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FINAL

REMEDIAL INVESTIGATION REPORT-REVISION 2 FOR

UNIVAR USA, INC.

Former Van Waters & Rogers Facility
Mosley Avenue Facility
Wichita, Kansas

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1.0 INTRODUCTION

SECOR International Incorporated (SECOR) was authorized by Van Waters & Rogers Inc. (VW&R) in June 1997 to prepare a Work Plan (Work Plan) for a Remedial Investigation/Feasibility Study (RI/FS), and to implement the RI at the VW&R Facility (Figure 1) located at 2041 North Mosley Avenue in the City of Wichita, Kansas (the "Facility"). This RI report is being submitted to the Kansas Department of Health & Environment (KDHE), for review and approval in accordance with the Administrative Order of Consent (Case No. 98-E-0096, May 29, 1998).

The Facility is located within the approximately ten square mile Wichita North Industrial Corridor (NIC). The components of the VW&R RI were designed and have been implemented to be generally consistent with the technical approach and methodology of investigations that have been, and are currently being, implemented as part of the overall NIC investigation by the City of Wichita. The City of Wichita has undertaken the NIC RI/FS pursuant to a Consent Order entered into with the State of Kansas and a Participation Agreement entered into between the City of Wichita and 22 private businesses, including VW&R. The VW&R RI/FS is being conducted to be consistent with the equivalent requirements of a Resource Conservation and Recovery Act (RCRA) Facility Investigation/Corrective Measures Study (RFI/CMS).

2.0 PURPOSE AND SCOPE

2.1 Purpose

The purpose of this RI was to collect sufficient data to adequately characterize the site for the purpose of assessing the potential existence of on-site contaminant source areas at the Facility. If an on-site contaminant source(s) was present, the RI was designed to then accommodate the performance of a Baseline Risk Assessment (BRA) and the development and evaluation of appropriate remedial alternatives and actions.

2.2 Scope

Specifically, the Scope of the RI/FS consisted of the following:

- Characterize significant "operable units" and Areas of Concern (AOCs) at the Facility to determine whether these entities represent potential contaminant source areas. If identified, a contaminant source characterization would be conducted to determine the type and nature of the source(s) of the contamination, causes or mechanism of the release(s), estimated quantity of the release(s), and determination if the release(s) was active or inactive.

- Characterize the nature, threat, and extent (vertical and horizontal) posed by any of the contaminants present at the site (including migration mechanisms) for the purpose of and to the extent necessary for developing and evaluating effective response actions and/or remedial alternatives. This characterization would also include the assessment of the chemical and physical properties of any detected contaminants of concern, their mobility and persistence in the environment, and the reasonable identification of any human and environmental targets that could be affected by the contaminants of concern.

- Collection of the necessary data such that if a release of contaminants had occurred, an assessment of potential risks to human health and the environment could be performed, associated with the on-site and immediately adjacent off-site areas. A BRA would be performed if on-site source areas were identified.

- Collection of data for the analysis (and design, if appropriate) of potential response actions associated with any contaminant source areas. Bench- or pilot-scale treatability studies would be performed if appropriate or applicable.

A feasibility study (FS), if appropriate, would be completed following review of data generated during the RI. The scope of the FS would be prepared and submitted to KDHE for review and approval prior to its initiation. The FS would be consistent with the KDHE guidelines "Scope Of Work For A Remedial Investigation (RI)/Feasibility Study (FS)" BER Policy #BER-RS-025 dated 1991 and revised 1996 (attached as an exhibit to the Consent Order for this facility).

3.0 FACILITY BACKGROUND INFORMATION

3.1 Introduction

In May 1998, SECOR completed preparation of a Description of Current Conditions (DCC) Report to document past and current facility operations and conditions, and develop the basis for the RI/FS Work Plan. The DCC Report was incorporated into the RI/FS Work Plan to aid the KDHE in their review of that document. The DCC Report presented background information pertaining to known conditions at the Facility. A summary of the DCC report is presented below.

3.2 Description of Current Conditions (DCC)

The information used to prepare the DCC report includes the various documents referenced in the DCC, and other information provided by VW&R.

3.2.1 Site Description

3.2.1.1 Site Location, Ownership, and Access

The Facility is located at 2041 North Mosley Avenue in the central portion of the City of Wichita, Sedgwick County, Kansas (Figure 1). The Facility is located at latitude 37 43'15" North, longitude 97 19'38" West. The Facility occupies a square-shaped lot, approximately two acres in size (Figure 2). VW&R has owned and operated the Facility since 1986, when it acquired the Facility as part of an asset acquisition of McKesson Chemical Company, the former owner of the Facility. The southwest corner of the property (approximately 18,750 square feet) is currently leased by VW&R from Mr. Clint Litsey (Figure 3).

The present configuration of the Facility is illustrated on Figure 4. Currently the Facility is used as a chemical distribution center by VW&R. The Facility includes one main building which is approximately 20,200 square feet in size (1,600 square feet is used for offices, the rest is warehouse space). Chemicals stored inside of the warehouse include acids and bases, and food grade chemicals such as sodium nitrate and sodium benzoate. A RCRA Part B container storage unit (Permit #KSD000809715) is located outside to the south of the warehouse building; the southeast quarter of the property is used for outside storage of products including oxidizers, compressed gases, corrosives, and flammable liquids. Empty drums and flammable liquid totes are stored on the southeast corner of the property. The yard area located to the south of the warehouse is paved with asphalt, while the loading docks and hazardous and non-hazardous waste storage areas are paved with concrete. The asphalt and concrete surfaces within these portions of the Facility are in good condition (being free of significant cracks, holes or other features that could potentially affect the integrity of these surfaces). These surfaces are routinely maintained by VW&R personnel.

Access to the Facility is controlled by security fencing. Gates in the fencing at the eastern sides of the Facility are open during the day to allow access. The gates are closed and locked at night.

North Mosley Avenue is a two-lane blacktop-covered roadway adjacent to the east side of the Facility. Railroad tracks for the Chicago, Rock Island, and Pacific railways occupy the immediately adjacent property to the west.

3.2.1.2 Site Setting and Land Use

The Facility is surrounded by industrial and/or commercial properties. The adjacent properties include a commercial building with associated open storage to the north, a warehouse/open storage area across Mosley Avenue to the east, a farm/ranch feed supply company is adjacent to the property to the south, and railroad tracks with adjacent open fields and/or storage are located to the west.

The open storage areas on properties to the immediate north, east, and west are predominantly empty, with some metal scrap, vehicles, and general debris present.

3.2.1.3 Topography and Surface Drainage

The City of Wichita, and most of Sedgwick County, are located within the Arkansas River Lowlands section of the central Lowlands physiographic province. The topography of the area is broad and flat in the river valley, and rolling in the adjacent uplands. United States Geological Survey (USGS) topographic maps showing the Facility indicate that the elevation of the Facility is approximately 1310 feet (ft) above mean sea level. Within a one-mile radius of the Facility, the topographic relief is less than 20 feet.

The site topography is generally flat, exhibiting a maximum slope of approximately one percent (USGS 1982). The asphalted and concreted surfaces associated with the Facility's storage and loading areas are sloped toward the south-central portion of the Facility. As such, surface drainage from these areas flow from the north, east and west toward the south-central portion of the Facility. Surface drainage may exit the Facility along its southern property boundary by flowing to the south over the asphalted alley-way (center of the property) to the 19th Street curb and gutter system, then easterly within the curb and gutter system to Mosley Avenue. This surface drainage then apparently flows southerly within the curb and gutter system to a storm sewer inlet located at 17th Street and Mosley Avenue. The storm sewer ultimately discharges to Chisholm Creek located beneath the elevated Interstate I-135. Figure 5 depicts the general surface drainage and storm sewer system at and adjacent to the Facility.

Regionally, surface water drainage patterns trend toward the south. Chisholm Creek flows primarily south through the northern portions of Wichita; however, a section of Chisholm Creek, approximately one block north of the Facility flows toward the east. The Little Arkansas River and the Arkansas River are both located within three miles west of the Facility. The Little Arkansas River and Chisholm Creek are tributaries of the Arkansas River.

3.2.1.4 Climate

Climatic conditions of the Wichita area are characteristic of a Temperate Zone. Temperatures in Wichita vary from a January mean of 29.6 degrees F, to a July mean of 81.4 degrees F. The area receives an average annual rainfall of 28.6 inches per year, and an average annual snowfall of 15.3 inches.

3.3 Site Summary

3.3.1 Site Use and Waste Management History

3.3.1.1 Historical Use and Activities

The Facility has been utilized for chemical distribution and intermittent chemical repackaging since 1952. Prior to that time, based on a review of Sanborn Insurance Maps, dated 1935 and 1950, and review of a 50-year chain-of-title search, the property was vacant land associated with a hog business and was owned by private parties. In 1952, Barada & Page constructed the Facility for use as a chemical distribution facility. In 1959, McKesson Chemical Company (McKesson), a chemical distributor and repacking company, acquired the property from Barada & Page.

The specific operations conducted by McKesson at the Facility included repackaging of mineral acids, caustics and solvents. Prior to 1977, Hydrochloric Acid (HCl) was drummed on the back dock of the warehouse adjacent to the railroad spur on the west side of the property (Figure 3). The HCl repack module on the dock was fed from an elevated, 500-gallon tank located above the southern end of the dock. This tank was removed and disposed of in 1980. Other products were also repackaged (drummed) from tanker trucks in an area paved with concrete along the south side of the warehouse (Figure 3). It is believed that these products included corrosives and solvents. In 1977, two above ground bulk storage tanks (ASTs) were installed adjacent to a small concrete building (containing a repackaging module) in the southeast quarter of the property. The ASTs were situated on a concrete pad surrounded by a concrete dike. Bulk liquid chemicals were repackaged from either of the two ASTs containing Trichloroethylene (TCE) and HCl located adjacent to the repackaging module, or from tanker trucks, and transferred into drums through fixed piping from the two ASTs and through hoses from railroad tanker cars and tanker trucks (VW&R, 1994).

McKesson also operated a 10,000-gallon underground storage tank (UST) used for storage of diesel fuel. This tank and ground level piping was located at the southeast corner of the property, south of the Mosley Avenue entrance gate to the property. The tank was used to fuel Facility trucks. This UST was installed in 1981 and removed in 1986. Reportedly, the tank was inspected during its removal and no leaks or damage was noted.

In October 1986, VW&R acquired the Facility from McKesson. Figure 3 presents the Facility configuration generally prior to VW&R's property acquisition. VW&R continued similar chemical distribution operations as McKesson. Materials historically handled at the Facility by McKesson and VW&R included solvents (Dichloromethane, 1,1,1-Trichloroethane (1,1,1-TCA), TCE, Acetone, Tetrahydrofuran, Cyclohexanone, Xylene, Methyl Ethyl Ketone (MEK), Mineral Spirits, Naptha), acids (Hydrochloric, Sulfuric, and Phosphoric), and Sodium Hydroxide. As discussed above, VW&R previously repackaged chemicals into drums in the repack building located on the southeast quarter of the property. The repack building also contained a drum wash area for poly drums that previously contained corrosive materials. The drum rinse water drained into a 1,500-gallon in-ground concrete, PVC-lined, neutralization tank located a few feet outside the

repack module. During operation, approximately 900 gallons of drum wash rinse water, following pH adjustment, was discharged to the municipal sanitary sewer system every two weeks.

In 1990, VW&R discontinued all repackaging of solvents and in 1992, all repackaging of corrosives was ceased. The ASTs previously used to store TCE and HCl, and the repackaging module, were removed in 1991 and 1992, respectively. No repackaging of chemicals has occurred at the Facility since that time (VW&R, 1994).

3.3.1.2 Current Use and Activities

Currently, the Facility is used by VW&R as a wholesale chemical distribution business. VW&R does not manufacture or blend any chemicals at the Facility. All products are received directly from the manufacturers and are stored in their original containers at the Facility prior to sale and shipment to customers. VW&R handles a wide variety of commercial and industrial chemicals in both liquid and dry form. In addition, the Facility handles a limited number of pest control products that are containerized in bags or boxes and stored on shelves in the warehouse. Drummed solvents and corrosives are stored inside the warehouse and in designated paved areas outside the warehouse. Empty drums are currently stored at the southeast corner of the Facility, which is adjacent to the former location of the diesel underground storage tank (UST). VW&R does not wash or rinse any drums at the Facility.

3.4 Site Environmental Permits

3.4.1 Historical Permits

On August 18, 1980, McKesson submitted a Notice of Hazardous Waste Activity (Notification) pursuant to Section 3010 (a) of the Resource Conservation and Recovery Act (RCRA), 42 U.S.C. 6930 (a) to the United States Environmental Protection Agency (USEPA). McKesson identified itself as a generator and an owner/operator of a Treatment, Storage, and/or Disposal facility (TSD) for hazardous wastes. The Facility was subsequently assigned USEPA ID # KSD000809715. On November 17, 1980, McKesson submitted a revised Part A notification to allow it to also act as a transporter of hazardous waste.

On September 7, 1982, the Facility received RCRA interim status as a TSD facility. On May 16, 1983, McKesson submitted the original Part B application. McKesson was granted a final Part B permit effective September 24, 1984, until September 25, 1994. In 1986, VW&R acquired the assets of McKesson and the Part B permit was transferred to VW&R (USEPA, 1990).

As authorized by the permit, VW&R has stored for transport and offsite disposal, waste generated onsite and waste collected from generators in the Wichita area under the company's ChemCare® program. These wastes are collected from VW&R's customers. The permitted hazardous waste storage area is used as a staging point for storing wastes prior to shipment to permitted hazardous waste treatment and/or disposal facilities (VW&R, 1987).

3.4.2 Current Permits

The Facility currently operates as a licensed TSD under USEPA Identification #

KSD000809715. The Facility also operates as a transporter of hazardous wastes licensed in several states. In addition, the Facility also holds a Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) permit and Pesticide permit from the Kansas State Board of Agriculture for the distribution of pesticides and herbicides (VW&R, 1987).

