



WORK PLAN FOR SUPPLEMENTAL SITE-WIDE INVESTIGATIONS

**FORMER FAIRFAX I SITE
KANSAS CITY, KANSAS**

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1.0 INTRODUCTION AND PURPOSE

Conestoga-Rovers & Associates (CRA) has prepared this Work Plan on behalf of the Motors Liquidation Company (MLC) [formerly known as General Motors Corporation (GM Corp.)], for soil and groundwater investigations to be conducted at the former Fairfax I Site in Kansas City, Kansas (Site). Refer to Figure 1.1 for the general location of the Site in the Kansas City area. The overall purpose of the investigative studies outlined in this Work Plan is to address a limited number of uncertainties in the understanding of soil and groundwater contamination at the Site as a whole. This Site has a long history of investigations (since the late 1980s) and remedial activities. These were performed under a variety of regulatory oversight by the Kansas Department of Health and Environment (KDHE) and in anticipation of the sale of distinct land parcels under the KDHE Voluntary Cleanup and Property Redevelopment Program (VCPRP). As a result of the over 24 years of studies at this Site, there is a wealth of information on Site conditions and on areas which need further remediation in order to meet the KDHE standards.

Meetings between KDHE and MLC representatives in 2009 resulted in the identification of five Areas of Concern (AOC) which need further investigation and/or remediation. These AOCs include the following identifiers and are discussed further in Section 1.4:

- The area around soil boring S-8
- The area around soil boring SB-110
- The area around temporary monitoring well TMW-127
- The area around monitoring well MW-103A
- The area around temporary monitoring well TMW-130

These locations are identified on Figures 1.2 and 1.3. The first three locations (S-8, SB-110, and TMW-127) require further investigations to determine if remediation will be necessary. The last two locations (TMW-130 and MW-103A) have been extensively studied, and remediation is planned for both of these AOCs. However, additional information is needed to support evaluation of various remedial alternatives at each area. As such, additional soil sampling and analyses are proposed at the MW-103A and TMW-130 areas.

1.1 SITE LOCATION

The former Fairfax I Plant Site is located at 100 Kindelberger Road in Kansas City, Kansas in an industrial area known as the Fairfax District. To the west and south of the Site are industrial facilities, including industrial operations, chemical companies, and refining and pipeline facilities. The Site is located south of a bend in the Missouri River, with the river located north, east, and southeast of the Site. A levee is present between the Site and the Missouri River (Figure 1.1). The active Fairfax II Plant is located to the southeast of the Site, between the Site and the Missouri River. The original Site property, that associated with the former Fairfax I Plant operations, covered over 107 acres. The western portion of the Site, which covered approximately 16 acres and is referred to as "Tract 2" was sold to a third party. The property associated with Tract 2 was entered into the VCPRP and received a No Further Action Letter from the KDHE in February 2007. The remaining Site property, approximately 91 acres, is also entered into the KDHE VCPRP.

1.2 SITE HISTORY

The Fairfax I Plant consisted of several buildings, a tank farm, rail support, and drum storage areas. The assembly building and former aircraft hangar provided over 2.2 million square feet of covered work area. The U.S. Government constructed the Fairfax I Plant in 1940 for North American Aviation. North American Aviation assembled B-25 bombers at the facility through 1944 for use in World War II. In 1945, GM negotiated a lease for this facility from the U.S. Government and began assembling automobiles. During the Korean conflict GM Corp. assembled F84F jet aircraft in addition to continuing to assemble automobiles. GM Corp. purchased the facility from the U.S. Government in 1960 and continued automobile assembly operations until 1986/1987.

The Fairfax I Site is vacant. Operations at the facility ceased in 1986/87, and the facility was demolished in 1987. All structures were taken down to the ground surface and current land is undeveloped. The newer Fairfax II Plant was constructed by GM Corp. on land adjacent to the Fairfax I property beginning in 1998. This is an active automobile assembly plant now operated by General Motors LLC (GM LLC).

GM Corp. sold the western most 16 acres (Tract 2) to a third party. In the past, GM has marketed and positioned for sale a number of different parcels of land associated with the original Fairfax I Plant property. This included a "Tract 1" parcel which was located

on the eastern portion of the original Site. This Tract 1 parcel has not been sold as of the date of this Work Plan and remains part of the overall 91 acres of the MLC Site property.

1.3 SITE GEOLOGY AND HYDROGEOLOGY

The Site is located in the floodplain of the Missouri River. Underlying Site geology typically consists of an upper layer of silty clay ranging in thickness from approximately 7 to 15 feet. This silty clay is underlain by fine to medium sands to depths of 25 to 40 feet, which grade into medium to coarse sands with some gravel and clay interbeds to depths of 60 to 80 feet. This interbedded layer is underlain by medium to coarse sands and gravels to the top of the bedrock. The thick sequence of sands and gravels comprise alluvial deposits that are underlain by shale bedrock at approximately 102 to 117 feet below grade. The present Missouri River channel follows a deeper valley cut into the bedrock by the ancestral Missouri River.

Groundwater flows beneath the Site area within a fining upward sequence of alluvial sands and gravels. Groundwater flow direction is seasonal and is dependent on precipitation events and the stage of the Missouri River. In general, groundwater flow direction is to the north and east, toward the Missouri River, in the fall and to the south and west, away from the Missouri River, in the spring. Significant vertical hydraulic gradients do not exist between deep and shallow groundwater zones, as water levels are similar in deep and shallow monitoring wells.

1.4 REMAINING AREAS OF CONCERN AND INVESTIGATIVE OBJECTIVES

As mentioned previously, the KDHE and MLC have identified five AOCs within the remaining property associated with the MLC Site which still need further investigation or remediation. These AOCs were discussed during a series of meetings and calls in 2009 between MLC and the KDHE regarding overall Site environmental conditions. Each of these five AOCs has previously been investigated under the VCPRP. The MW-103A area was subject to remediation from 1991 to 1994 using soil vapor extraction.

The following summarizes the five AOCs (refer to Figures 1.2 and 1.3) at the Site and the data gaps or uncertainties which will be addressed through implementation of this Work Plan.

1.4.1 S-8 SOIL BORING LOCATION

Previous studies indicated that the presence of tetrachloroethene (PCE) above the KDHE standard. A subsequent boring in this area (SB-113) did not identify PCE at the same depth. There is still uncertainty about the location of the original S-8 boring and the distribution of PCE and other volatile organic compounds (VOCs) around this area. As such, there is a need to further delineate PCE and other VOCs in soils and groundwater at this location.

1.4.2 SB-110 SOIL BORING LOCATION

Previous studies in the late 1980s had investigated an area of former underground storage tanks (USTS) and identified VOCs in soils and groundwater beneath the former USTs. More recent studies of soils and groundwater around this area in 2004 through 2007 have delineated the extent of impacts in soils and groundwater by VOCs. However, additional studies are necessary to gather information to support the development of cleanup objectives and remedial planning for this area.

1.4.3 TMW-127 TEMPORARY MONITORING WELL LOCATION

Previous studies in 2006 indicated an isolated detection of cis-1,2-dichloroethene (cis-1,2,-DCE) above the standards in the groundwater sample from this temporary monitoring well. As such, additional information is needed to verify if this exceedence is isolated in nature or if additional contamination exists in this area of the Site.

1.4.4 MW-103A MONITORING WELL LOCATION

Investigations and remedial actions have been performed at this area since the early 1990s. The remedial system, which operated in this area for VOCs in soils and groundwater and the intermittent presence of light non-aqueous phase liquid (LNAPL), was shut down in 1994. Subsequent studies in 1999 and 2000 delineated the area of soil impacts that are the source of a localized area of groundwater contamination and of LNAPL. Studies in this area have also included the collection of information to support in situ biological remedial technologies. Additional studies, however, are necessary to gather more information in support of other remedial options, such as off-Site disposal or on-site land farming, etc.

1.4.5 TMW-130 TEMPORARY MONITORING WELL LOCATION

Initial studies in 2006 indicated the presence of LNAPL in monitoring well TMW-130. Since then, a number of soil and groundwater studies have been completed to delineate the extent of the separate phase hydrocarbons in soils and groundwater. The extent of the LNAPL has been well characterized. Recent studies in 2009 have also determined the extent of the impacts to soils and groundwater from dissolved phase chemical constituents.

Additional soil and groundwater data will be collected from this area to support the evaluation of various remedial measures.

2.0 BACKGROUND AND HISTORY OF PREVIOUS INVESTIGATIONS AT THE FIVE AOCS

This section provides a brief history of investigations and of the source of contamination (where known) for each of the five AOCS described previously. This information is intended to provide the background for the rationale for the additional studies planned for each of these areas and discussed in Sections 3.0 and 4.0.

In preparation for demolishing the Fairfax I Plant buildings, HDR Engineering, Inc. (HDR) performed an Environmental Site Assessment (ESA) for GM between August 1987 and January 1988 that was designed to determine potential impacts to soil and groundwater. All aboveground storage tanks (ASTs) and USTs were removed during that time.

In 2003, the KDHE requested that GM perform a confirmatory soil and groundwater investigation of the whole Site to address uncertainties remaining from the 1987 and 1988 studies. A number of groundwater and soil investigations had been performed by GM at a number of areas on the Site (i.e., the MW-103A area and a comprehensive groundwater investigation program). These confirmatory investigations addressed a number of sample locations and data generated previously by HDR. The confirmatory investigations were completed in a number of stages starting in 2004 and continuing through 2006.

Summary tables and figures indicating the soil and groundwater exceedences identified during the previous investigations are provided in Appendix A. However, Figure A.1 presents the soil exceedences only identified by CRA in soil samples that were collected beginning in May 1999, and does not include exceedences in soil samples collected by HDR prior to May 1999. Also, Figure A.2 presents the groundwater exceedences only identified in the most recent groundwater samples collected from the Site monitoring wells.

2.1 S-8 AREA

One of the areas investigated during the HDR ESA was the baler room and UST 10 area (referred to in this Work Plan as the S-8 Area). The location of this AOC is indicated on Figures 1.2 and 1.3. Soil boring locations are presented on Figure 2.1. Detected analytical data for soil samples from CRA boring SB-113 are presented in Appendix A, Table A.1.

The baler room was formerly located approximately 200 feet north of the southwest corner of the assembly building. The baler room was used to collect general plant refuse and contained a large trash compactor/baler. UST 10, which contained unleaded gasoline and was removed in August 1987, was located adjacent to the northern exterior wall of the baler room.

Soil boring S-8, installed by HDR in 1987, contained PCE above the Tier 2 standard at 10 feet below ground surface (bgs) and 15 feet bgs. No VOCs were detected in the soil samples collected from other intervals (5, 20, 25, and 30 feet bgs). Groundwater collected from S-8 contained 1,2-DCE, PCE, and trichloroethene (TCE) above the Tier 2 standard. Soil boring S-9 did not contain VOCs. Groundwater from S-9 contained benzene above the Tier 2 standard. Soil borings S-107 and S-108, installed in January 1988, contained no VOCs. 1,2-DCE was detected above the Tier 2 standard in groundwater from S-107.

CRA collected a soil sample from soil boring SB-113 in December 2004 in the vicinity of UST 10 and the baler room at a depth of 10 to 12 feet bgs to verify that soil at the approximate depth of the base of the tank is not impacted at levels above KDHE risk based standards. No VOCs were detected at concentrations above Tier 2 values at SB-113.

2.2 SB-110 AREA

One of the areas investigated during the HDR ESA was the powerhouse area (referred to in this report as the SB-110 Area, Figures 1.2 and 1.3). The powerhouse/SB-110 Area is located northwest of the former main plant building (see Figure 2.2 for soil boring locations). Eight USTs, which were removed in August 1987, were located in the powerhouse area in three clusters. The USTs contained diesel fuel, waste fuel oil, and gasoline. Detected analytical results from CRA soil and groundwater samples are presented in Appendix A, Table A.2 and Appendix A, Table A.3, respectively.

Soil samples were collected by HDR beneath and in the vicinity of USTs 3 and 4, formerly located in the SB-110 Area. No VOCs were detected above the Tier 2 criteria in August 1987 soil samples 87-209, 87-211, and S-15 or in January 1988 soil sample S-111. No VOCs were detected above the Tier 2 criteria in January 1988 groundwater collected at S-111.

Soil samples were collected by HDR beneath and in the vicinity of USTs 5, 6, and 11, located north of USTs 3 and 4. No VOCs were detected in two of the August 1987 soil

samples while PCE [626 micrograms per kilogram ($\mu\text{g}/\text{kg}$)] and xylenes (1,100 $\mu\text{g}/\text{kg}$) were detected in 87-206. No VOCs were detected in soil collected in August 1987 at S-16, S-17, and S-18 or in soil collected in January 1988 at S-112. No VOCs were detected in groundwater at S-16 and S-18. 1,2-DCE was detected in groundwater at S-17 [16 micrograms per liter ($\mu\text{g}/\text{L}$)] and S-112 (133 $\mu\text{g}/\text{L}$). PCE was detected in groundwater at S-17 (16 $\mu\text{g}/\text{L}$).

No VOCs were detected in soil samples S-19 through S-22 collected in August 1987 in the vicinity of USTs 7, 8, and 9, located north of USTs 5, 6, and 11).

CRA collected soil samples in December 2004 at a depth of 10 to 12 feet bgs to verify that soil at the approximate depth of the base of the tanks is not impacted at levels above KDHE risk based standards. Soil sample SB-110 was collected in the vicinity of USTs 3 and 4, soil sample SB-109 was collected in the vicinity of USTs 5, 6, and 11, and soil sample SB-108 was collected in the vicinity of USTs 7, 8, and 9. No VOCs were detected at concentrations above Tier 2 values at SB-108 or SB-109. PCE was detected at SB-110 above the soil to groundwater protection pathway value of 0.18 mg/kg at a concentration of 0.19 mg/kg.

In December 2005, CRA installed and sampled five additional borings to verify the PCE concentration detected at SB-110 and to delineate PCE surrounding SB-110. SB-118 through SB-121 were advanced approximately 20 feet from SB-110 in each cardinal direction. SB-122 was advanced adjacent to SB-110. PCE concentrations were below the Tier 2 soil objective in soil samples SB-120 (10-12 ft) and SB-121 (9-10 ft). The PCE laboratory detection limit was above the KDHE Tier 2 soil objective in soil samples SB-118 (9-10 ft) and SB-122 (9-10 ft). The PCE concentration in soil sample SB-119 (10-12 ft) was above the KDHE Tier 2 soil objective.

In November 2006, one soil boring (SB-137) was advanced to approximately 15 feet bgs to delineate PCE contamination in the soil east of soil boring SB-110 (Figure 2.2). PCE was detected in soil sample SB-137 at a concentration below Tier 2 standards.

Temporary monitoring well TMW-138 was installed in November 2006 (screened from approximately 25 to 35 feet bgs) to determine if PCE is present in the shallow groundwater above the KDHE Tier 2 standard downgradient¹ of soil boring SB-110. PCE was detected in the groundwater sample at an estimated concentration well below Tier 2 standard. Temporary monitoring well TMW-138 was abandoned in March 2007.

¹ Based on groundwater flow towards the Missouri River.

Monitoring well MW-125 was installed in October 2007 in the SB-110 area near former temporary monitoring well TMW-138 to monitor PCE previously detected in soil in that area of the Site. PCE was not detected in the groundwater samples collected at MW-125 in November 2007, March 2008, and June 2008. .

2.3 TMW-127 AREA

The TMW-127 Area is located in the northeast quadrant of the footprint of the former Fairfax I Plant building (see Figures 1.2 and 1.3). Soil boring SB-127/temporary monitoring well TMW-127 (Figure 2.3) was installed and sampled in November 2006 in response to an August 2006 request from the KDHE to perform investigative work in areas where little to no investigative work had occurred. There were no exceedences of the Tier 2 criteria in the soil sample collected at SB-127 (27.5 to 30 feet bgs). Total arsenic, manganese, cis-1,2-DCE, and methylene chloride were detected in the groundwater sample at TMW-127 at concentrations above the Tier 2 criteria. However, manganese was detected above the Tier 2 criteria in all nine temporary well groundwater samples collected inside the former Fairfax I Plant building footprint and at concentrations similar to those observed throughout the Former Fairfax I Site in past groundwater sampling events. Soil and groundwater analytical results are presented in Appendix A, Tables A.4 and A.5, respectively.

Temporary monitoring well TMW-127 was redeveloped and sampled for total and dissolved (filtered) arsenic in September 2007 in response to the March 12, 2007 letter from the KDHE. Total arsenic was detected above the criteria and dissolved arsenic was not detected in the groundwater sample from TMW-127.

2.4 MW-103A AREA

The MW-103A Area is located at the north-central portion of the Fairfax I property (refer to Figures 1.2 and 1.3). This area is near the former rail spur, the aboveground tank farm, and the location of the remediation system that operated from 1991 to 1994 (see Figure 2.4).

Detected analytical data from soil samples are presented in Appendix A, Table A.6. Detected analytical data from groundwater samples are presented in Appendix A, Table A.7. Soil boring, and soil screening, and monitoring well MW-103A, MW-104, and MW-115A locations are shown on Figure 2.4. Monitoring well MW-102A and MW-105 locations are shown on Figure 1.2.

Soil and groundwater contamination were discovered at the Site in 1987 during the ESA. The primary sources of contamination were determined to be gasoline and paint thinner from a tank farm along with suspect historic releases of PCE from prior to GM Corp. operations. GM Corp. initiated its own voluntary cleanup program in 1988, which included semiannual groundwater monitoring, groundwater contaminant plume definition, and remedial design and construction. The remediation system for the small tank farm area comprised groundwater extraction and treatment by air stripping along with soil vapor extraction and treatment by thermal oxidation. The remedial action was initiated in 1991 and shut down in 1994, and the semiannual groundwater monitoring was discontinued.

GM Corp. performed a comprehensive groundwater sampling event in October 1998. Concentrations of VOCs were detected above standards at MW-103A and were similar to levels detected during the 1991 to 1994 remediation program.

Concentrations of VOCs in groundwater samples collected from MW-103A indicated elevated levels of benzene, toluene, acetone, xylenes, and 4-methyl-2-pentanone. These parameters were also detected in soil samples collected in the nearby area prior to plant demolition. Therefore, the continuous detection of these VOCs at MW-103A and the historical documentation of contaminated soils suggest that a local source of residual soil or LNAPL contamination may be affecting groundwater quality. The source of the VOC contamination in the soils and groundwater in the vicinity of MW-103A is likely the historical releases from the tanks, rail line, or building structures during historical operations by GM Corp. and its predecessor.

The following activities were completed in the MW-103A Area in May 1999.

- Performed a soil screening survey in order to identify areas of soil contamination; 27 soil screening (headspace) samples (S-1 to S-27) collected from 5 to 7 feet bgs were analyzed by an on-Site laboratory for BTEX, 2-butanone (MEK), and 4-methyl-2-pentanone (MIBK)
- Collected 20 soil samples (SB-28 to SB-47) at shallow depths (5 to 7 feet bgs) and at depths near the water table (10 to 12 feet bgs) and submitted the samples for laboratory analysis of target compound list (TCL) VOCs in order to delineate the extent of residual contamination (Figure 2.4)
- Collected groundwater samples from five monitoring wells (MW-102A, MW-103A, MW-104, and MW-105, and newly installed well MW-115A) for analysis of TCL VOCs

2.5 TMW-130 AREA

The TWM-130 Area is located in the southeast quadrant of the footprint of the former Fairfax I Plant building (see Figures 1.2 and 1.3). See Figure 2.5 for soil boring and temporary monitoring well locations. See Appendix A, Table A.8 for soil sampling results and Table A.9 for groundwater sampling results.

In November 2006, soil boring SB-130 and temporary monitoring well TMW-130 were installed in response to an August 2006 request from the KDHE to perform investigative work in areas where little to no investigative work had occurred. There were exceedences of the current Tier 2 criteria for 2-methylnaphthalene and naphthalene in the soil sample collected at SB-130 (5.5 to 7.0 feet bgs). A 0.99 foot layer of LNAPL was observed in temporary well TMW-130 while collecting groundwater elevation measurements prior groundwater sampling. Therefore, no groundwater sample was collected at TMW-130.

In October 2007, 16 soil borings (SB-200 to SB-215) were advanced to 25 feet bgs, and the soil was screened using a photoionization detector (PID) for the presence of petroleum hydrocarbons to determine the extent of LNAPL impact. Soil samples were not submitted for laboratory analysis. In addition, eight temporary monitoring wells (TMW-139 to TMW-146) were installed. Fluid levels were monitored weekly for 6 weeks and intermittently through March 2008 at TMW-130 and the eight surrounding temporary wells. Wells with LNAPL present were bailed until the standing product within each well was removed. LNAPL was present in TMW-130 and TMW-139 to TMW-142 at depths varying from a trace to 3 feet. No LNAPL was detected at TMW-143 to TMW-146.

In February 2008, a Laser-Induced Fluorescence (LIF) investigation using an ultraviolet optical screening tool (UVOST) was conducted at 24 locations to delineate the LNAPL horizontally and vertically and to approximate the LNAPL saturation profile and type.

In September 2008, a 2-day multi-phase extraction (MPE) pilot study was conducted at the LNAPL plume area. In addition, five soil borings (SB-E1, SB-F1, SB-F3, SB-F4, and SB-G1) were advanced within the UVOST grid. Borings SB-E1, SB-F1, and SB-G1 were soil screening borings installed at the request of the KDHE to complete soil delineation of the impacted area. Soil samples were not submitted for laboratory analysis. Borings SB-F3 and SB-F4 were installed to collect waste characterization samples from the impacted area.

In September 2009, nine soil sampling borings (SB-B3-A, SB-B5-A, SB-D4-A, SB-E4-A, SB-E2-A, SB-F4-A, SB-F5-A, SB-G2-A, and SB-G4-A) were advanced at UVOST grid locations. Soil samples for laboratory analysis were collected from 1 to 3 feet bgs and from the interval above the water table that exhibited the highest UVOST result. Five delineation borings (SB-300, SB-301, SB-302, SB-303, and SB-304) were advanced outside the LNAPL-impacted area. Soil samples for laboratory analysis were collected from the interval above the water table. Groundwater samples were collected from the four temporary wells that did not contain LNAPL (TMW-143, TMW-144, TMW-145, and TMW-146) for laboratory analysis. Soil and groundwater samples were analyzed for TCL VOCs, total petroleum hydrocarbon as gasoline range organics (TPH-GRO), and total petroleum hydrocarbon as diesel range organics (TPH-DRO).

The LNAPL has been characterized as a degraded diesel/fuel oil distillate material based on the results of laboratory analysis of the material and is situated approximately 22 to 32 feet bgs. It was concluded that the historical source of the LNAPL may be located between TMW-130 and TMW-140, where the highest average fluorescence and the greatest observed LNAPL thickness were observed.

3.0 RATIONALE FOR ADDITIONAL SAMPLING AT THE FIVE AREAS OF CONCERN

Additional data from the five identified AOCs are needed in order to delineate areas of impact both vertically and horizontally and to provide a further understanding of conditions at each location. Similarly, additional data are necessary to continue the review and evaluation of remedial measures at some locations.

3.1 DATA GAPS FOR EXTENT OF IMPACT IN SOIL AND GROUNDWATER

Additional information will be obtained to fill data gaps in the following areas.

3.1.1 S-8 AREA

PCE was detected above the Tier 2 standard at soil boring S-8, installed in 1987 by HDR. No VOCs were detected in the soil sample collected in 2004 by CRA from soil boring SB-113. Additional soil samples and one groundwater sample will be collected in the vicinity of boring S-8 to determine the presence or absence of impacts in the S-8 Area (Figure 2.1).

3.1.2 SB-110 AREA

PCE was detected in soil borings SB-110 and SB-119 above the Tier 2 standards. Additional soil samples and one groundwater sample will be collected in the vicinity of soil borings SB-118 and SB-119 to delineate the extent of the VOC impact in the SB-110 Area (Figure 2.2).

3.1.3 TMW-127 AREA

cis-1,2-DCE was detected at a concentration above the Tier 2 criteria in the groundwater sample collected at temporary monitoring well TMW-127. Soil and groundwater samples will be collected in the TMW-127 area to determine the extent of the VOC impact in this area (Figure 2.3).

In addition to the AOC specific studies described above, soil samples will be collected from areas of the Site not expected to be impacted by past operations. These

background soil samples will be used to support the development of cleanup objectives and remedial designs.

3.2 DATA NEEDS FOR FEASIBILITY STUDIES AND REMEDIAL DESIGNS AT MW-103A AND TMW-130 AREAS

Additional analytical data for the MW-103A and TMW-130 areas are required in order to complete feasibility studies to determine cleanup levels and remedial designs for those areas. Site-specific total organic carbon (TOC) data obtained from an area of the Site previously determined not to be impacted is required. The TOC data will be used in determining Site cleanup levels.

3.2.1 MW-103A AREA

Site-specific TOC data obtained from an area of the Site previously determined not to be impacted is required. The TOC data will be used in determining Site cleanup levels.

Waste profile analytical data is needed for the MW-103A Area, and two soil borings will be advanced (Figure 2.4).

3.2.2 TMW-130 AREA

Site-specific TOC data obtained from an area of the Site previously determined not to be impacted is required. The TOC data will be used in determining Site cleanup levels.

Waste profile analytical data and geotechnical data are needed for the TMW-130 Area. One waste profile and two geotechnical soil borings will be advanced.

3.3 COMPREHENSIVE GROUNDWATER SAMPLING PROGRAM

The KDHE has suggested that a routine groundwater sampling program be implemented at the Site while remedial measures are being evaluated, designed, and implemented. A Site-wide groundwater monitoring program had recently been completed over a year's time on a quarterly basis. These sampling events were completed in 2007 and 2008 and all results were reported to the KDHE. In order to build upon the data collected during this previous groundwater sampling program, it is

proposed that a one time, comprehensive sampling event be completed after the wells proposed in this Plan are installed. This comprehensive sampling event would provide data necessary to then develop a focused routine groundwater sampling program for the Site. An evaluation of data collected during the planned comprehensive event, as outlined in the Work Plan, would result in the determination of specific monitoring wells and specific parameters to monitor on a routine basis in the future.

All 34 existing permanent and temporary shallow monitoring wells, along with the six temporary monitoring wells to be installed, will be gauged, purged, and sampled using the protocols described in the Sampling and Analysis Plan provided in Appendix B. Table 3.1 presents the list of wells to be sampled, and Figure 3.1 indicates the locations of the 34 existing monitoring wells.

4.0 INVESTIGATIVE APPROACH

The general approach to the groundwater and soil investigations for each of the five AOCs and for the comprehensive groundwater sampling event are discussed in this Section. Appendix B (Sampling and Analysis Plan) provides the specifics and details on field methods to be utilized during these investigations.

A surveyor will be subcontracted to mark the locations of S-8 Area soil borings S-8 and SB-113 and SB-110 Area soil borings SB-110, SB-118, SB-119, and SB-120 prior to the start of field work. After the new soil borings have been advanced and the temporary monitoring wells have been installed, the surveyor will survey the new borings for location and the temporary wells for location and elevation (ground surface and top of casing). Locations will be referenced to the Plant Grid Coordinate System.

The location for each soil boring and monitoring well to be installed will be cleared for subsurface utilities by a private locator before drilling begins.

4.1 S-8 AREA

The following tasks will be performed in this AOC.

- Advance four soil borings to the water table adjacent to soil boring S-8, each approximately 20 feet from soil boring S-8 in a cardinal direction
- Collect one soil sample from each soil boring for laboratory analysis of TCL VOCs from the interval exhibiting the highest PID reading or visual or olfactory evidence of impact or from the interval above the water table if no evidence of impact is encountered
- Install one temporary monitoring well in the soil boring that exhibits the highest PID reading or visual or olfactory evidence of impact; it is anticipated that the well will be approximately 25 feet deep, with a 10 foot long screen that straddles the water table
- Develop the newly installed temporary monitoring well
- Collect a groundwater sample from the newly installed temporary monitoring well for laboratory analysis of TCL VOCs

Refer to Figure 2.1 for the anticipated locations of the soil borings and the temporary monitoring well.

4.2 SB-110 AREA

The following tasks will be performed in this AOC.

- Advance two soil borings to the water table, one approximately 20 feet south and the other approximately 20 feet east of soil boring SB-119
- Advance one soil boring to the water table north of and adjacent to soil boring SB-118 and a second soil boring approximately 20 feet north of the first boring
- Collect one soil sample from each soil boring for laboratory analysis of TCL VOCs from the interval exhibiting the highest PID reading or visual or olfactory evidence of impact or from the interval above the water table if no evidence of impact is encountered
- Install one temporary monitoring well in the soil boring that exhibits the highest PID reading or visual or olfactory evidence of impact; it is anticipated that the well will be approximately 25 feet deep, with a 10 foot long screen that straddles the water table
- Develop the newly installed temporary monitoring well
- Collect groundwater samples from the newly installed temporary monitoring well and from existing monitoring well MW-125 for laboratory analysis of TCL VOCs

Refer to Figure 2.2 for the anticipated locations of the soil borings and the temporary monitoring well.

4.3 TMW-127 AREA

The following tasks will be performed in this AOC.

- Advance three soil borings to the water table, in the vicinity of temporary monitoring well TMW-127, each approximately 200 feet to the northwest, southwest, and southeast of TMW-127
- Collect one soil sample from each soil boring for laboratory analysis of TCL VOCs from the interval exhibiting the highest PID reading or visual or olfactory evidence of impact or from the interval above the water table if no evidence of impact is encountered

- Install a temporary monitoring well in each soil boring located 200 feet from TMW-127; it is anticipated that the wells will be approximately 25 feet deep, with a 10 foot long screen that straddles the water table
- Install one deep monitoring well adjacent to temporary monitoring well TMW-127; the well will be approximately 60 feet deep, with a 10 foot long screen
- Develop the four newly installed wells
- Collect one groundwater sample for laboratory analysis of TCL VOCs from the three newly installed temporary monitoring wells, from the newly installed deep monitoring well, and from existing temporary monitoring well TMW-127

Refer to Figure 2.3 for the anticipated locations of the soil borings and the temporary monitoring wells.

4.4 MW-103A AREA

In order to assist in the selection of an appropriate remedy for the MW-103A Area and to help with remedial design, the following tasks will be performed.

- Advance two soil borings to 15 feet bgs in the area to be excavated
- Collect one soil sample from each boring from the interval that exhibits the highest PID reading or visual or olfactory evidence of impact
- Submit the soil samples for laboratory analysis of waste profiling parameters
- Collect one groundwater sample from monitoring well MW-103A
- Submit the groundwater sample for laboratory analysis of nutrient and microbial counts

Refer to Figure 2.4 for the anticipated locations of the soil borings.

4.5 TMW-130 AREA

In order to assist in the selection of an appropriate remedy for the TMW-130 Area and to help with remedial design, the following tasks will be performed.

- Advance one soil boring to 10 feet bgs in the area to be excavated

- Collect one soil sample from the boring from the interval that exhibits the highest PID reading or visual or olfactory evidence of impact
- Submit the soil sample for laboratory analysis of waste profiling parameters
- Collect one groundwater sample from each of five temporary monitoring wells with a history of LNAPL (TMW-130, TMW-139, TMW-140, TMW-141, and TMW-142)
- Submit the groundwater samples for laboratory analysis of surfactants and of nutrient and microbial counts
- Advance two geotechnical borings in the areas displaying the highest LIF/UVOST readings
- Collect one geotechnical sample/soil core from the smear zone interval (approximately 22 to 32 feet bgs) above the water table at each boring
- Submit the geotechnical samples for analysis of grain size, Atterberg Limits/compaction, and porosity

Refer to Figure 2.5 for the anticipated location of the soil borings.

4.6 SITE-WIDE BACKGROUND INFORMATION

The following tasks will be performed to assist in the determination of a background soil conditions for the Site.

- Advance one soil boring approximately 20 feet west of monitoring wells MW-118A/B
- Collect one soil sample from a shallow interval (1 to 2 feet bgs) and one soil sample from a deep interval (10 to 12 feet bgs)
- Submit the soil samples for laboratory analysis of total organic carbon (TOC)

4.7 COMPREHENSIVE GROUNDWATER SAMPLING PROGRAM

The comprehensive groundwater sampling program will consist of the following:

- Measure the depth to water and depth to LNAPL, if present, in the wells that comprise the comprehensive groundwater sampling program network

- Collect groundwater samples from the 34 existing permanent and temporary Site shallow monitoring wells, along with the five temporary monitoring wells and one deep monitoring well to be installed, using low flow sampling techniques
- Wells with LNAPL present will not be sampled
- Submit the groundwater samples from 34 existing and six new monitoring wells for laboratory analysis of TCL VOCs
- Submit groundwater samples from eight monitoring wells located at the TMW-130 and MW-103A areas (TMW-132, TMW-143, TMW-144, TMW-145, TMW-146, MW-103A, MW-104, and MW-115A) for laboratory analysis of semivolatile organic compounds (SVOCs), total petroleum hydrocarbons as gasoline range organics (TPH-GRO), and total petroleum hydrocarbons as diesel range organics (TPH-DRO)

Refer to Figure 3.1 for the locations of the 34 existing permanent and temporary shallow monitoring wells.

5.0 PROJECT PLANS

The following project plans have been developed to support the investigation activities discussed in Section 4.0.

5.1 SAMPLING AND ANALYSIS PLAN

A Sampling and Analysis Plan (SAP) is provided in Appendix B. Investigative activities will be conducted in accordance with the protocols detailed in the SAP.

5.2 HEALTH AND SAFETY PLAN

A Site-specific Health and Safety Plan (HASP) is provided in Appendix C. Investigative activities will be conducted in accordance with the protocols detailed in this HASP.

5.3 QUALITY ASSURANCE PROJECT PLAN

A Quality Assurance Project Plan (QAPP) is provided in Appendix D. Investigative activities will be conducted in accordance with the protocols detailed in this QAPP.

6.0 REPORTING

A summary report presenting the results of the Site-wide investigations will be prepared. The report will summarize the activities completed and present the findings from the investigations. Data will be compiled and presented in tables and on figures. Laboratory analytical data will be compared to the KDHE Tier 2 residential and non-residential risk-based scenarios for comparison purposes only. Comparison to these standards will assist in the determination of the extent of contamination and in the assessment of remedial measures. However, alternate cleanup objectives may be established once all the data are evaluated. Data will be validated and a data validation memorandum will be prepared and submitted with the final report. Conclusions and recommendations will be presented in the summary report. These will include an assessment of the need, if any, of remediation at AOCs such as the S-8, SB-110, and the TMW-127 Areas. Likewise, a recommendation for a future routine groundwater monitoring program will be provided in the summary report.

7.0 SCHEDULE

Figure 7.1 provides a general schedule of the field activities, data evaluation, and reporting tasks for the scope or work outlined in this Work Plan.

8.0 REFERENCES

CRA 2000. Results of Soil and Groundwater Investigations Near Monitoring Well MW-103A, Former General Motors Fairfax I Plant, June 2000.

CRA 2000. Environmental Site Assessment Summary of Subsurface Conditions, Former General Motors Fairfax I Plant, July 2000.

CRA 2005. Results of Confirmatory Sampling Program, Former General Motors Fairfax I Plant, April 2005.

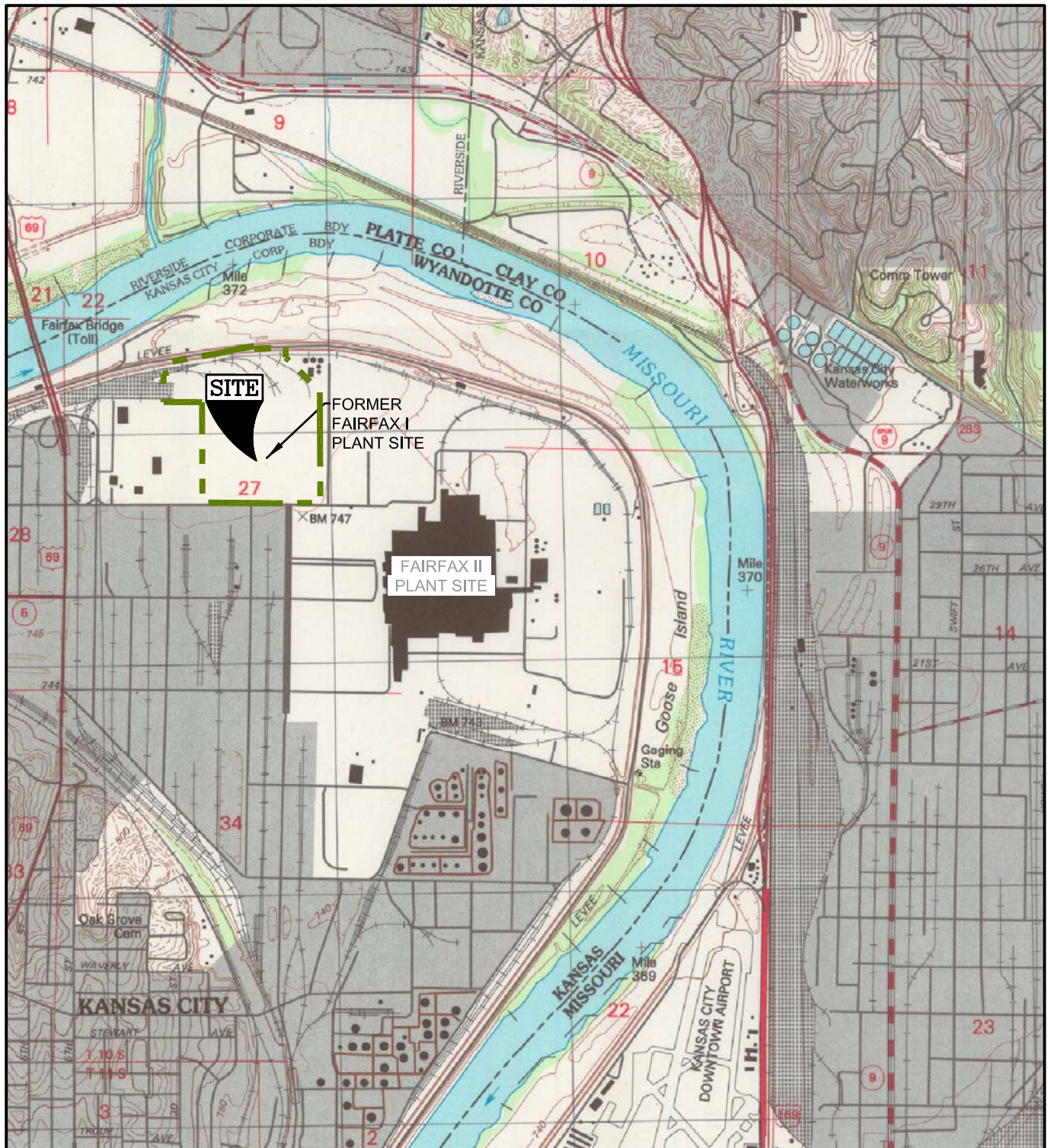
CRA 2006. Supplemental Confirmation Sampling Results, letter report from CRA to KDHE, May 9, 2006.

CRA 2007. Additional Groundwater and Soil Sampling Data, letter report from CRA to KDHE, February 19, 2007.

CRA 2008. Results of LNAPL Investigations – TMW-130 Area, letter report from CRA to KDHE, May 22, 2008.

CRA 2009. Groundwater Monitoring Results (Second Quarter 2008) – Revision 1, letter report from CRA to KDHE, November 18, 2009.

CRA 2010. Results of Soil and Groundwater Characterization investigation TMW-130 Area, Revision 1, Former General Motors Fairfax I Plant, April 2010.



LEGEND:



FORMER FAIRFAX I PROPERTY BOUNDARY
(MLC PROPERTY ID 1289-1)

BASE SOURCE: USGS 7.5 MINUTE TOPOGRAPHIC QUADRANGLE;
NORTH KANSAS CITY, MO-KS 1990

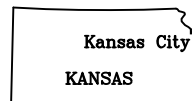
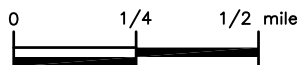


figure 1.1

SITE LOCATION
FORMER FAIRFAX I SITE
Kansas City, Kansas



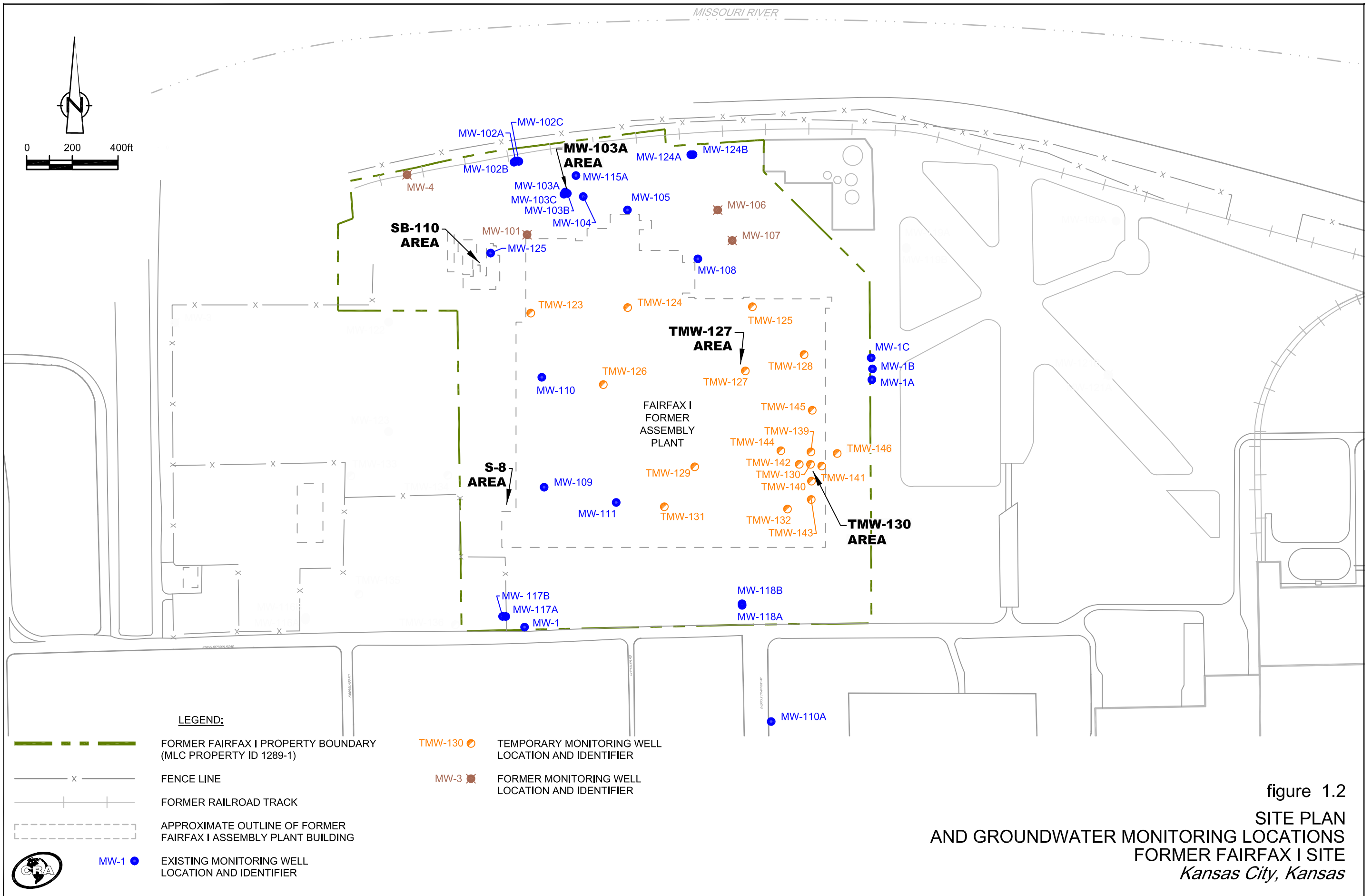
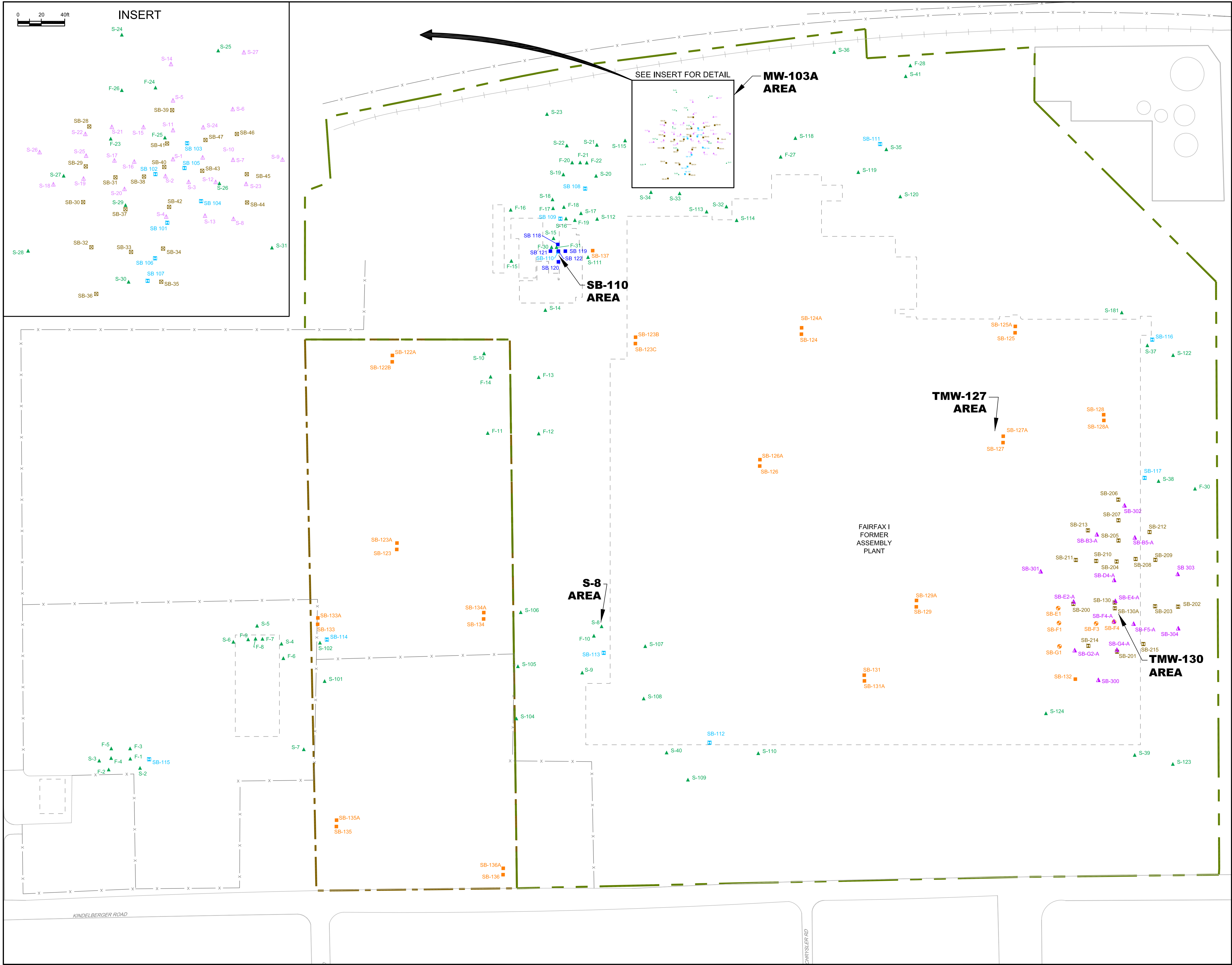


figure 1.2
 SITE PLAN
 AND GROUNDWATER MONITORING LOCATIONS
 FORMER FAIRFAX I SITE
 Kansas City, Kansas



NO	Revision	Date	Initial

Approximate Scale

LEGEND:

- FORMER FAIRFAX I PROPERTY BOUNDARY (MLC PROPERTY ID 1289-1)
- TRACT 2 PARCEL BOUNDARY (MLC PROPERTY ID 1289-2)
- FORMER BUILDING STRUCTURE
- FORMER FENCE LINE
- FORMER RAILROAD TRACKS
- HDR SOIL BORING LOCATION AND IDENTIFIER
- SOIL SCREENING BOREHOLE LOCATION AND IDENTIFIER (SCREENING ONLY; NO ANALYTICAL DATA (CRA, MAY 1999))
- SOIL BORING LOCATION AND IDENTIFIER (CRA, MAY 1999 AND DECEMBER 2004)
- SOIL BORING LOCATION AND IDENTIFIER (CRA, DECEMBER 2005)
- SOIL BORING LOCATION AND IDENTIFIER (CRA, OCTOBER/NOVEMBER 2006)
- SOIL BORING LOCATION AND IDENTIFIER; PID SCREENING; NO ANALYTICAL DATA (CRA, OCTOBER 2007)
- SOIL BORING LOCATION AND IDENTIFIER (CRA, SEPTEMBER 2008)
- SOIL BORING LOCATION AND IDENTIFIER (CRA, SEPTEMBER 2009)

SCALE VERIFICATION

THIS BAR MEASURES 1" ON ORIGINAL. ADJUST SCALE ACCORDINGLY.

Approved		

DRAWING STATUS		

FORMER FAIRFAX I SITE
KANSAS CITY, KANSAS

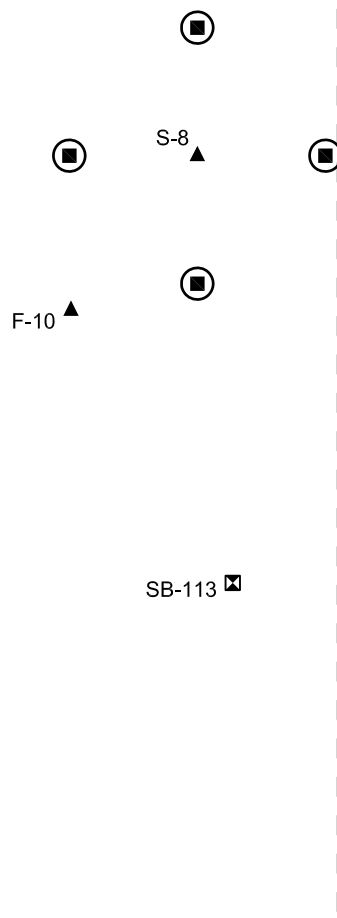
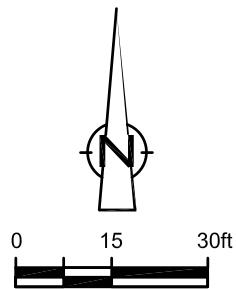
FORMER FAIRFAX I SITE

SITE PLAN
AND SOIL BORING LOCATIONS

CONESTOGA-ROVERS & ASSOCIATES

Source Reference:

Project Manager: P. HARVEY	Reviewed By: P. KLICK	Date: JANUARY 11, 2010
Scale: 1:120	Project N°: 012559-04-202080	Report N°: 021
Drawing N°: figure 1.3		



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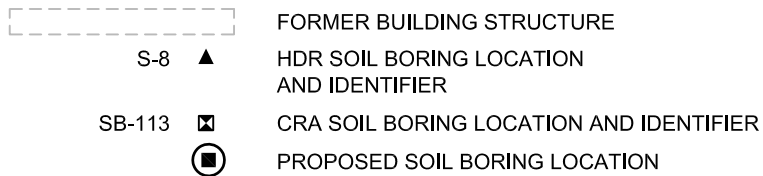
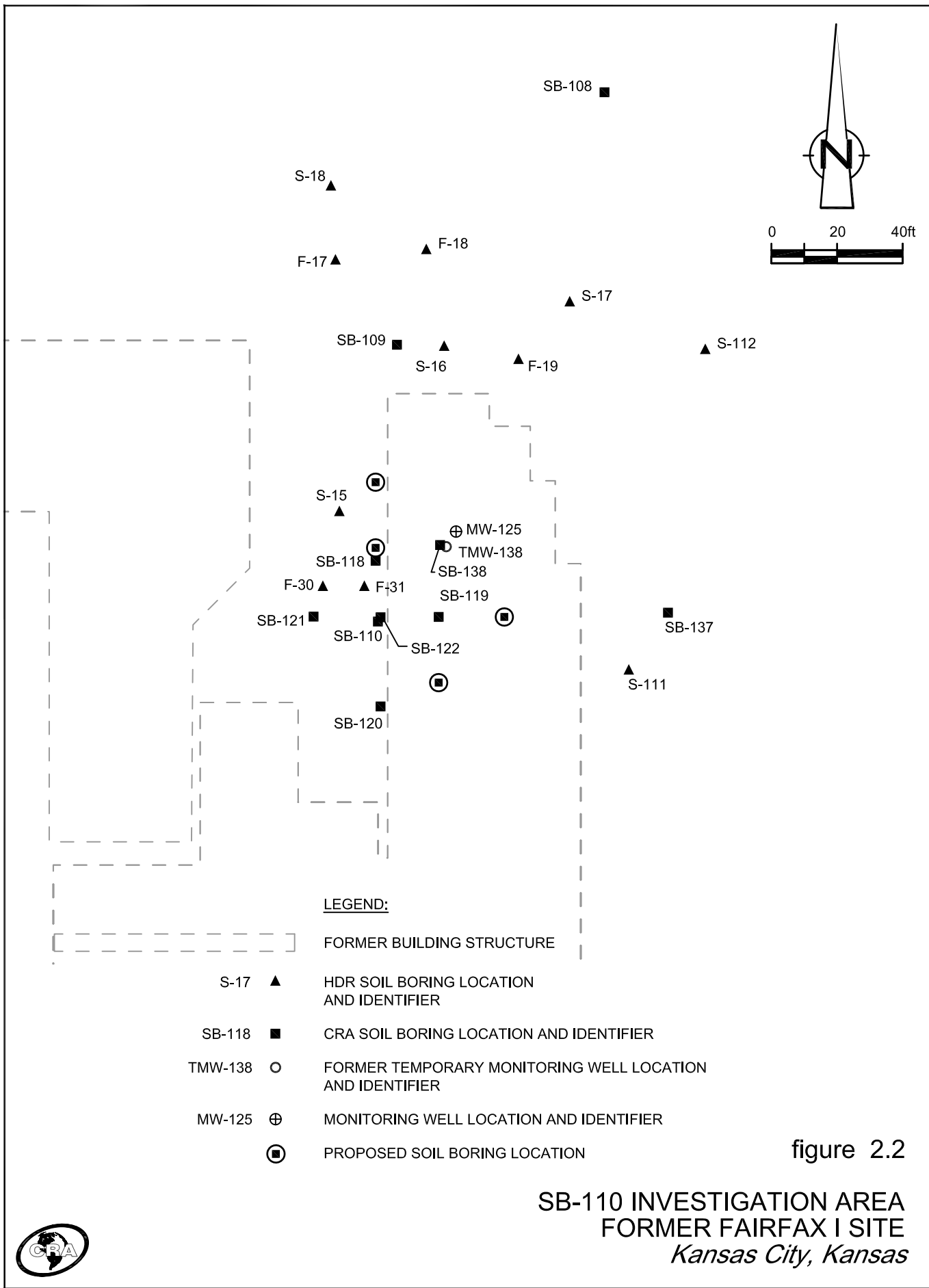
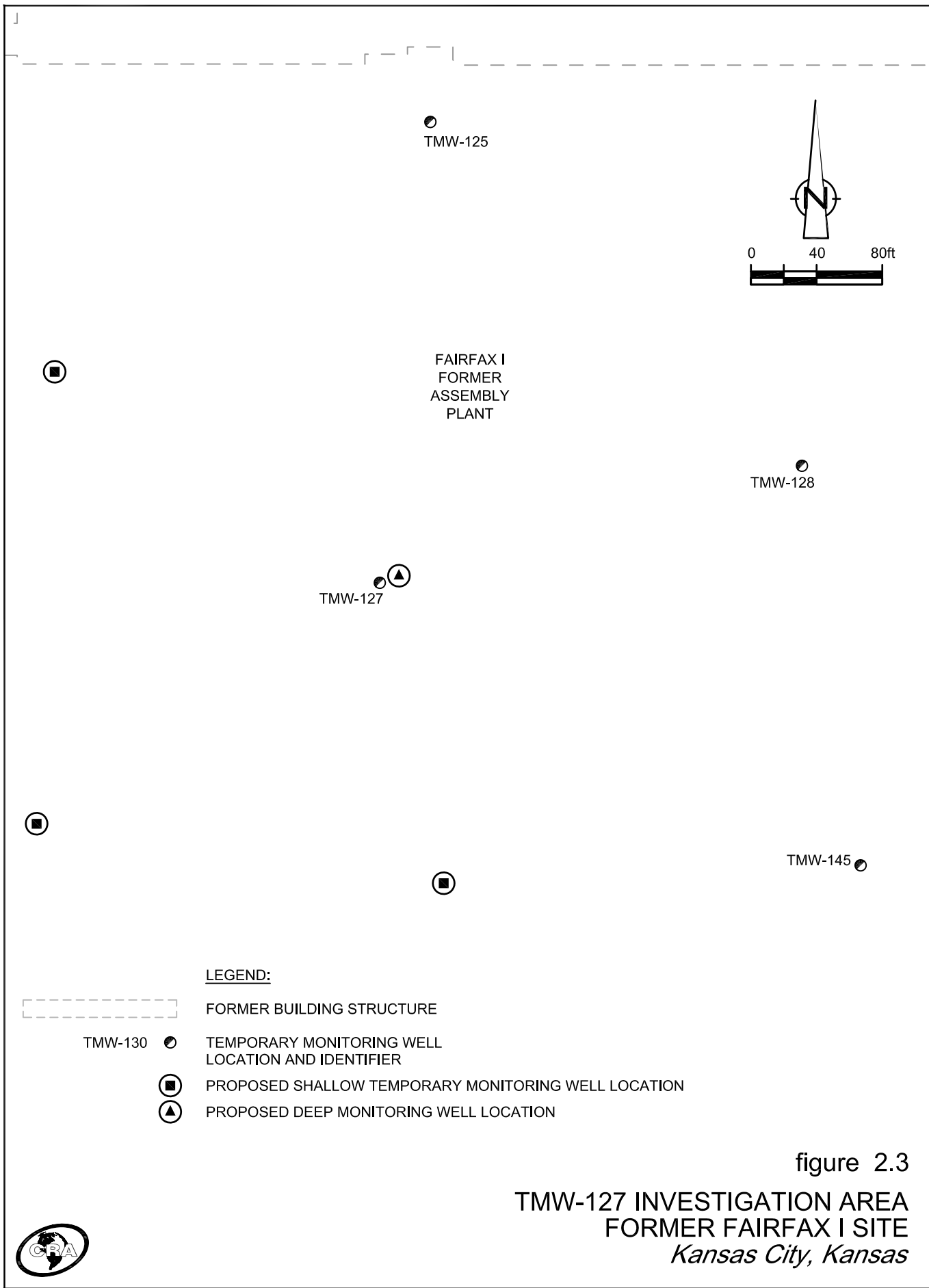
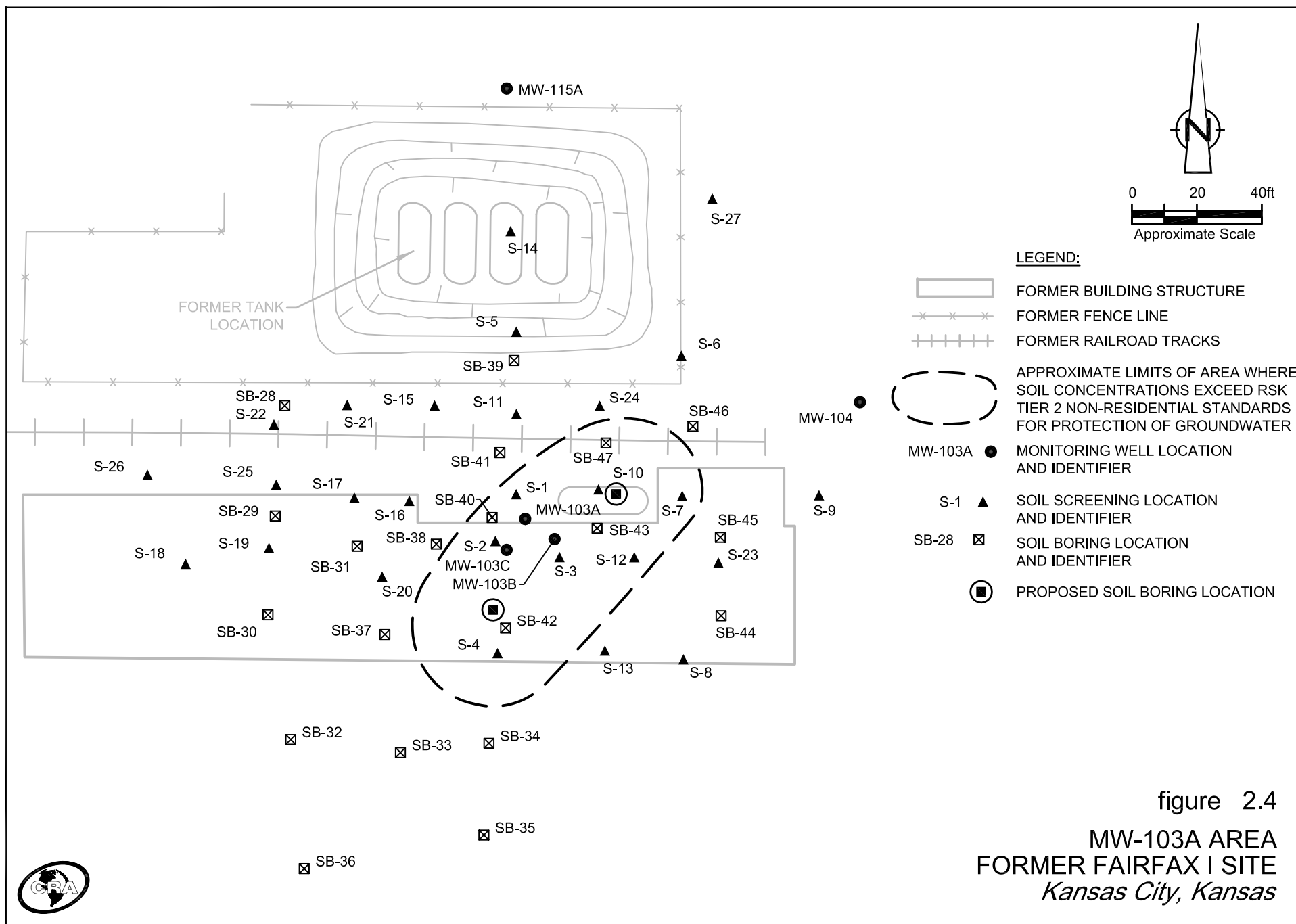
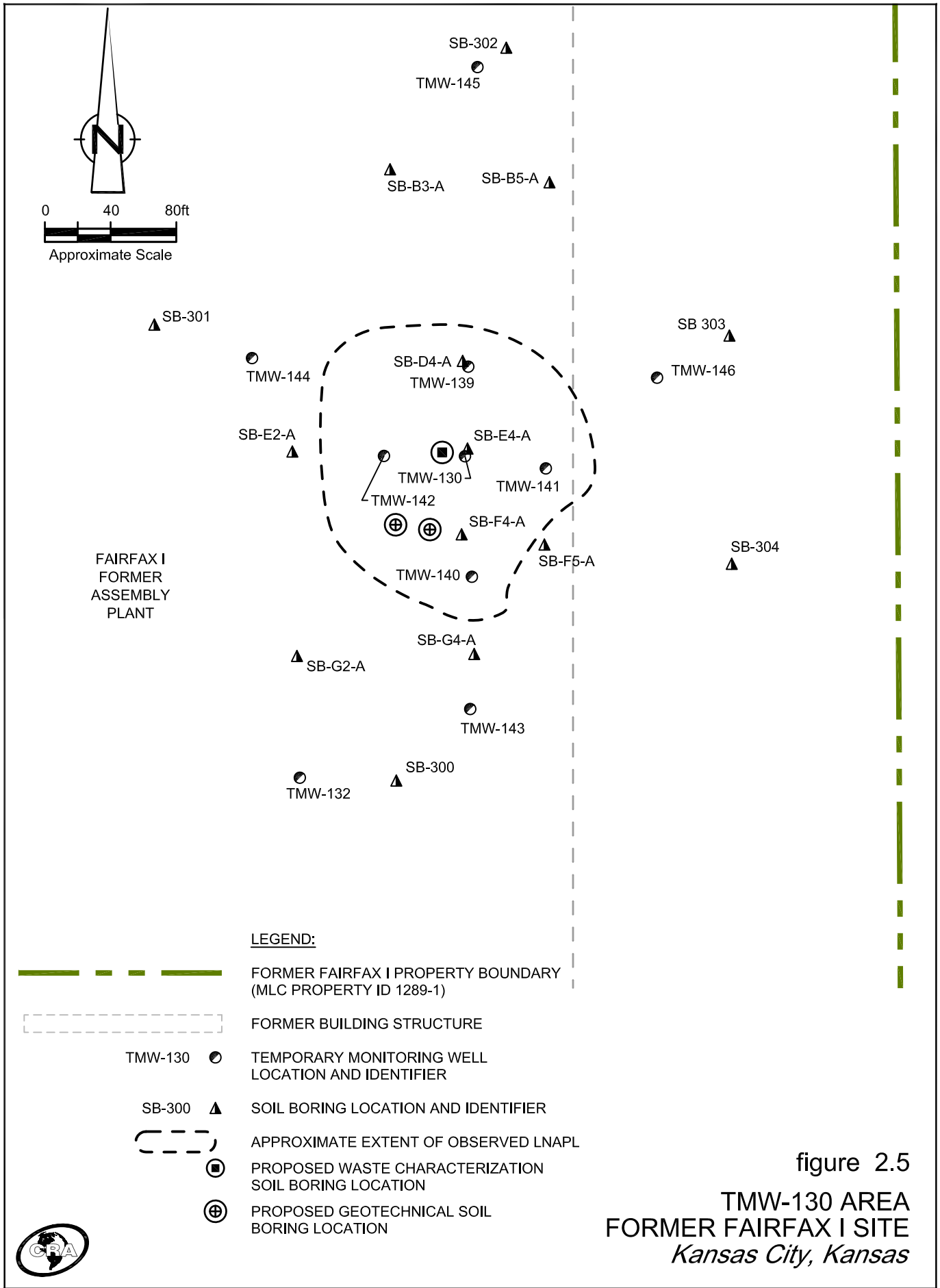


