GROUNDWATER / VAPOR INTRUSION ANALYSIS REPORT

GREER TANK FACILITY
2921 WEST INTERNATIONAL AIRPORT ROAD
ANCHORAGE, ALASKA

November 29, 2013

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1. INTRODUCTION

This report presents the results of a groundwater monitoring and indoor air vapor assessment completed by Rescon Alaska LLC (Rescon) at the Greer Tank Facility in Anchorage, Alaska. The assessment activities were completed on behalf of Alaska National Insurance Company (herein referred to as "the client"), and in accordance with the project work plan dated July 15, 2013 and the workplan addendum dated September 10, 2013.

The assessment was completed as part of an effort to characterize the environmental contamination resulting from historic releases of chlorinated solvents at the Greer Tank Facility property in the early 1980s. Cleanup of the environmental contamination is regulated by the Alaska Department of Environmental Contamination (ADEC). The ADEC file number for the property is 2100.38.369.

The project activities consisted of the installation of two new monitoring wells, collection of groundwater analytical samples, an evaluation of the groundwater hydraulic gradient and collection of indoor air vapor samples in the Greer Tank Facility and adjacent property building to the northwest. For clarity purposes, the adjacent property, which is occupied by Stanley Automotive, and the Greer Tank property are referred to jointly in this report as "the site". The work was conducted to attempt to meet the following objectives:

- Sample the site's monitoring wells for the presence and concentration of chlorinated solvent contamination in the local groundwater.
- Determine the local hydraulic gradient at the site to support delineation of the groundwater contamination.
- Install two additional monitoring wells to define contaminant boundaries at the site.
- Assess vapor intrusion risk for the contaminants of concern (COC) in the Greer Tank and Stanley Motors buildings.

This report has been drafted to provide a detailed description of the field activities, sample collection and data analysis performed to meet the above listed objectives; as well as to make recommendations for additional activities necessary to move this site to closure status in the ADEC Contaminated Sites system.

1.1. Site Description

The Greer Tank Facility (Greer) property is located at 2921 West International Airport Road in Anchorage, Alaska as shown in Figure 1. The facility is located in a commercial/industrial area in west Anchorage. The Greer property consists of an irregularly shaped building surrounded by an asphalt paved lot. North of the building are two hangar tents, which are used for sand blasting activities. A chain link fence encloses the property to the north, west and south.

The Stanley Automotive (Stanley) property is located adjacent to the northwest of the Greer property. The Stanley property sits approximately four feet lower in elevation from the Greer property. The two lots are separated by a concrete retaining wall. The Stanley building consists of an automotive body shop, office space, a vehicle detailing bay, and a RV rental shop as shown on Figure 2.

The elevation of the property is approximately 80 feet above mean sea level with little observable topographic relief across the site. The water table in the area of the contaminant plume has been documented between 7 to 10 feet below the ground surface. Previous investigation and monitoring efforts have reported differing groundwater gradients at the site, with groundwater directions ranging from the north-northwest to the southwest in the area. A groundwater direction to the west-northwest was observed during 2013 field efforts.

1.2. Site History

The Greer property has been occupied by Greer Tank and Welding, Inc. since 1972. The company operations consist of storage tank fabrication and sales and custom tank welding.

The ADEC database records document several known or suspected environmental releases that have occurred on the property.

1.2.1. Petroleum Contamination

According to the ADEC Leaking Underground Storage Tank (LUST) database, two 1,500 gallon underground storage tanks (USTs) were removed from the site in 1991. The storage tanks contained diesel and gasoline for fueling company vehicles. Analytical samples collected during the tank removal detected concentrations of diesel range organics (DRO) and benzene above ADEC cleanup levels in the soil. An excavation effort was performed to ensure removal of the petroleum impacted soil from the site. Approximately 10 cubic yards (cy) of contaminated soil was hauled offsite for thermal remediation. In 2009, ADEC issued a Corrective Action Completion Determination, indicating that the exposure concern from the petroleum released from the USTs did not pose an unacceptable risk to human health or the environment.

1.2.2. Chlorinated Solvent Contamination

Based on available historic site information, two potential chlorinated solvent releases were documented at the site. According to the ADEC Contaminated Sites (CS) Database file on the site, sometime during the winter of 1979-1980, a fire broke out at the facility. At the time of the fire, up to three 55-gallon drums of paint thinner and a vat containing solvent were located in the western portion of the shop building. It was unconfirmed whether any contaminants were released to the environment during the fire. A second incident occurred during the summer of 1981 or 1982, when a forklift punctured a 55-gallon drum containing Tetrachlorethylene (PCE), releasing an estimated 40 gallons of PCE directly to the soil. Resulting from those two and potentially other unreported incidents; several contaminants have been documented in the soil and groundwater at the site. According to the CS Database, the soil has been found to contain concentrations of PCE, 1,1-Dichloroethene (DCE), Trichloroethene (TCE) 1,1,2-Trichloroethane, cis-1,2-Dichloroethylene (Cis-1,2-DCE) and methylene chloride. In addition, concentrations of PCE have been detected in the groundwater above ADEC cleanup criteria. The historical site investigation activities and findings documented in the Contaminated Sites Database are summarized below.

A site characterization was performed by Terrasat Environmental (Terrasat) in 1992. The characterization consisted of the advancement of soil borings and the installation of monitoring wells on the property to evaluate the extent of contamination. Laboratory analysis detected concentrations of methylene chloride and PCE in all of the soil borings and several groundwater samples collected during the effort. Concentrations detected in the soil were several orders of magnitude over the ADEC cleanup criteria.