3.4.3 Notice of Violations

From 1980 to 1989, Facility violations were occasionally noted during regulatory inspections. These violations consisted of primarily storage, labeling, and paperwork deficiencies. (USEPA, 1990).

According to the Resource, Conservation, and Recovery Information System (RCRIS) listings for the Facility, the only violation listed was for financial responsibility requirements that resulted in written informal administrative actions, dated April 21, 1989.

3.5 Known Spills and Releases

On July 16, 1984, there was a release of approximately 375 gallons of TCE into the diked area around the TCE bulk storage tank. The release apparently was caused by overfilling of the tank during transfer of the material from a rail car. The released material was reportedly fully contained within the diked area and completely recovered. Two soil samples were collected outside the diked area to determine whether any of the material had escaped into the underlying soils. These samples were found to have a total volatile organic concentration of between 3 and 4 parts per million (ppm) (VW&R, 1987). Figure 6 depicts the locations of soil samples collected in association with this release.

On May 6, 1986, approximately one quart of nitric acid was discovered to have been released onto the floor of a trailer that was delivered to the Facility. The spilled material was neutralized and disposed of properly. There was no evidence that any uncontained product escaped from the trailer. Corrective measures were implemented to ensure proper loading of trailers (VW&R, 1987, 1994).

On July 15, 1986, there was a release of approximately 75 gallons of TCE into the diked area around the TCE bulk storage tank. The release reportedly occurred due to a hose rupture during the transfer of the materials from a rail car into the TCE bulk storage tank. All of the released material was reportedly contained within the dike area, removed from that area and placed into drums for appropriate disposal (VW&R, 1987, 1994).

There have been five recorded releases of hazardous substances at the Facility during operation by VW&R.

- On April 3, 1989, there was a spill of hydrofluoric acid on the warehouse concrete floor. The spilled material was neutralized, containerized and disposed of appropriately (VW&R, 1994).

- On January 22, 1990, there was small leak from a cylinder of sulfur dioxide. The leak was stopped by tightening a valve and fuse plug (VW&R, 1994).

- On July 18, 1990, there was a spill of approximately 5 gallons of 50% sodium hydroxide that occurred from a small hole in a drum. The spilled material was neutralized with citric acid and disposed of appropriately (VW&R, 1994).

- On May 13, 1991, there was a spill of approximately one-gallon of caustic soda that occurred as a result of dropping a drum in the warehouse. The spilled material was neutralized with citric acid and put into another drum for appropriate disposal (VW&R, 1994).

- On May 29, 1991, two gallons of hydrochloric acid were released during the transfer of product from one test container to another. The spilled material was collected into a VW&R neutralization tank, neutralized and disposed of appropriately (VW&R, 1994).

3.6 Previous Environmental Investigations and Remedial Activities

A summary of previous environmental investigations and remedial activities associated with the VW&R Facility proper, and areas adjacent to the VW&R Facility are presented below:

- On October 22, 1990, a limited subsurface investigation was performed at the Facility associated with a broken drain-line near the acid repack area (Geraghty & Miller, Inc., 1991). Three soil borings were advanced to an approximate depth of 12 feet bgs. Figure 6 depicts the locations of soil samples collected in association with this investigation. The soil borings were completed above the water table which was anticipated to be approximately 10 to 15 feet bgs. Soil samples were collected at one-foot intervals. Soil samples were collected for field analysis to determine changes in litho logy, pH measurements, and headspace screening. Samples were selected for laboratory analysis based on field observations. These samples were submitted for analysis of TCE, 1,1,1-TCA, and Hexane by USEPA Method 8240. Methanol and n-Propyl Alcohol were also analyzed, as well as pH. The results of the analysis indicated that pH values ranged from 6.6 to 7.0 pH units. TCE was the only analyte detected above laboratory detection limits and was present in four of the five samples submitted at concentrations ranging from 24 to 120 micrograms per kilogram (µg/kg, part per billion equivalent). These concentrations were below the *Risk-Based Standards for Kansas (RSK Manual – 3rd version, dated March 3, 2003)* of 0.2 milligrams per kilogram (mg/kg, part per million equivalent).

- The only other reported investigation at the Facility consisted of the soil samples collected to assess the 1984 TCE release discussed previously in Section 3.5.

- As previously noted the Facility is located within the NIC, currently the subject of an RI/FS being performed by the City of Wichita under the direction of the KDHE. Prior to its formation, the NIC was comprised of three investigation areas. From north to south, these areas were referred to as the Northeast Investigation Area, the 29th and Mead Investigation Site, and the 13th and Washington Investigation Site. The VW&R Facility is situated within the south-central portion of the 29th and Mead Investigation Site. Subsurface data associated with past investigations within the Northeast Investigation Area, the 29th and Mead Investigation Site, the 13th and Washington Investigation Site, and the current NIC investigation have indicated that groundwater throughout the NIC, and in particular within the Former Northeast Investigation Area and the Former 29th and Mead Site, are contaminated with VOCs. Constituents identified include but are not limited to

Tetrachloroethene (PCE), TCE, 1,1,1-TCA, 1,1-dichloroethene (1,1-DCE), Cis-1,2-dichloroethene and Trans-1,2-dichloroethene (1,2-DCE), 1,1-dichloroethane (1,1-DCA), 1,2-dichloroethane (1,2-DCA), Carbon Tetrachloride, Methylene Chloride, Chloroform, and petroleum related compounds (CDM, 1999).

3.7 Solid Waste Management Unit and Potential Areas of Concern Description and Evaluation

A total of four Solid Waste Management Units (SWMUs) have been identified at the Facility by USEPA and two potential AOCs have been identified by VW&R (Figure 4). One of the SWMUs is currently in use by VW&R (SWMU 1; Container Storage Unit/Former Repack Area). In this section, each SWMU and potential AOC is described and the potential for releases from individual SWMUs and potential AOCs are evaluated. The USEPA EPI/PA Report (USEPA, 1990), and the Site Environmental Review (VW&R, 1987) were utilized as the primary references in the preparation of this section.

The USEPA EPI/PA was performed as part of the USEPA's routine assessment program. Results of the USEPA EPI/PA did not indicate that past or current facility operations had resulted in any adverse impacts to the environment. As such, the USEPA did not require any additional information to supplement their assessment, nor did they recommend any soil or groundwater investigations. The Site Environmental Review was performed by VW&R to assess potential environmental issues associated with the recent (then) acquisition of McKesson. The following presents a summary of the SWMUs and potential AOCs identified by USEPA and VW&R, respectively.

3.7.1 Container Storage Unit/Former Repack Area (SWMU 1)

3.7.1.1 Description

The Container Storage Unit/Former Repack area is a concrete pad surrounded by a concrete dike that was originally constructed in 1970 with the dike added in 1987 (Figure 4). This area has been used to store customers' spent solvent drums (until approximately 60 drums were accumulated) for offsite reconditioning or disposal. In addition, VW&R stored small volumes of accumulated solvent rinsate generated from repackaging operations in this area (USEPA, 1990; Figure 3). This rinsate typically consisted of one or more of the materials listed below in Section 3.7.1.2. At the time of the USEPA EPI/PA in 1990, only accumulated solvent rinses were noted. It was determined that the containment structure was constructed to prevent precipitation run-on from entering the storage unit area. At the time of the USEPA EPI/PA, no accumulation of precipitation was observed. However, it was noted that, when present, the accumulated precipitation is assessed via laboratory analysis prior to pumping and discharge to either the municipal sanitary sewer, if determined to be acceptable, or containerized for offsite management if not acceptable for sanitary sewer disposal (USEPA, 1990).

3.7.1.2 Waste Characterization

The drums stored in this area contained waste products consisting of one or more of the following:

- 1,1,1-TCA;
- TCE;
- Methylene chloride;
- Acetone;
- Xylenes;
- Acetate;
- Methanol;
- Cyclohexanol;
- Isopropanol;
- Mineral spirits;
- Di-isopropyl ether; and,
- Still bottoms.

3.7.1.3 Characterization of Potential Releases

According to the USEPA EPI/PA Report, the floor and dike of the Container Storage Unit area was in good condition. Prior to construction of the dike, the primary migration pathway for a release from this area would have been surface drainage onto the paved area, and then flowing in a southeasterly direction to the south-central portion of the Facility. A release could then migrate in a southerly direction to the Facility's southern property boundary. If a release was of sufficient quantity, material could potentially migrate off-site via surface drainage over the asphalted alley-way to the 19th Street curb and gutter system, then easterly within the curb and gutter system to Mosley Avenue, and then southerly within the curb and gutter system to a storm sewer inlet located at 17th Street and Mosley Avenue (Figure 5).

3.7.2 Former Elementary Neutralization Tank (SWMU 2)

3.7.2.1 Description

A 1,500-gallon elementary neutralization tank was constructed in 1976 by McKesson and used for accumulation of mineral acids and caustics associated with the rinsing and filling of containers used for storage of sulfuric, hydrochloric, and phosphoric acids, caustic soda and bleach (Figure 4). The tank was constructed of concrete and was lined with a 65-millimeter thick polyvinyl chloride (PVC) liner. The liner material was periodically replaced during the period of operation. The tank had a wooden cover. Historically, materials were conveyed to the tank from the repacking area by underground PVC piping that emerged immediately east of the tank, and ran above grade for the remaining distance to the tank. Acids and caustics were conveyed in designated piping to the lined tank. Figure 7 depicts the former conveyance piping system associated with the neutralization tank. Historically, materials were held until the volume was within 10 inches from the tank's top. Following neutralization to a pH of between 6 and 7, the water was pumped using a portable pump and discharged to the sanitary sewer as an exempted waste (USEPA, 1990). This discharge was accomplished using underground PVC piping that extended from immediately east of the neutralization tank to the north-south trending sanitary sewer line located in the center of the Facility (Figure 7). In 1992, the elementary neutralization tank was removed from service and abandoned in place.

The elementary neutralization tank and associated piping was designed to accommodate the storage and disposal of mineral acids and caustics associated with the rinsing and filling of containers used for storage of sulfuric, hydrochloric, and phosphoric acids, caustic soda and bleach. Employees at the Facility were instructed as to what lines were to be used for each of the specific chemicals being handled. It is noted that TCE was stored and handled within the immediate area of this system. Therefore, a potential exists that the accidental introduction of this material into the system could have occurred. However, there are no records or information which indicate such an occurrence.

3.7.2.2 Waste Characterization

Prior to neutralization, all liquids stored in this tank were considered characteristically hazardous, based on corrosivity. Neutralization of these wastes is exempt from RCRA regulations pursuant to Code of Federal Regulations (CFR) 264.1(g) (6).

3.7.2.3 Characterization of Potential Releases

The primary migration pathway for a release from the elementary neutralization tank would have been through vertical migration of constituents occurring through leaks in the liner and cracks in the concrete to soils beneath the unit. No evidence of leaks or cracks has been historically observed in association with this area during routine maintenance and replacement of the liners.

Soils located to the east of the elementary neutralization tank were sampled during a 1990 soil boring investigation in response to a suspected drain-line leak. The pH of the soils were assessed during the investigation and were found to be between 6 to 7 pH units to a maximum depth of 12 feet bgs (Geraghty & Miller, Inc., 1991).

3.7.3 Former Satellite Accumulation and Former VW&R Repack Building Area (SWMU 3)

3.7.3.1 Description

At the time of the USEPA EPI/PA, a small satellite accumulation area used for storage of drummed solvent rinsate was located to the east of the former VW&R chemical repackaging and drum rinsing building (Figure 4). VW&R stored a maximum of two drums in this location prior to moving them to the waste container storage area. VW&R also used this area for filling drums with product from railroad tanker cars, tanker trucks, and the HCl and TCE ASTs. This area is paved; however, no secondary containment features were present outside the Repack building (USEPA, 1990).

3.7.3.2 Waste Characterization

This area was used to store waste rinsate generated from rinsing and refilling of reusable solvent drums. Wastes include the following:

- TCE;
- 1,1,1-TCA;
- Methanol;
- Hexane;
- Toluene; and,
- Isopropyl alcohol.

3.7.3.3 Characterization of Potential Releases

Soils located to the southwest of the former satellite accumulation area (south of the repackaging building) were also sampled and analyzed for the presence of TCE, 1,1,1-TCA, Hexane, and n-Propyl Acetate by USEPA Method 8240 during the above noted 1990 soil investigation activities. Analyses also included Methanol and n-Propyl Alcohol. Results of the analysis indicated that TCE was present in four of the five samples submitted. TCE was detected in soil at intervals of 4.5 to 8 feet bgs. Concentrations ranged from 24 to 120 µg/kg of TCE. At the time of the investigation, these concentrations were determined to be below state action levels and no further action was initiated (Geraghty & Miller, Inc., 1991).

In addition, samples were collected in 1984 from soil located to the west of the former TCE AST at a depth of one foot bgs (Figure 4). Two samples were collected and submitted for analysis of volatiles (USEPA Method 624). Results of the analysis indicated that detected compounds included Chloroform, 1,2 and/or 1,4-Dichlorobenzene, 1,1-DCE, trans-1,2-DCE, 1,1,1-TCA, and TCE. Chloroform was detected at concentrations ranging from non-detected to 7 mg/kg. 1,2 and/or 1,4-Dichlorobenzene was detected at concentrations ranging from 140 to 410 mg/kg. 1,1-DCE was detected at concentrations ranging from non-detected to 5 mg/kg. Trans-1,2-DCE was detected at concentrations of 87 to 960 mg/kg. 1,1,1-TCA was detected at concentrations ranging from non-detected to 54 mg/kg. TCE was detected at concentrations of 3.2 mg/kg and 2.8 mg/kg, respectively (VW&R, 1987).

3.7.4 Former Waste Liner Storage Area (SWMU 4)

3.7.4.1 Description

Polyvinyl liners associated with the neutralization tank that were periodically removed, triple-rinsed, cut up and placed in poly-drums prior to disposal, were stored in this area (Figure 4). Drums containing the waste liners were staged in a storage area located to the south of the satellite storage area. A maximum of two drums were stored in this location at any one time (USEPA, 1990).