figure 2.1
S-8 INVESTIGATION AREA
FORMER FAIRFAX I SITE
Kansas City, Kansas









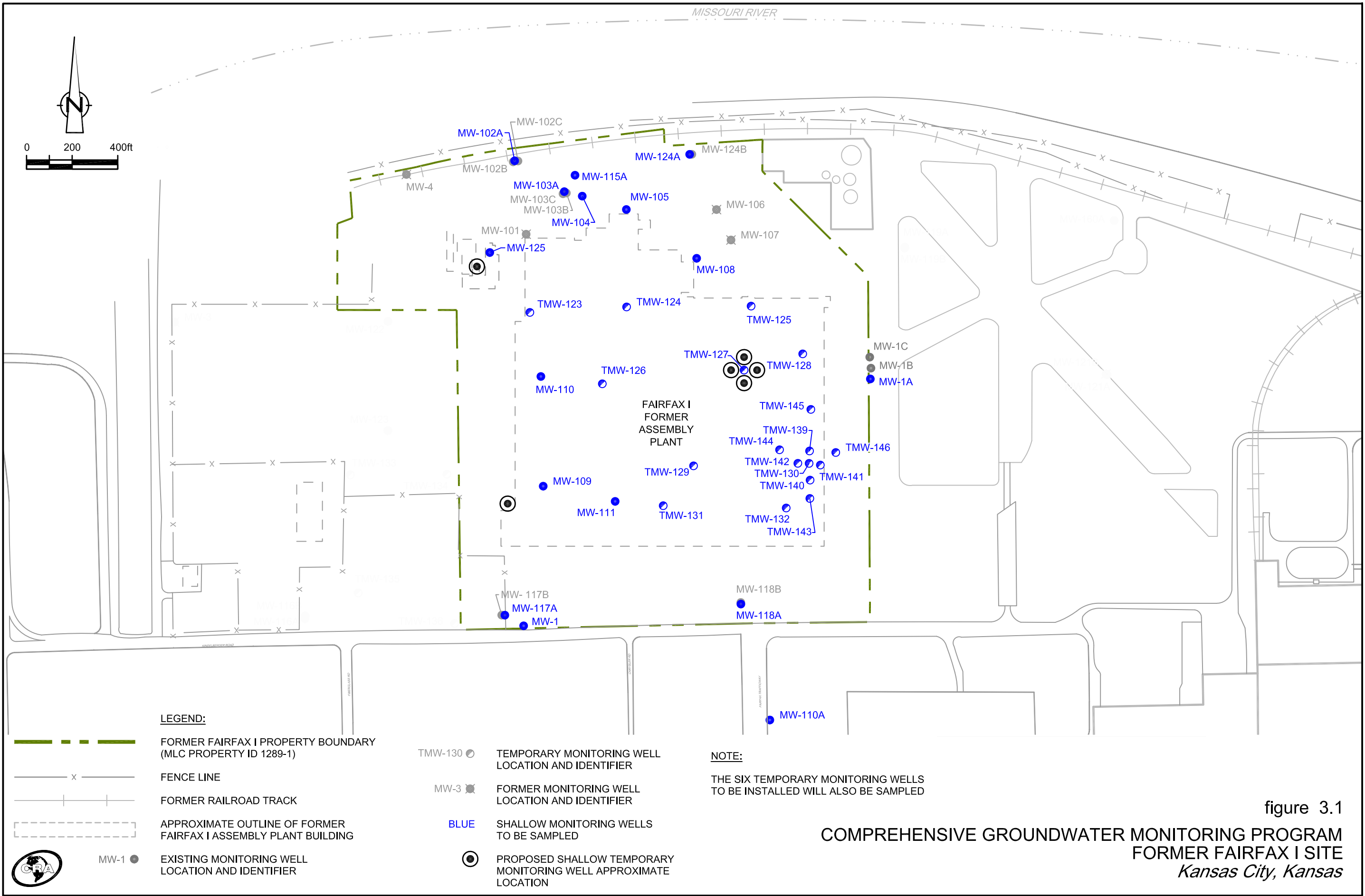
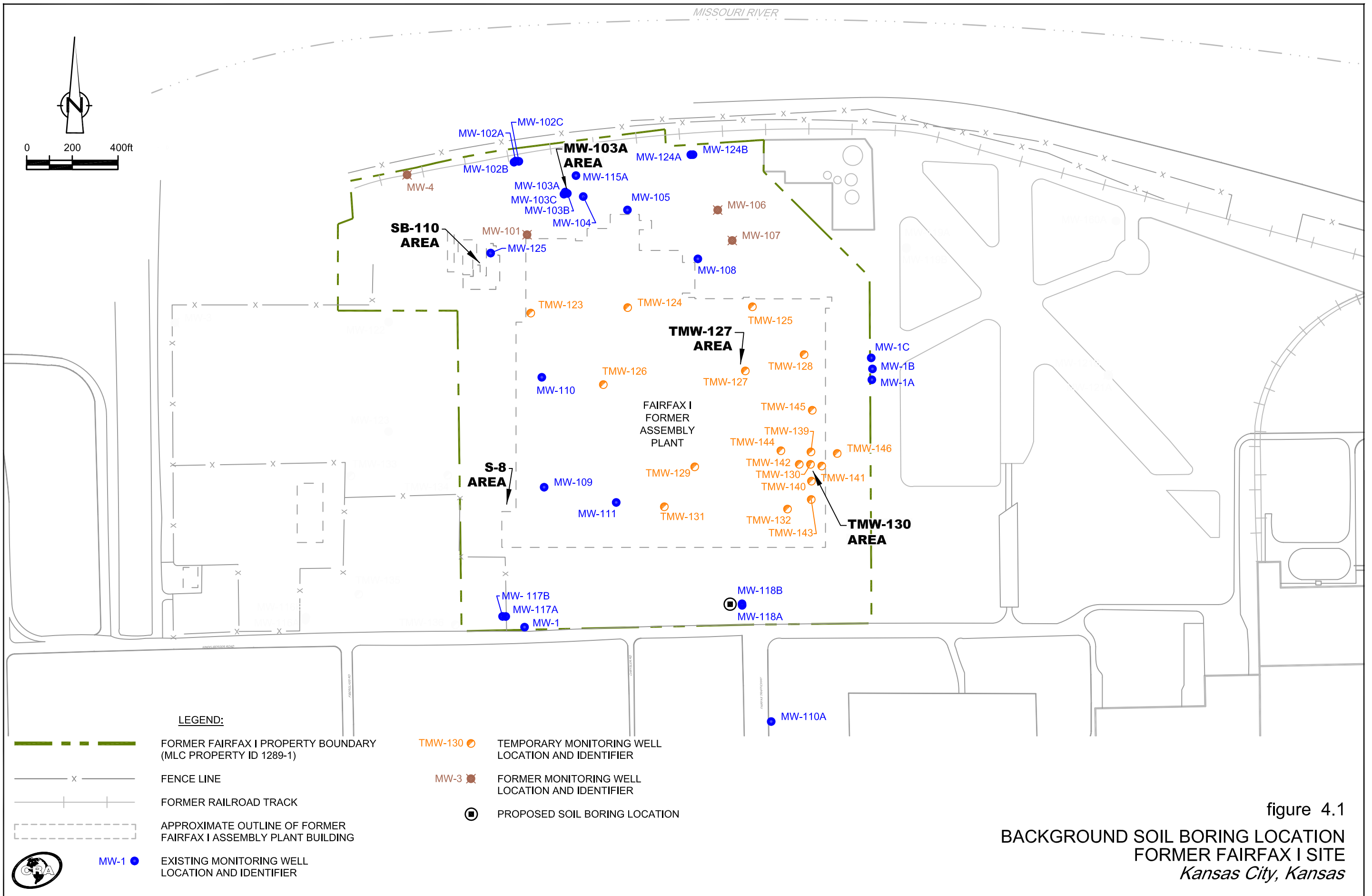


figure 3.1



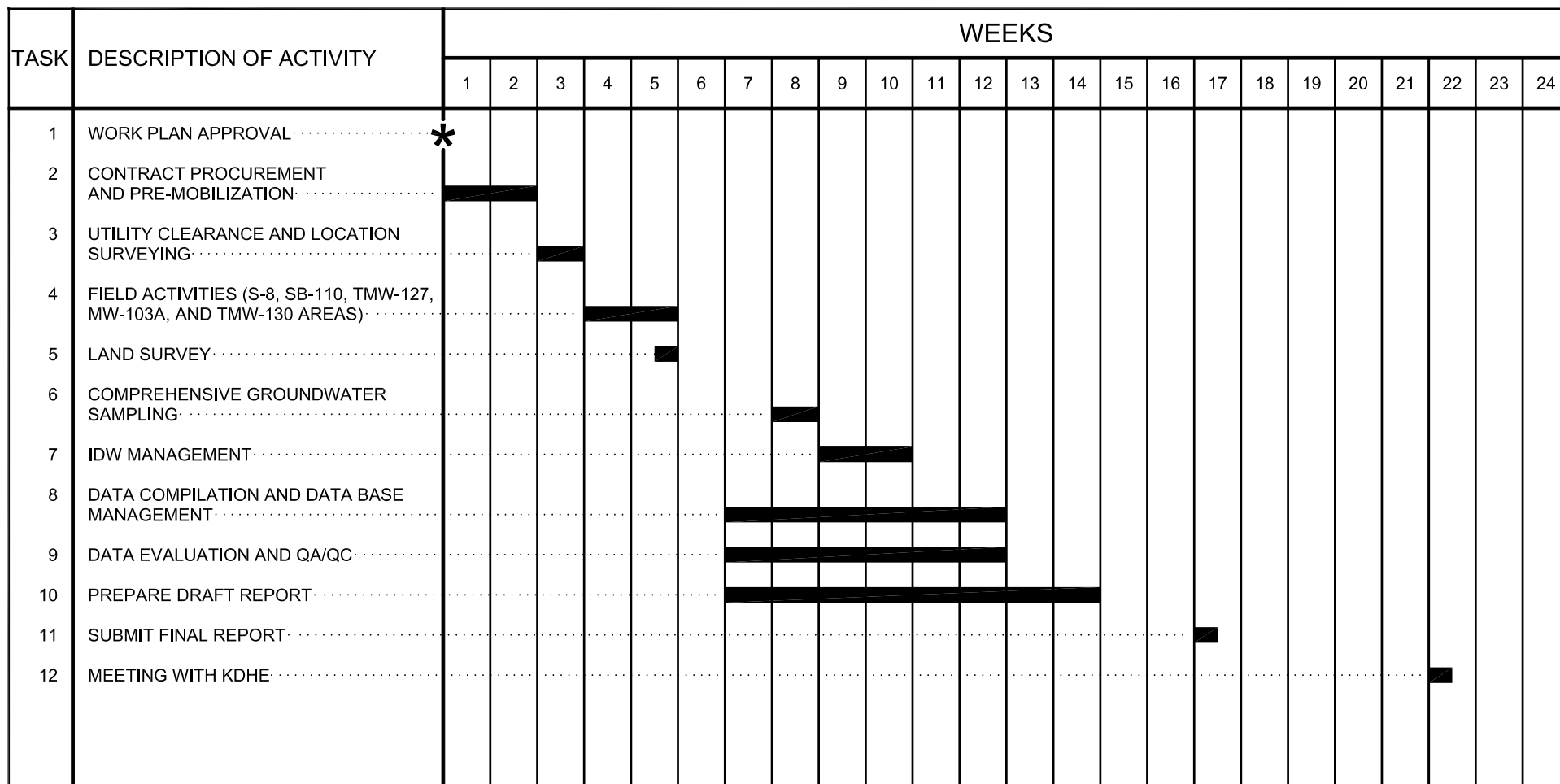


figure 7.1
GENERAL SCHEDULE
FORMER FAIRFAX I SITE
Kansas City, Kansas



TABLE 3.1

**LIST OF MONITORING WELLS TO BE SAMPLED
COMPREHENSIVE GROUNDWATER SAMPLING EVENT
FORMER FAIRFAX I SITE
KANSAS CITY, KANSAS**

<i>Permanent Shallow Monitoring Wells</i>	<i>Temporary Monitoring Wells</i>
MW-1	TMW-123
MW-1A	TMW-124
MW-102A	TMW-125
MW-103A	TMW-126
MW-104	TMW-127
MW-105	TMW-128
MW-108	TMW-129
MW-109	TMW-130
MW-110	TMW-131
MW-110A	TMW-132
MW-111	TMW-139
MW-115A	TMW-140
MW-117A	TMW-141
MW-118A	TMW-142
MW-124A	TMW-143
MW-125	TMW-144
	TMW-145
	TMW-146

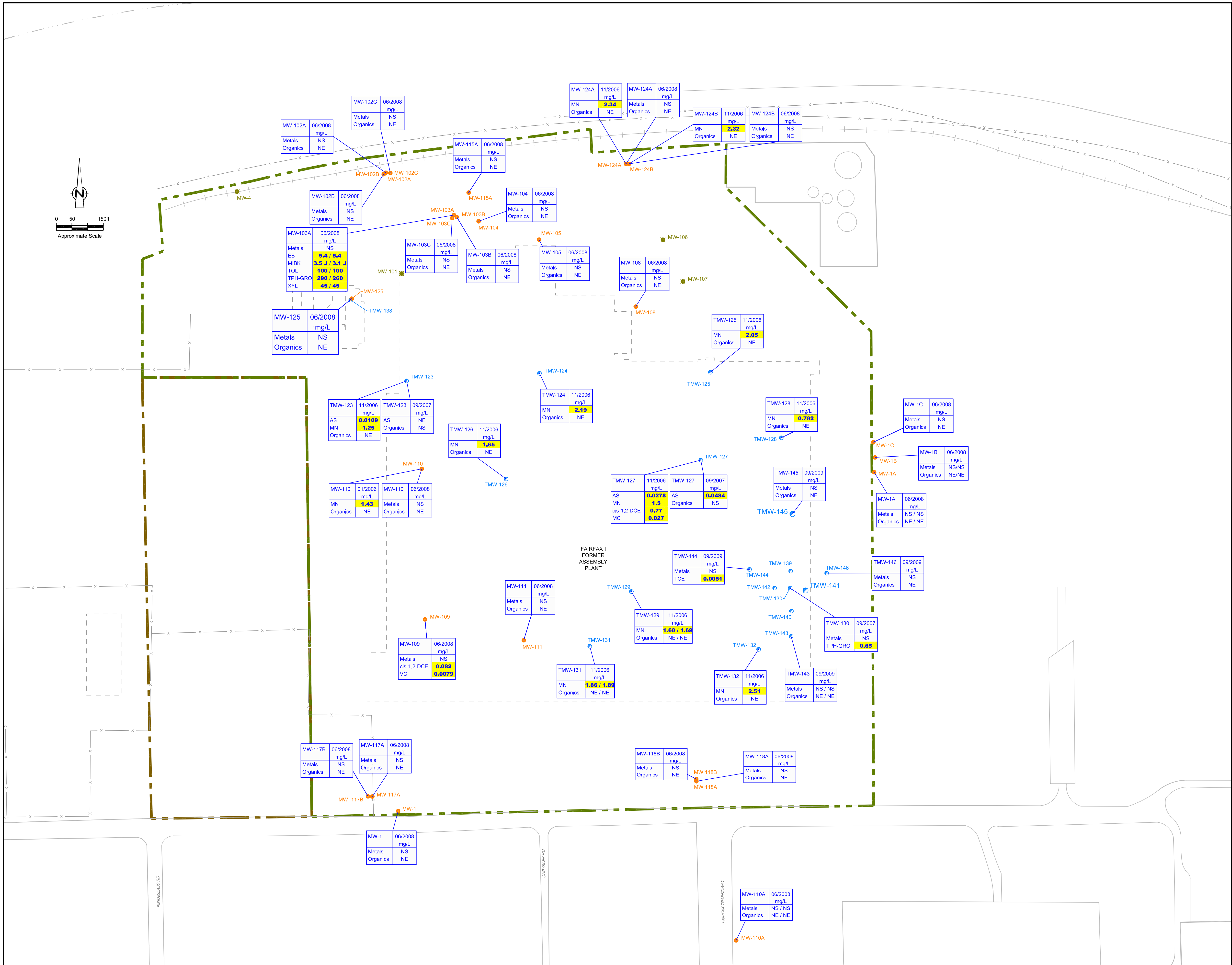
Notes:

The six new monitoring wells to be installed will also be sampled.

If LNAPL is encountered in a well, the well will not be sampled.

APPENDIX A

BACKGROUND INFORMATION



NO	Revision	Date	Initial

LEGEND:

- FORMER FAIRFAX I PROPERTY BOUNDARY (MLC PROPERTY ID 1289-1)
- TRACT 2 PARCEL BOUNDARY (MLC PROPERTY ID 1289-2)
- FORMER BUILDING STRUCTURE
- FORMER FENCE LINE
- FORMER RAILROAD TRACKS
- MONITORING WELL LOCATION AND IDENTIFIER
- TEMPORARY MONITORING WELL LOCATION AND IDENTIFIER
- FORMER MONITORING WELL LOCATION AND IDENTIFIER

SAMPLE IDENTIFIER

SAMPLE DATE
RESULT UNIT MILLIGRAMS/LITER
SAMPLE RESULT/DUPLICATE SAMPLE RESULT
DETECTED ANALYTE

NO EXCEEDENCES
NE
NS
NOT SAMPLED
ESTIMATED VALUE
YELLOW SHADING INDICATES AN EXCEEDENCE OF ANY KDHE TIER 2 CRITERIA

TPH-GRO
B(b)F
Benz(b)fluoranthene
B(k)F
Benzo(k)fluoranthene
D(ah)A
Dibenzo(a,h)anthracene
I(123-CD)P
Indeno(1,2,3-cd)pyrene
MBK
4-Methyl-2-Pentanone (Methyl Isobutyl Ketone)
cis-1,2-DCE
EB
Ethylbenzene
MC
Methylene chloride
TOL
Toluene
TCE
Trichloroethene
VC
Vinyl chloride
XYL
Xylene (total)
AS
Arsenic
MN
Manganese

NOTES:
TMW-138 WAS ONLY SAMPLED FOR PCE, WITH NO EXCEEDENCES
TMW-138 THROUGH TMW-142 WERE NOT SAMPLED

SCALE VERIFICATION

THIS BAR MEASURES 1" ON ORIGINAL. ADJUST SCALE ACCORDINGLY.

Approved		

DRAWING STATUS		

**FORMER FAIRFAX I PLANT
KANSAS CITY, KANSAS**

FORMER FAIRFAX I PLANT

**SUMMARY OF EXCEEDENCES IN GROUNDWATER-
MOST RECENT SAMPLING DATA FOR EACH LOCATION**

CONESTOGA-ROVERS & ASSOCIATES

Source Reference:

Project Manager: P. HARVEY	Reviewed By: K. DUWAL	Date: DATE
Scale: 1:200	Project N°: 012559-04-202080	Report N°: 021
		Drawing N°: figure A.2

TABLE A.1

SUMMARY OF SOIL DETECTED ANALYTICAL DATA
S-8 AREA
FORMER FAIRFAX I SITE
KANSAS CITY, KANSAS

<i>Sample Location</i> <i>Sample ID</i> <i>Sample Date</i> <i>Sample Depth</i> <i>Sample Type</i>		<i>KDHE Tier 2 Risk-Based Criteria</i>				<i>SB-113</i>
		<i>Non-Residential</i>		<i>Residential</i>		<i>S-122104-DS-120</i>
		<i>Soil Pathway</i>	<i>Soil to GW</i>	<i>Soil Pathway</i>	<i>Soil to GW</i>	<i>12/21/2004</i>
						<i>(10-12) ft BGS</i>
	<i>Units</i>	<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>	
<i>Metals</i>						
Aluminum	mg/kg	NC	NC	NC	NC	1520
Arsenic	mg/kg	38	NC	11	NC	2.3
Barium	mg/kg	140000	NC	5500	NC	50.1
Calcium	mg/kg	NC	NC	NC	NC	4250 J
Chromium	mg/kg	4000	NC	390	NC	3.4 J
Cobalt	mg/kg	NC	NC	NC	NC	2.6 J
Copper	mg/kg	76000	NC	2900	NC	1.6 J
Iron	mg/kg	NC	NC	NC	NC	4400
Lead	mg/kg	1000	NC	400	NC	2.9
Magnesium	mg/kg	NC	NC	NC	NC	1850
Manganese	mg/kg	95000	NC	3600	NC	81.6
Nickel	mg/kg	41000	NC	1600	NC	6.7 J
Potassium	mg/kg	NC	NC	NC	NC	329 J
Vanadium	mg/kg	14000	NC	550	NC	6.1
Zinc	mg/kg	610000	NC	23000	NC	13.3
<i>Semivolatile Organic Compounds</i>						ND
<i>Volatile Organic Compounds</i>						
Acetone	mg/kg	6200	3.8	1700	1.1	0.0033 J
Methylene chloride	mg/kg	230	0.03	150	0.03	0.0083
Tetrachloroethene	mg/kg	140	0.18	79	0.18	0.0026 J
Toluene	mg/kg	1000	40	930	40	0.00061 J

Notes:

ND () - Not present at or above the associated value

J - Estimated concentration

NC - No Criteria

ft BGS - feet below ground surface

mg/kg - milligrams per kilogram

Risk Based Standards for Kansas, RSK Manual - 4th Version, Kansas Department of Health and Environment, June 2007, Appendix A

TABLE A.2

SUMMARY OF SOIL DETECTED ANALYTICAL DATA
SB-110 AREA
FORMER FAIRFAX I SITE
KANSAS CITY, KANSAS

Sample Location		KDHE Tier 2 Risk-Based Criteria				SB-108	SB-109	SB-110	SB-118	SB-119	SB-120	SB-121	SB-122	SB-122	SB-137
Sample ID		Non-Residential		Residential		S-122004-DS-115	S-122004-DS-116	S-122004-DS-117	S-012559-122005-SC-006	S-012559-121505-SC-001	S-012559-121505-SC-002	S-012559-122005-SC-003	S-012559-122005-SC-004	S-012559-122005-SC-005	SB137 14-15
Sample Date		Soil Pathway	Soil to GW	Soil Pathway	Soil to GW	12/20/2004	12/20/2004	12/20/2004	12/20/2005	12/15/2005	12/15/2005	12/20/2005	12/20/2005	12/20/2005	11/6/2006
Sample Depth						(10-12) ft BGS	(10-12) ft BGS	(10-12) ft BGS	(9-10) ft BGS	(10-12) ft BGS	(10-12) ft BGS	(9-10) ft BGS	(9-10) ft BGS	(9-10) ft BGS	(14-15) ft BGS
Sample Type		a	b	c	d	Duplicate									
Units															
Metals															
Aluminum	mg/kg	NC	NC	NC	NC	5660	5690	7340	--	--	--	--	--	--	--
Arsenic	mg/kg	38	NC	11	NC	5.3	3.9	4.6	--	--	--	--	--	--	--
Barium	mg/kg	140000	NC	5500	NC	183	205	208	--	--	--	--	--	--	--
Beryllium	mg/kg	4100	NC	160	NC	0.17 J	0.14 J	0.21 J	--	--	--	--	--	--	--
Calcium	mg/kg	NC	NC	NC	NC	13000	21200	20200	--	--	--	--	--	--	--
Chromium	mg/kg	4000	NC	390	NC	10.3	10.7	12.3	--	--	--	--	--	--	--
Cobalt	mg/kg	NC	NC	NC	NC	4.8 J	6.7 J	6.8 J	--	--	--	--	--	--	--
Copper	mg/kg	76000	NC	2900	NC	11.8	12.3	18.2	--	--	--	--	--	--	--
Iron	mg/kg	NC	NC	NC	NC	9460 J	12900 J	12200 J	--	--	--	--	--	--	--
Lead	mg/kg	1000	NC	400	NC	9.0	9.3	10.5	--	--	--	--	--	--	--
Magnesium	mg/kg	NC	NC	NC	NC	3810	8270	7500	--	--	--	--	--	--	--
Manganese	mg/kg	95000	NC	3600	NC	247	274	277	--	--	--	--	--	--	--
Mercury	mg/kg	20	NC	2	NC	0.013 J	0.0099 J	0.016 J	--	--	--	--	--	--	--
Nickel	mg/kg	41000	NC	1600	NC	12.4	16.9	17.0	--	--	--	--	--	--	--
Potassium	mg/kg	NC	NC	NC	NC	1160	1530	2110	--	--	--	--	--	--	--
Selenium	mg/kg	10000	NC	390	NC	0.43 J	ND(0.68)	ND(0.69)	--	--	--	--	--	--	--
Sodium	mg/kg	NC	NC	NC	NC	267 J	121 J	176 J	--	--	--	--	--	--	--
Vanadium	mg/kg	14000	NC	550	NC	16.6	18.8	19.6	--	--	--	--	--	--	--
Zinc	mg/kg	610000	NC	23000	NC	38.5	47.7	51.5	--	--	--	--	--	--	--
Semivolatile Organic Compounds															
2,4-Dimethylphenol	mg/kg	14000	81	1300	13	ND(0.39)	ND(0.45)	0.048 J	--	--	--	--	--	--	--
Volatile Organic Compounds															
Acetone	mg/kg	6200	3.8	1700	1.1	ND(0.018)	0.0092 J	ND(0.025)	--	--	--	--	--	--	--
Tetrachloroethene	mg/kg	140	0.18	79	0.18	ND(0.0046)	ND(0.0065)	0.19 ^{bd}	ND(0.29)	0.45 ^{bd}	0.034	0.15	ND(0.27)	ND(0.27)	0.024
Toluene	mg/kg	1000	40	930	40	0.0025 J	ND(0.0065)	0.00091 J	--	--	--	--	--	--	--
Trichloroethene	mg/kg	98	0.20	62	0.20	ND(0.0046)	ND(0.0065)	0.001 J	--	--	--	--	--	--	--
Xylene (total)	mg/kg	700	700	700	700	0.0081 J	ND(0.013)	ND(0.013)	--	--	--	--	--	--	--

Notes:
ND () - Not present at or above the associated value
J - Estimated concentration
UJ - Estimated reporting limit
NC - No Criteria
--: Not Analyzed
ft BGS - feet below ground surface
mg/kg - milligrams per kilogram
Risk Based Standards for Kansas, RSK Manual - 4th Version, Kansas Department of Health and Environment, June 2007, Appendix A
Shading denotes exceedence of the criteria

TABLE A.3

**SUMMARY OF GROUNDWATER DETECTED ANALYTICAL DATA
SB-110 AREA
FORMER FAIRFAX I SITE
KANSAS CITY, KANSAS**

<i>Sample Location</i>		<i>KDHE Tier 2 Risk-Based Criteria</i>		<i>MW-125</i>	<i>MW-125</i>	<i>MW-125</i>	<i>MW-125</i>	<i>TMW-138</i>
<i>Sample ID</i>		<i>Non-Residential</i>	<i>Residential</i>	<i>WG-110107-JH-001</i>	<i>GW-120607-JH-032</i>	<i>GW-031208-JH-015</i>	<i>GW-062508-JH-014</i>	<i>GW112806GC010</i>
<i>Sample Date</i>		<i>WG Pathway</i>	<i>WG Pathway</i>	<i>11/1/2007</i>	<i>12/6/2007</i>	<i>3/12/2008</i>	<i>6/25/2008</i>	<i>11/28/2006</i>
<i>Sample Type</i>	<i>Units</i>							
Total Petroleum Hydrocarbons		a	b	ND	ND	ND	ND	ND
<i>Volatile Organic Compounds</i>								
Bromodichloromethane	mg/L	0.08	0.08	0.00017 J	ND(0.001)	ND(0.001)	ND(0.001)	--
Chloroform (Trichloromethane)	mg/L	0.08	0.08	0.00033 J	ND(0.001)	ND(0.001)	ND(0.001)	--
cis-1,2-Dichloroethene	mg/L	0.07	0.07	ND(0.0005)	0.00048 J	ND(0.0005)	ND(0.0005)	--
Tetrachloroethene	mg/L	0.005	0.005	ND(0.001)	0.00047 J	ND(0.001)	ND(0.001)UJ	0.00032 J

Notes:

ND () - Not present at or above the associated value.

--: Not Analyzed

mg/L - milligrams per liter

Risk Based Standards for Kansas, RSK Manual - 4th Version, Kansas Department of Health and Environment, June 2007, Appendix A

TABLE A.4

**SUMMARY OF SOIL DETECTED ANALYTICAL DATA
TMW-127AREA
FORMER FAIRFAX I SITE
KANSAS CITY, KANSAS**

<i>Sample Location</i>		<i>KDHE Tier 2 Risk-Based Criteria</i>				<i>SB-127</i>	<i>SB-127A</i>
<i>Sample ID</i>		<i>Non-Residential</i>		<i>Residential</i>		<i>SB-127 27.5-30'</i>	<i>S11806KGSB127A27.5-30</i>
<i>Sample Date</i>		<i>Soil Pathway</i>	<i>Soil to GW</i>	<i>Soil Pathway</i>	<i>Soil to GW</i>	<i>11/3/2006</i>	<i>11/8/2006</i>
<i>Sample Depth</i>						<i>(27.5-30) ft BGS</i>	<i>(27.5-30) ft BGS</i>
<i>Sample Type</i>		<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>		
	<i>Units</i>						
<i>Metals</i>							
Aluminum	mg/kg	NC	NC	NC	NC	796	--
Arsenic	mg/kg	38	NC	11	NC	1.4 J	--
Barium	mg/kg	140000	NC	5500	NC	15.0 J	--
Calcium	mg/kg	NC	NC	NC	NC	2360	--
Chromium	mg/kg	4000	NC	390	NC	2.0	--
Cobalt	mg/kg	NC	NC	NC	NC	1.8 J	--
Copper	mg/kg	76000	NC	2900	NC	0.98 J	--
Iron	mg/kg	NC	NC	NC	NC	2190	--
Lead	mg/kg	1000	NC	400	NC	1.7 J	--
Magnesium	mg/kg	NC	NC	NC	NC	835	--
Manganese	mg/kg	95000	NC	3600	NC	30.5	--
Nickel	mg/kg	41000	NC	1600	NC	4.1 J	--
Potassium	mg/kg	NC	NC	NC	NC	201 J	--
Vanadium	mg/kg	14000	NC	550	NC	3.1 J	--
Zinc	mg/kg	610000	NC	23000	NC	8.9 J	--
<i>Semivolatile Organic Compounds</i>							
Pyrene	mg/kg	140	140	140	140	0.018 J	--
<i>Volatile Organic Compounds</i>							ND

Notes:

ND () - Not present at or above the associated value

J - Estimated concentration

--: Not Analyzed

ft BGS - feet below ground surface

mg/kg - milligrams per kilogram

Risk Based Standards for Kansas, RSK Manual - 4th Version, Kansas Department of Health and Environment, June 2007, Appendix A

TABLE A.5

**SUMMARY OF GROUNDWATER DETECTED ANALYTICAL DATA
TMW-127 AREA
FORMER FAIRFAX I SITE
KANSAS CITY, KANSAS**

<i>Sample Location</i>		<i>KDHE Tier 2 Risk-Based Criteria</i>		<i>TMW-127</i>	<i>TMW-127</i>
<i>Sample ID</i>		<i>Non-Residential</i>	<i>Residential</i>	<i>GW112706GC003</i>	<i>GW-091407-NT-002</i>
<i>Sample Date</i>		<i>WG Pathway</i>	<i>WG Pathway</i>	<i>11/27/2006</i>	<i>9/14/2007</i>
	<i>Units</i>	<i>a</i>	<i>b</i>		
<i>Metals</i>					
Aluminum	mg/L	NC	NC	5.46	--
Arsenic	mg/L	0.01	0.01	0.0278 ^{ab}	0.0484 ^{ab}
Arsenic (dissolved)	mg/L	0.01	0.01	--	ND(0.01)
Barium	mg/L	2.0	2.0	0.302	--
Calcium	mg/L	NC	NC	142	--
Chromium	mg/L	0.1	0.1	0.0094 J	--
Cobalt	mg/L	NC	NC	0.0037 J	--
Copper	mg/L	1.3	1.3	0.0087 J	--
Iron	mg/L	NC	NC	23	--
Lead	mg/L	0.015	0.015	0.007	--
Magnesium	mg/L	NC	NC	38.1	--
Manganese	mg/L	0.05	0.05	1.5 ^{ab}	--
Potassium	mg/L	NC	NC	8.98	--
Sodium	mg/L	NC	NC	45.8	--
Vanadium	mg/L	0.71	0.11	0.0159 J	--
<i>Semivolatile Organic Compounds</i>				ND	ND
<i>Volatile Organic Compounds</i>					
Chloromethane (Methyl chloride)	mg/L	0.04	0.02	0.0044	--
cis-1,2-Dichloroethene	mg/L	0.07	0.07	0.77 ^{ab}	--
Methylene chloride	mg/L	0.005	0.005	0.027 ^{ab}	--
trans-1,2-Dichloroethene	mg/L	0.1	0.1	0.0057	--

Notes:

ND () - Not present at or above the associated value

NC - No Criteria

J - Estimated concentration

--: Not Analyzed

UJ - Estimated reporting limit

mg/L - milligrams per liter

Risk Based Standards for Kansas, RSK Manual - 4th Version, Kansas Department of Health and Environment, June 2007, Appendix A

Shading denotes exceedence of the criteria

SUMMARY OF SOIL DETECTED ANALYTICAL DATA
MW-103A AREA
FORMER FAIRFAX I SITE
KANSAS CITY, KANSAS

Sample Location	KDHE Tier 2 Risk-Based Criteria				SB-28	SB-28	SB-29	SB-29	SB-30	SB-30
Sample ID	Non-Residential		Residential		S-051199-PK-001	S-051199-PK-002	S-051199-PK-003	S-051199-PK-004	S-051199-PK-005	S-051199-PK-006
Sample Date	Soil Pathway	Soil to GW	Soil Pathway	Soil to GW	5/11/1999	5/11/1999	5/11/1999	5/11/1999	5/11/1999	5/11/1999
Sample Depth					(5-7) ft BGS	(10-12) ft BGS	(5-7) ft BGS	(10-12) ft BGS	(5-7) ft BGS	(10-12) ft BGS
Sample Type	a	b	c	d						
	Units									
Volatile Organic Compounds										
1,2-Dichloroethene (total)	mg/kg	NC	NC	NC	NC	ND(0.005)	ND(0.005)	ND(0.005)	ND(0.005)	ND(0.005)
2-Butanone (Methyl ethyl ketone) (MEK)	mg/kg	21000	12	6400	3.6	ND(0.02)	ND(0.02)	ND(0.02)	ND(0.02)	ND(0.02)
4-Methyl-2-pentanone (Methyl isobutyl ketone) (MIBK)	mg/kg	3600	1.4	1000	0.41	ND(0.01)	ND(0.01)	ND(0.01)	ND(0.01)	ND(0.01)
Acetone	mg/kg	6200	3.8	1700	1.1	ND(0.1)	ND(0.1)	ND(0.1)	ND(0.1)	ND(0.1)
Benzene	mg/kg	17	0.08	9.8	0.08	ND(0.005)	ND(0.005)	ND(0.005)	ND(0.005)	ND(0.005)
Carbon disulfide	mg/kg	950	0.45	460	0.14	ND(0.005)	ND(0.005)	ND(0.005)	ND(0.005)	ND(0.005)
cis-1,2-Dichloroethene	mg/kg	180	0.80	57	0.80	ND(0.005)	ND(0.005)	ND(0.005)	ND(0.005)	ND(0.005)
Ethylbenzene	mg/kg	650	55	650	55	ND(0.005)	1.1	0.31	0.01	ND(0.005)
Tetrachloroethene	mg/kg	140	0.18	79	0.18	ND(0.005)	ND(0.005)	ND(0.005)	ND(0.005)	0.012
Toluene	mg/kg	1000	40	930	40	ND(0.005)	ND(0.005)	ND(0.005)	ND(0.005)	ND(0.005)
Xylene (total)	mg/kg	700	700	700	700	ND(0.005)	5.8	0.91	ND(0.005)	ND(0.005)

SUMMARY OF SOIL DETECTED ANALYTICAL DATA
MW-103A AREA
FORMER FAIRFAX I SITE
KANSAS CITY, KANSAS

Sample Location	KDHE Tier 2 Risk-Based Criteria				SB-31	SB-31	SB-32	SB-32	SB-33	SB-33
Sample ID	Non-Residential		Residential		S-051199-PK-007	S-051199-PK-008	S-051199-PK-009	S-051199-PK-010	S-051199-PK-011	S-051199-PK-012
Sample Date	Soil Pathway	Soil to GW	Soil Pathway	Soil to GW	5/11/1999	5/11/1999	5/11/1999	5/11/1999	5/11/1999	5/11/1999
Sample Depth					(5-7) ft BGS	(10-12) ft BGS	(5-7) ft BGS	(10-12) ft BGS	(5-7) ft BGS	(10-12) ft BGS
Sample Type	a	b	c	d						
	Units									
Volatile Organic Compounds										
1,2-Dichloroethene (total)	mg/kg	NC	NC	NC	NC	ND(0.005)	ND(0.005)	ND(0.005)	ND(0.005)	ND(0.005)
2-Butanone (Methyl ethyl ketone) (MEK)	mg/kg	21000	12	6400	3.6	ND(0.02)	ND(0.02)	ND(0.02)	ND(0.02)	ND(0.02)
4-Methyl-2-pentanone (Methyl isobutyl ketone) (MIBK)	mg/kg	3600	1.4	1000	0.41	ND(0.01)	ND(0.01)	ND(0.01)	ND(0.01)	ND(0.01)
Acetone	mg/kg	6200	3.8	1700	1.1	ND(0.1)	ND(0.1)	ND(0.1)	ND(0.1)	ND(0.1)
Benzene	mg/kg	17	0.08	9.8	0.08	ND(0.005)	ND(0.005)	ND(0.005)	ND(0.005)	ND(0.005)
Carbon disulfide	mg/kg	950	0.45	460	0.14	ND(0.005)	ND(0.005)	ND(0.005)	ND(0.005)	ND(0.005)
cis-1,2-Dichloroethene	mg/kg	180	0.80	57	0.80	ND(0.005)	ND(0.005)	ND(0.005)	ND(0.005)	ND(0.005)
Ethylbenzene	mg/kg	650	55	650	55	ND(0.005)	0.033	ND(0.005)	ND(0.005)	ND(0.005)
Tetrachloroethene	mg/kg	140	0.18	79	0.18	ND(0.005)	ND(0.005)	ND(0.005)	ND(0.005)	ND(0.005)
Toluene	mg/kg	1000	40	930	40	ND(0.005)	ND(0.005)	ND(0.005)	ND(0.005)	ND(0.005)
Xylene (total)	mg/kg	700	700	700	700	ND(0.005)	ND(0.005)	ND(0.005)	ND(0.005)	ND(0.005)

SUMMARY OF SOIL DETECTED ANALYTICAL DATA
MW-103A AREA
FORMER FAIRFAX I SITE
KANSAS CITY, KANSAS

Sample Location		KDHE Tier 2 Risk-Based Criteria				SB-34	SB-34	SB-35	SB-35	SB-36	SB-36
Sample ID		Non-Residential		Residential		S-051199-PK-013	S-051199-PK-014	S-051199-PK-015	S-051199-PK-016	S-051199-PK-017	S-051199-PK-018
Sample Date		Soil Pathway	Soil to GW	Soil Pathway	Soil to GW	5/11/1999	5/11/1999	5/11/1999	5/11/1999	5/11/1999	5/11/1999
Sample Depth						(5-7) ft BGS	(10-12) ft BGS	(5-7) ft BGS	(10-12) ft BGS	(7-9) ft BGS	(10-12) ft BGS
Sample Type		a	b	c	d						
	Units										
Volatile Organic Compounds											
1,2-Dichloroethene (total)	mg/kg	NC	NC	NC	NC	ND(0.005)	ND(0.005)	ND(0.006)	ND(0.005)	ND(0.005)	ND(0.005)
2-Butanone (Methyl ethyl ketone) (MEK)	mg/kg	21000	12	6400	3.6	ND(0.02)	ND(0.02)	ND(0.022)	ND(0.02)	ND(0.02)	ND(0.02)
4-Methyl-2-pentanone (Methyl isobutyl ketone) (MIBK)	mg/kg	3600	1.4	1000	0.41	ND(0.01)	ND(0.01)	ND(0.011)	ND(0.01)	ND(0.01)	ND(0.01)
Acetone	mg/kg	6200	3.8	1700	1.1	ND(0.1)	ND(0.1)	ND(0.11)	ND(0.1)	ND(0.1)	ND(0.1)
Benzene	mg/kg	17	0.08	9.8	0.08	ND(0.005)	ND(0.005)	ND(0.006)	ND(0.005)	ND(0.005)	ND(0.005)
Carbon disulfide	mg/kg	950	0.45	460	0.14	ND(0.005)	ND(0.005)	ND(0.006)	ND(0.005)	ND(0.005)	ND(0.005)
cis-1,2-Dichloroethene	mg/kg	180	0.80	57	0.80	ND(0.005)	ND(0.005)	ND(0.006)	ND(0.005)	ND(0.005)	ND(0.005)
Ethylbenzene	mg/kg	650	55	650	55	ND(0.005)	ND(0.005)	ND(0.006)	ND(0.005)	ND(0.005)	ND(0.005)
Tetrachloroethene	mg/kg	140	0.18	79	0.18	ND(0.005)	ND(0.005)	ND(0.006)	ND(0.005)	0.006	ND(0.005)
Toluene	mg/kg	1000	40	930	40	ND(0.005)	ND(0.005)	ND(0.006)	ND(0.005)	ND(0.005)	ND(0.005)
Xylene (total)	mg/kg	700	700	700	700	ND(0.005)	ND(0.005)	ND(0.006)	ND(0.005)	ND(0.005)	ND(0.005)

SUMMARY OF SOIL DETECTED ANALYTICAL DATA
MW-103A AREA
FORMER FAIRFAX I SITE
KANSAS CITY, KANSAS

Sample Location	KDHE Tier 2 Risk-Based Criteria				SB-37	SB-37	SB-38	SB-38	SB-39	SB-39
Sample ID	Non-Residential		Residential		S-051199-PK-019	S-051199-PK-020	S-051199-PK-021	S-051199-PK-022	S-051299-PK-023	S-051299-PK-024
Sample Date	Soil Pathway	Soil to GW	Soil Pathway	Soil to GW	5/11/1999	5/11/1999	5/11/1999	5/11/1999	5/12/1999	5/12/1999
Sample Depth					(5-7) ft BGS	(10-12) ft BGS	(5-7) ft BGS	(10-12) ft BGS	(5-7) ft BGS	(10-12) ft BGS
Sample Type	a	b	c	d						
	Units									
Volatile Organic Compounds										
1,2-Dichloroethene (total)	mg/kg	NC	NC	NC	NC	ND(0.005)	ND(0.005)	ND(0.005)	ND(0.005)	ND(0.005)
2-Butanone (Methyl ethyl ketone) (MEK)	mg/kg	21000	12	6400	3.6	ND(0.02)	ND(0.02)	ND(0.02)	ND(0.02)	ND(0.02)
4-Methyl-2-pentanone (Methyl isobutyl ketone) (MIBK)	mg/kg	3600	1.4	1000	0.41	ND(0.01)	ND(0.01)	ND(0.01)	ND(0.01)	ND(0.01)
Acetone	mg/kg	6200	3.8	1700	1.1	ND(0.1)	ND(0.1)	ND(0.1)	ND(0.1)	ND(0.1)
Benzene	mg/kg	17	0.08	9.8	0.08	ND(0.005)	ND(0.005)	ND(0.005)	0.022	ND(0.005)
Carbon disulfide	mg/kg	950	0.45	460	0.14	ND(0.005)	ND(0.005)	ND(0.005)	ND(0.005)	ND(0.005)
cis-1,2-Dichloroethene	mg/kg	180	0.80	57	0.80	ND(0.005)	ND(0.005)	ND(0.005)	ND(0.005)	ND(0.005)
Ethylbenzene	mg/kg	650	55	650	55	ND(0.005)	ND(0.005)	ND(0.005)	1.1	ND(0.005)
Tetrachloroethene	mg/kg	140	0.18	79	0.18	ND(0.005)	ND(0.005)	ND(0.005)	ND(0.005)	ND(0.005)
Toluene	mg/kg	1000	40	930	40	ND(0.005)	ND(0.005)	ND(0.005)	ND(0.005)	ND(0.005)
Xylene (total)	mg/kg	700	700	700	700	ND(0.005)	ND(0.005)	ND(0.005)	5.8	ND(0.005)

TABLE A.6

SUMMARY OF SOIL DETECTED ANALYTICAL DATA
MW-103A AREA
FORMER FAIRFAX I SITE
KANSAS CITY, KANSAS

Sample Location		KDHE Tier 2 Risk-Based Criteria				SB-40	SB-40	SB-41	SB-41	SB-42	SB-42
Sample ID		Non-Residential		Residential		S-051299-PK-025	S-051299-PK-026	S-051299-PK-027	S-051299-PK-028	S-051299-PK-029	S-051299-PK-030
Sample Date		Soil Pathway	Soil to GW	Soil Pathway	Soil to GW	5/12/1999	5/12/1999	5/12/1999	5/12/1999	5/12/1999	5/12/1999
Sample Depth						(5-7) ft BGS	(10-12) ft BGS	(5-7) ft BGS	(10-12) ft BGS	(5-7) ft BGS	(10-12) ft BGS
Sample Type		a	b	c	d						
Volatile Organic Compounds		Units									
1,2-Dichloroethene (total)	mg/kg	NC	NC	NC	NC	ND(0.005)	ND(0.005)	ND(0.005)	ND(0.005)	ND(0.005)	0.008 J
2-Butanone (Methyl ethyl ketone) (MEK)	mg/kg	21000	12	6400	3.6	ND(0.02)	ND(0.02)	ND(0.02)	ND(0.02)	ND(0.02)	22 ^{bd}
4-Methyl-2-pentanone (Methyl isobutyl ketone) (MIBK)	mg/kg	3600	1.4	1000	0.41	ND(0.01)	ND(0.01)	ND(0.01)	ND(0.01)	ND(0.01)	410 ^{bd}
Acetone	mg/kg	6200	3.8	1700	1.1	ND(0.1)	ND(0.1)	0.13	ND(0.1)	ND(0.1)	190 J ^{bd}
Benzene	mg/kg	17	0.08	9.8	0.08	0.095 J ^{bd}	0.033	ND(0.005)	0.018	0.072 J	4.7 J ^{bd}
Carbon disulfide	mg/kg	950	0.45	460	0.14	ND(0.005)	ND(0.005)	ND(0.005)	ND(0.005)	ND(0.005)	ND(0.005)UJ
cis-1,2-Dichloroethene	mg/kg	180	0.80	57	0.80	ND(0.005)	ND(0.005)	ND(0.005)	ND(0.005)	ND(0.005)	0.007 J
Ethylbenzene	mg/kg	650	55	650	55	18	19	6.4 J	4.6	2.3	890 ^{abcd}
Tetrachloroethene	mg/kg	140	0.18	79	0.18	ND(0.005)	ND(0.005)	ND(0.005)	ND(0.005)	ND(0.005)	ND(0.005)UJ
Toluene	mg/kg	1000	40	930	40	64 ^{bd}	2.8 J	9.5 J	13	1	2300 ^{abcd}
Xylene (total)	mg/kg	700	700	700	700	180	120	32	87	11	4700 ^{abcd}

SUMMARY OF SOIL DETECTED ANALYTICAL DATA
MW-103A AREA
FORMER FAIRFAX I SITE
KANSAS CITY, KANSAS

Sample Location		KDHE Tier 2 Risk-Based Criteria				SB-43	SB-43	SB-44	SB-44	SB-45	SB-45
Sample ID		Non-Residential		Residential		S-051299-PK-031	S-051299-PK-032	S-051299-PK-033	S-051299-PK-034	S-051299-PK-035	S-051299-PK-036
Sample Date		Soil Pathway	Soil to GW	Soil Pathway	Soil to GW	5/12/1999	5/12/1999	5/12/1999	5/12/1999	5/12/1999	5/12/1999
Sample Depth						(5-7) ft BGS	(10-12) ft BGS	(5-7) ft BGS	(10-12) ft BGS	(5-7) ft BGS	(10-12) ft BGS
Sample Type		a	b	c	d						
		Units									
Volatile Organic Compounds											
1,2-Dichloroethene (total)	mg/kg	NC	NC	NC	NC	ND(0.006)	ND(0.005)	ND(0.005)	ND(0.005)	ND(0.005)	ND(0.005)
2-Butanone (Methyl ethyl ketone) (MEK)	mg/kg	21000	12	6400	3.6	ND(0.022)	ND(0.02)	ND(0.02)	ND(0.02)	ND(0.02)	ND(0.02)
4-Methyl-2-pentanone (Methyl isobutyl ketone) (MIBK)	mg/kg	3600	1.4	1000	0.41	0.93 ^d	0.21	ND(0.01)	0.039	ND(0.01)	ND(0.01)
Acetone	mg/kg	6200	3.8	1700	1.1	0.33	ND(0.1)	ND(0.1)	ND(0.1)	0.1	ND(0.1)
Benzene	mg/kg	17	0.08	9.8	0.08	ND(0.006)	0.084 ^{bd}	ND(0.005)	ND(0.005)	ND(0.005)	ND(0.005)
Carbon disulfide	mg/kg	950	0.45	460	0.14	ND(0.006)	ND(0.005)	ND(0.005)	ND(0.005)	ND(0.005)	ND(0.005)
cis-1,2-Dichloroethene	mg/kg	180	0.80	57	0.80	ND(0.006)	ND(0.005)	ND(0.005)	ND(0.005)	ND(0.005)	ND(0.005)
Ethylbenzene	mg/kg	650	55	650	55	1.7	22	ND(0.005)	0.007	ND(0.005)	ND(0.005)
Tetrachloroethene	mg/kg	140	0.18	79	0.18	ND(0.006)	ND(0.005)	ND(0.005)	ND(0.005)	ND(0.005)	ND(0.005)
Toluene	mg/kg	1000	40	930	40	0.72	0.1 J	ND(0.005)	0.038	ND(0.005)	ND(0.005)
Xylene (total)	mg/kg	700	700	700	700	14	110	ND(0.005)	0.042	ND(0.005)	ND(0.005)

TABLE A.6

SUMMARY OF SOIL DETECTED ANALYTICAL DATA
MW-103A AREA
FORMER FAIRFAX I SITE
KANSAS CITY, KANSAS

Sample Location		KDHE Tier 2 Risk-Based Criteria				SB-46	SB-46	SB-47	SB-47
Sample ID		Non-Residential		Residential		S-051299-PK-037	S-051299-PK-038	S-051299-PK-039	S-051299-PK-040
Sample Date		Soil Pathway	Soil to GW	Soil Pathway	Soil to GW	5/12/1999	5/12/1999	5/12/1999	5/12/1999
Sample Depth						(5-7) ft BGS	(10-12) ft BGS	(5-7) ft BGS	(10-12) ft BGS
Sample Type		a	b	c	d				
		Units							
Volatile Organic Compounds									
1,2-Dichloroethene (total)		mg/kg	NC	NC	NC	ND(0.005)	ND(0.005)	ND(0.005)	ND(0.006)
2-Butanone (Methyl ethyl ketone) (MEK)		mg/kg	21000	12	6400	ND(0.02)	ND(0.02)	ND(0.021)	ND(0.024)
4-Methyl-2-pentanone (Methyl isobutyl ketone) (MIBK)		mg/kg	3600	1.4	1000	ND(0.01)	ND(0.011)	ND(0.01)	ND(0.012)
Acetone		mg/kg	6200	3.8	1700	ND(0.1)	0.24	ND(0.1)	ND(0.12)
Benzene		mg/kg	17	0.08	9.8	ND(0.005)	0.007	ND(0.005)	0.12 ^{bd}
Carbon disulfide		mg/kg	950	0.45	460	ND(0.005)	0.008	ND(0.005)	ND(0.006)
cis-1,2-Dichloroethene		mg/kg	180	0.80	57	ND(0.005)	ND(0.005)	ND(0.005)	ND(0.006)
Ethylbenzene		mg/kg	650	55	650	ND(0.005)	2.8 J	ND(0.005)	0.7
Tetrachloroethene		mg/kg	140	0.18	79	ND(0.005)	ND(0.005)	ND(0.005)	ND(0.006)
Toluene		mg/kg	1000	40	930	ND(0.005)	ND(0.005)	ND(0.005)	ND(0.006)
Xylene (total)		mg/kg	700	700	700	ND(0.005)	84	0.054	0.13

Notes:
ND () - Not present at or above the associated value
J - Estimated concentration
UJ - Estimated reporting limit
NC - No Criteria
--: Not Analyzed
ft BGS - feet below ground surface
mg/kg - milligrams per kilogram
Risk Based Standards for Kansas, RSK Manual - 4th Version, Kansas Department of Health and Environment, June 2007, Appendix A
Shading denotes exceedence of the criteria

SUMMARY OF GROUNDWATER DETECTED ANALYTICAL DATA
MW-103A AREA
FORMER FAIRFAX I SITE
KANSAS CITY, KANSAS

Sample Location	KDHE Tier 2 Risk-Based Criteria		MW-102A	MW-102A	MW-102A	MW-102A	MW-102A	MW-102A	MW-102A	MW-102A	MW-102A	MW-102A	MW-102A	MW-102A	MW-102A
Sample ID	Non-Residential	Residential	MW-102A	MW-102A	MW-102A	MW-102A	MW-102A	MW-102A	MW-102A	MW-102A	MW-102A	MW-102A	MW-102A	MW-102A	MW-102A
Sample Date	WG Pathway	WG Pathway	10/1/1988	6/1/1989	7/1/1989	11/1/1989	5/1/1990	11/1/1990	5/1/1991	11/1/1991	5/1/1992	11/1/1992	6/1/1993	11/1/1993	6/21/1994
Sample Type	Units														
Metals	a	b													
Arsenic	mg/L	0.01	0.01	0.007	--	--	--	--	--	--	--	--	--	--	--
Barium	mg/L	2.0	2.0	0.185	--	--	--	--	--	--	--	--	--	--	--
Beryllium	mg/L	0.004	0.004	ND(0.001)	--	--	--	--	--	--	--	--	--	--	--
Cadmium	mg/L	0.005	0.005	0.005	--	--	--	--	--	--	--	--	--	--	--
Calcium	mg/L	NC	NC	--	--	--	--	--	--	--	--	--	--	--	--
Calcium (dissolved)	mg/L	NC	NC	--	--	--	--	--	--	--	--	--	--	--	--
Chromium	mg/L	0.1	0.1	0.016	--	--	--	--	--	--	--	--	--	--	--
Cobalt	mg/L	NC	NC	--	--	--	--	--	--	--	--	--	--	--	--
Copper	mg/L	1.3	1.3	0.005	--	--	--	--	--	--	--	--	--	--	--
Iron	mg/L	NC	NC	--	--	--	--	--	--	--	--	--	--	--	--
Lead	mg/L	0.015	0.015	0.03 ^{ab}	--	--	--	--	--	--	--	--	--	--	--
Magnesium	mg/L	NC	NC	--	--	--	--	--	--	--	--	--	--	--	--
Magnesium (dissolved)	mg/L	NC	NC	--	--	--	--	--	--	--	--	--	--	--	--
Manganese	mg/L	0.05	0.05	--	--	--	--	--	--	--	--	--	--	--	--
Manganese (dissolved)	mg/L	0.05	0.05	--	--	--	--	--	--	--	--	--	--	--	--
Mercury	mg/L	0.002	0.002	0.0005	--	--	--	--	--	--	--	--	--	--	--
Nickel	mg/L	0.10	0.10	0.029	--	--	--	--	--	--	--	--	--	--	--
Potassium	mg/L	NC	NC	--	--	--	--	--	--	--	--	--	--	--	--
Selenium	mg/L	0.05	0.05	ND(0.001)	--	--	--	--	--	--	--	--	--	--	--
Silver	mg/L	0.1	0.1	0.003	--	--	--	--	--	--	--	--	--	--	--
Sodium	mg/L	NC	NC	--	--	--	--	--	--	--	--	--	--	--	--
Thallium	mg/L	NC	NC	0.031	--	--	--	--	--	--	--	--	--	--	--
Zinc	mg/L	5	5	0.08	--	--	--	--	--	--	--	--	--	--	--
Pesticides															
Aldrin	mg/L	0.0002	0.00005	--	--	--	--	--	--	--	--	--	--	--	--
Total Petroleum Hydrocarbons															
Total Petroleum Hydrocarbons - Purgeable (GRO)	mg/L	0.500	0.500	--	--	--	--	--	--	--	--	--	--	--	--
Semivolatile Organic Compounds															
2,4-Dimethylphenol	mg/L	1.8	0.28	--	--	--	--	--	--	--	--	--	--	--	--
2,6-Dinitrotoluene	mg/L	0.004	0.001	--	--	--	--	--	--	--	--	--	--	--	--
Acetophenone	mg/L	0.00006	0.00002	--	--	--	--	--	--	--	--	--	--	--	--
bis(2-Ethylhexyl)phthalate (DEHP)	mg/L	0.006	0.006	--	--	--	--	--	--	--	--	--	--	--	--

TABLE A.7

SUMMARY OF GROUNDWATER DETECTED ANALYTICAL DATA
MW-103A AREA
FORMER FAIRFAX I SITE
KANSAS CITY, KANSAS

Sample Location	KDHE Tier 2 Risk-Based Criteria		MW-102A	MW-102A	MW-102A	MW-102A	MW-102A	MW-102A	MW-102A	MW-102A	MW-102A	MW-102A	MW-102A	MW-102A	MW-102A
Sample ID	Non-Residential	Residential	MW-102A	MW-102A	MW-102A	MW-102A	MW-102A	MW-102A	MW-102A	MW-102A	MW-102A	MW-102A	MW-102A	MW-102A	MW-102A
Sample Date	WG Pathway	WG Pathway	10/1/1988	6/1/1989	7/1/1989	11/1/1989	5/1/1990	11/1/1990	5/1/1991	11/1/1991	5/1/1992	11/1/1992	6/1/1993	11/1/1993	6/21/1994
Sample Type															
	Units														
Volatile Organic Compounds															
1,2-Dichloroethene (total)	mg/L	NC	NC	--	--	--	--	--	--	--	--	--	--	--	ND(0.005)
2-Butanone (Methyl ethyl ketone) (MEK)	mg/L	2.8	0.82	ND(0.01)	--	--	--	--	--	--	--	--	--	--	--
4-Methyl-2-pentanone (Methyl isobutyl ketone) (MIBK)	mg/L	0.23	0.07	ND(0.01)	--	--	--	--	--	--	--	--	--	--	--
Acetone	mg/L	0.93	0.26	ND(0.005)	--	--	--	--	--	--	--	--	--	--	--
Benzene	mg/L	0.005	0.005	ND(0.005)	ND(0.005)	ND(0.005)	ND(0.005)	ND(0.005)	ND(0.005)	ND(0.005)	ND(0.005)	ND(0.005)	ND(0.005)	ND(0.005)	ND(0.005)
Carbon disulfide	mg/L	0.03	0.009	--	--	--	--	--	--	--	--	--	--	--	--
Chloroform (Trichloromethane)	mg/L	0.08	0.08	ND(0.005)	--	--	--	--	--	--	--	--	--	--	--
cis-1,2-Dichloroethene	mg/L	0.07	0.07	--	--	--	--	--	--	--	--	--	--	--	--
Dichloroethene	mg/L	NC	NC	ND(0.005)	--	ND(0.005)	ND(0.005)	ND(0.005)	ND(0.005)	ND(0.005)	ND(0.005)	ND(0.005)	ND(0.005)	ND(0.005)	--
Ethylbenzene	mg/L	0.7	0.7	ND(0.005)	ND(0.005)	ND(0.005)	ND(0.005)	ND(0.005)	ND(0.005)	ND(0.005)	ND(0.005)	ND(0.005)	ND(0.005)	ND(0.005)	ND(0.005)
Methylene chloride	mg/L	0.005	0.005	ND(0.01)	--	--	--	--	--	--	--	--	--	--	--
Tetrachloroethene	mg/L	0.005	0.005	ND(0.005)	--	--	--	--	--	--	--	--	--	--	--
Toluene	mg/L	1	1	ND(0.005)	ND(0.005)	ND(0.005)	ND(0.005)	ND(0.005)	ND(0.005)	ND(0.005)	ND(0.005)	ND(0.005)	ND(0.005)	ND(0.005)	ND(0.005)
Trichloroethene	mg/L	0.005	0.005	ND(0.005)	--	--	--	--	--	--	--	--	--	--	--
Xylene (total)	mg/L	10	10	ND(0.005)	ND(0.005)	ND(0.005)	ND(0.005)	ND(0.005)	ND(0.005)	ND(0.005)	ND(0.005)	ND(0.005)	ND(0.005)	ND(0.005)	ND(0.005)
General Chemistry															
Aerobic BTEX specific microbial population	cfu/mL	NC	NC	--	--	--	--	--	--	--	--	--	--	--	--
Nitrate (as N)	mg/L	NC	NC	--	--	--	--	--	--	--	--	--	--	--	--
Total heterotropic bacteria	cfu/mL	NC	NC	--	--	--	--	--	--	--	--	--	--	--	--
Total organic carbon (TOC)	mg/L	NC	NC	--	--	--	--	--	--	--	--	--	--	--	--

TABLE A.7

SUMMARY OF GROUNDWATER DETECTED ANALYTICAL DATA
MW-103A AREA
FORMER FAIRFAX I SITE
KANSAS CITY, KANSAS

Sample Location		KDHE Tier 2 Risk-Based Criteria		MW-102A	MW-102A	MW-102A	MW-102A	MW-102A	MW-102A	MW-103A	MW-103A	MW-103A	MW-103A
Sample ID		Non-Residential	Residential	GW-051299-JH-102	GW-062706-JH-014	GW-091207-NT-020	GW-120507-JH-014	GW-031208-JH-016	GW-062408-JH-010	MW-103A	MW-103A	MW-103A	MW-103A
Sample Date		WG Pathway	WG Pathway	5/12/1999	6/27/2006	9/12/2007	12/5/2007	3/12/2008	6/24/2008	10/1/1988	6/1/1989	7/1/1989	11/1/1989
Sample Type													
		Units											
Metals		a	b										
Arsenic	mg/L	0.01	0.01	--	--	--	--	--	--	0.279 ^{ab}	--	--	--
Barium	mg/L	2.0	2.0	--	--	--	--	--	--	0.254	--	--	--
Beryllium	mg/L	0.004	0.004	--	--	--	--	--	--	0.001	--	--	--
Cadmium	mg/L	0.005	0.005	--	--	--	--	--	--	0.0083 ^{ab}	--	--	--
Calcium	mg/L	NC	NC	--	--	--	--	--	--	--	--	--	--
Calcium (dissolved)	mg/L	NC	NC	--	--	--	--	--	--	--	--	--	--
Chromium	mg/L	0.1	0.1	--	--	--	--	--	--	0.061	--	--	--
Cobalt	mg/L	NC	NC	--	--	--	--	--	--	--	--	--	--
Copper	mg/L	1.3	1.3	--	--	--	--	--	--	0.041	--	--	--
Iron	mg/L	NC	NC	--	--	--	--	--	--	--	--	--	--
Lead	mg/L	0.015	0.015	--	--	--	--	--	--	0.34 ^{ab}	--	--	--
Magnesium	mg/L	NC	NC	--	--	--	--	--	--	--	--	--	--
Magnesium (dissolved)	mg/L	NC	NC	--	--	--	--	--	--	--	--	--	--
Manganese	mg/L	0.05	0.05	--	--	--	--	--	--	--	--	--	--
Manganese (dissolved)	mg/L	0.05	0.05	--	--	--	--	--	--	--	--	--	--
Mercury	mg/L	0.002	0.002	--	--	--	--	--	--	0.0005	--	--	--
Nickel	mg/L	0.10	0.10	--	--	--	--	--	--	0.8 ^{ab}	--	--	--
Potassium	mg/L	NC	NC	--	--	--	--	--	--	--	--	--	--
Selenium	mg/L	0.05	0.05	--	--	--	--	--	--	ND(0.001)	--	--	--
Silver	mg/L	0.1	0.1	--	--	--	--	--	--	0.023	--	--	--
Sodium	mg/L	NC	NC	--	--	--	--	--	--	--	--	--	--
Thallium	mg/L	NC	NC	--	--	--	--	--	--	0.232	--	--	--
Zinc	mg/L	5	5	--	--	--	--	--	--	0.46	--	--	--
Pesticides													
Aldrin	mg/L	0.0002	0.00005	--	--	--	--	--	--	0.00007 ^b	--	--	--
Total Petroleum Hydrocarbons													
Total Petroleum Hydrocarbons - Purgeable (GRO)	mg/L	0.500	0.500	--	--	0.037 J	ND(0.1)	ND(0.1)	ND(0.1)	--	--	--	--
Semivolatile Organic Compounds													
2,4-Dimethylphenol	mg/L	1.8	0.28	--	--	--	--	--	--	ND(0.004)	--	--	--
2,6-Dinitrotoluene	mg/L	0.004	0.001	--	--	--	--	--	--	ND(0.004)	--	--	--
Acetophenone	mg/L	0.00006	0.00002	--	--	--	--	--	--	--	--	--	--
bis(2-Ethylhexyl)phthalate (DEHP)	mg/L	0.006	0.006	--	--	--	--	--	--	ND(0.004)	--	--	--

SUMMARY OF GROUNDWATER DETECTED ANALYTICAL DATA
MW-103A AREA
FORMER FAIRFAX I SITE
KANSAS CITY, KANSAS

Sample Location		KDHE Tier 2 Risk-Based Criteria		MW-102A	MW-102A	MW-102A	MW-102A	MW-102A	MW-102A	MW-103A	MW-103A	MW-103A	MW-103A
Sample ID		Non-Residential	Residential	GW-051299-JH-102	GW-062706-JH-014	GW-091207-NT-020	GW-120507-JH-014	GW-031208-JH-016	GW-062408-JH-010	MW-103A	MW-103A	MW-103A	MW-103A
Sample Date		WG Pathway	WG Pathway	5/12/1999	6/27/2006	9/12/2007	12/5/2007	3/12/2008	6/24/2008	10/1/1988	6/1/1989	7/1/1989	11/1/1989
Sample Type													
	Units												
Volatile Organic Compounds													
1,2-Dichloroethene (total)	mg/L	NC	NC	ND(0.001)	--	--	--	--	--	--	--	--	--
2-Butanone (Methyl ethyl ketone) (MEK)	mg/L	2.8	0.82	ND(0.02)	ND(0.01)	ND(0.01)	ND(0.01)	ND(0.01)	ND(0.01)	ND(1)	--	--	--
4-Methyl-2-pentanone (Methyl isobutyl ketone) (MIBK)	mg/L	0.23	0.07	ND(0.01)	ND(0.01)	ND(0.01)	ND(0.01)	ND(0.01)	ND(0.01)	ND(1)	--	--	--
Acetone	mg/L	0.93	0.26	ND(0.1)	ND(0.01)	ND(0.01)	ND(0.01)	ND(0.01)	ND(0.01)	ND(0.5)	--	--	--
Benzene	mg/L	0.005	0.005	ND(0.001)	ND(0.001)	ND(0.001)	ND(0.001)	ND(0.001)	ND(0.001)	ND(0.5)	ND(0.005)	ND(0.005)	0.35 ^{ab}
Carbon disulfide	mg/L	0.03	0.009	ND(0.005)	ND(0.001)	ND(0.001)	ND(0.001)	ND(0.001)	ND(0.001)	--	--	--	--
Chloroform (Trichloromethane)	mg/L	0.08	0.08	ND(0.001)	ND(0.001)	ND(0.001)	ND(0.001)	ND(0.001)	ND(0.001)	1.5 ^{ab}	--	--	--
cis-1,2-Dichloroethene	mg/L	0.07	0.07	ND(0.001)	ND(0.0005)	ND(0.0005)	ND(0.0005)	ND(0.0005)	ND(0.0005)	--	--	--	--
Dichloroethene	mg/L	NC	NC	--	--	--	--	--	--	ND(0.5)	--	ND(0.005)	ND(0.005)
Ethylbenzene	mg/L	0.7	0.7	ND(0.001)	ND(0.001)	0.00071 J	ND(0.001)	ND(0.001)	ND(0.001)	2.45 ^{ab}	0.018	0.018	22.5 ^{ab}
Methylene chloride	mg/L	0.005	0.005	ND(0.005)	ND(0.001)	ND(0.001)	ND(0.001)	ND(0.001)	ND(0.001)	2 ^{ab}	--	--	--
Tetrachloroethene	mg/L	0.005	0.005	ND(0.001)	ND(0.001)	ND(0.001)	ND(0.001)	ND(0.001)	ND(0.001)UJ	ND(0.5)	--	--	--
Toluene	mg/L	1	1	ND(0.001)	ND(0.001)	0.0009 J	ND(0.001)	ND(0.001)	ND(0.001)	51.65 ^{ab}	ND(0.010)	0.071	63.1 ^{ab}
Trichloroethene	mg/L	0.005	0.005	ND(0.001)	ND(0.001)	ND(0.001)	ND(0.001)	ND(0.001)	ND(0.001)	ND(0.5)	--	--	--
Xylene (total)	mg/L	10	10	ND(0.003)	ND(0.001)	0.00071 J	ND(0.001)	ND(0.001)	ND(0.001)UJ	8.75	ND(0.005)	0.005	4.33
General Chemistry													
Aerobic BTEX specific microbial population	cfu/mL	NC	NC	--	--	--	--	--	--	--	--	--	--
Nitrate (as N)	mg/L	NC	NC	--	--	--	--	--	--	--	--	--	--
Total heterotropic bacteria	cfu/mL	NC	NC	--	--	--	--	--	--	--	--	--	--
Total organic carbon (TOC)	mg/L	NC	NC	--	--	--	--	--	--	--	--	--	--