In 1993, Terrasat documented findings from an additional release investigation effort in 1992 to characterize the extent of impact. Several additional groundwater monitoring wells and four vapor extraction wells were installed on the property. Soil samples collected from the wells detected concentrations of methylene chloride, PCE, DCE, TCE and 1,1,2-Trichloroethane above the respective ADEC cleanup levels. Concentrations of PCE were detected in the groundwater samples above cleanup levels in several of the monitoring wells.

In 1993, Terrasat also installed a soil vapor extraction (SVE) unit to volatize and extract the contaminant compounds in the soil.

In 1994 Dowl Engineers (Dowl) assumed management of the remediation effort at the Greer property. By 1995, Dowl calculated that operation of the SVE unit from 1993 to 1995 had removed approximately 93 to 103 pounds of PCE from the contaminated area. The SVE unit was approved for decommissioning in 1997 on the grounds that operation of the unit was not extracting PCE at levels to justify its use. A monitoring effort conducted by Dowl in 1995 detected concentrations of PCE, TCE, DCE, 1,1,2-Trichloroethane, and cis-1,2-Dichloroethylene (Cis-1,2-DCE) in the groundwater.

In 1996, the ADEC contacted the property's insurance company, Alaska National Insurance Company, to address the concern of offsite migration of contaminants down gradient of the source area to the adjacent property to the north (the Stanley property).

In the summer of 2009, Dowl performed a site reconnaissance and groundwater monitoring of the site to assess the condition of the onsite monitoring wells and to collect groundwater data from the operational wells on the Stanley property. Five monitoring wells (MW-2, MW-3, MW-4, MW-105 and MW-106) were selected for the monitoring effort. However, one of the wells, MW-2 was reportedly unable to be sampled. Using the water level measurement data, Dowl calculated a slight groundwater gradient to the west-southwest at the site. This finding conflicted with previous gradient determinations that the groundwater flowed in a northwesterly direction in the area. The groundwater sample results concluded that concentrations of PCE and TCE were present in the groundwater above ADEC cleanup levels. Cis-1,2-DCE was also detected in the groundwater samples, but below the cleanup limit. Based on contaminant concentrations detected in the groundwater and previously reported in the soil, Dowl concluded that exposure from vapor intrusion of indoor and outdoor air at the site was a concern. Dowl recommended additional investigation and the completion of ADEC Building Surveys to the onsite and adjacent buildings to assess the vapor intrusion concern.

Dowl conducted another monitoring effort at the site in 2011 to further define the existing groundwater contamination. Five groundwater wells (MW-4, MW-105, MW-106, MW-109 and MW-113) were sampled as part of the monitoring effort. Concentrations of PCE, TCE and Cis-1,2-DCE were detected in several of the wells. However, PCE was the only COC detected above the ADEC cleanup criteria.

1.3. Contaminants of Concern

Based on the findings of previous environmental investigations, the COCs at the site consist of PCE, TCE, DCE, cis-1,2-DCE, 1,1,2-Trichloroethane, methylene chloride and vinyl chloride. Vinyl chloride has not been detected in the soil or groundwater at the site. However, vinyl chloride is a breakdown product of the COCs detected at the site and therefore is included as a COC.

1.4. Regulatory Framework

The regulatory framework for this project were developed under consideration of the following regulations and guidance documents

- 18 Alaska Administrative Code (AAC) 75, ADEC Oil and Other Hazardous Substances Pollution Control, dated April, 2012.
- 18 AAC 78, ADEC Underground Storage Tank Regulations, dated July 2012.
- Vapor Intrusion Guidance for Contaminated Sites, ADEC Division of Spill Prevention and Response, Contaminated Sites Program, dated October 2012.
- Vapor Intrusion Pathway: A Practical Guideline, Interstate Technology Regulatory Council, dated January 2007.

Analytical results of the groundwater samples collected during this monitoring effort are evaluated using the groundwater cleanup levels listed in Table C of 18 AAC 75.345. The indoor air samples are compared against the ADEC target levels for commercial indoor air listed in Appendix D of the ADEC Vapor Intrusion Guidance.

2. FIELD ACTIVITIES

Site investigation activities occurred in late summer and early fall of 2013 at the project site in Anchorage, Alaska. The field work was conducted by Nate Oberlee and Zack Kirk, both qualified field scientists as defined in 18 AAC 75.990(100) (ADEC, 2012a). A photograph log documenting site conditions is included to this report as Appendix A. Copies of the project field notes and groundwater monitoring forms are included in Appendix B.

Fieldwork for this project was performed as outlined in the ADEC approved workplan dated July 15, 2013 and workplan addendum dated September 10, 2013. The addendum activities included the installation of two additional groundwater monitoring wells, the deployment of three additional 3-week passive diffusion samples in the office area of the Stanley Automotive building, and the decommissioning of well MW-2. The additional investigation effort was performed to address data gaps that arose after review of the initial data from the groundwater and indoor air investigation.

2.1. Groundwater Monitoring

Upon arriving at the site, Rescon located and inspected the condition of the monitoring wells at the site. The field team was able to locate all of the site's wells, including MW-7, which had been previously reported to be decommissioned. Field personnel opened the well monument covers and inspected the condition of the casings. In general the condition of the wells was good with little or no maintenance required. The one exception was well MW-104, which was missing a monument cover. The well monument was filled with bentonite clay and covered with plastic visqueen sheeting beneath gravel and broken asphalt chunks. After removing the bentonite clay, the casing was observed to be intact and in good condition. The only well that could not be monitored as planned was MW-2, because the well casing was completely filled with bentonite clay, likely from a previous partial decommissioning effort.

2.1.1. Groundwater Elevations and Surveying Activities

After clearing the monuments, the Rescon field team opened the well casings and collected groundwater and well depth measurements. The groundwater and well casing depths were measured using an electronic water level meter with graduated cable. For consistency purposes, measurements were collected from the north edge of the well casings. The depth measurements were measured to the nearest hundredth of a foot and recorded in the field log book.

