented sooner.

- Chemical Oxidation (ChemOx): ChemOx would work under the same principal as EB, meaning the contaminant mass would be destroyed in-situ, rather than extracting the contaminants like other methods presented herein. No water or air discharge permits would be required. Unlike EB, ChemOx requires adding an oxidizing chemical such as Permanganate, Peroxide or Persulfate into the ground rather than relying on naturally occurring organisms to degrade contaminants (as does EB). ChemOx kills the naturally occurring organisms, thereby reducing the ability for natural attenuation to occur. It is often difficult to predict the effective time frame of oxidation chemicals following application as they can react with many solid compounds in the ground, not just the contaminants. ChemOx would require a similar amount of injection wells to be installed as for EB. Also, cost of ChemOx reagents is much higher than the nutrients that would be used for EB. Although *ChemOx would be a viable remedial option, it is not recommended ahead of EB* for the reasons discussed (higher cost, killing the natural biota and approximately the same time to achieve attainment of SHSs as EB).

- Source Removal: Source removal involves removing the mass of contaminants at the source in both soil and groundwater media. The highest concentrations of COC in the groundwater plume occur at or just downgradient of the former gasoline UST excavation area. When the gasoline UST was removed in December 2015, all excavated soils were placed back into the excavation. Source Removal has a relatively high "up front" cost for

transportation, disposal and clean-fill emplacement, but if the source is successfully removed it can prove to be in the long run a very cost competitive option compared with other remedial options that are based on extracting and treating the contaminants. Extracting and treating the contaminants would not be an effective option until the source has been removed. It has been reported by Shenango Township and the PADEP that the contaminated soil was observed to be concentrated at the west end of the excavated area, however, the soil was removed during removal of the UST and placed back into the excavation, likely resulting in mixing of the impacted soil. The 4 soil samples collected during SC activities that exceeded SHS are located within the UST excavation area and just north of the existing diesel fuel UST. During the source removal action for soil, groundwater that accumulates in the excavation will be removed using a vacuum truck. Groundwater will also be extracted from recovery well RW-1 that shows high COC concentrations. The source removal option was suggested by PADEP during an on-site meeting on January 30, 2017. *Source Removal of soil coupled with concurrent groundwater extraction is recommended as the primary remedial option.*

- Monitored Natural Attenuation (MNA): This option, also known as Passive Remediation, involves no physical action and involves only groundwater monitoring and testing to show that a dissolved contaminant plume is stable and/or degrading naturally. MNA is not recommended as more active remedial action is necessary to protect water supply wells.

10.0 REMEDIAL APPROACH

10.1 Historical Remedial Activities

Interim remedial actions have not been necessary to prevent an immediate threat to human health or the environment. Water supplies have not been affected. Free product, or separate phase liquid (SPL), has not been encountered at the Site.

10.2 Remedial Goals – Request for Relief from Liability

Remedial goals are attainment of Statewide Health Standards Residential for both soil and groundwater as described in Section 8.1. The goal for indoor air quality is to meet the appropriate screening values presented in *PADEP Document Number 261-0300-101, Land Recycling Program Technical Guidance Manual for Vapor Intrusion into Buildings from Groundwater and Soil under Act 2*, effective January 18, 2017. Upon attaining the remedial goals, Shenango Township requests relief from liability for the chemical compounds that have

been tested, as listed in Tables 3 through 5 of this SCR-RAP, and for all media for which has been tested that have achieved attainment of SHSs.

10.3 Remedial Options Chosen

The primary remedial option chosen is Source Removal, involving both soil and groundwater. When the gasoline UST was removed in December 2015, all excavated soils were placed back into the excavation. It has been reported by Shenango Township and the PADEP that the contaminated soil is likely concentrated at the west end of the excavated area and the former line to the dispenser, as the soil was replaced from the same general area that it had been removed. The observed impacted area however was excavated during removal of the UST, placed in a common pile and returned to the excavation, likely causing mixing of the observed contaminated soil. As Source Removal is taking place, a Professional Geologist from CES will field screen soils as they are excavated to segregate obviously contaminated soils from soil that is not obviously contaminated. Field screening methods will include the use of a photoionization detection (PID) meter, visual observation of stained soils, and olfactory senses to detect hydrocarbon impacted soil. The soil appearing clean will be tested for the COC parameters described in this report prior to being returned to the excavation. The amount of samples collected will be determined by the volume of apparently clean soil, but a minimum of 4 samples will be tested to document that the soil is not impacted. PADEP solid waste regulations and guidelines will be followed to determine re-use options. Hydrocarbon impacted soil will be disposed of at a disposal facility licensed to accept the type of waste. Prior to disposal, the waste will be properly characterized and will be transported under the appropriate waste manifest protocol. Waste transportation documents and disposal receipts will be included in a report of the source removal option that will accompany a RAPR.