SUMMARY OF GROUNDWATER DETECTED ANALYTICAL DATA
MW-103A AREA
FORMER FAIRFAX I SITE
KANSAS CITY, KANSAS

Sample Location	KDHE Tier 2 Risk-Based Criteria		MW-103A	MW-103A	MW-103A	MW-103A	MW-103A	MW-103A	MW-103A	MW-103A	MW-103A	MW-103A	MW-103A	MW-103A	MW-103A	MW-103A	MW-103A
Sample ID	Non-Residential	Residential	MW-103A	MW-103A	MW-103A	MW-103A	MW-103A	MW-103A	MW-103A	MW-103A	MW-103A	MW-103A	MW-103A	MW-103A	MW-103A	MW-103A	MW-103A
Sample Date	WG Pathway	WG Pathway	5/1/1990	11/1/1990	11/1/1990	5/1/1991	5/1/1991	11/1/1991	11/1/1991	5/1/1992	5/1/1992	11/1/1992	6/1/1993	6/1/1993	11/1/1993	6/1/1994	6/22/1994
Sample Type			Duplicate		Duplicate		Duplicate		Duplicate		Duplicate		Duplicate				
	Units																
Metals	a	b															
Arsenic	mg/L	0.01	0.01	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Barium	mg/L	2.0	2.0	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Beryllium	mg/L	0.004	0.004	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Cadmium	mg/L	0.005	0.005	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Calcium	mg/L	NC	NC	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Calcium (dissolved)	mg/L	NC	NC	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Chromium	mg/L	0.1	0.1	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Cobalt	mg/L	NC	NC	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Copper	mg/L	1.3	1.3	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Iron	mg/L	NC	NC	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Lead	mg/L	0.015	0.015	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Magnesium	mg/L	NC	NC	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Magnesium (dissolved)	mg/L	NC	NC	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Manganese	mg/L	0.05	0.05	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Manganese (dissolved)	mg/L	0.05	0.05	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Mercury	mg/L	0.002	0.002	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Nickel	mg/L	0.10	0.10	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Potassium	mg/L	NC	NC	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Selenium	mg/L	0.05	0.05	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Silver	mg/L	0.1	0.1	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Sodium	mg/L	NC	NC	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Thallium	mg/L	NC	NC	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Zinc	mg/L	5	5	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Pesticides																	
Aldrin	mg/L	0.0002	0.00005	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Total Petroleum Hydrocarbons																	
Total Petroleum Hydrocarbons - Purgeable (GRO)	mg/L	0.500	0.500	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Semivolatile Organic Compounds																	
2,4-Dimethylphenol	mg/L	1.8	0.28	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2,6-Dinitrotoluene	mg/L	0.004	0.001	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Acetophenone	mg/L	0.00006	0.00002	--	--	--	--	--	--	--	--	--	--	--	--	--	--
bis(2-Ethylhexyl)phthalate (DEHP)	mg/L	0.006	0.006	--	--	--	--	--	--	--	--	--	--	--	--	--	--

TABLE A.7

SUMMARY OF GROUNDWATER DETECTED ANALYTICAL DATA
MW-103A AREA
FORMER FAIRFAX I SITE
KANSAS CITY, KANSAS

Sample Location	KDHE Tier 2 Risk-Based Criteria		MW-103A	MW-103A	MW-103A	MW-103A	MW-103A	MW-103A	MW-103A	MW-103A	MW-103A	MW-103A	MW-103A	MW-103A	MW-103A	MW-103A	MW-103A
Sample ID	Non-Residential	Residential	MW-103A	MW-103A	MW-103A	MW-103A	MW-103A	MW-103A	MW-103A	MW-103A	MW-103A	MW-103A	MW-103A	MW-103A	MW-103A	MW-103A	MW-103A
Sample Date	WG Pathway	WG Pathway	5/1/1990	11/1/1990	11/1/1990	5/1/1991	5/1/1991	11/1/1991	11/1/1991	5/1/1992	5/1/1992	11/1/1992	6/1/1993	6/1/1993	11/1/1993	6/1/1994	6/22/1994
Sample Type			Duplicate			Duplicate		Duplicate		Duplicate		Duplicate					
Units																	
Volatile Organic Compounds																	
1,2-Dichloroethene (total)	mg/L	NC	NC	--	--	--	--	--	--	--	--	--	--	--	--	--	ND(0.25)
2-Butanone (Methyl ethyl ketone) (MEK)	mg/L	2.8	0.82	--	--	--	--	--	--	--	--	--	--	--	--	--	--
4-Methyl-2-pentanone (Methyl isobutyl ketone) (MIBK)	mg/L	0.23	0.07	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Acetone	mg/L	0.93	0.26	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Benzene	mg/L	0.005	0.005	ND(2.5)	0.57 ^{ab}	0.56 ^{ab}	0.13 ^{ab}	0.14 ^{ab}	0.35 ^{ab}	0.35 ^{ab}	ND(0.25)	ND(0.25)	0.21 ^{ab}	0.067 ^{ab}	0.062 ^{ab}	ND(2.5)	ND(0.25)
Carbon disulfide	mg/L	0.03	0.009	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Chloroform (Trichloromethane)	mg/L	0.08	0.08	--	--	--	--	--	--	--	--	--	--	--	--	--	--
cis-1,2-Dichloroethene	mg/L	0.07	0.07	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Dichloroethene	mg/L	NC	NC	ND(2.5)	ND(0.005)	ND(0.005)	ND(0.005)	ND(0.005)	ND(0.25)	ND(0.25)	ND(0.25)	ND(0.25)	ND(0.005)	ND(0.05)	ND(0.05)	ND(2.5)	ND(0.25)
Ethylbenzene	mg/L	0.7	0.7	7 ^{ab}	7.7 ^{ab}	7.5 ^{ab}	0.57	0.56	3.2 ^{ab}	2.7 ^{ab}	1.3 ^{ab}	1.3 ^{ab}	1.7 ^{ab}	1.5 ^{ab}	1.5 ^{ab}	6.1 ^{ab}	0.56
Methylene chloride	mg/L	0.005	0.005	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Tetrachloroethene	mg/L	0.005	0.005	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Toluene	mg/L	1	1	150 ^{ab}	142 ^{ab}	145 ^{ab}	0.29	0.35	27 ^{ab}	25 ^{ab}	5.3 ^{ab}	4.8 ^{ab}	19 ^{ab}	7.2 ^{ab}	7.2 ^{ab}	93 ^{ab}	9.9 ^{ab}
Trichloroethene	mg/L	0.005	0.005	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Xylene (total)	mg/L	10	10	49 ^{ab}	44 ^{ab}	44 ^{ab}	1.2	2.3	21 ^{ab}	18 ^{ab}	10	9.9	13 ^{ab}	7.9	9.8	34 ^{ab}	3.6
General Chemistry																	
Aerobic BTEX specific microbial population	cfu/mL	NC	NC	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Nitrate (as N)	mg/L	NC	NC	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Total heterotropic bacteria	cfu/mL	NC	NC	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Total organic carbon (TOC)	mg/L	NC	NC	--	--	--	--	--	--	--	--	--	--	--	--	--	--

TABLE A.7

SUMMARY OF GROUNDWATER DETECTED ANALYTICAL DATA
MW-103A AREA
FORMER FAIRFAX I SITE
KANSAS CITY, KANSAS

Sample Location		KDHE Tier 2 Risk-Based Criteria		MW-103A	MW-103A	MW-103A	MW-103A	MW-103A	MW-103A	MW-103A	MW-103A	
Sample ID		Non-Residential	Residential	GW-100398-JM-003	GW-051399-JH-105	GW-051399-JH-106	GW-091207-NT-017	GW-091207-NT-018	GW-120607-JH-030	GW-120607-JH-031	GW-031208-JH-020	GW-031208-JH-021
Sample Date		WG Pathway	WG Pathway	10/3/1998	5/13/1999	5/13/1999	9/12/2007	9/12/2007	12/6/2007	12/6/2007	3/12/2008	3/12/2008
Sample Type						Duplicate		Duplicate		Duplicate		Duplicate
	Units											
Metals		a	b									
Arsenic	mg/L	0.01	0.01	--	--	--	--	--	--	--	--	--
Barium	mg/L	2.0	2.0	--	--	--	--	--	--	--	--	--
Beryllium	mg/L	0.004	0.004	--	--	--	--	--	--	--	--	--
Cadmium	mg/L	0.005	0.005	--	--	--	--	--	--	--	--	--
Calcium	mg/L	NC	NC	--	--	--	--	--	--	--	--	--
Calcium (dissolved)	mg/L	NC	NC	--	--	--	--	--	--	--	--	--
Chromium	mg/L	0.1	0.1	--	--	--	--	--	--	--	--	--
Cobalt	mg/L	NC	NC	--	--	--	--	--	--	--	--	--
Copper	mg/L	1.3	1.3	--	--	--	--	--	--	--	--	--
Iron	mg/L	NC	NC	--	--	--	--	--	--	--	--	--
Lead	mg/L	0.015	0.015	--	--	--	--	--	--	--	--	--
Magnesium	mg/L	NC	NC	--	--	--	--	--	--	--	--	--
Magnesium (dissolved)	mg/L	NC	NC	--	--	--	--	--	--	--	--	--
Manganese	mg/L	0.05	0.05	--	--	--	--	--	--	--	--	--
Manganese (dissolved)	mg/L	0.05	0.05	--	--	--	--	--	--	--	--	--
Mercury	mg/L	0.002	0.002	--	--	--	--	--	--	--	--	--
Nickel	mg/L	0.10	0.10	--	--	--	--	--	--	--	--	--
Potassium	mg/L	NC	NC	--	--	--	--	--	--	--	--	--
Selenium	mg/L	0.05	0.05	--	--	--	--	--	--	--	--	--
Silver	mg/L	0.1	0.1	--	--	--	--	--	--	--	--	--
Sodium	mg/L	NC	NC	--	--	--	--	--	--	--	--	--
Thallium	mg/L	NC	NC	--	--	--	--	--	--	--	--	--
Zinc	mg/L	5	5	--	--	--	--	--	--	--	--	--
Pesticides												
Aldrin	mg/L	0.0002	0.00005	--	--	--	--	--	--	--	--	--
Total Petroleum Hydrocarbons												
Total Petroleum Hydrocarbons - Purgeable (GRO)	mg/L	0.500	0.500	--	--	--	390 ^{ab}	380 ^{ab}	470 ^{ab}	540 ^{ab}	210 J ^{ab}	360 J ^{ab}
Semivolatile Organic Compounds												
2,4-Dimethylphenol	mg/L	1.8	0.28	--	--	--	--	--	--	--	--	--
2,6-Dinitrotoluene	mg/L	0.004	0.001	--	--	--	--	--	--	--	--	--
Acetophenone	mg/L	0.00006	0.00002	--	--	--	--	--	--	--	--	--
bis(2-Ethylhexyl)phthalate (DEHP)	mg/L	0.006	0.006	--	--	--	--	--	--	--	--	--

TABLE A.7

SUMMARY OF GROUNDWATER DETECTED ANALYTICAL DATA
MW-103A AREA
FORMER FAIRFAX I SITE
KANSAS CITY, KANSAS

Sample Location	KDHE Tier 2 Risk-Based Criteria			MW-103A	MW-103A	MW-103A	MW-103A	MW-103A	MW-103A	MW-103A	MW-103A	
Sample ID	Non-Residential	Residential		GW-100398-JM-003	GW-051399-JH-105	GW-051399-JH-106	GW-091207-NT-017	GW-091207-NT-018	GW-120607-JH-030	GW-120607-JH-031	GW-031208-JH-020	GW-031208-JH-021
Sample Date	WG Pathway	WG Pathway		10/3/1998	5/13/1999	5/13/1999	9/12/2007	9/12/2007	12/6/2007	12/6/2007	3/12/2008	3/12/2008
Sample Type						Duplicate		Duplicate		Duplicate		Duplicate
Units												
Volatile Organic Compounds												
1,2-Dichloroethene (total)	mg/L	NC	NC	--	0.003	0.003	--	--	--	--	--	--
2-Butanone (Methyl ethyl ketone) (MEK)	mg/L	2.8	0.82	1.5 ^b	0.81 J	0.8 J	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
4-Methyl-2-pentanone (Methyl isobutyl ketone) (MIBK)	mg/L	0.23	0.07	81 ^{ab}	30 ^{ab}	29 ^{ab}	30 J ^{ab}	33 J ^{ab}	160 ^{ab}	160 ^{ab}	67 ^{ab}	68 ^{ab}
Acetone	mg/L	0.93	0.26	270 ^{ab}	140 ^{ab}	120 ^{ab}	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)
Benzene	mg/L	0.005	0.005	0.34 ^{ab}	0.13 ^{ab}	0.14 ^{ab}	ND(5)	ND(5)	ND(5)	ND(5)	ND(5)	ND(5)
Carbon disulfide	mg/L	0.03	0.009	ND(0.001)	ND(0.005)	ND(0.005)	ND(5)	ND(5)	ND(5)	ND(5)	2.7 J ^{ab}	ND(5)
Chloroform (Trichloromethane)	mg/L	0.08	0.08	ND(0.001)	ND(0.001)	ND(0.001)	ND(5)	ND(5)	ND(5)	ND(5)	ND(5)	ND(5)
cis-1,2-Dichloroethene	mg/L	0.07	0.07	ND(0.001)	0.003	0.002	ND(2.5)	ND(2.5)	ND(2.5)	ND(2.5)	ND(2.5)	ND(2.5)
Dichloroethene	mg/L	NC	NC	--	--	--	--	--	--	--	--	--
Ethylbenzene	mg/L	0.7	0.7	1.4 ^{ab}	0.5	0.57	7.4 ^{ab}	7.9 ^{ab}	8 ^{ab}	7.5 ^{ab}	6.6 ^{ab}	7.4 ^{ab}
Methylene chloride	mg/L	0.005	0.005	ND(0.002)	ND(0.005)	ND(0.005)	ND(5)	ND(5)	ND(5)	ND(5)	ND(5)	ND(5)
Tetrachloroethene	mg/L	0.005	0.005	ND(0.001)	ND(0.001)	ND(0.001)	ND(5)	ND(5)	ND(5)	ND(5)	ND(5)	ND(5)
Toluene	mg/L	1	1	34 ^{ab}	8.9 ^{ab}	9 ^{ab}	120 ^{ab}	130 ^{ab}	150 ^{ab}	140 ^{ab}	120 ^{ab}	120 ^{ab}
Trichloroethene	mg/L	0.005	0.005	ND(0.001)	ND(0.001)	ND(0.001)	ND(5)	ND(5)	ND(5)	ND(5)	ND(5)	ND(5)
Xylene (total)	mg/L	10	10	11 ^{ab}	3.8	3.9	63 ^{ab}	67 ^{ab}	57 ^{ab}	56 ^{ab}	52 ^{ab}	55 ^{ab}
General Chemistry												
Aerobic BTEX specific microbial population	cfu/mL	NC	NC	--	--	--	--	--	--	--	--	--
Nitrate (as N)	mg/L	NC	NC	--	--	--	--	--	--	--	--	--
Total heterotropic bacteria	cfu/mL	NC	NC	--	--	--	--	--	--	--	--	--
Total organic carbon (TOC)	mg/L	NC	NC	--	--	--	--	--	--	--	--	--

TABLE A.7

SUMMARY OF GROUNDWATER DETECTED ANALYTICAL DATA
MW-103A AREA
FORMER FAIRFAX I SITE
KANSAS CITY, KANSAS

Sample Location	KDHE Tier 2 Risk-Based Criteria		MW-103A	MW-103A	MW-104	MW-104	MW-104	MW-104	MW-104	MW-104	MW-104	MW-104	MW-104	MW-104	MW-104	MW-104
	Non-Residential	Residential	GW-062508-JH-018	GW-062508-JH-019	MW-104	MW-104	MW-104	MW-104	MW-104	MW-104	MW-104	MW-104	MW-104	MW-104	MW-104	MW-104
	WG Pathway	WG Pathway	6/25/2008	6/25/2008	10/1/1988	6/1/1989	7/1/1989	10/1/1989	5/1/1990	11/1/1990	5/1/1991	11/1/1991	5/1/1992	11/1/1992	6/1/1993	11/1/1993
	Units		Duplicate													
Metals			a	b												
Arsenic	mg/L		0.01	0.01	--	--	0.009	--	--	--	--	--	--	--	--	--
Barium	mg/L		2.0	2.0	--	--	0.422	--	--	--	--	--	--	--	--	--
Beryllium	mg/L		0.004	0.004	--	--	0.001	--	--	--	--	--	--	--	--	--
Cadmium	mg/L		0.005	0.005	--	--	0.006 nd	--	--	--	--	--	--	--	--	--
Calcium	mg/L		NC	NC	--	--	--	--	--	--	--	--	--	--	--	--
Calcium (dissolved)	mg/L		NC	NC	--	--	--	--	--	--	--	--	--	--	--	--
Chromium	mg/L		0.1	0.1	--	--	0.02	--	--	--	--	--	--	--	--	--
Cobalt	mg/L		NC	NC	--	--	--	--	--	--	--	--	--	--	--	--
Copper	mg/L		1.3	1.3	--	--	0.017	--	--	--	--	--	--	--	--	--
Iron	mg/L		NC	NC	--	--	--	--	--	--	--	--	--	--	--	--
Lead	mg/L		0.015	0.015	--	--	0.05 nd	--	--	--	--	--	--	--	--	--
Magnesium	mg/L		NC	NC	--	--	--	--	--	--	--	--	--	--	--	--
Magnesium (dissolved)	mg/L		NC	NC	--	--	--	--	--	--	--	--	--	--	--	--
Manganese	mg/L		0.05	0.05	--	--	--	--	--	--	--	--	--	--	--	--
Manganese (dissolved)	mg/L		0.05	0.05	--	--	--	--	--	--	--	--	--	--	--	--
Mercury	mg/L		0.002	0.002	--	--	0.0005	--	--	--	--	--	--	--	--	--
Nickel	mg/L		0.10	0.10	--	--	0.055	--	--	--	--	--	--	--	--	--
Potassium	mg/L		NC	NC	--	--	--	--	--	--	--	--	--	--	--	--
Selenium	mg/L		0.05	0.05	--	--	ND(0.001)	--	--	--	--	--	--	--	--	--
Silver	mg/L		0.1	0.1	--	--	0.003	--	--	--	--	--	--	--	--	--
Sodium	mg/L		NC	NC	--	--	--	--	--	--	--	--	--	--	--	--
Thallium	mg/L		NC	NC	--	--	0.032	--	--	--	--	--	--	--	--	--
Zinc	mg/L		5	5	--	--	0.1	--	--	--	--	--	--	--	--	--
Pesticides																
Aldrin	mg/L		0.0002	0.00005	--	--	--	--	--	--	--	--	--	--	--	--
Total Petroleum Hydrocarbons																
Total Petroleum Hydrocarbons - Purgeable (GRO)	mg/L		0.500	0.500	290 nd	260 nd	--	--	--	--	--	--	--	--	--	--
Semivolatile Organic Compounds																
2,4-Dimethylphenol	mg/L		1.8	0.28	--	--	--	--	--	--	--	--	--	--	--	--
2,6-Dinitrotoluene	mg/L		0.004	0.001	--	--	--	--	--	--	--	--	--	--	--	--
Acetophenone	mg/L		0.00006	0.00002	--	--	--	--	--	--	--	--	--	--	--	--
bis(2-Ethylhexyl)phthalate (DEHP)	mg/L		0.006	0.006	--	--	--	--	--	--	--	--	--	--	--	--

SUMMARY OF GROUNDWATER DETECTED ANALYTICAL DATA
MW-103A AREA
FORMER FAIRFAX I SITE
KANSAS CITY, KANSAS

Sample Location	KDHE Tier 2 Risk-Based Criteria			MW-103A	MW-103A	MW-104	MW-104	MW-104	MW-104	MW-104	MW-104	MW-104	MW-104	MW-104	MW-104	MW-104
Sample ID	Non-Residential	Residential		GW-062508-JH-018	GW-062508-JH-019	MW-104	MW-104	MW-104	MW-104	MW-104	MW-104	MW-104	MW-104	MW-104	MW-104	MW-104
Sample Date	WG Pathway	WG Pathway		6/25/2008	6/25/2008	10/1/1988	6/1/1989	7/1/1989	10/1/1989	5/1/1990	11/1/1990	5/1/1991	11/1/1991	5/1/1992	11/1/1992	6/1/1993
Sample Type				Duplicate												
	Units															
Volatile Organic Compounds																
1,2-Dichloroethene (total)	mg/L	NC	NC	--	--	--	--	--	--	--	--	--	--	--	--	--
2-Butanone (Methyl ethyl ketone) (MEK)	mg/L	2.8	0.82	ND(25)	ND(25)	ND(0.01)	--	--	--	--	--	--	--	--	--	--
4-Methyl-2-pentanone (Methyl isobutyl ketone) (MIBK)	mg/L	0.23	0.07	3.5 J ^{ab}	3.1 J ^{ab}	ND(0.01)	--	--	--	--	--	--	--	--	--	--
Acetone	mg/L	0.93	0.26	ND(25)	ND(25)	0.0657	--	--	--	--	--	--	--	--	--	--
Benzene	mg/L	0.005	0.005	ND(2.5)	ND(2.5)	ND(0.005)	ND(0.005)	ND(0.005)	ND(0.005)	ND(0.005)	ND(0.005)	ND(0.005)	ND(0.005)	ND(0.005)	ND(0.005)	ND(0.005)
Carbon disulfide	mg/L	0.03	0.009	ND(2.5)	ND(2.5)	--	--	--	--	--	--	--	--	--	--	--
Chloroform (Trichloromethane)	mg/L	0.08	0.08	ND(2.5)	ND(2.5)	0.0072	--	--	--	--	--	--	--	--	--	--
cis-1,2-Dichloroethene	mg/L	0.07	0.07	ND(1.2)	ND(1.2)	--	--	--	--	--	--	--	--	--	--	--
Dichloroethene	mg/L	NC	NC	--	--	ND(0.005)	--	ND(0.005)	ND(0.005)	ND(0.005)	ND(0.005)	ND(0.005)	ND(0.005)	ND(0.005)	ND(0.005)	ND(0.005)
Ethylbenzene	mg/L	0.7	0.7	5.4 ^{ab}	5.4 ^{ab}	ND(0.005)	ND(0.005)	ND(0.005)	ND(0.005)	ND(0.005)	ND(0.005)	ND(0.005)	ND(0.005)	ND(0.005)	ND(0.005)	ND(0.005)
Methylene chloride	mg/L	0.005	0.005	ND(2.5)	ND(2.5)	0.0429 ^{ab}	--	--	--	--	--	--	--	--	--	--
Tetrachloroethene	mg/L	0.005	0.005	ND(2.5)UJ	ND(2.5)UJ	ND(0.005)	--	--	--	--	--	--	--	--	--	--
Toluene	mg/L	1	1	100 ^{ab}	100 ^{ab}	0.005	ND(0.005)	ND(0.005)	ND(0.005)	ND(0.005)	ND(0.005)	ND(0.005)	ND(0.005)	ND(0.005)	ND(0.005)	ND(0.005)
Trichloroethene	mg/L	0.005	0.005	ND(2.5)	ND(2.5)	ND(0.005)	--	--	--	--	--	--	--	--	--	--
Xylene (total)	mg/L	10	10	45 ^{ab}	45 ^{ab}	ND(0.005)	ND(0.005)	ND(0.005)	ND(0.005)	ND(0.005)	ND(0.005)	ND(0.005)	ND(0.005)	ND(0.005)	ND(0.005)	ND(0.005)
General Chemistry																
Aerobic BTEX specific microbial population	cfu/mL	NC	NC	--	--	--	--	--	--	--	--	--	--	--	--	--
Nitrate (as N)	mg/L	NC	NC	--	--	--	--	--	--	--	--	--	--	--	--	--
Total heterotropic bacteria	cfu/mL	NC	NC	--	--	--	--	--	--	--	--	--	--	--	--	--
Total organic carbon (TOC)	mg/L	NC	NC	--	--	--	--	--	--	--	--	--	--	--	--	--

SUMMARY OF GROUNDWATER DETECTED ANALYTICAL DATA
MW-103A AREA
FORMER FAIRFAX I SITE
KANSAS CITY, KANSAS

Sample Location	KDHE Tier 2 Risk-Based Criteria		MW-104	MW-104	MW-104	MW-104	MW-104	MW-104	MW-104	MW-104	MW-105	MW-105
Sample ID	Non-Residential	Residential	MW-104	GW-051299-JH-101	GW-062706-JH-012	GW-062706-JH-013	GW-091207-NT-014	GW-120507-JH-019	GW-031208-JH-025	GW-062508-JH-021	MW-105	MW-105
Sample Date	WG Pathway	WG Pathway	6/23/1994	5/12/1999	6/27/2006	6/27/2006	9/12/2007	12/5/2007	3/12/2008	6/25/2008	10/1/1988	6/1/1989
Sample Type	Units		Duplicate									
Metals	a	b										
Arsenic	mg/L	0.01	0.01	--	--	--	--	--	--	--	0.002	--
Barium	mg/L	2.0	2.0	--	--	--	--	--	--	--	0.235	--
Beryllium	mg/L	0.004	0.004	--	--	--	--	--	--	--	ND(0.001)	--
Cadmium	mg/L	0.005	0.005	--	--	--	--	--	--	--	0.006 ^{ab}	--
Calcium	mg/L	NC	NC	--	--	--	--	--	--	--	--	--
Calcium (dissolved)	mg/L	NC	NC	--	--	--	--	--	--	--	--	--
Chromium	mg/L	0.1	0.1	--	--	--	--	--	--	--	0.005	--
Cobalt	mg/L	NC	NC	--	--	--	--	--	--	--	--	--
Copper	mg/L	1.3	1.3	--	--	--	--	--	--	--	0.005	--
Iron	mg/L	NC	NC	--	--	--	--	--	--	--	--	--
Lead	mg/L	0.015	0.015	--	--	--	--	--	--	--	0.024 ^{ab}	--
Magnesium	mg/L	NC	NC	--	--	--	--	--	--	--	--	--
Magnesium (dissolved)	mg/L	NC	NC	--	--	--	--	--	--	--	--	--
Manganese	mg/L	0.05	0.05	--	--	--	--	--	--	--	--	--
Manganese (dissolved)	mg/L	0.05	0.05	--	--	--	--	--	--	--	--	--
Mercury	mg/L	0.002	0.002	--	--	--	--	--	--	--	0.0005	--
Nickel	mg/L	0.10	0.10	--	--	--	--	--	--	--	0.044	--
Potassium	mg/L	NC	NC	--	--	--	--	--	--	--	--	--
Selenium	mg/L	0.05	0.05	--	--	--	--	--	--	--	ND(0.001)	--
Silver	mg/L	0.1	0.1	--	--	--	--	--	--	--	0.002	--
Sodium	mg/L	NC	NC	--	--	--	--	--	--	--	--	--
Thallium	mg/L	NC	NC	--	--	--	--	--	--	--	0.025	--
Zinc	mg/L	5	5	--	--	--	--	--	--	--	0.019	--
Pesticides												
Aldrin	mg/L	0.0002	0.00005	--	--	--	--	--	--	--	--	--
Total Petroleum Hydrocarbons												
Total Petroleum Hydrocarbons - Purgeable (GRO)	mg/L	0.500	0.500	--	--	--	0.037 J	ND(0.1)	ND(0.1)	0.034 J	--	--
Semivolatile Organic Compounds												
2,4-Dimethylphenol	mg/L	1.8	0.28	--	--	--	--	--	--	--	--	--
2,6-Dinitrotoluene	mg/L	0.004	0.001	--	--	--	--	--	--	--	--	--
Acetophenone	mg/L	0.00006	0.00002	--	--	--	--	--	--	--	--	--
bis(2-Ethylhexyl)phthalate (DEHP)	mg/L	0.006	0.006	--	--	--	--	--	--	--	--	--

SUMMARY OF GROUNDWATER DETECTED ANALYTICAL DATA
MW-103A AREA
FORMER FAIRFAX I SITE
KANSAS CITY, KANSAS

Sample Location	KDHE Tier 2 Risk-Based Criteria			MW-104	MW-104	MW-104	MW-104	MW-104	MW-104	MW-104	MW-104	MW-105	MW-105
Sample ID	Non-Residential	Residential		MW-104	GW-051299-JH-101	GW-062706-JH-012	GW-062706-JH-013	GW-091207-NT-014	GW-120507-JH-019	GW-031208-JH-025	GW-062508-JH-021	MW-105	MW-105
Sample Date	WG Pathway	WG Pathway		6/23/1994	5/12/1999	6/27/2006	6/27/2006	9/12/2007	12/5/2007	3/12/2008	6/25/2008	10/1/1988	6/1/1989
Sample Type	Duplicate												
	Units												
Volatile Organic Compounds													
1,2-Dichloroethene (total)	mg/L	NC	NC	ND(0.005)	ND(0.001)	--	--	--	--	--	--	--	--
2-Butanone (Methyl ethyl ketone) (MEK)	mg/L	2.8	0.82	--	ND(0.02)	ND(0.01)	ND(0.01)	ND(0.01)	ND(0.01)	ND(0.01)	ND(0.01)	ND(0.01)	--
4-Methyl-2-pentanone (Methyl isobutyl ketone) (MIBK)	mg/L	0.23	0.07	--	ND(0.01)	ND(0.01)	ND(0.01)	ND(0.01)	ND(0.01)	ND(0.01)	ND(0.01)	ND(0.01)	--
Acetone	mg/L	0.93	0.26	--	ND(0.1)	ND(0.01)	ND(0.01)	ND(0.01)	ND(0.01)	ND(0.01)	ND(0.01)	ND(0.005)	--
Benzene	mg/L	0.005	0.005	ND(0.005)	ND(0.001)	ND(0.001)	ND(0.001)	ND(0.001)	ND(0.001)	ND(0.001)	ND(0.001)	ND(0.005)	ND(0.005)
Carbon disulfide	mg/L	0.03	0.009	--	ND(0.005)	ND(0.001)	ND(0.001)	ND(0.001)	ND(0.001)	0.0009 J	ND(0.001)	--	--
Chloroform (Trichloromethane)	mg/L	0.08	0.08	--	ND(0.001)	ND(0.001)	ND(0.001)	ND(0.001)	ND(0.001)	ND(0.001)	ND(0.001)	ND(0.005)	--
cis-1,2-Dichloroethene	mg/L	0.07	0.07	--	ND(0.001)	0.00021 J	ND(0.0005)	0.00025 J	0.00022 J	0.00023 J	ND(0.0005)	--	--
Dichloroethene	mg/L	NC	NC	--	--	--	--	--	--	--	--	0.019	--
Ethylbenzene	mg/L	0.7	0.7	ND(0.005)	ND(0.001)	ND(0.001)	ND(0.001)	ND(0.001)	ND(0.001)	ND(0.001)	ND(0.001)	ND(0.005)	ND(0.005)
Methylene chloride	mg/L	0.005	0.005	--	ND(0.005)	ND(0.001)	ND(0.001)	ND(0.001)	ND(0.001)	ND(0.001)	ND(0.001)	ND(0.01)	--
Tetrachloroethene	mg/L	0.005	0.005	--	ND(0.001)	ND(0.001)	ND(0.001)	ND(0.001)	ND(0.001)	ND(0.001)	ND(0.001)UJ	ND(0.005)	--
Toluene	mg/L	1	1	ND(0.005)	ND(0.001)	ND(0.001)	ND(0.001)	ND(0.001)	ND(0.001)	ND(0.001)	ND(0.001)	ND(0.005)	ND(0.005)
Trichloroethene	mg/L	0.005	0.005	--	ND(0.001)	ND(0.001)	ND(0.001)	ND(0.001)	ND(0.001)	ND(0.001)	ND(0.001)	ND(0.005)	--
Xylene (total)	mg/L	10	10	ND(0.005)	ND(0.003)	ND(0.001)	ND(0.001)	ND(0.001)	ND(0.001)	ND(0.001)	ND(0.001)	ND(0.005)	ND(0.005)
General Chemistry													
Aerobic BTEX specific microbial population	cfu/mL	NC	NC	--	--	--	--	--	--	--	--	--	--
Nitrate (as N)	mg/L	NC	NC	--	--	--	--	--	--	--	--	--	--
Total heterotropic bacteria	cfu/mL	NC	NC	--	--	--	--	--	--	--	--	--	--
Total organic carbon (TOC)	mg/L	NC	NC	--	--	--	--	--	--	--	--	--	--

SUMMARY OF GROUNDWATER DETECTED ANALYTICAL DATA
MW-103A AREA
FORMER FAIRFAX I SITE
KANSAS CITY, KANSAS

Sample Location	KDHE Tier 2 Risk-Based Criteria		MW-105	MW-105	MW-105	MW-105	MW-105	MW-105	MW-105	MW-105	MW-105	MW-105	MW-105	MW-105	MW-105	MW-105
Sample ID	Non-Residential	Residential	MW-105	MW-105	MW-105	MW-105	MW-105	MW-105	MW-105	MW-105	MW-105	MW-105	MW-105	GW-051299-JH-100	GW-122004-DS-003	GW-062706-JH-009
Sample Date	WG Pathway	WG Pathway	7/1/1989	11/1/1989	5/1/1990	11/1/1990	5/1/1991	11/1/1991	5/1/1992	11/1/1992	6/1/1993	11/1/1993	6/22/1994	5/12/1999	12/20/2004	6/27/2006
Sample Type	Units															
Metals		a	b													
Arsenic	mg/L	0.01	0.01	--	--	--	--	--	--	--	--	--	--	--	0.0062 J	--
Barium	mg/L	2.0	2.0	--	--	--	--	--	--	--	--	--	--	--	0.24	--
Beryllium	mg/L	0.004	0.004	--	--	--	--	--	--	--	--	--	--	--	ND(0.0050)	--
Cadmium	mg/L	0.005	0.005	--	--	--	--	--	--	--	--	--	--	--	ND(0.0050)	--
Calcium	mg/L	NC	NC	--	--	--	--	--	--	--	--	--	--	--	172	--
Calcium (dissolved)	mg/L	NC	NC	--	--	--	--	--	--	--	--	--	--	--	169	--
Chromium	mg/L	0.1	0.1	--	--	--	--	--	--	--	--	--	--	--	ND(0.010)	--
Cobalt	mg/L	NC	NC	--	--	--	--	--	--	--	--	--	--	--	0.0034 J	--
Copper	mg/L	1.3	1.3	--	--	--	--	--	--	--	--	--	--	--	ND(0.025)	--
Iron	mg/L	NC	NC	--	--	--	--	--	--	--	--	--	--	--	10.4	--
Lead	mg/L	0.015	0.015	--	--	--	--	--	--	--	--	--	--	--	ND(0.0030)	--
Magnesium	mg/L	NC	NC	--	--	--	--	--	--	--	--	--	--	--	43.1	--
Magnesium (dissolved)	mg/L	NC	NC	--	--	--	--	--	--	--	--	--	--	--	42.3	--
Manganese	mg/L	0.05	0.05	--	--	--	--	--	--	--	--	--	--	--	1.5 ^{ab}	--
Manganese (dissolved)	mg/L	0.05	0.05	--	--	--	--	--	--	--	--	--	--	--	1.5 ^{ab}	--
Mercury	mg/L	0.002	0.002	--	--	--	--	--	--	--	--	--	--	--	ND(0.00020)	--
Nickel	mg/L	0.10	0.10	--	--	--	--	--	--	--	--	--	--	--	0.0052 J	--
Potassium	mg/L	NC	NC	--	--	--	--	--	--	--	--	--	--	--	10.2 J	--
Selenium	mg/L	0.05	0.05	--	--	--	--	--	--	--	--	--	--	--	0.0076	--
Silver	mg/L	0.1	0.1	--	--	--	--	--	--	--	--	--	--	--	ND(0.010)	--
Sodium	mg/L	NC	NC	--	--	--	--	--	--	--	--	--	--	--	71.8	--
Thallium	mg/L	NC	NC	--	--	--	--	--	--	--	--	--	--	--	ND(0.010)	--
Zinc	mg/L	5	5	--	--	--	--	--	--	--	--	--	--	--	ND(0.020)	--
Pesticides																
Aldrin	mg/L	0.0002	0.00005	--	--	--	--	--	--	--	--	--	--	--	--	--
Total Petroleum Hydrocarbons																
Total Petroleum Hydrocarbons - Purgeable (GRO)	mg/L	0.500	0.500	--	--	--	--	--	--	--	--	--	--	--	--	--
Semivolatile Organic Compounds																
2,4-Dimethylphenol	mg/L	1.8	0.28	--	--	--	--	--	--	--	--	--	--	--	0.00055 J	--
2,6-Dinitrotoluene	mg/L	0.004	0.001	--	--	--	--	--	--	--	--	--	--	--	0.001 J	--
Acetophenone	mg/L	0.00006	0.00002	--	--	--	--	--	--	--	--	--	--	--	0.00053 J ^{ab}	--
bis(2-Ethylhexyl)phthalate (DEHP)	mg/L	0.006	0.006	--	--	--	--	--	--	--	--	--	--	--	0.0023 J	--

TABLE A.7

SUMMARY OF GROUNDWATER DETECTED ANALYTICAL DATA
MW-103A AREA
FORMER FAIRFAX I SITE
KANSAS CITY, KANSAS

Sample Location	KDHE Tier 2 Risk-Based Criteria		MW-105	MW-105	MW-105	MW-105	MW-105	MW-105	MW-105	MW-105	MW-105	MW-105	MW-105	MW-105	MW-105	MW-105
Sample ID	Non-Residential	Residential	MW-105	MW-105	MW-105	MW-105	MW-105	MW-105	MW-105	MW-105	MW-105	MW-105	MW-105	GW-051299-JH-100	GW-122004-DS-003	GW-062706-JH-009
Sample Date	WG Pathway	WG Pathway	7/1/1989	11/1/1989	5/1/1990	11/1/1990	5/1/1991	11/1/1991	5/1/1992	11/1/1992	6/1/1993	11/1/1993	6/22/1994	5/12/1999	12/20/2004	6/27/2006
Sample Type																
	Units															
Volatile Organic Compounds																
1,2-Dichloroethene (total)	mg/L	NC	NC	--	--	--	--	--	--	--	--	--	0.015	ND(0.001)	--	--
2-Butanone (Methyl ethyl ketone) (MEK)	mg/L	2.8	0.82	--	--	--	--	--	--	--	--	--	--	ND(0.02)	ND(0.01)	ND(0.01)
4-Methyl-2-pentanone (Methyl isobutyl ketone) (MIBK)	mg/L	0.23	0.07	--	--	--	--	--	--	--	--	--	--	ND(0.01)	ND(0.01)	ND(0.01)
Acetone	mg/L	0.93	0.26	--	--	--	--	--	--	--	--	--	--	ND(0.1)	ND(0.01)	ND(0.01)
Benzene	mg/L	0.005	0.005	ND(0.005)	ND(0.005)	ND(0.005)	ND(0.005)	ND(0.005)	ND(0.005)	ND(0.005)	ND(0.005)	ND(0.005)	ND(0.005)	ND(0.001)	ND(0.001)	ND(0.001)
Carbon disulfide	mg/L	0.03	0.009	--	--	--	--	--	--	--	--	--	--	ND(0.005)	ND(0.001)	ND(0.001)
Chloroform (Trichloromethane)	mg/L	0.08	0.08	--	--	--	--	--	--	--	--	--	--	ND(0.001)	ND(0.001)	ND(0.001)
cis-1,2-Dichloroethene	mg/L	0.07	0.07	--	--	--	--	--	--	--	--	--	--	ND(0.001)	0.0063	0.0049
Dichloroethene	mg/L	NC	NC	ND(0.005)	0.015	0.026	0.012	0.011	ND(0.005)	0.018	0.009	0.009	ND(0.005)	--	--	--
Ethylbenzene	mg/L	0.7	0.7	ND(0.005)	ND(0.005)	ND(0.005)	ND(0.005)	ND(0.005)	ND(0.005)	ND(0.005)	ND(0.005)	ND(0.005)	ND(0.005)	ND(0.001)	ND(0.001)	ND(0.001)
Methylene chloride	mg/L	0.005	0.005	--	--	--	--	--	--	--	--	--	--	ND(0.005)	ND(0.001)	ND(0.001)
Tetrachloroethene	mg/L	0.005	0.005	--	--	--	--	--	--	--	--	--	--	0.001	ND(0.001)	ND(0.001)
Toluene	mg/L	1	1	ND(0.005)	ND(0.005)	ND(0.005)	ND(0.005)	ND(0.005)	ND(0.005)	ND(0.005)	ND(0.005)	ND(0.005)	ND(0.005)	ND(0.001)	ND(0.001)	ND(0.001)
Trichloroethene	mg/L	0.005	0.005	--	--	--	--	--	--	--	--	--	--	ND(0.001)	ND(0.001)	0.00058 J
Xylene (total)	mg/L	10	10	ND(0.005)	ND(0.005)	ND(0.005)	ND(0.005)	ND(0.005)	ND(0.005)	ND(0.005)	ND(0.005)	ND(0.005)	ND(0.005)	ND(0.003)	ND(0.002)	ND(0.001)
General Chemistry																
Aerobic BTEX specific microbial population	cfu/mL	NC	NC	--	--	--	--	--	--	--	--	--	--	--	65000	--
Nitrate (as N)	mg/L	NC	NC	--	--	--	--	--	--	--	--	--	--	--	0.032 J	--
Total heterotropic bacteria	cfu/mL	NC	NC	--	--	--	--	--	--	--	--	--	--	--	110000	--
Total organic carbon (TOC)	mg/L	NC	NC	--	--	--	--	--	--	--	--	--	--	--	1	--

SUMMARY OF GROUNDWATER DETECTED ANALYTICAL DATA
MW-103A AREA
FORMER FAIRFAX I SITE
KANSAS CITY, KANSAS

Sample Location	KDHE Tier 2 Risk-Based Criteria		MW-105	MW-105	MW-105	MW-105	MW-105	MW-115A	MW-115A	MW-115A	MW-115A	
Sample ID	Non-Residential	Residential	GW-062706-JH-010	GW-091207-NT-013	GW-120507-JH-018	GW-031208-JH-026	GW-062508-JH-022	GW-051399-JH-104	GW-091207-NT-019	GW-031208-JH-019	GW-062508-JH-015	
Sample Date	WG Pathway	WG Pathway	6/27/2006	9/12/2007	12/5/2007	3/12/2008	6/25/2008	5/13/1999	9/12/2007	3/12/2008	6/25/2008	
Sample Type	Units		Duplicate									
Metals	a	b										
Arsenic	mg/L	0.01	0.01	--	--	--	--	--	--	--	--	
Barium	mg/L	2.0	2.0	--	--	--	--	--	--	--	--	
Beryllium	mg/L	0.004	0.004	--	--	--	--	--	--	--	--	
Cadmium	mg/L	0.005	0.005	--	--	--	--	--	--	--	--	
Calcium	mg/L	NC	NC	--	--	--	--	--	--	--	--	
Calcium (dissolved)	mg/L	NC	NC	--	--	--	--	--	--	--	--	
Chromium	mg/L	0.1	0.1	--	--	--	--	--	--	--	--	
Cobalt	mg/L	NC	NC	--	--	--	--	--	--	--	--	
Copper	mg/L	1.3	1.3	--	--	--	--	--	--	--	--	
Iron	mg/L	NC	NC	--	--	--	--	--	--	--	--	
Lead	mg/L	0.015	0.015	--	--	--	--	--	--	--	--	
Magnesium	mg/L	NC	NC	--	--	--	--	--	--	--	--	
Magnesium (dissolved)	mg/L	NC	NC	--	--	--	--	--	--	--	--	
Manganese	mg/L	0.05	0.05	--	--	--	--	--	--	--	--	
Manganese (dissolved)	mg/L	0.05	0.05	--	--	--	--	--	--	--	--	
Mercury	mg/L	0.002	0.002	--	--	--	--	--	--	--	--	
Nickel	mg/L	0.10	0.10	--	--	--	--	--	--	--	--	
Potassium	mg/L	NC	NC	--	--	--	--	--	--	--	--	
Selenium	mg/L	0.05	0.05	--	--	--	--	--	--	--	--	
Silver	mg/L	0.1	0.1	--	--	--	--	--	--	--	--	
Sodium	mg/L	NC	NC	--	--	--	--	--	--	--	--	
Thallium	mg/L	NC	NC	--	--	--	--	--	--	--	--	
Zinc	mg/L	5	5	--	--	--	--	--	--	--	--	
Pesticides												
Aldrin	mg/L	0.0002	0.00005	--	--	--	--	--	--	--	--	
Total Petroleum Hydrocarbons												
Total Petroleum Hydrocarbons - Purgeable (GRO)	mg/L	0.500	0.500	--	0.031 J	ND(0.1)	ND(0.1)	ND(0.1)	--	0.13	ND(0.1)	ND(0.1)
Semivolatile Organic Compounds												
2,4-Dimethylphenol	mg/L	1.8	0.28	--	--	--	--	--	--	--	--	
2,6-Dinitrotoluene	mg/L	0.004	0.001	--	--	--	--	--	--	--	--	
Acetophenone	mg/L	0.00006	0.00002	--	--	--	--	--	--	--	--	
bis(2-Ethylhexyl)phthalate (DEHP)	mg/L	0.006	0.006	--	--	--	--	--	--	--	--	

SUMMARY OF GROUNDWATER DETECTED ANALYTICAL DATA
MW-103A AREA
FORMER FAIRFAX I SITE
KANSAS CITY, KANSAS

Sample Location	KDHE Tier 2 Risk-Based Criteria			MW-105	MW-105	MW-105	MW-105	MW-105	MW-115A	MW-115A	MW-115A	MW-115A	
Sample ID	Non-Residential	Residential		GW-062706-JH-010	GW-091207-NT-013	GW-120507-JH-018	GW-031208-JH-026	GW-062508-JH-022	GW-051399-JH-104	GW-091207-NT-019	GW-031208-JH-019	GW-062508-JH-015	
Sample Date	WG Pathway	WG Pathway		6/27/2006	9/12/2007	12/5/2007	3/12/2008	6/25/2008	5/13/1999	9/12/2007	3/12/2008	6/25/2008	
Sample Type				Duplicate									
	Units												
Volatile Organic Compounds													
1,2-Dichloroethene (total)	mg/L	NC	NC	--	--	--	--	--	ND(0.001)	--	--	--	
2-Butanone (Methyl ethyl ketone) (MEK)	mg/L	2.8	0.82	ND(0.01)	ND(0.01)	ND(0.01)	ND(0.01)	ND(0.01)	ND(0.02)	ND(0.01)	ND(0.01)	ND(0.01)	
4-Methyl-2-pentanone (Methyl isobutyl ketone) (MIBK)	mg/L	0.23	0.07	ND(0.01)	ND(0.01)	ND(0.01)	ND(0.01)	ND(0.01)	ND(0.01)	0.00044 J	ND(0.01)	ND(0.01)	
Acetone	mg/L	0.93	0.26	ND(0.01)	ND(0.01)	ND(0.01)	ND(0.01)	ND(0.01)	ND(0.1)	ND(0.01)	ND(0.01)	ND(0.01)	
Benzene	mg/L	0.005	0.005	ND(0.001)	ND(0.001)	ND(0.001)	ND(0.001)	ND(0.001)	ND(0.001)	ND(0.001)	ND(0.001)	ND(0.001)	
Carbon disulfide	mg/L	0.03	0.009	ND(0.001)	ND(0.001)	ND(0.001)	ND(0.001)	ND(0.001)	ND(0.005)	ND(0.001)	ND(0.001)	ND(0.001)	
Chloroform (Trichloromethane)	mg/L	0.08	0.08	ND(0.001)	ND(0.001)	ND(0.001)	ND(0.001)	ND(0.001)	ND(0.001)	ND(0.001)	ND(0.001)	ND(0.001)	
cis-1,2-Dichloroethene	mg/L	0.07	0.07	0.0049	0.0031	0.0037	0.0038	0.0012	ND(0.001)	ND(0.0005)	ND(0.0005)	ND(0.0005)	
Dichloroethene	mg/L	NC	NC	--	--	--	--	--	--	--	--	--	
Ethylbenzene	mg/L	0.7	0.7	ND(0.001)	ND(0.001)	ND(0.001)	ND(0.001)	ND(0.001)UJ	ND(0.001)	0.0019	ND(0.001)	ND(0.001)	
Methylene chloride	mg/L	0.005	0.005	ND(0.001)	ND(0.001)	ND(0.001)	ND(0.001)	ND(0.001)	ND(0.005)	ND(0.001)	ND(0.001)	ND(0.001)	
Tetrachloroethene	mg/L	0.005	0.005	ND(0.001)	0.00063 J	0.00035 J	0.00032 J	0.0013 J	ND(0.001)	ND(0.001)	ND(0.001)	ND(0.001)UJ	
Toluene	mg/L	1	1	ND(0.001)	ND(0.001)	ND(0.001)	ND(0.001)	ND(0.001)	ND(0.001)	0.016	ND(0.001)	ND(0.001)	
Trichloroethene	mg/L	0.005	0.005	0.00043 J	0.0013	0.00075 J	0.0007 J	0.00053 J	ND(0.001)	ND(0.001)	ND(0.001)	ND(0.001)	
Xylene (total)	mg/L	10	10	ND(0.001)	ND(0.001)	ND(0.001)	ND(0.001)	ND(0.001)UJ	ND(0.003)	0.016	ND(0.001)	ND(0.001)	
General Chemistry													
Aerobic BTEX specific microbial population	cfu/mL	NC	NC	--	--	--	--	--	--	--	--	--	
Nitrate (as N)	mg/L	NC	NC	--	--	--	--	--	--	--	--	--	
Total heterotropic bacteria	cfu/mL	NC	NC	--	--	--	--	--	--	--	--	--	
Total organic carbon (TOC)	mg/L	NC	NC	--	--	--	--	--	--	--	--	--	

Notes:

ND () - Not present at or above the associated value

J - Estimated concentration

UJ - Estimated reporting limit

NC - No Criteria

--: Not Analyzed

mg/L - milligrams per liter

BTEX - benzene, toluene, ethylbenzene, xylenes

Risk Based Standards for Kansas, RSK Manual - 4th Version, Kansas Department of Health and Environment, June 2007, Appendix A

Shading denotes exceedence of the criteria

TABLE A.8

SUMMARY OF SOIL DETECTED ANALYTICAL DATA
TMW-130 AREA
FORMER FAIRFAX I SITE
KANSAS CITY, KANSAS

Sample Location Sample ID Sample Date Sample Depth Sample Type	KDHE Tier 2 Risk-Based Criteria				SB-130	SB-130A	SB-130A	SB-300	SB-301	SB-301	SB-301	SB-302	SB-303	SB-304
	Non-Residential		Residential		SB-130 5-7.5'	S11806KGSB130A5-7.5	DUP-2	S-092809-JH-001	S-092809-JH-002	S-092809-JH-003	S-092809-JH-004	S-092809-JH-005	S-092909-JH-006	
	Soil Pathway	Soil to GW	Soil Pathway	Soil to GW	11/3/2006	11/8/2006	11/8/2006	9/28/2009	9/28/2009	9/28/2009	9/28/2009	9/28/2009	9/28/2009	9/29/2009
					(5-7.5) ft BGS	(5-7.5) ft BGS	(5-7.5) ft BGS	(18-20) ft BGS	(9-11) ft BGS	(17-19) ft BGS	(17-19) ft BGS	(17-19) ft BGS	(17-19) ft BGS	(17-19) ft BGS
	Units	a	b	c	d		Duplicate							
Metals														
Aluminum	mg/kg	NC	NC	NC	NC	6680	--	--	--	--	--	--	--	--
Arsenic	mg/kg	38	NC	11	NC	5.2 J	--	--	--	--	--	--	--	--
Barium	mg/kg	140000	NC	5500	NC	216	--	--	--	--	--	--	--	--
Beryllium	mg/kg	4100	NC	160	NC	0.35 J	--	--	--	--	--	--	--	--
Cadmium	mg/kg	1000	NC	39	NC	0.31 J	--	--	--	--	--	--	--	--
Calcium	mg/kg	NC	NC	NC	NC	15200	--	--	--	--	--	--	--	--
Chromium	mg/kg	4000	NC	390	NC	10.6	--	--	--	--	--	--	--	--
Cobalt	mg/kg	NC	NC	NC	NC	6.1 J	--	--	--	--	--	--	--	--
Copper	mg/kg	76000	NC	2900	NC	16.0	--	--	--	--	--	--	--	--
Iron	mg/kg	NC	NC	NC	NC	12400	--	--	--	--	--	--	--	--
Lead	mg/kg	1000	NC	400	NC	9.6 J	--	--	--	--	--	--	--	--
Magnesium	mg/kg	NC	NC	NC	NC	5960	--	--	--	--	--	--	--	--
Manganese	mg/kg	95000	NC	3600	NC	258	--	--	--	--	--	--	--	--
Mercury	mg/kg	20	NC	2	NC	0.027 J	--	--	--	--	--	--	--	--
Nickel	mg/kg	41000	NC	1600	NC	16.4	--	--	--	--	--	--	--	--
Potassium	mg/kg	NC	NC	NC	NC	1490	--	--	--	--	--	--	--	--
Vanadium	mg/kg	14000	NC	550	NC	17.8	--	--	--	--	--	--	--	--
Zinc	mg/kg	610000	NC	23000	NC	48.9	--	--	--	--	--	--	--	--
Total Petroleum Hydrocarbons														
Total Petroleum Hydrocarbons - Extractable (DRO)	mg/kg	20000	15000	2000	3000	--	--	--	ND(12)	ND(10)	ND(11)	ND(10)	ND(12)	ND(10)
Total Petroleum Hydrocarbons - Purgeable (GRO)	mg/kg	450	150	220	39	--	--	--	ND(0.11)	ND(0.12)	ND(0.11)	ND(0.11)	ND(0.13)	ND(0.11)
Semivolatile Organic Compounds														
2-Methylnaphthalene	mg/kg	1461	45.0	213	12.2	270 ^{bcd}	--	--	--	--	--	--	--	--
Anthracene	mg/kg	13	13	13	13	5.3 J	--	--	--	--	--	--	--	--
Dibenzofuran	mg/kg	1351	86.5	252	27	7.8 J	--	--	--	--	--	--	--	--
Fluorene	mg/kg	270	270	270	200	12 J	--	--	--	--	--	--	--	--
Naphthalene	mg/kg	325	3.52	104	1.05	39 J ^{bd}	--	--	--	--	--	--	--	--
Phenanthrene	mg/kg	NC	NC	NC	NC	41 J	--	--	--	--	--	--	--	--
Pyrene	mg/kg	140	140	140	140	7.2 J	--	--	--	--	--	--	--	--
Volatile Organic Compounds														
2-Butanone (Methyl ethyl ketone) (MEK)	mg/kg	21000	12	6400	3.6	--	ND(6.5)	ND(13)	ND(0.011)	ND(0.012)	ND(0.01)	ND(0.011)	ND(0.013)	ND(0.011)
Acetone	mg/kg	6200	3.8	1700	1.1	--	ND(6.5)	ND(13)	ND(0.011)	ND(0.012)	ND(0.01)	ND(0.011)	ND(0.013)	ND(0.011)
Benzene	mg/kg	17	0.08	9.8	0.08	--	ND(1.6)	ND(3.1)	ND(0.011)	ND(0.012)	ND(0.01)	ND(0.011)	ND(0.013)	ND(0.011)
Ethylbenzene	mg/kg	650	55	650	55	--	ND(1.6)	0.26 J	ND(0.011)	ND(0.012)	ND(0.01)	ND(0.011)	ND(0.013)	ND(0.011)
Methylene chloride	mg/kg	230	0.03	150	0.03	--	ND(1.6)	ND(3.1)	0.0051 J	0.0028 J	0.0038 J	0.0033 J	0.0054 J	0.0048 J
Toluene	mg/kg	1000	40	930	40	--	ND(1.6)	ND(3.1)	ND(0.011)	ND(0.012)	ND(0.01)	ND(0.011)	ND(0.013)	ND(0.011)
Xylene (total)	mg/kg	700	700	700	700	--	0.11 J	1.1 J	ND(0.011)	ND(0.012)	ND(0.01)	ND(0.011)	ND(0.013)	ND(0.011)

TABLE A.8
SUMMARY OF SOIL DETECTED ANALYTICAL DATA
TMW-130 AREA
FORMER FAIRFAX I SITE
KANSAS CITY, KANSAS

Sample Location	KDHE Tier 2 Risk-Based Criteria				SB-B3-A	SB-B3-A	SB-B5-A	SB-B5-A	SB-D4-A	SB-D4-A	SB-E2-A	SB-E2-A	SB-E4-A	
Sample ID	Non-Residential		Residential		S-092909-JH-021	S-092909-JH-022	S-092909-JH-023	S-092909-JH-024	S-092909-JH-017	S-092909-JH-018	S-092909-JH-019	S-092909-JH-020	S-092909-JH-015	
Sample Date	Soil Pathway	Soil to GW	Soil Pathway	Soil to GW	9/29/2009	9/29/2009	9/29/2009	9/29/2009	9/29/2009	9/29/2009	9/29/2009	9/29/2009	9/29/2009	
Sample Depth					(1-3) ft BGS	(13-15) ft BGS	(1-3) ft BGS	(13-15) ft BGS	(1-3) ft BGS	(8-10) ft BGS	(1-3) ft BGS	(17-19) ft BGS	(1-3) ft BGS	
Sample Type														
	Units	a	b	c	d									
Metals														
Aluminum	mg/kg	NC	NC	NC	NC	--	--	--	--	--	--	--	--	
Arsenic	mg/kg	38	NC	11	NC	--	--	--	--	--	--	--	--	
Barium	mg/kg	140000	NC	5500	NC	--	--	--	--	--	--	--	--	
Beryllium	mg/kg	4100	NC	160	NC	--	--	--	--	--	--	--	--	
Cadmium	mg/kg	1000	NC	39	NC	--	--	--	--	--	--	--	--	
Calcium	mg/kg	NC	NC	NC	NC	--	--	--	--	--	--	--	--	
Chromium	mg/kg	4000	NC	390	NC	--	--	--	--	--	--	--	--	
Cobalt	mg/kg	NC	NC	NC	NC	--	--	--	--	--	--	--	--	
Copper	mg/kg	76000	NC	2900	NC	--	--	--	--	--	--	--	--	
Iron	mg/kg	NC	NC	NC	NC	--	--	--	--	--	--	--	--	
Lead	mg/kg	1000	NC	400	NC	--	--	--	--	--	--	--	--	
Magnesium	mg/kg	NC	NC	NC	NC	--	--	--	--	--	--	--	--	
Manganese	mg/kg	95000	NC	3600	NC	--	--	--	--	--	--	--	--	
Mercury	mg/kg	20	NC	2	NC	--	--	--	--	--	--	--	--	
Nickel	mg/kg	41000	NC	1600	NC	--	--	--	--	--	--	--	--	
Potassium	mg/kg	NC	NC	NC	NC	--	--	--	--	--	--	--	--	
Vanadium	mg/kg	14000	NC	550	NC	--	--	--	--	--	--	--	--	
Zinc	mg/kg	610000	NC	23000	NC	--	--	--	--	--	--	--	--	
Total Petroleum Hydrocarbons														
Total Petroleum Hydrocarbons - Extractable (DRO)	mg/kg	20000	15000	2000	3000	6.7 J	64000 ^{abcd}	ND(12)	ND(12)	8900 ^{cd}	31	850	ND(11)	54
Total Petroleum Hydrocarbons - Purgeable (GRO)	mg/kg	450	150	220	39	ND(0.12)	720 ^{abcd}	ND(6)	ND(6)	78 J ^d	0.17	ND(0.11)	ND(0.13)	0.085 J
Semivolatile Organic Compounds														
2-Methylnaphthalene	mg/kg	1461	45.0	213	12.2	--	--	--	--	--	--	--	--	
Anthracene	mg/kg	13	13	13	13	--	--	--	--	--	--	--	--	
Dibenzofuran	mg/kg	1351	86.5	252	27	--	--	--	--	--	--	--	--	
Fluorene	mg/kg	270	270	270	200	--	--	--	--	--	--	--	--	
Naphthalene	mg/kg	325	3.52	104	1.05	--	--	--	--	--	--	--	--	
Phenanthrene	mg/kg	NC	NC	NC	NC	--	--	--	--	--	--	--	--	
Pyrene	mg/kg	140	140	140	140	--	--	--	--	--	--	--	--	
Volatile Organic Compounds														
2-Butanone (Methyl ethyl ketone) (MEK)	mg/kg	21000	12	6400	3.6	0.0037 J	ND(32)	ND(0.012)	ND(0.011)	ND(1.1)	0.0065 J	ND(0.011)	ND(0.013)	0.007 J
Acetone	mg/kg	6200	3.8	1700	1.1	0.015	ND(32)	ND(0.012)	ND(0.011)	ND(1.1)	0.036	ND(0.011)	ND(0.013)	0.035
Benzene	mg/kg	17	0.08	9.8	0.08	ND(0.011)	ND(32)	ND(0.012)	ND(0.011)	ND(1.1)	0.0031 J	ND(0.011)	ND(0.013)	0.00082 J
Ethylbenzene	mg/kg	650	55	650	55	ND(0.011)	5.5 J	ND(0.012)	ND(0.011)	0.31 J	0.0022 J	ND(0.011)	ND(0.013)	0.0051 J
Methylene chloride	mg/kg	230	0.03	150	0.03	0.0047 J	25 J ^{bd}	0.0061 J	0.0015 J	0.68 J ^{bd}	0.0079 J	0.0047 J	0.0051 J	0.0065 J
Toluene	mg/kg	1000	40	930	40	ND(0.011)	ND(32)	0.00039 J	ND(0.011)	ND(1.1)	ND(0.013)	0.00032 J	ND(0.013)	ND(0.013)
Xylene (total)	mg/kg	700	700	700	700	ND(0.011)	43	ND(0.012)	ND(0.011)	0.15 J	ND(0.013)	ND(0.011)	ND(0.013)	0.0037 J

TABLE A.8

SUMMARY OF SOIL DETECTED ANALYTICAL DATA
TMW-130 AREA
FORMER FAIRFAX I SITE
KANSAS CITY, KANSAS

Sample Location	KDHE Tier 2 Risk-Based Criteria				SB-E4-A	SB-F4-A	SB-F4-A	SB-F5-A	SB-F5-A	SB-G2-A	SB-G2-A	SB-G4-A	SB-G4-A	
Sample ID	Non-Residential		Residential		S-092909-JH-016	S-092909-JH-011	S-092909-JH-012	S-092909-JH-013	S-092909-JH-014	S-092909-JH-009	S-092909-JH-010	S-092909-JH-007	S-092909-JH-008	
Sample Date	Soil Pathway	Soil to GW	Soil Pathway	Soil to GW	9/29/2009	9/29/2009	9/29/2009	9/29/2009	9/29/2009	9/29/2009	9/29/2009	9/29/2009	9/29/2009	
Sample Depth					(17-19) ft BGS	(1-3) ft BGS	(17-19) ft BGS	(1-3) ft BGS	(17-19) ft BGS	(1-3) ft BGS	(17-19) ft BGS	(1-3) ft BGS	(17-19) ft BGS	
Sample Type														
	Units	a	b	c	d									
Metals														
Aluminum	mg/kg	NC	NC	NC	NC	--	--	--	--	--	--	--	--	
Arsenic	mg/kg	38	NC	11	NC	--	--	--	--	--	--	--	--	
Barium	mg/kg	140000	NC	5500	NC	--	--	--	--	--	--	--	--	
Beryllium	mg/kg	4100	NC	160	NC	--	--	--	--	--	--	--	--	
Cadmium	mg/kg	1000	NC	39	NC	--	--	--	--	--	--	--	--	
Calcium	mg/kg	NC	NC	NC	NC	--	--	--	--	--	--	--	--	
Chromium	mg/kg	4000	NC	390	NC	--	--	--	--	--	--	--	--	
Cobalt	mg/kg	NC	NC	NC	NC	--	--	--	--	--	--	--	--	
Copper	mg/kg	76000	NC	2900	NC	--	--	--	--	--	--	--	--	
Iron	mg/kg	NC	NC	NC	NC	--	--	--	--	--	--	--	--	
Lead	mg/kg	1000	NC	400	NC	--	--	--	--	--	--	--	--	
Magnesium	mg/kg	NC	NC	NC	NC	--	--	--	--	--	--	--	--	
Manganese	mg/kg	95000	NC	3600	NC	--	--	--	--	--	--	--	--	
Mercury	mg/kg	20	NC	2	NC	--	--	--	--	--	--	--	--	
Nickel	mg/kg	41000	NC	1600	NC	--	--	--	--	--	--	--	--	
Potassium	mg/kg	NC	NC	NC	NC	--	--	--	--	--	--	--	--	
Vanadium	mg/kg	14000	NC	550	NC	--	--	--	--	--	--	--	--	
Zinc	mg/kg	610000	NC	23000	NC	--	--	--	--	--	--	--	--	
Total Petroleum Hydrocarbons														
Total Petroleum Hydrocarbons - Extractable (DRO)	mg/kg	20000	15000	2000	3000	14000 ^{cd}	6.4 J	12000 ^{cd}	3.7 J	8.7 J	19	ND(10)	15	ND(12)
Total Petroleum Hydrocarbons - Purgeable (GRO)	mg/kg	450	150	220	39	120 ^d	ND(0.12)	76 J ^d	ND(0.11)	ND(0.11)	ND(0.12)	ND(0.11)	ND(0.095)	ND(0.12)
Semivolatile Organic Compounds														
2-Methylnaphthalene	mg/kg	1461	45.0	213	12.2	--	--	--	--	--	--	--	--	--
Anthracene	mg/kg	13	13	13	13	--	--	--	--	--	--	--	--	--
Dibenzofuran	mg/kg	1351	86.5	252	27	--	--	--	--	--	--	--	--	--
Fluorene	mg/kg	270	270	270	200	--	--	--	--	--	--	--	--	--
Naphthalene	mg/kg	325	3.52	104	1.05	--	--	--	--	--	--	--	--	--
Phenanthrene	mg/kg	NC	NC	NC	NC	--	--	--	--	--	--	--	--	--
Pyrene	mg/kg	140	140	140	140	--	--	--	--	--	--	--	--	--
Volatile Organic Compounds														
2-Butanone (Methyl ethyl ketone) (MEK)	mg/kg	21000	12	6400	3.6	ND(3.7)	ND(0.011)	ND(5.5)	ND(0.011)	0.0024 J	ND(0.012)	ND(0.011)	ND(0.0097)	ND(0.012)
Acetone	mg/kg	6200	3.8	1700	1.1	ND(3.7)	ND(0.011)	ND(5.5)	ND(0.011)	0.016	ND(0.012)	ND(0.011)	ND(0.0097)	ND(0.012)
Benzene	mg/kg	17	0.08	9.8	0.08	0.078 J	ND(0.011)	0.12 J ^{bd}	ND(0.011)	ND(0.012)	ND(0.012)	ND(0.011)	ND(0.0097)	ND(0.012)
Ethylbenzene	mg/kg	650	55	650	55	1.4 J	ND(0.011)	1.3 J	ND(0.011)	ND(0.012)	ND(0.012)	ND(0.011)	ND(0.0097)	ND(0.012)
Methylene chloride	mg/kg	230	0.03	150	0.03	2.4 J ^{bd}	0.0015 J	3.7 J ^{bd}	0.0066 J	0.0097 J	0.003 J	0.0042 J	0.0042 J	0.0048 J
Toluene	mg/kg	1000	40	930	40	ND(3.7)	ND(0.011)	ND(5.5)	ND(0.011)	ND(0.012)	ND(0.012)	ND(0.011)	ND(0.0097)	ND(0.012)
Xylene (total)	mg/kg	700	700	700	700	0.18 J	ND(0.011)	0.38 J	ND(0.011)	ND(0.012)	ND(0.012)	ND(0.011)	ND(0.0097)	ND(0.012)

Notes:
ND () - Not present at or above the associated value
J - Estimated concentration
UJ - Estimated reporting limit
NC - No Criteria
--: Not Analyzed
ft BGS - feet below ground surface
mg/kg - milligrams per kilogram
Risk Based Standards for Kansas, RSK Manual - 4th Version, Kansas Department of Health and Environment, June 2007, Appendix A
Shading denotes exceece of the criteria

TABLE A.9

SUMMARY OF GROUNDWATER DETECTED ANALYTICAL DATA
 TMW-130 AREA
 FORMER FAIRFAX I SITE
 KANSAS CITY, KANSAS

Sample Location	KDHE Tier 2 Risk-Based Criteria		<i>TMW-143</i>	<i>TMW-143</i>	<i>TMW-144</i>	<i>TMW-145</i>	<i>TMW-146</i>
Sample ID	Non-Residential	Residential	<i>GW-093009-JH-028</i>	<i>GW-093009-JH-029</i>	<i>GW-093009-JH-025</i>	<i>GW-093009-JH-026</i>	<i>GW-093009-JH-027</i>
Sample Date	WG Pathway	WG Pathway	<i>9/30/2009</i>	<i>9/30/2009</i>	<i>9/30/2009</i>	<i>9/30/2009</i>	<i>9/30/2009</i>
Sample Type				<i>Duplicate</i>			
	<i>Units</i>	a	b				
<i>Total Petroleum Hydrocarbons</i>				ND	ND	ND	ND
<i>Volatile Organic Compounds</i>							
cis-1,2-Dichloroethene	mg/L	0.07	0.07	ND(0.0005)	ND(0.0005)	0.024	ND(0.0005)
Tetrachloroethene	mg/L	0.005	0.005	0.0016	0.0016	ND(0.001)	ND(0.001)
trans-1,2-Dichloroethene	mg/L	0.1	0.1	ND(0.0005)	ND(0.0005)	0.0013	ND(0.0005)
Trichloroethene	mg/L	0.005	0.005	ND(0.001)	ND(0.001)	0.0051^{ab}	ND(0.001)

Notes:

ND () - Not present at or above the associated value

mg/L - milligrams per liter

Risk Based Standards for Kansas, RSK Manual - 4th Version, Kansas Department of Health and Environment, June 2007, Appendix A

Shading denotes exceedence of the criteria

APPENDIX B

SAMPLING AND ANALYSIS PLAN

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1.0 INTRODUCTION

The procedures and protocols presented herein detail the sampling and analytical protocols to be utilized during the Supplemental Site-Wide Investigation at the former Fairfax I Site property located in Kansas City, Kansas (Site). The objectives of the specific activities to be conducted are presented in the *Work Plan for Supplemental Site-Wide Investigations* (Work Plan).