In conjunction with the groundwater depth measurements, Rescon contracted Karibelnikoff Surveying to survey the elevations of the tops of the monitoring well casings. For consistency with the groundwater depth measurements, the survey measurements were recorded from the from the north edge of the casing. The survey team used the nearest established benchmark at the Ted Stevens International Airport as a reference for the elevation measurements.

2.1.2. Monitoring Groundwater Quality Parameters

Prior to collecting groundwater samples, the field team purged the monitoring wells in accordance with the low-flow sampling techniques outlined in the ADEC *Draft Field Sampling Guidance* (ADEC, 2010). The groundwater was pumped to the surface using a peristaltic pump and dedicated Teflon-lined tubing. The tubing was connected to a flow-through cell for measurement of water quality parameters using a YSI 556 meter (YSI). Groundwater quality parameters were monitored continuously with the YSI during purging. The pumping speed was set to maintain a minimum water level drawdown of less than one tenth of a meter (< 0.1 m or < 0.33 feet [ft]). In accordance with low-flow sampling requirements, the monitoring wells were purged until four consecutive readings of water quality parameters, collected 3-5 minutes apart, met the following stability criteria:

- ± 3% for temperature (minimum of ± 0.2 °C),
- ± 0.1 for pH,
- ± 3% for conductivity,
- ± 10 mv for redox potential, and
- ± 10% for dissolved oxygen (DO).

All groundwater quality measurements and field observations were documented on the groundwater monitoring data sheets (Appendix B). The groundwater parameter data from the monitoring wells is tabulated in Table 1.

2.1.3. Groundwater Sampling

Following stabilization of the groundwater parameters the field team collected groundwater samples from seven of the onsite monitoring wells. Groundwater samples were collected from monitoring wells MW-3, MW-4, MW-105, MW-106, MW-109, MW-112 and MW-113. As stated above in Section 2.1, monitoring well MW-2 could not be sampled as planned because the well casing was filled with bentonite clay.

The analytical samples were collected into laboratory-provided clean 40 mL VOA vials with septa lids. The sample containers were completely filled to ensure no headspace was present to prevent volatilization. After filling, the containers were immediately capped, turned over and tapped to ensure no air bubbles were present. If air bubbles were observed, the container was opened, filled further, capped and inspected again. This process was repeated until no air bubbles were observed in the container. Once the containers were appropriately filled, the vials were labeled and immediately placed into a cooler with sufficient ice to maintain the sample temperatures at 4° ± 2°C.

The groundwater samples were delivered to SGS Laboratories, an ADEC approved laboratory, under proper chain of custody procedures for analysis of the identified COCs (PCE, TCE, DCE, cis-1,2-DCE, 1,1,2-Trichloroethane, methylene chloride and vinyl chloride) by EPA Method 8260.

2.1.4. Monitoring Well Installation

The two additional monitoring wells, MW-120 and MW-121, were placed in locations to the east and west of the contaminant source area as shown on Figure 2. The two monitoring wells were added to the site with objectives of improving the understanding of groundwater conditions at the site, by:

- Providing up-gradient and down-gradient contaminant boundaries to monitor contaminant migration; and
- Providing a greater horizontal distance between monitoring wells to support calculation of a more accurate and consistent hydraulic gradient at the site.

Monitoring well MW-121 was installed down-gradient (or west, northwest) of the source area and the main grouping of wells on the Stanley property as shown on Figure 2. The well was installed to a depth of 11 feet below ground surface (bgs), with a well screen from 6 to 11 feet bgs.

Well MW-120 was placed up-gradient (east) of the source area. During the installation of the well, the groundwater layer was not encountered until drilling reached 11 feet bgs, which was lower than the other wells in the vicinity (MW-112 at 6.92 feet bgs and MW-104 at 6.85 feet bgs). The groundwater depth at MW-120 was compared with the historical boring logs of the previously removed wells MW-114 and MW-115, which had also been installed to the east of the source area. Review of the boring logs for MW-114 and MW-115 confirmed that the groundwater table in the eastern portion of the site is approximately 4 to 5 feet deeper than the wells further to the west. The considerable difference in groundwater depth between MW-120 and the remaining site wells is likely due to the presence of a perched aquifer that encompasses all but the eastern portion of the site where MW-120 (and formerly MW-114 and MW-115) is located. A ten foot well screen was set at MW-120 from 8 to 18 feet bgs.

Rescon surveyed the well casings relative to the tops of casings in nearby site wells to calculate the elevations of the two new wells. The field team then measured the depth to groundwater in the wells to calculate the groundwater elevations for incorporation in the hydraulic gradient evaluation.

In accordance with the ADEC Monitoring Well Guidance, the monitoring wells were developed 24 hours after installation. Rescon developed the wells by surging and pumping until turbidity cleared and water quality parameters stabilized. Following development, the wells were purged and sampled in accordance with the procedures detailed above in Sections 2.1.2 and 2.1.3.

2.1.5. Monitoring Well Decommissioning

Monitoring well MW-2 could not be sampled due to significant amounts of bentonite in the well casting. The well may have been partially decommissioned in the past, but the well monument and well casing had not been removed.

As the well was already completely filled with bentonite, the well was decommissioned in the following manner.

1. The top section of PVC well casing was removed by unscrewing it at the factory joint.
2. The flush mounted well monument was removed from the asphalt by chiseling it out with a digging bar.
3. The void from the well monument was backfilled with pea gravel.
4. The asphalt was repaired using compacted asphalt cold patch.

2.2. Indoor Air Vapor Intrusion Assessment

In order to understand the vapor intrusion exposure concern at the site, Rescon performed an indoor air vapor assessment in the Greer and Stanley buildings. The indoor air assessment consisted of the completion of indoor air building surveys on the two structures and the collection of air samples to analyze for the presence of the volatile COCs at the site.