3.7.4.2 Waste Characterization

Since the liners are triple-rinsed to remove any residual contamination, they are considered solid waste (non-hazardous).

3.7.4.3 Characterization of Potential Releases

The primary migration pathway for a release from the waste liner storage area would be through vertical migration of residual constituents from the drums containing the triple-rinsed liners. However, as these materials had been thoroughly rinsed prior to containerization, any such releases would be considered insignificant with respect to constituents or characteristics of concern.

3.7.5 Former Hydrochloric Acid Repack Area (AOC-1)

3.7.5.1 Description

Prior to construction of the repacking module, HCl was placed into drums on the back dock area adjacent to the railroad tracks on the west side of the property (Figure 4). The repacking area was filled from overhead pipes from an elevated 500-gallon tank on the south side of the dock. This tank was dismantled and removed in 1980 (VW&R, 1987).

3.7.5.2 Waste Characterization

This area was reportedly used for transfer of HCl from bulk storage tanks to drums.

3.7.5.3 Characterization of Potential Releases

The primary migration pathway for a release from the former aboveground acid storage tank would be through vertical migration of waste constituents in soil adjacent to the loading dock area. This area was not assessed during the USEPA EPI/PA.

3.7.6 Former Drum Filling Area (AOC-2)

3.7.6.1 Description

Solvent and corrosive materials were drummed from railroad tanker cars and tanker trucks in a concrete-paved area located along the southwest corner of the Facility (Figure 4, VW&R, 1987).

3.7.6.2 Waste Characterization

This area was reportedly used for the transfer of corrosives and solvents for distribution. Spills and releases could have potentially occurred during routine operations within this area.

3.7.6.3 Characterization of Potential Releases

The primary migration pathway for a release from the drum filling area would be through vertical migration of waste constituents into and through the soil. This area was not assessed during the USEPA EPI/PA.

3.7.7 DCC Summary

An evaluation of historical data and Facility operating procedures indicated that the four SWMUs identified by the USEPA and two potential AOCs identified by VW&R could be divided into the following two categories: Areas of Primary Concern and Areas of Minimal Concern with respect to the objectives of the RI.

The Areas of Primary Concern include the following:

- SWMU-1, the Container Storage Unit/Former Repack Area. This area is an active chemical container storage unit, and was historically used for chemical repackaging.

- SWMU-3, the Former Satellite Accumulation Area/Former Repack Area. This area historically served as a small satellite accumulation area to store drummed solvent rinsate and was also used for chemical repackaging into drums with product from railroad tanker cars, tanker trucks, and the HCl and TCE ASTs. The ASTs were located within a secondary containment structure positioned at the northeast portion of the SWMU. No secondary containment features were present outside the Repack building.

- Tanker trucks would off-load product for repackaging at the northwest corner of the repack building using removable above ground flexible hosing. Railroad tankers would off-load product for repackaging using a combination of permanent, rigid piping that ran between the rail spur and SWMU-3 and removable flexible piping runs that connected to the rail tanker and the repackaging building to the rigid permanent above ground piping. During the off-loading process the tanker cars would be staged on the rail spur at the southwestern corner of the Facility. Figure 8 depicts the former railroad tanker car staging area and transfer piping runs associated with product off-loading.

- AOC-1, the Former HCl Drum Fill Area and Loading Dock. This area historically served as a HCl repacking module and potentially as a general receiving location for materials delivered by rail car.

- AOC-2, Former Caustic and Solvent Unloading Area. This area historically served as a solvent and corrosive materials off-loading area for railroad tanker cars. This area was reportedly used for some repackaging, but primarily activities were associated with the coupling of transfer piping between railroad tankers and the permanent above ground transfer piping. Some drumming of product materials occurred in association with these activities. Figure 8 depicts the former railroad tanker car staging area and transfer piping runs associated with product off-loading.

The Areas of Minimal Concern include the following:

- SWMU-2, Former Elementary Neutralization Tank. This area historically contained a 1,500-gallon elementary neutralization tank used for accumulation of mineral acids and caustics associated with the rinsing and filling of containers used for storage of sulfuric, hydrochloric, and phosphoric acids, caustic soda and bleach. The tank was constructed of concrete and was lined with a 65-millimeter thick PVC liner. Historically, materials placed in the lined tank

were held until the volume was within 10 inches from the tank's top. Following neutralization to a pH of between 6 and 7, the waste was discharged to the sanitary sewer as an exempted waste.

- SWMU-4, Former Waste Liner storage area. This area was used to store polyvinyl liners associated with the neutralization tank. These liners were periodically removed, triple rinsed, cut up and placed in poly-drums and stored in this area prior to disposal.

The objectives of the RI were designed to address the potential concerns associated with both the Areas of Primary and Minimal Concern. However, because of the small aerial extent of the property, the similarity in both the potential for release(s) and in waste characteristics, and the contiguous nature of the SWMUs and potential AOCs, the RI activities were deemed to be sufficient to address the potential concerns associated with these entities, as well as the Facility as a whole.

The chemical constituents of concern included VOCs, while characteristics of concern included the affects (pH) from acids and bases. The potential for migration of these constituents into the environment and toward potential receptors is discussed in the following subsections.

3.7.7.1 Surface Water

The nearest surface water to the Facility is Chisholm Creek, located approximately 500 feet to the north. Due to the topographic expression in the vicinity of the Facility, Chisholm Creek flows toward the southeast.

Review of City of Wichita Public Works records indicated that no sanitary sewer system inlets or drains were present on-site at the Facility (only direct connections exist). These records also indicated that the surface drainage south of Chisholm Creek flowed to the south away from the creek. Surface drainage from the Facility (if of sufficient volume) would flow toward the storm sewer inlet at 17th and Mosley Avenue, and ultimately discharge to Chisholm Creek located beneath the elevated Interstate I-135. Surface drainage north of Chisholm Creek (in the vicinity of the Facility) would discharge into the creek on the northwest side of the Mosley Avenue bridge. Figure 5 depicts the general locations of storm sewer system discharge points within the vicinity of the Facility.

3.7.7.2 Groundwater

Available information prior to the initiation of the RI activities suggested that depth to groundwater in the vicinity of the Facility would be within 15 feet bgs (Lane, 1965). At the time of the DCC report preparation, no groundwater had been assessed at the Facility. The soils above the groundwater table were determined to be comprised of alluvial sediments of low-to-moderate permeability. The rate of filtration through the vadose zone beneath the Facility was unknown. Groundwater elevation data associated with NIC investigation activities indicated that the direction of groundwater movement in the vicinity of the Facility should be generally toward the south-southeast (KDHE, personal communication).

3.7.7.3 Air

The data reviewed had not indicated the existence of either state or federal air permits. As the Facility currently operates as a sales and distribution center with no bulk storage or repackaging, it was deemed unlikely that significant air quality issues would exist.

4.0 INVESTIGATION METHODOLOGIES

4.1 Soil Boring Methodologies

All soil borings (including those for monitoring wells) were advanced using hollow stem auger drilling techniques. This technique utilized a truck mounted drilling rig and 4 ¼ inch inside diameter (I.D.) continuous flight steel augers. All borings were advanced by Lane Inc. of Wichita, Kansas.

4.2 Soil Sampling Methodologies

Soil sampling was accomplished using a CME continuous sampler. Using the CME continuous sampler, a 3-inch I.D., 5-foot long split-barrel sampler is advanced into the soil concurrently with the hollow stem auger. After the split-barrel sampler and augers had been advanced the appropriate distance (typically at five foot intervals), the sampler and attached drilling rods were removed from the hole. Soil samples retrieved during boring activities were field screened for the presence of VOCs using a Photo-Ionization Detector (PID). The soil samples were screened immediately following retrieval and opening of the split-barrel sampler. A portion of the sample from each interval was initially placed in a resealable plastic bag and allowed to equilibrate at approximately room temperature for approximately 5 to 10 minutes. At the same time, a portion of the sample was immediately placed in a laboratory supplied sample container and placed in an iced cooler under appropriate COC procedure. One sample was collected from the interval exhibiting the highest detector reading above background for laboratory analysis. If no positive readings were detected by the PID, samples were obtained from approximately three to six feet bgs and from immediately above the water table interface for analysis. The remainder of each sample was then logged for characterization. After the entire boring had been characterized, the bagged samples were tested with a PID for head-space analysis.

At each boring/monitoring well location, all soil samples for pH analyses were collected from the same depth intervals utilized for VOC sample collection. In addition, soil samples were collected for physical property analyses including: bulk density, porosity, total organic content, cation exchange capacity (CEC), moisture content, and particle size and distribution. Physical property sample collection locations were field-determined to ensure the collection of representable samples for the limited variability of subsurface stratigraphic and hydrostratigraphic conditions at the Facility. In general, the sample locations were determined based on the intent to obtain at least two soil samples from each distinct stratigraphic zone across the Facility.

Equipment for soil sampling consisted of a 5-foot continuous split-spoon barrel sampler and a stainless steel spoon or knife to remove soil from the split-spoon sampler. Disposable nitrile gloves were worn by sampling personnel during the sampling operations, and gloves were changed between each split spoon sample.

4.2.1 Soil Classification Methodologies

Soil classification occurred as samples were obtained in the field. Samples were visually and manually classified by the crew chief in accordance with ASTM: D 2488-84. Representative portions of the samples were submitted for laboratory examination and verification of the field classification. Boring logs indicating the depth and identification of the various strata, water elevation information, and pertinent information regarding the method of maintaining and advancing the drill hole were prepared.

4.3 Decontamination Methodologies

The drilling rig was steam-cleaned prior to initiation of any drilling activities. All down-hole drilling equipment was steam-cleaned prior to initiation of any drilling activities and between each boring. All decontamination wastes were containerized and retained on-site pending results of characterization analyses (VOCs and pH by USEPA Methods 8260 and 9040, respectively) for appropriate disposal.

4.4 Monitoring Well Installation Methodologies

All monitoring well installations were performed by Lane Inc. of Wichita Kansas, a Kansas licensed contractor using hollow stem auger drilling techniques. The monitoring wells were constructed and installed in accordance with current Kansas Bureau of Waters (BOW) regulations.

4.4.1 Shallow Well Construction

All borings used to accommodate the shallow aquifer wells utilized 4 ¼ inch I.D. hollow stem augers in conjunction with 5-foot continuous split-barrel soil sampling. All shallow monitoring wells consist of two-inch I.D., ten-foot long #10 slot, schedule-40 PVC well screens connected to the ground surface by two-inch I.D., schedule-40 PVC well casing. The mid-point of the monitoring well screen was placed approximately three feet below the water table surface (resulting in approximately two feet of the well screen being above the water table surface). The borehole annulus, from the bottom of the boring to a point approximately two feet above the top of the screen, was backfilled with clean, medium-grained washed sand. The remaining borehole annulus was backfilled with cement/bentonite grout to land surface. All shallow monitoring wells were completed as flush-mounts housed in traffic grade well vaults.

4.4.2 Deep Well Construction

All borings used to accommodate the deep aquifer wells utilized 4 ¼ inch I.D. hollow stem augers in conjunction with 5-foot continuous split-barrel sampling. All deep monitoring well installations consist of two-inch I.D., five-foot long #10 slot, schedule-40, PVC well screens connected to the ground surface by two-inch I.D. PVC well casing. The monitoring well screen was placed at the bottom of the unconsolidated materials that form the shallow water bearing unit (i.e., at the contact with the underlying Wellington Shale Formation). The borehole annulus, from the bottom of the boring to a point approximately two feet above the top of the screen, was

backfilled with clean, medium-grained washed sand. The remaining borehole annulus was backfilled with cement/bentonite grout to land surface. All deep monitoring wells were completed as flush-mounts housed in traffic grade well vaults.

4.5 Survey of Soil Borings and Monitoring Wells

All soil boring and monitoring well locations were surveyed with respect to a known United States Geological Survey (USGS) datum point (providing easting and northing coordinates consistent with the Wichita North Industrial Corridor (NIC) investigation data base coordinate system) by Armstrong Land Survey, P.A., a Kansas-licensed contractor. The Facility survey was completed on June 29, 1998. In addition, the surface elevations of each soil boring and the measuring point elevations of each monitoring well were surveyed. Survey data, including top of casing (TOC) elevations, ground surface elevations, and monitoring well screen intervals is outlined in Table 8.

4.6 Groundwater Sampling

4.6.1 Fluid Level Measurements2.4.1 Fluid Level Measurements

Prior to sampling the monitoring wells, fluid level measurements were taken at each individual well. Measurements were taken with a water level meter capable of measuring to the nearest 0.01 feet. Total depth of the well and depth to water were recorded for each well. Between wells, the water level indicator cable was decontaminated using an alconox and water spray followed by a distilled water rinse.

4.6.2 Monitoring Well Purging

The monitoring wells were purged using dedicated disposal bailers. At least three well volumes were removed during the purging process. Copies of sample collection data sheets illustrating purge volume amounts are included in Appendix E. The amount of water to be purged per well volume was calculated according to the following formula:

(3.1416 x (r/12 inches)) x (TD-DTW) x 7.481 = 1 well volume (gallons)

Where,

r = well radius (inches)
TD = Total depth (feet)
DTW = depth to water (feet)
3.1416 = π
7.481 = constant (gallons per cubic foot)

4.6.3 Field Analytical Measurements2.4.3 Field Analytical Measurements

Field readings of pH, temperature, and conductivity were performed on samples collected from each purge volume, and noted in the field notebook. A well was considered adequately purged for sampling when the readings had stabilized to within 10 percent over consecutive readings.

At least three well volumes were purged from each well prior to collection of the required samples.

The pH/temperature/conductivity meter was calibrated at the beginning of each day, and again during the midpoint of each days sampling event. Purge water collected during the sampling event was containerized and retained on-site pending characterization analyses (VOCs and pH by USEPA Methods 8260 and 9040, respectively).