The estimated size of the source removal excavation is 33 feet long by 21 feet wide by 7 feet deep. The estimated size of the gasoline dispenser line area to be excavated is 10 feet long by 5 feet wide by 5 feet deep. The total soil volume for estimation purposes is 190 cubic yards, or approximately 295 tons. CES expects only 40% (76 cubic yards / 118 tons) of this estimated volume will be contaminated and require disposal.

Once the on-site Geologist has determined that the impacted soil has been sufficiently removed, eight biased soil samples will be collected from the sides of the excavation above the soil/water interface. These samples will be collected from points where any possible remaining contamination would likely be located in order to confirm that the excavation has successfully removed impacted soils. Samples will be tested for the COC parameters described elsewhere in this report and as shown in Table 3.

During the soil removal action, groundwater encountered within the excavation and from RW-1 will be removed using a vacuum truck. All water recovered by the vacuum truck will be transported from the Site to a licensed treatment/disposal facility. The volume of water that would be removed and disposed is estimated to be from 500 to 3,000 gallons. Liquid waste transportation and treatment/disposal documents will be maintained as described above for solid waste. Before the excavation is backfilled, a recovery well will be placed in the backfill to facilitate future water removal if necessary.

Three additional "Vacuum Truck Liquid Removal" ("Vac") events are proposed monthly following the Source Removal. Water will be removed from RW-1 and RW-2 (which will be installed in the backfill of the excavation). In addition to water removal from the recovery wells, monitoring wells that have shown exceedances of SHS will have groundwater removed during each event. These monitoring wells are MW-3, MW-4, MW-6, MW-19, MW-21, and MW-23. As described above, all liquid waste will be taken to a licensed treatment/disposal facility and all transportation and disposal records will be maintained and included in a RAPR.

Upon completion of the proposed Vac events, the need for additional remedial action will be re-evaluated and a Revised Remedial Action Plan will be submitted to PADEP if additional remedial action is necessary, as determined by the concentration of any remaining COC, based on groundwater analytical results. If additional remedial action is necessary, Enhanced Bioremediation will likely be the method proposed.

Upon approval of the RAP or otherwise "go ahead" is provided by PADEP, CES will provide USTIF with a cost estimate for performing the proposed work and will begin within 10 work days upon funding approval.

10.4 Remedial Action Progress Reports

Upon approval of the SCR-RAP by PADEP remedial action progress reports (RAPRs) will be provided quarterly until attainment of SHSs for soil and groundwater is completed. Until the SCR-RAP is approved, quarterly monitoring, sampling and testing of groundwater as performed for the first quarter 2017 will be continued. The RAPRs will include new information obtained during the reporting period, including updated tables of analytical results, maps of sampling locations and isoconcentration maps. RAPRs will be submitted by the end of the month following completion of each quarter.

10.5 Schedule

The following is an approximate schedule for the Site including additional SC tasks and proposed remedial action items through September 2017.

- Township water supply well pumping test and monthly sample collection – March 2017
- Indoor air and sub-slab air phase sampling – April 2017
- Township Water Well monthly sample collection – April 2017
- Source Removal / Liquids removal – May 2017
- Township Water Well monthly sample collection – May 2017
- 2nd Quarter 2017 groundwater sampling – June 2017
- Vacuum Truck Liquid Removal Event – June 2017
- Township Water Well monthly sample collection – June 2017
- Vacuum Truck Liquid Removal Event – July 2017
- Township Water Well monthly sample collection – July 2017
- 2nd Quarter 2017 RAPR
- Vacuum Truck Liquid Removal Event – August 2017
- Township Water Well monthly sample collection – August 2017
- 3rd Quarter 2017 groundwater sampling – August 2017
- Township Water Well monthly sample collection – September 2017
- Submit revised RAP (if necessary) – End of October 2017

Parts of this schedule which are subject to approvals are subject to change based on the time frame of the RAP approval from PADEP and approval of funding for remedial actions by USTIF.