2.2.1. Building Survey

In order to evaluate the potential exposure concern from the source contaminants to the buildings in the study area, Rescon completed an ADEC Building Inventory and Indoor Air Sampling Questionnaire from Appendix I of the ADEC Draft Vapor Intrusion Guidance for Contaminated Sites. The building surveys, which are included in Appendix B, were conducted to assess the presence of any structural or chemical storage conditions that could introduce and/or contribute to volatile concentrations in the buildings.

The building surveys were conducted in accordance with the following procedures:

- Performance of building walk-throughs, documenting the building usage, construction, the number of occupied spaces, any active HVAC or ventilation systems or other equipment that could effect air flow patterns in the buildings. The surveys also documented the floor layout of each space and any access points in the foundation such as cracks and seams, piping penetrations, sumps, etc. which could provide a preferential pathway for volatile contaminants.
- Inspection of the buildings to identify any conditions that may affect or interfere with the collection of indoor air samples.
- Survey and documentation of the chemical products used in the buildings with known concentrations of COCs. The U.S. Department of Health and Human Services Household Products Database identifies 30 household products that contain PCE and 12 products that contain TCE. Lists of the household product containing PCE and TCE are provided in Appendix C.

Of the listed COCs, only methylene chloride (noted in paint containers in both buildings) was observed in products used at the site.

2.2.2. Initial Indoor Air Monitoring

Following completion of, and based on observations of the building surveys, Rescon selected sampling locations inside the buildings to evaluate the potential for vapor intrusion of COCs. Three 24-hour indoor air samples, plus one duplicate sample, were placed in each building to evaluate the vapor intrusion exposure over the course of a day. In addition, extended duration passive diffusion samples were placed in the Greer building to monitor the total exposure concern over the course of a 3-week monitoring period.

The location of the vapor samples were determined based on observations made during the building surveys. The location of the vapor samples in the buildings are shown on Figure 4. The samples were situated in locations that are representative of ambient breathing air in the building, and in areas where the samples would not be disturbed during the period of monitoring.

The samples were collected into 6-L 100% certified Summa canister for analysis of the COCs (PCE, TCE, DCE, cis-1,2-DCE, 1,1,2-Trichloroethane, methylene chloride and vinyl chloride) using EPA Method TO-15. The Summa canisters were fitted with laboratory calibrated flow regulators designed to ensure collection rates of approximately 0.65 milliliters per minute (mL/min).

Prior to placement of the samples, the Rescon field team measured the initial canister vacuum and documented the canister identification number (ID) and the flow controller ID on the canister tag and the field log book. After documenting the initial canister vacuum, the field team connected the canisters with the corresponding flow controllers and performed a leak test to verify the integrity and ensure the collection of representative samples. The leak detection test on the canister, flow controller connection consisted of the following steps:

- The Summa canister and corresponding flow controller were connected and a brass end cap installed on the end of the flow controller to ensure no loss of vacuum.
- The canister valve was opened momentarily until the vacuum gauge on the flow controller displayed the canister vacuum.
- The canister valve was then closed and the gauge monitored for any loss of vacuum over a period of one minute.
    - If the vacuum reading on the flow controller gauge decreased; the flow controller was reconnected and/or tightened further and the test repeated.
    - This procedure was repeated until no loss of vacuum was observed on the gauge.

After satisfactory tests had been achieved for each canister, the brass end caps were removed from the flow controllers and the samples were deployed for the 24-hour monitoring period. Upon completion of the 24-hour sample period, the flow controllers were removed and the final canister vacuum was recorded on the canister tag and in the field notes. The canisters were shipped to Eurofins Air Toxics Inc. (Air Toxics), an ADEC approved laboratory, under proper chain of custody procedures.

The 3-week samples were collected using passive diffusion adsorbent cartridges designed for sample collection over an extended period of time. Two cartridges were placed in the Greer building; one in the office and the second inside the shop nearest the release source. The cartridges were placed in the same location as the 24-hour Summa canisters to enable comparison of the analytical data. At the completion of the 3-week sampling period, the adsorbent cartridges were retrieved, packaged and shipped to Air Toxics for analysis of the COCs using EPA Method TO-17.

2.2.3. Stanley Motors Passive Diffusion Sampling

Three additional passive diffusion samples were added to the investigation effort to further evaluate the presence of volatile organic compounds in vicinity of the office area in the Stanley building. One sample and a duplicate (PD-3 and PD-4) was attached to a shelving unit in the office room and a third (PD-5) was mounted on a storage rack in a utility room adjacent to the south of the office.

Following completion of the three-week monitoring period, Rescon returned to the site to retrieve the samplers. While attempting to retrieve the office samples (PD-3 and PD-4), it was discovered that they had either fallen or had been removed from their previous location. The PD-3 sampler was located on the office counter adjacent to the original shelf location. The duplicate of sample PD-3, PD-4, could not be found at the site. Stanley employees were unaware of what happened to the PD-4 sampler, or when the two were removed from their original location on the shelving unit. Although it had been moved, the PD-3 sampler was still in the open position in the same area as the original location for the collection of the air sample. The PD-5 sampler was recovered from its original location, with no indication of disturbance to the unit.

2.3. Investigative Derived Waste

The investigative derived waste (IDW) that was generated during the environmental effort included purge water, decontamination water, soil cuttings and disposable sampling equipment. Purge and decontamination water generated from the groundwater monitoring effort was captured in 5-gallon buckets during sampling and transferred to an open-topped steel 55-gallon drum. Soil cuttings from the installation of the two monitoring wells were placed into a second 55-gallon drum on site. The drums were sealed and labeled with content information and the generation date and stored onsite.