4.6.4 Groundwater Sample Collection

Samples for VOC analysis (USEPA 8260) were collected in 40 ml glass vials provided by the laboratory conducting the analysis. Disposable nitrile gloves were worn during the sampling event. Monitoring wells were sampled in order from the anticipated cleanest to the most impacted. During sampling, the dedicated disposable polyethylene bailer was slowly lowered into the well water, filled, and retrieved. VOC samples were collected by decanting water from the bailer into 40 ml vials. Vials were filled until a convex meniscus was present, and then immediately capped. The cap was then secured and the vial checked for trapped air. Any samples with entrained air were discarded, and new samples collected. Duplicate and field blank samples were also collected in accordance with the Quality Assurance Project Plan (QAPP).

Samples for pH analysis (USEPA Method 9090 were collected in 25 ml containers provided by the laboratory conducting the analysis. During sampling, the dedicated disposable polyethylene bailer was slowly lowered into the well water, filled, and retrieved. pH samples were collected by decanting water from the bailer into the 25 ml containers. Containers were filled until a convex meniscus was present, and then immediately capped. Disposable nitrile gloves were worn during the sampling event.

Samples for Total Organic Content analysis (USEPA Method 9060) were collected in 50 ml containers provided by the laboratory conducting the analysis. During sampling, the dedicated disposable polyethylene bailer was slowly lowered into the well water, filled, and retrieved. Total Organic Content samples were collected by decanting water from the bailer into the 50 ml containers. Containers were filled until a convex meniscus was present, and then capped. Disposable nitrile gloves were worn during the sampling event.

Groundwater samples were immediately placed on ice in a cooler in the field following collection. Field checklists were used to verify the proper execution of the sampling tasks. These forms were completed as part of the field notebook documentation, and are presented within the groundwater analytical data appendix.

4.7 Analytical Methodologies

4.7.1 Soil Analytical Methodologies

Soil samples, soil investigation derived waste (IDW) samples, travel blanks, and QA/QC samples were analyzed for VOCs, pH, total organic content, and CEC using USEPA Methods 8260, 9040, 9060 and 9080, respectively, (SW-846, USEPA, 1986). A summary of the anticipated number of samples, sample matrices, and analytical methodologies to be utilized

during the RI activities are presented on Table 3-1 of the Field Sampling Plan (FSP) attached as Appendix A to the RI/FS Work Plan for this Facility. Appropriate sample containers, necessary preservation(s), and holding times for the proposed analytical methods were presented on Table 3-2 of the above referenced FSP.

It is noted that the following soil laboratory analytical methods outlined in the FSP were modified by the laboratory during the RI activities:

- pH analyses were performed by USEPA Method 9045A rather than USEPA Method 9040. The results for soil pH are presented as corrosivity;
- Total organic content were performed by SMCA Walkey-Bloc Method rather than USEPA Method 9060. The results are presented as milligrams per kilogram; and
- CEC was performed by USEPA Method 9081 rather than USEPA Method 9080. The results are presented as milligrams per kilogram.

These analytical method modifications were undertaken by the laboratory to conform to Kansas certification protocol, and do not negatively impact the quality or reliability of the data reported.

4.7.2 Groundwater Analytical Methodologies

Groundwater samples, water investigation derived waste (IDW) samples, travel blanks, and QA/QC samples were analyzed for VOCs, pH, and total organic content, using USEPA Methods 8260, 9040, and 9060, respectively, (SW-846, USEPA, 1986). A summary of the anticipated number of samples, sample matrices, and analytical methodologies which were utilized during the RI activities are presented on Table 3-1 of the Field Sampling Plan (FSP) attached as Appendix A to the RI/FS Work Plan for this Facility. Appropriate sample containers, necessary preservation(s), and holding times for the proposed analytical methods were presented on Table 3-2 of the above referenced FSP.

It is noted that no modifications to the proposed laboratory analytical methods outlined in the above referenced FSP were made by the laboratory during the RI groundwater assessment activities:

4.8 Data Quality Objectives

Data Quality Objectives (DQO) are qualitative and quantitative statements which specify the quality of the data required to support decisions made during the completion of environmental activities and are based on the end uses of the data to be collected. As such, different data uses may require different levels of data quality. Soil and groundwater samples collected during the RI activities were analyzed using DQO Level 3. A summary of the five analytical levels which address various data uses and the QA/QC effort and methods required to achieve the desired level of quality was presented in Appendix B of the RI/FS Work Plan. In addition, Table 1-3 of the QAPP presented a summary of the anticipated number of samples to be collected from each medium and the appropriate DQO level associated with those samples.

4.9 Aquifer Characteristic Assessment Methodologies

4.9.1 Single Well Hydraulic Conductivity Testing

Aquifer characteristic assessments were performed to determine in-situ permeability of the saturated media underlying the Facility. The tests were initiated by causing an instantaneous change in the water level at the selected monitoring well through the sudden introduction or removal of a slug of known volume. The change in water level and its recovery associated with the introduction or removal of the known volume was recorded electronically with an In-Situ Troll Model SP-4000 data logger positioned in the well.

The analysis of the test data is a function of the well configuration, aquifer type, and the position of the water table relative to that of the well screen. The following data analysis methods were employed as appropriate:

- Bouwer and Rice (1976)
- Bouwer (1989)
- Cooper et al (1967)
- Hvorslev (1951)
- Papadopulos et al (1973)
- Thompson (1987)

These methods are referenced in the following papers:

Bouwer, H. and R.C. Rice. 1976. A slug test to determine the hydraulic conductivity of unconfined aquifers with completely or partially penetrating wells. Water Resources Research, Vol. 12, pp. 423-428.

Cooper H.H., Jr., J.D. Bredehoeft, and I.S. Papadopulos. 1967. Response of a finite diameter well to an instantaneous charge of water. Water Resources Research, Vol. 3, pp. 263-269.

Papadopulos, I.S., J.D. Bredehoeft, and Cooper H.H. 1973. On the analysis of slug test data. Water Resources Research, Vol. 9, pp. 1087-1089.

4.9.2 Grain Size Distribution Analyses

Aquifer characteristic assessments were also performed to determine in-situ permeability of the media underlying the Facility. These assessments utilized grain size distributions obtained from sieve analyses performed on selected soil samples collected during soil boring activities. The sieve analyses were performed on 16 soil samples collected during Phase I boring activities. The samples were analyzed in accordance with ASTM method D 422 for particle size distribution. Two soil samples that contained greater than 20 percent fines by weight warranted utilization of the Hydrometer portion of the analysis.

Utilizing the grain-size distribution curve, empirical formulas were employed to estimate hydraulic conductivity. All samples were analyzed using three empirical equations Hazen,

Krumbein & Monk and Kozeny & Carmen. One of the most reliable empirical formulas for sandy soils is the Hazen method.
These methods are referenced in the following:

- Fetter, C.W. Applied Hydrogeology: Second Edition: Macmillan Publishing Company (1988) p. 81.
- Louden, A.G. The Computation of Permeability from Simple Soil Tests: Geotechnique (1952), Volume 3. p. 165-183.
- Krumbein, W.C. and Monk, G.D. Permeability as a Function of the Size Parameters of Sedimentary Particles: Petroleum Technology. (July 1942), p. 1-11.
- Freeze, R.A. and Cherry, J.A. Groundwater: Prentice-Hall (1979), p. 550-551.
- Williams, E.B. Fundamental Concepts of Well Design: Groundwater: (1981) Volume 19 Number 5 p. 527-542.
- Shepherd, R.G. Correlations of Permeability and Grain Size: Groundwater (1989) Volume 25 Number 5 p. 633-538.

5.0 INVESTIGATION RESULTS

5.1 Background Information

5.1.1 Field Activities

Field investigation activities performed during this RI/FS were conducted in two phases. The first phase consisted of the activities outlined in the Work Plan accompanying the Consent Order as Exhibit 1. The second phase consisted of supplemental soil boring, monitoring well installation and laboratory analyses of soil and groundwater samples as outlined in the VW&R request for additional investigation activities dated August 25, 1998 and approved by the KDHE on September 19, 1998. The Phase II activities were undertaken to further assess the subsurface conditions at the facility and confirm the initial determination that no potential on-site source areas existed at the Facility. The following sections summarize activities performed during these two phases of the field investigation.

5.2 Geology

5.2.1 Regional Geologic Setting

Geology in the general vicinity of the Facility consists of 10 to 15 feet of silts and clays underlain by unconsolidated sands and gravelly deposits. These alluvial deposits average 45 feet in thickness and form the primary water-bearing unit in the area. A shale unit, the Wellington Formation, underlies the alluvial deposits.

The Facility is situated on soil classified as the Elandco series (Soil Conservation Service, 1979). These are well-drained silt loams that are moderately permeable. The Elandco soil, which is formed in silty and clayey alluvial sediments, is typically found on flood plains and low terraces in the area. Elandco soils are generally deep, well drained and moderately permeable (0.6 to 2.0 inches/hour). The surface layer of this series is a silt loam. These soils are formed in silty, alluvial sediments on 0 to 3 percent slopes and are highly erodible by fluvial and eolian processes (USDA 1979). Throughout Wichita, these soils are protected from flooding by the Wichita-Valley Center floodway.

The bedrock that underlies the Facility consists of the Permian-age Wellington Formation, which consists of approximately 550 feet of gray and blue shale interbedded with thin beds of maroon shale, impure limestone, gypsum, and anhydrite. The thick Hutchinson Salt Member is present near the middle of the Wellington Formation in western Sedgwick County (Lane 1965).

5.2.2 Site Geology

5.2.2.1 Soil Borings

5.2.2.1.1 Phase I Soil Borings

Between June 1 and 17, 1998, a total of 18 soil borings were advanced at the site during Phase I investigative activities. Soil boring depths ranged from approximately 10 to 45 feet below

ground surface (bgs). Fifteen of the soil borings were completed as groundwater monitoring wells (MW-1S, MW-1D, MW-2S, MW-2D, MW-3, MW-4S, MW-4D, MW-5S, MW-5D, MW-6, MW-7S, MW-7D, MW-8S, MW-8D, and MW-9S). The soil borings completed as monitoring wells were located throughout the Facility to assess subsurface conditions at, and adjacent to, the identified SWMUs and AOCs. The remaining soil borings (SB-1, SB-2, and SB-3) were advanced adjacent to, and within the footprint of the former Repack Building (SWMU-3). Soil borings SB-1 and SB-2 were advanced within areas where previously reported releases had been documented, and SB-3 was advanced within the center of the SWMU-3 AST pad. Figure 9 depicts the Phase I soil boring and monitoring well locations, and Table 1 presents the rationale for the selected locations. Phase I soil boring logs are presented in Appendix A.

5.2.2.1.2 Phase II Soil Borings

Between September 29 and October 2, 1998, a total of eight soil borings were advanced at the site during the Phase II investigative activities. Phase II soil boring depths ranged from 15 to 40 feet bgs. Three of the soil borings were completed as groundwater monitoring wells (MW-9D, MW-10S, and MW-10D). The remaining soil borings (SB-4, SB-5, SB-6, SB-7, and SB-8) were advanced adjacent to, and within the footprint of, the former Repack Building. The purpose of the soil boring program was to further assess subsurface conditions associated with the SWMU-3 area. Figure 10 depicts the Phase II soil boring and monitoring well locations, and Table 2 presents the rationale for the selected locations. Phase II soil boring logs are presented in Appendix A.

5.2.3.1 Soil Sampling

5.2.3.1.1 Phase I Soil Sampling

Phase I soil sampling and field screening were accomplished using hollow stem auger drilling techniques and a CME continuous sampler as described in Section 4.2 of this report. Soil samples from 6 of the 13 Phase I soil boring/monitoring well locations exhibited PID headspace readings above background levels. PID headspace readings ranged from non-detectable to a maximum of 30 ppm (benzene equivalence) at soil boring/monitoring well SB-3 at a depth of approximately 5 feet bgs. Table 3 presents a summary of PID headspace screening results.

At the same time as the field screening activities, a portion of the sample was placed in a laboratory supplied sample container and placed in an iced cooler under appropriate COC procedure. Two soil samples were selected for VOC analysis from each boring location, with the exception of the location for soil borings/monitoring well MW-5. Only one sample was collected from this location as no associated soil samples exhibited PID screening readings above background levels, and the distal location of the borings from the identified SWMUs and AOCs. At all other locations, soil samples were collected from the interval exhibiting the highest PID reading above background levels for laboratory analysis, and from approximately three feet above the water table interface. If no positive PID headspace readings were detected, or if the highest PID reading was immediately above the water table interface, samples were collected from above the water table interface and from a depth of approximately three to six feet bgs. At each boring/monitoring well location, soil samples for pH analyses were collected from the same depth interval utilized for VOC sample collection.

A soil sample from soil boring SB-3 was not submitted for laboratory analysis as the sample was compromised prior to shipment to the laboratory (i.e. the sample container was broken). As such, the sample was not sent to the laboratory for analysis.

In addition, soil samples were collected for physical property analyses. These samples included: 16 samples for bulk density analyses; 16 samples for particle size distribution (porosity), and moisture content; 9 samples for total organic content analyses; and 9 samples for CEC analyses. The bulk density, particle size distribution (porosity), and moisture content samples were collected from a total of six soil borings/monitoring well locations across the Facility (MW-1, MW-2, MW-4, MW-5, MW-7 and MW-8) at depths ranging from 4 to 5 feet bgs to 31 to 32 feet bgs. The total organic content and CEC samples were collected from a total of four soil boring/monitoring well locations across the Facility (MW-2, MW-5, MW-7 and MW-8) at depths ranging from 4 to 5 feet bgs to 27 to 29 feet bgs.

5.2.3.1.2 Phase II Soil Sampling

Phase II soil sampling was also accomplished using hollow stem auger drilling techniques and a CME continuous sampler as described in Section 4.2 of this report. One of the seven Phase II soil boring/monitoring well locations exhibited PID headspace readings above background levels. PID headspace readings ranged from non-detectable to a maximum of 3 ppm (benzene equivalent) at soil boring/monitoring well SB-4 at a depth of approximately 5 feet bgs. Table 3 presents a summary of PID headspace screening results.