11.0 REMEDIAL ACTION COMPLETION

11.1 Soil Attainment Demonstration – Points of Compliance

Once groundwater attainment has been achieved, additional soil sampling will be performed to demonstrate attainment of SHSs according to *PA Code Title 25 Chapter 250.703*. Additional information on regulated substances in soil and soil sampling completed during SC is provided in Section 3.2.1. All soil sampling locations (areas where known impacts have occurred that have not demonstrated attainment of SHSs) will be considered POC locations. Soil attainment of SHSs will be evaluated in accordance with *PA Code Title 25, Chapters 250.703 and 250.707.*

Points of Compliance (POCs) for soil will be all areas of concern where soil samples were above SHSs, including the former UST excavation

11.2 Groundwater Attainment Demonstration – Point of Compliance Locations

The attainment demonstration of SHSs in groundwater is to consist of monitoring and sampling/testing at Point of Compliance (POC) locations for a minimum of 8 consecutive

calendar quarters, with the possible request to reduce the testing period based on test results, as stipulated in *PA Code Title 25 Chapter 250.704,* upon the approval of the Department. Groundwater POC locations will include shallow monitoring wells near the property boundaries: MW-1; MW-10; MW-11; MW-12; and MW-24; and all bedrock monitoring wells: MW-9, MW-18, MW-20, and MW-23. The Township water supply well will also be considered a POC location and tested along with attainment sampling events. Attainment sampling will begin following the remedial actions proposed and when it appears that the COC in groundwater have been removed to SHSs and/or the plume is stable. Additional information on regulated substances in groundwater is provided in Section 3.2.2.

11.3 Soil Vapor / Indoor Air Quality Demonstration

Analytical results from all of the sampling performed in association with evaluating soil vapors and potential impact to indoor air quality from the release of unleaded gasoline are provided in Table 5. Additional testing is needed to evaluate indoor air quality. Sub-slab vapor samples will be collected from two locations within the garage area of the main building and a second round of air phase samples will be collected from the two office areas in April 2017 (locations shown in Figure 4B). Additional air phase sampling will take place once the source removal event has been completed and the Site meets the indoor air quality screening standards presented in the *PADEP Land Recycling Program Technical Guidance Manual-Section IV.A.4, Vapor Intrusion into Buildings from Groundwater and Soil under the Act 2.*

11.4 Remedial Action Completion Report

A Remedial Action Completion Report (RACR) will be prepared and submitted to the Department as soon as possible upon attainment of SHSs for all media. All groundwater monitoring wells, extraction wells, soil vapor points, and any other infrastructure will be properly abandoned following approval of the RACR.

11.5 Post Remediation Care Requirements

Upon demonstration of attainment of the selected SHS for all media, as is the remedial goal, no Post Remediation Care will be needed, and as a result, no Post Remediation Care Plan is included in this RAP. It is anticipated that remedial measures addressed in the report will eliminate all potential exposure pathways addressed in this report.

12.0 SITE SPECIFIC PLANS

12.1 Health and Safety Plan

A Health and Safety Plan specific to the Site is provided in Appendix D.

12.2 Sampling and Analysis Plan

Soil sampling, screening and handling will be conducted by CES according to the procedures provided in Appendix D – Policies and Procedures, specifically: Procedure D – Soil Sampling; Procedure E – Jar Headspace Screening; and Procedure F – Preparation of a Chain of Custody Form. Certification of the testing laboratory can be documented by the accreditation information provided on the Certificate-of-Analysis laboratory reports.

CES has and will use testing laboratories that are accredited by PADEP for testing of all media.

Soil attainment sampling will be conducted according to *PA Code Title 25, Chapter 250.703*, which states that "sampling points for demonstration of attainment of soils shall be selected to be random and representative both horizontally and vertically". Groundwater sampling will continue to be performed according to applicable sections of CES's Policies and Procedures listed in this section. All areas having COC in soil above the SHS (Table 3) will be considered POC locations.

Additional soil vapor/air phase sampling is necessary. Soil vapor/air phase sampling conducted by CES has utilized pre-cleaned and laboratory prepared "summa canisters" that had a laboratory set vacuum. During testing, pre and post sampling air vacuum readings on the summa canister were recorded as well as the start and stop time of sample collection. This information was provided to the testing laboratory on the Chain-of-Custody. Air phase samples collected by CES were obtained over a period of 30 minutes. CES will continue to follow proper protocols during additional soil vapor/air phase sampling as provided in Appendix D.

12.3 Quality Assurance / Quality Control Plan

CES's Quality Assurance / Quality Control Plan includes adherence to all of the applicable items included in Appendix D, including: Health and Safety Plan; MSDS for Unleaded Gasoline; and all Policies and Procedures, in particular the Limited QA/QC procedure.

13.0 REFERENCES

References used in conjunction with SC and remedial action planning are provided in Appendix A.

TABLE 6
Conceptual Site Model - Exposure Pathways
Shenango Township Municipal Complex
3439 Hubbard-West Miiddlesex Road
Shenango Township; Mercer County
PADEP Facility ID 43-04177; USTIF Claim No. 2016-008(S)