2.0 GENERAL PROTOCOLS

2.1 EQUIPMENT CLEANING

2.1.1 INVESTIGATIVE EQUIPMENT

All equipment brought to the Site will be in good repair and free from dirt and debris. Before initiating drilling/sampling at each location, all downhole equipment and monitoring well components will be pre-cleaned to prevent potential cross-contamination. Pre-cleaning will be accomplished by flushing and wiping the components to remove all visible sediments followed by steam cleaning or high pressure washing with potable water (using a brush if necessary) to remove visible particulate matter and surface films.

2.1.2 SAMPLING EQUIPMENT

All sampling equipment will be decontaminated prior to field use and after each sample is collected to prevent potential cross-contamination between samples. Duplicate samples shall be collected concurrently with original samples; therefore, sampling equipment will not be decontaminated before collection of the duplicate samples. Decontamination of equipment will be performed as follows:

- i) wash with potable water and Alconox™ detergent using a brush, if necessary, to remove all visible foreign matter;
- ii) rinse thoroughly with distilled water; and
- iii) allow the equipment to air dry on a clean plastic sheet or aluminum foil as long as possible.

Following the final rinse, equipment will be visually inspected to verify that it is free of soil and other solid material that could contribute to possible cross-contamination.

2.2 FIELD SAMPLING

2.2.1 SAMPLE LABELING

Each sample will be labeled with a unique sample code that will facilitate tracking and cross-referencing of sample information. The sample identification code system is described below.

Example: GW-100109-XX-01

GW - designates the type of sample (GW-groundwater, S-soil, SW-surface water)
100109 - designates date of collection presented as month/day/year
XX - sampler's initials
01 - sequential number that started with 01 at the beginning of the project

Quality Control (QC) samples also will be numbered with a unique sample identification number, consistent with the numbering system described above.

2.2.2 FIELD LOG

A summary of all activities performed at the Site will be recorded in the field logbook. The field logbook will be a bound document with consecutively numbered pages. The entries for each day will commence on a new page, which will be dated. Changes to an entry will be made by marking through the error with a single line, so as to remain legible, and initialing this action followed by the written correction. The field logbooks generated will be numbered consecutively and maintained in the CRA Chicago office.

The following information will be recorded in the field logbook for each day of investigative/sampling activity:

- i) sample location information;
- ii) nature of activities being performed at the Site;
- iii) unique sample identification number;
- iv) date and time of sample collection;
- v) weather conditions;
- vi) designation as to the type of sample (groundwater, soil, etc.);
- vii) designation as to the means of collection (grab, bailer, etc.);
- viii) name of sampling technician;
- ix) analyses to be performed on sample; and
- x) any other relevant comments such as odor, staining, texture, filtering, preservation, etc.

For the installation of investigative borings the following will be recorded in the field logbook:

- i) weather conditions;
- ii) date of installation;
- iii) type of equipment used;
- iv) length of time to complete the investigative boring;
- v) depth of boring;
- vi) appearance of soil cuttings;
- vii) geologic log of the borehole; and
- viii) any other relevant comments.

Alternatively, the stratigraphic information for each soil boring or monitoring well may be recorded on the appropriate CRA field form.

2.2.3 CHAIN-OF-CUSTODY FORMS

Chain-of-custody forms will be used to track all samples from time of collection to the arrival of samples at the laboratory. Each sample cooler being shipped to the laboratory will contain a chain-of-custody form. The chain-of-custody form consists of four copies that are distributed to the sampler, to the shipper, to the contract laboratory, and to the office file of the project engineer. The sampler and shipper will maintain their copies, while the other two copies are enclosed in a waterproof enclosure within the shipping container. The laboratory, upon receiving the samples, will complete the remaining copies. The laboratory will maintain one copy for its records. The executed original will be returned to CRA with the data deliverables package.

2.2.4 SAMPLE CONTAINERS AND HANDLING

All samples will be placed in appropriate sample containers, labeled, and properly sealed. The sample labels will include the Site name, sample identification number, date of collection, and analyses to be performed. Samples will be cushioned within the shipping coolers by the use of bubble pack and kept cool by the use of sealed plastic bags of ice. A trip blank will accompany each shipment of aqueous samples submitted for VOC analysis.

Samples will be shipped to the project laboratory by commercial courier. For samples collected on a Sunday or holiday, additional ice will be placed in the coolers, and the coolers will be sealed and stored in a secure location and dropped off or picked up by the courier service on the next business day.

Tape will be placed over the lid on the front and back of each shipping cooler. The tape will secure the lid and provide evidence that the samples have not been tampered with en route to the laboratory.

Upon receipt of the cooler by the laboratory, the designated sample custodian will inspect the cooler. The sample custodian will note the condition of the cooler and tape on the chain-of-custody form. The sample custodian will then check the contents of the cooler against the information noted on the chain-of-custody form. If damage or discrepancies are observed, they will be duly recorded in the remarks column of the chain-of-custody form. The form will then be signed and dated. Moreover, any observed damage or discrepancies will be reported immediately to the laboratory supervisor who will inform the laboratory manager and QC officer.

3.0 INVESTIGATIVE PROTOCOLS

3.1 SOIL SAMPLE COLLECTION

Soil borings will be advanced using direct push (e.g., Geoprobe) or hollow stem auger (HSA) drilling methods. Soil borings for monitoring wells will be advanced using HSA drilling methods and split-spoon samplers. Representative soil samples will be collected continuously during the advancement of each soil boring for field screening and stratigraphic classification. Protocols for field screening and stratigraphic classification are detailed in the following section.

3.1.1 FIELD SCREENING

A representative aliquot of soil from each sample interval (maximum 5-foot intervals) will be field-screened using a photoionization detector (PID) and examined and classified in accordance with the Unified Soil Classification System to define subsurface stratigraphy.

Field screening will be conducted by placing a portion of the sample into a zip lock bag. The bag will be sealed and agitated, if necessary, to break up clumps of soil. After approximately 5 minutes, a headspace reading will be obtained by inserting the tip of the PID into the zip lock bag and recording the highest headspace reading. The PID reading will be recorded in the field logbook or alternatively on the CRA stratigraphic form.

3.2 MONITORING WELL INSTALLATION

Temporary and/or permanent monitoring wells will be installed during this investigation. The monitoring wells will be installed using hollow stem auger drilling methods. A geoprobe or split-spoon sampler will be used to collect soil samples above the water table. Once collected, the samples will be logged, and headspace and chemical analyses samples may then be collected.

The boreholes for the monitoring wells will be advanced to a depth of at least 7 feet below the observed water level table. Upon reaching the target depth, the monitoring well will be constructed within the borehole using the following protocols:

- i) a nominal 2-inch diameter Schedule 40 (No. 10 slot) polyvinyl chloride (PVC) screen, 10 feet in length, attached to a sufficient length of Schedule 40 PVC riser pipe to extend to 2 feet above grade surface, will be placed into the open borehole;
- ii) a filter sand pack consisting of silica sand will be installed to a minimum height of 2 feet above the top of the screen;
- iii) a minimum 2-foot thick seal consisting of 3/8-inch diameter bentonite pellets or chips will be placed on top of the sand pack and hydrated, if necessary, using potable water;
- iv) the borehole annulus will be sealed to within 1 to 2 feet of the surface using either bentonite chips or bentonite grout for temporary monitoring wells or cement/bentonite grout for permanent monitoring wells;
- v) the remaining portion of the annulus will be filled with concrete. The well head will be fitted with a water-tight, lockable cap; and
- vi) a steel protective outer casing will be installed over the well and set with concrete.

3.2.1 MONITORING WELL DEVELOPMENT

In order to establish good hydraulic communication with the aquifer and reduce the volume of sediment in the monitoring well, monitoring well development will be conducted in accordance with the procedure outlined below:

- i) Monitoring wells will be surged using a precleaned surge block or stainless-steel bailer for a period of at least 10 minutes.
- ii) Water will be purged from the monitoring well using a precleaned stainless steel bailer or an electronic or pneumatic submersible pump.
- iii) Groundwater will be collected at regular intervals and the pH, conductivity, and temperature will be measured using field instruments. These instruments will be calibrated daily according to the manufacturer's specifications. Additionally, observations such as color, odor, and turbidity of the purged water will be recorded.

- iv) Development will continue until a minimum of ten standing well volumes are purged, the turbidity and silt content of the monitoring well are significantly reduced, and three consistent readings of pH, temperature, and conductivity are recorded. Ten standing well volumes will be calculated as shown below for the 2-inch diameter wells:

$$V_p = 10(0.16H)$$

where: V_p = purge volume (in gallons)
 H = height of the water column in the well (in feet)
 $0.16H$ = one standing well volume (in gallons)

In the event that a monitoring well is purged dry prior to the removal of at least ten well volumes, development will consist of purging the well dry on three consecutive days, or three times on a more frequent schedule if the water level recovers quicker.

3.3 SURVEYING

Horizontal and vertical control at the monitoring well locations will be established by survey. The survey will locate horizontal coordinates to an accuracy of ± 0.5 foot as referenced to the existing Site coordinate system. Top of casing to an accuracy of within 0.01 foot, and ground surface elevations to an accuracy of within 0.1 foot will be measured at each of the monitoring wells. Elevation measurements shall be referenced to a United States Geological Survey (USGS) vertical datum in feet above mean sea level (AMSL). Surveying activities will be conducted by a professional surveyor.

3.4 BOREHOLE ABANDONMENT

Soil borings in which a monitoring well will not be installed will be abandoned by filling the borehole with cement/bentonite grout. The grout will be placed in the borehole using a tremie pipe that is placed at the bottom of the borehole. The cement/bentonite grout mixture should consist of 5 pounds of powdered bentonite and 8½ gallons of water for each 94 pound sack of Portland cement. The abandoned borehole will be topped with soil.

4.0 SAMPLING PROTOCOLS

4.1 SOIL SAMPLING PROTOCOLS

Soil samples for laboratory analysis will be collected separately from the soil aliquots collected for field screening purposes. The soil samples will be collected using the following procedures:

- i) A new pair of disposable nitrile gloves will be donned at each location.
- ii) Prior to use, sampling equipment will be decontaminated in accordance with procedures outlined in Section 2.1.2.
- iii) Soil samples will be collected directly into laboratory-supplied containers.
- iv) Each collected soil sample will be supplied with a unique sample identification number.
- v) Collected samples will be placed immediately into an iced cooler pending delivery to the project laboratory. All equipment used in sample collection will be decontaminated prior to use at the next sampling location.

Samples and any duplicate soil samples will be collected directly into the laboratory-supplied containers concurrently. The sample and duplicate sample will each be assigned a unique sample identification number.

4.2 GROUNDWATER SAMPLING PROTOCOLS

Groundwater samples will be collected from monitoring wells to delineate the extent of impacts. The groundwater samples will be collected in accordance with the Slow Purging/Minimal Disturbance protocols specified below:

- i) A new pair of disposable nitrile gloves (or equivalent) will be donned at each location. Ensure that all sampling equipment has been properly decontaminated and that all instruments have been properly calibrated.
- ii) Measure the depth to water in each well to the nearest 0.01 foot using a pre-cleaned electronic water level meter or oil water interface meter. The depth to water will be measured from a fixed reference point on the north side of the well casing. Well depth should be obtained from the well log.
- iii) Purging and sampling will be conducted using a peristaltic pump or a stainless steel electric submersible pump (Grundfos® or similar).

- iv) If possible, a minimum of 2 feet should be maintained between the pump intake and the well bottom or sediment level, if present.
- v) Purge the monitoring well purging at a pumping rate of between 100 and 500 milliliters per minute (mL/min). The pumping should commence at a very low flow rate and be increased slowly to minimize the agitation of solids and to minimize drawdown.
- vi) Measure the groundwater level with an electronic water level meter while purging with a goal of less than 0.33 feet of drawdown while purging or 25 percent of the distance between the top of the well screen and the pump inlet (if possible). Adjust the flow within the specified range as necessary.
- vii) Measure water field parameters approximately every 3 to 5 minutes using a flow-through cell and a turbidity meter. If purge water initially appears turbid, continue purging until the purge water becomes visibly less turbid before connecting the flow-through cell.
- viii) Continue purging until field parameters have stabilized. Stabilization is achieved after all parameters have stabilized for last three consecutive readings and are within the following limits:

pH	±0.1 pH units;
temperature	±0.5 degrees Celsius or ±1 degree Fahrenheit;
conductivity	±13 percent;
dissolved oxygen	±0.1 mg/L and
turbidity	±10 percent or a final value of less than 10 nephelometric turbidity units (NTU).

Should stabilization not be achieved for all field parameters, purging is continued until a maximum of five well screen volumes have been purged from the well. After purging five well screen volumes, purging is continued if the purge water remains visually turbid and appears to be clearing, or if stabilization parameters are varying slightly outside of the stabilization criteria listed above and appear to be approaching stabilization. In the event field parameter stabilization is not achieved or appears to be approaching stabilization following the removal of five well screen volumes the stabilization criteria will be ignored and the groundwater sample will be collected.

- ix) Disconnect the tubing from flow-through cell and collect groundwater through the tubing directly into laboratory supplied containers in order of decreasing analyte volatility using techniques that minimize sample agitation.

Samples should be collected and containerized in the order of decreasing volatility. Samples collected for dissolved analyses will be field filtered using a

dedicated 0.45-micron filter prior to the addition of sample preservative. Groundwater samples must be labeled immediately and placed into a cooler containing ice.

In the event that the groundwater recharge to the monitoring well is insufficient and the drawdown within the well cannot be limited to less than 0.33 feet (even at the lowest possible pump flow rate), then the well will be pumped until the removal of five well screen volumes and flow rate and the stabilization criteria will be ignored. However, the water level within the well will not be allowed to draw down within the screen interval. Pumping will be stopped if the drawdown approaches the top of the well screen. The water level within the well will then be allowed to recover to within 90 percent of the original water level prior to collecting the groundwater sample.

Duplicate groundwater samples will be collected at a frequency of one per 20 investigative samples collected or at a minimum of one per sampling event.

Samples will be collected for matrix spike/matrix spike duplicate (MS/MSD) analysis at a frequency of one per 20 investigative samples. The sample for MS/MSD analysis will be collected from a well representative of the condition of the majority of the monitoring wells. The chain-of-custody forms sent to the project laboratory will identify those samples collected for MS/MSD analysis.

Field equipment blank (rinsate) samples will be collected at a frequency of one per 20 investigative samples collected or at a minimum of one per sampling event. These samples consist of distilled/deionized water pumped into, and then sampled out of, the equipment being used to purge and sample the monitoring wells. This provides a quality assurance check on the decontamination procedures employed for the pump, tubing, and sample containers. The equipment blank samples will be analyzed for the same analytical parameters as investigative samples.

A trip blank will be provided by the laboratory for each sample cooler containing multiple aqueous samples for VOC analysis. Trip blanks will be analyzed for VOCs.

5.0 WASTE HANDLING PROTOCOLS

Wastes generated may include general refuse, used personal protective equipment (PPE), soil cuttings from soil borings, decontamination water, and development and purge water. General refuse, including plastic sheeting, buckets, paper bags, etc., daily refuse and PPE will be collected in plastic bags and disposed of at the end of each day.

Soil cuttings, decontamination water, development water, and purge water generated from the soil borings and monitoring wells to be installed as part of this Work Plan will be containerized and staged on Site pending characterization and disposal.

The analytical data for the most recent sampling of the existing permanent and temporary monitoring wells indicate that the groundwater from six of the wells to be sampled exhibited concentrations which exceeded the KDHE standards, namely:

MW-103A	MW-109	TMW-123	TMW-127
TMW-130	TMW-144		

Purge water from these six wells will be containerized and staged on Site pending characterization and disposal. Purge water from the remaining 28 existing permanent and temporary monitoring wells to be sampled (where KDHE standards have not been exceeded) will be placed on the ground in the vicinity of the monitoring well.

APPENDIX C

HEALTH AND SAFETY PLAN

EMERGENCY CONTACT LIST AND HOSPITAL ROUTE MAP

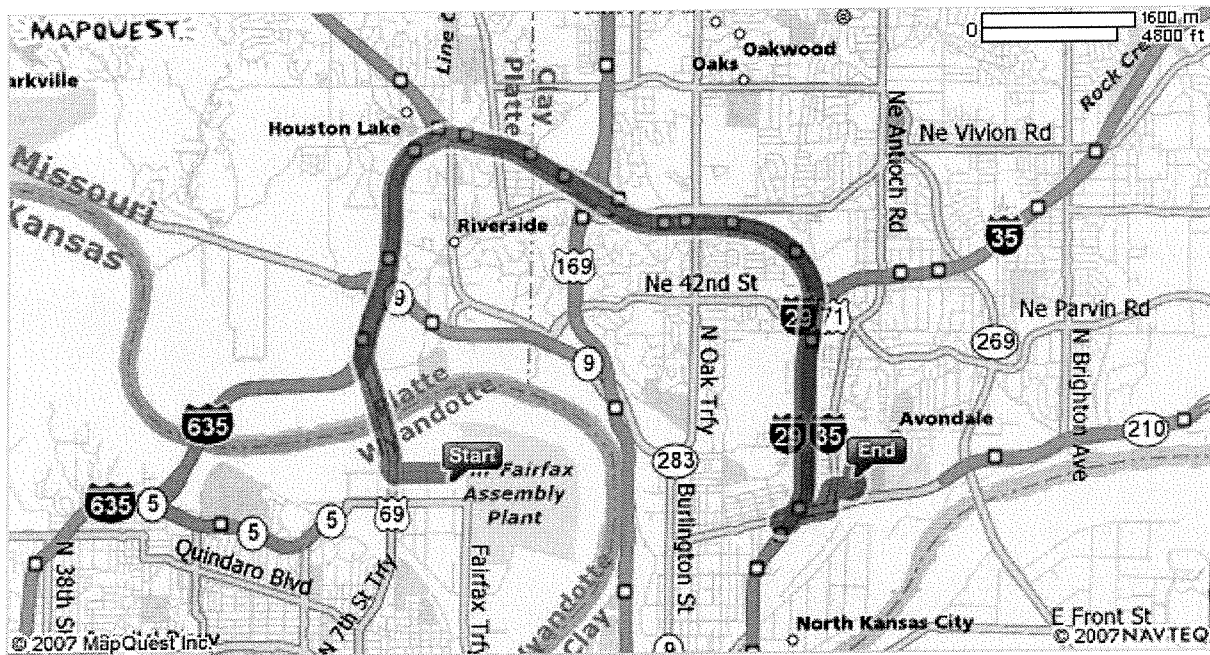
EMERGENCY CONTACT SHEET

CRA FORMER FAIRFAX I SITE

EMERGENCY INFORMATION		
Contact	Phone Number	Hospital Directions
Local Police	911	Directions: Go west on Kindelberger Road. Turn slight right onto N 7 th Street Trafficway/ US-69. Continue on US-60 in Missouri. Merge onto I-635 N. Merge onto I-29 S/US-71 S via Exit 12B toward I-35. Merge onto Armour Road via Exit 6A. Turn left onto Vernon Street/MO-1. Turn right onto E 26 th Avenue. E. 26 th Street becomes Clay Edwards Drive.
Fire Department	911	
Ambulance	911	
Local Hospital: North Kansas City Hospital 2800 Clay Edwards Drive North Kansas City, MO	816-691-2000	Driving Time: 15 minutes Driving Distance: 10 miles
National Poison Center	800-222-1222	CRA – Incident Reporting Hotline Please call (866) 529-4886 and provide: - Name and location of caller - Description of incident - Name of any injured persons - Description of injuries - Phone number for return call
Project Manager Phil Harvey Work: 773-380-9933 Cell: 773-415-9333		
Site Supervisor CRA Personnel Work: Chicago 773-380-9933 Topeka 785-783-8982		
CRA Regional S&H Manager Bill Doyle Work: 734-453-5123 Cell: 734-536-1282		
Site Contact Work: Cell:		
Client Contact Dave Favero Work: 217-522-6714 Cell: 217-741-6235		
Person to verify hospital route CRA Personnel	Signature	

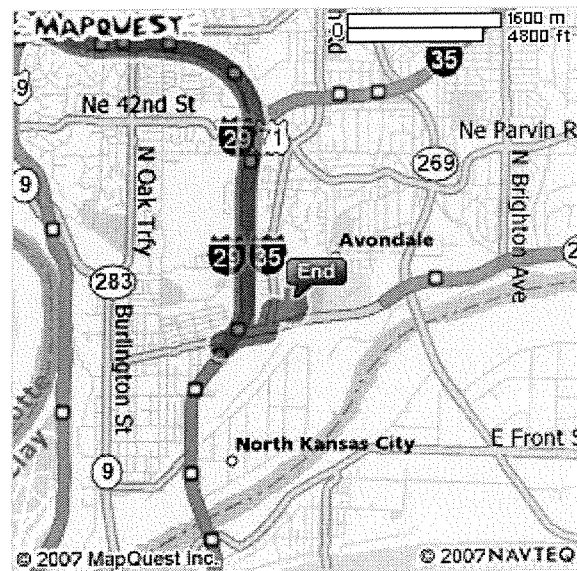
* Hospital Route must be field validated before site work commences.

Driving Directions from 100 Kindleberger Rd, Kansas City, KS to North Kansas City Ho...



Start:
100 Kindleberger Rd
Kansas City, KS 66115, US

End:
North Kansas City Hospital:
816-691-2000
2800 Clay Edwards Dr, Kansas City, MO
64116, US



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These directions are informational only. No representation is made or warranty given as to their content, road conditions or route usability or expeditiousness. User assumes all risk of use. MapQuest and its suppliers assume no responsibility for any loss or delay resulting from such use.

HEALTH AND SAFETY PLAN
Signature Page

Site Name: Former Fairfax I Site

Location Address: 100 Kindelberger Road, Kansas City, Kansas 66115

Reference No.: 012559 CRA Office: Chicago

Anticipated Start Date: October 2010 Anticipated Project Duration: Ongoing

Prepared By (Signature): Pat Kied Date: Aug. 30, 2010

Project Manager (Signature): Pat Flawz Date: 8/30/10

Reviewed By (Signature): Paul J. [Signature] Date: 8/31/2010

Reviewed By (Signature): Wayne St. Denis Date: Aug. 27, 2010

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1.0 INTRODUCTION

1.1 PURPOSE

The purpose of this site-specific health and safety plan (HASP) is to provide specific guidelines and establish procedures for the protection of personnel performing the activities described in Section 2.0 Site Operations. The information in this HASP has been developed in accordance with applicable standards and is, to the extent possible, based on information available to date. The HASP is also a living document, in that it must continually evolve as site conditions and knowledge of the site work activities develop. The HASP is consistent with Motors Liquidation Company (MLC) health and safety guidance (July 2010).

A vital element of CRA's Safety and Health Policies and Procedures is the implementation of a site-specific HASP for field activities. The HASP, as applicable to this project, includes the following measures:

- Communicate the contents of this HASP to site personnel.
- Eliminate unsafe conditions. Efforts must be initiated to identify conditions that can contribute to an incident and to remove exposure to these conditions.
- Utilize the STAR (Stop, Think, Act, and Review) process before beginning any activity/task/job, after an incident, and/or during any unusual circumstances. Stop the activities to think about the task, analyze the task hazards and determine methods to reduce risk, and review the results with affected personnel.
- Revise or develop Job Safety Analysis (JSA) forms for activities. Supervisors and affected personnel are responsible for JSA development. A blank JSA form has been included in Appendix B of this HASP.
- Complete behavioral-based safety observations via the use of the Safe Task Evaluation Process (STEP).
- Reduce unsafe acts [please note that 88 percent of all incidents are directly caused by unsafe acts. Use the CRA BBS tools (STEPS, JSAs, STAR, etc.) to reduce the number of unsafe acts]. Personnel shall make a conscious effort to work safely. A high degree of safety awareness must be maintained so that safety factors become an integral part of the task. Supervisory personnel shall ensure that personnel committing unsafe acts are held accountable via counseling, mentoring, and, if necessary, reprimand.
- Inspect frequently. Regular documented safety inspections of the work site, materials, and equipment by qualified persons ensure early detection of unsafe

conditions. Safety and health deficiencies shall be corrected as soon as possible or project activities shall be suspended. Documentation of daily inspections and corrective actions should be kept with the project files.

1.2 STOP WORK AUTHORITY

All CRA employees are empowered and expected to stop the work of co-workers, subcontractors, client employees, or other contractors if any person's safety or the environment are at risk. No repercussions will result from this action. Reporting of unsafe condition/acts and/or Stop Work Authority shall be documented using the Unsafe Condition/ Acts and SWA form located in Appendix A.

The discovery of any condition that would suggest the existence of a situation more hazardous than anticipated shall result in the removal of site personnel from that area and re-evaluation of the hazard and the levels of protection.

1.3 PERSONNEL REQUIREMENTS

All personnel conducting activities on site must conduct their activities in compliance with all applicable Safety and Health legislation throughout North America to include, but not limited to, U.S. legislation, the Occupational Safety and Health Administration (OSHA) 29 CFR 1910, 29 CFR 1926, and CRA's policies and procedures. **Project personnel must also be familiar with the procedures and requirements of this HASP.** In the event of conflicting safety procedures/requirements, personnel must implement those safety practices affording the highest level of safety and protection.

1.4 SHORT SERVICE EMPLOYEES

CRA Employees identified as Short Service Employees (SSE) (6 months or less) shall not be permitted to work without another non-SSE employee present.

1.5 PROJECT MANAGEMENT AND SAFETY RESPONSIBILITIES

Project Manager – CRA – Phil Harvey

The CRA Project Manager (PM) shall be responsible for the overall implementation of the HASP, and for ensuring that all safety and health (S&H) responsibilities are carried

out in conjunction with this project. This shall include, but is not limited to, review and approval of the HASP, ensuring that the Safe Task Evaluation Process (STEP) forms are completed properly, qualifying and directing subcontractors relative to S&H performance, coordinating all S&H submittals, and consultation with the SS regarding appropriate changes to the HASP. The PM will also ensure that the appropriate resources are provided to support the project with respect to all operations.

Site Supervisor – CRA – CRA Personnel

The Site Supervisor (SS) is the person who, under the supervision of the project manager, shall be responsible for the communication of site requirements to site project personnel and subcontractors, and is responsible for carrying out the safety and health responsibilities by ensuring:

1. Conduct a daily Tailgate Safety meeting that communicates the site-specific hazards for the operations that day, and what proactive measure will minimize the hazards. Each meeting must be documented on the Tailgate Safety Meeting Form to include all topics covered, and the signatures of those in attendance.
2. All necessary cleanup and maintenance of safety equipment is conducted by project personnel.
3. Emergency phone numbers and services, including hospital and clinic locations, are verified.
4. Site personnel are implementing the STAR process before initiating activities.
5. JSA forms are developed and revised accordingly.
6. Forms attached to the HASP are completed, filed, and submitted correctly, including daily tailgate meetings and completion of daily inspection checklists.
7. A pre-entry briefing is conducted and documented, and serves to familiarize on-site personnel with the procedures, requirements, and provisions of the HASP.

Other duties include overall implementation of the HASP and ensuring that all safety and health responsibilities are carried out in conjunction with the project. This shall include, but is not limited to, review and approval of the HASP, communication of site requirements to subcontractor personnel, and consultation with the client/site representative regarding appropriate changes to the HASP.

The SS is also responsible for enforcing safe work practices for project employees. The SS watches for ill effects on any crew member, especially those symptoms caused by

cold/heat stress or chemical exposure. The SS oversees the safety of visitors who enter the site. The SS maintains communication with the client/site representative(s).

Other specific duties of the SS include:

- Ordering the immediate shutdown and/or stop work of site activities in the case of a medical emergency, unsafe condition, or unsafe practice
- Providing the safety equipment, personal protective equipment (PPE), and other items necessary for employees
- Enforcing the use of required safety equipment, PPE, and other items necessary for employee or community safety
- Conducting job site inspections as a part of quality assurance for safety and health
- Reporting safety and health concerns to site and/or project management as necessary

Regional Safety & Health Manager - CRA - Bill Doyle

The Regional Safety & Health Manager (RSHM) is a full-time CRA employee who is trained as a safety and health professional, and serves in a consulting role to the PM and SS regarding potential safety and health issues.

Employee Safety Responsibility

CRA employees are responsible for their own safety as well as the safety of those around them. CRA employees shall use any equipment provided in a safe and responsible manner, as directed by their supervisor.

Employees are directed to take the following actions when appropriate:

- Suspend any operations that may cause an imminent health hazard to employees, subcontractors, or others.
- Utilize the STAR process before initiating work.
- Assist in the development and revision of JSA forms that are appropriate to their current scope of work.
- Prepare, submit, and review behavior-based safety observations using the STEP form. The STEP form is to be used in conjunction with the appropriate JSA to identify positive aspects of task performance as well as to identify any deficiencies associated with the observed task.

- Inspect tools and other equipment before each use or as manufacturer and/or OSHA dictates.
- Correct job site hazards when possible without endangering life or health.
- Report safety and health concerns to the SS, PM, or RSHM.

Subcontractors. CRA subcontractors are responsible for the implementation of their own HASP and agree to comply with its contents. In the event of conflicting safety procedures or requirements, personnel must implement those safety practices that afford the highest level of safety and protection. In addition, non-compliance with safety and health policies and procedures may subject the subcontractor to disciplinary action up to and including termination of their contract with CRA. Subcontractors will be required to attend an initial site orientation and subsequent safety meetings.

Equipment Operators. All equipment operators are responsible for the safe operation of heavy equipment. Operators are responsible for inspecting their equipment on a daily basis to ensure safe performance. Brakes, hydraulic lines, backup alarms, and fire extinguishers must be inspected routinely throughout the project. Equipment will be taken out of service if an unsafe condition occurs. Documentation of daily inspections is required.

Authorized Visitors. Authorized visitors, as approved by MLC, shall be provided with all known information with respect to the site operations and hazards as applicable to the purpose of their visit. All authorized visitors shall read and be familiar with this HASP and sign an acknowledgment statement to this affect. EVERYONE NEEDS TO READ AND SIGN ACKNOWLEDGEMENT.

1.6 SITE HASP AMENDMENTS

Any change to the scope of work must be evaluated for its impact on the overall health and safety of the project and associated personnel. A minor change is one that adjusts already documented hazards within the HASP and does not expose site personnel to chemicals above exposure limits, such as the introduction of a new JSA/JLA, Journey Management Plan, or PPE that does not involve a change in respiratory protection. Minor amendments must be documented on the Site Health and Safety Plan Minor Amendment Form located in Appendix A, in addition to notifications to key personnel.

Significant changes to the scope of work require a rewrite and review/approval of the HASP.

1.7 TRAINING REQUIREMENTS

All personnel conducting work at this site shall have completed the appropriate safety and health training as applicable to their job tasks/duties. The required training is referenced throughout the HASP and identified on each JSA form.

1.7.1 SITE-SPECIFIC TRAINING

An initial site-specific training session or briefing shall be conducted by the PM or SS prior to commencement of work activities. During this initial training session, employees shall be instructed on the following topics:

- Personnel responsibilities
- Content and implementation of the HASP
- Site hazards and controls
- Site-specific hazardous procedures (e.g., drilling, excavations, etc.)
- Training requirements
- PPE requirements
- Emergency information, including local emergency response team phone numbers, route to nearest hospital, incident reporting procedures, and emergency response procedures
- Instruction in the completion of required inspections and forms
- Location of safety equipment, such as portable eyewash, first aid kit, fire extinguishers, etc.

The various components of the project HASP will be presented, followed by an opportunity to ask questions to ensure that each attendee understands the HASP. Personnel will not be permitted to enter or work in potentially contaminated areas of the site until they have completed the site-specific training session. Personnel successfully completing the training session shall sign the HASP Training Acknowledgement Form, which is presented in Appendix A.

In addition to the initial site briefing conducted at the commencement of the project, supplemental brief safety meetings shall be conducted by the SS to discuss potential safety and health hazards associated with upcoming tasks and necessary precautions to be taken.

1.7.2 SAFETY MEETING/SAFETY AND HEALTH PLAN REVIEW

"Tailgate" safety meetings will take place each day prior to beginning the day's work. All site personnel will attend these safety meetings conducted by the SS. The safety meetings will cover specific safety and health issues, including the appropriate JSAs, site activities, changes in site conditions, and a review of topics covered in the site-specific pre-entry briefing. The safety meetings will be documented each day with written sign-in sheets containing a list of topics discussed. To assist with the compliance of documentation of the Tailgate safety meetings, there are two formats available. For meetings attended by more than four people, please use the Tailgate Safety Meeting Form-Large Group daily format, which requires one page for each Tailgate safety meeting conducted. If there are four or less people at the site, please use the Tailgate Safety Meeting Form-Small Group multiple-day format, which provides room to document three Tailgate safety meetings on one page. The two Tailgate Safety Meeting Forms (Large Group and Small Group) are located in Appendix A.

2.0 SITE OPERATIONS

2.1 SITE HISTORY/BACKGROUND

The former Fairfax I Site (Site) is located at 100 Kindleberger Road in Kansas City, Kansas in an industrial area known as the Fairfax District. The Site is located south of a bend in the Missouri River, with the river located north, east, and southeast of the Site. A levee is located between the Site and the Missouri River.

The Site was decommissioned in 1987. The facility consisted of several buildings totaling approximately 2.2 million square feet of covered work area. Several support buildings, such as a powerhouse, cooling towers, and maintenance areas were present along with above ground storage tanks (ASTs), underground storage tanks (USTs) and various waste storage areas. The Fairfax II Plant was constructed southeast of the Site in 1988 and remains an active facility.

The former Fairfax I Site is mostly vacant land, except for a small paved area located at the southwest corner.

The original Site property associated with the former Fairfax I Plant operations covered over 109 acres. The western portion of the property was sold, and the current Site consists of 91 acres. The Site was enrolled in the Kansas Department of Health and Environment (KDHE) Voluntary Cleanup and Property Redevelopment Program (VCPRP).

2.2 SCOPE OF WORK

The objectives of this project are to conduct soil, groundwater, and light non-aqueous phase liquid (LNAPL) investigative activities.

This HASP covers the specific site activities that will be conducted by CRA personnel and their subcontractors. These activities are as follows:

- Mobilization of personnel, materials, and equipment to and from the Site;
- Site reconnaissance activities;
- advancement of soil borings using direct push or hollow stem auger technology;
- installation of temporary and permanent monitoring wells;
- monitoring well and borehole abandonment;

- collection of soil, groundwater, and LNAPL samples;
- site surveying activities; and
- decontamination of personnel and equipment.

If site operations are altered or if additional tasks are assigned, an addendum to this HASP shall be developed to address the specific hazards associated with these changes.

3.0 HAZARD EVALUATION

This section identifies and evaluates the potential chemical, physical, and biological hazards that may be encountered during the completion of this project. These hazards and the anticipated initial exposure levels are based on client data, historical data, etc.

Specific activity JSA forms (located in Appendix B) have been developed to address the hazards associated with the site operations outlined in Section 2.0. New JSAs will be developed on an as-necessary basis if a JSA for that specific task is not available in the HASP. Additionally, current JSAs will be modified and customized in the field to ensure that the task-specific requirements are addressed each time the task is performed.

3.1 CHEMICAL HAZARDS

The chemical hazards associated with conducting site operations include the potential exposure to on-site contaminants encountered during field activities such as advancement of soil borings, installation of monitoring wells, collection of soil, groundwater, and LNAPL samples, products used in decontamination of equipment, and support products such as fuel. The potential routes of exposure from these products during normal use may occur through inhalation of vapors and dusts, or direct contact or absorption with the materials. The chemical hazards of concern that may be encountered during the tasks identified in the project's scope of work include volatile organic compounds and chlorinated solvents, including vinyl chloride, benzene, ethylbenzene, toluene, and xylenes. A listing of the contaminants of concern is found in Table 1.0, which includes exposure limits, signs and symptoms of exposure, chemical properties, and physical characteristics.

3.1.1 CHEMICAL HAZARD CONTROLS

Exposure to potential on-site contaminants/chemicals, such as those listed in Table 1.0 and Appendix C Material Safety Data Sheets (MSDSs), shall be controlled by:

- Monitoring air concentrations with appropriate equipment in the breathing zone
- Revising JSAs to list chemical hazards and associated hazard controls on a task-specific basis
- Employing dust control measures such as wetting the immediate area

- Using PPE/respiratory protection, as appropriate, in areas known to have concentrations above the specified action level for each contaminant

3.1.2 SKIN CONTACT AND ABSORPTION CONTAMINANTS

Skin contact with chemicals may be controlled by use of the proper PPE and good housekeeping procedures. The proper PPE (e.g., Tyvek®, gloves) as described in Section 4.0 shall be worn for all activities where contact with potentially harmful media or materials is anticipated. Utilize manufacturer data on permeation and degradation to minimize skin contact potential (see Section 4.2.1 for additional information).

3.1.3 HAZARD COMMUNICATION

Personnel required to handle or use hazardous materials as part of their job duties will be trained and educated in accordance with the Hazard Communication standard as applicable. The training shall include instruction on the safe use and handling procedures of hazardous materials, how to read and access MSDSs, and the proper labeling requirements.

The appropriate MSDS for the chemicals in use at the site will be maintained by and available for project personnel throughout the course of the project. A copy of all MSDSs is provided in Appendix C.

3.1.4 FLAMMABLE AND COMBUSTIBLE LIQUIDS

The storage, dispensing, and handling of flammable and combustible liquids must be in accordance with industry standards such as National Fire Protection Agency (NFPA) guidelines. The specific flammable or combustible liquids used at the site may include gasoline, diesel, kerosene, oils, and solvents.

Flammable and combustible liquids are classified according to flash point. This is the temperature at which the liquid gives off sufficient vapors to readily ignite. Flammable liquids have flash points below 100°F (37.8°C). Combustible liquids have flash points above 100°F (37.8°C) and below 200°F (93.3°C).

Storage

Many flammables can ignite at temperatures at or below room temperature. They are far more dangerous than combustibles when they are heated. As a result, these products must be handled very carefully. At normal temperatures, these liquids can release vapors that are explosive and hazardous to employee health. Exposure to heat can cause some of these liquids to break down into acids, corrosives, or toxic gases. For this reason, flammable and combustible liquids should be stored in cool, well ventilated areas away from any source of ignition. Always consult the MSDS of the product for specific information.

Flammable and combustible liquids must be stored in designated areas. Such areas must be isolated from equipment and work activity that may produce flames, sparks, heat, or any form of ignition, including smoking. The most practical method is the use of one or more approved (commercially available) flammable/combustible liquid storage cabinets.

Cabinets must be labeled "Flammable – Keep Fire Away." Doors must be kept closed and labeled accordingly. Containers must be kept in the cabinet when not in use.

General Requirements

- Keep containers of flammable/combustible liquids closed when not in use.
- Keep flammable/combustible liquids in designated areas and approved cabinets.
- Do not allow use of unapproved containers for transfer or storage. Use only approved safety cans (5-gallon maximum) with a spring closing lid and spout cover, designated to safely relieve internal pressure when exposed to heat or fire.
- Use only approved self-closing spigots, faucets, and manual pumps when drawing flammable/combustible liquids from larger containers/barrels.
- Use only approved metal waste cans with lids for disposal of shop towels/oily rags.
- Designate "Smoking" and "No Smoking" areas.
- Designate fueling areas.
- Observe all signs indicating "No Smoking," "No Flames," and "No Ignition."

Transferring Flammable/Combustible Liquids

- This seemingly routine task can be hazardous if certain precautions are not followed. Grounding and bonding must be observed at all times to prevent the accumulation of static electricity when transferring containers/barrels one to another.
- Drums should be grounded to a grounding rod using a #4 copper conductor.

- Bonding is necessary between conductive containers (e.g., a barrel and a 5-gallon container).

3.2 PHYSICAL HAZARDS

Physical hazards that may be present during project work include: potential for close proximity to heavy equipment and drilling devices, noise, overhead or underground utilities, , material handling, heavy lifting, , use of hand and power tools, , slip/trip/hit/fall injuries), heat/cold stress, , biological hazards, other potential adverse weather conditions, , and aggressive or menacing behavior. In addition, personnel must be aware that the protective equipment worn may limit dexterity and visibility and may increase the difficulty of performing some tasks.

3.2.1 HEAVY EQUIPMENT AND DRILLING SAFETY

Heavy Equipment

The following practices shall be adhered to by personnel operating heavy equipment (such as backhoes) and personnel working in the vicinity of heavy equipment:

- Heavy equipment is to be inspected when equipment is initially mobilized, delivered to a job site, or after it is repaired and returned to service, to ensure that it meets all manufacturer and OSHA specifications (e.g., fire extinguishers, backup alarms, etc.).
- Heavy equipment is to be inspected on a daily basis. Documentation of this daily pre-operational inspection is to be filed with the project files.
- Heavy equipment is only to be operated by authorized, competent operators.
- Seat belts are to be provided on heavy equipment that is not designed for stand-up operation.
- Equipment/vehicles whose payload is loaded by crane, excavator, loader, etc. will have a cab shield and/or canopy to protect the operator.
- Personnel will not be raised/lowered in buckets.
- Personnel will not ride on fender steps or any place outside the cab.
- Before leaving the equipment controls, ensure that the equipment is in its safe resting position. For a backhoe, apply the parking brake, put the front loader bucket down on the ground level, and ensure that the rear excavator bucket is locked in the

travel position. Bulldozers and scraper blades, loader buckets, dump bodies, and similar equipment will be fully lowered or blocked when not in use.

- Before raising any booms, buckets, etc., check for overhead obstructions.
- Employees involved in the operation shall not wear any loose-fitting clothing, as it has the potential to be caught in moving machinery.
- Personnel shall wear high visibility safety vests, steel toed shoes, safety glasses, hearing protection, and hard hats during heavy equipment operations.
- When moving heavy equipment or when working within 10 feet of a stationary object or in tight quarters, a spotter will be used.

Drilling Equipment

The following practices shall be adhered to by drilling personnel:

- Equipment should be inspected daily by the operator to ensure that there are no operational problems.
- The kill switch will be function-checked and verified to be operational during the documented daily equipment check.
- Personnel shall be instructed in the location and use of the emergency kill switch on the drill rig.
- Employees involved in the operation shall not wear any loose-fitting clothing, including untied shoe/boot laces, draw strings, etc., which have the potential to be caught in moving machinery.
- Before leaving the controls, shift the transmission controlling the rotary drive into neutral and place the feed lever in neutral. Before leaving the vicinity of the drill, shut down the drill engine.
- Before raising the mast, check for overhead obstructions.
- Before the mast of a drill rig is raised, the drill rig must first be leveled and stabilized with leveling jacks and/or cribbing. Re-level the drill rig if it settles after initial setup. Lower the mast only when the leveling jacks are down, and do not raise the leveling jack pads until the mast is lowered completely.
- During freezing weather, do not touch any metal parts of the drill rig with exposed flesh. Freezing of moist skin to metal can occur almost instantaneously.
- Personnel shall wear steel toed shoes, safety glasses, hearing protection, and hard hats during drilling operations.
- The area shall be roped off, marked, or posted to keep the area clear of pedestrian traffic or spectators.

3.2.2 NOISE

Project activities that include working in close proximity to heavy equipment and/or drilling operations, or using power tools that generate noise levels exceeding the decibel range of 85 dBA, will require the use of hearing protection with a Noise Reduction Rating (NRR) of at least 20. Hearing protection (earplugs/muffs) will be available to personnel and visitors requiring entry into these areas.

When it is difficult to hear a coworker at normal conversation distance, the noise level is approaching or exceeding 85 dBA, and hearing protection is necessary. All site personnel who may be exposed to high noise levels will participate in CRA's Hearing Conservation Program.

3.2.3 UTILITY CLEARANCES

Elevated superstructures (e.g., drill rigs, back hoes, scaffolding, ladders, cranes) shall remain a distance of 10 feet away from utility lines (<50 kV) and 20 feet away from power lines (>50 kV). Underground utilities, if present, shall be clearly marked and identified prior to commencement of work. Follow local/state/provincial regulations and client requirements with regards to utility locating requirements (e.g., One-Call).

Personnel involved in intrusive work shall:

- Confirm proposed excavation(s) and heavy truck routes are not in the area of subsurface utilities. This meeting is to be documented.
- Review and adhere to CRA's Subsurface Utility Clearance Protocol. Use prudent digging techniques inside 18 inches of the outside edge of an underground facility. This distance will vary based on state law, facility/client requirements, etc.
- **Utilize the Property Access/Utility Clearance Data Sheet (QSF-019). This is to be completed prior to initiating excavation activities.**
- Be able to determine the minimum distance from marked utilities, identify the work that can be conducted with the assistance of the locator line service, coordinate document/drawing review, and inspect the site for manholes, catch basins, valve boxes, etc. that may indicate the direction/depth of underground installations. Marking indicates only the approximate location of buried lines. After obtaining the facility owner's permission, hand dig test holes (or use an equivalent means) in a careful and prudent manner to determine the precise location of underground

facility lines. If the location of the lines is still undeterminable after hand digging/probing/soft digging, call the facility owner for additional direction and assistance prior to initiating intrusive operations.

- If you must expose a line, state law requires CRA to protect and support the underground facility line while working at the site.

3.2.4 VEHICLE TRAFFIC AND CONTROL

The PM has evaluated this condition and determined that it is not a hazard for this site or project. If conditions change, SWA will be exercised. The PM, SS, and RSHM will review the changes and the HASP will be revised to include this section. Those affected will be notified.

3.2.5 MATERIAL HANDLING AND STORAGE

Material handling and storage practices to be conducted at the project site include manual lifting of materials and possibly the use of hoisting and rigging equipment. As a rule, use mechanical means for lifting heavy loads whenever possible.

General Storage Practices

The basic safety requirement for storage areas is that the storage of materials and supplies shall not create a hazard. Additional general storage area practices include the following:

- Bags, containers, bundles, etc. stored in tiers shall be stacked, blocked, interlocked, and limited in height so that they are stable and secure against sliding or collapse.
- All stacked materials, cargo, etc. shall be examined for sharp edges, protrusions, signs of damage, or other factors likely to cause injury to persons handling these objects. Defects should be corrected as they are detected.
- Storage areas shall be kept free from accumulation of materials that constitute hazards from tripping, fire, explosion, or pest haborage.
- Storage areas shall have provisions to minimize manual lifting and carrying. Aisles and passageways shall provide for the movement of mechanical lifting and conveyance devices.
- Stored materials shall not block or obstruct access to emergency exits, fire extinguishers, alarm boxes, first aid equipment, lights, electrical control panels, or other control boxes.

- "NO SMOKING" signs shall be conspicuously posted, as needed, in areas where combustible or flammable materials are stored and handled.

Cylindrical materials such as pipes and poles shall be stored in racks or stacked on the ground and blocked.

Special Precautions for Hazardous or Incompatible Materials Storage

Generally, materials are considered hazardous if they are ignitable, corrosive, reactive, or toxic. Manufacturers and suppliers of these materials must provide the recipient with MSDSs, which describe their hazardous characteristics and give instructions for their safe handling and storage.

Many hazardous materials are incompatible, which means they form mixtures that may have hazardous characteristics not described on the individual MSDSs. The following special precautions shall be followed regarding the storage of hazardous materials:

- Based on the information available on the MSDSs, incompatible materials shall be kept in separate storage areas
- Warning signs shall be conspicuously posted, as needed, in areas where hazardous materials are stored

3.2.6 HOISTING AND RIGGING

The PM has evaluated this condition and determined that it is not a hazard for this site or project. If conditions change, SWA will be exercised. The PM, SS, and RSHM will review the changes and the HASP will be revised to include this section. Those affected will be notified.

3.2.7 CRANES AND HOISTS

The PM has evaluated this condition and determined that it is not a hazard for this site or project. If conditions change, SWA will be exercised. The PM, SS, and RSHM will review the changes and the HASP will be revised to include this section. Those affected will be notified.

3.2.8 MANUAL LIFTING

Proper lifting takes the hazard out of moving heavy objects. Below are some items that should be considered prior to a lift.

- Establish that you can lift the load safely; if the load is in excess of 50 pounds, you are required to ask for assistance
- Use a mechanical lifting device if available
- Inspect route to be traveled, confirming sufficient clearance
- Look for any obstructions or spills
- Inspect the object to determine how it should be grasped
- Look for any sharp edges, slivers, or other things that may cause personal injury
- Do not move any object that will obstruct your field of vision when transporting the load

When lifting objects, use the following proper lifting techniques:

- Feet must be parted, with one foot alongside the object being lifted and one foot behind. When the feet are comfortably spread, a more stable lift can occur and the rear foot is in a better position for the upward thrust of the lift.
- Use the squat position and keep the back straight - but remember that straight does not mean vertical. A straight back keeps the spine, back muscles, and organs of the body in correct alignment, and minimizes the compression of the guts that can cause a hernia.
- Grip is one of the most important elements of correct lifting. The fingers and the hand are extended around the object, using the full palm. Fingers have very little power, so use the strength of your entire hand.
- The load must be drawn close, and the arms and elbows must be tucked into the side of the body. Holding the arms away from the body increases the strain on the arms and elbows. Keeping the arms tucked in helps keep the body weight centered.

The body must be positioned so that the weight of the body is centered over the feet. This provides a more powerful line of thrust and also ensures better balance. Start the lift with a thrust of the rear foot. Do not twist.

3.2.9 HAND AND POWER TOOLS

Hand Tools

- Hand tools must meet the manufacturer's safety standards
- Hand tools must not be altered in any way

- At a minimum, eye protection must be used when working with hand tools
- Wrenches (including adjustable, pipe, end, and socket wrenches) must not be used when jaws are sprung to the point that slippage occurs
- Impact tools (such as drift pins, wedges, and chisels) must be kept free of mushroom heads
- Wooden handles must be free of splinters or cracks and secured tightly to the tool
- Any damaged or defective tools must be immediately removed from service and tagged for destruction

Power Tools

- All power tools must be inspected regularly and used in accordance with the manufacturer's instructions and the tool's capabilities
- Electric tools must not be used in areas subject to fire or explosion hazards, unless they are approved for that purpose
- Portable electric tools must be connected to a Ground Fault Circuit Interrupter (GFCI) when working in wet areas
- Proper eye protection must be used when working with power tools
- Personnel must be trained in the proper use of each specific tool
- Any damaged or defective power tools must be immediately tagged and removed from service

3.2.10 ELECTRICAL HAZARDS

The PM has evaluated this condition and determined that it is not a hazard for this site or project. If conditions change, SWA will be exercised. The PM, SS, and RSHM will review the changes and the HASP will be revised to include this section. Those affected will be notified.

3.2.11 CONTROL OF HAZARDOUS ENERGY

The PM has evaluated this condition and determined that it is not a hazard for this site or project. If conditions change, SWA will be exercised. The PM, SS, and RSHM will review the changes and the HASP will be revised to include this section. Those affected will be notified..

3.2.12 EXCAVATIONS

The PM has evaluated this condition and determined that it is not a hazard for this site or project. If conditions change, SWA will be exercised. The PM, SS, and RSHM will review the changes and the HASP will be revised to include this section. Those affected will be notified.

3.2.13 COMPRESSED GAS CYLINDERS

Compressed gases present several hazards. The cylinder must be properly labeled, identifying the hazardous properties of the gas, such as toxicity, flammability, or the presence of an oxidizer, and a MSDS must be supplied by the manufacturer. In addition to the gas hazards, compressed gas cylinders pose other hazards simply because they contain gas under pressure.

Regardless of the properties of the gas, any gas under pressure can explode if the cylinder is improperly stored or handled. Improperly releasing the gas from a compressed gas cylinder is extremely dangerous. A sudden release of the gas can cause a cylinder to become a missile-like projectile, destroying everything in its path. Cylinders have been known to penetrate concrete-block walls. To prevent such a dangerous situation, there are several general procedures to follow for the safe storage and handling of a compressed gas cylinder:

- Store cylinders in an area specifically designated for that purpose. This area must protect the cylinders from being struck by another object. The area must be well-ventilated, away from sources of heat, and at least 20 feet away from highly combustible materials. Oxidizers must be stored at least 20 feet away from flammable gases.
- Cylinders must not be dropped or allowed to fall. Chain and rack them in an upright position during use and storage. When transporting cylinders, they must be secured from falling.
- When moving a cylinder, even for a short distance, all the valves must be closed, the regulator removed, and the valve cap installed. Never use the valve cap to lift a cylinder. If you are using a crane or some other lifting device to move a cylinder, use a cradle or boat designed for that purpose. Never use a sling or a magnet to move a cylinder.
- Never permit cylinders to contact live electrical equipment or grounding cables.

- Cylinders must be protected from the sun's direct rays, especially in high-temperature climates. Cylinders must also be protected from ice and snow accumulation.
- Before the gas is used, install the proper pressure-reducing regulator on the valve. After installation, verify the regulator is working, all gauges are operating correctly, and all connections are tight to ensure that there are no leaks. When you are ready to use the gas, open the valve with your hands. Never use a wrench or other tool. If you cannot open it with your hands, do not use it.

3.2.14 FALL HAZARDS

The PM has evaluated this condition and determined that it is not a hazard for this site or project. If conditions change, SWA will be exercised. The PM, SS, and RSHM will review the changes and the HASP will be revised to include this section. Those affected will be notified.

3.2.15 PORTABLE LADDERS

The PM has evaluated this condition and determined that it is not a hazard for this site or project. If conditions change, SWA will be exercised. The PM, SS, and RSHM will review the changes and the HASP will be revised to include this section. Those affected will be notified.

3.2.16 SLIP/TRIP/HIT/FALL

Slip/trip/hit/fall injuries are the most frequent of all injuries to workers. They occur for a wide variety of reasons, but can be minimized by the following prudent practices:

- Spot check the work area to identify hazards
- Establish and utilize a pathway free of slip and trip hazards
- Beware of trip hazards such as wet floors, slippery floors, and uneven surfaces or terrain
- Carry only loads you can see over
- Keep work areas clean and free of clutter, especially in storage rooms and walkways
- Communicate hazards to on-site personnel
- Secure all loose clothing and ties, and remove jewelry while around machinery.
- Report and/or remove hazards

- Keep a safe buffer zone between workers using equipment and tools

3.2.17 HEAT STRESS

Recognition and Symptoms

Temperature stress is one of the most common illnesses faced by project personnel when working in elevated temperatures and/or humidity. Acclimatization and frequent rest periods must be established for conducting activities where temperature stress may occur. Below are listed signs and symptoms of heat stress. Personnel should follow appropriate guidelines if any personnel exhibit these symptoms:

- **Heat Rash:** Redness of skin. Frequent rest and change of clothing.
- **Heat Cramps:** Painful muscle spasms in hands, feet, and/or abdomen. Administer lightly salted water by mouth, unless there are medical restrictions.
- **Heat Exhaustion:** Clammy, moist, pale skin, along with dizziness, nausea, rapid pulse, fainting. Remove to cooler area and administer fluids.
- **Heat Stroke:** Hot dry skin; red, spotted, or bluish; high body temperature of 104°F; mental confusion; loss of consciousness; convulsions or coma. Immediately cool victim by immersion in cool water. Wrap with wet sheet and sponge with cool liquid while fanning, treat for shock. **DO NOT DELAY TREATMENT. COOL BODY WHILE AWAITING AMBULANCE.**

Work Practices

The following procedures will be carried out to reduce heat stress:

- Heat stress monitoring
- Acclimatization
- Work/rest regimes (schedule of breaks) - mandatory breaks scheduled in summer months or during high risk activities for heat stress
- Heat stress safety personal protective equipment (cool-vests, bandanas, etc.)
- Liquids that replace electrolytes, water, and salty foods available during rest
- Use of buddy system

Acclimatization

The level of heat stress at which excessive heat strain will result depends on the heat tolerance capabilities of the worker. Each worker has an upper limit for heat stress,

beyond which the resulting heat strain can cause the worker to become a heat casualty. In most workers, appropriate repeated exposure to elevated heat stress causes a series of physiologic adaptations called acclimatization, whereby the body becomes more efficient in coping with the heat stress. Work/rest regimes should be planned as a component of project preparation and discussed during the daily tailgate safety meetings.

Worker Information and Training

All new and current employees who work in areas where there is a reasonable likelihood of heat injury or illness should be kept informed through continuing education programs (e.g., hazards, effects, preventative measures, drug/alcohol interaction).

3.2.18 SUN EXPOSURE

Overexposure to sunlight is a common concern when field activities occur during warm weather conditions. Overexposure can occur on clear, sunny days as well as on overcast and cloudy days. Ultraviolet (UV) rays from the sun can cause skin damage or sunburn, but can also result in vision problems, allergic reactions, and other skin concerns. Two types of UV rays are emitted from the sun: UVA and UVB rays.

UVB rays cause sunburn, skin cancer, and premature aging of the skin. UVB rays stimulate tanning but are also linked to other problems such as impaired vision, skin rashes, and some allergic and other reactions to certain drugs. Extra care should be taken if activities are to be conducted on or near water. Sunlight reflected off the surface of the water is intensified resulting in accelerated effects. The following steps should be taken to protect against overexposure to sunlight:

- **Always Use Sunscreen:** Apply a broad spectrum sunscreen with Sun Protection Factor (SPF) of at least 15 or higher liberally on exposed skin. Reapply every 2 hours or more. Even waterproof sunscreen can come off when you towel off or sweat.
- **Cover Up:** Wearing tightly woven, loose-fitting, and full-length clothing is a good way to protect your skin from UV rays.
- **Wear a Hat:** A hat with a wide brim offers good sun protection to your eyes, ears, face, and the back of your neck – areas particularly prone to overexposure to the sun.
- **Wear Sunglasses That Block 99 to 100 Percent of UV Radiation:** Sunglasses that provide 99 to 100 percent UVA and UVB protection will greatly reduce sun exposure

that can lead to cataracts and other eye damage. Check the label when buying sunglasses.

- **Seek Shade:** Shade is a good source of protection, but keep in mind that shade structures (e.g., trees, umbrellas, canopies) do not offer complete sun protection.
- **Limit Time in the Midday Sun:** The sun's rays are strongest between 10 a.m. and 4 p.m. Whenever possible, limit exposure to the sun during these hours.

3.2.19 COLD STRESS

Cold stress is similar to heat stress, in that it is caused by a number of interacting factors including environmental conditions, clothing, and workload, as well as the physical and conditioning characteristics of the individual. Fatal exposures to cold have been reported in employees failing to escape from low environmental air temperatures or from immersion in low temperature water. Hypothermia, a condition in which the body's deep core temperature falls significantly below 98.6°F (37°C), can be life threatening. A drop in core temperature to 95°F (35°C) or lower must be prevented.

Air temperature is not sufficient to determine the cold hazard of the work environment. The wind chill must be considered as it contributes to the effective temperature and insulating capabilities of clothing. The equivalent chill temperature should be used when estimating the combined cooling affect of wind and low air temperatures on exposed skin or when determining clothing insulation requirements to maintain the body's core temperature.

The body's physiologic defense against cold includes constriction of the blood vessels, inhibition of the sweat glands to prevent loss of heat via evaporation, glucose production, and involuntary shivering to produce heat by rapid muscle contraction.

The frequency of incidents increases with cold temperature exposures as the body's nerve impulses slow down, individuals react sluggishly, and numb extremities make for increased clumsiness. Additional safety hazards include ice, snow blindness, reflections from snow, and possible skin burns from contact with cold metal.

Pain in the extremities may be the first early warning of danger to cold stress. During exposure to cold, maximum severe shivering develops when the body temperature has fallen to 95°F (35°C). This must be taken as a sign of danger to the employees on site, and cold exposures should be immediately terminated for any employee when severe shivering becomes evident. Useful physical or mental work is limited when severe shivering occurs.

Predisposing Factors for Cold Stress

Certain predisposing factors make an individual more susceptible to cold stress. The project team members are responsible for informing the SHO/SS to monitor an individual, if necessary, or use other means of preventing/reducing the individual's likelihood of experiencing a cold related illness or disorder.

Predisposing factors that will increase an individual's susceptibility to cold stress are listed below:

- **Dehydration:** The use of diuretics and/or alcohol, or diarrhea can cause dehydration. Dehydration reduces blood circulation to the extremities.
- **Fatigue During Physical Activity:** Exhaustion reduces the body's ability to constrict blood vessels. This results in the blood circulation occurring closer to the surface of the skin and the rapid loss of body heat.
- **Age:** Some older and very young individuals may have an impaired ability to sense cold.
- **Poor Circulation:** Vasoconstriction of peripheral vessels reduces blood flow to the skin surface.
- **Heavy Work Load:** Heavy workloads generate metabolic heat and make an individual perspire even in extremely cold environments. If perspiration is absorbed by the individual's clothing and is in contact with the skin, cooling of the body will occur.
- **Use of PPE:** PPE usage that traps sweat inside the PPE may increase an individual's susceptibility to cold stress.
- **Lack of Acclimatization:** Acclimatization, the gradual introduction of workers into a cold environment, allows the body to physiologically adjust to cold working conditions.
- **History of Cold Injury:** Previous injury from cold exposures may result in increased cold sensitivity.

Prevention of Cold Stress

A variety of measures can be implemented to prevent or reduce the likelihood of employees developing cold related ailments and disorders. These include acclimatization, fluid and electrolyte replenishment, eating a well-balanced diet, wearing warm clothing, the provision of shelter from the cold, thermal insulation of metal surfaces, adjusting work schedules, and employee education.

- **Acclimatization:** Acclimatization is the gradual introduction of workers into the cold environment to allow their bodies to physiologically adjust to cold working conditions. However, the physiological changes are usually minor and require repeated uncomfortably cold exposures to induce them.
- **Fluid and Electrolyte Replenishment:** Cold, dry air can cause employees to lose significant amounts of water through the skin and lungs. Dehydration affects the flow of blood to the extremities and increases the risk of cold injury. Warm, sweet, caffeine-free, non-alcoholic drinks and soup are good sources to replenish body fluids.
- **Eating a Well-Balanced Diet:** Restricted diets including low salt diets can deprive the body of elements needed to withstand cold stress. Eat high-energy foods throughout the day.
- **Warm Clothing:** Maintaining air space between the body and outer layers of clothing is beneficial in order to retain body heat. However, the insulating effect provided by such air spaces is lost when the skin or clothing is wet.
- **Work/Rest Regimes:** Schedule work during the warmest part of the day, if possible. Rotate personnel and adjust the work/rest schedule to enable employees to recover from the effects of cold stress.

The parts of the body most important to keep warm are the feet, hands, head, and face. As much as 40 percent of body heat can be lost when the head is exposed.

3.2.20 ADVERSE WEATHER CONDITIONS

The SS shall decide on the continuation or discontinuation of work based on current and pending weather conditions. Electrical storms, heavy rains, hurricanes, tornado warnings, and sustained strong winds (approximately 40 mph) are examples of conditions that would call for the discontinuation of work and evacuation of site.

In addition, no work with elevated super structures (e.g., drilling, crane operations) will be permitted during any type of electrical storm or during wind events that have wind speeds exceeding 40 mph.

3.2.21 HOT WORK HAZARDS

The PM has evaluated this condition and determined that it is not a hazard for this site or project. If conditions change, SWA will be exercised. The PM, SS, and RSHM will review the changes and the HASP will be revised to include this section. Those affected will be notified.

3.2.22 SPECIAL WORK CONDITIONS/SITUATIONS

The PM has evaluated this condition and determined that it is not a hazard for this site or project. If conditions change, SWA will be exercised. The PM, SS, and RSHM will review the changes and the HASP will be revised to include this section. Those affected will be notified.

3.2.23 AGGRESSIVE OR MENACING BEHAVIOR

When confronted by an individual whose behavior becomes aggressive or menacing, staff should remain as calm as possible. Avoid arguing with or physically confronting the individual. Attempt to distance yourself from the individual. Advise others in the area to leave the scene and request police assistance by having someone call 911. Use the team approach. A staff member who is physically unable to break away from an attacker should shout for help.

The use of physical force is justified when a person believes that such force is necessary to protect himself or herself against the use or imminent use of unlawful physical force by another person. The use of physical force is also justified in the defense of another party, such as a co-worker, who is being subjected to unlawful physical force. Staff members can use any technique of legal self-defense in order to halt or distract an attacker until law officers arrive on the scene.

Should an aggressor only be interested in the taking or damaging of property, do not interfere. Obtain a description of the individual to provide to local authorities, including height, weight, race, sex, clothing, accent, unusual markings such as tattoos, facial piercings, scars, hair color, and weapon, if any.

File an Incident Report with your immediate supervisor who will forward same accordingly.

3.3 BIOLOGICAL HAZARDS

CRA employees conduct numerous project activities that may encounter biological hazards, including bloodborne pathogens, insects, spiders, scorpions, rodents, snakes, and large predators. This section identifies precautions to be taken if these hazards are encountered.

3.3.1 VEGETATION OVERGROWTH

Overgrown weeds, bushes, trees, grass, and other vegetation are fire and safety hazards. A number of hidden hazards may not be immediately recognized due to the overgrowth of vegetation in areas where field activities may occur, including discarded junk, litter, and debris. Construction materials such as boards, nails, concrete, and other debris may be hidden beneath tall grass, weeds, and bushes. Other hazards may include steep slopes, potholes, trenches, soft spots, dips, etc., all dangerously concealed from the view of the individual walking or operating motorized equipment in the area. Additionally, biological hazards such as snakes, ticks, chiggers, and mosquitoes may be present, as they breed in overgrowth conditions.