Two soil samples were selected for VOC analysis from each boring location, with the exception of the location for soil borings/monitoring well MW-10. Only one sample was collected from this location as associated soil samples did not exhibit PID screening readings above background levels, and the distal location of the borings from the identified SWMUs and AOCs. At the remaining locations, soil samples were collected from the interval exhibiting the highest PID reading above background for laboratory analysis, and from approximately three feet above the water table interface. If no positive PID headspace readings were detected, or if the highest PID reading was immediately above the water table interface, samples were collected from above the water table interface and from a depth of approximately three to six feet bgs. At each boring/monitoring well location, soil samples for pH analyses were collected from the same depth interval utilized for VOC sample collection. As a compensatory measure, soil boring SB-4 was advanced immediately adjacent from SB-3 (which was advanced during Phase I soil sampling).

No physical property samples were collected from these locations, as the primary purpose of the Phase II activities was to further assess VOC distribution within the shallow and deep groundwater zones, and the absence of VOC impacted soils immediately beneath, and adjacent to, the former Repack Building (SWMU-3).

5.6 Site Geology

Data generated during the RI activities indicate that the Facility is underlain by a combination of unconsolidated alluvial sediments which are underlain by bedrock of the Wellington Shale Formation. The alluvial sediments exhibit compositional characteristics that allow for the generic designations of shallow and deep zones. The shallow zone at the facility typically

consists of silty-sands, sandy-silts, and fine sands that extend to depths of approximately 20 to 25 feet bgs. The deep zone typically consists of a general coarsening downward sequence of silty-sand to fine-gravel, and is first encountered at depths of approximately 20 to 28 feet bgs. The deep zone extends to the underlying bedrock interface (depths of approximately 40 to 45 feet bgs). Laterally discontinuous lenses of silt and clay of various thicknesses (typically of 0.0 to 1.5 feet) were encountered beneath much of the Facility. These discontinuous lenses were typically encountered at depths ranging from approximately 20 to 28 feet bgs.

Where present, these discontinuous lenses corresponded to the transition from the shallow to the deep zones of the alluvial sediments. In the absence of the lenses, the shallow to deep zone transition was typically identified by a noticeable change in sediments (a sequence of sandy-silts and silts overlying coarse sands to fine gravels). Figure 11 is a cross-sectional location map, and Figures 12 and 13 present cross sections of the subsurface materials underlying the Facility.

5.7 Hydrogeology

5.7.1 Regional Hydrogeology

5.7.1.1 Groundwater Occurrence

The Facility is located in the Arkansas River Valley in Sedgwick County, Kansas. Unconsolidated deposits underlying the Arkansas River Valley serve as the principal source of groundwater in the area. Groundwater usage from the underlying bedrock units is limited due to its generally poor quality (Lane, 1965). The depth to groundwater in the vicinity of the Facility area ranges from 10 to 15 feet below ground surface (bgs).

The water table in the Arkansas Valley exhibits a generally uniform southeasterly slope of about 7 feet per mile. Locally, however, the slope reportedly varies from 5 to 10 feet per mile. Groundwater movement is in the direction of the water table slope, which typically mirrors the surrounding topography. In the valley, the groundwater reportedly moves toward the Little Arkansas River and toward the Arkansas River below the confluence of these two rivers. In some areas, and at various depths, the groundwater movement may be different than the water table gradient as a result of localized conditions. However, the resultant overall direction of groundwater movement is considered to be to the southeast (Lane, 1965).

5.7.1.2 Beneficial Uses of Groundwater and Surface Water

The majority of the drinking water for the City of Wichita comes from a well field approximately 25 miles northwest of Wichita where wells are completed in the Neogene Age Equus beds at depths ranging from 50 to 250 feet bgs, and from the Cheney Reservoir located 21 miles west of Wichita. Wichita also has several production wells located approximately 2.5 miles southwest of the Facility. These wells are used only in times of high water demand when the main well field and Cheney Reservoir cannot meet demand. These wells are completed in unconsolidated Neogene deposits (Little Arkansas and Arkansas alluvium deposits) at depths ranging from 50 to 60 feet bgs. Well yields range from a few gallons per minute (gpm) up to 2,000 gpm per well. Typically, the groundwater is moderately hard to very hard and in some areas contains high concentrations of dissolved iron and salts. Due to extensive pumping at the Wichita well fields,

depth to groundwater in the vicinity of the well fields has increased. Depth to water in the vicinity of the Facility is reported to be approximately 10 to 15 feet bgs, or approximately 1285 feet above mean sea level (msl) (Lane, 1965).

5.7.2 Site Hydrogeology

5.7.2.1 Monitoring Well Installation

5.7.2.1.1 Phase I Monitoring Well Installations

Between June 1 and 17, 1998, a total of 15 monitoring wells were installed at the Facility. Figure 14 depicts the monitoring well locations associated with the Phase I and Phase II activities. Well installations consisted of six nested pairs and three solitary shallow wells. The shallow zone wells (nested pair and solitary) were screened across the water table surface (typically screened from 10 to 20 feet bgs, utilizing a 10-slot, 10-foot screened interval). The deep zone wells were screened at the base of the unconsolidated sediments (typically screened from depths ranging between 35 to 40 feet bgs, utilizing a 20-slot, five-foot screen interval). Well completion diagrams are presented in Appendix A.

5.7.2.1.2 Phase II Monitoring Well Installations

Between September 29 and October 2, 1998, a total of three additional monitoring wells were installed at the Facility. Well installations consisted of one nested pair of wells (MW-10S and MW-10D) and one solitary deep zone well (MW-9D; Figure 14). The shallow zone wells were screened across the water table surface (screened from 10 to 20 feet bgs, utilizing a 10-slot, 10-foot screened interval). The deep zone wells were screened at the base of the unconsolidated sediments (typically screened from depths ranging between 35 to 40 feet bgs, utilizing a 10-slot, five-foot screen interval). Well completion diagrams are presented in Appendix A.

5.7.3 Groundwater Sampling

5.7.3.1 Phase I Groundwater Sampling

Between June 16 and 17, 1998, all Phase I groundwater monitoring wells were sampled for laboratory analyses. The sampling activities followed the methodology outlined in Section 4.6 of this report. Monitoring wells MW-1S, MW-1D, MW-2S, MW-2D, MW-3, MW-4S, MW-4D, MW-5S, MW-5D, MW-6, MW-7S, MW-7D, MW-8S, MW-8D and MW-9S were sampled for VOC and pH analyses by USEPA Methods 8260 and 9040, respectively. Monitoring wells MW-1S and MW-4S were also sampled for Total Organic Content analyses by USEPA Method 9060.

In addition, two field blank samples, two trip blank samples and a blind duplicate (MW-5S) sample were collected and analyzed for VOCs during this sampling event. A summary of the Phase I groundwater analytical results are presented in Section 5.11 of this report.

5.7.3.2 Phase II Groundwater Sampling

Between October 8 and 13, 1998, all Phase I and Phase II groundwater monitoring wells were sampled for laboratory analyses. The sampling activities followed the methodology outlined in

Section 4.6 of this report. Monitoring wells MW-1S, MW-1D, MW-2S, MW-2D, MW-3, MW-4S, MW-4D, MW-5S, MW-5D, MW-6, MW-7S, MW-7D, MW-8S, MW-8D, MW-9S, MW-9D, MW-10S and MW-10D were all sampled for VOC analyses by USEPA Methods 8260.

In addition, one blind duplicate, one field blank and one trip blank sample were collected and analyzed for VOCs during this sampling period. Results of the Phase II sampling are presented in Section 5.11 of this report.

5.8 Groundwater Occurrence and Movement

Groundwater occurs beneath the Facility at an approximate depth of 12 to 13 feet bgs in both the shallow and the deep monitoring wells. During the installation of the deep monitoring wells, several relatively thin and laterally discontinuous lenses of silty-clay to clay was encountered at approximately 20 to 28 feet bgs. Groundwater measurements for the shallow and deep zone monitoring wells exhibit similar potentiometric surface elevations, indicating that the laterally discontinuous silty-clay to clay lenses do not cause a hydraulic separation between the shallow and deep zones of the aquifer underlying the Facility.

Groundwater elevation data have been collected at the Facility on two occasions. The first data collection event occurred in June 1998 prior to the collection of Phase I groundwater analytical samples. The second data collection event occurred in October 1998 prior to the collection of Phase II groundwater analytical samples. Data associated with these events for the shallow and deep zones are presented in the following sections.

5.8.1 Shallow Zone

Phase I groundwater elevation data indicated that shallow zone groundwater was present at elevations ranging between 1296.02 and 1295.67 feet msl. Groundwater movement was toward the southeast across the Facility, and exhibited a gradient of approximately 0.00090 feet per feet.

Phase II groundwater elevation data also indicated that shallow zone groundwater was present at elevations ranging between 1296.69 and 1296.36 feet above msl. Groundwater movement during this event was also toward the southeast across the Facility, and exhibited a similar gradient to that of the Phase I event, being approximately 0.00087 feet per feet.

Phase I and Phase II groundwater elevation contour maps for the shallow zone are presented in Figures 15 and 16, respectively.

5.8.2 Deep Zone

Phase I groundwater elevation data indicated that deep zone groundwater was present at elevations ranging between 1295.99 to 1295.75 feet MSL. Groundwater movement was toward the southeast across the Facility, and exhibited a gradient of approximately 0.00063 feet per feet.

Phase II groundwater elevation data also indicated that deep zone groundwater was present at elevations ranging between 1296.67 and 1296.37 feet above MSL. Groundwater movement

during this event was also toward the southeast across the Facility, and exhibited a similar gradient to that of the Phase I event, being approximately 0.00066 feet per feet.

Figures 17 and 18 present groundwater elevation contour maps for the deep zone associated with the Phase I and Phase II gauging events, respectively.

5.9 Permeability Assessment

5.9.1 Grain Size Distribution

Soil samples were collected for grain size distribution (and associated porosity, bulk density and moisture content) from six soil borings/monitoring well locations across the Facility (MW-1, MW-2, MW-4, MW-5, MW-7 and MW-8). Samples were collected at four general depth intervals ranging from 4 to 5 feet bgs to 31 to 32 feet bgs to assess variability in subsurface materials and provide a comparison between the shallow and deep aquifer zones. Unsaturated samples from the shallow zone were collected at depths ranging between 4 to 10 feet bgs. Saturated shallow zone samples were collected at depths ranging from 9 to 19 feet bgs. Saturated deep zone samples were collected at depths ranging between 21 and 35 feet bgs. Samples collected from approximately 18 to 28 feet bgs typically corresponded to the transition zone materials that occurred between the shallow and deep zones of the aquifer. Hydraulic conductivity estimates were performed using the grain size distribution data associated with the 16 samples and utilizing the Hazen estimation method. Laboratory data sheets and a description of the methodology associated with these analyses are presented in Appendix B.

5.9.1.1 Shallow Zone Permeability

Four samples were collected from depth intervals equivalent to the unsaturated portion of the shallow aquifer zone. These samples exhibited hydraulic conductivity values that ranged between 1.7×10^{-2} to 1.0×10^{-4} centimeters per second (cm/sec). Three samples were collected from the saturated portion of the shallow aquifer zone. These samples exhibited hydraulic conductivity values that ranged between 2.9×10^{-2} to 4.0×10^{-3} cm/sec. Table 4 presents a summary of shallow zone grain size permeability estimates.

5.9.1.2 Deep Zone Permeability

Six samples were collected from depth intervals equivalent to the saturated portion of the deep aquifer zone. These samples exhibited hydraulic conductivity values that ranged between 1.0×10^{-1} to 6.3×10^{-2} cm/sec. Table 4 presents a summary of deep zone grain size permeability estimates.

5.9.1.3 Transition Zone Permeability

Three samples were collected from soils representative of the laterally discontinuous lenses of the transition zone that occurs between the shallow and deep aquifer zones. These samples exhibited hydraulic conductivity values that ranged between 8.0×10^{-3} to 1.0×10^{-4} cm/sec. Table 4 presents a summary of deep zone grain size permeability estimates.

5.10 In-situ Permeability Testing

Between August 4 and 7, 1998, a total of 12 monitoring wells (six shallow zone and six deep zone) were utilized for single well hydraulic conductivity tests (slug tests). During each test, data were collected under rising and falling head conditions caused by the instantaneous introduction or removal of 1¼ inch by 5-foot slug. Electronic data loggers (In-Situ Troll Model SP4000) were utilized for the collection of groundwater elevation changes associated with each of the tests.

5.10.1 Shallow Zone

The shallow zone monitoring wells utilized for the testing included MW-1S, MW-2S, MW-4S, MW-5S, MW-7S and MW-8S. Test data were reduced and analyzed with the use of computer driven software (Aqtesolv, Geraghty & Miller, Inc.). Test results indicate that permeability within the shallow zone of the aquifer range between approximately 1.1×10^{-2} to 7.8×10^{-2} cm/sec. Table 5 summarizes the test results. Test data and copies of each analysis are presented in Appendix C.

5.10.2 Deep Zone

The deep monitoring wells utilized for the testing included MW-1D, MW-2D, MW-4D, MW-5D, MW-7D and MW-8D. Test data were reduced and analyzed with the use of computer driven software (Aqtesolv, Geraghty & Miller, Inc.). Test results indicate that permeability within the deep portion of the aquifer ranged between 1.0×10^{-1} and 2.0×10^{-1} cm/sec. Table 5 summarizes the test results. Test data and copies of each analysis are presented in Appendix C.

5.11 Laboratory Analyses

Soil and groundwater samples were collected during the Phase I and Phase II investigative activities to assess subsurface conditions at the Facility. All laboratory analyses were performed by Quanterra Incorporated (Quanterra) of Houston, Texas. .