As previously addressed in the 2009 Dowl groundwater sampling report, no documentation on the release has been identified to indicate if the contamination source is classified as U210 for unused solvent or as F002 for spent solvent material. According to the United States Environmental Protection Agency's (USEPA) waste characterization guidelines; if the owner operator cannot make such a determination because documentation regarding the information is not available, or inconclusive, and the waste does not exhibit toxicity characteristics, then the owner operator may assume the source, contaminant or waste is not a listed hazardous waste (Dowl, 2009). Consistent with recent monitoring efforts, the sample results indicate that the groundwater and soil cuttings do not exhibit toxicity characteristics and therefore, are not considered listed wastes.

Rescon contracted Emerald Alaska (Emerald) to dispose of the purge water and soil cuttings drums from the site. Emerald was informed of the classification of the waste drums and the reasoning for the non-hazardous determination. A copy of the laboratory analytical report indicating that the waste did not exhibit toxicity characteristics was delivered to Emerald in advance of the removal of the drums from the site. ADEC granted approval to transport the drums to the Emerald facility in the 'Contaminated Soil Transport and Treatment Approval Form' dated November 26, 2013. The drums were transported to Emerald's Anchorage facility for treatment and proper disposal. A copy of the approved form is included in Appendix D.

The remaining IDW, including disposable sample gloves, sampling tubing, paper towels and miscellaneous paper waste was bagged and taped shut and placed in an onsite solid waste receptacle for disposal at the Anchorage Municipal Landfill.

3. RESULTS AND DISCUSSION

The analytical results are summarized in Tables 1 and 2. The final laboratory analytical reports from SGS and Air Toxics are provided in Appendix E. The ADEC Laboratory Data Review Checklists for the analytical data packages are also included in Appendix E.

3.1. Hydraulic Gradient Evaluation

As stated in Section 1.1, conflicting reports of the hydraulic gradient and flow direction from previous site investigations had significant variation in the groundwater flow direction at the site. Based on the findings of previous investigations, the reported groundwater flow direction had fluctuated between north-northwest and southwest. That variation in the reported directional groundwater gradient has prevented an accurate understanding of the direction and extent of migration of contaminants from the original source area. This variation was likely due to the relatively close horizontal distance between the wells used to determine the flow direction. To determine a more accurate groundwater gradient and flow direction at the site, an updated elevation survey of the monitoring well casings was performed and additional wells were installed to increase the horizontal distance between the wells used for the gradient evaluation.

Following receipt of the survey data, Rescon compared the groundwater depth measurements with the well casing elevations to calculate the groundwater elevations in each of the monitoring wells at the site. The groundwater elevations for the wells used in the hydraulic gradient evaluation are shown on Figure 3.

Wells MW-120 and MW-121 were installed to augment groundwater gradient data for the site by providing a greater horizontal distance between the wells. Groundwater elevation data was not used from well MW-120 since it was not located on the perched aquifer as the other source area wells. Groundwater elevation data from wells MW-3, MW-113 and MW-121 were used to determine the gradient and groundwater flow direction at the site. The gradient calculation indicates that groundwater at the site flows in a northwesterly direction with a hydraulic gradient of approximately 0.009 ft/ft.

3.2. Groundwater Sample Results

A total of ten groundwater samples were collected from eight of the original site wells (MW-3, MW-4, MW-104, MW-105, MW-106, MW-109, MW-112, and MW-113) and the two new monitoring wells (MW-120 and MW-121). In addition, two field duplicates (MW-100 and MW-130) were collected from wells MW-105 and MW-121.

The groundwater sample results are compared against the ADEC groundwater cleanup levels (GCLs) listed in Table C of ADEC Regulation 18 AAC 75, Oil and Other Hazardous Substances Pollution Control (ADEC, 2012).

Analysis of the groundwater samples detected the presence of chlorinated solvents in all but four of the site wells (MW-3, MW-113, MW-120 and MW-121). In the remaining wells, PCE was the only COC reported above the respective ADEC groundwater cleanup level. All other COC's were below the GCLs. Concentrations of PCE were detected above the cleanup level in wells MW-4, MW-104, MW-105, MW-106, MW-109 and MW-112. As shown on Figure 3, these wells are located in close proximity to each other in the source area.

The contaminants of concern at this site were not detected in the wells located to the south (MW-3), north (MW-113), east (MW-120) or west (MW-121) of the contaminant plume. The data from well MW-120 confirms that background, or groundwater up-gradient of the source area, is not impacted with COCs. As groundwater moves through the source area near MW-4, contaminants are desorbed from the source area soils into the groundwater. A clean result from well MW-121 confirms that source area contaminants are being attenuated prior to reaching MW-121, directly down-gradient of the source area. Clean results in wells MW-3 and MW-113 provide contaminant boundaries that are cross-gradient of the source area.

3.2.1. Mann-Kendall Trend Analysis

To evaluate the stability of the PCE contaminant plume at the site, a Mann-Kendall statistical analysis was performed on the historical analytical concentrations at key site wells. The Mann-Kendall test requires a minimum of four data entries for a sufficient data set to evaluate contaminant trends. Historical PCE concentrations were used from wells MW-4, MW-104, MW-105 and MW-106. The assumptions and criterion used in the Mann-Kendall determinations are detailed in Appendix F. The individual Mann-Kendall calculation tables for each well are also included in Appendix F.

The results of the Mann-Kendall tests confirm that the PCE concentrations in three of the four wells (MW-4, MW-104 and MW-106) are declining. In all three wells, the trend analysis indicated declining concentrations with an over 90% degree of confidence. While the PCE concentration at the forth well, MW-105, does not exhibit a declining trend, the coefficient of variance for that data set indicates that the concentration is stable.