Here are some simple actions you can take:

- Assess the work area and determine if the area requires vegetation clearance. Consider that overgrowth extending above the lowest level of motorized equipment (i.e., bumper or fender) or 6 inches above your ankle has hidden hazards that you will not be able to readily identify.
- Determine if the area is safe to walk or whether you need motorized equipment. Consider the limitations of the equipment.
- Identify slip, trip, and fall hazards and remove from the general work area. Remember to give adequate clearance so that the items being removed do not pose future hazards.
- Adequately protect yourself against the hazards by wearing boots that protect the ankles, wearing long pants, and using insecticides.
- Consider the limitations of manual or mechanical equipment for the clearance of overgrowth, particularly the safety hazards when using sling blades, machetes, weed eaters, bush hogs, or other brush removing equipment.

Before taking any action, determine whether there are any ecological issues that would affect or prevent the removal of overgrowth in protected areas such as wetlands, wildlife habitats, or sanctuaries for endangered and/or protected species.

3.3.2 POISONOUS PLANTS

Common **poison ivy** grows as a small plant, a vine, and a shrub. Poison ivy occurs in every state. The leaves always consist of three glossy leaflets. **Poison sumac** grows as a woody shrub or small tree 5 to 25 feet tall. It usually contains nine leaves, with eight paired leaves and one on top, and is common in swampy areas. The plants are potent sensitizers and can cause a mild to severe allergic reaction, referred to as "contact dermatitis." *These plants are found in the U.S. and Canada.*

Dermatitis, in Rhus-sensitive persons, may result from contact with the milky sap found in the roots, stems, leaves, and fruit, and may be carried by contacted animals, equipment, or apparel.

The best form of prevention is to avoid contact. Wearing long sleeves, gloves, and disposable clothing, such as Tyvek, is recommended in high-risk areas to avoid exposure from contaminated apparel. Barrier creams and cleaners are also recommended.

3.3.3 INSECTS

Ticks

Ticks are blood feeding external parasites of mammals, birds, and reptiles throughout the world. Some human diseases of current interest in the United States caused by tick-borne pathogens include Lyme disease, ehrlichiosis, babesiosis, Rocky Mountain spotted fever, tularemia, and tick-borne relapsing fever. Lyme disease is caused by a bacterial parasite called spirochete and is spread by infected ticks that live in and near wooded areas, tall grass, and brush. The ticks that cause the disease in the Northeast and Midwest are often no bigger than a poppy seed or a comma in newsprint. The peak months for human infection are June through October. Many other tick-borne diseases, such as Rocky Mountain spotted fever, can be carried by a variety of ticks. The prevention and treatment of these diseases are similar to those of Lyme disease.

Prevention

Preventative measures include wearing light-colored clothing, keeping clothing buttoned, tucking pant legs in socks, and keeping shirttails tucked in. Periodic checks for ticks should be made during the day, and especially at night. Hair should also be checked by parting it and combing through it to make sure that no ticks have attached to the scalp. Also, check clothing when it is first removed, before ticks have a chance to crawl off. A shower or bath should be taken as soon as possible after leaving the site for the day.

The most common repellent recommended for ticks is N,N-dimethyl-m-toluamide, or DEET. It is important to follow the manufacturer's instructions found on the container with all insecticides, especially those containing DEET.

In general, DEET insect repellent should only be applied to clothing, not directly on the skin. Do not apply to sunburns, cuts, or abrasions. Use soap and water to remove DEET once indoors. However, the DEET user is required to read the insect repellent label and/or MSDS for safe use requirements. If ticks are not responding to DEET or other safety methods, then the PM and RSHM are to be notified and additional safety controls may be utilized.

Removal

The best way to remove a tick is removal by tweezers. If tweezers are not available, cover your fingers (use a tissue) while grasping the tick. It is important to grasp the tick as close as possible to the site of attachment and use a firm steady pull to remove it. When removing the tick, be certain to remove all the mouth parts from your skin so as not to cause irritation or infection. Wash hands immediately after with soap and water, and apply antiseptic to the area where tick was removed. Get medical attention if necessary.

Symptoms of Lyme Disease

The first symptoms of Lyme disease usually appear from 2 days to a few weeks after a person is bitten by an infected tick. Symptoms usually consist of a ring-like red rash on the skin where the tick attached, and is often bulls eye-like with red on the outside and clear in the center. The rash may be warm, itchy, tender, and/or "doughy" and appears in only 60 to 80 percent of infected persons. An infected person also has flu-like symptoms of fever, fatigue, chills, headaches, a stiff neck, and muscle aches and pains (especially knees). Rashes may be found some distance away from original rash. Symptoms often disappear after a few weeks.

Bees, Wasps, and Yellow Jackets

Stinging insects are members of the order Hymenoptera of the class Insecta. There are two major subgroups: aphids (honeybees and bumblebees) and vespids (wasps, yellow jackets, and hornets). Aphids are docile and usually do not sting unless provoked. The stinger of the honeybee has multiple barbs, which usually detach after a sting. Vespids have few barbs and can inflict multiple stings.

Types of stinging insects that might be encountered on this project site may include:

- Carpenter bees
- Paper wasps
- Honeybees
- Bumblebees
- Yellow jackets
- Mud dauber wasps
- Giant hornets

Symptoms

If you are stung, three types of reactions are possible: a normal, a toxic, or an allergic reaction.

- **Normal Reaction:** Only lasts a few hours and consists of pain, redness, swelling, itching, and warmth near the sting area
- **Toxic Reaction:** Will last for several days, results from multiple stings, and may cause cramps, headaches, fever, and drowsiness
- **Allergic Reaction:** Can cause hives, itching, swelling, tightness in the chest area, and a possibility of breathing difficulties, dizziness, unconsciousness, and cardiac arrest.

The stingers of many Hymenoptera may remain in the skin and should be removed as quickly as possible without concern for the method of removal. An ice cube placed over the sting will reduce pain; aspirin may also be useful. Persons with known hypersensitivity to such stings should carry a kit containing epinephrine in a prefilled syringe. Antihistamines may help decrease hives and angioedema. Persons who have severe symptoms of anaphylaxis, have positive venom skin test results, and are at risk for subsequent stings should receive immunotherapy regardless of age or time since anaphylaxis.

Precautions

The following precautions can help you avoid stings. Try to wear light colored clothing and shy away from dark or floral prints. Avoid wearing perfumes, hairsprays, colognes, and scented deodorants while working outside. If eating outside, keep all food and

drinks covered; sweet foods and strong scents attract stinging insects as well. Never swat or swing at the insect; it is best to wait for it to leave, softly blow it away, or gently brush it aside. Seek medical attention when the reaction to a sting includes swelling, itching, dizziness, or shortness of breath.

If physical control measures are not effective, use a pesticide that will have a minimal impact on both you and the environment.

Fire Ants

Fire ants are reddish-brown in color and range from 1/8 inch to 3/8 inch in length. When a fire ant stings an individual, the individual is rarely only stung once. Most fire ant stings result in a raised welt with a white pustule. If stung by a fire ant, continue to observe the welt and try to prevent secondary infection by keeping the welt intact. However, some individuals may have an allergic reaction to a fire ant sting and require immediate medical attention. Pesticides and even hot water can be used to kill fire ant colonies. *Fire ants are normally seen in the southern states.*

Mosquitoes

Mosquitoes are common pests that can be found in any state and any work environment where warm, humid conditions exist. Mosquitoes can pass along diseases such as West Nile virus and malaria. Several different methods can be used to control adult mosquito populations: repellants such as DEET, mosquito traps, foggers, and vegetation and water management. *Mosquitoes are found from the tropics to the Arctic Circle and from lowlands to the peaks of high mountains.*

3.3.4 POISONOUS SPIDERS

Black Widow

Black Widow spiders are not usually deadly (especially to adults) and only the female is venomous. The female spider is shiny black, usually with a reddish hourglass shape on the underside of her spherical abdomen. Her body is about 1.5 inches long, while the adult male's is approximately half that. The spider's span ranges from 1 to 3 inches. The adult males are harmless, have longer legs, and usually have yellow and red bands and spots over their back, while the young black widows are colored orange and white. The bite of a black widow is often not painful and may go unnoticed. However, the poison injected by the spider's bite can cause severe reactions in certain individuals.

Symptoms

Symptoms include abdominal pain, profuse sweating, swelling of the eyelids, pains to muscles or the soles of the feet, salivation and dry-mouth (alternating), and paralysis of the diaphragm. If a person is bitten, they should seek immediate medical attention. Clean the area of the bite with soap and water. Apply a cool compress to the bite location. Keep effected limb elevated to about heart level. Ask a doctor if Tylenol or aspirin can be taken to relieve minor symptoms. Additional information can be obtained from the Poison Center (1-800-222-1222). ***Black widows are found throughout the tropics, U.S., and Canada.***

Brown Recluse

Brown recluse spiders are usually light brown in color, but in some instances they may be darker. Brown recluse spiders are highly venomous spiders, native to the United States, and found coast to coast. The brown recluse can vary in size, but some can obtain bodies of 5/8 inches in length with a leg span of 1 1/2 inches in diameter. They can be identified by their three pairs of eyes along the head area and their fiddle shaped markings on the back. Most brown recluse bites are defensive rather than offensive. They generally only bite when they feel threatened.

Symptoms

If bitten by a brown recluse, an individual may experience open, ulcerated sores, which when left untreated may become infected and cause tissue necrosis. If an individual believes a spider has bitten them, they need to seek medical attention as soon as possible. In order to minimize the occurrence of brown recluse bites, individuals should shake their clothing and shoes thoroughly, eliminate the presence of cluttered areas, and spray the building perimeters with pesticides. ***Brown recluse are found throughout the U.S., Mexico, and Canada.***

3.3.5 THREATENING DOGS

If you are approached by a frightened or menacing dog:

- Do not attempt to run and don't turn your back
- Stay quiet, and remember to breathe
- Be still, with arms at sides or folded over chest with hands in fists
- Slowly walk away sideways
- Don't stare a dog in the eyes, as this will be interpreted as a threat

- Avoid eye contact
- If you have a jacket, you could wrap it around your arm and should he snap, take the bite harmlessly

3.3.6 RODENTS

Rodentia: (rats, mice, beavers, squirrels, guinea pigs, capybaras, coypu)

Rodents, or Rodentia, are the most abundant order of mammals. There are hundreds of species of rats; the most common are the black and brown rat.

The **Brown Rat** has small ears, blunt nose, and short hair. It is approximately 14 to 18 inches long (with tail). They frequently infest garbage/rubbish, slaughterhouses, domestic dwellings, warehouses, shops, and supermarkets; they also frequent any space with an easy meal and potential nesting sites.

The **Black Rat** can be identified by its tail, which is always longer than the combined length of the head and body. It is also slimmer and more agile than the Norwegian or Brown rat. Its size varies according to its environment and food supply.

The **House Mouse** has the amazing ability to adapt and now can frequently be found in human dwellings. In buildings, mice will live anywhere and they are very difficult to keep out. Mice are also totally omnivorous; in other words, they will eat anything.

Rats and mice often become a serious problem in cold winter months when they seek food and warmth inside buildings. They may suddenly appear in large numbers when excavation work disturbs their in-ground nesting locations or their food source is changed.

There are six major problems caused by rats and mice:

1. They eat food and contaminate it with urine and excrement.
2. They gnaw into materials such as paper, books, wood, or upholstery, which they use as nest material. They also gnaw plastic, cinder blocks, soft metals such as lead and aluminum, and wiring, which may cause a fire hazard.
3. Rats occasionally bite people and may kill small animals.
4. They, or the parasites they carry (such as fleas, mites, and worms), spread many diseases such as salmonella, trichinosis, rat bite fever, hantavirus, Weil's disease, and the bubonic plague.

5. Rats can damage ornamental plants by burrowing among the roots or feeding on new growth or twigs. They also eat some garden vegetables, such as corn and squash.
6. Rats and mice are socially unacceptable. These rodents have been a problem for centuries, chiefly because they have an incredible ability to survive and are so difficult to eliminate. In addition, they are extremely compatible with human behavior and needs.

3.3.7 SNAKES

Snakes may be found in any region of the country. While many snakes encountered are not venomous, a few are, so all snakes should be given a wide berth. Of the 7,000 venomous snakebites reported each year, only about 15 prove to be fatal, so your chances of survival are extremely high. The usual snake encounter is one in which they see you before you see them, and they slither away from you quickly, startling you. If you see a snake, back away from it slowly and do not touch it. If you or someone you know are bitten, try to see and remember the color and shape of the snake, which can help with treatment of the snakebite.

Venomous snakes include the coral snake and pit vipers, such as the cottonmouth (water moccasin), copperhead, and rattlesnake. The venom of pit vipers is primarily *hematoxic* because it acts upon the victim's blood system. This venom breaks down blood cells and blood vessels and affects heart action. Bite victims experience severe burning pain, localized swelling and discoloration for the first 3 to 30 minutes, followed by nausea, vomiting, occasional diarrhea, and usually shock.

Preventing Snakebites

The best ways to prevent snakebites are to watch where you step, put your hands, or sit down. Poisonous snakes live on or near the ground and often like rocks, woodpiles, and other spots that offer both a place to sun and a place to hide. Most bites occur in and around the ankle. About 99 percent of all bites occur below the knee, except when someone accidentally picks up or falls on the snake.

Watching where you step and wearing boots in tall grass can prevent most snakebites. Snake chaps can also help protect against snakebites.

Signals that indicate a poisonous snakebite include:

- One or two distinct puncture wounds, which may or may not bleed - the exception is the coral snake, whose teeth leave a semicircular mark
- Severe pain and burning at the wound site immediately after or within 4 hours of the incident
- Swelling and discoloration at the wound site immediately after or within 4 hours of the incident

Emergency First Aid for Poisonous Snakebite

Although it is important to obtain medical aid immediately, emergency first aid can slow the spread of poison from the bite. Remain calm and avoid unnecessary movement, especially if someone is with you. The rate of venom distribution throughout your body will be slower if you are still and quiet. *Do not* use home remedies, and *do not* drink alcoholic beverages.

To care for a bite from a pit viper, such as a rattlesnake, copperhead, or cottonmouth, follow these steps:

- Call 9-1-1 or the local emergency number
- Wash the wound
- Keep the injured area still and lower than the heart; if possible, carry a person who must be taken to a medical facility or have him or her walk slowly
- Do not apply ice
- Do not cut the wound
- Do not apply suction
- Do not apply a tourniquet
- Do not use electric shock, such as from a car battery

Care for a bite from an elapid snake, such as a coral snake, is the same as for a pit viper, except that after washing the wound you should apply an elastic roller bandage by following these steps (see Section 10 for more information on using an elastic bandage):

- Check for feeling, warmth, and color of the limb beyond where you will be placing the bandage by noting changes in skin color and temperature.
- Place the end of the bandage against the skin and use overlapping turns.

- Gently stretch the bandage as you continue wrapping. The wrap should cover a long body section, such as an arm or a calf, beginning at the point farthest from the heart. For a joint like a knee or ankle, use figure-eight turns to support the joint.
- Always check the area above and below the injury site for feeling, warmth, and color, especially fingers and toes, after you have applied an elastic roller bandage. By checking before and after bandaging, you will be able to tell if any tingling or numbness is from the bandaging or the injury.
- Check the snugness of the bandaging—a finger should easily, but not loosely, pass under the bandage.
- Keep the injured area still and lower than the heart. If possible, carry a person who must be taken to a medical facility or have him or her walk slowly.
- Do not apply ice.
- Do not cut the wound.
- Do not apply suction.
- Do not apply a tourniquet.
- Do not use electric shock, such as from a car battery.

3.3.8 BLOODBORNE PATHOGENS

Hepatitis and other communicable diseases are largely transmitted through exposure to bodily fluids containing the hepatitis virus, which could be found on refuse encountered in subsurface investigations. This includes activities occurring at landfills, sewage treatment facilities, sewers, topical spreading of treated waste and medical wastes (e.g., contaminated needles and syringes). Individuals performing tasks for these types of project should consult with their physicians and be properly vaccinated. The primary method of transmission depends on the prevalence of the disease in a given area.

Hepatitis A is a liver disease caused by the hepatitis A virus. Hepatitis A can affect anyone and can occur in situations ranging from isolated cases of disease to widespread epidemics.

Hepatitis B is a serious disease caused by a virus that attacks the liver. The virus, which is called hepatitis B virus (HBV), can cause lifelong infection, cirrhosis (scarring) of the liver, liver cancer, liver failure, and death.

Hepatitis C is a liver disease caused by the hepatitis C virus (HCV), which is found in the blood of persons who have the disease. HCV is spread by contact with the blood of an infected person.

Hepatitis D is a liver disease caused by the hepatitis D virus (HDV), a defective virus that needs the hepatitis B virus to exist. HDV is found in the blood of persons infected with the virus.

Hepatitis E is a liver disease caused by the hepatitis E virus (HEV) and is transmitted in much the same way as hepatitis A virus. Hepatitis E, however, does not often occur in North America.

Prevention

Preventative measures include wearing appropriate PPE: leather work gloves, a long sleeved shirt, and safety footwear. Several vaccines have been developed for the prevention of hepatitis B and C virus infection. Vaccines rely on the use of one of the viral proteins (hepatitis B surface antigen or HBsAg). The vaccine was originally prepared from plasma obtained from patients who had long-standing hepatitis B virus infection. However, currently these are more often made using recombinant technology, though plasma-derived vaccines continue to be used; the two types of vaccines are equally effective and safe.

4.0 PERSONAL PROTECTIVE EQUIPMENT (PPE)

4.1 GENERAL

This section shall cover the applicable personal protective equipment (PPE) requirements, which shall include eye, face, hand, head, foot, and respiratory protection.

The purpose of PPE is to shield or isolate individuals from the chemical and physical hazards that may be encountered during work activities.

4.2 TYPES OF PERSONAL PROTECTIVE EQUIPMENT (PPE)

The type of PPE required for a project will vary based on the level of protection required to protect the employee from physical, chemical, biological, and thermal hazards.

4.2.1 TYPES OF PROTECTIVE MATERIAL

Protective clothing is constructed of a variety of different materials for protection against exposure to specific chemicals. No universal protective material exists. All will decompose, be permeated, or otherwise fail to protect under certain circumstances.

Fortunately, most manufacturers list guidelines for the use of their products. These guidelines usually concern gloves or coveralls and generally only measure rate of degradation (failure to maintain structure). It should be noted that a protective material may not necessarily degrade but may allow a particular chemical to permeate its surface. For this reason, guidelines must be used with caution. When permeation tables are available, they should be used in conjunction with degradation tables.

In order to obtain optimum usage from PPE, the following procedures are to be followed by all site personnel using PPE:

- When using disposable coveralls, don a clean, new garment after each rest break or at the beginning of each shift
- Inspect all clothing, gloves, and boots both prior to and during use for
 - Imperfect seams
 - Non-uniform coatings
 - Tears

- Poorly functioning closures
- Inspect reusable garments, boots, and gloves both prior to and during use for
 - Visible signs of chemical permeation
 - Swelling
 - Discoloration
 - Stiffness
 - Brittleness
 - Cracks
 - Any sign of puncture
 - Any sign of abrasion

Reusable gloves, boots, or coveralls exhibiting any of the characteristics listed above will be discarded. PPE used in areas known or suspected to exhibit elevated concentrations of chemicals will not be reused.

4.3 RESPIRATORY PROTECTION

The PM has evaluated this condition and determined that it is not a hazard for this site or project. If conditions change, SWA will be exercised. The PM, SS, and RSHM will review the changes and the HASP will be revised to include this section. Those affected will be notified.

4.4.1 REASSESSMENT OF PROTECTION LEVELS

Protection levels provided by PPE selection shall be upgraded or downgraded based upon a change in site conditions or the review of the results of air monitoring or the initial exposure assessment-monitoring program, if one was conducted.

When a significant change occurs, the hazards shall be reassessed. Some indicators of the need for reassessment are:

- Commencement of a new work phase
- Change in job tasks during a work phase
- Change of season/weather

- Temperature extremes or individual medical considerations limit the effectiveness of PPE
- Chemicals other than those expected to be encountered are identified
- Change in ambient levels of chemicals
- Change in work scope, which affects the degree of contact with areas of potentially elevated chemical presence

All proposed changes to protection levels and PPE requirements will be reviewed and approved prior to their implementation by the SS.

5.0 AIR MONITORING PROGRAM

Inhalation hazards are caused from the intake of vapors and contaminated dust. Air monitoring shall be performed while intrusive activities are taking place to detect the presence and relative level of those air contaminants that are inhalation hazards. The purpose of air monitoring is to identify and quantify airborne contaminants in order to determine the level of worker protection needed. Initial screening for identification is often qualitative, but the determination of its concentration (quantification) must await subsequent testing.

All instruments will be calibrated on a daily basis in accordance with the manufacturer's guidelines. Records of all calibrations and real-time measurements will be kept in a bound field logbook or documented via air monitoring and calibration log sheets.

When air monitoring is required, the workers breathing zone(s) will be monitored and the results recorded. Additionally, area samples at the following locations will be taken daily. Record time, location, and results of monitoring and actions taken based on the readings:

- Upwind of work areas to establish background concentrations
- In support zone to check for contamination or migration of emissions
- Along decontamination line to check that decontamination workers are properly protected and on-site workers are not removing protective equipment in a contaminated area
- Downwind of work area to track any contaminants/emissions leaving the site

The data collected throughout the monitoring effort shall be used to determine the appropriate levels of protection. Action levels for upgrading or downgrading of PPE have been established and Table 2 presents the action levels for the on-site Air Monitoring Program.

5.1 EXPOSURE MONITORING

Air monitoring equipment to be used during site activities shall consist of:

- a photoionization detector (PID).

5.1.1 PHOTOIONIZATION DETECTORS

Exposure to volatile organic compounds (VOCs) shall be monitored with a photoionization detector (PID) with a 10.6 eV lamp. The PID has the ability to detect organic vapor concentrations from 1 part per million (ppm) to 2,000 ppm. All PID monitoring shall be conducted in the breathing zone.

5.1.2 MONITORING FREQUENCY

Monitoring will be conducted continuously during ground intrusive activities or during any activity where airborne hazards (e.g., organic vapors) may be present. The monitoring equipment listed per work activity relates to the initial level of protection. The monitoring frequency may be decreased if the work areas and activities are unchanging, the result of the first hour of monitoring indicate contaminant concentrations are non-detect, and no differing conditions are observed.

Monitoring results will be legibly documented each work day. They will note project name/number, date, time, serial number, date of last calibration, name of person performing calibration, name of person performing monitoring, monitor location within the site, and monitoring results. Daily documentation will be kept with the SS and included in the project file.

5.1.3 SAFETY AND HEALTH ACTION LEVELS

An action level is a point at which increased protection or cessation of activities is required due to the concentration of contaminants in the work area. All activities shall be initiated in Modified Level D. The appropriate actions are to be taken at designated action levels. The initial action level(s) for site work can be located in Table 2.

In addition to the action level, an upgrade to Level C is required if:

- Any symptoms occur, as described in Section 3.0
- Requested by an individual performing the task
- Any irritation to eye, nose, throat, or skin occurs

A work stoppage and evacuation (cease and desist) at the specific work area is required if levels in the breathing zone exceed the protection factor of the respirator.

6.0 SITE CONTROL

The purpose of site control is to minimize potential contamination of workers and protect the public from hazards found on site. Site control is especially important in emergency situations.

Site control and work area demarcation will be achieved through posting of signage and placement of barricades. All construction areas will have the appropriate signage posted. Barricades and warning signs will be placed to warn personnel of potential hazards. A standby person (spotter) may be utilized in place of barricades, where appropriate. The following materials may be used to barricade construction areas, crane swing radius, and control traffic:

- Temporary fence
- High visibility tape, rope, or chains
- Traffic cones
- Sawhorses
- Wood or metal guardrails

One pathway should be established for heavy equipment and one for personnel decontamination.

The majority of site operations, as well as access to the site, could be controlled from the support zone. The support zone will provide for team communications, emergency response, and sanitary facilities. Appropriate safety and support equipment also will be located in this zone.

The support zone will be located upwind of site operations if possible, and would be used as a potential evacuation point if appropriate. No potentially contaminated personnel or materials are allowed in this zone.

6.1 COMMUNICATION

Each member of the project team will be able to communicate with other team members at all times. Communications will be by way of telephone or hand signals.

The primary means for external communication are telephones and radio. If telephone lines are not installed at a site, all team members should:

- Know the location of the nearest telephone
- Have the necessary telephone numbers readily available

(Note: The authorized use of cellular phones must be cleared by the client prior to entering site.)

Understanding of the following standard hand signals will be mandatory for all employees, regardless of other means of communication:

- Hand gripping throat – Cannot breathe
- Hands on top of head – Need assistance
- Thumbs up – OK, I'm all right, I understand
- Thumbs down – No, negative
- Gripping partner's wrist, or gripping both of your own hands on wrist (if partner is out of reach) – Leave area immediately

6.2 BUDDY SYSTEM

6.2.1 RESPONSIBILITIES

A buddy system shall be implemented when conducting intrusive activities on this site. This buddy shall be able to:

- Provide his or her partner with assistance
- Observe his or her partner for signs of chemical exposure or temperature stress
- Periodically check the integrity of his or her partner's protective clothing
- Notify emergency personnel if emergency help is needed

6.3 SITE SECURITY

Site security is provided by the area being fenced in by MLC and is necessary to prevent the exposure of unauthorized, unprotected people to site hazards and to avoid interference with safe working procedures. Security shall be maintained outside of the

actual work area(s) so as to prevent unauthorized entry into the work area(s). Members of the general public are to be protected from site hazards.

6.4 DECONTAMINATION

The following are questions/items that may need to be addressed based on site-specific protocols:

- Is formal equipment and/or personal decontamination necessary? If so, what measures will be implemented to manage residual wash waters, sediments, soils, etc.? Disposal measures for used/spent PPE?
- Does a decontamination pad already exist?
- What type(s) of equipment and decontamination cleansers/reagents will be necessary?
- Will wipe sampling and/or other forms of verification be required?
- Is there a decontamination pad/facility present at the site or will a pad need to be constructed? Location(s) of permanent and/or temporary facilities?
- Who is responsible for disposal of any wastes generated by decontamination activities?

The SS is responsible for ensuring that all personnel and pieces of equipment coming off site are properly decontaminated according to the procedures outlined below. Documentation of decontamination must be made in the field log notebook and will become part of the permanent project file.

6.4.1 PERSONNEL AND EQUIPMENT DECONTAMINATION PROCEDURES

All PPE will be disposed of and/or decontaminated at the conclusion of each workday as described below. Decontamination procedures will follow the concept of decontaminating the most contaminated PPE first.

All disposable equipment shall be removed before meal breaks and at the conclusion of the workday, and will be replaced with new equipment prior to commencing work.

Procedures for decontamination must be followed to prevent the spread of contamination and to eliminate the potential for chemical exposure:

- **Personnel:** Decontamination will be initiated prior to exiting the contaminated work area and completed in the Contamination Reduction Zone.
- **Modified Level D:** First, remove outer protective wear. Remove gloves and properly dispose in designated waste container. Wash hands and face.
- **Level C:** Wash and rinse outer gloves, boots and suit, and remove; remove respirator; dispose of cartridges; wash respirator; and remove inner gloves and dispose. Wash hands and face. Handle all clothing inside out when possible.
- **Equipment:** All equipment must be decontaminated with Alconox/Liquinox solution or discarded upon exit from the contaminated area in a well-ventilated area. A temporary decontamination pad with a low-volume high-pressure washer will be set up on site during project operations. All decontamination materials will be drummed for subsequent disposal.

7.0 EMERGENCY PROCEDURES

7.1 ON-SITE EMERGENCIES

Emergencies can range from minor to serious conditions. Various procedures for responding to site emergencies are listed in this section. The PM or SS is responsible for contacting local emergency services, if necessary, for specific emergency situations. Various individual site characteristics will determine preliminary action to ensure that these entry procedures are successfully implemented in the event of an emergency. The project team will address necessary facility/client emergency protocols to ensure compatibility between this document and facility/client programs and expectations.

An Emergency Information Sheet containing the hospital location, directions, government agency phone numbers, emergency phone numbers, and a map with directions to the hospital is located in Appendix A.

7.2 INCIDENT, INJURY, AND ILLNESS REPORTING AND INVESTIGATION

Any work-related incident, injury, illness, exposure, or property loss must be reported to your supervisor, the SS, and **within 1 hour** through the CRA Incident Reporting Hotline. Motor vehicle accidents must also be reported through this system. CRA's Incident Reporting Form, located in Appendix A, must also be filled out and provided to the SS. The report must be filed for the following circumstances:

- Incident, injury, illness, or exposure of an employee
- Injury of a subcontractor
- Damage, loss, or theft of property
- Any motor vehicle accident, regardless of fault, which involves a company vehicle, rental vehicle, or personal vehicle while the employee is acting in the course of employment

Occupational incidents resulting in employee injury or illness will be investigated by the SS. This investigation will focus on determining the cause of the incident and modifying future work activities to eliminate the hazard.

All employees have the right and obligation to report unsafe work conditions, previously unrecognized safety hazards, or safety violations of others. If you wish to

make such a report, it may be made orally to your supervisor or other member of management, or you may submit your concern in writing, either signed or anonymously.

7.3 EMERGENCY EQUIPMENT/FIRST AID

Safety equipment will be available for use by site personnel, located within 30 feet of the work area(s), and maintained at the site. The safety equipment may include, but is not limited to, the following:

- First Aid kit (size is dependant upon the number of personnel on-site):

Contents: Each first aid kit shall contain, as a minimum (ANSI 308.1-2003):

- 1 Absorbent Compress (32 square inches, no side less than 4 inches)
- 16 Adhesive Bandages (1 inch x 3 inches)
- 1 Adhesive Tape (roll, 3/8 inch x 5 yards)
- 10 Individual Antiseptic (0.5 g)
- 6 Burn Treatments (Antibiotic) (each 1/32 oz.)
- 2 pair Medical Exam Gloves (not to be reused)
- 4 Sterile Pads (3 inches x 3 inches)
- 1 Triangular Bandage

This list shall be placed in each first aid kit for the purposes of inspection and restocking.

- Automated External Defibrillators (AEDs) are optional first aid response equipment for conditions related to heart stoppage. If a unit is on site, designated personnel must be trained in the specific AED unit in addition to First Aid and CPR certification, conduct monthly inspections, and contact listed AED Unit coordinator.
- Emergency eyewash bottles and/or an eyewash station lasting 15 minutes.
- Emergency alarms as a means to alert all personnel instantaneously for an emergency.
- Fire extinguisher (at a minimum, a 2A/10BC will be on site).

7.4 EMERGENCY PROCEDURES FOR CONTAMINATED PERSONNEL

Whenever possible, personnel should be decontaminated in the contamination reduction zone before administering first aid, without causing further harm to the patient.

- **Skin Contact:** Remove contaminated clothing, wash immediately with water, and use soap, if available.
- **Inhalation:** Remove victim from contaminated atmosphere. Remove any respiratory protection equipment. Initiate artificial respiration, if necessary. Transport to the hospital.
- **Ingestion:** Remove from contaminated atmosphere. Do not induce vomiting if victim is unconscious. Never induce vomiting when acids, alkalis, or petroleum products are suspected. Transport to the hospital, if necessary.

Any person transporting an injured/exposed person to a clinic or hospital for treatment should take with them directions to the hospital and a listing of the contaminants of concern to which they may have been exposed.

Any vehicle used to transport contaminated personnel will be cleaned or decontaminated, as necessary.

7.5 SITE EVACUATION

In the event of an emergency situation such as fire, explosion, or significant release of toxic gases, project personnel in the field will be notified through cellular phone established communications to evacuate the area. In the event of an emergency, CRA personnel will gather at their primary mustering point for a head count. The SS will determine a primary and secondary muster point to be used as an assembly area in the event of an emergency. The secondary muster point will be located at least 90 degrees from the primary. These locations will be communicated to the work crew(s) during the site-specific training prior to commencement of work activities, weekly thereafter, and prior to the advent of potentially threatening weather. Muster points will be identified in the Emergency Information Sheet and may be indicated on the map.

7.6 SPILL AND RELEASE CONTINGENCIES

If a spill has occurred, the first step is personal safety, then controlling the spread of contamination, if possible. CRA personnel will immediately contact site management to inform them of the spill and activate emergency spill procedures.

8.0 RECORDKEEPING

The SS shall establish and maintain records of all necessary and prudent monitoring activities as described below:

- Name and job classification of the employees involved on specific tasks
- Air monitoring/sampling results and instrument calibration logs
- Records of training acknowledgment forms (site-specific training, toolbox meetings, etc.)
- Documentation of site inspections, results of inspections, and corrective actions implemented
- Emergency reports describing any incidents or accidents

TABLE 1

PROPERTIES OF POTENTIAL SITE CONTAMINANTS

Chemical Name (Synonyms)	Concentration at Site	Exposure Limits	Routes Of Entry	Symptoms/Health Effects	Chemical Properties	Physical Characteristics
Benzene Benzol CAS-71-43-2		TLV: 0.5 ppm [skin] PEL: 1 ppm STEL: 2.5 ppm IDLH: 500 ppm	Inhalation Absorption (skin) Ingestion	ACUTE: Irritation to eyes, skin, respiratory tract; dizziness; headache; nausea; staggered gait; fatigue, abdominal pain. CHRONIC: Defatting of the skin, may have effects on bone marrow and immune system, decrease in blood cells. Carcinogenic to humans.	(FP) 12°F (VP) 75 mm (IP) 9.24 eV (UEL) 7.8% (LEL) 1.2%	Colorless to light-yellow liquid with an aromatic odor. Solid below 42°F.
Ethylbenzene Ethylbenzol EB CAS-100-41-4		TLV: 100 ppm PEL: 100 ppm STEL: 125 ppm IDLH: 800 ppm	Inhalation Ingestion Skin contact Eye contact	ACUTE: Causes irritation of the eyes, skin, mucous membranes, and respiratory tract. Effects on CNS. CHRONIC: Defatting of the skin, narcosis, and coma.	(FP) 55°F (VP) 7 mm (IP) 8.76 eV (UEL) 6.7% (LEL) 0.8%	Colorless liquid with an aromatic odor.
Toluene Methylbenzene Toluol CAS-108-88-3		TLV: 20 ppm [skin] PEL: 200 ppm STEL: NE IDLH: 500 ppm	Inhalation Ingestion Absorption	ACUTE: Irritation to eyes and respiratory tract. Ingestion may cause chemical pneumonitis. Affects CNS. Unconsciousness and cardiac dysrhythmia at high level exposures. CHRONIC: Defatting of the skin. Affects CNS. Enhanced hearing damage.	(FP) 40°F (VP) 21 mm (IP) 8.82 eV (UEL) 7.1% (LEL) 1.1%	Colorless liquid with a sweet, pungent, benzene like odor.
Xylene (o,m,p isomers) CAS-106-42-3		TLV: 100 ppm PEL: 100 ppm STEL: 150 ppm IDLH: 900 ppm	Inhalation Absorption Ingestion	ACUTE: Irritation to eyes and respiratory tract. Ingestion may cause chemical pneumonitis. Affects CNS. CHRONIC: Defatting of the skin, lung damage resulting in chronic bronchitis. Affects CNS and blood.	(FP) 90/82/81°F (IP) 7/9/9 mm (IP) 8.56eV (UEL) 6.7% (LEL) 0.9%	Colorless liquid with an aromatic odor. (p-isomer solid <56°F).
Vinyl Chloride Chloroethene VCM Chloroethylene CAS-75-01-4		TLV: 1 ppm PEL: 1 ppm STEL: NE IDLH: NE	Inhalation Skin contact Eye contact	ACUTE: Irritation to eyes. Affects CNS. May cause unconsciousness. CHRONIC: Affects liver, spleen, blood and peripheral blood vessels, tissue and bones in fingers. Human carcinogen.	(FP) NA (gas) (VP) 3.3 atm (IP) 9.99 eV (UEL) 33.0% (LEL) 3.6%	Colorless gas or liquid (<7°F) with a pleasant odor at high concentrations.
MIBK Methyl isobutyl ketone Hexone 4-methyl-2-pentanone CAS-108-10-1		TLV: 50 ppm PEL: 100 ppm STEL: 75 ppm IDLH: 500 ppm	Inhalation Ingestion Skin contact Eye contact	ACUTE: Irritation of eyes, skin and respiratory tract. Ingestion risks chemical pneumonitis. May effect CNS at high concentrations, resulting in narcosis. CHRONIC: Dermatitis.	(FP) 64°F (VP) 16 mm (IP) 9.30 eV (UEL) 8.0% @ 200°F (LEL) 1.2% @ 200°F 1.2%	Colorless liquid with a pleasant odor.

Notes:

FP	FP - Flash Point	PEL	PEL - OSHA Permissible Exposure Limit
IDLH	IDLH - Immediately Dangerous to Life and Health	STEL	STEL - Short Term Exposure Limit
IP	IP - Ionization Potential	TLV	TLV - ACGIH Threshold Limit Value
NE	NE - Not Established (Information Not Available)	VP	VP - Vapor Pressure
NA	NA - Not Applicable	C	C - Ceiling Exposure Limit
CNS	CNS - Central Nervous System	[skin]	[skin] - potential for dermal absorption
PNS	PNS - Peripheral Nervous System	mm	mm - millimeters Hg (mercury)
ppm	ppm - parts per million	eV	eV - electrovolts
mg/m ³	mg/m ³ - milligrams per cubic meter		

TABLE 1

PROPERTIES OF POTENTIAL SITE CONTAMINANTS

Chemical Name (Synonyms)	Concentration at Site	Exposure Limits	Routes Of Entry	Symptoms/Health Effects	Chemical Properties	Physical Characteristics
MEK 2-Butanone Methyl ethyl ketone Methyl acetone CAS-78-93-3		TLV: 200 ppm PEL: 200 ppm STEL: 300 ppm IDLH: 3,000 ppm	Inhalation Ingestion Skin contact Eye contact	ACUTE: Vapors are irritating to eyes, skin, nose and causes headaches. Ingestion causes dizziness and vomiting. May affect CNS. CHRONIC: Defatting of the skin.	(FP) 16°F (VP) 78 mm (IP) 9.54 eV (UEL) 11.4% (LEL) 1.4%	Colorless liquid with a moderately sharp, fragrant mint- or acetone-like odor.
Acetone 2-Propanone Methyl ketone Dimethyl ketone CAS-67-64-1		TLV: 500 ppm PEL: 1,000 ppm STEL: 750 ppm IDLH: 2,500 ppm	Inhalation Ingestion Skin contact Eye contact	ACUTE: Vapors irritating to eyes and respiratory tract. May cause headaches and dizziness, effects on CNS, liver, kidneys and gastrointestinal tract. CHRONIC: Prolonged contact causes defatting of the skin, possibly dermatitis. Substance may affect blood and bone marrow.	(FP) 0°F (VP) 180 mm (IP) 9.69 eV (UEL) 12.8% (LEL) 2.5%	Colorless liquid, with a fragrant mint-like odor.
cis-1,2-Dichloroethene Acetylene dichloride 1,2-Dichloroethylene CAS-540-59-0		TLV: 200 ppm PEL: 200 ppm STEL: NE IDLH: 1000 ppm	Inhalation Ingestion Skin contact Eye contact	ACUTE: Irritation of the eyes and respiratory tract. CNS depression. Exposure could cause lowering of consciousness. CHRONIC: Defatting of the skin. May cause damage to liver.	(FP) 36-39°F (VP) 180-265 mm (IP) 9.65 eV (UEL) 12.8% (LEL) 5.6%	Colorless liquid (usually a mixture of the cis and trans isomers) with a slightly acrid, chloroform-like odor.
Tetrachloroethene PCE Perchloroethylene Tetrachloroethylene CAS-127-18-4		TLV: 25 ppm PEL: 100 ppm STEL: 100 ppm IDLH: 150 ppm	Inhalation Ingestion Absorption	ACUTE: Irritation to skin, eyes and respiratory tract. Ingestion may cause chemical pneumonitis. Affects CNS. Unconsciousness at high level exposures. CHRONIC: Dermatitis. May cause liver and kidney damage. Probable human carcinogen.	(FP) NA (VP) 14 mm (IP) 9.32 eV (UEL) NA (LEL) NA	Colorless liquid with a mild, chloroform-like odor.

Notes:

FP	FP - Flash Point	PEL	PEL - OSHA Permissible Exposure Limit
IDLH	IDLH - Immediately Dangerous to Life and Health	STEL	STEL - Short Term Exposure Limit
IP	IP - Ionization Potential	TLV	TLV - ACGIH Threshold Limit Value
NE	NE - Not Established (Information Not Available)	VP	VP - Vapor Pressure
NA	NA - Not Applicable	C	C - Ceiling Exposure Limit
CNS	CNS - Central Nervous System	[skin]	[skin] - potential for dermal absorption
PNS	PNS - Peripheral Nervous System	mm	mm - millimeters Hg (mercury)
ppm	ppm - parts per million	eV	eV - electrovolts
mg/m ³	mg/m ³ - milligrams per cubic meter		

TABLE 2

**ON-SITE AIR MONITORING PROGRAM ACTION LEVELS
HEALTH AND SAFETY PLAN
FORMER FAIRFAX I SITE
KANSAS CITY, KANSAS**

<i>Monitoring Device</i>	<i>Action Level</i>	<i>Action</i>
Photoionization Detector (PID)	VOCs	
10.6 or greater eV lamp	< 1.0 ppm or Background	Full-face air purifying respirator available
	>1 ppm and < 50 ppm	Full-face air purifying respirator Level C PPE MSA GME P100 Cartridges
	<u>≥ 50 ppm</u>	Cease operations and move to a safe place. Notify SHO.

If CRA is unable to identify/quantify the contaminants, supplied air will be required when the PID reading is greater than background, as the contaminant will be unknown and NIOSH, OSHA, and the manufacturer's use requirements for Level C (air purifying respirators) will not be met. If PID readings subside, workers can downgrade as necessary. CRA will upgrade to supplied air and attempt to obtain additional information for possible chemicals present in CRA's work area. The Owner will need to provide/obtain additional information as to the identity of the contaminant(s) in order to permit the use of Modified D and/or Level C.

Notes:

SHO Safety and Health Officer
LEL Lower Explosive Limit
PPE Personnel Protective Equipment
ppm parts per million

APPENDIX A

FORMS

1. EMERGENCY CONTACT SHEET
2. HASP ACKNOWLEDGEMENT FORM
3. TAILGATE SAFETY MEETING FORMS:
 - LARGE GROUP
 - SMALL GROUP
4. CRA INCIDENT REPORTING FORM
5. CRA NEAR LOSS REPORTING FORM
6. UNSAFE ACT AND CONDITIONS AND STOP WORK AUTHORITY FORM
7. SAFE TASK EVALUATION PROCESS FORM
8. PROPERTY ACCESS/UTILITY CLEARANCE DATA SHEET
9. SAFETY COORDINATION REVIEW
10. MAP TO THE HOSPITAL (Attach this document to the plan)
11. DAILY OPERATOR CHECKLIST
12. SITE HASP MINOR AMENDMENT FORM

EMERGENCY CONTACT LIST AND HOSPITAL ROUTE MAP

EMERGENCY CONTACT SHEET

CRA FORMER FAIRFAX I SITE

EMERGENCY INFORMATION		
Contact	Phone Number	Hospital Directions
Local Police	911	Directions: Go west on Kindelberger Road. Turn slight right onto N 7 th Street Trafficway/US-69. Continue on US-60 in Missouri. Merge onto I-635 N. Merge onto I-29 S/US-71 S via Exit 12B toward I-35. Merge onto Armour Road via Exit 6A. Turn left onto Vernon Street/MO-1. Turn right onto E 26 th Avenue. E. 26 th Street becomes Clay Edwards Drive.
Fire Department	911	
Ambulance	911	
Local Hospital: North Kansas City Hospital 2800 Clay Edwards Drive North Kansas City, MO	816-691-2000	Driving Time: 15 minutes Driving Distance: 10 miles
National Poison Center	800-222-1222	CRA – Incident Reporting Hotline Please call (866) 529-4886 and provide: - Name and location of caller - Description of incident - Name of any injured persons - Description of injuries - Phone number for return call
Project Manager Phil Harvey Work: 773-380-9933 Cell: 773-415-9333		
Site Supervisor CRA Personnel Work: Chicago 773-380-9933 Topeka 785-783-8982		
CRA Regional S&H Manager Bill Doyle Work: 734-453-5123 Cell: 734-536-1282		
Site Contact Work: Cell:		
Client Contact Dave Favero Work: 217-522-6714 Cell: 217-741-6235		
Person to verify hospital route CRA Personnel	Signature	

* Hospital Route must be field validated before site work commences.

HASP ACKNOWLEDGMENT SHEET

This is to certify that I have received a pre-entry briefing regarding this HASP (CRA Former Fairfax I Site) and I understand its contents. My failure to follow and comply with the requirements contained in this plan may result in disciplinary action and/or termination.

Print Name

Signature

Date _____

[illegible]

**TAILGATE SAFETY MEETING FORM
LARGE GROUP FORMAT - SINGLE DAY
FORMER FAIRFAX I SITE**

Date: _____ Time: _____ Presenter: _____

Safety topics/items discussed:

Site personnel in attendance:

Print Name	Signature	Company
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
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_____	_____	_____

**TAILGATE SAFETY MEETING FORM
SMALL GROUP FORMAT - MULTIPLE DAYS
FORMER FAIRFAX I SITE**

Date: _____ Time: _____ Presenter: _____

Safety topics/items discussed:

Site personnel in attendance:

Print Name	Signature	Company
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

Date: _____ Time: _____ Presenter: _____

Safety topics/items discussed:

Print Name	Signature	Company
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

Date: _____ Time: _____ Presenter: _____

Safety topics/items discussed:

Print Name	Signature	Company
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

**TAILGATE SAFETY MEETING FORM
SMALL GROUP FORMAT - MULTIPLE DAYS
FORMER FAIRFAX I SITE**

Date: _____ Time: _____ Presenter: _____

Safety topics/items discussed:

Site personnel in attendance:

Print Name	Signature	Company
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

Date: _____ Time: _____ Presenter: _____

Safety topics/items discussed:

Print Name	Signature	Company
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

Date: _____ Time: _____ Presenter: _____

Safety topics/items discussed:

Print Name	Signature	Company
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

**TAILGATE SAFETY MEETING FORM
SMALL GROUP FORMAT - MULTIPLE DAYS
FORMER FAIRFAX I SITE**

Date: _____ Time: _____ Presenter: _____

Safety topics/items discussed:

Site personnel in attendance:

Print Name	Signature	Company
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

Date: _____ Time: _____ Presenter: _____

Safety topics/items discussed:

Print Name	Signature	Company
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

Date: _____ Time: _____ Presenter: _____

Safety topics/items discussed:

Print Name	Signature	Company
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____



CONESTOGA-ROVERS & ASSOCIATES (CRA) INCIDENT REPORTING FORM

Incidents must be called into Incident Hot Line: 1-866-529-4886



Safety Means Awareness
Responsibility Teamwork

Instructions: For Personal Injuries, Occupational Illnesses, and Property Damage, complete Sections 1 and 2.
For Vehicle Accidents, Complete Sections 1, 2, and 4. **Initial report must be submitted within 24 hours.**

Report Status (insert date)	Initial Report	Update Report	Final Report	Verification/Validation	Report Input into SMART Database

SECTION 1

A. Employee Identification					
☐ CRA Employee ☐ Temporary Employee ☐ Subcontractor					
Employee No.	Last Name	First Name	Middle Name/Initial	☐ Male ☐ Female	
Area Code ()	Telephone Number	Employee Home Address (Street, City, State, Province, Zip Code)			
Date of Hire	Position/Title	Supervisor	Employee's Company/Home Office Location		
B. General Information					
Where did the incident occur and which country?			Type of incident (Check all that apply)		
☐ Office ☐ Project Site ☐ Other _____			☐ Employee Injury/Illness ☐ Vehicle Accident		
☐ Canada ☐ United States ☐ UK			☐ Property Damage Only		
Address of Incident (City, State, Province, Zip Code)			Specific Location of incident (e.g., where on site)		
Date and Hour of Incident		Date and Hour Reported to Employer		Date and Hour Last Worked	
MM/DD/YYYY	a.m. p.m.	MM/DD/YYYY	a.m. p.m.	MM/DD/YYYY	a.m. p.m.
Normal Work Hours		Witnesses?		Witness Name and Telephone Number	
From: To:		☐ Yes ☐ No			
C. Project Information (Project Related Incident Only) Project Related? ☐ Yes ☐ No					
Project #	Project Name	Project Manager	Site Telephone Number ()	Project Manager Cell Number ()	
Client Name	Was the Client Advised of the Incident? ☐ Yes ☐ No		Name	Date and Time	

SECTION 2

A. Details of the Incident	
1. What job/task was being performed when the incident occurred? (Example: collecting groundwater samples).	
2. Provide a detailed description of the employee's specific activities at the time of the incident. Include details of equipment/materials being used, including the size and weight of objects being handled, and weather conditions at time of the incident. If necessary, attach additional pages to the report.	
3. For injuries, identify the specific part of body injured, and specify left or right side. For illnesses, identify and describe the affected area/body part.	
4. Identify the object or substance that directly injured the employee and how. Include size, weight, and shape of object, quantity of substance, etc.	
5. Identify property damaged and how it was damaged (include owner of property, nature and source of damage, and model and serial number, if appropriate).	
B. Health Care/Medical Treatment	
Employee received health care?	Identify the type of health care provided and where it was performed. (Check all that apply).
☐ Yes ☐ No	☐ First Aid ☐ Medical treatment other than first aid (sutures, etc.) ☐ Hospitalized ☐ Clinic ☐ Hospital emergency room ☐ On location by self or CRA employee ☐ On site by EMT
Name of Health Care Provider, Physician's Name, Phone Number, Address (Street, City, Province/State, and Postal/Zip Code)	

SECTION 2 (continued)

C. Incident Investigation

☐ 5 Why Root Cause Analysis Investigation [Non-OSHA Recordable, <\$5,000 damage]

☐ Tap Root Cause Analysis [OSHA Recordable, and/or >\$5,000 damages]

HASP prepared?

☐ Yes ☐ No ☐ N/A

Submit a PDF of HASP and relevant JSA(s) to Investigation Team.

If yes, was the HASP on site?

☐ Yes ☐ No

Did the safety plan identify and provide safety procedures for the specific tasks the employee was conducting when injured?

☐ Yes ☐ No If no, why not? (Explain) _____

Did the employee utilize the STAR process before initiating the task?

☐ Yes ☐ No If no, why not? (Explain) _____

Was the employee drug & alcohol tested post incident? ☐ Yes ☐ No

5-Why Root Cause: Incident Statement

1. Why did "above" happen?

2. Why did "1" happen?

3. Why did "2" happen?

4. Why did "3" happen?

5. Why did "4" happen?

6. Why did "5" happen?

Additional information: Attach photos, witness statement(s), affected employee statement, accident diagrams, as applicable, to the end of this document.

See *Corrective Actions/Verification and Validation* Section (Page 4)

D. Accountability

Initial Report Date
Month Day Year

Initial Report Prepared by: (please print)

Initial Report Prepared by: (signature)

Investigation Team

Company

Position/Title

Final Report Date
Month Day Year

Final Report Prepared by: (please print)

Final Report Prepared by: (signature)

E. Stewardship

Will an Incident Summary be Prepared? ☐ Yes ☐ No

By:

Disciplinary Action Taken? ☐ Yes ☐ No

Quality Review By:

Date:

Findings:

Fax Completed Form to CRA's Incident Reporting Fax: (832) 485-5259
Send Original to CRA's Incident Reporting Department, Houston, Texas

SECTION 3

A. Agency Reporting and Recording Information (To be completed by the Regional Safety and Health Manager)**CANADA**

Form 7 Sent to WSIB?

☐ Yes ☐ Not required

Employee Injury Information (Injury met the following criteria):

☐ First Aid ☐ Medical Treatment ☐ Critical Injury ☐ Modified Duty ☐ Lost Time Injury

If medical treatment, what?

Joint Safety and Health Committee Notified?

☐ Yes ☐ No

Total days of modified duty

Total days of lost time (if any)

Date employee returned to work

Month Day Year

If exceeds 7 days, report to WSIB

UNITED STATES

OSHA Recordable Injury?

☐ Yes ☐ No

Employee Injury Information (Injury met the following OSHA 300 Log criteria)

☐ First Aid ☐ Medical Treatment ☐ Restricted Duty ☐ Lost Time Injury

If medical treatment, what?

Total days of restricted duty:

Total days of lost time (if any)

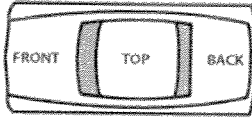
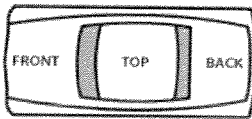
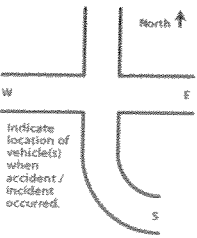
Date employee returned to work

Month Day Year

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VEHICLE ACCIDENT SECTION
(Complete this Section for all Vehicle Accidents)

SECTION 4

A. CRA Vehicle					
License Plate No.		State/Province		Police Department	City State/Province
Vehicle Year/Make/Model		Odometer Reading at Time of Accident		Police Report Number	Weather Conditions
Name of Person Operating Vehicle			"X" IN AREA OF VEHICLE DAMAGE  CIRCLE 0 No Damage 1 Light 2 Moderate 3 Heavy 4 Rolled 5 Burned		
Address					
City	State/Province	Zip Code			
Telephone: Area Code ()					
Vehicle Type: ☐ Personal ☐ Rental ☐ CRA-Own Description of Vehicle Damage:					
B. Other Vehicles Involved					
Name of Owner		Address		City/State/Prov./Zip	Area Code and Telephone Number ()
Operator's Name (if different from above)		Address		City/State/Prov./Zip	Area Code and Telephone Number ()
Year/Make/Model	Description of Property Damage:			"x" IN AREA OF VEHICLE DAMAGE  CIRCLE 0 No Damage 1 Light 2 Moderate 3 Heavy 4 Rolled 5 Burned	
Insurance Co. Name & Telephone					
License Plate No./State/Province					
C. Injured Persons					
Name	Address Street, City, State/Prov./Zip Code		Phone Number	Nature of Injury	Indicate if Injured was a Vehicle Driver/ Passenger, CRA Employee, Other, or Pedestrian
1.					
2.					
3.					
D. Witnesses					
Name		Address Street, City, State/Prov./Zip Code			Area Code and Telephone Number
1.					()
2.					()
E. Description of Accident					
PLEASE COMPLETE OR ATTACH SEPARATE DIAGRAM  Indicate location of vehicle(s) when accident / incident occurred.					
Was Ticket Issued? Reason: ☐ Other Operator ☐ CRA Operator					
Report Date Month Day Year	Report Prepared by: (please print)		Report Prepared by: (signature)		

Note: If Additional Space is Required to Complete this Report, Use Separate Sheet of Paper and Attach.

Fax Completed Form to CRA's Incident Reporting Fax: (832) 485-5259
Send Original to CRA's Incident Reporting Department, Houston, Texas



INCIDENT REPORT CORRECTIVE ACTIONS/VERIFICATION AND VALIDATION



Safety Means Awareness
Responsibility Teamwork

Causative Factors and Corrective Actions					Verification (Did we do what we said we would do?) and Validation (Is it working?)			
Item No.	CF	Corrective Actions (Must match Causative Factor)	Responsible Party	Date Due	Date Completed	Verified By/ Validated By	Date	Details
						Verified By:		
						Validated By:		
						Verified By:		
						Validated By:		
						Verified By:		
						Validated By:		
						Verified By:		
						Validated By:		

CRA 10 CAUSATIVE FACTORS

Personal Factors		Company Factors		External Factors	
1	Insufficient training for task	5	Incomplete or no procedures	10	Exposure to conditions
2	Hurrying to complete the task	6	Procedures not known or enforced		
3	Easier if proper process not followed	7	Improper PPE		
4	Took shortcuts without prior incident	8	Improper tools		
		9	Improper workplace layout		



CONESTOGA-ROVERS & ASSOCIATES (CRA) NEAR LOSS REPORTING FORM

A Significant Near Loss must be called into Incident Hot Line: 1-866-529-4886



Safety Means Awareness
Responsibility Teamwork

- Instructions:
- 1) Employee completes the Near Loss Report and submits to Supervisor.
 - 2) Supervisor reviews and makes other comments.
 - 3) Employee discusses Near Loss with Project Manager.
 - 4) Submit to Regional Safety & Health Manager.

Report Status (insert date)	Initial Report	Update Report	Final Report	Verification/Validation	Report Input into SMART Database

SECTION 1

A. Employee Identification ☐ CRA Employee ☐ Temporary Employee ☐ Subcontractor								
Employee No.	Last Name	First Name		Employee's Company - if Subcontractor				
Date of Hire	Position/Title	Supervisor		Home Office Location - if CRA Employee				
B. General Information								
Where did the Near Loss occur? ☐ Office ☐ Project Site ☐ Other _____ ☐ Canada ☐ United States ☐ UK			Type of Near Loss (Check all that apply) ☐ Employee Injury/Illness ☐ Vehicle Accident ☐ Property Damage ☐ Environmental					
Address of Near Loss (City, State, Providence, Zip Code)			Specific Location of Near Loss (e.g., where on site)					
Date and Hour of Near Loss		Date and Hour Reported to CRA		Time Employee Began Work				
Month	Day	Year	a.m. p.m.	Month	Day	Year	a.m. p.m.	a.m. p.m.
Witnesses? ☐ Yes ☐ No		Witness Name and Telephone Number						
C. Project Information (Project Related Near Loss Only): Project Related: () Yes () No								
Project #	Project Name	CRA Project Manager	Client	Client Contact				
Was the Client Advised of the Near Loss? ☐ Yes ☐ No ☐ N/A		Name:		Date and Time				

SECTION 2

A. Details of the Near Loss
1. What job/task was being performed when the Near Loss occurred? (Example: collecting groundwater samples).
2. Provide a detailed description of the employee's specific activities at the time of the Near Loss. Include details of equipment/materials being used, including the size and weights of objects being handled, and weather conditions at time of the Near Loss. If necessary, attach additional pages to the report.

B. Near Loss Investigation

Conduct a 5-Why Root Cause Analysis Investigation. In addition, if there was the potential for a significant injury or loss, report the Near Loss to the Incident Hot Line (this will determine if a Tap Root Cause Analysis is necessary).

HASP prepared? ☐ Yes ☐ No ☐ N/A Submit a PDF of HASP to Investigation Team. If yes, was the HASP on site? ☐ Yes ☐ No	Did the safety plan identify and provide safety procedures for the specific tasks being performed when the Near Loss occurred? ☐ Yes ☐ No If no, why not? (Explain) _____ Did the employee utilize the STAR process before initiating the task? ☐ Yes ☐ No If no, why not? (Explain) _____

SECTION 2 (continued)

5-Why Root Cause:			Additional information: Attach photos, witness statement(s), affected employee statement, as applicable, to the end of this document.
1. Why did "above" happen?			
2. Why did "1" happen?			
3. Why did "2" happen?			
4. Why did "3" happen?			
5. Why did "4" happen?			
6. Why did "5" happen?			See Section 3 Below: Corrective Actions/ Verification and Validation
C. Accountability			
Initial Report Date Month Day Year		Initial Report Prepared by: (please print)	Initial Report Prepared by: (signature)
Investigation Team		Company	Position/Title
Final Report Date Month Day Year		Final Report Prepared by: (please print)	Final Report Prepared by: (signature)
D. Stewardship			
Will a Near Loss Summary be Prepared? ☐ Yes ☐ No If yes, by:			
Quality Review By:		Date:	Findings:

SECTION 3

Corrective Action					Validation & Verification		
CF	Corrective Actions (Must match Causative Factor)	Responsible Party	Due Date	Date Completed	Verified By/ Validated By	Date	Details
					Verified By		
					Validated By		
					Verified By		
					Validated By		
					Verified By		
					Validated By		

CRA 10 CAUSATIVE FACTORS (CF)

PERSONAL FACTORS		COMPANY FACTORS		EXTERNAL FACTORS	
1	Insufficient training for task	5	Incomplete or no procedures	10	Exposure to conditions
2	Hurrying to complete the task	6	Procedures not known or enforced		
3	Easier if proper process not followed	7	Improper PPE		
4	Took shortcuts without prior incident	8	Improper tools		
		9	Improper workplace layout		



UNSAFE ACT/UNSAFE CONDITIONS/STOP WORK AUTHORITY (SWA) REPORT



Safety Means Awareness
Responsibility Framework

To:	CRA RSHM -
Reported By:	
Date:	
Employee Supervisor:	
Employee Shareholder:	

Re: (check all that apply)

☐ Unsafe Act

☐ Unsafe Condition

☐ Stop Work Authority (SWA)

Date/Time Reported to Supervisor/PM:	
Date/Time Corrected:	

Describe the unsafe act, unsafe condition, or SWA Situation:

List corrective action(s) implemented:

Did the corrective action(s) mitigate the unsafe act/unsafe condition?



DRIVING SAFE TASK EVALUATION PROCESS (D-STEP)



Report Status:

(insert date)

Initial Report

Updated Report

Final Report

Verification/Validation

Report Input to SMART Database

Date:	Time:
Client:	Project Name:
PM's Office:	Site Location:
Project Manager:	Project No. (If applicable):
Subcontractor: ☐ Yes ☐ No	Subcontractor Company Name:

Feedback Conducted By:	Date:	Time:
Observee's Supervisor:	Observer's Name:	

Driving Conditions			
☐ Freeway/Interstate	☐ Wet	☐ Day	☐ Raining
☐ Surface Street	☐ Dry	☐ Night	☐ Windy
☐ Dirt Road	☐ Snow/Ice		☐ Snowing
	☐ Mud		☐ Fog

Driving Conditions			
☐ Car	☐ Truck	☐ Van	☐ Pulling Trailer
☐ Company Owned	☐ Rental	☐ Personal	

Background Information (Give a brief description of where you are driving from and to and your surroundings)

Observer's Positive Comments

1. 2. 3.

Feedback Session Conclusion:

If NO Questionable Items: Brief Recap of Positive Actions/Comments

If Questionable Items: Brief Recap of Positive Actions/Comments AND Why the Questionable Item(s) Occurred



DRIVING SAFE TASK EVALUATION PROCESS (D-STEP)



Safety Means Awareness
Responsibility Means Work

PRE-DRIVING	Meets Work Standards	???	N/A	Evaluation Comments
1. JMP/JSA developed and/or reviewed			☐	
2. STAR performed			☐	
3. Stop Work Authority -- understood and considered			☐	
4. Registration/insurance/last maintenance report			☐	
5. Tire inflation and tread			☐	
6. Wipers and washer fluid/clean windows/mirrors			☐	
7. Horn/lights operation/instrument panel			☐	
8. Body damage/overall vehicle appearance			☐	
9. Under-vehicle check for leaks/obstructions			☐	
10. Secure loose items			☐	
11. Check fluid levels			☐	
12. Fire extinguisher/triangles/first aid kit/jack/spare			☐	
13. Verifies area is clear before moving vehicle			☐	
BODY POSITIONING	Meets Work Standards	???	N/A	Evaluation Comments
14. Adjust seat			☐	
15. Adjust head rest			☐	
16. Adjust mirrors to minimize blind spots			☐	
17. Seat belts (driver/passengers)			☐	
18. Locks doors			☐	
OPERATING PROCEDURES	Meets Work Standards	???	N/A	Evaluation Comments
19. Yields right-of-way and allows other vehicles to merge, change lanes, turn			☐	
20. Respects pedestrians, cyclists, other drivers			☐	
21. Is courteous/tolerant of others' poor driving			☐	
22. Two hands on wheel at 9 and 3 or 10 and 2			☐	
23. Skill in handling distractions			☐	
24. Adjusts to traffic conditions (speed / traffic)			☐	
25. Uses turn signals (for turns and lane changes)			☐	
26. Following distance is appropriate (4-second rule)			☐	
27. Avoids sudden acceleration and deceleration			☐	
28. Before backing up, looks behind vehicle/checks for traffic, pedestrians, parked vehicles, uses spotter			☐	
29. Scans the road ahead (15-second eye lead or 2-3 blocks-1/4 mile) and anticipates actions of others to avoid sudden swerves, stops, lane changes			☐	
30. Checks mirrors every 5-8 seconds			☐	
31. Checks for hazards on the road (e.g., animals, debris, road conditions)			☐	
32. Reads and obeys traffic signals			☐	
33. Makes complete stops at signals, at a safe distance			☐	
34. Scans intersection left and right/anticipates intent of other vehicles before reaching "point of no return"			☐	
35. Covers brakes safely and adjusts speed			☐	
36. Does not use cell phone during operation of vehicle			☐	
37. Other (be specific)			☐	
OPERATING PROCEDURES - PARKING	Meets Work Standards	???	N/A	Evaluation Comments
38. Looks for pull through parking before backing in			☐	
39. Uses signals, leaves adequate space before pulling back into lane			☐	
40. Obeys signs and uses signals in parking lot			☐	
41. Maintains proper speed inside the lot			☐	
42. Ensures vehicle is legally/properly parked			☐	
43. Sets parking brake and secures vehicle			☐	
44. Other (be specific)			☐	
Observation Total Occurrences				
% Observations to Meet Work Standards				
Item Specific to Work Task	Meets Work Standards	???		Evaluation Comments
Insert Task/JSA/SOP Step				
Insert Task/JSA/SOP Step				
Insert Task/JSA/SOP Step				



DRIVING SAFE TASK EVALUATION PROCESS (D-STEP)



Safety Starts Here
Responsibility Starts Here

Causative Factors and Corrective Actions					Verification (Did we do what we said we would do?) and Validation (Is it working?)			
Item No.	CF	Corrective Actions (Must match Causative Factor)	Responsible Party	Date Due	Date Completed	Verified By/ Validated By	Date	Details
						Verified By:		
						Validated By:		
						Verified By:		
						Validated By:		
						Verified By:		
						Validated By:		
						Verified By:		
						Validated By:		

CRA 10 CAUSATIVE FACTORS

Personal Factors			Company Factors		External Factors	
1	Insufficient training for task	5	Incomplete or no procedures	10	Exposure to conditions	
2	Hurrying to complete the task	6	Procedures not known or enforced			
3	Easier if proper process not followed	7	Improper PPE			
4	Took shortcuts without prior incident	8	Improper tools			
		9	Improper workplace layout			



FIELD SAFE TASK EVALUATION PROCESS (F-STEP)



Report Status:

(insert date)

Initial Report

Updated Report

Final Report

Verification/Validation

Report Input to SMART Database

Date:	Time:
Client:	Project Name:
PM's Office:	Site Location:
Project Manager:	Project No. (If applicable):
Subcontractor: ☐ Yes ☐ No	Subcontractor Company Name:

Feedback Conducted By:	Date:	Time:
Observee's Supervisor:	Observer's Name:	

Check Task Being Observed (if not listed here, go to columns at right)		If checking this column, write in the specific task	
☐ Air Knifing	☐ Manual Lifting	☐ Agricultural Services	
☐ Clearing	☐ Mob/Demob	☐ Construction	
☐ Demolition	☐ Project Oversight	☐ Landfill	
☐ Drilling	☐ Soil Sampling	☐ Office Operations	
☐ Driving	☐ Stack Testing	☐ O&M	
☐ Electrical Work	☐ Surveys & Audits	☐ Pipeline	
☐ Excavation	☐ Traffic Control	☐ Refinery	
☐ General Site Cleaning	☐ UST Removal	☐ Treatment Plants	
☐ Heavy Equipment Operations	☐ Water Sampling	☐ Other	
☐ IH Sampling	☐ Well Management		

Background Information (Give a brief description of task being performed and your surroundings)

Observer's Positive Comments

- 1.
- 2.
- 3.