5.11.1 Soil Analyses

5.11.1.1 Volatile Organic Compounds

A total of 40 soil samples were collected and submitted for VOC analyses by USEPA Method 8260 during the Phase I and Phase II investigation activities. Phase I analytical results indicate that only two VOCs (TCE and Methylene Chloride) were detected at or above the analytical method detection limit. TCE detections were observed at soil boring/monitoring well or well pair locations MW-3 and MW-8 within the 4 to 5 foot bgs interval and 2 to 3 foot bgs interval, respectively, during the Phase I investigation activities. TCE concentrations detected at MW-3 were 5.2 mg/kg and TCE concentrations detected at MW-8 were 12 mg/kg. There were no detections at greater depths within these borings. Methylene Chloride was detected at soil boring/monitoring well MW-9 at a concentration of 5.5 mg/kg from a depth interval of 17 to 18 feet bgs. This detection is considered here to be a laboratory contaminant, as this compound is

a common laboratory contaminant and was reported in several of the laboratory QA/QC samples at similar concentrations.

A summary of Phase I and Phase II VOC analytical results is presented in Tables 6 and 7. Figures 9 and 10 depict Phase I and Phase II soil boring locations. Laboratory analytical data sheets are presented in Appendix D.

5.11.1.2 Corrosivity

A total of 35 soil samples were collected and submitted for corrosivity (pH) analyses by USEPA Method 9045A during the Phase I and Phase II investigation activities. Analytical results indicate that corrosivity values range between 5.2 and 8.0 (unitless) at soil borings/monitoring wells MW-3 (13 to 14 feet bgs) and SB-1 (4 to 5 feet bgs), respectively.

A summary of Phase I and Phase II corrosivity analytical results is presented in Tables 6 and 7. Laboratory analytical data sheets are presented in Appendix D.

5.11.1.3 Cation Exchange Capacity

A total of 9 soil samples were collected and submitted for CEC analyses by USEPA Method 9081 during the Phase I investigation activities. CEC samples were not collected for analysis during the Phase II investigation activities. Analytical results indicate that CEC values range between 127 mg/kg to 2480 mg/kg at soil borings/monitoring wells MW-5 (9 to 10 feet bgs) and MW-2 (18 to 19 feet bgs), respectively.

A summary of cation exchange capacity analytical results is presented in Table 6. Laboratory analytical data sheets are presented in Appendix D.

5.11.1.4 Total Organic Content

A total of 9 soil samples were collected and submitted for total organic content analyses by the SMCA Walkley-Bloc Method during the Phase I investigation activities. No total organic content samples were collected for analyses during the Phase II investigation activities. Analytical results indicate that total organic content concentrations were at non detectable levels for seven of the sample locations (MW-2 (4 to 5 feet bgs), MW-2 (18 to 19 feet bgs), MW-5 (9 to 10 feet bgs), MW-5 (25 to 26 feet bgs), MW-7 (20 to 22 feet bgs), MW-8 (7 to 8 feet bgs), and MW-8 (27 to 29 feet bgs). Total organic content concentration of 531 mg/kg and 619 mg/kg were detected at soil boring/monitoring well locations MW-8 (13 to 14 feet bgs) and MW-7 (9 to 10 feet bgs), respectively.

A summary of total organic content analytical results is presented in Table 6. Laboratory analytical data sheets are presented in Appendix D.

5.11.2 Groundwater Analyses

5.11.2.1 Shallow Zone

5.11.2.1.1 Volatile Organic Compounds

A total of 24 shallow zone groundwater samples (including two field blanks, one duplicate and two trip blanks) were collected and submitted for VOC analyses by USEPA Method 8260 during the Phase I and Phase II investigation activities. Analytical results as shown on Figures 19 through 32 indicate that ten VOCs; 1,1-DCA, 1,1-DCE, Cis-1,2-DCE, Trans-1,2-DCE, PCE, 1,1,1-TCA, TCE, Vinyl Chloride, Chloroform and Methylene Chloride were detected at or below 270 micrograms per liter (µg/L).

1,1-DCA detections were observed at monitoring wells MW-1S, MW-8S, MW-9S, and MW-10S. Detected concentrations ranged between 5.2 µg/L to 10.0 µg/L, at monitoring wells MW-8S and MW-10S, respectively.

1,1-DCE detections were observed at monitoring wells MW-1S, MW-7S, MW-8S, and MW-9S. Detected concentrations ranged between 7.8 µg/L and 20 µg/L, at monitoring wells MW-7S and MW-9S, respectively.

Cis-1,2-DCE detections were observed at MW-1S, MW-3, MW-4S, MW-5S, MW-6, MW-7S, MW-8S, MW-9S, and MW-10S. Detected concentrations ranged between 7.4 µg/L and 130 µg/L, at monitoring wells MW-3 and MW-1S, respectively.

Trans-1,2-DCE detections were observed at MW-1S and MW-9S. Detected concentrations ranged between 2.7 µg/L and 2.9 µg/L, at monitoring wells MW-9S and MW-1S, respectively.

PCE detections were observed at MW-4S, MW-6, and MW-10S. Detected concentrations ranged between 5.9 µg/L and 11 µg/L, at monitoring wells MW-10S and MW-4S, respectively.

1,1,1-TCA detections were observed in MW-6S at 5.0 µg/L.

TCE detections were observed at MW-1S, MW-3, MW-4S, MW-5S, MW-6, MW-7S, MW-8S, MW-9S, and MW-10S. Detected concentrations ranged between 62 µg/L and 270 µg/L, at monitoring wells MW-4S and MW-1D, respectively.

Vinyl Chloride detections were observed only in up gradient monitoring well MW-1S. Detected concentrations ranged between 12 µg/L and 22 µg/L for Phase I and Phase II activities, respectively.

Chloroform detections were observed at MW-5S and MW-8S. Detected concentrations ranged between 10 µg/L and 22 µg/L at monitoring wells MW-8S and MW-5S, respectively.

A summary of Phase I and Phase II VOC analytical results is presented in Tables 9 and 11. Figure 14 depicts Phase I and Phase II monitoring well locations. Laboratory analytical data sheets are presented in Appendix D.

5.11.2.1.2 pH

A total of ten shallow zone groundwater samples (including one duplicate sample) were collected and submitted for pH analyses by USEPA Method 9040 during the Phase I and Phase II investigation activities. Analytical results indicate that pH values ranged between 6.7 and 7.2, at monitoring wells MW-4S and MW-6, and MW-4S and MW-5S and MW-7S, respectively.

A summary of Phase I pH analytical results is presented in Table 9. Figure 14 depicts Phase I and Phase II monitoring well locations. Laboratory analytical data sheets are presented in Appendix D.

5.11.2.1.3 Total Organic Content

Two shallow zone groundwater samples were collected and submitted for total organic content analyses by USEPA Method 9060 during the Phase I and Phase II investigation activities. Analytical results indicate that total organic content values ranged between 2.1 and 3.3 µg/L, at monitoring wells MW-4S and MW-1S, respectively.

A summary of total organic content analytical results is presented in Table 9. Figure 14 depicts Phase I and Phase II monitoring well locations. Laboratory analytical data sheets are presented in Appendix D.

5.11.2.2 Deep Zone

5.11.2.2.1 Volatile Organic Compounds

A total of 21 deep zone groundwater samples (including two field blanks, one duplicate and two trip blanks) were collected and submitted for VOC analyses by USEPA Method 8260 during the Phase I and Phase II investigation activities. Analytical results indicate that five VOCs (1,1-DCE, Cis-1,2-DCE, Vinyl Chloride and Methylene Chloride) were detected at concentrations less than 760 µg/L.

1,1-DCE detections were observed at monitoring wells MW-1D, MW-2D, MW-4D, MW-5D, MW-7D, MW-8D, MW-9D and MW-10D. Detected concentrations ranged between 10 µg/L and 53 µg/l, at monitoring wells MW-10D and MW-1D, respectively.

Cis-1,2-DCE detections were observed at MW-1D, MW-2D, MW-4D, MW-5D, MW-7D, MW-8D, MW-9D, and MW-10D. Detected concentrations ranged between 55 µg/L and 190 µg/L, at monitoring wells MW-10D, and MW-1D respectively.

TCE detections were observed at MW-1D, MW-2D, MW-4D, MW-5D, MW-7D, MW-8D, MW-9D, and MW-10D. Detected concentrations ranged between 160 µg/L and 760 µg/l, at monitoring wells MW-10D and MW-1D, respectively.

Vinyl Chloride detections were observed at MW-1D, MW-2D, MW-4D, MW-5D, MW-7D, MW-8D, MW-9D, and MW-10D. Detected concentrations ranged between 26 µg/L and 96 µg/l, at monitoring wells MW-10D and MW-2D, respectively.

A summary of Phase II VOC analytical results is presented in Tables 11 and 12. Figure 14 depicts Phase I and Phase II monitoring well locations. Laboratory analytical data sheets are presented in Appendix D.

5.11.2.2.2 pH

A total of six deep zone groundwater samples (including one duplicate sample) were collected and submitted for pH analyses by USEPA Method 9040 during the Phase I and Phase II investigation activities. Analytical results indicate that pH values ranged between 6.9 and 8.1, at monitoring wells MW-4D and MW-8D, respectively.

A summary of pH analytical results is presented in Table 11. Figure 14 depicts Phase I and Phase II monitoring well locations. Laboratory analytical data sheets are presented in Appendix D.

5.11.2.2.3 Total Organic Content

One deep zone groundwater sample was collected and submitted for total organic content analyses by USEPA Method 9060 during the Phase I and Phase II investigation activities. Analytical results indicate that the total organic content value at monitoring well MW-8D was 5.0 µg/L.

A summary of total organic content analytical result is presented in Table 11. Figure 14 depicts Phase I and Phase II monitoring well locations. Laboratory analytical data sheets are presented in Appendix D.

5.11.2.3 Quality Assurance/Quality Control

Quality Assurance/Quality Control (QA/QC) samples were collected and laboratory analyzed during each monitoring event. The QA/QC program included the collection of trip blanks, field blanks, and blind duplicate samples. Results of these analyses are presented in Table 9 through Table 12.

Four trip blanks and five field blanks were analyzed during Phase I and Phase II sampling activities. Methylene Chloride was detected in two Phase I trip blanks at levels of 16 µg/L and 60 µg/L and one field blank at 17 µg/L, respectively. Methylene Chloride was also detected in one Phase II trip blank at 5.8 µg/L. These detections are considered to be a laboratory contaminant, as this compound is a common laboratory contaminant and were reported in several of the laboratory QA/QC samples. According to the USEPA data validation protocol, positive sample results less than five times the concentration in associated blank samples are considered to be non-detect (5 times rule). Therefore, reported detections of Methylene Chloride less than this limit should be considered as non-detections.

Two duplicate samples were collected and analyzed during Phase I and Phase II sampling activities. Results of field samples and their respective blind duplicates exhibit a good correlation with respect to detected analytes and respective levels of concentration. Analytical results for blind duplicates and blank samples are included in Appendix A.

6.0 DISCUSSION OF RESULTS

6.1 Site Soil Characteristics

6.1.1 Physical Parameters

Data generated during the RI activities indicate that the Facility is underlain by a combination of unconsolidated alluvial sediments which are underlain by bedrock of the Wellington Shale Formation. The alluvial sediments exhibited compositional characteristics that allowed for the generic designations of shallow and deep zones. Results of the 16 particle size distribution analyses have identified compositional characteristic differences between the shallow, deep and transition zones (particularly the laterally discontinuous lenses), and support field observations recorded during boring activities. These data and field observations indicate that the shallow zone is comprised of silty-sands, sandy-silts, and fine sands that extend to depths of approximately 20 feet bgs, and that the deep zone typically consists of a general coarsening downward sequence of silty-sand to fine-gravel. The deep zone is typically first encountered at depths of approximately 20 to 25 feet bgs and extends to the underlying bedrock interface, at depths of approximately 40 to 45 feet bgs. Field observations also indicated the existence of a transitional zone comprised of sandy-silts, silty-clays and clays. At several locations beneath the Facility this transitional zone is identified by thin, laterally discontinuous, lenses of clays to silty-clays.

Results of the nine soil samples collected from soil borings/monitoring well groupings MW-2, MW-5, MW-7 and MW-8 indicate that CECs are variable across the Facility (ranging from 127 mg/kg to 2480 mg/kg). The highest values correspond to silt or clay rich zones within subsurface materials. The highest value reported (2480 mg/kg) corresponds to a silty-clay interval located at MW-2, at a depth of 18 to 19 feet bgs (positioned within the upper portion of the shallow aquifer zone). The lowest CEC value reported (127 mg/kg) corresponds to a poorly sorted sand interval with few fines located at MW-5 within the upper portion of the shallow aquifer zone.

Results of the nine soil samples collected from soil borings/monitoring well groupings MW-2, MW-5, MW-7 and MW-8 indicate that the total organic carbon content of the soils is limited. Total organic content concentrations were below the analytical method detection limit for seven of the nine samples analyzed. Total organic content was detected in samples from soil borings/monitoring wells MW-7 (9 to 10 feet bgs) at 619 mg/kg and at MW-8 (13 to 14 feet bgs) at 531 mg/kg.

6.1.2 Contaminant Occurrence and Distribution

The occurrence and distribution of soil contamination beneath the Facility were assessed through the advancement of soil borings at 18 locations designed to assess the four identified SWMUs and two AOCs, as well as the Facility as a whole, and the laboratory analysis of 40 soil samples for the presence of VOCs and 36 soil samples for corrosivity (pH) values. PID field screening results associated with soils retrieved during boring advancements exhibited low PID values ranging between non-detectable to 23 ppm (benzene equivalent; Table 3). The elevated PID values were attributable to moisture deflections associated with the sample matrix. The PID values exhibited are considered representative of background conditions. Laboratory

analytical results associated with the soil analyses generally confirmed the absence of VOC contamination within the unsaturated soil samples.