3.3. Vapor Intrusion Assessment

3.3.1. Building Survey Discussion

The completed ADEC Building Survey and Indoor Air Sampling Questionnaires including copies of the floor plan diagrams are provided with the field notes in Appendix B. The results of the building surveys are summarized below. At the time of the site visits, conducted at the end of July, the warm weather conditions enabled the buildings' doors and garage doors to be open during work hours allowing for natural ventilation from outdoor air into the structures.

3.3.1.1. Greer Tank Building

Operations at the Greer building consist primarily of steel tank fabrication and repair. Activities observed in the building included welding, painting, coating, industrial cleaning, sand blasting and the use of cutting torches. Large scale sand blasting of tanks was conducted in two hangar tents adjacent to the building to the north.

An overhead ventilation system was observed inside the shop area. However, the shop manager stated that it was not working at the time. Various chemicals were observed in the buildings, most of which were used for painting, priming or coating. Some containers of motor oil were also observed at the northwest corner of the building. While some products listed the presence of VOCs, with the exception of methylene chloride none of the site COCs was observed in the product contents listings. Volatile vapors from painting and priming activities were noted in the shop area during the site visit.

As shown on the building diagram, two floor drains were noted along the northern edge of the structure. A floor sump was observed along the south building wall. According to the shop manager, the drains and sump drain into the municipal sewer system. Several signs of degradation, cracks and seams were observed in the building's concrete slab.

3.3.1.2. Stanley Automotive Building

The eastern end of the Stanley Automotive building, closest to the source area, is an automobile body repair shop. Activities observed in the facility consisted of vehicle body repair, painting and detailing. An active ventilation system is present in the building to remove vapors from painting operations. Two ventilated vehicle painting rooms are located along the southeast corner of the building. The painting room ventilation system exhaust point is located at the southeast corner of the building, in vicinity of monitoring wells MW-4, MW-104 and MW-112. Despite the active ventilation and several open vehicle bay doors, at the time of the survey, strong paint fume vapors were noted in the main shop area, and in particular in vicinity of the vehicle painting rooms.

Chemical products observed in the building included paints, paint thinners and removers, primers, various vehicle servicing fluids and lubricants, motor oils and antifreeze. Of the site COC constituents, only methylene chloride, in some of the paint and paint remover containers, was identified in products in the building.

The building is constructed of a slab on grade foundation. The building slab was observed to be in good condition with no major cracks or seams. A raised area is located beneath the office and warehouse area. Further investigation was performed to determine if a crawl space was located beneath this area. A crawl space was not present. Building maintenance staff confirmed that the raised area contained fill material between concrete retaining walls with a concrete slab on the surface. The raised area was constructed higher to facilitate a loading dock for the warehouse area.

Two trench drains were observed in the building. One was observed running along the center of the main shop area. The other trench drain is located in the vehicle detailing bay at the west end of the building. The building also has two sumps; one in the main shop area and the second in the detailing bay. The drains and sumps in the building are connected to the municipal sewer system.

3.3.2. Indoor Air Sample Results

The results of the 24-hour Summa canister and 3-week passive diffusion samples are displayed in Table 2 in comparison with the ADEC target levels for indoor air.

Greer Tank Building

Three 24-hour samples plus a duplicate, and two 3-week passive diffusion samples were collected from the Greer Tank building. A 24-hour sample (GT-V5) and a passive diffusion sample (GT-PD1) were collected from the west end of the main shop area, closest to the contaminant source area. A 24-hour sample (GT-V8) and a passive diffusion sample (GT-PD2) were collected from the main office area on the first floor. The remaining 24-hour sample (GT-V6) and duplicate (GT-V7) were collected from the second floor of the office area. The results from all of the samples in the Greer Tank building were below commercial indoor air target levels for the COCs.

Stanley Automotive Building

Three 24-hour samples plus a duplicate were initially collected from the Stanley Automotive building. A 24-hour sample (GT-V4) was located on the south wall of the main shop in the area closest to the source area. A 24-hour sample (GT-V1), and duplicate (GT-V2) were located above a drain sump on the west end of the main shop. The remaining 24-hour sample (GT-V3) was located in the office area. The results of all the samples were below target levels for the COCs except sample GT-V3 from the office area. Sample GT-V3 had a TCE result of 9.8 ug/m^3, which exceeded the ADEC commercial indoor air target level of 8.8 ug/m^3.

The initial project plan intended for the collection of only 24-hour samples in the Stanley building. However, after receipt of the results from the 24-hour samples, it was determined that further investigation with the passive diffusion samplers was beneficial to investigate the possible TCE exposure concern in the Stanley office area. Rescon installed three additional 3-week passive diffusion cartridges in the office area and adjacent utility room. The analytical results of two of the passive diffusion cartridges (GT-PD3 and GT-PD5; GT-PD4 was not recovered) detected considerably lower (by at least one order of magnitude) TCE concentrations then the concentration in the GT-V3 sample. TCE was not detected in GT-PD5.

3.4. Laboratory Quality Analytical Report

Laboratory Quality Assurance/Quality Control (QA/QC) data associated with the analysis of project samples was reviewed to evaluate the integrity of the analytical data generated during groundwater and air sampling at the site in August, September and October 2013.

Environmental groundwater samples were delivered and analyzed by SGS in Anchorage, Alaska. The groundwater analytical results were reported in three sample delivery groups (SDGs), 1133503, 1135142, and 1135060. Air samples were analyzed by Eurofins AirToxics of Folsom, CA. Air results were reported in three SDGs: 1308191, 1310170, and 1308679. Samples were collected, reported, and shipped in general accordance with the work plan.

All data were reviewed in accordance with appropriate United States Environmental Protection Agency (EPA) procedural guidance documents (EPA 2008) and ADEC regulatory guidance documents (ADEC 2009; 2010; 2012).