Feedback Session Conclusion:

If NO Questionable Items: Brief Recap of Positive Actions/Comments

If Questionable Items: Brief Recap of Positive Actions/Comments AND Why the Questionable Item(s) Occurred



FIELD SAFE TASK EVALUATION PROCESS (F-STEP)



PERSONAL PROTECTIVE EQUIPMENT	Meets Work Standards	???	N/A	Evaluation Comments
1. Hearing Protection (e.g., Ear Plugs)			☐	
2. Head Protection (e.g., Hard Hat)			☐	
3. Eye Protection (e.g., Safety Glasses/Goggles)			☐	
4. Hand Protection (e.g., Gloves)			☐	
5. Foot Protection (e.g., Steel-toe Boots)			☐	
6. Respiratory Protection			☐	
7. Fall Protection (e.g., lanyard/harness)			☐	
8. High Visibility Clothing (e.g., Work Vest)			☐	
9. First Aid Kit/Fire Extinguisher			☐	
10. Other (be specific)			☐	
BODY POSITION	Meets Work Standards	???	N/A	Evaluation Comments
11. Proper Body Positioning When Exerting Force (Lifting/Pushing/Pulling)			☐	
12. Pinch Points/Moving Equipment - Hands/Body Placement			☐	
13. 3-Points of Contact			☐	
14. Other (be specific)			☐	
WORK ENVIRONMENT	Meets Work Standards	???	N/A	Evaluation Comments
15. Work/Walk Surface Clear (Free And Clear Pathway)			☐	
16. Housekeeping/Equipment Storage			☐	
17. Controlled Work Zone (e.g., Warning Devices, Barricades, Cones, Flags)			☐	
18. Emergency Stop/Safety Switches			☐	
19. Materials Labeled Correctly			☐	
20. Storage/Disposal of Waste			☐	
21. Other (be specific)			☐	
OPERATING PROCEDURES	Meets Work Standards	???	N/A	Evaluation Comments
22. STAR Performed/Job Planning			☐	
23. Stop Work Authority			☐	
24. JSA/JLA Reviewed and Followed			☐	
25. Daily Site Inspection			☐	
26. High Risk Task Specific (Hot Work, Confined Space, LOTO, Excavation/Trenching)			☐	
27. Inspect Work Zone for Hazards			☐	
28. Coordinate/Communicate with Site Rep and/or others on site			☐	
29. Spotters used appropriately			☐	
30. Underground/Overhead Utilities Identified			☐	
31. Other (be specific)			☐	
TOOLS/EQUIPMENT	Meets Work Standards	???	N/A	Evaluation Comments
32. Hand/Power Tool - Selection, Condition, and Use			☐	
33. Field/Test Equipment - Selection, Condition, and Use			☐	
34. Heavy Equipment - Selection, Condition, and Use			☐	
35. Other (be specific)			☐	
Observation Total Occurrences				
% Observations to Meet Work Standards				
Item Specific to Work Task	Meets Work Standards	???		Evaluation Comments
Insert Task/JSA/SOP Step				
Insert Task/JSA/SOP Step				
Insert Task/JSA/SOP Step				



Personal Factors		Company Factors		External Factors
1	Insufficient training for task	5	Incomplete or no procedures	10
2	Hurrying to complete the task	6	Procedures not known or enforced	
3	Easier if proper process not followed	7	Improper PPE	
4	Took shortcuts without prior incident	8	Improper tools	
		9	Improper workplace layout	

PROPERTY ACCESS/UTILITY CLEARANCE DATA SHEET

(QSF-019)

PROJECT NAME:	_____	PROJECT NUMBER:	_____
CRA REPRESENTATIVE:	_____		
CLIENT:	_____	CLIENT REPRESENTATIVE:	_____
ON-SITE PROPERTY ACCESS APPROVAL	_____	PHONE:	_____
OFF-SITE PROPERTY ACCESS APPROVAL (if applicable)	_____		(OWNER OR AUTHORIZED AGENT SIGNATURE)
UTILITY CLEARANCE APPROVAL	_____		(OWNER OR AUTHORIZED AGENT SIGNATURE)
CONTRACTOR VERIFICATION APPROVAL	_____		(OWNER OR AUTHORIZED AGENT SIGNATURE)
	_____		(OWNER OR AUTHORIZED AGENT SIGNATURE)

[illegible]

Additional Comments:

* Note as appropriate, Contractor, Client or Owner, or Agent to sign, indicating no utilities are at the selected borehole/excavation locations.

SECTION A - JOB SCOPE

☐	Pre-Job Meeting/Prep HASP	Completed by: _____
☐	On-Site Orientation Meeting	_____
☐	End of Job Evaluation	_____
☐	Tailgate Safety Meeting Planning Tool	_____
☐	Site Audit	_____

Date: _____ Project Name: _____ Project Number: _____

Project Location: _____

Project Description _____

CRA Project Team

PM: _____ Site Supervisor: _____ SHO: _____

Technician(s): _____ Others: _____

CLIENT INFORMATION

Company Name: _____

Address: _____

Primary Contact: _____

Phone: _____ Cell: _____ Fax: _____

SUBCONTRACTOR INFORMATION

Company Name: _____

Address: _____

Primary Contact: _____

Phone: _____ Cell: _____ Fax: _____

additional subcontractors listed on last page

SECTION B - PROJECT SAFETY COORDINATION**1.1 High Risk Activities**

Confirm activities to be conducted during project

	Resource	Yes	No
Working at or above 6 feet (fall protection)	PM	☐	☐
Aerial lift	PM	☐	☐
Heavy equipment	PM	☐	☐
Drilling	PM	☐	☐
Excavation	PM	☐	☐
Lock-Out Tag-Out permit(s) required	PM	☐	☐
Hot work	PM	☐	☐
Hot work permit(s) required	PM	☐	☐
Confined space entry	PM	☐	☐
Confined space entry permit required	PM	☐	☐
Subsurface activities	PM	☐	☐
ATV, Snowmobile, 4 wheeler	PM	☐	☐
Access agreements in-hand and signed by property owner	PM	☐	☐
Permit requirements communicated to affected employees	PM	☐	☐

1.2 Guiding Principals <i>(All items identified, verified and discussed)</i>	Resource	Yes	No	
Safety Commitment	SMART			
Injury Free Operation (IFO)	SMART			
Stop Work Authority	SMART			
Lessons Learned	SMART			
Any unresolved safety concerns or issues	SS			
1.3 Personnel Requirements <i>(All items identified, verified and discussed)</i>	Resource	Yes	No	N/A
Site personnel trained to execute the Scope of Work	PM			
Verification of all personnel's training certifications	PM			
Potential for language barrier issues for this project	PM			
Potential technical understanding barriers for this project	PM			
Number of SSE(s) on site concurrent with CRA/client policy	PM			
Short Service Employee(s) identification	PM			
Mentor assignment for each SSE(s)	PM			
Employees trained to use the tools/equipment	PM			
Verification of all personnel's:				
- Medical clearance & respirator fit test (as required)	Safety Admin			
- Alcohol & drug clearance	Safety Admin			
Daily personnel evaluation if they are fit to function and working safely	SS			
Safety Health Officer required for the site	PM			
1.4 Behavior Based Safety - SMART Tools <i>(All items identified, verified and discussed)</i>	Resource	Yes	No	N/A
STAR/Loss Prevention Self Assessment (LPSAs)	SMART			
Near loss/incident reporting procedure	SMART			
STEP/LPO	SMART			
At-risk behaviors and observation trends	SMART			
1.5 HASP Development & Review <i>(All items identified, verified and discussed)</i>	Resource	Yes	No	N/A
Site-specific Health & Safety Plan developed	HASP			
Site-specific Health & Safety Plan approval by CRA safety professional	HASP			
System to modify the Health & Safety Plan in the field (i.e., "dirty JSA/JLA")	HASP			
1.6 JSA/JLA <i>(All items identified, verified and discussed)</i>	Resource	Yes	No	N/A
On-site hazard assessment	PM			
JSA/JLAs available for all tasks including those performed by subcontractors	HASP			
Requirement to have JSA/JLAs modified in the field daily (i.e., "dirty JSA/JLA")	SS			
MSDSs obtained, reviewed, and hazards incorporated into JSA/JLAs	HASP			

1.7	PPE <i>(All items identified, verified and discussed)</i> Confirm task-specific PPE per JSA/JLAs System to inspect PPE before start of work	Resource HASP SS	<table border="1"> <thead> <tr> <th>Yes</th> <th>No</th> <th>N/A</th> </tr> </thead> <tbody> <tr> <td></td> <td></td> <td></td> </tr> <tr> <td></td> <td></td> <td></td> </tr> </tbody> </table>	Yes	No	N/A																																										
Yes	No	N/A																																														
1.8	Site Emergency Response <i>(All items identified, verified and discussed)</i> First-aid requirements Minimum - one first-aid trained person on-site First-aid equipment within 50 feet of risk Eye wash/shower within 50 feet of risk Spill response equipment inspected and available within 50 feet of risk Emergency Action Plan (EAP) - specific personnel identified for key incident command roles - discussed role responsibilities and actions with all site personnel, mustering/meeting location set Site emergency evacuation alarm confirmed EAP drill schedule Nearest hospital confirmation Nearest hardwired telephone confirmation Emergency shut-off switch/valve locations confirmation Emergency contact confirmation - coordinate with facility and client	Resource HASP HASP HASP HASP HASP HASP SS HASP HASP Site Drawing Site Drawing HASP	<table border="1"> <thead> <tr> <th>Yes</th> <th>No</th> <th>N/A</th> </tr> </thead> <tbody> <tr><td></td><td></td><td></td></tr> <tr><td></td><td></td><td></td></tr> <tr><td></td><td></td><td></td></tr> <tr><td></td><td></td><td></td></tr> <tr><td></td><td></td><td></td></tr> <tr><td></td><td></td><td></td></tr> <tr><td></td><td></td><td></td></tr> <tr><td></td><td></td><td></td></tr> <tr><td></td><td></td><td></td></tr> <tr><td></td><td></td><td></td></tr> <tr><td></td><td></td><td></td></tr> <tr><td></td><td></td><td></td></tr> <tr><td></td><td></td><td></td></tr> <tr><td></td><td></td><td></td></tr> </tbody> </table>	Yes	No	N/A																																										
Yes	No	N/A																																														
1.9	Utility Locates <i>(All items identified, verified and discussed)</i> CRA and/or client-specific Subsurface Utility Clearance Protocol reviewed and adhered to QSF-019 Property Access Form completed Client-specific requirements communicated to all affected employees One-call responses verified	Resource PM PM PM PM	<table border="1"> <thead> <tr> <th>Yes</th> <th>No</th> <th>N/A</th> </tr> </thead> <tbody> <tr><td></td><td></td><td></td></tr> <tr><td></td><td></td><td></td></tr> <tr><td></td><td></td><td></td></tr> <tr><td></td><td></td><td></td></tr> </tbody> </table>	Yes	No	N/A																																										
Yes	No	N/A																																														
1.10	Traffic Control Program <i>(All items identified, verified and discussed)</i> Temporary Traffic Control Plan (TTCP) required TTCP provided TTCP approval by the client, if required	Resource PM PM PM	<table border="1"> <thead> <tr> <th>Yes</th> <th>No</th> <th>N/A</th> </tr> </thead> <tbody> <tr><td></td><td></td><td></td></tr> <tr><td></td><td></td><td></td></tr> <tr><td></td><td></td><td></td></tr> </tbody> </table>	Yes	No	N/A																																										
Yes	No	N/A																																														
1.11	Site Control <i>(All items identified, verified and discussed)</i> Have the following areas been considered for site control: Fencing, barricades or other identifiers Signage to control pedestrian traffic Safety perimeter around equipment and work zone Swing radius barricades and/or signage struck-by (crush zones) reviewed and controlled.	Resource SS SS SS SS	<table border="1"> <thead> <tr> <th>Yes</th> <th>No</th> <th>N/A</th> </tr> </thead> <tbody> <tr><td></td><td></td><td></td></tr> <tr><td></td><td></td><td></td></tr> <tr><td></td><td></td><td></td></tr> <tr><td></td><td></td><td></td></tr> <tr><td></td><td></td><td></td></tr> </tbody> </table>	Yes	No	N/A																																										
Yes	No	N/A																																														
1.12	Equipment <i>(All items identified, verified and discussed)</i> Proper lifting/transport of heavy objects (drums, augers) Equipment inspected and documented where required GFCI used and tested	Resource SS SS SS	<table border="1"> <thead> <tr> <th>Yes</th> <th>No</th> <th>N/A</th> </tr> </thead> <tbody> <tr><td></td><td></td><td></td></tr> <tr><td></td><td></td><td></td></tr> <tr><td></td><td></td><td></td></tr> </tbody> </table>	Yes	No	N/A																																										
Yes	No	N/A																																														

1.13 Weather <i>(All items identified, verified and discussed)</i>	Resource	Yes	No	N/A
Weather condition changes discussed - how to handle during work	HASP			
Weather monitoring- who is responsible	HASP			
Weather related hazards (heat/cold accommodations)	HASP			
Hold time after lightning and thunder	SS			
1.14 Crew Commitment <i>(All items identified, verified and discussed)</i>	Resource	Yes	No	N/A
Crew is aware of Safety Commitment that they are making	TBD			
1.15 Materials <i>(All items identified, verified and discussed)</i>	Resource	Yes	No	N/A
MSDSs availability for all HAZCOM/WHMIS regulated materials on the job site	HASP			
Affected employees aware of special handling instructions for hazardous materials	HASP			
Hazardous materials stored appropriately	HASP			
Plan for dealing with leftover and/or waste materials	WP			
1.16 Sub-Contractors <i>(All items identified, verified and discussed)</i>	Resource	Yes	No	N/A
Approval through the QSF 12, 22, 30, 31	PM			
CRA Safety Coordination Review Form completed with the subcontractor as applicable	PM			
1.17 Documentation		Yes	No	N/A
All required QS Forms are available and attached to the project file	PM			
- QSF-12	PM			
- QSF-13	PM			
- QSF-16	PM			
- QSF-19	PM			
- QSF-22	PM			
- QSF-30/31	PM			
- Meeting attendance sign in sheets	PM			
Daily Tailgate sign in sheets	PM			
Permits/air monitoring records	PM			
STEP observation form	PM			
Equipment inspection forms	PM			
Client specific forms	PM			

Action Items:

Due Date

[illegible]

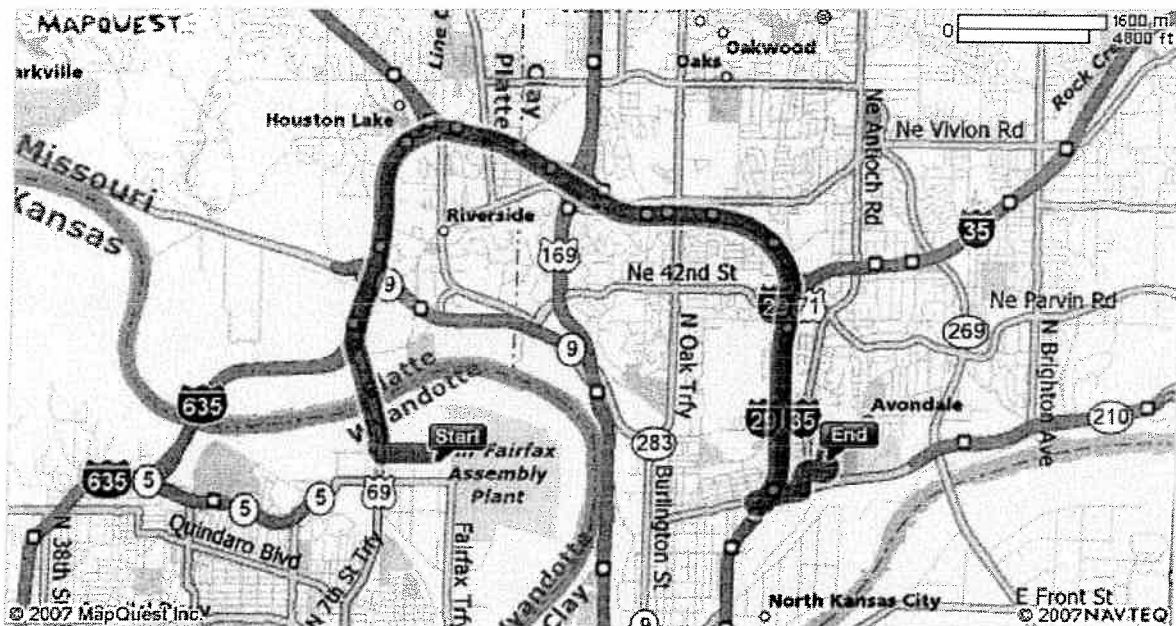
SHO Safety & Health Officer

Phone: _____ Cell: _____ FAX: _____

Phone: _____ Cell: _____ FAX: _____

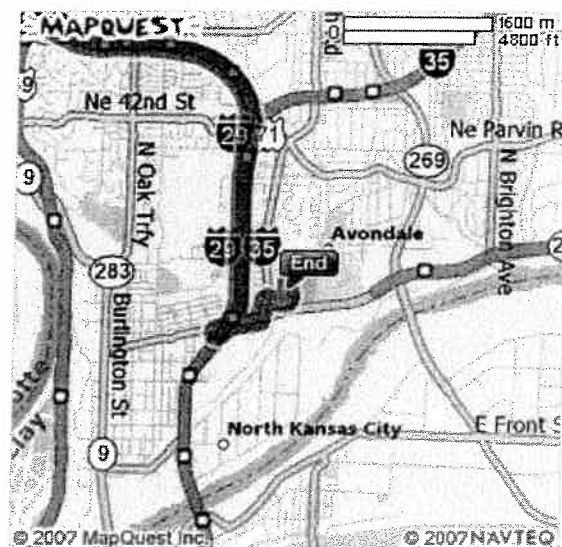
CRA 400012 Safety Coordination Review Checklist - Rev. 8 - 04/02/2009 - 012559 (21) APC

Driving Directions from 100 Kindleberger Rd, Kansas City, KS to North Kansas City Ho...



Start:
100 Kindleberger Rd
Kansas City, KS 66115, US

End:
North Kansas City Hospital:
816-691-2000
2800 Clay Edwards Dr, Kansas City, MO
64116, US



All rights reserved. Use Subject to License/Copyright

These directions are informational only. No representation is made or warranty given as to their content, road conditions or route usability or expeditiousness. User assumes all risk of use. MapQuest and its suppliers assume no responsibility for any loss or delay resulting from such use.

SAFETY INSPECTION CHECKLIST - MOBILE EQUIPMENT SAFETY

Week Ending:		Job No.:		Equipment:					
Superintendent: _____ (This form is to be completed daily by the operator. Deficiencies should be addressed immediately.)									
Date:		Mon.	Tues.	Wed.	Thurs.	Fri.	Sat.	Sun.	Comments
Start:									
Stop:									
Fluid Levels:									
	Oil								
	Hydraulic								
	Transmission								
	Radiator								
	Grease Fittings								
	Fuel								
Safety Checks:									
	Fire Extinguisher								
	Seat and Safety Belts								
	Warning Devices (backup alarms, lights, etc.)								
	Housekeeping								
	Brakes								
	Mirrors								
	Windshield and Wipers								
	Steering								
	Horn								
	Lights								
	Tires								
	Guards								
	Instruments								
	Exhaust System								
Accessories:									
	Boom or Mast								
	Controls								
	Level Indicators								
	Tracks								
	Other								
Sign-Off:									
	Operator's Initials								
	Supervisor's Initials								

Additional Comments: (Please write any additional comments here. Use the back of this form if necessary.)

√ = OK NR = Needs Repair NA = Not Applicable

SITE HEALTH AND SAFETY PLAN MINOR AMENDMENT FORM

Amendment #

Site Name/Project ID

JSA/JLA Title

Date

Type of Amendment

Reason for Amendment

Alternate or Additional
Safeguard Procedures

Required changes in PPE

Project Manager Notified

☐

RSHM Notified

☐

Client PM Notified (if necessary)

☐

Site Safety and Health Officer

Date

Note: To be used for changes such as MSDS additives, JSA changes, and equipment changes.

This original form must remain on site and a copy placed in the project file. Any changes to the original HASP must be discussed with all affected site personnel prior to commencing work.

APPENDIX B

JOB SAFETY ANALYSIS SHEETS



JOB SAFETY ANALYSIS (JSA)

Driving



Safety Means Awareness
Responsibility Teamwork

Field staff must review job-specific work plan and coordinate with project manager to verify that all up-front logistics are completed prior to starting work including, but not limited to, permitting, access agreements, and notification to required contacts (e.g., site managers, inspectors, clients, subcontractors, etc.). Additionally, a tailgate safety meeting must be performed and documented at the beginning of each workday. **Stop, Think, Act, Review (STAR)** must be used prior to any activity. All personnel must possess the appropriate training prior to initiating scheduled tasks. Also consider weather conditions. CRA personnel have the authority and responsibility to use **Stop Work Authority (SWA)**.

Date Issued/Revised:	9/11/09	JSA Type:	Driving
Work Type:	Environmental	Client:	Motors Liquidation Company
Work Activity:	Travel to/from site with company/rental/personal vehicles without trailers or equipment		
Work Site:	100 Kindelberger Road Kansas City, Kansas		
Key Equipment:	Vehicle, valid driver's license		
Task-specific Training:	Defensive Driving		

MINIMUM REQUIRED PERSONAL PROTECTIVE EQUIPMENT (see job steps for task-specific requirements)					
☐ Reflective Vest	☐ Goggles	☐ Gloves*	Supplied Air	APR	
☐ Hard Hat	☐ Face Shield*	☐ Coveralls*	☐ SCBA	☐ Full Face APR	☐ Particulate ☐ Organic Vapor
☐ Lifeline/Harness*	☐ Hearing Protection*	☐ PPE Clothing*	☐ Airline Respirator (attach description)	☐ Half Mask APR	☐ Particulate/Organic Vapor Combined
☐ Safety Glasses	☐ Safety-toed Boots				☐ Acid Gas
☐ Other*		☐ Other*		☐ Other*	
ADDITIONAL PPE (*provide specific type(s) or descriptions of this item below)					

Project Development Team		Position/Title	Modified By	Reviewed By	Position/Title	Date
Name	Signature					
John Hargens		Geologist				



JOB SAFETY ANALYSIS (JSA)

Driving



Safety Means Awareness
Responsibility Teamwork

Job Steps ⁽¹⁾	Task Activity	Potential Hazard(s) ⁽²⁾	Corrective Measure(s) ⁽³⁾	Person Responsible
1	Discuss STAR and SWA	Site personnel not aware of STAR and SWA	- Project team (CRA) discusses importance of and documentation procedures for SWA during pre-job safety meeting - Discuss route, concerns, and alternate routes with passenger and drivers of other vehicles - Use SWA to stop any work that is unsafe - Ensure proper vehicle selected for travel (use a truck if going to construction site or area with rough conditions that would damage a small vehicle?)	Driver and passenger
2	Check weather	- Unexpected storm - Fog; rain; snow; lightening/thunder - Heat/cold stress	- Check local weather forecast - Discuss weather issues and precautions to take while driving and on site during the pre-job safety meeting - If weather conditions (e.g., fog, rain, snow, etc.) impair the ability/vision of the driver, exit at nearest safe location and assess the situation - While on site, at first sign of lightening/thunder utilize SWA and assess weather conditions - In extreme temperatures, ensure all personnel have proper clothing, hydration, and heat/cold protection (e.g., canopy, fan, glove warmers)	Driver or Passenger
3	Complete CRA Daily Operator Vehicle Checklist	- Damaged vehicle lights, tires, windows, mirrors, horn - Inadequate vehicle documents and/or safety items	- Check for fluid leaks under vehicle - Test operation of headlights, front/rear turn signals, backup lights, brake lights, and emergency flashers - Visually check the pressure/wear of tires - Ensure the vehicle has a properly inflated spare tire and associated tools to install - Assure windshield and window glass is clean and free from obstructions - Assure all fluids are topped off (e.g., windshield wiper fluid) and scheduled routine maintenance has occurred (e.g., oil changes). - Test the windshield wipers and horn - Verify vehicle registration, insurance card, and inspection sticker is present and valid - If the vehicle contains a first aid kit, fire extinguisher, and road hazard kit, verify that all items with expiration dates are current and that fire extinguisher has had documented monthly check - Do not use vehicle if any safety device is found not functioning	Driver or Passenger
4	Check and adjust seat, steering wheel, headrest, and mirrors	- Back/body strain - Blind spot - Impaired vision	- Adjust seat, headrest, and steering wheel height so body is fully supported/comfortable and pedals are within easy reach - Ensure mirrors are properly adjusted	Driver or Passenger
5	Fasten seat belt(s) and ensure passengers' seat belts are fastened	Serious injury, ejection, or death from collision and/or traffic citation	Verify driver and passenger(s) seat belts are in good condition and properly latched	Driver or Passenger
6	Ensure vehicle doors are locked	- Serious injury, ejection, or death from collision - Unwanted intrusion - Lost equipment	Manually lock all doors to vehicle prior to starting the vehicle	Driver



JOB SAFETY ANALYSIS (JSA)

Driving



Safety Means Awareness
Responsibility Teamwork

Job Steps ⁽¹⁾	Task Activity	Potential Hazard(s) ⁽²⁾	Corrective Measure(s) ⁽³⁾	Person Responsible
7	Start engine and check gauges and warning lights	Vehicle breakdown	Verify sufficient fuel and other hazard lamps (e.g., battery, oil, and temperature) are not lit	Driver
8	Driving – Use defensive driving techniques and stay alert	- Arriving late - Collision - Blind spots of other vehicles - Injury or death to occupants or other parties	- Acknowledge and comply with all traffic regulations, laws, and ordinances - Do not use two-way communicating devices or perform other distracting activities while vehicle is in motion - Constantly scan intersections, move eyes, check mirrors, and assess traffic lights (fresh vs. stale) - Recognize other vehicle's blind spots and minimize time spent within these zones - Maintain safety cushion around vehicle (front, sides, and rear) and 4-second following distance (add an extra second for each hazardous condition, triple following distance in poor weather conditions) - Signal well in advance before changing lanes or turning - Utilize all driving defensive techniques	Driver
9	Arrive at site	- Pedestrian injury - Collision	Maintain awareness of pedestrian/vehicular traffic when entering site and traveling to work zone	Driver
10	Park vehicle – assign a spotter if necessary (when in doubt use a spotter)	- Pedestrian injury - Collision - Property damage	- Maintain awareness of pedestrian/vehicular traffic - Park vehicle in pull-through parking space or facing the exit - Use caution and mirrors/spotter when backing vehicle - Set parking brake	Driver
11	Demobilization – conduct a vehicle walk-around inspection paying particular attention to path(s) of travel	- Collision - Injury or death to occupants or other parties	- Perform perimeter vehicle check - Maintain awareness of pedestrian/vehicular traffic when exiting site - Utilize defensive driving techniques - Complete post-departure checklist and report vehicle problems to company vehicle maintenance manager or rental car agency	Driver or Passenger
12	Report maintenance or mechanical problems upon returning vehicle	Conditions worsen leading to mechanical failure resulting in collision and injury	- Report vehicle problems immediately to company representative or rental car agency - Schedule and/or perform repairs as soon as possible	Driver

- (1) Each Job or Task consists of a set of steps. Be sure to list all the steps in the sequence that they are performed. Specify the equipment or other details to set the basis for the potential (associated) hazards.
- (2) A hazard is a potential danger. What can go wrong? How can someone get hurt? Consider, but do not limit, the analysis to: **Contact** - victim is struck by or strikes an object; **Caught** - victim is caught on, caught in or caught between objects; **Fall** - victim falls to ground or lower level (includes slips and trips); **Exertion** - excessive strain or stress/ergonomics/lifting techniques; **Exposure** - inhalation/skin hazards. Specify the hazards and do not limit the description to a single word such as "Caught".
- (3) Aligning with the Job Steps, Task Activity Description, and Potential Hazard columns, describe what actions or procedures are necessary to eliminate or minimize the hazards. Be clear, concise and specific. Use objective, observable, and quantified terms. Avoid subjective general statements such as "be careful" or "use as appropriate".



JOB SAFETY ANALYSIS (JSA)

Soil Borings



Safety Means Awareness
Responsibility Teamwork

Field staff must review job-specific work plan and coordinate with project manager to verify that all up-front logistics are completed prior to starting work including, but not limited to, permitting, access agreements, and notification to required contacts (e.g., site managers, inspectors, clients, subcontractors, etc.). Additionally, a tailgate safety meeting must be performed and documented at the beginning of each workday. **Stop, Think, Act, Review (STAR)** must be used prior to any activity. All personnel must possess the appropriate training prior to initiating scheduled tasks. Also consider weather conditions. CRA personnel have the authority and responsibility to use **Stop Work Authority (SWA)**.

Date Issued/Revised:	9/11/09	JSA Type:	Drilling
Work Type:	Environmental	Client:	Motors Liquidation Company
Work Activity:	Drilling		
Work Site:	100 Kindelberger Road, Kansas City, Kansas		
Key Equipment:	Air monitoring equipment; safety cones/fencing/barricades		
Task-specific Training:	CRA Field Method Training		

MINIMUM REQUIRED PERSONAL PROTECTIVE EQUIPMENT (see job steps for task-specific requirements)			
☒ Reflective Vest	☐ Goggles	☒ Gloves*	Supplied Air
☒ Hard Hat	☐ Face Shield*	☐ Coveralls*	☐ SCBA
☐ Lifeline/Harness*	☒ Hearing Protection*	☐ PPE Clothing*	☐ Airline Respirator (attach description)
☒ Safety Glasses	☒ Safety-toed Boots		
☐ Other*		☐ Other*	
APR			
		☐ Full Face APR	☐ Particulate ☐ Organic Vapor
		☐ Half Mask APR	☐ Particulate/Organic Vapor Combined
			☐ Acid Gas
☐ Other*			
ADDITIONAL PPE (*provide specific type(s) or descriptions of this item below)			

Project Development Team		Position/Title	Modified By	Reviewed By	Position/Title	Date
Name	Signature					
John Hargens		Geologist				



JOB SAFETY ANALYSIS (JSA)

Soil Borings



Safety Means Awareness
Responsibility Teamwork

Job Steps ⁽¹⁾	Task Activity	Potential Hazard(s) ⁽²⁾	Corrective Measure(s) ⁽³⁾	Person Responsible
1	Markout underground utilities	- Property damage - Explosion - Electrocution - Injury - Death	- Call public underground utility agency (One-Call) at least 5 or more days prior to work activities - Review State Law pertaining to underground pipe line safety and have private utility mark-out performed - Expose lines if warranted (i.e., hand dig, test pit, or daylight)	Project Manager and Site Supervisor
2	Conduct site walk - identify unsafe conditions and determine sample point locations	- Traffic hazard - Slip/trip/fall hazards - Biological hazard - Overhead/underground hazards	- Maintain awareness of on-site traffic and walking surfaces - When selecting soil boring locations, be aware of biological hazards (e.g., ants, poison ivy, wasps) and overhead/underground hazards (e.g., overhead utilities, concrete scarring, station canopy)	Site Personnel
3	Equipment inspection	- Pinch points - Property damage - Lost time due to damaged equipment/parts	- Discuss pinch points on equipment (e.g., drill rig, air knife, pressure washer, etc.) - Familiarize all personnel with location/operation of fire extinguisher(s) and kill switch on drill rig - Visually inspect equipment/parts for damage and document inspections	Site Personnel
4	Set up work zone for drilling	- Traffic hazard - Slip/trip/fall hazards - Property damage - Overhead hazards - Environmental impact	- Maintain awareness of on-site traffic, work zones, walking surfaces, overhead hazards (e.g., canopy and low hanging overhead lines) - Utilize barricades/cones/caution tape to define work zone and direct traffic - Wear leather/cotton when setting up barricades - Be aware of any potential sensitive receptors and verify all personnel are aware of the location of spill kit	Site Personnel
5	Set up staging area	- Traffic hazard - Slip/trip/fall hazards - Lifting hazards - Back injury - Manual material handling - Pinch points - Heat/cold stress	- Maintain awareness of on-site traffic and walking surfaces - Utilize barricades/cones/caution tape to define work zone and direct traffic - Reduce distance needed to travel when carrying materials and or equipment - Wear leather/cotton gloves when setting up barricades - Size up the load, If the object is too large or odd shaped OR is in excess of 50 pounds (23 kg) then assistance (mechanical or a buddy lift) will be required. - Lift with the legs (bend at the knees and use the leg muscles) to protect the lower back and keep lower back in a neutral position - Avoid one-handed carrying if possible; maintain awareness of footing - Avoid placing hands/fingers in pinch point locations - In extreme temperatures, ensure all personnel have proper clothing, hydration, and heat/cold protection (e.g., canopy, fan, glove warmers)	Site Personnel



JOB SAFETY ANALYSIS (JSA)

Soil Borings



Safety Means Awareness
Responsibility Teamwork

Job Steps ⁽¹⁾	Task Activity	Potential Hazard(s) ⁽²⁾	Corrective Measure(s) ⁽³⁾	Person Responsible
6	Contractor oversight/ management of hole clearance/drilling activities	• Traffic hazard • Slip/trip/fall hazards • Lifting hazards • Back injury • Manual material handling • Underground utilities • Contaminant exposure • Heat/cold stress	• Maintain awareness of on-site traffic and practice good housekeeping • Perform a prestart meeting, inform subcontractor of safe lifting practices • Refer to step 5 and the HASP for additional lifting information • Ensure subcontractors don proper PPE (e.g., face shield, leather/cotton gloves, hearing protection) • If non-native material (e.g., pea gravel, sand, fill material) or underground utilities are observed, utilize SWA and assess situation • Monitor safe drill movement/positional setup • Monitor breathing zone and refer to HASP for action levels • Monitor all personnel for signs and symptoms of heat/cold stress and refer to HASP for recommendations • Be aware of unsafe hoisting and material handling practices • Be aware of proper augering and auger handling techniques	Site Personnel
7	Site/boring security	• Traffic hazard • Slip/trip/fall hazards • Lifting hazards • Back safety • Manual material handling	• Wear leather/cotton gloves when moving barricades • Maintain awareness of on-site traffic and walking surfaces • Maintain proper lifting techniques as described in Step 5 and 6. • Ensure good house keeping methods are practiced. Work area is kept clean of debris. • Secure boring location if open overnight	Site Personnel

- (1) Each Job or Task consists of a set of steps. Be sure to list all the steps in the sequence that they are performed. Specify the equipment or other details to set the basis for the potential (associated) hazards.
- (2) A hazard is a potential danger. What can go wrong? How can someone get hurt? Consider, but do not limit, the analysis to: **Contact** - victim is struck by or strikes an object; **Caught** - victim is caught on, caught in or caught between objects; **Fall** - victim falls to ground or lower level (includes slips and trips); **Exertion** - excessive strain or stress/ergonomics/lifting techniques; **Exposure** - inhalation/skin hazards. Specify the hazards and do not limit the description to a single word such as "Caught".
- (3) Aligning with the Job Steps, Task Activity Description, and Potential Hazard columns, describe what actions or procedures are necessary to eliminate or minimize the hazards. Be clear, concise and specific. Use objective, observable, and quantified terms. Avoid subjective general statements such as "be careful" or "use as appropriate".



JOB SAFETY ANALYSIS (JSA)

Hand Augering



Safety Means Awareness
Responsibility Teamwork

Field staff must review job-specific work plan and coordinate with project manager to verify that all up-front logistics are completed prior to starting work including, but not limited to, permitting, access agreements, and notification to required contacts (e.g., site managers, inspectors, clients, subcontractors, etc.). Additionally, a tailgate safety meeting must be performed and documented at the beginning of each workday. **Stop, Think, Act, Review (STAR)** must be used prior to any activity. All personnel must possess the appropriate training prior to initiating scheduled tasks. Also consider weather conditions. CRA personnel have the authority and responsibility to use **Stop Work Authority (SWA)**.

Date Issued/Revised:	9/11/09	JSA Type:	Drilling
Work Type:	Environmental	Client:	Motors Liquidation Company
Work Activity:	Hand auger soil sampling		
Work Site:	100 Kindelberger Road, Kansas City, Kansas		
Key Equipment:	Air monitoring equipment, PPE		
Task-specific Training:	CRA Field Method Training on Soil Sampling Procedures		

MINIMUM REQUIRED PERSONAL PROTECTIVE EQUIPMENT (see job steps for task-specific requirements)					
☐ Reflective Vest	☐ Goggles	☒ Gloves*	Supplied Air	APR	
☒ Hard Hat	☐ Face Shield*	☐ Coveralls*	☐ SCBA	☐ Full Face APR	☐ Particulate ☐ Organic Vapor
☐ Lifeline/Harness*	☐ Hearing Protection*	☒ PPE Clothing*	☐ Airline Respirator (attach description)	☐ Half Mask APR	☐ Particulate/Organic Vapor Combined
☒ Safety Glasses	☒ Safety-toed Boots				☐ Acid Gas
☐ Other*		☐ Other*		☐ Other*	
ADDITIONAL PPE (*provide specific type(s) or descriptions of this item below)					
Tyvek PPE clothing if Level C initiated					

Project Development Team		Position/Title	Modified By	Reviewed By	Position/Title	Date
Name	Signature					
John Hargens		Geologist				



JOB SAFETY ANALYSIS (JSA)

Hand Augering



Safety Means Awareness
Responsibility Teamwork

Job Steps ⁽¹⁾	Task Activity	Potential Hazard(s) ⁽²⁾	Corrective Measure(s) ⁽³⁾	Person Responsible
1	Discuss STAR and SWA	Site personnel not aware of STAR and SWA	- Project team (CRA) discusses importance of and documentation procedures for SWA during pre-job safety meeting - Use SWA to stop any work that is unsafe	Site Personnel
2	Inspect and calibrate sampling and monitoring equipment	- Lost time from improperly functioning equipment - Incorrect sampling procedures/ collection due to malfunctioning equipment	Ensure all equipment is functioning properly; complete Quality Control documents	CRA Geologist
3	Advancing hand auger	- Overhead and underground utilities - Lifting hazards - Back injury - Manual material handling - Improper hand auger operation - Dust/flying debris/contaminants	- Inspect route to be traveled - Avoid moving objects that block field of vision - Use precaution when advancing hand auger tool - Assess the potential for underground structures (i.e., utilities) at the sign of unusual resistance - Do not work under overhead utilities - Know the length of the hand auger tool and how close it could come to utilities - Use proper bending/lifting techniques by bending and lifting with legs and not with back - Do not twist at waist when turning the auger - Dust particles may become airborne; if dust becomes excessive, use a dust mask - When pulling the hand auger out of the boring, materials can become airborne - Pull up slowly using your legs - Do not jerk the hand auger out of the hole - Get assistance if you cannot maintain proper posture by yourself - Wear nitrile gloves under the leather gloves when advancing the hand auger to avoid dermal contact with potential contaminants	Site Personnel
4	Prepare to collect soil samples	- Back strain - Pinch points - Cuts - Punctures - Sample misidentification	- Lift with the legs (bend at the knees and use the leg muscles) to protect the lower back - If the object is in excess of 50 pounds (23 kg) then assistance (buddy lift) will be required - Avoid placing hands/fingers in pinch point locations - Use proper tools when opening container packaging - Do not use fixed open blade knives when opening boxes or containers. - Ensure the sample ID label matches sample location with site plan/CRA Site Supervisor/subcontractor	CRA Geologist
5	Sample collection	- Contaminant exposure - Cuts from container breakage - Sample misidentification	- Wear nitrile gloves and replace between soil samples - Inspect glass bottles for breaks/cracks - Do not attempt to use any suspect containers - Close glass sample containers carefully to avoid breakage - Check sample labels for accuracy prior to placing in cooler	CRA Geologist
6	Headspace screening of samples	- Contaminant exposure - Incorrect headspace readings	- Wear nitrile gloves - Ensure proper calibration of equipment	CRA Geologist



JOB SAFETY ANALYSIS (JSA)

Hand Augering



Safety Means Awareness
Responsibility Teamwork

Job Steps ⁽¹⁾	Task Activity	Potential Hazard(s) ⁽²⁾	Corrective Measure(s) ⁽³⁾	Person Responsible
7	Sample selection	• Bottle breakage • Contaminant exposure • Pinch points • Lost time due to incorrect sample selection	• Wear nitrile gloves when handling sample containers • Confirm selected samples are correct based on work plan selection criteria, PID readings, and soil boring logs • Avoid placing hands/fingers in pinch point locations (e.g., between cooler and lid)	CRA Geologist
8	Packing samples in cooler(s)	• Bottle breakage • Contaminant exposure • Cuts • Pinch points • Back strain • Lost time due to incorrect sample packaging or hold time exceedances	• Wear nitrile gloves when handling sample containers • Pack glass containers in bubble wrap • Check COC against sample labels and SSOW for accuracy before shipping • Avoid placing hands/fingers in pinch point locations (e.g., between cooler and lid) • Refer to steps 3 and 4 and the HASP for additional lifting techniques • Ensure equipment and supplies are loaded correctly and do not shift during transport	CRA Geologist
9	Investigation derived waste (IDW) management	• Contaminant exposure • Heavy lifting • Pinch points • Slip/trip/fall hazards • Mislabeled waste	• Wear nitrile gloves when handling IDW • Use proper lifting techniques (mechanical or buddy system) to transport/dispose of IDW into drums • Refer to steps 3 and 4 and the HASP for additional lifting techniques • Avoid placing hands/fingers in pinch point locations • Maintain awareness of walking surfaces • Label IDW with generator, a contact number, identification of contents, and site location • Specify IDW as either hazardous or non-hazardous material	CRA Geologist

- (1) Each Job or Task consists of a set of steps. Be sure to list all the steps in the sequence that they are performed. Specify the equipment or other details to set the basis for the potential (associated) hazards.
- (2) A hazard is a potential danger. What can go wrong? How can someone get hurt? Consider, but do not limit, the analysis to: **Contact** - victim is struck by or strikes an object; **Caught** - victim is caught on, caught in or caught between objects; **Fall** - victim falls to ground or lower level (includes slips and trips); **Exertion** - excessive strain or stress/ergonomics/lifting techniques; **Exposure** - inhalation/skin hazards. Specify the hazards and do not limit the description to a single word such as "Caught".
- (3) Aligning with the Job Steps, Task Activity Description, and Potential Hazard columns, describe what actions or procedures are necessary to eliminate or minimize the hazards. Be clear, concise and specific. Use objective, observable, and quantified terms. Avoid subjective general statements such as "be careful" or "use as appropriate".



JOB SAFETY ANALYSIS (JSA)

Oversight of Monitoring Well Installation and/or Soil Boring



Safety Means Awareness
Responsibility Teamwork

Field staff must review job-specific work plan and coordinate with project manager to verify that all up-front logistics are completed prior to starting work including, but not limited to, permitting, access agreements, and notification to required contacts (e.g., site managers, inspectors, clients, subcontractors, etc.). Additionally, a tailgate safety meeting must be performed and documented at the beginning of each workday. **Stop, Think, Act, Review (STAR)** must be used prior to any activity. All personnel must possess the appropriate training prior to initiating scheduled tasks. Also consider weather conditions. CRA personnel have the authority and responsibility to use **Stop Work Authority (SWA)**.

Date Issued/Revised:	9/11/09	JSA Type:	Drilling/Environmental
Work Type:	Environmental - Oversight	Client:	Motors Liquidation Company
Work Activity:	Oversight of installation of monitoring wells, abandonment of monitoring wells, and general repair (bollards and concrete pads).		
Work Site:	100 Kindelberger Road, Kansas City, Kansas		
Key Equipment:	Air monitoring equipment; safety cones/fencing/barricades (not needed in vacant, fenced areas)		
Task-specific Training:	CRA Field Method Training		

MINIMUM REQUIRED PERSONAL PROTECTIVE EQUIPMENT (see job steps for task-specific requirements)					
☒ Reflective Vest	☐ Goggles	☒ Gloves*	Supplied Air	APR	
☒ Hard Hat	☐ Face Shield*	☐ Coveralls*	☐ SCBA	☐ Full Face APR	☐ Particulate ☐ Organic Vapor
☐ Lifeline/Harness*	☒ Hearing Protection*	☐ PPE Clothing*	☐ Airline Respirator (attach description)	☐ Half Mask APR	☐ Particulate/Organic Vapor Combined
☒ Safety Glasses	☒ Safety-toed Boots				☐ Acid Gas
☐ Other*		☐ Other*		☐ Other*	
ADDITIONAL PPE (*provide specific type(s) or descriptions of this item below)					

Project Development Team		Position/Title	Modified By	Reviewed By	Position/Title	Date
Name	Signature					
John Hargens		Geologist				



JOB SAFETY ANALYSIS (JSA)

Oversight of Monitoring Well Installation and/or Soil Boring



Safety Means Awareness
Responsibility Teamwork

Job Steps ⁽¹⁾	Task Activity	Potential Hazard(s) ⁽²⁾	Corrective Measure(s) ⁽³⁾	Person Responsible
1	Markout underground utilities	- Property damage - Explosion - Electrocution - Injury - Death	- Call public underground utility agency (One-Call) at least 5 or more days prior to work activities - Review State Law pertaining to underground pipe line safety and have private utility mark-out performed - Expose lines if warranted (i.e., hand dig, test pit, or daylight)	Project Manager and Site Supervisor
2	Conduct site walk - identify unsafe conditions and determine sample point locations	- Traffic hazard - Slip/trip/fall hazards - Biological hazard - Overhead/underground hazards	- Maintain awareness of on-site traffic and walking surfaces - When selecting soil boring locations, be aware of biological hazards (e.g., ants, poison ivy, wasps) and overhead/underground hazards (e.g., overhead utilities, concrete scarring, station canopy)	Site Personnel
3	Equipment inspection	- Pinch points - Property damage - Lost time due to damaged equipment/parts	- Discuss pinch points on equipment (e.g., drill rig, air knife, pressure washer, etc.) - Familiarize all personnel with location/operation of fire extinguisher(s) and kill switch on drill rig - Visually inspect equipment/parts for damage and document inspections	Site Personnel
4	Set up work zone for drilling	- Traffic hazard - Slip/trip/fall hazards - Property damage - Overhead hazards - Environmental impact	- Maintain awareness of on-site traffic, work zones, walking surfaces, overhead hazards (e.g., canopy and low hanging overhead lines) - Utilize barricades/cones/caution tape to define work zone and direct traffic - Wear leather/cotton when setting up barricades - Be aware of any potential sensitive receptors and verify all personnel are aware of the location of spill kit	Site Personnel
5	Set up staging area	- Traffic hazard - Slip/trip/fall hazards - Lifting hazards - Back injury - Manual material handling - Pinch points - Heat/cold stress	- Maintain awareness of on-site traffic and walking surfaces - Utilize barricades/cones/caution tape to define work zone and direct traffic - Reduce distance needed to travel when carrying materials and or equipment - Wear leather/cotton gloves when setting up barricades - Size up the load, If the object is too large or odd shaped OR is in excess of 50 pounds (23 kg) then assistance (mechanical or a buddy lift) will be required. - Lift with the legs (bend at the knees and use the leg muscles) to protect the lower back and keep lower back in a neutral position - Avoid one-handed carrying if possible; maintain awareness of footing - Avoid placing hands/fingers in pinch point locations - In extreme temperatures, ensure all personnel have proper clothing, hydration, and heat/cold protection (e.g., canopy, fan, glove warmers)	Site Personnel



JOB SAFETY ANALYSIS (JSA)

Oversight of Monitoring Well Installation and/or Soil Boring



Safety Means Awareness
Responsibility Teamwork

Job Steps ⁽¹⁾	Task Activity	Potential Hazard(s) ⁽²⁾	Corrective Measure(s) ⁽³⁾	Person Responsible
6	Contractor oversight/ management of hole clearance/drilling activities	- Traffic hazard - Slip/trip/fall hazards - Lifting hazards - Back injury - Manual material handling - Damage to underground utilities - Contaminant exposure - Heat/cold stress - Injury to personnel and public - Cross-contamination - Equipment failure	- Maintain awareness of on-site traffic and practice good housekeeping - Perform a prestart meeting, inform subcontractor of safe lifting practices - Refer to step 5 and the HASP for additional lifting information - Ensure subcontractors don proper PPE (e.g., face shield, leather/cotton gloves, hearing protection). No loose clothing. - Complete and sign off utility clearance. If non-native material (e.g., pea gravel, sand, fill material) or underground utilities are observed, utilize SWA and assess situation. - Monitor breathing zone and refer to HASP for action levels - Monitor all personnel for signs and symptoms of heat/cold stress and refer to HASP for recommendations - Be aware of unsafe hoisting and material handling practices - Be aware of proper augering and auger handling techniques. Visually monitor performance and functioning of drill rig for signs of failure. Monitor safe drill movement/positional setup. - Decontaminate sampling equipment after collecting a sample and decontaminate drilling equipment after each borehole - Watch where you step, look for debris which may be covered by brush or rubble	Site Personnel
7	Construct well	- Lifting hazards - Back injury - Manual material handling - Cross-contamination - Non-approved construction - Slip, trip, and fall hazards - Eye injury - Cuts	- Use proper lifting techniques as discussed in Step 5 and HASP - Prior to going into the borehole, inspect casing and other materials to ensure they are free of jagged/sharp edges - Confirm construction with project manager - Ensure presence or other authorization by any required inspectors for well installation/grouting - Keep pathways and work area clean of debris and possible tripping hazards - Use PPE and monitoring in accordance with the JSA - Use safe cutting tools (no fixed open blade knives)	Site Personnel
8	Site/boring security, clean site, demobilize	- Traffic hazard - Slip/trip/fall hazards - Lifting hazards - Back safety - Manual material handling	- Use buddy system as necessary to remove traffic control - Do not work with your back to traffic - Wear leather/cotton gloves when moving barricades - Maintain awareness of on-site traffic and walking surfaces - Maintain proper lifting techniques as described in Step 5 and HASP. - Ensure good house keeping methods are practiced. Work area is kept clean of debris. - Leave site clean of refuse and debris - Clearly mark/barricade any borings that need later topping off or curing - Notify property personnel of departure - Secure boring location if open overnight	Site Personnel

- (1) Each Job or Task consists of a set of steps. Be sure to list all the steps in the sequence that they are performed. Specify the equipment or other details to set the basis for the potential (associated) hazards.
- (2) A hazard is a potential danger. What can go wrong? How can someone get hurt? Consider, but do not limit, the analysis to: **Contact** - victim is struck by or strikes an object; **Caught** - victim is caught on, caught in or caught between objects; **Fall** - victim falls to ground or lower level (includes slips and trips); **Exertion** - excessive strain or stress/ergonomics/lifting techniques; **Exposure** - inhalation/skin hazards. Specify the hazards and do not limit the description to a single word such as "Caught".
- (3) Aligning with the Job Steps, Task Activity Description, and Potential Hazard columns, describe what actions or procedures are necessary to eliminate or minimize the hazards. Be clear, concise and specific. Use objective, observable, and quantified terms. Avoid subjective general statements such as "be careful" or "use as appropriate".



JOB SAFETY ANALYSIS (JSA)

Opening Acetate Liners from Direct Push Probing



Safety Means Awareness
Responsibility Teamwork

Field staff must review job-specific work plan and coordinate with project manager to verify that all up-front logistics are completed prior to starting work including, but not limited to, permitting, access agreements, and notification to required contacts (e.g., site managers, inspectors, clients, subcontractors, etc.). Additionally, a tailgate safety meeting must be performed and documented at the beginning of each workday. **Stop, Think, Act, Review (STAR)** must be used prior to any activity. All personnel must possess the appropriate training prior to initiating scheduled tasks. Also consider weather conditions. CRA personnel have the authority and responsibility to use **Stop Work Authority (SWA)**.

Date Issued/Revised:	9/11/09	JSA Type:	Drilling
Work Type:	Environmental	Client:	Motors Liquidation Company
Work Activity:	Soil sampling		
Work Site:	100 Kindelberger Road, Kansas City, Kansas		
Key Equipment:	Direct-push hydraulic soil probe, liner holder, cutting tools, extra blades		
Task-specific Training:	Hand Tool Safety; Drilling Safety		

MINIMUM REQUIRED PERSONAL PROTECTIVE EQUIPMENT (see job steps for task-specific requirements)

☐ Reflective Vest	☐ Goggles	☒ Gloves*	Supplied Air	APR	
☐ Hard Hat	☐ Face Shield*	☐ Coveralls*		☐ SCBA	☐ Full Face APR
☐ Lifeline/Harness*	☒ Hearing Protection*	☒ PPE Clothing*	☐ Airline Respirator (attach description)	☐ Half Mask APR	☐ Particulate/Organic Vapor Combined
☒ Safety Glasses	☒ Safety-toed Boots				☐ Acid Gas
☐ Other*			☐ Other*	☐ Other*	

ADDITIONAL PPE (*provide specific type(s) or descriptions of this item below)

Cut-resistant gloves – see table below for specifications

See Table 2 for specific Action Level requirements

Project Development Team		Position/Title	Modified By	Reviewed By	Position/Title	Date
Name	Signature					
John Hargens		Geologist				



JOB SAFETY ANALYSIS (JSA)

Opening Acetate Liners from Direct Push Probing



Safety Means Awareness
Responsibility Teamwork

Job Steps ⁽¹⁾	Task Activity	Potential Hazard(s) ⁽²⁾	Corrective Measure(s) ⁽³⁾	Person Responsible
1	Discuss STAR and (SWA)	Site personnel not aware of STAR and SWA	Project team (CRA) discusses importance of and documentation procedures for SWA during pre-job safety meeting. Use SWA to stop any work that is unsafe.	All Staff
2	Unload equipment from vehicle	- Back strain - Cuts - Pinch points - Hand/foot injury - Damaged equipment	- Use proper lifting techniques and buddy system if needed. - Wear leather/cotton gloves to minimize minor cuts/abrasions and avoid placing hands/fingers in pinch point locations. - Wear steel toe boots. - Be aware of equipment that may have shifted during transport.	All Staff – Consultant, Contractors
3	Inspect sampling equipment	- Lost time from improperly functioning equipment - Incorrect sampling procedures/ collection due to malfunctioning equipment	- Ensure all equipment is functioning properly before mobilizing to job site. - Review sampling procedures and sampling plan (if available).	Sampling Technician
4	General sample handling	Exposure to contaminated materials/soils/groundwater	Wear appropriate PPE including nitrile gloves, safety glasses and neck-to-toe clothing. Review HASP.	All Staff – Consultant, Contractors
5	Opening the sample liner	Sharp tools	- Ensure that you have a steady work surface (e.g., tailgate of a pickup, sturdy portable folding table). - Secure the liner prior to cutting Best Practice: - Use Geoprobe® Universal Liner Holder (catalog no. 22734) - Use Correct Tools For Opening Acetate Liners Best Practice: - Use Geoprobe® DT325 Liner Cutter for DT325 soil sampling system (1.85" core diameter) - Use Geoprobe® MC Liner Cutter for Macro Core soil sampling system (1.5" core diameter) (AT8010) - Ensure proper footing and lighting - Use proper work gloves Best Practice: - Kevlar Gloves (http://www.seattlemarine.net/atlas_gloves/cut_resistant_gloves.htm) - Anti-puncture/cut Police Gloves (http://www.red-diamond-unif.com/hatch3.htm) - Turtle Skin gripped gloves (https://www.turtleskin.com/store/category.aspx?categoryID=4) - Leather work gloves - Cut the liner using the specialty cutting tool using a pulling motion to pull the tool across your body, but not directly toward it. - Ensure that there are no bystanders or obstructions in the path of the cutting tool. - If a cut cannot be started in the liner with the Geoprobe cutting tools STOP WORK and re-assess using the procedures listed below.	Contractor or Sample Technician
6	Assess why cut cannot be started using specialized liner cutters	Management of change	- Dull Blade - a dull blade(s) requires more force and is more likely to slip than a sharp one. Change the blade whenever it starts to tear instead of cut. See proper procedure below. - Cut cannot be started due to soil conditions, or crimping or other damage to the acetate liner. See proper procedure below.	All Staff – Consultant, Contractors



JOB SAFETY ANALYSIS (JSA)

Opening Acetate Liners from Direct Push Probing



Safety Means Awareness
Responsibility Teamwork

Job Steps ⁽¹⁾	Task Activity	Potential Hazard(s) ⁽²⁾	Corrective Measure(s) ⁽³⁾	Person Responsible
7	Changing blades in the specialty cutting tool	- Cuts due to sharp edges - Chemical hazard	- Use a proper tool (e.g. a screwdriver) to access the blades and ensure a good fit. - Have a suitable surface to work on such as a table or tailgate. - Ensure proper footing and lighting. - Wear cut/puncture resistant gloves. - Avoid holding on to other objects while changing the blades (such as the new blades) or for balance. - Always hold the blade at the non-sharp side. - Make sure to re-assemble the tool correctly. Make sure screws are tight. - Clean/decon tool before performing maintenance.	Contractor or Sample Technician
8	Disposal of used blades	Cuts due to sharp edges	- While wearing cut/puncture resistant gloves, carefully wrap a spent blade in several layers of tape to cover the sharp edges and points. - Dispose of spent blades and associated litter so that the sharp edges do not puncture a trash bag.	Contractor or Sample Technician
9	Cutting a resistant, crimped, or otherwise damaged acetate liner with a safety knife. Assumes that the condition of the liner prevents the use of the specialty-cutting tool in its standard configuration	- Sharp tools - Exertion - Line-of-fire	- Remove one of the two blades from the specialty cutting tool, and then attempt to cut the liner. If successful, twist the liner approximately 60 to 90 degrees down the radial axis before making a second cut. It may be most appropriate to continue the job using the specialty cutting tool in this configuration, if site conditions are causing multiple liners to become damaged. - If liners still cannot be cut with the specialty cutting tool, the most appropriate method is to use a safety knife with a self-retracting hook blade to cut through only the damaged/affected portion of the liner, then resume with the specialty-cutting tool as described above (with either one blade or two installed). Best Practice - Uline Comfort Grip Safety Knife, model H-1370 (http://www.uline.com/ProductDetail.asp?model=H-1370) - Hook Blades: Stanley 11-961 - Regular Hook Blades (5-Pack) - The safe procedure for cutting the liner with a safety knife is described below: - Always be sure that blades are properly seated in knives and that knives are properly closed and/or fastened together before use. - Always use sharp blades. A dull blade requires more force and is more likely to slip than a sharp one. Change the blade whenever it starts to tear instead of cut. - Always wear a cut resistant glove on your free hand while cutting with a self-retracting hook bladed razor knife. - Always keep your free hand (and other body parts) away from the line of the cut. Never cut towards yourself (body, hands, face, etc.). - Always pull - never push the knife. The blade could break off, wedging in the material and cutting your arm severely as it passes over the broken blade. - Blades are brittle and can snap easily. Do not bend or apply side loads to blades by using them to pry loose objects. - Do not overexert yourself – ensure you can maintain complete control of the knife throughout the cut.	Contractor or Sample Technician



JOB SAFETY ANALYSIS (JSA)

Opening Acetate Liners from Direct Push Probing



Safety Means Awareness
Responsibility Teamwork

- (1) Each Job or Task consists of a set of steps. Be sure to list all the steps in the sequence that they are performed. Specify the equipment or other details to set the basis for the potential (associated) hazards.
- (2) A hazard is a potential danger. What can go wrong? How can someone get hurt? Consider, but do not limit, the analysis to: **Contact** - victim is struck by or strikes an object; **Caught** - victim is caught on, caught in or caught between objects; **Fall** - victim falls to ground or lower level (includes slips and trips); **Exertion** - excessive strain or stress/ergonomics/lifting techniques; **Exposure** - inhalation/skin hazards. Specify the hazards and do not limit the description to a single word such as "Caught".
- (3) Aligning with the Job Steps, Task Activity Description, and Potential Hazard columns, describe what actions or procedures are necessary to eliminate or minimize the hazards. Be clear, concise and specific. Use objective, observable, and quantified terms. Avoid subjective general statements such as "be careful" or "use as appropriate".



JOB SAFETY ANALYSIS (JSA)

Preservative Bottle Labeling



Safety Means Awareness
Responsibility Teamwork

Field staff must review job-specific work plan and coordinate with project manager to verify that all up-front logistics are completed prior to starting work including, but not limited to, permitting, access agreements, and notification to required contacts (e.g., site managers, inspectors, clients, subcontractors, etc.). Additionally, a tailgate safety meeting must be performed and documented at the beginning of each workday. **Stop, Think, Act, Review (STAR)** must be used prior to any activity. All personnel must possess the appropriate training prior to initiating scheduled tasks. Also consider weather conditions. CRA personnel have the authority and responsibility to use **Stop Work Authority (SWA)**.

Date Issued/Revised:	9/11/09	JSA Type:	Sample Bottle Labeling (pre-labeling bottle sets before field use)
Work Type:	Environmental	Client:	Motors Liquidation Company
Work Activity:	Preservative bottle labeling		
Work Site:	100 Kindelberger Road, Kansas City, Kansas		
Key Equipment:	Marker, PPE		
Task-specific Training:	Bottle Labeling, PPE; reference HASP for additional site/client safety training requirements		

MINIMUM REQUIRED PERSONAL PROTECTIVE EQUIPMENT (see job steps for task-specific requirements)					
☐ Reflective Vest	☒ Goggles	☒ Gloves*	Supplied Air	APR	
☐ Hard Hat	☐ Face Shield*	☐ Coveralls*	☐ SCBA	☐ Full Face APR	☐ Particulate ☐ Organic Vapor
☐ Lifeline/Harness*	☐ Hearing Protection*	☐ PPE Clothing*	☐ Airline Respirator (attach description)	☐ Half Mask APR	☐ Particulate/Organic Vapor Combined
☐ Safety Glasses	☐ Safety-toed Boots				☐ Acid Gas
☐ Other*		☐ Other*		☐ Other*	
ADDITIONAL PPE (*provide specific type(s) or descriptions of this item below)					
Use nitrile gloves and chemical-resistant goggles when performing work					

Project Development Team		Position/Title	Modified By	Reviewed By	Position/Title	Date
Name	Signature					
John Hargens		Geologist				



JOB SAFETY ANALYSIS (JSA)

Preservative Bottle Labeling



Safety Means Awareness
Responsibility Teamwork

Job Steps ⁽¹⁾	Task Activity	Potential Hazard(s) ⁽²⁾	Corrective Measure(s) ⁽³⁾	Person Responsible
1	Opening cooler	- Chemical exposure to skin, eyes, and/or inhalation from preservative leakage - Cuts from broken glass	- Inspect cooler for signs of broken bottles or bottle preservative leakage - Wear nitrile gloves and goggles	Sampling Technician
2	Open specific bottle set bag prepared by laboratory	- Chemical exposure to skin, eyes, and/or inhalation from preservative leakage - Cuts from broken glass	- Wear proper PPE (Ndex nitrile gloves) and safety goggles for task - Inspect bag for broken glass and other sharp objects - Inspect bottle set bag for liquid preservative leakage before placing hand inside plastic bag	Sampling Technician
3	Label individual bottles	- Chemical exposure to skin, eyes, and/or inhalation from preservative leakage - Cuts from broken glass	- Check seal on each bottle by tipping away from the body - Wear proper PPE (Ndex nitrile gloves) and safety goggles for task - Label individual bottles with Sharpie marker - Inspect for other hazards that may affect the hands (broken glass or other sharp objects)	Sampling Technician
4	Place labeled bottle set back inside cooler	Hand injury	- Wear proper PPE (Ndex nitrile gloves) - Be careful not to break glass containers - Use sufficient ice and packing material	Sampling Technician

- (1) Each Job or Task consists of a set of steps. Be sure to list all the steps in the sequence that they are performed. Specify the equipment or other details to set the basis for the potential (associated) hazards.
- (2) A hazard is a potential danger. What can go wrong? How can someone get hurt? Consider, but do not limit, the analysis to: **Contact** - victim is struck by or strikes an object; **Caught** - victim is caught on, caught in or caught between objects; **Fall** - victim falls to ground or lower level (includes slips and trips); **Exertion** - excessive strain or stress/ergonomics/lifting techniques; **Exposure** - inhalation/skin hazards. Specify the hazards and do not limit the description to a single word such as "Caught".
- (3) Aligning with the Job Steps, Task Activity Description, and Potential Hazard columns, describe what actions or procedures are necessary to eliminate or minimize the hazards. Be clear, concise and specific. Use objective, observable, and quantified terms. Avoid subjective general statements such as "be careful" or "use as appropriate".



JOB SAFETY ANALYSIS (JSA)

Fluid Level Monitoring



Safety Means Awareness
Responsibility Teamwork

Field staff must review job-specific work plan and coordinate with project manager to verify that all up-front logistics are completed prior to starting work including, but not limited to, permitting, access agreements, and notification to required contacts (e.g., site managers, inspectors, clients, subcontractors, etc.). Additionally, a tailgate safety meeting must be performed and documented at the beginning of each workday. **Stop, Think, Act, Review (STAR)** must be used prior to any activity. All personnel must possess the appropriate training prior to initiating scheduled tasks. Also consider weather conditions. CRA personnel have the authority and responsibility to use **Stop Work Authority (SWA)**.

Date Issued/Revised:	9/11/09	JSA Type:	Fluid Level Monitoring
Work Type:	Environmental	Client:	Motors Liquidation Company
Work Activity:	Fluid level monitoring (collecting water/LNAPL levels/gauging wells)		
Work Site:	100 Kindelberger Road, Kansas City, Kansas		
Key Equipment:	Water level meter or oil/water interface meter, PID, PPE		
Task-specific Training:	Fluid Level Monitoring; reference HASP for additional site/client safety training requirements		

MINIMUM REQUIRED PERSONAL PROTECTIVE EQUIPMENT (see job steps for task-specific requirements)					
☒ Reflective Vest	☐ Goggles	☒ Gloves*	Supplied Air	APR	
☒ Hard Hat	☐ Face Shield*	☐ Coveralls*	☐ SCBA	☐ Full Face APR	☐ Particulate ☐ Organic Vapor
☐ Lifeline/Harness*	☐ Hearing Protection*	☐ PPE Clothing*	☐ Airline Respirator (attach description)	☐ Half Mask APR	☐ Particulate/Organic Vapor Combined
☒ Safety Glasses	☒ Safety-toed Boots				☐ Acid Gas
☐ Other*		☐ Other*		☐ Other*	
ADDITIONAL PPE (*provide specific type(s) or descriptions of this item below)					
Use nitrile gloves when performing work; use hearing protection as necessary based on site conditions					

Project Development Team		Position/Title	Modified By	Reviewed By	Position/Title	Date
Name	Signature					
John Hargens		Geologist				



JOB SAFETY ANALYSIS (JSA)

Fluid Level Monitoring



Safety Means Awareness
Responsibility Teamwork

Job Steps ⁽¹⁾	Task Activity	Potential Hazard(s) ⁽²⁾	Corrective Measure(s) ⁽³⁾	Person Responsible
1	Inspect/calibrate equipment	Loss due to malfunctioning equipment	Check all equipment to ensure it is in proper working order and has been calibrated to CRA and manufacturer's standards, then document	Sampling Technician
2	Establish work zone at monitoring well location	- Traffic - Pinch points - Lifting hazards - Back injury - Manual material handling	- Review work zone controls using the STAR process; is it safe to proceed? - Maintain awareness of on-site traffic patterns and walking paths - Reduce travel distance when there is a need to carry/lift materials - Make sure grip is adequate; wear leather/cotton gloves - Size up the load; if the object is too large or odd shaped OR is in excess of 50 pounds (23 kg) then assistance (mechanical or a buddy lift) will be required - Lift with the legs (bend at the knees and use the leg muscles) to protect the lower back and keep lower back in a neutral position - Avoid one-handed carrying if possible; maintain awareness of footing	Sampling Technician
3	Open monitoring well cover(s)	- Pinch points - Hand injury - Biological hazards	- Avoid placing hands in pinch points - Wear proper PPE for task and use the proper tool when opening well covers (open face wrench/socket wrench) - Maintain good housekeeping; stow bolts, locks, wrench, plug, etc. in a safe area to prevent loss - Inspect for other hazards that may affect the hands (hypodermic needles, etc.) - Use PID to monitor air quality in breathing space - Heightened awareness of wasps, ants, bees, spiders, and poison plants	Sampling Technician
4	Measure water/LNAPL levels	- Contaminant exposure - Cross contamination	- Wear proper PPE; use chemical-resistant gloves but be aware of abrasion hazards using the STAR process - Use PID to monitor air quality in breathing space - Decon probe and measuring tape following gauging of well	Sampling Technician
5	Close monitoring well cover	- Traffic - Hand injury - Pinch points	- Maintain awareness of on-site traffic patterns; verify barricades are still in place - Wear abrasion-resistant gloves and use proper tools - Avoid placing hands in pinch points	Sampling Technician

- (1) Each Job or Task consists of a set of steps. Be sure to list all the steps in the sequence that they are performed. Specify the equipment or other details to set the basis for the potential (associated) hazards.
- (2) A hazard is a potential danger. What can go wrong? How can someone get hurt? Consider, but do not limit, the analysis to: **Contact** - victim is struck by or strikes an object; **Caught** - victim is caught on, caught in or caught between objects; **Fall** - victim falls to ground or lower level (includes slips and trips); **Exertion** - excessive strain or stress/ergonomics/lifting techniques; **Exposure** - inhalation/skin hazards. Specify the hazards and do not limit the description to a single word such as "Caught".
- (3) Aligning with the Job Steps, Task Activity Description, and Potential Hazard columns, describe what actions or procedures are necessary to eliminate or minimize the hazards. Be clear, concise and specific. Use objective, observable, and quantified terms. Avoid subjective general statements such as "be careful" or "use as appropriate".