Results of laboratory soil analyses indicate that two areas of insignificant surficial contamination may exist at the Facility. These areas are associated with SWMU-3 and AOC-1. Soil boring/monitoring well locations MW-3 (AOC-1) and MW-8 (SWMU-3) exhibited low soil concentrations of TCE (5.0 mg/kg and 12.0 mg/kg) to depths of approximately 5 feet bgs. VOCs were not detected in soils at soil borings/monitoring wells MW-3 or MW-8 at depths greater than 13 feet bgs or 7 feet bgs, respectively. The detected concentrations associated with soil boring/monitoring well locations MW-3 (AOC-1) are indicative of incidental spillage and does not (in the opinion of UNIVAR) constitute a potential source area for groundwater contamination. The concentrations associated with soil boring/monitoring well locations MW-8 and the data from adjacent soil borings SB-1, SB-2, SB-3, SB-4, SB-5, SB-6, SB-7 and SB-8 support the determination that previously reported releases in this area were contained and adequately controlled, and that the area does not (in the opinion of UNIVAR) constitute a potential source area for groundwater contamination.

Corrosivity analysis results ranged from between 5.2 to 8.0. These values do not indicate the presence of any abnormally elevated or depressed soil pH that would be indicative of base or acid contamination, with the possible exception of the sample collected from soil boring/monitoring well MW-3 at a depth 13 to 14 feet bgs which exhibited a corrosivity value of 5.2. Soil boring/monitoring well MW-3 is completed adjacent to AOC-1 (the former location of an HCl AST). However, given the depth of the sample and corrosivity value, and the fact that a shallow soil sample collected from a depth of 4 to 5 feet bgs in the same boring exhibited a value of 7.1, this area does not represent an area of contamination.

Figures 9 and 10 depict the Phase I and Phase II soil boring/monitoring well location network utilized to determine the presence or absence of soil contamination at the Facility.

6.2 Site Aquifer Characteristics

6.2.1 Groundwater Occurrence and Movement

6.2.1.1 Groundwater Occurrence and Movement

Groundwater occurs beneath the Facility in unconfined (water table conditions) at an approximate depth of 12 to 13 feet bgs in both the shallow and the deep zone monitoring wells. During the installation of the deep monitoring wells, several relatively thin and laterally discontinuous lenses of silty-clays to clays were encountered at the depth interval ranging between approximately 20 to 28 feet bgs. Groundwater measurements for the shallow and deep zone monitoring wells exhibit similar potentiometric surface elevations and groundwater elevation fluctuations with time, indicating that the laterally discontinuous silty-clay to clay lenses do not generally cause a hydraulic separation between the shallow and deep zones of the aquifer underlying the Facility.

Groundwater elevation data have been collected from the Facility's groundwater monitoring well network on two occasions. The first data collection event occurred in June 1998 prior to the collection of Phase I groundwater analytical samples. The second data collection event

occurred in October 1998 prior to the collection of Phase II groundwater analytical samples. Groundwater elevation data was collected at each individual well with a water level meter capable of measuring to the nearest 0.01 foot.

Phase I and II groundwater elevation data for the monitoring periods of June and October 1998, indicate that shallow zone groundwater is present at elevations ranging between a maximum of 1296.69 feet msl and a minimum of 1295.67 feet msl (monitoring wells MW-1S and MW-9S, respectively). During these periods groundwater movement was consistently toward the southeast across the Facility, and exhibited an average gradient of approximately 0.00089 feet per feet.

Phase I and II groundwater elevation data or the monitoring periods of June and October 1998, indicate that deep zone groundwater is present at elevations ranging between a maximum of 1295.99 to a minimum of 1295.75 feet MSL (monitoring wells MW-1D and MW-8D for June 1998 and MW-1D and MW-9D for October 1998, respectively). During these periods groundwater movement was consistently toward the southeast across the Facility, and exhibited an average gradient of approximately 0.00065 feet per feet. Table 8 presents groundwater elevation data collected from Phase I and Phase II monitoring events, while Figures 15, 16, 17 and 18 illustrate groundwater elevation contour maps for the shallow and deep zones associated with the Phase I and Phase II gauging events respectively.

Comparisons of groundwater elevation data at each of the nested pairs indicated that during the Phase I monitoring period a slight downward vertical gradient was observed at all locations except monitoring well pair MW-8. The downward vertical gradients ranged between 0.0010 feet per feet and 0.0046 feet per feet (monitoring locations MW-1 and MW-2, respectively) and exhibited an average downward vertical gradient of 0.0035 feet per feet. During the Phase II monitoring period a generally upward vertical gradient was observed. Upward vertical gradients were observed at locations MW-2, MW-4, MW-5, MW-7, MW-9, and MW-10. Upward vertical gradients ranged between 0.00045 feet per feet and 0.00287 feet per feet (monitoring locations MW-2 and MW-10, respectively), with an average upward vertical gradient of 0.0012 feet per feet. Downward gradients were observed at monitoring locations MW-1 and MW-8. The two downward vertical gradients ranged between 0.00045 feet per feet and 0.0019 feet per feet (monitoring locations MW-8 and MW-1, respectively), and exhibited an average gradient of 0.00119 feet per feet.

Average linear groundwater flow velocities were calculated for the Facility to ascertain estimates of horizontal groundwater movement within the shallow and deep zones of the aquifer. Using the average hydraulic conductivity values from the in-situ tests and average gradients presented below, and an assumed effective porosity of 30 percent, the following relation was used to estimate average horizontal groundwater flow velocities:

Average Linear Velocity = (hydraulic conductivity x hydraulic gradient/effective porosity)

Shallow aquifer zone average linear flow velocity ranges between 0.0085 and 0.663 feet per day. Deep aquifer zone average linear flow velocity ranges between 0.685 and 1.25 feet per day. Thus, the estimated range for yearly horizontal groundwater flow velocities for the shallow and deep aquifer zones are approximately between 3.1 and 242 feet per year and 250 and 455 feet per year, respectively. These ranges in hydraulic conductivity data, particularly within the

shallow zone aquifer, indicate a heterogeneous nature in the subsurface materials. Through this heterogeneity, there is a potential for the presence of both horizontal and vertical preferential flow paths.

6.2.2 Permeability Assessment

Shallow and deep aquifer zone permeability was assessed through the use of physical parameters (particle size distribution) data and the performance of in-situ single well hydraulic conductivity tests.

6.2.2.1 Physical Parameters

Permeability estimates based on particle size distribution indicated that the unsaturated portion of the shallow aquifer zone exhibited hydraulic conductivity values that ranged between 1.7×10^{-2} to 1.0×10^{-4} cm/sec. Permeability associated with the saturated portion of the shallow aquifer zone exhibited hydraulic conductivity values that ranged between 2.9×10^{-2} to 4.0×10^{-3} cm/sec. Permeability estimates for the saturated portion of the deep aquifer zone exhibited hydraulic conductivity values that ranged between 1.0×10^{-1} to 6.3×10^{-2} cm/sec. Permeability estimates for the laterally discontinuous lenses of the transition zone that occurs between the shallow and deep aquifer zones exhibited hydraulic conductivity values that ranged between 8.0×10^{-3} to 1.0×10^{-4} cm/sec. Table 4 summarizes grain size permeability estimates.

These test results indicate that the average hydraulic conductivity values associated with the shallow and deep zones of the aquifer are similar (approximately 2.0×10^{-2} cm/sec). The average hydraulic conductivity of the laterally discontinuous lenses associated with the transition zone between the shallow and deep zones was approximately five times lower. These results, particularly those associated with the transition zone materials are consistent with field observations recorded during boring advancements. These results also suggest that within portions of the Facility where the laterally discontinuous lenses are present, a condition of retarded vertical movement likely exists.

6.2.2.2 Single Well Hydraulic Conductivity Tests

Shallow zone monitoring wells utilized for these tests included MW-1S, MW-2S, MW-4S, MW-5S, MW-7S and MW-8S. Test results indicate that permeability within the shallow zone of the aquifer range between approximately 1.1×10^{-2} to 7.8×10^{-2} cm/sec. Deep monitoring wells utilized for these tests included MW-1D, MW-2D, MW-4D, MW-5D, MW-7D and MW-8D. Test results indicate that permeability within the deep portion of the aquifer is approximately one order of magnitude greater than the shallow zone ranging between 1.1×10^{-1} and 2.0×10^{-1} cm/sec. Table 5 summarizes the test results.

These test results are consistent with field observations recorded during boring advancements and laboratory particle size distribution analyses that indicated the shallow aquifer zone media contained a noticeably higher percentage of fines and fine-grained materials that typically reduce overall aquifer permeability. However, it is noted that single well hydraulic conductivity

tests are order of magnitude approximations, and as such the overall permeability differences expressed between the shallow and deep aquifer zones may vary from those values reported.

6.2.3 Contaminant Occurrence and Distribution

The occurrence and distribution of groundwater contamination beneath the Facility was assessed through the installation of ten shallow zone monitoring wells and seven deep zone monitoring wells at ten separate locations throughout the Facility, and the laboratory analysis of 45 groundwater samples for the presence of VOCs. Results of these analyses indicate that ten VOCs; 1,1-DCA, 1,1-DCE, Cis-1,2-DCE, Trans-1,2-DCE, PCE, 1,1,1-TCA, TCE, Vinyl Chloride, Chloroform and Methylene Chloride were detected at or above the analytical method detection limit. Of the ten detected VOCs; 1,1-DCA, 1,1-DCE, Cis-1,2-DCE, PCE, TCE and Vinyl Chloride exceeded of the Risk-Based Contaminant Levels (RCLs) of 5 µg/L, 7 µg/L, 70 µg/L, 5 µg/L, 5 µg/L, and 2 µg/L, respectively.

The VOC constituents detected within the shallow and deep aquifer zones at the Facility were consistent with those identified throughout the aquifer at the Northeast Investigation Area, the 29th and Mead Site, the 13th and Washington Site, and the overall NIC investigation area. Based on data generated during this investigation, and preliminary data from the Phase I and II of the NIC RI (CDM, 1999), the demonstrated up gradient concentrations of these VOC constituents relative to the VW&R Facility are equivalent to those at and down gradient of the VW&R Facility. In particular, groundwater data associated with the Phase I and Phase II investigation activities indicate that the highest TCE concentrations have been detected in both the up gradient well locations (MW-1S and MW-1D at 150 µg/L and 760 µg/L, respectively) and the down gradient well locations (MW-9S and MW-9D at 270 µg/L and 290 µg/L, respectively). Shallow zone detections, although generally similar in concentration to those from up gradient to down gradient locations, may be influenced by upward vertical gradients and/or preferential flow paths within the heterogeneous sediments that comprise the shallow zone. These factors directly influence the occurrence and distribution of VOC constituents across the site. The same pattern can be observed in the deep zone, where detected VOC concentrations are higher in up gradient wells than in down gradient wells. Based on these data it is the opinion of UNIVAR that the observed VOC constituents beneath the Facility are a result of an off site source(s), and do not support the existence of an on-site source area(s) at the Facility.

6.2.3.1 Shallow Zone Contaminant Occurrence and Distribution - VOCs

Shallow zone analyses indicate that 1,1-DCE, Cis-1,2-DCE, PCE, TCE and Vinyl Chloride are present at concentrations above the RCLs. The following present a summary of VOCs exceedances for the Phase I and II sampling events and associated shallow zone monitoring locations:

- 1,1-DCE was detected above the RCL (7 µg/L) at up gradient monitoring well MW-1S at Phase I and II concentrations of 13 µg/L and 13 µg/L, respectively; at cross-gradient monitoring well MW-7S at Phase II concentrations of 7.8 µg/L and not detected, respectively; and at down gradient monitoring wells MW-8S and MW-9S at Phase I and II concentrations of 8.5 µg/L and not detected, 20 µg/L and 13 µg/L, respectively.

- Cis-1,2-DCE was detected above the RCL (70 µg/L) at up gradient monitoring well MW-1S at Phase I and Phase II concentrations of 78 µg/L and 130 µg/L, respectively; and at down gradient monitoring well MW-9S at Phase I and II concentrations of 87 and 92 µg/L, respectively.

- PCE was detected above the RCL (5 µg/L) at mid-Facility monitoring well MW-4S at Phase I and II concentrations of 6.0 µg/L and 11 µg/L, respectively; at mid-Facility monitoring well MW-6S at Phase I and II concentrations of 6.9 µg/L and 8.8 µg/L, respectively; and at mid-Facility monitoring well MW-10S at Phase II concentrations of 5.9 µg/L.

- TCE was detected above the RCL (5 µg/L) at up gradient monitoring well MW-1S at Phase I and Phase II concentrations of 140 µg/L and 150 µg/L, respectively; at northwestern Facility monitoring well MW-3 at Phase I and Phase II concentrations of 130 µg/L and 110 µg/L, respectively; at mid-Facility monitoring well MW-4S at Phase I and II concentrations of 63 µg/L and 62 µg/L, respectively; at mid-Facility monitoring well MW-5S at Phase I and Phase II concentrations of 110 µg/L and 130 µg/L, respectively; at mid-Facility monitoring well MW-6 at Phase I and Phase II concentrations of 92 µg/L and 82 µg/L, respectively; at southwestern/cross gradient monitoring well MW-7S at Phase I and Phase II concentrations of 120 µg/L and 100 µg/L, respectively; at down gradient monitoring well MW-8S at Phase I and Phase II concentrations of 190 µg/L and 180 µg/L, respectively; at down gradient monitoring well MW-9S at Phase I and Phase II concentrations of 190 µg/L and 270 µg/L, respectively; and, at mid-Facility monitoring well MW-10S at a Phase II concentration of 120 µg/L.

- Vinyl Chloride was detected above the RCL (2 µg/L) only at up gradient monitoring well MW-1S at Phase I and Phase II concentrations of 12 µg/L and 22 µg/L, respectively.

These data indicate that up gradient concentrations of the VOC constituents of concern are consistent with those at mid-Facility and/or down gradient monitoring locations. Based on the lack of significant increases in VOC concentrations in the down gradient direction beneath the Facility, it is the opinion of UNIVAR that these data indicate the observed VOC constituents are a result of an off-site source(s) and do not support the existence of on-site source areas at the Facility. Figures 19, 20, 21 and 22 depict Phase I shallow zone TCE, Cis-1,2-DCE, PCE and Vinyl Chloride concentrations, respectively. Figures 23, 24, 25 and 26 depict Phase II shallow zone TCE, Cis-1,2-DCE, PCE and Vinyl Chloride concentrations, respectively.