The sample coolers were delivered with custody seals in place, unbroken and intact. All sample containers in the sample coolers were received at the laboratory intact, with proper documentation with the following exception. In SDG 1135060, samples SD-1 and MW-120 were listed on the chain of custody but were not used in sampling. These samples were shipped back to the laboratory for disposal. Samples were received at the laboratory within the specified temperature range of 4°C +/- 2°C, with the following exceptions. In SDG 1133503, samples were received at 7.4°C. No samples were qualified due to temperature.

All samples were extracted, digested and analyzed within the holding time criteria for the applicable analytical methods and in accordance with work plan specifications. Trip blanks were submitted for volatile organic analyses. Results were not detected.

Three field duplicates were submitted for analysis -- primary 13-MW-105 with duplicate 13-MW-100; Primary GT-V1 with duplicate GT-V2; and Primary GT-V6 with duplicate GT-V7. Relative percent difference (RPDs) were below the ADEC recommended limits of <30% for water samples and <25% for air samples. When one result was reported as not detected at the LOD and the other result was positive, an RPD could not be calculated.

No contaminant compounds were detected in the laboratory Method blanks. Analysis of laboratory control samples (LCS) and LCS duplicates (LCSD) for target analytes met laboratory and project QC goals for target analytes, with the following exceptions. In SDG 1135060, the LCSD percent recovery (%R) was above the limits in methyl-t-butyl-ether. Associated results in samples 13-MW-121 and 13-MW-130 were not detected and qualified as estimated (UJL).

The MS/MSD %R and RPDs were within limits, with the following exceptions. In SDG 1135142, the MS/MSD RPDs were outside the limits for 1,1-dichloroethene, carbon disulfide, naphthalene and 1,2,3-trichlorobenzene. Results for 1,2,3-Trichlorobenzene, Carbon disulfide, Naphthalene and 1,1-Dichloroethene in sample DC-1 were not detected and qualified as estimated (UJM). The LCS/LCSD was within limits.

Surrogate recovery indicates overall method performance. Surrogate recoveries were within prescribed control limits for all primary samples and LCS/LCSD, with one exception. In SDG 1135142, the surrogate recovery was outside the limits for the instrument blank in Analytes associated with this surrogate were less than the limit of quantification (LOQ). Qualification was not necessary.

Method Detection Limits (DLs) and LOQs met or were below established criteria specified for all analyses in the project work plans. The reporting limits were also below the ADEC established target levels.

Based upon the information provided, the data are acceptable for use. All requested analyses were performed in accordance with work plan specifications. Sample results are considered usable and meet project objectives. Although some results are considered estimated due to certain quality control criteria that were not met, no results were rejected. The overall project completeness is 100%. In general, the overall quality of the data was acceptable for the objectives established for this project. All data is suitable for use.

4. CONCEPTUAL SITE MODEL

A conceptual site model (CSM) evaluation was performed during the development of the project work plan to assess the potential exposure pathways and to guide the focus of the additional investigation. Following analysis of the results from the 2013 investigation and monitoring effort, Rescon updated the CSM to reflect the most current environmental exposure concerns for the site. The CSM was completed in accordance with the ADEC Contaminated Sites Program Policy Guidance on Developing CSMs, updated in October 2010. The ADEC CSM graphic and scoping forms are presented in Appendix G of this report.

4.1.1. Current and Future Receptor Profile

The subject property is an industrial facility located in a commercial/industrial area in Anchorage, Alaska. Access to the two site properties is restricted to approved company workers and visitors. With the exception of customer parking areas (to the east of the Greer Tank building and to the south of the Stanley Automotive building), the properties are enclosed by gated fencing preventing unauthorized access to the site. The site is not considered accessible for public use or recreation by residents. As a result, the current and future receptors at the site are limited to industrial workers and construction workers. Construction workers are considered potential future receptors due to the possibility of construction or demolition efforts at the site in the future.

4.1.2. Contaminant Source Areas

The petroleum contaminated soil detected during the removal of the diesel and gasoline USTs in 1991 was excavated and hauled offsite for remediation. Based on the tank closure documentation and confirmation sampling following removal of the impacted soil, ADEC determined that the source area, stemming from leaks on the former USTs, was no longer a potential exposure concern.

The chlorinated solvent release (or releases) occurred in vicinity of the western end of the Greer Tank property. Over time, the contaminant plume has migrated down gradient to the Stanley Automotive property near the southeast corner of the Stanley Automotive building. The source contaminants, which likely derive from one or multiple releases of PCE in the early 1980s, consist of PCE and the various PCE breakdown daughter products (TCE, DCE, cis-1,2-DCE, 1,1,2-Trichloroethane, and vinyl chloride) and methylene chloride. Contaminated media detected on the property include soil impacted with PCE, TCE, DCE, cis-1,2-DCE, 1,1,2-Trichloroethane and methylene chloride and groundwater impacted with PCE. Prior to the 2013 field effort, the extent of migration of the PCE plume had not yet been completely defined. Previous groundwater data from wells MW-3 and MW-113 had delineated the southern and northern extents. However, the extent of the plume to the east (up-gradient) and west (down gradient), was unknown. The addition of monitoring wells MW-120 and MW-121 addressed that data gap; as PCE was not detected in the groundwater of either well.

4.1.3. Exposure Pathways

The complete exposure pathways for current and future receptors at the site include ingestion of groundwater and inhalation of indoor air. The subject property is located within the municipality of Anchorage and the properties in the area are likely serviced by the municipal water utility. However, the groundwater in the area cannot be ruled out as a reasonably expected future source of drinking water. As a result the ingestion of groundwater pathway is considered complete for future receptors.