JOB SAFETY ANALYSIS (JSA)

Monitoring Well Sampling



Safety Means Awareness
Responsibility Teamwork

Field staff must review job-specific work plan and coordinate with project manager to verify that all up-front logistics are completed prior to starting work including, but not limited to, permitting, access agreements, and notification to required contacts (e.g., site managers, inspectors, clients, subcontractors, etc.). Additionally, a tailgate safety meeting must be performed and documented at the beginning of each workday. **Stop, Think, Act, Review (STAR)** must be used prior to any activity. All personnel must possess the appropriate training prior to initiating scheduled tasks. Also consider weather conditions. CRA personnel have the authority and responsibility to use **Stop Work Authority (SWA)**.

Date Issued/Revised:	9/11/09	JSA Type:	Environmental
Work Type:	Environmental	Client:	Motors Liquidation Company
Work Activity:	Monitoring well sampling/gauging		
Work Site:	100 Kindelberger Road, Kansas City, Kansas		
Key Equipment:	Water level meter, pump or bailer		
Task-specific Training:	CRA Field Method Training, Groundwater Sampling Procedures		

MINIMUM REQUIRED PERSONAL PROTECTIVE EQUIPMENT (see job steps for task-specific requirements)					
☐ Reflective Vest	☐ Goggles	☐ Gloves*	Supplied Air	APR	
☐ Hard Hat	☐ Face Shield*	☐ Coveralls*	☐ SCBA	☐ Full Face APR	☐ Particulate ☐ Organic Vapor
☐ Lifeline/Harness*	☐ Hearing Protection*	☐ PPE Clothing*	☐ Airline Respirator (attach description)	☐ Half Mask APR	☐ Particulate/Organic Vapor Combined
☐ Safety Glasses	☐ Safety-toed Boots				☐ Acid Gas
☐ Other*		☐ Other*		☐ Other*	
ADDITIONAL PPE (*provide specific type(s) or descriptions of this item below)					
Nitrile gloves					

Project Development Team		Position/Title	Modified By	Reviewed By	Position/Title	Date
Name	Signature					
John Hargens		Geologist				



JOB SAFETY ANALYSIS (JSA)

Monitoring Well Sampling



Safety Means Awareness
Responsibility Teamwork

Job Steps ⁽¹⁾	Task Activity	Potential Hazard(s) ⁽²⁾	Corrective Measure(s) ⁽³⁾	Person Responsible
1	Coordinate site access	Delays or added work	Notify other required personnel if applicable (city, regulators, private property owners, etc.)	Sampling Technician
2	Mobilize with proper equipment/supplies for sampling	- Delay or improper/unsafe performance of work due to improper equipment on site - Cross-contamination of wells	- Review work plan to determine equipment/supply needs - Make sure all sampling/gauging equipment is decontaminated - Bring ice for sample storage - Review THE HASP and gather necessary PPE	Sampling Technician
3	Notify other personnel on site	- Unknown traffic or other work hazards - Lack of communication between all interested parties	Meet with site personnel and explain planned activities	Sampling Technician
4	Determine sampling order	Cross-contamination of samples and wells due to incomplete decontamination of sampling equipment	Review prior analytical results and set sampling order from lowest to highest concentration wells	Sampling Technician
5	Perform STAR and tailgate safety meeting upon arrival at site	Consider worst-case scenario (including weather conditions)	- Review HASP with co-workers - Highlight aspects identified by HASP and, if necessary, add to HASP - Get signature of all co-workers on HASP	Sampling Technician
6	Set up exclusion zone(s)	- Injury or exposure to public or other on-site personnel - Slip/trip/fall hazards	- Implement exclusion zone setup instructions of THE HASP (barricades, caution tape, cones, etc.) - Set up work area free of trip hazards	Sampling Technician
7	Gauge water levels and product thickness (where applicable) in wells	- Back strain - Inhalation or dermal exposure to chemical hazards	- Don any additional PPE and initiate air quality monitoring in accordance with the HASP - Maintain safe distance from well head - Bend at knees, not waist	Sampling Technician
8	Purge well(s) and collect purge water	- Cross-contamination - Lifting hazards - Back injury - Manual material handling - Inhalation or dermal exposure to chemicals - Slip/trip/fall hazards - Spilling contaminated water	- Decontaminate purging equipment between each sampling location - Reduce travel distance when there is a need to carry/lift materials - Make sure grip is adequate; wear leather/cotton gloves - Size up the load; if the object is too large or odd shaped OR is in excess of 50 pounds (23 kg) then assistance (mechanical or a buddy lift) will be required - Lift with the legs (bend at the knees and use the leg muscles) to protect the lower back and keep lower back in a neutral position - Avoid one-handed carrying if possible; maintain awareness of footing - Use PPE and monitoring in accordance with the HASP - Keep work area clear of tripping or slipping hazards - Store purge water in appropriate containers	Sampling Technician



JOB SAFETY ANALYSIS (JSA)

Monitoring Well Sampling



Safety Means Awareness
Responsibility Teamwork

Job Steps ⁽¹⁾	Task Activity	Potential Hazard(s) ⁽²⁾	Corrective Measure(s) ⁽³⁾	Person Responsible
9	Collect samples in accordance with sampling plan	- Cross-contamination - Lifting hazards - Back injury - Manual material handling - Inhalation or dermal exposure to chemical hazards - Slip/trip/fall hazards - Improper labeling or storage - Injury due to acid burn (unsealed or leaking sample bottle) - Injury from broken sample bottle (cuts or acid burn)	- Use PPE in accordance with the HASP - Use PPE whenever handling or labeling samples - Decontaminate sampling equipment between each well (unless disposable) - Refer to step 9 and the HASP for additional lifting methods - Label samples in accordance with sampling plan - Keep samples stored in proper containers, at correct temperature, and away from work area - Wear nitrile gloves when handling bottles - Handle bottles carefully	Sampling Technician
10	Dispose or store purge water onsite	- Lifting hazards - Back injury - Manual material handling - Exposure to chemicals - If disposing through on-site treatment system, damage or injury from improper use of equipment - Improper storage or disposal	- Use proper equipment to transport water (pumps, drum dollies, etc.) - Refer to step 9 and the HASP for additional lifting methods - Where PPE in accordance with the HASP - Review any necessary instructions for use of on-site treatment systems - Label storage containers properly and locate in isolated area away from traffic and other site functions - Coordinate off-site disposal (where applicable)	Sampling Technician
11	Clean site/demobilize	- Traffic - Nuisance or safety hazard left on site - Back strain	- Use buddy system as necessary to remove traffic control - Leave site clean of refuse and debris - Notify personnel of departure, and note any purge water left on site - Exercise caution when lifting coolers out of the trunk of a car; use the buddy system if justified	Sampling Technician
12	Package and deliver samples to lab	- Bottle breakage - Improper temperature - Exceeding hold times - Improper completion of Chain of Custody (COC)	- Pack samples in ice, use bubble wrap/bags for sample bottles - Use standard COC forms and labels - Submit samples to lab as soon as possible (no more than 3 days, but check sampling plan for any special requirements such as rush turnaround or special hold time restrictions)	Sampling Technician

- (1) Each Job or Task consists of a set of steps. Be sure to list all the steps in the sequence that they are performed. Specify the equipment or other details to set the basis for the potential (associated) hazards.
- (2) A hazard is a potential danger. What can go wrong? How can someone get hurt? Consider, but do not limit, the analysis to: **Contact** - victim is struck by or strikes an object; **Caught** - victim is caught on, caught in or caught between objects; **Fall** - victim falls to ground or lower level (includes slips and trips); **Exertion** - excessive strain or stress/ergonomics/lifting techniques; **Exposure** - inhalation/skin hazards. Specify the hazards and do not limit the description to a single word such as "Caught".
- (3) Aligning with the Job Steps, Task Activity Description, and Potential Hazard columns, describe what actions or procedures are necessary to eliminate or minimize the hazards. Be clear, concise and specific. Use objective, observable, and quantified terms. Avoid subjective general statements such as "be careful" or "use as appropriate".



JOB SAFETY ANALYSIS (JSA)

Groundwater Sampling (Peristaltic Pump)



Safety Means Awareness
Responsibility Teamwork

Field staff must review job-specific work plan and coordinate with project manager to verify that all up-front logistics are completed prior to starting work including, but not limited to, permitting, access agreements, and notification to required contacts (e.g., site managers, inspectors, clients, subcontractors, etc.). Additionally, a tailgate safety meeting must be performed and documented at the beginning of each workday. **Stop, Think, Act, Review (STAR)** must be used prior to any activity. All personnel must possess the appropriate training prior to initiating scheduled tasks. Also consider weather conditions. CRA personnel have the authority and responsibility to use **Stop Work Authority (SWA)**.

Date Issued/Revised:	9/11/09	JSA Type:	Groundwater Sampling
Work Type:	Environmental	Client:	Motors Liquidation Company
Work Activity:	Groundwater sampling		
Work Site:	100 Kindelberger Road, Kansas City, Kansas		
Key Equipment:	Bailer or peristaltic pump (select one or both – address in task activity and hazards); photoionization detector; safety cones/barricades		
Task-specific Training:	Electrical Safety (if using pump), Groundwater Sampling Procedures – reference HASP for additional site/client safety training requirements.		

MINIMUM REQUIRED PERSONAL PROTECTIVE EQUIPMENT (see job steps for task-specific requirements)

☒ Reflective Vest	☐ Goggles	☒ Gloves*	Supplied Air	APR	
☐ Hard Hat	☐ Face Shield*	☐ Coveralls*		☐ SCBA	☐ Full Face APR
☐ Lifeline/Harness*	☒ Hearing Protection*	☐ PPE Clothing*	☐ Airline Respirator (attach description)	☐ Half Mask APR	☐ Particulate/Organic Vapor Combined
☒ Safety Glasses	☒ Safety-toed Boots				☐ Acid Gas
☒ Other* Sunscreen and Insect Repellant		☐ Other*		☐ Other*	

ADDITIONAL PPE (*provide specific type(s) or descriptions of this item below)

Use Ndex nitrile gloves when handling wet sampling containers; use abrasion/cut-resistant gloves for other tasks; use hearing protection as necessary based on site conditions.

Project Development Team		Position/Title	Modified By	Reviewed By	Position/Title	Date
Name	Signature					
John Hargens		Geologist				



JOB SAFETY ANALYSIS (JSA)

Groundwater Sampling (Peristaltic Pump)



Safety Means Awareness
Responsibility Teamwork

Job Steps ⁽¹⁾	Task Activity	Potential Hazard(s) ⁽²⁾	Corrective Measure(s) ⁽³⁾	Person Responsible
1	Inspect/calibrate sampling equipment	Loss due to malfunctioning equipment	Check all equipment to ensure it is in proper working order and has been calibrated to CRA and manufacturer's standards, and document	Sampling Technician
2	Establish work zone at monitoring well location	- Traffic - Pinch points - Lifting hazards - Back injury - Manual material handling	- Maintain awareness of on-site traffic patterns and walking paths; setup barricades - Reduce travel distance when there is a need to carry/lift materials - Make sure grip is adequate; wear leather/cotton gloves when setting up barricades - Size up the load; if the object is too large or odd shaped OR is in excess of 50 pounds (23 kg) then assistance (mechanical or a buddy lift) will be required - Lift with the legs (bend at the knees and use the leg muscles) to protect the lower back and keep lower back in a neutral position - Avoid one-handed carrying if possible; maintain awareness of footing	Sampling Technician
3	Open monitoring well cover(s)	- Pinch points - Hand injury - Biological hazards	- Avoid placing hands in pinch points - Wear proper PPE (gloves) for task and use the proper tool(s) when opening well covers (open face wrench/socket wrench) - Inspect for other hazards that may affect the hands (hypodermic needles, etc.) - Heightened awareness of wasps, ants, bees, spiders, and poison plants	Sampling Technician
4	Measure water levels	- Contaminant exposure - Cross contamination	- Wear proper PPE (Ndex nitrile gloves) - use PID to monitor air quality - Decon probe and measuring tape following gauging of well	Sampling Technician
5	Develop/purge monitoring well location (select one or both – peristaltic pump or bailer – hazards will be contingent upon method)	- Slip/trip/fall hazards - Cuts - Pinch points - Electrical (AC or DC) - Back and shoulder strain	- Maintain housekeeping; be aware of ground conditions - Use PPE and proper tools - Keep hands away from pinch points - Inspect wiring, clamps, cables, etc.; avoid arcing - Stretch affected muscles (triceps, back, neck, and shoulder) prior to/during/after activity - Avoid repetitive motions and overhead lifts; use proper lifting techniques and neutral postures and take breaks	Sampling Technician
6	Collect groundwater sample utilizing bailer or peristaltic pump	- Chemical exposure - Cuts from container breaking - Sample misidentification	- Wear proper PPE - Inspect bottles for signs of breakage/damage; do not use suspect containers - Close glass bottles carefully – avoid cross threading lid and bottle - Ensure sample id numbers match sample location/site plan - Check sample labels for accuracy prior to placing in container	Sampling Technician
7	Close monitoring well cover	- Traffic - Hand injury - Pinch points	- Maintain awareness of on-site traffic patterns; verify barricades are still in place - Wear appropriate gloves and use proper tool(s) - Avoid placing hands in pinch points	Sampling Technician
8	Pack samples in container (i.e., cooler)	- Bottle breakage - Chemical exposure - Lifting hazards - Back injury - Manual material handling - Lost time due to sampling error	- Pack glass containers in bubble wrap or equivalent protection - Wear appropriate PPE (Ndex nitrile gloves) - Refer to step 2 and the HASP for additional lifting techniques/information - Ensure samples are packed/labeled/shipped correctly – double check	Sampling Technician



JOB SAFETY ANALYSIS (JSA)

Groundwater Sampling (Peristaltic Pump)



Safety Means Awareness
Responsibility Teamwork

Job Steps ⁽¹⁾	Task Activity	Potential Hazard(s) ⁽²⁾	Corrective Measure(s) ⁽³⁾	Person Responsible
9	Manage any investigative derived waste (IDW)	• Chemical exposure • Pinch points • Slip/trip/fall hazards • Lifting hazards • Back injury • Manual material handling • Mislabeling waste	• Wear appropriate PPE (Ndex gloves) and work gloves • Avoid pinch points • Use proper PPE • Inspect for proper housekeeping; clean up work area • Refer to step 2 and the HASP for additional lifting techniques/information • Label IDW appropriately (generator, contact number, identification of contents, and site location); specify type of contents; arrange for disposal	Sampling Technician and Project Manager

- (1) Each Job or Task consists of a set of steps. Be sure to list all the steps in the sequence that they are performed. Specify the equipment or other details to set the basis for the potential (associated) hazards.
- (2) A hazard is a potential danger. What can go wrong? How can someone get hurt? Consider, but do not limit, the analysis to: **Contact** - victim is struck by or strikes an object; **Caught** - victim is caught on, caught in or caught between objects; **Fall** - victim falls to ground or lower level (includes slips and trips); **Exertion** - excessive strain or stress/ergonomics/lifting techniques; **Exposure** - inhalation/skin hazards. Specify the hazards and do not limit the description to a single word such as "Caught".
- (3) Aligning with the Job Steps, Task Activity Description, and Potential Hazard columns, describe what actions or procedures are necessary to eliminate or minimize the hazards. Be clear, concise and specific. Use objective, observable, and quantified terms. Avoid subjective general statements such as "be careful" or "use as appropriate".



JOB SAFETY ANALYSIS (JSA)

NAPL Purging/Monitoring



Safety Means Awareness
Responsibility Teamwork

Field staff must review job-specific work plan and coordinate with project manager to verify that all up-front logistics are completed prior to starting work including, but not limited to, permitting, access agreements, and notification to required contacts (e.g., site managers, inspectors, clients, subcontractors, etc.). Additionally, a tailgate safety meeting must be performed and documented at the beginning of each workday. **Stop, Think, Act, Review (STAR)** must be used prior to any activity. All personnel must possess the appropriate training prior to initiating scheduled tasks. Also consider weather conditions. CRA personnel have the authority and responsibility to use **Stop Work Authority (SWA)**.

Date Issued/Revised:	9/11/09	JSA Type:	NAPL Purging
Work Type:	Environmental Investigation/Environmental Remediation	Client:	Motors Liquidation company
Work Activity:	NAPL Purging		
Work Site:	100 Kindelberger Road, Kansas City, Kansas		
Key Equipment:	Photoionization detector, colorimetric tubes (as required), Tyvek, full-face respirator (as required)		
Task-specific Training:	CRA Field Method Training, Air Monitoring		

MINIMUM REQUIRED PERSONAL PROTECTIVE EQUIPMENT (see job steps for task-specific requirements)					
☒ Reflective Vest	☐ Goggles	☒ Gloves*	Supplied Air	APR	
☐ Hard Hat	☐ Face Shield*	☐ Coveralls*	☐ SCBA	☒ Full Face APR	☐ Particulate ☐ Organic Vapor
☐ Lifeline/Harness*	☐ Hearing Protection*	☒ PPE Clothing*	☐ Airline Respirator (attach description)	☐ Half Mask APR	☒ Particulate/Organic Vapor Combined
☒ Safety Glasses	☒ Safety-toed Boots				☐ Acid Gas
☐ Other*		☐ Other*		☐ Other*	
ADDITIONAL PPE (*provide specific type(s) or descriptions of this item below)					
Tyvek and two layers (4-mil nitrile inner, nitrile rubber outer) of gloves will be worn during site activities. Full-face respirator will be worn if necessary based on field conditions.					

Project Development Team		Position/Title	Modified By	Reviewed By	Position/Title	Date
Name	Signature					
John Hargens		Geologist				



JOB SAFETY ANALYSIS (JSA)

NAPL Purging/Monitoring



Safety Means Awareness
Responsibility Teamwork

Job Steps ⁽¹⁾	Task Activity	Potential Hazard(s) ⁽²⁾	Corrective Measure(s) ⁽³⁾	Person Responsible
1	Inspect/calibrate equipment	- Loss due to malfunctioning equipment - Property damage - Personal injury	- Apply STAR during all phases of work preparation and work activities - Check all equipment to ensure it is in proper working order and has been calibrated to CRA and manufacturer's standards, then document	Sampling Technician
2	Establish work zone at monitoring well location	- Site and public traffic - Pinch points - Back strain	- Maintain awareness of on-site traffic patterns and walking paths; setup barricades if necessary - Use work gloves when setting up barricades and be aware of hand placement - Warm up cold muscles after the tailgate safety meeting or prior to any physical activity - Use buddy system and proper lifting techniques - Reduce travel distance when there is a need to carry/lift materials - Make sure grip is adequate; wear leather/cotton gloves - Size up the load; if the object is too large or odd shaped OR is in excess of 50 pounds (23 kg) then assistance (mechanical or a buddy lift) will be required - Lift with the legs (bend at the knees and use the leg muscles) to protect the lower back and keep lower back in a neutral position - Avoid one-handed carrying if possible; maintain awareness of footing - Review JSA and HASP - Practice STAR - Properly secure all equipment inside the vehicle	Sampling Technician
3	Open monitoring well cover(s)	- Pinch points - Hand injury - Biological hazards - Contaminant exposure	- Avoid placing hands in pinch points - Wear proper PPE (gloves) for task and use the proper tool(s) when opening well covers (open face wrench/socket wrench). Inspect for other hazards that may affect the hands (hypodermic needles, etc.) - Maintain good housekeeping; stow bolts, locks, wrench, plug, etc. in safe area to prevent loss - Heightened awareness of wasps, ants, bees, spiders, and poison plants - Measure breathing zone with PID - If greater than 1 ppm, use vinyl chloride and benzene colorimetric tubes (four tubes an average for one reading) to determine presence - If they are present, 1 ppm is the action level for Level C, and if they are not present, 10 ppm is the action level	Sampling Technician
4	Measure depth to water, product, and bottom	- Contaminant exposure - Cross contamination	- Wear proper PPE (Ndex nitrile gloves – inner and outer but be aware of any abrasion hazards using the STAR process) - Use PID to monitor air quality; Level C if necessary - Decon oil water interface probe and measuring tape following gauging of well	Sampling Technician



JOB SAFETY ANALYSIS (JSA)

NAPL Purging/Monitoring



Safety Means Awareness
Responsibility Teamwork

Job Steps ⁽¹⁾	Task Activity	Potential Hazard(s) ⁽²⁾	Corrective Measure(s) ⁽³⁾	Person Responsible
5	Purge monitoring well location	- Slip/trip/fall hazards - Cuts - Pinch points - Electrical (AC or DC) - Back and shoulder strain - Contaminant exposure	- Maintain good housekeeping; be aware of ground conditions - Use proper PPE and tools (chemical-resistant gloves but be aware of any abrasion hazards using the STAR process) - Keep hands away from pinch points - Inspect wiring, clamps, cables, etc.; avoid arcing - Stretch affected muscles (triceps, back, neck, and shoulder) prior to/during/after activity - Avoid repetitive motions and overhead lifts; use proper lifting techniques and neutral postures; take breaks - Continue air monitoring with PID - Purged water and product is to be placed in closed top bung drums	Sampling Technician
6	Collect groundwater sample using bailer or inertial pump	- Contaminant exposure - Cuts from container breaking - Sample misidentification	- Wear proper PPE based on action levels (chemical-resistant gloves but be aware of any abrasion hazards using the STAR process) - If using a bailer, address a work/rest regimen in order to prevent fatigue and muscle strain - Inspect bottles for signs of breakage/damage - Do not use suspect containers. - Close glass bottles carefully; avoid cross threading lid and bottle - Ensure sample ID numbers match sample location/site plan; Check sample labels for accuracy prior to placing in container	Sampling Technician
7	Close monitoring well cover and replace all necessary bolts and locks	- Traffic - Hand injury - Pinch points	- Maintain awareness of on-site traffic patterns - Verify barricades are still in place (if necessary) - Wear appropriate abrasion-resistant gloves and use proper tools - Avoid placing hands in pinch points	Sampling Technician
8	Pack samples in cooler	- Bottle breakage - Contaminant exposure - Back strain - Lost time due to sampling error	- Pack glass containers in bubble wrap or equivalent protection. (refer to JSA for Sample Jar Preparation) - Wear appropriate PPE (Ndex nitrile gloves) - Use proper lifting techniques and buddy lifts (if necessary) when carrying and loading/unloading coolers into vehicle (i.e., lift with the legs (bend at the knees and use the leg muscles) to protect the lower back and keep lower back in a neutral position) - Ensure samples are packed/labeled/shipped correctly – double check	Sampling Technician
9	Manage any investigative derived waste (IDW)	- Contaminant - Pinch points - Slip/trip/fall hazards - Heavy lifting - Mislabeling waste	- Wear appropriate PPE (Ndex gloves) and work gloves and Tyvek - Avoid pinch points - Inspect for proper housekeeping; clean up work area - Size up the load; if the object is too large or odd shaped OR is in excess of 50 pounds (23 kg) then assistance (mechanical or a buddy lift) will be required - Lift with the legs (bend at the knees and use the leg muscles) to protect the lower back and keep lower back in a neutral position - Label IDW appropriately (generator, contact number, identification of contents, and site location); specify type of contents; arrange for disposal	Sampling Technician and Project Manager



JOB SAFETY ANALYSIS (JSA)

NAPL Purging/Monitoring



Safety Means Awareness
Responsibility Teamwork

- (1) Each Job or Task consists of a set of steps. Be sure to list all the steps in the sequence that they are performed. Specify the equipment or other details to set the basis for the potential (associated) hazards.
- (2) A hazard is a potential danger. What can go wrong? How can someone get hurt? Consider, but do not limit, the analysis to: **Contact** - victim is struck by or strikes an object; **Caught** - victim is caught on, caught in or caught between objects; **Fall** - victim falls to ground or lower level (includes slips and trips); **Exertion** - excessive strain or stress/ergonomics/lifting techniques; **Exposure** - inhalation/skin hazards. Specify the hazards and do not limit the description to a single word such as "Caught".
- (3) Aligning with the Job Steps, Task Activity Description, and Potential Hazard columns, describe what actions or procedures are necessary to eliminate or minimize the hazards. Be clear, concise and specific. Use objective, observable, and quantified terms. Avoid subjective general statements such as "be careful" or "use as appropriate".



JOB SAFETY ANALYSIS (JSA)

Plugging and Abandoning



Safety Means Awareness
Responsibility Teamwork

Field staff must review job-specific work plan and coordinate with project manager to verify that all up-front logistics are completed prior to starting work including, but not limited to, permitting, access agreements, and notification to required contacts (e.g., site managers, inspectors, clients, subcontractors, etc.). Additionally, a tailgate safety meeting must be performed and documented at the beginning of each workday. **Stop, Think, Act, Review (STAR)** must be used prior to any activity. All personnel must possess the appropriate training prior to initiating scheduled tasks. Also consider weather conditions. CRA personnel have the authority and responsibility to use **Stop Work Authority (SWA)**.

Date Issued/Revised:	9/11/09	JSA Type:	Well Abandonment
Work Type:	Environmental	Client:	Motors Liquidation Company
Work Activity:	Oversight of plugging and abandoning activities		
Work Site:	100 Kindelberger Road, Kansas City, Kansas		
Key Equipment:	Safety cones/barricades; Geoprobe		
Task-specific Training:	HAZCOM, PPE, Heavy/Mobile Equipment Safety, Remember Charlie		

MINIMUM REQUIRED PERSONAL PROTECTIVE EQUIPMENT (see job steps for task-specific requirements)					
☒ Reflective Vest	☐ Goggles	☒ Gloves*	Supplied Air	APR	
☒ Hard Hat	☐ Face Shield*	☐ Coveralls*	☐ SCBA	☐ Full Face APR	☐ Particulate ☐ Organic Vapor
☐ Lifeline/Harness*	☒ Hearing Protection*	☐ PPE Clothing*	☐ Airline Respirator (attach description)	☐ Half Mask APR	☐ Particulate/Organic Vapor Combined
☒ Safety Glasses	☒ Safety-toed Boots				☐ Acid Gas
☐ Other*		☐ Other*		☒ Other*	
ADDITIONAL PPE (*provide specific type(s) or descriptions of this item below)					
Cease operations and re-evaluate the scope of work or upgrade to Level C (full face respirator with OV carts, Tyvek, nitrile inner and outer gloves, safety rated rubber boots or overboots) if sustained background readings are 1 ppm or greater					

Project Development Team		Position/Title	Modified By	Reviewed By	Position/Title	Date
Name	Signature					
John Hargens		Geologist				



JOB SAFETY ANALYSIS (JSA)

Plugging and Abandoning



Safety Means Awareness
Responsibility Teamwork

Job Steps ⁽¹⁾	Task Activity	Potential Hazard(s) ⁽²⁾	Corrective Measure(s) ⁽³⁾	Person Responsible
1	Discuss STAR and SWA	Site personnel not aware of STAR and SWA	- Project team (CRA) discusses importance of and documentation procedures for SWA during pre-job safety meeting - Use SWA to stop any work that is unsafe	Site Personnel
2	Tailgate safety meeting	Not identifying all hazards	- Discuss work to be performed and associated hazards - Open communication among team members - Have all team members sign safety meeting form - Include discussion on SWA, hospital route, evacuation procedures, emergency contact(s), etc. - Identify personnel responsible for respective JSA critical actions for job steps	Site Personnel
3	Conduct site walk, identify unsafe conditions, and inspect well locations	- Traffic - Slip/trip/fall hazards - Biological and overhead hazards	- Maintain awareness of on-site traffic and walking surfaces - When inspecting well locations; be aware of biological hazards (e.g., ants, poison ivy, wasps) and overhead hazards (e.g., overhead utilities)	Site Personnel
4	Inspection of equipment	- Pinch points - Injury; property damage - Lost time due to damaged equipment/parts	- Discuss pinch points on equipment (e.g., Geoprobe, etc.) - Familiarize all personnel with location/operation of fire extinguisher(s) and kill switch on Geoprobe - Visually inspect equipment/parts for damage	Site Personnel
5	Setup of staging area and work zone	- Traffic - Slip/trip/fall hazards - Pinch points - Lifting hazards - Back injury - Manual material handling - Heat stress	- Maintain awareness of on-site traffic and walking surfaces - Utilize barricades/cones/caution tape to define staging area and to direct traffic - Wear leather/cotton gloves when setting up barricades - Identify heavy loads (>50 lbs/23kg) or loads with shapes or weight distribution that makes them unwieldy - Use at least two people to lift and carry loads greater than 50 lbs - Bend and lift with legs and arms not back - Determine path of travel prior to lifting any object - Ensure all personnel have proper clothing, hydration, and heat/cold protection (e.g., canopy)	Site Personnel
6	Subcontractor oversight of removing well casing from ground surface	- Equipment failure - Hand injury - Lifting hazards - Back injury - Manual material handling - Slip/trip/fall hazards	- Perform periodic inspections of Geoprobe - Perform a pre-start meeting and inform the subcontractor of safe lifting practices (move objects with cart or dolly when possible) - Refer to step 5 and the HASP for additional lifting information - Ensure operators are wearing leather gloves and using proper body positioning - Practice good housekeeping techniques by keeping work zone free of tripping hazards - Maintain awareness of open borehole	Site Personnel
7	Subcontractor oversight of breaking and removing of concrete from monitor well pad	- Traffic - Slip/trip/fall hazards - Flying debris, property damage - Hearing loss - Cuts/scrapes - Lifting hazards - Back injury - Manual material handling	- Stay within designated work zones and maintain awareness of on-site traffic and walking surfaces, use rig as shield - Keep workers/vehicles out of line of fire - Ensure all on-site personnel are wearing hearing protection (ear plugs) when in the vicinity of the drill rig - Ensure subcontractors wear leather gloves while handling concrete and watch for rebar and sharp corners of concrete - Refer to step 5 and the HASP for additional lifting information	Site Personnel



JOB SAFETY ANALYSIS (JSA)

Plugging and Abandoning



Safety Means Awareness
Responsibility Teamwork

Job Steps ⁽¹⁾	Task Activity	Potential Hazard(s) ⁽²⁾	Corrective Measure(s) ⁽³⁾	Person Responsible
8	Subcontractor oversight of surface completion	• Lifting hazards • Back injury • Manual material handling • Eye injury • Skin exposure to concrete • Particulate inhalation • Slip/trip/fall hazards	• Ensure subcontractors are using proper lifting techniques and equipment to mix concrete • Do not allow individual subcontractors to lift greater than 50 lbs • Subcontractors must wear nitrile gloves, dust mask, and safety glasses with side shields • Practice good housekeeping techniques by keeping work zone free of tripping hazards • Verify surface completions with concrete at grade to prevent a future tripping hazard • Leave barricades over former well locations until concrete is safe to drive on • Refer to step 5 and the HASP for additional lifting information	Site Personnel
9	Site cleanup and demobilization (see also job step 2)	• Slip/trip/fall hazards • Vapors and airborne particulates • Lowering mast	• Pick up tools, materials, equipment, and debris to prevent tripping hazards • Wear appropriate PPE including safety glasses, face shield (splash hazard), dust masks (if necessary), and pants • Stay upwind of vapors • Keep hands and other body parts clear of mast while lowering to avoid pinch points • Wear leather work gloves	Site Personnel

- (1) Each Job or Task consists of a set of steps. Be sure to list all the steps in the sequence that they are performed. Specify the equipment or other details to set the basis for the potential (associated) hazards.
- (2) A hazard is a potential danger. What can go wrong? How can someone get hurt? Consider, but do not limit, the analysis to: **Contact** - victim is struck by or strikes an object; **Caught** - victim is caught on, caught in or caught between objects; **Fall** - victim falls to ground or lower level (includes slips and trips); **Exertion** - excessive strain or stress/ergonomics/lifting techniques; **Exposure** - inhalation/skin hazards. Specify the hazards and do not limit the description to a single word such as "Caught".
- (3) Aligning with the Job Steps, Task Activity Description, and Potential Hazard columns, describe what actions or procedures are necessary to eliminate or minimize the hazards. Be clear, concise and specific. Use objective, observable, and quantified terms. Avoid subjective general statements such as "be careful" or "use as appropriate".

APPENDIX C

MATERIAL SAFETY DATA SHEETS

Manufactured for

**INDUSTRIAL SCIENTIFIC
CORPORATION**

1001 Oakdale Road
Oakdale, PA 15071-1500

Phone (412) 788-4353
TOLL-FREE 800-DETECTS
Fax (412) 788-8353

MATERIAL SAFETY DATA SHEET

Prepared to U.S. OSHA, CMA, ANSI and Canadian WHMIS Standards

1. PRODUCT IDENTIFICATION

CHEMICAL NAME; CLASS: NON-FLAMMABLE GAS MIXTURE

Containing One or More of the Following Components in a Nitrogen Balance Gas:

Oxygen 0-23.5%; Isobutylene, 0.0005-0.9%

NOTE: MIXTURES COMPRISED OF AN AIR BALANCE GAS CONTAIN BETWEEN 19.5-23.5% OXYGEN.

SYNONYMS: Not Applicable

CHEMICAL FAMILY NAME: Not Applicable

FORMULA: Not Applicable

Document Number: 50054 (Replaces ISC MSDS No.1810-2939, 1810-2739, 1810-4547, 1810-4554, 1810-4562, 1810-4588, 1810-4950)

Note: The Material Safety Data Sheet is for this gas mixture supplied in cylinders with 33 cubic feet (935 liters) or less gas capacity (DOT - 39 cylinders). This MSDS has been developed for various gas mixtures with the composition of components within the ranges listed in Section 2 (Composition and Information on Ingredients). Refer to the product label for information on the actual composition of the product.

PRODUCT USE: Calibration of Monitoring and Research Equipment
SUPPLIER/MANUFACTURER'S NAME: CALGAZ, LLC
ADDRESS: 821 Chesapeake Drive
Cambridge, MD 21613
EMERGENCY PHONE: CHEMTREC: 1-800-424-9300
BUSINESS PHONE: 1-410-228-6400
General MSDS Information: 1-713/868-0440
Fax on Demand: 1-800/231-1366

2. COMPOSITION and INFORMATION ON INGREDIENTS

CHEMICAL NAME	CAS #	mole %	EXPOSURE LIMITS IN AIR					
			ACGIH-TLV		OSHA-PEL		NIOSH IDLH ppm	OTHER ppm
			TWA ppm	STEL ppm	TWA ppm	STEL ppm		
Isobutylene	115-11-7	0.0005-0.9%	There are no specific exposure limits for Isobutylene.					
Oxygen	7782-44-7	0-23.5%	There are no specific exposure limits for Oxygen.					
Nitrogen	7727-37-9	Balance	There are no specific exposure limits for Nitrogen. Nitrogen is a simple asphyxiant (SA). Oxygen levels should be maintained above 19.5%.					

NE = Not Established.

See Section 16 for Definitions of Terms Used.

NOTE (1): ALL WHMIS required information is included in appropriate sections based on the ANSI Z400.1-1998 format. This gas mixture has been classified in accordance with the hazard criteria of the CPR and the MSDS contains all the information required by the CPR.

3. HAZARD IDENTIFICATION

EMERGENCY OVERVIEW: This is a colorless, odorless gas mixture. Releases of this gas mixture may produce oxygen-deficient atmospheres (especially in confined spaces or other poorly-ventilated environments); individuals in such atmospheres may be asphyxiated. Isobutylene, a component of this gas mixture, may cause drowsiness and other central nervous system effects in high concentrations; however, due to its low concentration in this gas mixture, this is unlikely to occur.

SYMPTOMS OF OVER-EXPOSURE BY ROUTE OF EXPOSURE: The most significant route of over-exposure for this gas mixture is by inhalation.

INHALATION: Due to the small size of an individual cylinder of this gas mixture, no unusual health effects from over-exposure to the product are anticipated under routine circumstances of use. The chief health hazard associated with this gas mixture is when this gas mixture contains less than 19.5% Oxygen and is released in a small, poorly-ventilated area (i.e. an enclosed or confined space). Under this circumstance, an oxygen-deficient environment may occur. Individuals breathing such an atmosphere may experience symptoms which include headaches, ringing in ears, dizziness, drowsiness, unconsciousness, nausea, vomiting, and depression of all the senses. Under some circumstances of over-exposure, death may occur. The effects associated with various levels of oxygen are as follows:

CONCENTRATION OF OXYGEN

12-16% Oxygen:

10-14% Oxygen:

6-10% Oxygen:

Below 6%:

OBSERVED EFFECT

Breathing and pulse rate increase, muscular coordination slightly disturbed.

Emotional upset, abnormal fatigue, disturbed respiration.

Nausea, vomiting, collapse, or loss of consciousness. Convulsive movements, possible respiratory collapse, and death.

HEALTH EFFECTS OR RISKS FROM EXPOSURE: An Explanation in Lay Terms. Over-exposure to this gas mixture may cause the following health effects:

ACUTE: Due to the small size of the individual cylinder of this gas mixture, no unusual health effects from exposure to the product are anticipated under routine circumstances of use. The most significant hazard associated with this gas mixture when it contains less than 19.5% oxygen is the potential for exposure to oxygen-deficient atmospheres. Symptoms of oxygen deficiency include respiratory difficulty, ringing in ears, headaches, shortness of breath, wheezing, headache, dizziness, indigestion, nausea, unconsciousness, and death. The skin of a victim of over-exposure may have a blue color. Additionally, Isobutylene, a component of this gas mixture, may cause drowsiness or central nervous system effects in high concentrations; however, due to its low concentration in this gas mixture, this is unlikely to occur.

CHRONIC: Chronic exposure to oxygen-deficient atmospheres (below 18% oxygen in air) may affect the heart and nervous system.

TARGET ORGANS: ACUTE: Respiratory system, eyes. CHRONIC: Heart, cardiovascular system, central nervous system.

HAZARDOUS MATERIAL IDENTIFICATION SYSTEM

HEALTH HAZARD

(BLUE)

1

FLAMMABILITY HAZARD

(RED)

0

PHYSICAL HAZARD

(YELLOW)

0

PROTECTIVE EQUIPMENT

EYES RESPIRATORY HANDS BODY

See Section 8

For Routine Industrial Use and Handling Applications

4. FIRST-AID MEASURES

RESCUERS SHOULD NOT ATTEMPT TO RETRIEVE VICTIMS OF EXPOSURE TO THIS GAS MIXTURE WITHOUT ADEQUATE PERSONAL PROTECTIVE EQUIPMENT. At a minimum, Self-Contained Breathing Apparatus must be worn.

No unusual health effects are anticipated after exposure to this gas mixture, due to the small cylinder size. If any adverse symptom develops after over-exposure to this gas mixture, remove victim(s) to fresh air as quickly as possible. Only trained personnel should administer supplemental oxygen and/or cardio-pulmonary resuscitation if necessary. Victim(s) who experience any adverse effect after over-exposure to this gas mixture must be taken for medical attention. Rescuers should be taken for medical attention if necessary. Take a copy of the label and the MSDS to physician or other health professional with victim(s).

MEDICAL CONDITIONS AGGRAVATED BY EXPOSURE: Acute or chronic respiratory conditions may be aggravated by over-exposure to this gas mixture.

RECOMMENDATIONS TO PHYSICIANS: Administer oxygen, if necessary; treat symptoms and eliminate exposure.

5. FIRE-FIGHTING MEASURES

FLASH POINT: Not applicable.

AUTOIGNITION TEMPERATURE: Not applicable.

FLAMMABLE LIMITS (in air by volume, %):

Lower (LEL): Not applicable.

Upper (UEL): Not applicable.

FIRE EXTINGUISHING MATERIALS: Non-flammable gas mixture. Use extinguishing media appropriate for surrounding fire.

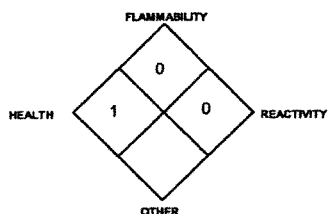
UNUSUAL FIRE AND EXPLOSION HAZARDS: This gas mixture is not flammable; however, containers, when involved in fire, may rupture or burst in the heat of the fire.

Explosion Sensitivity to Mechanical Impact: Not sensitive.

Explosion Sensitivity to Static Discharge: Not sensitive.

SPECIAL FIRE-FIGHTING PROCEDURES: Structural firefighters must wear Self-Contained Breathing Apparatus and full protective equipment.

NFPA RATING



6. ACCIDENTAL RELEASE MEASURES

LEAK RESPONSE: Due to the small size and content of the cylinder, an accidental release of this gas mixture presents significantly less risk of an oxygen deficient environment and other safety hazards than a similar release from a larger cylinder. However, as with any chemical release, extreme caution must be used during emergency response procedures. In the event of a release in which the atmosphere is unknown, and in which other chemicals are potentially involved, evacuate immediate area. Such releases should be responded to by trained personnel using pre-planned procedures. Proper protective equipment should be used. In case of a leak, clear the affected area, protect people, and respond with trained personnel.

Allow the gas mixture to dissipate. If necessary, monitor the surrounding area (and the original area of the release) for oxygen. Oxygen levels must be above 19.5% before non-emergency personnel are allowed to re-enter area.

If leaking incidentally from the cylinder, contact your supplier.

7. HANDLING and USE

WORK PRACTICES AND HYGIENE PRACTICES: Be aware of any signs of dizziness or fatigue; exposures to fatal concentrations of this gas mixture could occur without any significant warning symptoms, due to oxygen deficiency. Do not attempt to repair, adjust, or in any other way modify the cylinders containing this gas mixture. If there is a malfunction or another type of operational problem, contact nearest distributor immediately.

STORAGE AND HANDLING PRACTICES: Cylinders should be firmly secured to prevent falling or being knocked-over. Cylinders must be protected from the environment, and preferably kept at room temperature (approximately 21°C [70°F]). Cylinders should be stored in dry, well-ventilated areas, away from sources of heat, ignition, and direct sunlight. Protect cylinders against physical damage. Full and empty cylinders should be segregated. Use a first-in, first-out inventory system to prevent full containers from being stored for long periods of time. These cylinders are not refillable. **WARNING! Do not refill DOT 39 cylinders. To do so may cause personal injury or property damage.**

SPECIAL PRECAUTIONS FOR HANDLING GAS CYLINDERS: **WARNING!** Compressed gases can present significant safety hazards. During cylinder use, use equipment designed for these specific cylinders. Ensure all lines and equipment are rated for proper service pressure.

PROTECTIVE PRACTICES DURING MAINTENANCE OF CONTAMINATED EQUIPMENT: Follow practices indicated in Section 6 (Accidental Release Measures). Make certain that application equipment is locked and tagged-out safely. Always use product in areas where adequate ventilation is provided.

8. EXPOSURE CONTROLS - PERSONAL PROTECTION

VENTILATION AND ENGINEERING CONTROLS: No special ventilation systems or engineering controls are needed under normal circumstances of use. As with all chemicals, use this gas mixture in well-ventilated areas. If this gas mixture is used in a poorly-ventilated area, install automatic monitoring equipment to detect the levels of Nitrous Oxide and Oxygen.

RESPIRATORY PROTECTION: No special respiratory protection is required under normal circumstances of use. Maintain oxygen levels above 19.5% in the workplace. Use supplied air respiratory protection when oxygen levels are below 19.5%, or during emergency response to a release of this gas mixture. During an emergency situation, before entering the area, check the concentration of Methane and Oxygen. If respiratory protection is needed, use only protection authorized in the U.S. Federal OSHA Standard (29 CFR 1910.134), applicable U.S. State regulations, or the Canadian CSA Standard Z94.4-93 and applicable standards of Canadian Provinces. Oxygen levels below 19.5% are considered IDLH by OSHA. In such atmospheres, use of a full-facepiece pressure/demand SCBA or a full facepiece, supplied air respirator with auxiliary self-contained air supply is required under OSHA's Respiratory Protection Standard (1910.134-1998).

EYE PROTECTION: Safety glasses. If necessary, refer to U.S. OSHA 29 CFR 1910.133 or appropriate Canadian Standards.

HAND PROTECTION: Wear leather gloves when handling cylinders. Chemically resistant gloves should be worn when using this gas mixture. If necessary, refer to U.S. OSHA 29 CFR 1910.138 or appropriate Standards of Canada.

BODY PROTECTION: No special protection is needed under normal circumstances of use. If a hazard of injury to the feet exists due to falling objects, rolling objects, where objects may pierce the soles of the feet or where employee's feet may be exposed to electrical hazards, use foot protection, as described in U.S. OSHA 29 CFR 1910.136.

9. PHYSICAL and CHEMICAL PROPERTIES

The following information is for Nitrogen, a main component of this gas mixture.

GAS DENSITY @ 32°F (0°C) and 1 atm: 0.072 lbs/ft³ (1.153 kg/m³)

BOILING POINT: -195.8°C (-320.4°F)

SPECIFIC GRAVITY (air = 1) @ 70°F (21.1°C): 0.906

SOLUBILITY IN WATER vol/vol @ 32°F (0°C) and 1 atm: 0.023

EVAPORATION RATE (nBuAc = 1): Not applicable.

ODOR THRESHOLD: Not applicable.

VAPOR PRESSURE @ 70°F (21.1°C) psig: Not applicable.

The following information is for Oxygen, a main component of this gas mixture.

GAS DENSITY @ 32°F (0°C) and 1 atm: 0.083 lb/cu ft (1.326 kg/m³)

FREEZING/MELTING POINT @ 10 psig: -218.8°C (-361.8°F)

SPECIFIC GRAVITY (air = 1) @ 70°F (21.1°C): 1.105

SOLUBILITY IN WATER vol/vol at 32°F (0°C) and 1 atm: 0.04.91

EVAPORATION RATE (nBuAc = 1): Not applicable.

ODOR THRESHOLD: Not applicable.

VAPOR PRESSURE @ 70°F (21.1°C) psig: Not applicable.

The following information is for the gas mixture.

APPEARANCE AND COLOR: This is a colorless, odorless gas mixture.

HOW TO DETECT THIS SUBSTANCE (warning properties): There are no unusual warning properties associated with a release of this gas mixture. In terms of leak detection, fittings and joints can be painted with a soap solution to detect leaks, which will be indicated by a bubble formation.

FREEZING/MELTING POINT @ 10 psig: -210°C (-345.8°F)

pH: Not applicable.

MOLECULAR WEIGHT: 28.01

EXPANSION RATIO: Not applicable.

SPECIFIC VOLUME (ft³/lb): 13.8

COEFFICIENT WATER/OIL DISTRIBUTION: Not applicable.

BOILING POINT: -183.0°C (-297.4°F)

pH: Not applicable.

MOLECULAR WEIGHT: 32.00

EXPANSION RATIO: Not applicable.

VOLUME (ft³/lb): 12.1

COEFFICIENT WATER/OIL DISTRIBUTION: Not applicable.

10. STABILITY and REACTIVITY

STABILITY: Normally stable in gaseous state.

DECOMPOSITION PRODUCTS: The thermal decomposition products of Isobutylene include carbon oxides. The other components of this gas mixture do not decompose, per se, but can react with other compounds in the heat of a fire.

MATERIALS WITH WHICH SUBSTANCE IS INCOMPATIBLE: Titanium will burn in the Nitrogen component of this gas mixture. Lithium reacts slowly with Nitrogen at ambient temperatures. The Isobutylene component of this gas mixture is also incompatible with strong oxidizers (i.e. chlorine, bromine pentafluoride, oxygen difluoride, and nitrogen trifluoride).

HAZARDOUS POLYMERIZATION: Will not occur.

CONDITIONS TO AVOID: Contact with incompatible materials. Cylinders exposed to high temperatures or direct flame can rupture or burst.

11. TOXICOLOGICAL INFORMATION

TOXICITY DATA: The following toxicology data are available for the components of this gas mixture:

ISOBUTYLENE:

LC₅₀ (inhalation, rat) = 620,000 mg/kg/4 hours

LC₅₀ (inhalation, mouse) = 415,000 mg/kg

NITROGEN:

There are no specific toxicology data for Nitrogen. Nitrogen is a simple asphyxiant, which acts to displace oxygen in the environment.

SUSPECTED CANCER AGENT: The components of this gas mixture are not found on the following lists: FEDERAL OSHA Z LIST, NTP, CAL/OSHA, and IARC; therefore, they are not considered to be, nor suspected to be, cancer-causing agents by these agencies.

IRRITANCY OF PRODUCT: Contact with rapidly expanding gases can be irritating to exposed skin and eyes.

SENSITIZATION TO THE PRODUCT: The components of this gas mixture are not known to cause human skin or respiratory sensitization.

REPRODUCTIVE TOXICITY INFORMATION: Listed below is information concerning the effects of this gas mixture and its components on the human reproductive system.

Mutagenicity: No mutagenicity effects have been described for the components in this gas mixture.

Embryotoxicity: No embryotoxic effects have been described for the components in this gas mixture.

Teratogenicity: No teratogenicity effects have been described for the components in this gas mixture.

Reproductive Toxicity: No reproductive toxicity effects have been described for the components in gas mixture.

*A **mutagen** is a chemical which causes permanent changes to genetic material (DNA) such that the changes will propagate through generation lines. An **embryotoxin** is a chemical which causes damage to a developing embryo (i.e. within the first eight weeks of pregnancy in humans), but the damage does not propagate across generational lines. A **teratogen** is a chemical which causes damage to a developing fetus, but the damage does not propagate across generational lines. A **reproductive toxin** is any substance which interferes in any way with the reproductive process.*

BIOLOGICAL EXPOSURE INDICES (BEIs): Currently, Biological Exposure Indices (BEIs) are not applicable for the components of this gas mixture.

12. ECOLOGICAL INFORMATION

ENVIRONMENTAL STABILITY: The components of this gas mixture occur naturally in the atmosphere. The gas will be dissipated rapidly in well-ventilated areas. The following environmental data are applicable to the components of this gas mixture.

OXYGEN: Water Solubility = 1 volume Oxygen/32 volumes water at 20°C. Log K_{ow} = -0.65

NITROGEN: Water Solubility = 2.4 volumes Nitrogen/100 volumes water at 0°C. 1.6 volumes Nitrogen/100 volumes water at 20°C.

EFFECT OF MATERIAL ON PLANTS or ANIMALS: No evidence is currently available on the effects of this gas mixture on plant and animal life.

EFFECT OF CHEMICAL ON AQUATIC LIFE: No evidence is currently available on the effects of this gas mixture on aquatic life.

13. DISPOSAL CONSIDERATIONS

PREPARING WASTES FOR DISPOSAL PREPARING WASTES FOR DISPOSAL: Waste disposal must be in accordance with appropriate Federal, State, and local regulations. Cylinders with undesired residual product may be safely vented outdoors with the proper regulator. For further information, refer to Section 16 (Other Information).

14. TRANSPORTATION INFORMATION

THIS GAS MIXTURE IS HAZARDOUS AS DEFINED BY 49 CFR 172.101 BY THE U.S. DEPARTMENT OF TRANSPORTATION.

PROPER SHIPPING NAME: Compressed gases, n.o.s. ("Oxygen, Nitrogen") or the gas component with the next highest concentration next to Nitrogen.

HAZARD CLASS NUMBER and DESCRIPTION: 2.2 (Non-Flammable Gas)

UN IDENTIFICATION NUMBER: UN 1956

PACKING GROUP: Not applicable.

DOT LABEL(S) REQUIRED: Class 2.2 (Non-Flammable Gas)

NORTH AMERICAN EMERGENCY RESPONSE GUIDEBOOK NUMBER (2000): 126

MARINE POLLUTANT: The components of this gas mixture are not classified by the DOT as Marine Pollutants (as defined by 49 CFR 172.101, Appendix B).

SPECIAL SHIPPING INFORMATION: Cylinders should be transported in a secure position, in a well-ventilated vehicle. The transportation of compressed gas cylinders in automobiles or in closed-body vehicles can present serious safety hazards. If transporting these cylinders in vehicles, ensure these cylinders are not exposed to extremely high temperatures (as may occur in an enclosed vehicle on a hot day). Additionally, the vehicle should be well-ventilated during transportation.

Note: DOT 39 Cylinders ship in a strong outer carton (overpack). Pertinent shipping information goes on the outside of the overpack. DOT 39 Cylinders do not have transportation information on the cylinder itself.

TRANSPORT CANADA TRANSPORTATION OF DANGEROUS GOODS REGULATIONS: This gas is considered as Dangerous Goods, per regulations of Transport Canada.

PROPER SHIPPING NAME: Compressed gases, n.o.s. ("Oxygen, Nitrogen") or the gas component with the next highest concentration next to Nitrogen.

HAZARD CLASS NUMBER and DESCRIPTION: 2.2 (Non-Flammable Gas)

UN IDENTIFICATION NUMBER: UN 1956

PACKING GROUP: Not Applicable

HAZARD LABEL: Class 2.2 (Non-Flammable Gas)

SPECIAL PROVISIONS: None

EXPLOSIVE LIMIT AND LIMITED QUANTITY INDEX: 0.12

ERAP INDEX: None

PASSENGER CARRYING SHIP INDEX: None

PASSENGER CARRYING ROAD VEHICLE OR PASSENGER CARRYING RAILWAY VEHICLE INDEX: 75

NORTH AMERICAN EMERGENCY RESPONSE GUIDEBOOK NUMBER (2000): 126

NOTE: Shipment of compressed gas cylinders via Public Passenger Road Vehicle is a violation of Canadian law (Transport Canada Transportation of Dangerous Goods Act, 1992).

15. REGULATORY INFORMATION

ADDITIONAL U.S. REGULATIONS:

U.S. SARA REPORTING REQUIREMENTS: The components of this gas mixture are not subject to the reporting requirements of Sections 302, 304, and 313 of Title III of the Superfund Amendments and Reauthorization Act.

U.S. SARA THRESHOLD PLANNING QUANTITY: There are no specific Threshold Planning Quantities for this gas mixture. The default Federal MSDS submission and inventory requirement filing threshold of 10,000 lb (4,540 kg) may apply, per 40 CFR 370.20.

U.S. TSCA INVENTORY STATUS: The components of this gas mixture are listed on the TSCA Inventory.

U.S. CERCLA REPORTABLE QUANTITY (RQ): Not applicable.

OTHER U.S. FEDERAL REGULATIONS:

- No component of this gas mixture is subject to the requirements of CFR 29 1910.1000 (under the 1989 PELs).
- Isobutylene is subject to the reporting requirements of Section 112(r) of the Clean Air Act. The Threshold Quantity for this gas is 10,000 pounds.
- The regulations of the Process Safety Management of Highly Hazardous Chemicals are not applicable (29 CFR 1910.119).
- This gas mixture does not contain any Class I or Class II ozone depleting chemicals (40 CFR Part 82).

15. REGULATORY INFORMATION (continued)

- Nitrogen and Oxygen are not listed as Regulated Substances, per 40 CFR, Part 68, of the Risk Management for Chemical Releases. Isobutylene is listed under this regulation in Table 3 as Regulated Substances (Flammable Substances), in quantities of 10,000 lbs (4,554 kg) or greater.

U.S. STATE REGULATORY INFORMATION: The components of this gas mixture are covered under the following specific State regulations:

Alaska - Designated Toxic and Hazardous Substances: No.
California - Permissible Exposure Limits for Chemical Contaminants: Nitrogen.
Florida - Substance List: Oxygen, Isobutylene.
Illinois - Toxic Substance List: No.
Kansas - Section 302/313 List: No.
Massachusetts - Substance List: Oxygen, Isobutylene.
Michigan - Critical Materials Register: No.
Minnesota - List of Hazardous Substances: No.
Missouri - Employer Information/Toxic Substance List: No.
New Jersey - Right to Know Hazardous Substance List: Oxygen, Nitrogen, Isobutylene.
North Dakota - List of Hazardous Chemicals, Reportable Quantities: No.
Pennsylvania - Hazardous Substance List: Oxygen, Nitrogen, Isobutylene.
Rhode Island - Hazardous Substance List: Oxygen, Nitrogen.
Texas - Hazardous Substance List: No.
West Virginia - Hazardous Substance List: No.
Wisconsin - Toxic and Hazardous Substances: No.

CALIFORNIA SAFE DRINKING WATER AND TOXIC ENFORCEMENT ACT (PROPOSITION 65): No component of this gas mixture is on the California Proposition 65 lists.

ADDITIONAL CANADIAN REGULATIONS:

CANADIAN DSL/NDL INVENTORY STATUS: The components of this gas mixture are listed on the DSL Inventory.

CANADIAN ENVIRONMENTAL PROTECTION ACT (CEPA) PRIORITIES SUBSTANCES LISTS: The components of this gas mixture are not on the CEPA Priorities Substances Lists.

CANADIAN WHMIS REGULATIONS: This gas mixture is categorized as a Controlled Product, Hazard Class A, as per the Controlled Product Regulations.

16. OTHER INFORMATION

INFORMATION ABOUT DOT-39 NRC (Non-Refillable Cylinder) PRODUCTS

DOT 39 cylinders ship as hazardous materials when full. Once the cylinders are relieved of pressure (empty) they are not considered hazardous material or waste. Residual gas in this type of cylinder is not an issue because toxic gas mixtures are prohibited. Calibration gas mixtures typically packaged in these cylinders are Nonflammable n.o.s., UN 1956. A small percentage of calibration gases packaged in DOT 39 cylinders are flammable or oxidizing gas mixtures.

For disposal of used DOT-39 cylinders, it is acceptable to place them in a landfill if local laws permit. Their disposal is no different than that employed with other DOT containers such as spray paint cans, household aerosols, or disposable cylinders of propane (for camping, torch etc.). When feasible, we recommend recycling for scrap metal content. CALGAZ, LLC will do this for any customer that wishes to return cylinders to us prepaid. All that is required is a phone call to make arrangements so we may anticipate arrival. Scrapping cylinders involves some preparation before the metal dealer may accept them. We perform this operation as a service to valued customers who want to participate.

MIXTURES: When two or more gases or liquefied gases are mixed, their hazardous properties may combine to create additional, unexpected hazards. Obtain and evaluate the safety information for each component before you produce the mixture. Consult an Industrial Hygienist or other trained person when you make your safety evaluation of the end product. Remember, gases and liquids have properties which can cause serious injury or death.

Further information about the handling of compressed gases can be found in the following pamphlets published by: Compressed Gas Association Inc. (CGA), 1725 Jefferson Davis Highway, Suite 1004, Arlington, VA 22202-4102. Telephone: (703) 412-0900.

P-1 "Safe Handling of Compressed Gases in Containers"
AV-1 "Safe Handling and Storage of Compressed Gases"
"Handbook of Compressed Gases"

PREPARED BY:

CHEMICAL SAFETY ASSOCIATES, Inc.
PO Box 3519, La Mesa, CA 91944-3519
619/670-0609
Fax on Demand: 1-800/231-1366



AIR LIQUIDE

This Material Safety Data Sheet is offered pursuant to OSHA's Hazard Communication Standard, 29 CFR, 1910.1200. Other government regulations must be reviewed for applicability to this gas mixture. To the best of CALGAZ, LLC's knowledge, the information contained herein is reliable and accurate as of this date; however, accuracy, suitability or completeness are not guaranteed and no warranties of any type, either express or implied, are provided. The information contained herein relates only to this specific product. If this gas mixture is combined with other materials, all component properties must be considered. Data may be changed from time to time. Be sure to consult the latest edition.

ALCONOX MSDS

Section 1 : MANUFACTURER INFORMATION

Product name: Alconox

Supplier: Same as manufacturer.

Manufacturer: Alconox, Inc.
30 Glenn St.
Suite 309
White Plains, NY 10603.

Manufacturer emergency 800-255-3924.
phone number: 813-248-0585 (outside of the United States).

Manufacturer: Alconox, Inc.
30 Glenn St.
Suite 309
White Plains, NY 10603.

Supplier MSDS date: 2005/03/09

D.O.T. Classification: Not regulated.

Section 2 : HAZARDOUS INGREDIENTS

C.A.S.	CONCENTRATION %	Ingredient Name	T.L.V.	LD/50	LC/50
25155-30-0	10-30	SODIUM DODECYLBENZENESULFONATE	NOT AVAILABLE	438 MG/KG RAT ORAL 1330 MG/KG MOUSE ORAL	NOT AVAILABLE
497-19-8	7-13	SODIUM CARBONATE	NOT AVAILABLE	4090 MG/KG RAT ORAL 6600 MG/KG MOUSE ORAL	2300 MG/M3/2H RAT INHALATION 1200 MG/M3/2H MOUSE INHALATION
7722-88-5	10-30	TETRASODIUM PYROPHOSPHATE	5 MG/M3	4000 MG/KG RAT ORAL 2980 MG/KG MOUSE ORAL	NOT AVAILABLE
7758-29-4	10-30	SODIUM PHOSPHATE	NOT AVAILABLE	3120 MG/KG RAT ORAL 3100 MG/KG MOUSE ORAL >4640 MG/KG RABBIT DERMAL	NOT AVAILABLE

Section 2A : ADDITIONAL INGREDIENT INFORMATION

Note: (supplier).

CAS# 497-19-8: LD50 4020 mg/kg - rat oral.

CAS# 7758-29-4: LD50 3100 mg/kg - rat oral.

Section 3 : PHYSICAL / CHEMICAL CHARACTERISTICS

Physical state: Solid

Appearance & odor: Almost odourless.
White granular powder.

Odor threshold (ppm): Not available.

Vapour pressure (mmHg): Not applicable.

Vapour density (air=1): Not applicable.

By weight: Not available.

Evaporation rate (butyl acetate = 1): Not applicable.

Boiling point (°C): Not applicable.

Freezing point (°C): Not applicable.

pH: (1% aqueous solution).
9.5

Specific gravity @ 20 °C: (water = 1).
0.85 - 1.10

Solubility in water (%): 100 - > 10% w/w

Coefficient of water\oil dist.: Not available.

VOC: None

Section 4 : FIRE AND EXPLOSION HAZARD DATA

Flammability: Not flammable.

Conditions of flammability: Surrounding fire.

Extinguishing media: Carbon dioxide, dry chemical, foam.
Water
Water fog.

Special procedures: Self-contained breathing apparatus required.
Firefighters should wear the usual protective gear.

Auto-ignition temperature: Not available.

Flash point (°C), method: None

Lower flammability limit (% vol): Not applicable.

Upper flammability limit (% vol): Not applicable.

Not available.

Sensitivity to mechanical impact: Not applicable.

Hazardous combustion products: Oxides of carbon (COx).
Hydrocarbons.

Rate of burning: Not available.

Explosive power: None

Section 5 : REACTIVITY DATA

Chemical stability: Stable under normal conditions.

Conditions of instability: None known.

Hazardous polymerization: Will not occur.

Incompatible substances: Strong acids.
Strong oxidizers.

Hazardous decomposition products: See hazardous combustion products.

Section 6 : HEALTH HAZARD DATA

Route of entry: Skin contact, eye contact, inhalation and ingestion.

Effects of Acute

Exposure

Eye contact: May cause irritation.

Skin contact: Prolonged contact may cause irritation.

Inhalation: Airborne particles may cause irritation.

Ingestion: May cause vomiting and diarrhea.
May cause abdominal pain.
May cause gastric distress.

Effects of chronic exposure: Contains an ingredient which may be corrosive.

LD50 of product, species & route: > 5000 mg/kg rat oral.

LC50 of product, species & route: Not available for mixture, see the ingredients section.

Exposure limit of material: Not available for mixture, see the ingredients section.

Sensitization to product: Not available.

Carcinogenic effects: Not listed as a carcinogen.

Reproductive effects: Not available.

Teratogenicity: Not available.

Mutagenicity: Not available.

Synergistic materials: Not available.

Medical conditions aggravated by exposure: Not available.

First Aid

Skin contact: Remove contaminated clothing.
Wash thoroughly with soap and water.
Seek medical attention if irritation persists.

Eye contact: Check for and remove contact lenses.
Flush eyes with clear, running water for 15 minutes while holding eyelids open: if irritation persists, consult a physician.

Inhalation: Remove victim to fresh air.
Seek medical attention if symptoms persist.

Ingestion: Dilute with two glasses of water.
Never give anything by mouth to an unconscious person.
Do not induce vomiting, seek immediate medical attention.

Section 7 : PRECAUTIONS FOR SAFE HANDLING AND USE

Leak/Spill: Contain the spill.
Recover uncontaminated material for re-use.
Wear appropriate protective equipment.
Contaminated material should be swept or shoveled into appropriate waste container for disposal.

Waste disposal: In accordance with municipal, provincial and federal regulations.

Handling procedures and equipment: Protect against physical damage.
Avoid breathing dust.
Wash thoroughly after handling.
Keep out of reach of children.
Avoid contact with skin, eyes and clothing.
Launder contaminated clothing prior to reuse.

Storage requirements: Keep containers closed when not in use.
Store away from strong acids or oxidizers.
Store in a cool, dry and well ventilated area.

Section 8 : CONTROL MEASURES

Precautionary Measures

Gloves/Type:



Neoprene or rubber gloves.

Respiratory/Type:



If exposure limit is exceeded, wear a NIOSH approved respirator.

Eye/Type:



Safety glasses with side-shields.

Footwear/Type: Safety shoes per local regulations.

Clothing/Type: As required to prevent skin contact.

Other/Type: Eye wash facility should be in close proximity.
Emergency shower should be in close proximity.

Ventilation requirements: Local exhaust at points of emission.

MATERIAL SAFETY DATA SHEET

Section 1. Chemical Product and Company Identification

Catalog Number(s)

Catalog Number(s)
00654-00, 05942-21, 05942-22, 05942-24, 05942-25, 05942-26, 05942-27, 35653-01, 35654-00

Product Identity

Product Identity
BUFFER, Standard, pH 4.01; BUFFER, High Accuracy, pH 4.000 (Color Coded Red)

Manufacturer's Name

RICCA CHEMICAL COMPANY

Emergency Telephone Number (24 hr)

CHEMTREC®: 800-424-9300

Address (Number, Street, City, State, and ZIP Code)

Telephone Number For Information

P.O. Box 13090

817-461-5601

Arlington, Texas 76094

Date Prepared

3-7-2000

Section 2. Composition / Information on Ingredients

Section 2. Composition / Information on Ingredients				
Component	CAS Registry #	Percent	Exposure Limits	
		Concentration	ACGIH TLV	OSHA PEL
Potassium Acid Phthalate	877-24-7	0.95 – 1.05	N/A	N/A
Preservative*	proprietary	<0.5	N/A	N/A
*(No Mercury compounds or Formaldehyde)				
Inert Dye	proprietary	<0.1	N/A	N/A
Water, Deionized	7732-18-5	Balance	N/A	N/A

Section 3. Hazards Identification

☆☆

EMERGENCY OVERVIEW

EMERGENCY OVERVIEW

Non-flammable, non-toxic, non-corrosive. Does not present any significant health hazards. Wash areas of contact with water.