The lack of observed up gradient PCE detections does not in and of itself indicate an on-site source. The shallow zone PCE detections, although generally similar in concentration from up gradient to down gradient monitoring locations, may be influenced by upward vertical gradients (particularly in the vicinity of SWMU-3), and/or preferential flow paths within the heterogeneous sediments that comprise the Shallow zone. These factors may directly influence the occurrence and distribution of VOC (including PCE) contamination across the site.

6.2.3.2 Deep Zone Contaminant Occurrence and Distribution –VOCs

Deep zone analyses indicate that TCE, Cis-1,2-DCE, Vinyl Chloride and 1,1-DCE are present at concentrations that are above the RCLs, generally at higher concentrations than in the shallow zone. The following present a summary of VOCs exceeded for the Phase I and II sampling events and associated deep zone monitoring locations:

- TCE was detected above the RCLs (5 µg/L) at up gradient monitoring well MW-1D at Phase I and II concentrations of 760 µg/L and 530 µg/L, respectively; at up gradient monitoring well MW-2D at Phase I and II concentrations of 630 µg/L and 660 µg/L, respectively; at mid-Facility monitoring well MW-4D at Phase I and II concentrations of 670 µg/L and 440 µg/L, respectively; at mid-Facility monitoring well MW-5D at Phase I and II concentrations of 510 µg/L and 350 µg/L, respectively; at southwestern cross-gradient monitoring well MW-7D at Phase I and II concentrations of 550 µg/L and 420 µg/L, respectively; at down gradient monitoring well MW-8D at Phase I and II concentrations of 700 µg/L and 450 µg/L, respectively; and at down gradient monitoring well MW-9D and mid-Facility monitoring well MW-10D at Phase II concentrations of 290 µg/L and 160 µg/L, respectively.

- Cis-1,2-DCE was detected above the RCLs (70 µg/L) at up gradient monitoring well MW-1D at Phase I and II concentrations of 180 µg/L and 190 µg/L, respectively; at up gradient monitoring well MW-2D at Phase I and II concentrations of 160 µg/L and 160 µg/L, respectively; at mid-Facility monitoring well MW-4D at Phase I and II concentrations of 180 µg/L and 150 µg/L, respectively; at mid-Facility monitoring well MW-5D at Phase I and II concentrations of 130 µg/L and 88 µg/L, respectively; at southwestern cross-gradient monitoring well MW-7D at Phase I and II concentrations of 140 µg/L and 100 µg/L, respectively; at down gradient monitoring well MW-8D at Phase I and II concentrations of 140 µg/L and 110 µg/L, respectively; and at down gradient monitoring well MW-9D and mid-Facility monitoring well MW-10D at Phase II concentrations of 92 µg/L and 55 µg/L, respectively.

- Vinyl Chloride was detected above the RCLs (2 µg/L) at up gradient monitoring well MW-1D at Phase I and II concentrations of 82 µg/L and 86 µg/L, respectively; at up gradient monitoring well MW-2D at Phase I and II concentrations of 73 µg/L and 96 µg/L, respectively; at mid-Facility monitoring well MW-4D at Phase I and II concentrations of 80 µg/L and 63 µg/L, respectively; at mid-Facility monitoring well MW-5D at Phase I and II concentrations of 65 µg/L and 40 µg/L, respectively; at southwestern cross-gradient monitoring well MW-7D at Phase I and II concentrations of 76 µg/L and 64 µg/L, respectively; at down gradient monitoring well MW-8D at Phase I and II concentrations of 70 µg/L and 60 µg/L, respectively; and at down gradient monitoring well MW-9D and mid-Facility monitoring well MW-10D at Phase II concentrations of 49 µg/L and 26 µg/L, respectively.

- 1,1-DCE was detected above the RCLs (7 µg/L) at up gradient monitoring well MW-1D at Phase I and II concentrations of 55 µg/L and 34 µg/L, respectively; at up gradient monitoring well MW-2D at Phase I and II concentrations of 52 µg/L and 39 µg/L, respectively; at mid-Facility monitoring well MW-4D at Phase I and II concentrations of 51 µg/L and not detected, respectively; at mid-Facility monitoring well MW-5D at Phase I and II concentrations of 40

µg/L and 19 µg/L, respectively; at southwestern cross-gradient monitoring well MW-7D at Phase I and II concentrations of 43 µg/L and not detected, respectively; at down gradient monitoring well MW-8D at Phase I and II concentrations of 43 µg/L and 26 µg/L, respectively; and at down gradient monitoring well MW-9D and mid-Facility monitoring well MW-10D at Phase II concentrations of 18 µg/L and 10 µg/L, respectively

As with the groundwater quality data from the shallow monitoring wells, these data indicate that up gradient concentrations of the VOC constituents of concern exhibit consistencies with those at mid-Facility and down gradient monitoring locations. Based on the data gathered to date, the lack of any significant increases in VOC concentrations in the down gradient direction (as compared to the up gradient locations) indicates that the observed VOC constituents beneath the Facility may be a result of off-site sources and do not confirm the existence of on-site source areas at the Facility. Figures 27, 28 and 29 depict Phase I deep zone TCE, Cis-1,2-DCE, and Vinyl Chloride concentrations, respectively. Figures 30, 31, and 32 depict Phase II shallow zone TCE, Cis-1,2-DCE, and Vinyl Chloride concentrations, respectively.

6.2.3.3 Shallow and Deep Zone Contaminant Occurrence and Distribution - pH

The occurrence and distribution of pH groundwater contamination beneath the Facility was assessed through the above referenced shallow and deep zone monitoring wells at ten separate locations throughout the Facility, and the laboratory analysis of 16 groundwater samples for pH values. Results of these analyses indicate that pH values for the shallow zone range between 6.7 and 7.2, and for the deep zone between 6.9 and 8.1. These values are with the range of naturally occurring groundwater.

These data support the determination that past and current Facility activities related to the handling and use of acids and bases have not adversely affected the groundwater system beneath the Facility. A summary of Phase I pH analytical results is presented in Tables 9 and 11. Figure 14 depicts Phase I monitoring well locations. Laboratory analytical data sheets are presented in Appendix D.

7.0 CONCLUSIONS AND RECOMMENDATIONS

7.1 Conclusions

Based on the evaluation of data generated to date in association with this Remedial Investigation, the following conclusions are presented by UNIVAR:

- Subsurface soil conditions at the Facility were assessed through the advancement of 24 soil borings;

- Data generated during the soil boring activities indicated that the Facility is underlain by a combination of unconsolidated alluvial sediments that are underlain by bedrock of the Wellington Shale Formation. The alluvial sediments exhibited compositional characteristics that allow for the generic designations of shallow and deep zones. The shallow zone typically consisted of silty-sands, sandy-silts, and fine sands that extended to depths of approximately 20 to 25 feet bgs. The deep zone typically consisted of a general coarsening downward sequence of silty-sand to fine-gravel, and was first encountered at depths of approximately 20 to 28 feet bgs. The deep zone extended to the underlying bedrock interface (depths of approximately 35 to 40 feet bgs). Laterally discontinuous lenses of various thicknesses (typically of 0.0 to 1.5 feet) were encountered beneath much of the Facility. These discontinuous lenses were comprised of clays to silty-clays, and were typically encountered at depths ranging from approximately 20 to 28 feet bgs;

- A total of 40 soil samples were collected for laboratory analyses of VOCs and 35 soil samples were collected for laboratory analyses of corrosivity (pH);

- Based on the soil analytical data gathered to date, it appears that the soils beneath the facility as a whole, and specifically the former re-pack area (the area of focus for the Phase II investigative activities) have not been adversely impacted by current or past Facility operations;

- Field screening results associated with soils retrieved during boring advancements exhibited low PID values and were representative of background conditions. Laboratory analytical results generally confirmed the absence of VOC contamination within the unsaturated soil samples;

- Data generated from the monitoring well network indicate that groundwater was present beneath the Facility at an approximate depth of 12 to 13 feet bgs in both the shallow and the deep monitoring wells. Groundwater measurements for the shallow and deep zone monitoring wells exhibit generally similar potentiometric surface elevations, indicating that the laterally discontinuous silty-clay to clay lenses do not cause a significant hydraulic separation between the shallow and deep zones of the aquifer underlying the Facility. However the heterogeneous nature of the subsurface materials have likely resulted in the development of preferential flow paths that may influence groundwater and contaminant movement in both the horizontal and/or vertical directions;

- A total of 45 groundwater samples were analyzed in association with the investigative activities. These data indicate that the groundwater beneath the facility as a whole, and specifically the former re-pack area, were impacted with similar contaminant constituents in up gradient monitoring wells, and noted throughout this portion of the NIC, in both hydraulically up gradient, cross-gradient and down gradient locations; and,

- The maximum TCE concentrations detected in the soil samples collected at the Facility from MW-8 (0.12 mg/kg) are below non-residential scenarios outlined in the "Soil to Groundwater Protection Pathway" (0.20 mg/kg) in the KDHE *Risk-Based Standards for Kansas* (RSK) manual. As concentrations are below the "Soil to Groundwater Protection Pathway", the evaluation of both soil and groundwater analytical data support the assessment that on site contaminant sources do not exist.

  Of the 40 soil samples collected at the VW&R Facility and analyzed for VOCs, only two exhibited concentrations above the analytical method detection limits. These detections occurred in shallow depths soils (2-3 feet bgs, and 4-5 feet bgs; MW-8 and MW-2, respectively) and were underlain by at least two consecutive sampling intervals that did not exhibit any VOC detection above the analytical detection limit.

  Based on the data gathered to date, the VOC constituents detected within the shallow and deep aquifer zones at the Facility appear consistent with those identified throughout the aquifer at the Northeast Investigation Area, the 29th and Mead Site, the 13th and Washington Site, and the overall NIC investigation areas. Based on data generated during this investigation, and preliminary data from the Phase I and Ia of the NIC RI (CDM, 1999) associated with the general vicinity of the VW&R Facility, demonstrate that the up gradient concentrations of these constituents of concern in the shallow and deep aquifer zones at the VW&R Facility are equivalent to those at, and down gradient of, the VW&R Facility. Based on these data it is the opinion of UNIVAR that the observed VOC constituents of concern beneath the Facility are a result of an off site source(s), and do not support the existence of an on-site source area(s) at the Facility.

7.2 Recommendations

Based on the data generated to date, the following recommendations are presented by UNIVAR:

- Based on the collective date generated to date from this investigation and the Phase I and Ia of the NIC RI (CDM, 1999) associated with the general vicinity of the VW&R Facility it is the opinion and experience of UNIVAR that the observed VOC constituents beneath the Facility are a result of an off site source(s), and do not support the existence of an on-site source area(s) at the Facility. However, in an effort to confirm this opinion, UNIVAR has proposed to conduct additional on-site soil and groundwater investigation activities within selected portions of the site.

- Based on the results of investigations performed to date it is recommended that a Baseline Risk assessment not be performed to define human use at the Facility, the ecology of the Facility, or a demographic profile for the immediate vicinity of the Facility; and,

- Based on the results of investigations performed to date it is recommended that a Feasibility Study not be performed to assess potential interim of final remedial alternatives for the Facility.

8.0 REFERENCES

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9.0 STANDARD OF CARE

The conclusions and recommendations contained in this report are based upon professional opinions with regard to the subject matter. These opinions have been arrived at in accordance with currently accepted hydrogeologic and engineering standards and practices applicable to this location.

This report was reviewed and prepared by SECOR International Incorporated.

Preparer:

Bradley A. Barquest — Date 8/22/05
Principal Hydrogeologist/Project Manager

Reviewer:

for Joel A. Barvels — Date 8/22/05
Principal Scientist

TABLE 8
Monitoring Well Survey Data
Shallow and Deep Wells
Van Waters & Rogers
Mosley Avenue Facility, Wichita, Kansas
SECOR Project No. 03OT.60001.00

Monitoring Well Location	Screened Interval (ft bgs)	TOC Elevation (ft msl)	Top of Screen Elevation (ft msl)	Bottom of Screen Elevation (ft msl)	Total Depth (ft msl)	Phase I Groundwater Elevation (ft msl)	Phase II Groundwater Elevation (ft msl)
MW-1S	14-24	1311.89	1297.89	1287.89	1287.89	1296.01	1296.69
MW-1D	33.5-38.5	1311.90	1278.40	1273.40	1273.40	1295.99	1296.65
MW-2S	15-25	1312.74	1297.74	1287.74	1287.74	1296.02	1296.66
MW-2D	36-41	1312.84	1276.84	1271.84	1271.84	1295.92	1296.67
MW-3S	9-19	1308.73	1299.73	1289.73	1289.73	1296.00	1296.63
MW-4S	9-19	1308.77	1299.77	1289.77	1289.77	1295.98	1296.61
MW-4D	31-36	1308.80	1277.80	1272.80	1272.80	1295.91	1296.62
MW-5S	10-20	1308.09	1298.09	1288.09	1288.09	1296.01	1296.53
MW-5D	30-35	1308.26	1278.26	1273.26	1273.26	1295.87	1296.54
MW-6S	10-20	1308.61	1298.61	1288.61	1288.61	1295.78	1296.42
MW-7S	10.5-20.5	1308.99	1298.49	1288.49	1288.49	1295.86	1296.47
MW-7D	31.5-36.5	1308.93	1277.43	1272.43	1272.43	1295.83	1296.51
MW-8S	9-19	1308.21	1299.21	1289.21	1289.21	1295.69	1296.41
MW-8D	31.5-36.5	1308.22	1276.72	1271.72	1271.72	1295.75	1296.40
MW-9S	9-19	1308.64	1299.64	1289.64	1289.64	1295.67	1296.36
MW-9D	33-38	1308.73	1275.73	1270.73	1270.73	NA	1296.37
MW-10S	10-20	1308.24	1298.24	1288.24	1288.24	NA	1296.46
MW-10D	30-35	1308.07	1278.07	1273.07	1273.07	NA	1296.52

ft = feet
bgs = below ground surface
TOC = top of casing
msl = mean sea level
NA = Well data not available