The exposure concern from vapor intrusion was investigated in both site buildings during the 2013 effort. Only one COC constituent (TCE) was detected above the ADEC target level at the GT-V3 location. However, the analytical results from the additional, longer duration, investigation at the GT-V3 location may indicate that that sample was an anomaly or was affected by a secondary contaminant source. Nevertheless, additional investigation is necessary during the winter season to evaluate indoor air conditions with temporal changes.

The incidental soil ingestion, inhalation of fugitive dust and outdoor air pathways are considered insignificant because of the presence of an asphalt cap at the site that mitigates the exposure of fugitive dust and contaminants in the soil. However, the pathways are considered complete for future receptors due to the potential for future activities such as demolition or construction projects, which could result in the removal of the asphalt and or disturbance of the soil.

5. CONCLUSIONS AND RECOMMENDATIONS

Based on the results of the 2013 investigation efforts, Rescon Alaska has developed the following conclusions and recommendations for the site.

5.1. PCE Groundwater Plume

The inclusion of groundwater elevation data from well MW-121 in the hydraulic gradient evaluation for the site provides greater confidence in the groundwater gradient and flow direction for the site. Rescon concludes that the groundwater flows to the northwest at the site with a gradient of 0.009 ft/ft.

PCE concentrations exceeded the ADEC GCLs in the source area wells. Based on the gradient determination, MW-121 is located down gradient of the PCE source area. PCE was not detected in MW-121 indicating that contaminants are being attenuated in the groundwater prior to reaching MW-121. The wells cross-gradient of the source area to the south (MW-3) and north (MW-113) did not contain detectable concentrations of PCE. Additionally, PCE was not detected in the groundwater sample collected from well MW-120, up-gradient of the source area. The four wells effectively delineate the boundaries of groundwater contamination at the site.

The monitoring results from the historical site wells were consistent with 2013 results. The results of a Mann-Kendall trend analysis on the historical and current PCE concentrations in four of site monitoring wells within the contaminant plume indicate that PCE levels are stable and/or declining.

Based on the results of the groundwater monitoring effort and the statistical trend analyses, the PCE plume has been delineated and contaminant concentrations appear to be attenuating naturally. Based on the above conclusions, Rescon recommends that no further groundwater sampling be required at this site provided the following institutional controls are maintained:

1. The site remains zoned as I-1 for 'light industrial use' per Anchorage Municipal Code 21.40.200. ADEC must be notified if a change in use occurs in the future.
2. ADEC is notified if any groundwater wells are installed at the site in the future.

5.2. Vapor Intrusion Analysis

Of the eight indoor air samples collected during the initial investigation, only one, the GT-V3 sample reported a COC concentration (TCE concentration of 9.8 $\mu g/m^3$) above the respective ADEC target level. All other detected concentrations were at least one order of magnitude less than the respective target level.

Additional investigation, over a longer duration, in vicinity of the GT-V3 sample was performed using passive diffusion samplers. The TCE concentration in GT-PD3 was more than one order of magnitude below the commercial indoor air target level and the level detected in the GT-V3 sample. TCE was not detected in the GT-PD5 sample. The results from multiple lines of evidence, including seven out of eight 24-hour indoor air samples and four 21-day passive diffusion samplers, indicates that indoor air concentrations of TCE and the other COCs are all below the ADEC indoor air target criteria in both site buildings.

The results of the subsequent passive diffusion sampling appears to indicate that the GT-V3 sample may have been an anomaly caused either by a laboratory error or exposure to a TCE-containing product during the 24-hour sampling period. The U.S. Department of Health and Human Services maintains a list of household products known to contain TCE. A copy of the list, included in this report in Appendix C, identifies 12 known products, 9 of which could reasonably be expected to be used at the Stanley Automotive business. None of the listed products, or any other TCE-containing chemicals, were identified during the building survey. However due to the nature of the business at the site, which involves the use of many various chemicals and compounds, it is possible that some unidentified agent or cleaning product could have been present at the time of sampling and contributed to the elevated TCE concentration at GT-V3.

As stated above, with the exception of the TCE detection at GT-V3, no other COC concentrations were detected in the indoor air samples above the ADEC target levels. Based on the remaining sample results, and the results of the passive diffusion sampling in the Stanley office area, it appears that the vapor intrusion of subsurface COCs is not occurring in either of the site buildings. Rescon recommends that these results be confirmed through a second round of sampling with 24-hour Summa canisters during the winter months. This will evaluate the indoor air conditions when the buildings receive less outdoor air ventilation through open doors and windows. Additionally, winter sampling will determine if the heating systems in the buildings are contributing to vapor intrusion of contaminants.

Due to the observed use of methylene chloride-containing paint products in both site buildings, Rescon recommends that the 24-hour sample period be conducted over a weekend or holiday to mitigate any potential interference caused by the use of such products during normal business hours. We also recommend the collection of one outdoor air sample per building to compare with the indoor air results. The results of the outdoor air samples will be used to determine if outdoor air is contributing to contaminants detected in the indoor samples. In accordance with the ADEC Vapor Intrusion Guidance, if it is concluded that outdoor air contaminants are affecting the indoor air quality, the outdoor contaminant levels may be subtracted from the contaminant concentrations of the indoor air samples.

6. REFERENCES

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FIGURES

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TABLES

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APPENDIX A

Photographic Log

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APPENDIX B

Project Field Notes, Building Survey Forms and Groundwater Data Sheets

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APPENDIX C

U.S. Department of Health and Human Services List of PCE and TCE-Containing Household Products

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APPENDIX D

Contaminated Soil Transport and Treatment Approval Form

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APPENDIX E

SGS Analytical Report and ADEC Laboratory Data Review Checklists

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APPENDIX F

Mann-Kendall Trend Analysis Assumptions and PCE Concentration Trends Tables

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APPENDIX G

ADEC CSM Graphic and Scoping Forms

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