☆☆

POTENTIAL HEALTH EFFECTS:

TARGET ORGANS: eyes, skin.

EYE CONTACT: May cause slight irritation.

INHALATION: Not likely to be hazardous by inhalation.

SKIN CONTACT: May cause slight irritation.

INGESTION: Large doses may cause nausea, vomiting, diarrhea and cramps.

CHRONIC EFFECTS / CARCINOGENICITY:

IARC – No

NTP - No

OSHA - No

TERATOLOGY (BIRTH DEFECT) INFORMATION:

TERATOLOGY (BIRTH DEFECT) INFORMATION:
No information found in "Registry of Toxic Effects of Chemical Substances" or other information sources.

REPRODUCTION INFORMATION:

REPRODUCTION INFORMATION:
No information found in "Registry of Toxic Effects of Chemical Substances" or other information sources.



MATERIAL SAFETY DATA SHEET

Section 4. First Aid Measures – In all cases, seek qualified evaluation.

EYE CONTACT: Irrigate immediately with large quantity of water for at least 15 minutes. Call a physician if irritation develops.

INHALATION: Remove to fresh air. Give artificial respiration if necessary. If breathing is difficult, give oxygen.

SKIN CONTACT: Flush with plenty of water for at least 15 minutes. Call a physician if irritation develops.

INGESTION: Dilute with water or milk. Call a physician if necessary.

Section 5. Fire Fighting Measures

FLAMMABLE PROPERTIES:

FLASH POINT: N/A

METHOD USED: N/A

FLAMMABLE LIMITS

LFL: N/A

UFL: N/A

EXTINGUISHING MEDIA: Use any means suitable for extinguishing surrounding fire.

FIRE & EXPLOSION HAZARDS: Not considered to be a fire or explosion hazard.

FIRE FIGHTING INSTRUCTIONS: Use normal procedures/instructions.

FIRE FIGHTING EQUIPMENT: Use protective clothing and breathing equipment appropriate for the surrounding fire.

Section 6. Accidental Release Measures

Absorb with suitable material and dispose of in accordance with local regulations.

Section 7. Handling and Storage

As with all chemicals, wash hands thoroughly after handling. Avoid contact with eyes and skin. Protect from freezing and physical damage. SAFETY STORAGE CODE: GENERAL

Section 8. Exposure Controls / Personal Protection

ENGINEERING CONTROLS: No specific controls are needed. Normal room ventilation is adequate.

RESPIRATORY PROTECTION: Normal room ventilation is adequate.

SKIN PROTECTION: Chemical resistant gloves.

EYE PROTECTION: Safety glasses or goggles.

Section 9. Physical and chemical Properties

APPEARANCE: Clear, red colored liquid

ODOR: odorless

SOLUBILITY IN WATER: infinite

SPECIFIC GRAVITY: approximately 1

pH: 4

BOILING POINT (°C): approximately 100

MELTING POINT (°C): approximately 0

VAPOR PRESSURE: N/A

Section 10. Stability and Reactivity

CHEMICAL STABILITY: Stable under normal conditions of use and storage.

INCOMPATIBILITY: Nitric Acid



MATERIAL SAFETY DATA SHEET

HAZARDOUS DECOMPOSITION PRODUCTS: Oxides of Carbon and Potassium.

HAZARDOUS POLYMERIZATION: Will not occur.

Section 11. Toxicological Information

LD50, Oral, Rat: >3200 mg/kg (Potassium Acid Phthalate), details of toxic effects not reported other than lethal dose value.

Section 12. Ecological Information

ECOTOXICOLOGICAL INFORMATION: No information found.

CHEMICAL FATE INFORMATION: No information found.

Section 13. Disposal Considerations

Dilute with water, neutralize with weak sodium hydroxide solution, and then flush to sewer if local regulations allow. If not allowed, save for recovery or recycling in an approved waste disposal facility. Always dispose of in accordance with local, state and federal regulations.

Section 14. Transport Information (Not meant to be all inclusive)

D.O.T. SHIPPING NAME: Not regulated
D.O.T. HAZARD CLASS: None
U.N. / N.A. NUMBER: None
PACKING GROUP: None
D.O.T. LABEL: None

Section 15. Regulatory Information (Not meant to be all inclusive - selected regulation represented)

OSHA STATUS: The above items either do not contain any specifically hazardous material or the potentially hazardous material is present in such low concentration that the items do not present any immediate threat to health and safety. These items do not meet the OSHA Hazard Communication Standard (29 CFR 1910.1200) definition of a hazardous material.

TSCA STATUS: All components of this solution are listed on the TSCA Inventory.

CERCLA REPORTABLE QUANTITY: Not reportable

SARA TITLE III:

SECTION 302 EXTREMELY HAZARDOUS SUBSTANCES: No

SECTION 311/312 HAZARDOUS CATEGORIES: No

SECTION 313 TOXIC CHEMICALS: No

RCRA STATUS: No

CALIFORNIA PROPOSITION 65: Not listed

Section 16. Other Information

NFPA® Ratings:	Health: 1	Flammability: 0	Reactivity: 0	Special Notice Key: None
HMIS® Ratings:	Health: 1	Flammability: 0	Reactivity: 0	Protective Equipment: B (Protective eyewear, gloves)

Rev 1, 10-16-2000: (Section 1) added catalog number 35653-01.

Rev 2, 03-25-2003: Reviewed and approved.

Rev 3, 03-20-2006: Reviewed and approved.

When handled properly by qualified personnel, the product described herein does not present a significant health or safety hazard. Alteration of its characteristics by concentration, evaporation, addition of other substances, or other means may present hazards not specifically addressed herein and which must be evaluated by the user. The information furnished herein is believed to be accurate and represents the best data currently available to us. No warranty, expressed or implied, is made and RICCA CHEMICAL COMPANY assumes no legal responsibility or liability whatsoever resulting from its use.

PRODUCT IDENTITY: BUFFER, Standard and High Accuracy, pH 4.01
EFFECTIVE DATE: 03-20-2006

CATALOG NUMBER (S): 00654-00, 35654-00, 05942-21, 05942-22, 05942-24, 05942-25, 05942-26, 05942-27, 35653-01
MSDS NUMBER 00506 Rev 3

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MATERIAL SAFETY DATA SHEET

Section 4. First Aid Measures – In all cases, seek qualified evaluation.

EYE CONTACT: Irrigate immediately with large quantity of water for at least 15 minutes. Call a physician if irritation develops.

INHALATION: Remove to fresh air. Give artificial respiration if necessary. If breathing is difficult, give oxygen.

SKIN CONTACT: Flush with plenty of water for at least 15 minutes. Call a physician if irritation develops.

INGESTION: Dilute with water or milk. Call a physician if necessary.

Section 5. Fire Fighting Measures

FLAMMABLE PROPERTIES:

FLASH POINT: N/A

METHOD USED: N/A

FLAMMABLE LIMITS

LFL: N/A

UFL: N/A

EXTINGUISHING MEDIA: Use any means suitable for extinguishing surrounding fire.

FIRE & EXPLOSION HAZARDS: Not considered to be a fire or explosion hazard.

FIRE FIGHTING INSTRUCTIONS: Use normal procedures/instructions.

FIRE FIGHTING EQUIPMENT: Use protective clothing and breathing equipment appropriate for the surrounding fire.

Section 6. Accidental Release Measures

Absorb with suitable material (vermiculite, clay, etc.) and dispose of in accordance with local regulations. Check with local agencies for the proper disposal of phosphate containing solutions.

Section 7. Handling and Storage

As with all chemicals, wash hands thoroughly after handling. Avoid contact with eyes and skin. Protect from freezing and physical damage. SAFETY STORAGE CODE: GENERAL

Section 8. Exposure Controls / Personal Protection

ENGINEERING CONTROLS: No specific controls are needed. Normal room ventilation is adequate.

RESPIRATORY PROTECTION: Normal room ventilation is adequate.

SKIN PROTECTION: Chemical resistant gloves.

EYE PROTECTION: Safety glasses or goggles.

Section 9. Physical and chemical Properties

APPEARANCE: Clear, green liquid

ODOR: Odorless

SOLUBILITY IN WATER: Infinite

SPECIFIC GRAVITY: approximately 1

pH: 7

BOILING POINT (°C): approximately 100

MELTING POINT (°C): approximately 0

VAPOR PRESSURE: N/A

Section 10. Stability and Reactivity

CHEMICAL STABILITY: Stable under normal conditions of use and storage.

INCOMPATIBILITY: None identified.

HAZARDOUS DECOMPOSITION PRODUCTS: Phosphorus oxides may form when heated to decomposition.



MATERIAL SAFETY DATA SHEET

HAZARDOUS POLYMERIZATION: Will not occur.

Section 11. Toxicological Information

LD50, Oral, Rat: (Sodium Phosphate Dibasic) 17 gm/kg; LD50, Dermal, Rabbit: (Potassium Phosphate Monobasic) >4640 mg/kg; details of toxic effects not reported other than lethal dose value.

Section 12. Ecological Information

ECOTOXICOLOGICAL INFORMATION: No information found.

CHEMICAL FATE INFORMATION: No information found.

Section 13. Disposal Considerations

Dilute with water, then flush to sewer if local regulations allow for the flushing of phosphate containing solutions. If not allowed, save for recovery or recycling in an approved waste disposal facility. Always dispose of in accordance with local, state and federal regulations.

Section 14. Transport Information (Not meant to be all inclusive)

D.O.T. SHIPPING NAME: Not regulated
D.O.T. HAZARD CLASS: None
U.N. / N.A. NUMBER: None
PACKING GROUP: None
D.O.T. LABEL: None

Section 15. Regulatory Information (Not meant to be all inclusive - selected regulation represented)

OSHA STATUS: The above items either do not contain any specifically hazardous material or the potentially hazardous material is present in such low concentration that the items do not present any immediate threat to health and safety. These items do not meet the OSHA Hazard Communication Standard (29 CFR 1910.1200) definition of a hazardous material.

TSCA STATUS: All components of this solution are listed on the TSCA Inventory or are mixtures (hydrates) of items listed on the TSCA Inventory.

CERCLA REPORTABLE QUANTITY: Sodium Phosphate, Dibasic - 5,000 pounds.

SARA TITLE III:

SECTION 302 EXTREMELY HAZARDOUS SUBSTANCES: No

SECTION 311/312 HAZARDOUS CATEGORIES: No

SECTION 313 TOXIC CHEMICALS: No

RCRA STATUS: No

CALIFORNIA PROPOSITION 65: Not listed.

PENNSYLVANIA: Sodium Phosphate Dibasic is listed as an environmental hazard on the state Hazardous Substance list.

Section 16. Other Information

NFPA Ratings:	Health: 1	Flammability: 0	Reactivity: 0	Special Notice Key: None
HMIS® Ratings:	Health: 1	Flammability: 0	Reactivity: 0	Protective Equipment: B
				(Protective eyewear, gloves)

Rev 1, 8-25-2000: (Section 2) corrected concentration of preservative from 1 - 2 to < 0.1%.
Rev 2, 03-25-2003: Reviewed and approved, (Section 15) added CERCLA reportable quantity.
Rev 3, 03-20-2006: Reviewed and approved.

When handled properly by qualified personnel, the product described herein does not present a significant health or safety hazard. Alteration of its characteristics by concentration, evaporation, addition of other substances, or other means may present hazards not specifically addressed herein and which must be evaluated by the user. The information furnished herein is believed to be accurate and represents the best data currently available to us. No warranty, expressed or implied, is made and RICCA CHEMICAL COMPANY assumes no legal responsibility or liability whatsoever resulting from its use.

PRODUCT IDENTITY: BUFFER, Standard, pH 7.00 (Color Coded Green) CAT. NO (S): 00654-04, 05942-41, 35654-04, 05942-42, 05942-44, 05942-45, 35653-02
EFFECTIVE DATE: 3-20-2006 MSDS NUMBER 00507 Rev 3 Page 3 of 3



MATERIAL SAFETY DATA SHEET

REPRODUCTION INFORMATION:

Reproductive data cited in "Registry of Toxic Effects of Chemical Substances" for Sodium Bicarbonate and Sodium Carbonate in mice.

Section 4. First Aid Measures – In all cases, seek qualified evaluation.

EYE CONTACT: Irrigate immediately with large quantity of water for at least 15 minutes. Call a physician if irritation develops.

INHALATION: Remove to fresh air. Give artificial respiration if necessary. If breathing is difficult, give oxygen.

SKIN CONTACT: Flush with plenty of water for at least 15 minutes. Call a physician if irritation develops.

INGESTION: Dilute with water or milk. Call a physician if necessary.

Section 5. Fire Fighting Measures

FLAMMABLE PROPERTIES:

FLASH POINT: N/A

METHOD USED: N/A

FLAMMABLE LIMITS

LFL: N/A

UFL: N/A

EXTINGUISHING MEDIA: Use any means suitable for extinguishing surrounding fire.

FIRE & EXPLOSION HAZARDS: Not considered to be a fire or explosion hazard.

FIRE FIGHTING INSTRUCTIONS: Use normal procedures/instructions.

FIRE FIGHTING EQUIPMENT: Use protective clothing and breathing equipment appropriate for the surrounding fire.

Section 6. Accidental Release Measures

Absorb with suitable material and treat as normal refuse. Small amounts of the liquid may be flushed to the drain with excess water. Always dispose of in accordance with local regulations.

Section 7. Handling and Storage

As with all chemicals, wash hands thoroughly after handling. Avoid contact with eyes and skin. Protect from freezing and physical damage. SAFETY STORAGE CODE: GENERAL

Section 8. Exposure Controls / Personal Protection

ENGINEERING CONTROLS: No specific controls are needed. Normal room ventilation is adequate.

RESPIRATORY PROTECTION: Normal room ventilation is adequate.

SKIN PROTECTION: Chemical resistant gloves.

EYE PROTECTION: Safety glasses or goggles.

Section 9. Physical and chemical Properties

APPEARANCE: Clear, blue colored liquid
ODOR: Odorless
SOLUBILITY IN WATER: Infinite
SPECIFIC GRAVITY: approximately 1

pH: 10
BOILING POINT (°C): approximately 100
MELTING POINT (°C): approximately 0
VAPOR PRESSURE: N/A



MATERIAL SAFETY DATA SHEET

Section 10. Stability and Reactivity

CHEMICAL STABILITY: Stable under normal conditions of use and storage.

INCOMPATIBILITY: Acids

HAZARDOUS DECOMPOSITION PRODUCTS: Oxides of Sodium.

HAZARDOUS POLYMERIZATION: Will not occur.

Section 11. Toxicological Information

LD50, Oral, Rat: 4090 mg/kg (Sodium Carbonate), 4220 mg/kg (Sodium Bicarbonate), details of toxic effects not reported other than lethal dose value.

Section 12. Ecological Information

ECOTOXICOLOGICAL INFORMATION: No information found.

CHEMICAL FATE INFORMATION: No information found.

Section 13. Disposal Considerations

Dilute with water, then flush to sewer if local regulations allow. If not allowed, save for recovery or recycling in an approved waste disposal facility. Always dispose of in accordance with local, state and federal regulations.

Section 14. Transport Information (Not meant to be all inclusive)

D.O.T. SHIPPING NAME: Not regulated
D.O.T. HAZARD CLASS: None
U.N. / N.A. NUMBER: None
PACKING GROUP: None
D.O.T. LABEL: None

Section 15. Regulatory Information (Not meant to be all inclusive - selected regulation represented)

OSHA STATUS: The above items either do not contain any specifically hazardous material or the potentially hazardous material is present in such low concentration that the items do not present any immediate threat to health and safety. These items do not meet the OSHA Hazard Communication Standard (29 CFR 1910.1200) definition of a hazardous material.

TSCA STATUS: All components of this solution are listed on the TSCA Inventory.

CERCLA REPORTABLE QUANTITY: Not reportable

SARA TITLE III:

SECTION 302 EXTREMELY HAZARDOUS SUBSTANCES: No

SECTION 311/312 HAZARDOUS CATEGORIES: No

SECTION 313 TOXIC CHEMICALS: No

RCRA STATUS: No

CALIFORNIA PROPOSITION 65: Not listed.

Section 16. Other Information

NFPA® Ratings:	Health: 1	Flammability: 0	Reactivity: 0	Special Notice Key: None
HMIS® Ratings:	Health: 1	Flammability: 0	Reactivity: 0	Protective Equipment: B (Protective eyewear, gloves)

Rev 1, 01-15-2003: added catalog number 35653-03.

Rev 2, 03-25-2003: Reviewed and approved.

Rev 3, 03-20-2006: Reviewed and approved.

When handled properly by qualified personnel, the product described herein does not present a significant health or safety hazard. Alteration of its characteristics by concentration, evaporation, addition of other substances, or other means may present hazards not specifically addressed herein and

PRODUCT IDENTITY: BUFFER, Standard and High Accuracy, pH 10.00
EFFECTIVE DATE: 3-20-2006

CATALOG NUMBER (S): 00654-08, 35654-08, 05942-61, 05942-62, 05942-64, 05942-65, 05942-66, 05942-67, 35653-03
MSDS NUMBER 00509 Rev 3

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MATERIAL SAFETY DATA SHEET

which must be evaluated by the user. The information furnished herein is believed to be accurate and represents the best data currently available to us. No warranty, expressed or implied, is made and RICCA CHEMICAL COMPANY assumes no legal responsibility or liability whatsoever resulting from its use.

MATERIAL SAFETY DATA SHEET

Section 1. Chemical Product and Company Identification

Catalog Number(s)

Catalog Number(s)
00606-10, 00653-15, 00653-16, 00653-18, 00653-20, 00653-23, 00653-27, 00653-32, 00653-47, 00653-50, 00653-89,
35653-09, 35653-10, 35653-11, 35653-12, 35653-13, 35656-18, 35656-47

Product Identity

CONDUCTIVITY STANDARD SOLUTIONS, < 90 mS

Manufacturer's Name

RICCA CHEMICAL COMPANY

Emergency Telephone Number (24 hr)

CHEMTREC®: 800-424-9300

Address (Number, Street, City, State, and ZIP Code)

Telephone Number For Information

P.O. Box 13090

817-461-5601

Date Prepared

Arlington, Texas 76094

3-17-2000

Section 2. Composition / Information on Ingredients

Section 2. Composition / Information on Ingredients				
Component	CAS Registry #	Percent Concentration	Exposure Limits	
			ACGIH TLV	OSHA PEL
Potassium Chloride	7447-40-7	< 6	N/A	N/A
Water, Deionized	7732-18-5	Balance	N/A	N/A

Section 3. Hazards Identification

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EMERGENCY OVERVIEW

EMERGENCY OVERVIEW
Clear, colorless liquid. Non-flammable, non-toxic, non-corrosive. Does not present any significant health hazards.

☆☆

POTENTIAL HEALTH EFFECTS:

TARGET ORGANS: eyes, skin.

EYE CONTACT: May cause irritation.

INHALATION: Not likely to be hazardous by inhalation.

SKIN CONTACT: May cause slight irritation.

INGESTION: Large doses may cause stomach upset.

CHRONIC EFFECTS / CARCINOGENICITY:

IARC - No

NTP - No

OSHA – No

TERATOLOGY (BIRTH DEFECT) INFORMATION:

Mutation data cited in 'Registry of Toxic Effects of Chemical Substances' for Potassium Chloride.

REPRODUCTION INFORMATION:

No information found in "Registry of Toxic Effects of Chemical Substances" or other information sources.

Section 4. First Aid Measures – In all cases, seek qualified evaluation.

EYE CONTACT: Irrigate immediately with large quantity of water for at least 15 minutes.



MATERIAL SAFETY DATA SHEET

INHALATION: Remove to fresh air. Give artificial respiration if necessary.

SKIN CONTACT: Flush with plenty of water for at least 15 minutes.

INGESTION: Dilute with water or milk. Call a physician if necessary.

Section 5. Fire Fighting Measures

FLAMMABLE PROPERTIES:

FLASH POINT: N/A

METHOD USED: N/A

FLAMMABLE LIMITS

LFL: N/A

UFL: N/A

EXTINGUISHING MEDIA: Use any means suitable for extinguishing surrounding fire.

FIRE & EXPLOSION HAZARDS: Not considered to be a fire or explosion hazard.

FIRE FIGHTING INSTRUCTIONS: Use normal procedures/instructions.

FIRE FIGHTING EQUIPMENT: Use protective clothing and breathing equipment appropriate for the surrounding fire.

Section 6. Accidental Release Measures

Absorb with suitable material (paper towels, etc.) and dispose of in accordance with local regulations. Small amounts may be flushed to the sewer with plenty of water.

Section 7. Handling and Storage

As with all chemicals, wash hands thoroughly after handling. Avoid contact with eyes and skin. Protect from freezing and physical damage. SAFETY STORAGE CODE: GENERAL

Section 8. Exposure Controls / Personal Protection

ENGINEERING CONTROLS: No specific controls are needed. Normal room ventilation is adequate.

RESPIRATORY PROTECTION: Normal room ventilation is adequate.

SKIN PROTECTION: Chemical resistant gloves are recommended.

EYE PROTECTION: Safety glasses or goggles.

Section 9. Physical and chemical Properties

APPEARANCE: Clear, colorless liquid

ODOR: Odorless

SOLUBILITY IN WATER: Infinite

SPECIFIC GRAVITY: approximately 1.0 – 1.04

pH: approximately 7

BOILING POINT (°C): approximately 100

MELTING POINT (°C): approximately 0

VAPOR PRESSURE: N/A

Section 10. Stability and Reactivity

CHEMICAL STABILITY: Stable under normal conditions of use and storage.

INCOMPATIBILITY: Bromine Trifluoride, Potassium Permanganate plus Sulfuric Acid.

HAZARDOUS DECOMPOSITION PRODUCTS: Oxides of Potassium.

HAZARDOUS POLYMERIZATION: Will not occur.



MATERIAL SAFETY DATA SHEET

Section 11. Toxicological Information

LD₅₀, Oral, Rat: 2600 mg/kg (Potassium Chloride), details of toxic effects not reported other than lethal dose value.
Irritation: eye, rabbit (500mg/24 hr mild).

Section 12. Ecological Information

ECOTOXICOLOGICAL INFORMATION: No information found.

CHEMICAL FATE INFORMATION: No information found.

Section 13. Disposal Considerations

Dilute with water and flush to sewer if local regulations allow. If not allowed, save for recovery or recycling in an approved waste disposal facility. Always dispose of in accordance with local, state and federal regulations.

Section 14. Transport Information (Not meant to be all inclusive)

D.O.T. SHIPPING NAME: Not regulated
D.O.T. HAZARD CLASS: None
U.N. / N.A. NUMBER: None
PACKING GROUP: None
D.O.T. LABEL: None

Section 15. Regulatory Information (Not meant to be all inclusive - selected regulation represented)

OSHA STATUS: The above items either do not contain any specifically hazardous material or the potentially hazardous material is present in such low concentration that the items do not present any immediate threat to health and safety. These items do not meet the OSHA Hazard Communication Standard (29 CFR 1910.1200) definition of a hazardous material.

TSCA STATUS: All components of this solution are listed on the TSCA Inventory.

CERCLA REPORTABLE QUANTITY: Not reportable

SARA TITLE III:

SECTION 302 EXTREMELY HAZARDOUS SUBSTANCES: No

SECTION 311/312 HAZARDOUS CATEGORIES: No

SECTION 313 TOXIC CHEMICALS: No

RCRA STATUS: No

CALIFORNIA PROPOSITION 65: Not listed

Section 16. Other Information

NFPA® Ratings:	Health: 0	Flammability: 0	Reactivity: 0	Special Notice Key: None
HMIS® Ratings:	Health: 0	Flammability: 0	Reactivity: 0	Protective Equipment: B (Protective eyewear, gloves)

Rev 1, 10-16-2000: (Section 1) added catalog numbers 35653-10, 35653-11, 35653-12, and 35653-13.

Rev 2, 12-06-2001: (Section 1) added catalog number 35653-09; revised description from 23µ - 80 mS.

Rev 3, 03-25-2003: Reviewed and approved, (Section 3) added mutation statement, (Section 11) added irritation data.

Rev 4, 03-20-2006: Reviewed and approved.

When handled properly by qualified personnel, the product described herein does not present a significant health or safety hazard. Alteration of its characteristics by concentration, evaporation, addition of other substances, or other means may present hazards not specifically addressed herein and which must be evaluated by the user. The information furnished herein is believed to be accurate and represents the best data currently available to us. No warranty, expressed or implied, is made and RICCA CHEMICAL COMPANY assumes no legal responsibility or liability whatsoever resulting from its use.

MATERIAL SAFETY DATA SHEET

ESSENTIALLY SIMILAR TO U.S. DEPT OF LABOR FORM OSHA-20
Preparation & Last date Printed: 12/10/98 REV: E
Page 1 of 2

KCI

SECTION 1 NAME, PRODUCT & COMPANY NAME

MYRON L COMPANY 6115 CORTE DEL CEDRO, CARLSBAD, CA 92009

INFORMATION PHONE #: (760) 438-2021, Contact either Jerry Adams or Gary Robinson
HOURS: Mon thru Fri 8:00-4:30 PM (Pacific Time)

CHEMICAL NAME: Potassium & Chloride & Water

CATALOG NUMBERS: KCI-70, KCI-700, KCI-7000,
KCI-18, KCI-180, KCI-1800,
KCI-18,000

C-P# 01489-92,94-97

TRADE NAME & SYNONYMS: TDS/Conductivity Standard Solution
KCI Solution

CHEMICAL FAMILY: Inorganic Salts

FORMULA: KCI & H₂O

CAS #: Water #7732-18-5
Potassium Chloride #7447-40-7

SECTION 2 PHYSICAL DATA

BOILING POINT, 760mm Hg (°C)	102-107	SPECIFIC GRAVITY	>1
FREEZE POINT (°C)	-0 TO -20	SOLUBILITY IN H ₂ O, % BY WT. @20°C	100%
VAPOR PRESSURE @ 20°C	N/A	APPEARANCE AND ODOR	COLORLESS, ODORLESS LIQUID
VAPOR DENSITY (AIR=1)	N/A	EVAPORATION RATE	N/A
PERCENT VOLATILES BY VOLUME	N/A		

SECTION 3 FIRE & EXPLOSION HAZARD DATA

FLASH POINT (TEST METHOD)	N/A	FLAMMABLE LIMITS	N/A	LeI N/A	UeI N/A
EXTINGUISHING MEDIA	NON-FLAMMABLE				
SPECIAL HAZARDS & PROCEDURES	N/A				
UNUSUAL FIRE & EXPLOSION HAZARDS	N/A				

SECTION 4 REACTIVITY DATA

STABLE (XX)	CONDUCTIONS TO AVOID	None
UNSTABLE	MATERIALS TO AVOID	
Product Stable	(N/A) WATER (N/A) ACIDS (N/A) BASES	
	(N/A) OTHER SPECIFY	

SECTION 5 SPILL OR LEAK PROCEDURES AND DISPOSAL

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED:
CLEAN SPILL USING ABSORBENT MATERIALS AND WATER, AND THEN AIR OUT AREA.

EPA WASTE NO. & DISPOSAL TREATMENT:
MATERIAL DOES NOT HAVE AN EPA WASTE NUMBER AND IS NOT A LISTED WASTE.

NOTE: ALWAYS CONTACT A PERMITTED WASTE DISPOSER (TSD) TO ASSURE COMPLIANCE AND ACCORDANCE WITH FEDERAL, STATE & LOCAL REGULATIONS

SECTION 6 HEALTH HAZARD DATA

THRESHOLD LIMIT VALUE: NONE KNOWN
EFFECTS OF OVER EXPOSURE: IRRITATING TO EYES & MUCOUS MEMBRANES, AND DIGESTIVE TRACT

FIRST AID PROCEDURES:
EYE CONTACT: FLUSH WITH WATER
SKIN CONTACT: RINSE WITH WATER
IF SWALLOWED: DRINK PLENTY OF WATER, DO NOT INDUCE VOMITING

CARCINOGENICITY: MATERIAL IS NOT LISTED (IARC, NTP, OSHA) AS A CANCER CAUSING AGENT

Cond/TDS

Page 2 of 2

SECTION 7

SPECIAL PROTECTION INFORMATION

RESPIRATORY PROTECTION: NONE REQUIRED
VENTILATION: NONE REQUIRED
EYE PROTECTION: RECOMMENDED
PROTECTIVE GLOVES: NONE REQUIRED
PROTECTIVE CLOTHING: NONE REQUIRED

ROUTES OF ENTRY: INGESTION

SECTION 8 SPECIAL HANDLING AND STORING PRECAUTIONS

STORE AT ROOM TEMPERATURE,
NORMAL USE DOES NOT GENERATE A HAZARDOUS SITUATION

SECTION 9 HAZARDOUS INGREDIENTS

(REFER TO SECTIONS 3 THROUGH 8)

CHEMICAL NAME	CAS NUMBER
N/A	NONE

SECTION 10 OTHER INFORMATION

COMMENTS: NONE	<u>NFPA Hazard Ratings</u>	
	Health:	0
	Flammability:	0
	Reactivity:	0
	Special Hazards:	0

SECTION 11 TOXICOLOGY INFORMATION

TOXICITY DATA: N/A

TOXICOLOGICAL FINDING:

Tests on laboratory animals indicate material does not produce adverse mutagenics effects.
Cited in Registry of Toxic Effects of Substances (RTECS)

SECTION 12 TRANSPORT INFORMATION

DOT Shipping Name..... Non-Regulated

DOT Number None

SECTION 13 REGULATORY INFORMATION

TSCA INVENTORY: THE CAS NUMBER OF THIS PRODUCT IS LISTED ON THE TSCA INVENTORY.

<u>COMPONENT</u>	N/A
<u>SARA EHS(302)</u>	N/A
<u>SARA EHS TOQ (LBS)</u>	N/A
<u>CERCLA RQ (LBS)</u>	N/A
<u>OSHA FLOOR LIST</u>	N/A
<u>SARA 313</u>	N/A
<u>DeMinimis for SARA 313 (%)</u>	N/A

MSDS APPROVED BY:.....



MSDS

For RICCA, SpectroPure, Red Bird, and Solutions Plus Brands
Emergency Contact(24 hr) – CHEMTREC®
Domestic: 800-424-9300
International: 703-527-3887

ZOBELL'S SOLUTION, APHA ORP Solution, ORP Standard (+200 mV)

Material Safety Data Sheet

Section 1: Chemical Product and Company Identification

Catalog Number: 5464.5, 9880, PX-918, S0932A, SZ117300	
Product Identity: ZOBELL'S SOLUTION, APHA ORP Solution, ORP Standard (+200 mV)	
Manufacturer's Name: RICCA CHEMICAL COMPANY LLC	Emergency Contact(24 hr) – CHEMTREC® Domestic: 800-424-9300 International: 703-527-3887
CAGE Code: 0V553	
Address: 448 West Fork Dr Arlington, TX 76012	Telephone Number For Information: 817-461-5601
Date Prepared: 11/9/98	Revision: 5 Last Revised: 04/12/2006 Date Printed: 04/27/2006 3:14:05 pm

Section 2. Composition/Information on Ingredients

Component	CAS Registry #	Concentration	ACGIH TLV	OSHA PEL
Potassium Ferricyanide	13746-66-2	<0.2	Not Available Not Available	Not Available Not Available
Potassium Ferrocyanide Trihydrate	14459-95-1	<0.5	Not Available Not Available	Not Available Not Available
Potassium Chloride	7447-40-7	<1	Not Available Not Available	Not Available Not Available
Water, Deionized	7732-18-5	Balance	Not Available Not Available	Not Available Not Available

Section 3: Hazard Identification

Emergency Overview: Non-flammable, non-toxic, non-corrosive. Does not present any significant health hazards. Wash areas of contact with water.

Target Organs: eyes, skin

Eye Contact: May cause slight irritation.

Inhalation: Not likely to be hazardous by inhalation.

Skin Contact: May cause slight irritation.

Ingestion: May cause nausea, vomiting, diarrhea and cramps.



MSDS

For RICCA, SpectroPure, Red Bird, and Solutions Plus Brands
Emergency Contact(24 hr) – CHEMTREC®
Domestic: 800-424-9300
International: 703-527-3887

ZOBELL'S SOLUTION, APHA ORP Solution, ORP Standard (+200 mV)

Chronic Effects/Carcinogenicity: None

IARC - No.

NTP - No.

OSHA - No.

Reproductive Information: Reproductive effects cited in 'Registry of Toxic Effects of Chemical Substances' for Potassium Ferrocyanide Trihydrate.

Teratology (Birth Defect) Information: Mutation data cited in 'Registry of Toxic Effects of Chemical Substances' for Potassium Chloride. Mutation data cited in 'Registry of Toxic Effects of Chemical Substances' for Potassium Ferricyanide.

Section 4: First Aid Measures - In all cases, seek qualified evaluation.

Eye Contact: Irrigate immediately with large quantity of water for at least 15 minutes. Call a physician if irritation develops.

Inhalation: Remove to fresh air. Give artificial respiration if necessary. If breathing is difficult, give oxygen.

Skin Contact: Flush with plenty of water for at least 15 minutes. Call a physician if irritation develops.

Ingestion: Dilute with water or milk. Do not induce vomiting. Call a physician if necessary.

Section 5: Fire Fighting Measures

Flash Point: Not Available.

LFL: Not Available.

Extinguishing Media: Use any means suitable for extinguishing surrounding fire.

Fire & Explosion Hazards: Not considered to be a fire or explosion hazard.

Fire Fighting Instructions: Use normal procedures/instructions.

Fire Fighting Equipment: Use protective clothing and breathing equipment appropriate for the surrounding fire.

Method Used: Not Available.

UFL: Not Available.

Section 6: Accidental Release Measures

Absorb with suitable material and treat as normal refuse. Small amounts of the liquid may be flushed to the drain with excess water. Always dispose of in accordance with local regulations.

Section 7: Handling and Storage

As with all chemicals, wash hands thoroughly after handling. Avoid contact with eyes and skin. Protect from freezing and physical damage.

Safety Storage Code: General

Section 8: Exposure Control/Personal Protection

Engineering Controls: No specific controls are needed. Normal room ventilation is adequate.

Respiratory Protection: Normal room ventilation is adequate.

Skin Protection: Chemical resistant gloves.

Eye Protection: Safety glasses or goggles.

Section 9: Physical and Chemical Properties

Appearance: Clear, yellow colored liquid

Odor: Odorless

Solubility in Water: Infinite

Specific Gravity: Approximately 1.0

pH: Not Available.

Boiling Point(°C): Approximately 100

Melting Point(°C): Approximately 0

Vapor Pressure: Not Applicable.

Section 10: Stability and Reactivity

Chemical Stability: Stable under normal conditions of use and storage.

Incompatibility: Acids, Bromine Trifluoride, Sodium Nitrate, ammonia, Chromium Trioxide, Chromic Anhydride, Cupric Nitrate.

Hazardous Decomposition Products: Oxides of Carbon, Nitrogen and Potassium, fumes of cyanide when heated to decomposition.



MSDS

For RICCA, SpectroPure, Red Bird, and Solutions Plus Brands
Emergency Contact(24 hr) – CHEMTREC®
Domestic: 800-424-9300
International: 703-527-3887

ZOBELL'S SOLUTION, APHA ORP Solution, ORP Standard (+200 mV)

Hazardous Polymerization: Will not occur.

Section 11. Toxicological Information

LD50, Oral Rat: (anhydrous Potassium Ferrocyanide) 6400 mg/kg, (Potassium Chloride) 2600 mg/kg; LD50, Oral, Mouse: (Potassium Ferricyanide) 2970 mg/kg, details of toxic effects not reported other than lethal dose value.

Section 12. Ecological Information

Ecotoxicological Information: No information found

Chemical Fate Information: No information found

Section 13. Disposal Considerations

Dilute with water, then flush to sewer if local regulations allow. If not allowed, save for recovery or recycling in an approved waste disposal facility. Always dispose of in accordance with local, state and federal regulations.

Section 14. Transport Information

Part Numbers:

This product is not regulated.

Section 15. Regulatory Information (Not meant to be all inclusive - selected regulation represented)

OSHA Status:The above items either do not contain any specifically hazardous material or the potentially hazardous material is present in such low concentration that the items do not present any immediate threat to health and safety. These items do not meet the OSHA Hazard Communication Standard (29 CFR 1910.1200) definition of a hazardous material.

TSCA Status:All components of this solution are listed on the TSCA Inventory or are mixtures (hydrates) of items listed on the TSCA Inventory.

Sara Title III:

Section 302 Extremely Hazardous Substances:Not Applicable.

Section 311/312 Hazardous Categories:No

Section 313 Toxic Chemicals:Not Applicable.

California: None Reported.

Pennsylvania: None Reported.

RCRA Status: Not Applicable.

CERCLA Reportable Quantity: None Reported.

WHMIS: Not Applicable.



For RICCA, SpectroPure, Red Bird, and Solutions Plus Brands
Emergency Contact(24 hr) -- CHEMTREC®
Domestic: 800-424-9300
International: 703-527-3887

ZOBELL'S SOLUTION, APHA ORP Solution, ORP Standard (+200 mV)

Section 16. Other Information

NFPA Ratings:

Health: 1

Flammability: 0

Reactivity: 0

Special Notice Key:None

HMIS Ratings:

Health: 1

Flammability: 0

Reactivity: 0

Protective Equipment:B (Protective Eyewear, Gloves)

Rev 1, 9-26-2000: Reformatted from WordPerfect® to Microsoft Word®; (Section 1) Revised emergency telephone number to CHEMTREC® 800-424-9300; (Section 2) revised concentrations to ranges; (Section 3) added Potassium Chloride, Potassium Ferrocyanide and Potassium Ferricyanide references; (Section 7) added storage code; (Section 15) added TSCA statement regarding hydrates.

Rev 2, 10-09-2001: Reformatted to electronic data format.

Rev 3, 03-12-2002: (Section 1) added ORP Standard (200 mV) to title; added catalog number 5464.5.

Rev 4, 06-26-2003: (Section 1) added catalog number S0932A.

Rev 5, 04-12-2006: (Section 1) added Red Bird catalog number PX-918.

When handled properly by qualified personnel, the product described herein does not present a significant health or safety hazard. Alteration of its characteristics by concentration, evaporation, addition of other substances, or other means may present hazards not specifically addressed herein and which must be evaluated by the user. The information furnished herein is believed to be accurate and represents the best data currently available to us. No warranty, expressed or implied, is made and RICCA CHEMICAL COMPANY assumes no legal responsibility or liability whatsoever resulting from its use.

Material Safety Data Sheet

June 1, 1999

YSI Incorporated
1725 Brannum Lane
Yellow Springs, OH 45387
USA

C-P# 05478-60

Information and Emergency Phone: (937) 767-7241

Page 1 of 2

SECTION 1 - MATERIAL IDENTIFICATION

PRODUCT NAME: YSI 3682 Zobell Solution

FORMULA: n/ap

Chemical Type: Inorganic chloride / cyanide

CAS No. n/app

SECTION 2 - HAZARDOUS / IMPORTANT INGREDIENTS

<u>Chemical</u>	<u>CAS No.</u>	<u>PERCENT</u>	<u>PEL/TLV</u>	<u>CARCINOGEN</u> (OSHA, NTP, IARC)
Potassium chloride	7447-40-7	72 - 78%	none	no
Potassium ferrocyanide, trihydrate	14459-95-1	10 - 15%	none	no
Potassium ferricyanide	13746-66-2	10 - 15%	none	no

SECTION 3 - CHEMICAL AND PHYSICAL PROPERTIES

Appearance: white powder

Boiling Point: n/av

Odor: none

Melting Point: n/av

pH: neutral

Specific Gravity: n/av

Water Solubility: infinite

Vapor Pressure: n/ap

Evaporation Rate: n/av

Vapor Density: n/ap

SECTION 4 - FIRE AND EXPLOSION HAZARDS

Flash Point: none Explosive Limits: none

Extinguishing Media: n/ap

Special Firefighting Procedures and Hazards: Material is not combustible. May emit toxic fumes when heated, such as NOx, HCN, HCl. Wear protection as described in Section 6.

SECTION 5 - REACTIVITY INFORMATION

Stable: X Unstable: _____ Precautions: none known

Hazardous Polymerization: Occurs: _____ Does Not Occur: X

Incompatibility: strong acids and oxidizing agents.

Hazardous Decomposition Products: When heated, possibly NOx, HCN, HCl.

SECTION 6 - HEALTH HAZARDS / PROTECTIVE MEASURES / FIRST AID**Inhalation:**

Possible irritation from dusts. (see CHRONIC below)
Use a NIOSH approved respirator for dusts. Get supplier recommendations. Provide adequate ventilation.
Minimize dusty conditions.
Remove to fresh air and provide artificial respiration if needed.

Skin:

Possible irritation from dusts. (see CHRONIC below)
Wear dust-proof gloves and other body protection as needed. Minimize dusty conditions.
Wash exposed areas with soap and water for 15 minutes. Remove contaminated clothing, and wash before re-using.

Eyes:

Possible irritation from dust.
Wear dust barrier goggles. Eliminate dusty conditions.
Flush with water for 15 minutes.

Ingestion

No effects expected from normal use and minor amounts ingested. Large amounts, over 1 tablespoon, can cause digestive system upset s. (see CHRONIC below)
Reduce dusting. Avoid mouth breathing. Use facemask. Provide adequate ventilation.
Avoid swallowing. Spit out. Drink large amounts of water. Induce vomiting if person is conscious. Otherwise, and if effects persist, get medical attention.

CHRONIC EFFECTS: None reported for this material. "Cyanides" in general are often reported as toxic to humans. Therefore, it is recommended that exposure via skin, inhalation, and ingestion be limited.

IN ALL CASES: GET MEDICAL ATTENTION IF EFFECTS PERSIST.

Most likely routes of entry: skin, eyes, ingestion.

SECTION 7 - PRECAUTIONS FOR SAFE HANDLING AND USE

Spills and Leaks: Take up powder in any container and hold for disposal. Flush residual to sewer or ground. Provide personal protection as described in Section 6.

Storage and Handling: Keep containers closed. Discard any material that may be contaminated. Minimize dusting.

Waste Disposal: Is not listed as RCRA hazardous waste at this date. Cyanides are restricted in water disposed to streams and to sewers. Therefore, landfill disposal is indicated; check with local disposal companies.

Empty Containers: Rinse well. Dispose as appropriate for glass and plastic containers.

SECTION 8 - REGULATORY INFORMATION

DOT: Not regulated.
SARA Title III, S.313, Form R: Nothing reportable.

The information contained herein is based on data available at this time and is believed to be accurate. However, no warranty is expressed or implied regarding the accuracy of these data or the results to be obtained from the use thereof. Since information contained herein may be applied under conditions beyond our control, and with which we may be unfamiliar, no responsibility is assumed for the results of its use. The person receiving this information shall make his own determination of the suitability of the material for his particular use.

A96008A

MATERIAL SAFETY DATA SHEET

Section 1. Chemical Product and Company Identification

Catalog Number(s)

00653-00

Product Identity

ZERO OXYGEN SOLUTION

Manufacturer's Name

RICCA CHEMICAL COMPANY

Address (Number, Street, City, State, and ZIP Code)

P.O. Box 13090

Arlington, Texas 76094

Emergency Telephone Number (24 hr)

CHEMTREC®: 800-424-9300

Telephone Number For Information

817-461-5601

Date Prepared

4-18-2000

Section 2. Composition / Information on Ingredients

Section 2. Composition / Information on Ingredients				
Component	CAS Registry #	Percent Concentration	Exposure Limits	
			ACGIH TLV	OSHA PEL
Sodium Sulfite	7757-83-7	4.5 – 5.5	N/A	N/A
Cobalt Chloride Hexahydrate	7791-13-1	< 0.01	0.02 mg/m ³ (as Co)	0.1 mg/m ³ (Dust as Co)
Water, Deionized	7732-18-5	Balance	N/A	N/A

Section 3. Hazards Identification

EMERGENCY OVERVIEW

EMERGENCY OVERVIEW

May cause irritation to the eyes, skin and respiratory tract. Contains Cobalt Chloride, a possible carcinogen according to International Agency for Research on Cancer (IARC). Wash areas of contact with water for at least 15 minutes. If ingested, dilute with water and call a physician. Although moderately toxic in large amounts, sulfites can pose risk to some asthmatics producing central nervous system depression, broncho constriction and anaphylaxis.

POTENTIAL HEALTH EFFECTS:

TARGET ORGANS: eyes, skin, respiratory tract.

EYE CONTACT: May cause irritation, redness and pain.

INHALATION: May cause irritation. This solution is not expected to be harmful via inhalation.

SKIN CONTACT: May cause mild irritation.

INGESTION: May cause gastric irritation by the liberation of sulfurous acid. Large doses may result in circulatory disturbances, diarrhea, and central nervous system depression.

CHRONIC EFFECTS / CARCINOGENICITY: Chronic exposure may affect thyroid, heart, lungs and kidneys due to the Cobalt.
IARC – Not classifiable as to carcinogenicity to humans (Sodium Sulfite), Possible carcinogen, limited evidence in humans (Cobalt)

NTP - No

OSHA – No

TERATOLOGY (BIRTH DEFECT) INFORMATION:

Mutation data cited in "Registry of Toxic Effects of Chemical Substances" for Cobalt Chloride and Sodium Sulfite.



REPRODUCTION INFORMATION:

Reproductive effects cited in "Registry of Toxic Effects of Chemical Substances" for Cobalt Chloride.

MATERIAL SAFETY DATA SHEET

Section 4. First Aid Measures – In all cases, seek qualified evaluation.

EYE CONTACT: Irrigate immediately with large quantity of water for at least 15 minutes.

INHALATION: Remove to fresh air. Give artificial respiration if necessary.

SKIN CONTACT: Flush with plenty of soap and water for at least 15 minutes. Call a physician if irritation develops.

INGESTION: Dilute with water or milk. Do not induce vomiting. Call a physician if necessary.

Section 5. Fire Fighting Measures

FLAMMABLE PROPERTIES:

FLASH POINT: N/A

METHOD USED: N/A

FLAMMABLE LIMITS

LFL: N/A

UFL: N/A

EXTINGUISHING MEDIA: Use any means suitable for extinguishing surrounding fire (water, dry chemical, chemical foam).

FIRE & EXPLOSION HAZARDS: Not considered to be an explosion hazard. May emit irritating and corrosive gases in fire.

FIRE FIGHTING INSTRUCTIONS: Use normal procedures/instructions. Poisonous gases may be produced in fire.

FIRE FIGHTING EQUIPMENT: Use protective clothing and NIOSH-approved self-contained breathing apparatus appropriate for the surrounding fire.

Section 6. Accidental Release Measures

Absorb with suitable material (vermiculite, etc.) and dispose of in accordance with local regulations.

Section 7. Handling and Storage

As with all chemicals, wash hands thoroughly after handling. Avoid contact with eyes and skin. Protect from freezing and physical damage. **SAFETY STORAGE CODE: GENERAL**

Section 8. Exposure Controls / Personal Protection

ENGINEERING CONTROLS: No specific controls are needed. Normal room ventilation is adequate.

RESPIRATORY PROTECTION: Normal room ventilation is adequate.

SKIN PROTECTION: Chemical resistant gloves, Nitrile Rubber or Neoprene.

EYE PROTECTION: Safety glasses or goggles.

Section 9. Physical and chemical Properties

APPEARANCE:

ODOR:

SOLUBILITY IN WATER:

SPECIFIC GRAVITY:

pH: N/A

BOILING POINT (°C): Approximately 100

MELTING POINT (°C): Approximately 0

VAPOR PRESSURE:

Section 10. Stability and Reactivity

CHEMICAL STABILITY:



MATERIAL SAFETY DATA SHEET

INCOMPATIBILITY: Strong oxidizing agents, Acids (liberates Sulfur Dioxide), high temperatures.

HAZARDOUS DECOMPOSITION PRODUCTS: Emits toxic and irritating fumes, including Sulfur Oxides, when heated to decomposition.

HAZARDOUS POLYMERIZATION:

Section 11. Toxicological Information

Section 12. Ecological Information

ECOTOXICOLOGICAL INFORMATION: No information found.

CHEMICAL FATE INFORMATION: No information found.

Section 13. Disposal Considerations

Whatever cannot be saved for recycling or recovery should be managed in an appropriate and approved waste disposal facility.

Section 14. Transport Information (Not meant to be all inclusive)

D.O.T. SHIPPING NAME:

D.O.T. HAZARD CLASS:

U.N. / N.A. NUMBER:

PACKING GROUP:

D.O.T. LABEL:

Section 15. Regulatory Information (Not meant to be all inclusive - selected regulation represented)

OSHA STATUS:

TSCA STATUS:

CERCLA REPORTABLE QUANTITY: Cobalt Chloride RQ 1 pound

SARA TITLE III:

SECTION 302 EXTREMELY HAZARDOUS SUBSTANCES:

SECTION 311/312 HAZARDOUS CATEGORIES:

SECTION 313 TOXIC CHEMICALS: No

RCRA STATUS:

CALIFORNIA PROPOSITION 65:

Section 16. Other Information

NFPA Ratings:	Health: 1	Flammability: 0	Reactivity: 0	Special Notice Key: None
HMIS® Ratings:	Health: 1	Flammability: 0	Reactivity: 0	Protective Equipment: B (Protective eyewear, gloves)

When handled properly by qualified personnel, the product described herein does not present a significant health or safety hazard. Alteration of its characteristics by concentration, evaporation, addition of other substances, or other means may present hazards not specifically addressed herein and which must be evaluated by the user. The information furnished herein is believed to be accurate and represents the best data currently available to us. No warranty, expressed or implied, is made and RICCA CHEMICAL COMPANY assumes no legal responsibility or liability whatsoever resulting from its use.

PRODUCT IDENTITY: ZERO OXYGEN SOLUTION
EFFECTIVE DATE: 4-18-2000

MSDS NUMBER: 00532

CATALOG NUMBER (S): 00653-00
Page 3 of 3

MATERIAL SAFETY DATA SHEET

MSDS #: 63701

Page 1 of 2

Sanford NA
2711 Washington Boulevard
Bellwood, IL 60104
Phone: 708-547-6650 or 800-323-0749

Emergency Medical Number: 888-786-0972

Creation Date: October 20, 2003

Section One: Product Information

Product Name: Uni-Paint Px-21 Fine and Px-20 Medium Marker

Colors: Black, Red, Blue, Green, Yellow, Violet, Orange, Light Blue, Pink, White, Silver, Gold

Writing Instrument Manufacturers Association (WIMA) certified. Conforms to ASTM D-4236. These markers and the inks contained within have been examined by the WIMA Board Certified Toxicologist in a program of toxicological evaluation to assure they are in compliance with Federal Hazardous Substances Act (FHSA), Labeling of Hazardous Art Materials Act (LHAMA), and ASTM D-4236.

Section Two: Composition

Xylene (1330-20-7), titanium dioxide (13463-67-1), resin, dyes

Section Three: Hazards Identification

Acute hazard: At high concentration, dizziness, drowsiness, and unconsciousness may occur. CAUTION: Contains xylene. Harmful or fatal if swallowed. KEEP OUT OF REACH OF CHILDREN. Direct contact may cause skin or eye irritation.

Section Four: First Aid Measures

Inhalation: Move person to fresh air and supply artificial respiration, if necessary.

Skin Contact: Wash with soap and water.

Eye Contact: Flush with water. If irritation persists, consult a physician.

Ingestion: If swallowed, do not induce vomiting. Call a physician.

Section Five: Fire Fighting Measures

Flash Point: 34.4C (CC)

Flammability Limits (% by volume): Lower: 1.1% Upper: 6.4%

Extinguishing Media: Dry chemical, carbon dioxide, regular foam

Special Fire Fighting Measures: For large fires, use foam or flood with fine water spray.

Unusual Fire and Explosion Hazards: Avoid inhalation of material or combustion by-products. Stay upwind.

Section Six: Accidental Release Measures

In Case of Spill or Accidental Release: Treat as flammable solvent. Use adequate ventilation.

Section Seven: Handling and Storage

Handling: No special handling requirements.

Storage: Keep away from open flames. KEEP OUT OF REACH OF CHILDREN.

Section Eight: Exposure Controls and Personal Protection

Eye Protection: None under normal use conditions.
Clothing: None under normal use conditions.
Respirator: None under normal use conditions.
Ventilation: Use in a well ventilated area.

Section Nine: Physical and Chemical Properties

For ink unless otherwise specified:

Boiling Point: 138.5C (xylene)
Specific Gravity: 1.25 - 1.32
Vapor Pressure: 6.72 mm Hg at 21C (xylene)
Solubility in Water: Insoluble
Evaporation Rate: Not available
Appearance; Odor: Colored ink; xylene odor

Section Ten: Stability and Reactivity

Stability: Stable
Conditions to Avoid: Avoid heat, flames, sparks, and other sources of ignition.
Chemical Incompatibility: Strong oxidizers
Hazardous Decomposition: Oxides of carbon in fire situation.
Hazardous Polymerization: Will not occur.

Section Eleven: Toxicological Information

IARC Monographs: No
National Toxicology Program: No
OSHA Regulated: No

Section Twelve: Ecological Information

Not available

Section Thirteen: Disposal Considerations

Dispose in accordance with Federal, State, and Local Regulations.

Section Fourteen: Transport Information

ORM-D Consumer Commodity
Flammable Liquid, n.o.s. (xylene), 3, UN1993, PGIII, (34.4C CC), Ltd. Qtys, EmS# 3-07
Consumer Commodity, 9, ID8000, packing instruction 910

Section Fifteen: Regulatory Information

TSCA INVENTORY: The product on this Material Safety Data Sheet is not listed on the Toxic Substances Control Act Inventory.
All ingredients used to manufacture this product are listed on the TSCA Inventory

Section Sixteen: Other Information**HMIS Code**

Health	2
Flammability	3
Reactivity	0
Personal Protection	N/A

0=Minimal / 4 = Severe

Sanford NA has been advised by Counsel that the OSHA Hazard Communication Standard does not apply to the Sanford Product described in this Material Safety Data Sheet. The reason for the exemption is contained in 29 CFR 1910.1200(b)(6)(ix) as amended July 1, 2002 per the Code of Federal Regulations. The information contained in this MSDS is forwarded to you for your information, but is not meant to imply that the product is covered by the Hazard Communication Standard nor is this MSDS meant to comply with all requirements of the Hazard Communication Standard.

APPENDIX D

QUALITY ASSURANCE PROJECT PLAN

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LIST OF ACRONYMS AND SHORT FORMS

AOI	-	Area of Interest
CRA	-	Conestoga-Rovers & Associates
DRO	-	Diesel Range Organics
GC/MS	-	Gas Chromatography/Mass Spectrometry
GRO	-	Gasoline Range Organics
KDHE	-	Kansas Department of Health and Environment
LCS	-	Laboratory Control Sample
MLC	-	Motors Liquidation Company
MS/MSD	-	Matrix Spike/Matrix Spike Duplicate
PE	-	Performance Evaluation
%R	-	Percent Recovery
%RSD	-	Percent Relative Standard Deviation
QA	-	Quality Assurance
QA/QC	-	Quality Assurance/Quality Control
QAPP	-	Quality Assurance Project Plan
QC	-	Quality Control
RCRA	-	Resource Conservation and Recovery Act
RPD	-	Relative Percent Difference
SAP	-	Sampling and Analysis Plan
Site	-	Former Fairfax I Site
SOP	-	Standard Operating Procedure
SRM	-	Standard Reference Material
SVOCs	-	Semi-Volatile Organic Compounds
TA	-	Test America Laboratories
TCL	-	Target Compound List
TPH	-	Total Petroleum Hydrocarbons
U.S. EPA	-	United States Environmental Protection Agency
VCRP	-	Voluntary Cleanup and Property Redevelopment Program
VOCs	-	Volatile Organic Compounds

1.0 INTRODUCTION

The Kansas Department of Health and Environment (KDHE) requires that investigations performed for their Voluntary Cleanup and Property Redevelopment Program (VCPRP) include a Quality Assurance Project Plan (QAPP) to ensure that data of known and documented quality are obtained. This QAPP presents the organization, objectives, functional activities, and specific quality assurance (QA) and quality control (QC) activities associated with the supplemental site-wide investigations at the Former Fairfax I Site in Kansas City, Kansas (Site). The supplemental investigative activities are described in "Work Plan for Supplemental Investigations, Former Fairfax I Site, Kansas City, Kansas" (Work Plan). This QAPP also describes or provides references to related Work Plan documents for the specific protocols that will be followed for sampling, sample handling and storage, chain of custody, laboratory analyses, and field measurements.

All QA/QC procedures will be in accordance with applicable professional technical standards, KDHE requirements, government regulations and guidelines, and specific project goals and requirements. This QAPP has been prepared by Conestoga-Rovers & Associates (CRA) in accordance with the requirements specified in Section 9 of "Voluntary Cleanup and Property Redevelopment Program Manual", KDHE, Division of Environment, Bureau of Environmental Remediation (undated publication).

2.0 PROJECT DESCRIPTION

This QAPP has been prepared by CRA for the supplemental site-wide investigations to be conducted at the Former Fairfax I Site.

2.1 SITE DESCRIPTION

A description of the Site, the regional setting, descriptions of the Site geology and hydrogeology, and a summary of previous studies, data collection, and remedial activities are provided in Section 1.0 of the Work Plan. Through previous studies conducted at the Site and several meetings with the KDHE and Motors Liquidation Company (MLC), three Areas of Concern (AOC) were identified to need further investigation and/or remediation.

The groundwater and soil data indicated that VOCs are present above applicable KDHE standards. Summaries of the AOCs are presented in section 1.4 of the Work Plan.

2.2 PROJECT OBJECTIVES AND SCOPE

Additional data from the identified AOCs are needed in order to delineate areas of impact both vertically and horizontally and provide a further understanding contaminated conditions at each location. Similarly, additional data are necessary to continue the review and evaluation of remedial measures at some locations.

Soil and groundwater samples will be collected from the S-8 Area, SB-110 Area, and TMW-127 Area. These samples will be submitted for analysis of Target Compound List Volatile Organic Compounds (TCL VOCs).

To assist in the determination of background soil conditions at the site, total organic carbon (TOC) data will be obtained from an area of the Site previously determined not to be impacted is required. The TOC data will be used in determining Site cleanup levels.

The KDHE has suggested that a comprehensive groundwater sampling program be implemented at the Site while remedial measures are being evaluated, designed, and implemented. Groundwater samples from 40 existing and newly installed permanent and temporary Site shallow monitoring wells will be analyzed for TCL VOCs, TCL Semi-Volatile Organic Compounds (SVOCs), Total Petroleum Hydrocarbons (TPH)-Gasoline Range Organics (GRO), and TPH-Diesel Range Organics (DRO).

Additional details regarding the soil and groundwater sampling program are provided in Section 4.0 of the Work Plan.

2.3 PARAMETERS TO BE TESTED

Sample matrices, analytical parameters, and frequencies of sample collection for the soil and groundwater sampling programs are presented in Table 2.1. Soil samples will be analyzed for TCL VOCs. Target analytes and quantitation limits for soil samples are presented in Table 2.2. Groundwater samples will be analyzed for VOCs, SVOCs, TPH-GRO, and TPH-DRO. Target analytes and quantitation limits for groundwater samples are presented in Table 2.3.

2.4 PROJECT SCHEDULE

The project schedule is presented in Section 7.0 of the Work Plan.

3.0 PROJECT ORGANIZATION AND RESPONSIBILITY

CRA has overall responsibility for the supplemental investigation activities at the Site. CRA will perform all sampling and oversee the investigative activities.

Test America Laboratories, Inc. (TA) located at 4104 Shuffel Drive in North Canton, Ohio (phone number 330-497-9396) will perform all chemical analyses of samples collected during the supplemental investigative activities.

All firms will provide project management as appropriate to their responsibilities. CRA will provide administrative oversight and QA/QC for all deliverables. CRA will maintain a file copy of all laboratory deliverables. All final project deliverables will be issued by CRA.

The key staff with QA responsibilities for the project and a summary of their responsibilities is presented below:

Phil Harvey - Project Manager - CRA

- overview of field activities
- overview of laboratory activities
- advise on field corrective action procedures
- data assessment
- preparation and review of reports
- technical representation of project activities
- coordinate CRA's technical group
- evidence file custodian

Susan Scrocchi - Quality Assurance Officer - CRA

- review laboratory QA/QC
- oversee data validation and assessment
- advise on laboratory corrective action procedures
- preparation and review of reports
- QA/QC representation of project activities

John Hargens - Field Quality Assurance Officer - CRA

- overview and review field QA/QC
- management of field activities and field QA/QC
- data assessment
- internal field performance and system audits
- technical representation of field activities
- preparation of standard operating procedures (SOPs) for field activities
- implement and document field corrective actions, if necessary

Denise Heckler - Project Manager - TA

- ensures all resources of the laboratory are available on an as-required basis
- overview of final analytical reports
- approve final reports prior to submission to CRA

Ray Risen - Operations Manager - TA

- coordinate laboratory analyses
- supervise in-house chain-of-custody
- schedule sample analyses
- oversee data review
- oversee preparation of analytical reports

Dorothy Leeson - QA Officer - TA

- overview laboratory quality assurance
- overview QA/QC documentation
- conduct detailed data review
- implement and document laboratory corrective actions, if required
- technical representation of laboratory QA procedures
- oversee preparation of laboratory SOPs

Sample Custodian – TA

- receive and inspect the incoming sample containers
- record the condition of the incoming sample containers
- sign appropriate documents
- verify correctness of chain-of-custody documentation
- notify laboratory Project Manager of sample receipt and inspection
- assign a unique identification number to each sample and record the information in the sample receiving log
- initiate transfer of the samples to appropriate lab sections
- control and monitor access/storage of samples and extracts

4.0 QUALITY ASSURANCE OBJECTIVES FOR MEASUREMENT DATA

The overall QA objective is to develop and implement procedures for field sampling, chain-of-custody, laboratory analyses, and reporting that will provide results which are legally defensible in a court of law. Specific procedures for sampling, chain-of-custody, laboratory instrument calibration, laboratory analysis, reporting of data, internal quality control, audits, preventive maintenance of field equipment, and corrective action are described in other sections of this QAPP. The purpose of this section is to address the specific objectives for accuracy, precision, completeness, representativeness and comparability.

4.1 PRECISION

Precision is a measure of degree to which two or more measurements are in agreement.

4.1.1 FIELD PRECISION OBJECTIVES

Precision of the field sample collection procedures will be assessed by the data from analysis of field duplicate samples. Relative percent differences (RPDs) will be calculated for detected analytes from field duplicate sample sets. RPDs of 50 percent and 100 percent for water and soil sample field duplicates, respectively, will be used as advisory limits. Professional judgment will be used for any data qualification.

Field precision for measurements obtained during groundwater monitoring will be assessed through the collection and measurement of duplicate samples or calibration solutions at a frequency of one per 20 or fewer groundwater samples.

4.1.2 LABORATORY PRECISION OBJECTIVES

Precision in the laboratory will be assessed through the calculation of RPDs for replicate/duplicate sample analyses. The equation to be used to determine precision is presented in Section 13.1 of this QAPP. Precision control limits for the analyses are presented in Table 4.1.

4.2 ACCURACY

Accuracy is the degree of agreement between a measured value and the accepted reference value.

4.2.1 FIELD ACCURACY OBJECTIVES

Accuracy of the field sample collection procedures will be assessed by the data from field and trip blank samples. Field and trip blank sample data will be evaluated using the procedures specified in Section 10.0. Qualification of the associated sample data will be performed by CRA's QA Officer using professional judgment. Accuracy will be ensured through adherence to all sample handling procedures, sample preservation requirements, and holding time periods.

Accuracy of field measurements obtained during groundwater monitoring will be assessed by analyzing calibration check samples.

4.2.2 LABORATORY ACCURACY OBJECTIVES

Laboratory accuracy will be assessed by determining percent recoveries from the analysis of matrix spikes, laboratory control samples (LCSs), or standard reference materials (SRMs). The equation to be used to determine accuracy for this project is presented in Section 13.2. Accuracy control limits are presented in Table 4.1.

The accuracy of the VOC and SVOC analyses also will be monitored through the analysis of surrogate compounds. Surrogate compounds are added to each sample, standard, blank, and QC sample prior to sample preparation and analysis. Surrogate compounds are not expected to be found occurring naturally in the samples, but behave analytically similar to the compounds of interest. Consequently, surrogate compound percent recoveries will provide information on the effect that the sample matrix exhibits on the accuracy of the analyses. Table 4.2 provides surrogate compound percent control limits for the VOC and SVOC analyses.

4.3 COMPLETENESS

Completeness is a measure of the amount of valid (usable) data obtained from a measurement system compared to the amount that was expected to be obtained under normal conditions.

4.3.1 FIELD COMPLETENESS OBJECTIVES

Field completeness is a measure of the amount of valid measurements obtained from all measurements taken during the project. The equation for completeness is presented in Section 13.3 of this QAPP. Field completeness for this project will be 90 percent or greater.

4.3.2 LABORATORY COMPLETENESS OBJECTIVES

Laboratory completeness is a measure of the amount of valid measurements compared to the total number of all the measurements obtained for the project. The equation for completeness is presented in Section 13.3 of this QAPP. Laboratory completeness for this project will be 90 percent or greater.

4.4 REPRESENTATIVENESS

Representativeness expresses the degree to which data accurately and precisely represent a characteristic of a population, parameter variations at a sampling point, a process condition, or an environmental condition.

4.4.1 MEASURES TO ENSURE REPRESENTATIVENESS OF FIELD DATA

Representativeness is dependent upon the proper design of the sampling program. Representativeness will be ensured by following the Sampling and Analysis Plan (SAP) presented in Appendix A of the Work Plan.

4.4.2 MEASURES TO ENSURE REPRESENTATIVENESS OF LABORATORY DATA

Representativeness in the laboratory is ensured by using the proper analytical procedures, meeting sample holding times, and analyzing and assessing field duplicate samples. The sampling network was designed to provide data representative of Site conditions. During development of this network, consideration is given to past waste disposal practices, existing analytical data, and physical setting and processes. The rationale for the sampling network is provided in Section 2.0 of the Work Plan.

4.5 COMPARABILITY

Comparability is an expression of the confidence with which one data set can be compared with another.

4.5.1 MEASURES TO ENSURE COMPARABILITY OF FIELD DATA

Comparability is dependent upon the proper design of the sampling program, and will be ensured by following the SAP and using proper sampling techniques.

4.5.2 MEASURES TO ENSURE COMPARABILITY OF LABORATORY DATA

The laboratory data to be obtained during the sample collection activities will be comparable to existing data when similar sampling and analytical methods are used. Comparability also is dependent on similar QA objectives. The method selected for VOC analysis is the same method that was used during the 1998 and 1999 monitoring events. Therefore, the VOC data from the supplemental sample collection activities will be comparable to previous VOC data.

4.6 LEVEL OF QC EFFORT

To assess the quality of data resulting from the field sampling program, field duplicate samples, matrix spike samples, laboratory duplicate samples, laboratory control samples, field blank samples, and trip blank samples will be collected/designated and submitted for analysis.

Field duplicate samples will be analyzed to check for sampling and analytical reproducibility. Field duplicate sample data will be used to measure precision throughout the sampling event. Field duplicate samples will be collected at a frequency of one per 20 or fewer investigative samples of each matrix.

Matrix spike/matrix spike duplicate (MS/MSD) samples will be collected/designated for VOCs, SVOCs, and TPH at a minimum frequency of one per 20 or fewer samples for each applicable analysis.

Field blank samples will be submitted at a frequency of one per 20 investigative samples collected or at least once per day of sampling equipment cleanings, whichever is more frequent. Field blank samples will be collected by routing distilled or deionized water through decontaminated sampling equipment. Field blank samples will be analyzed to check procedural contamination and/or ambient conditions and/or sample container contamination at the Site that may cause sample contamination. Field blank samples will not be collected for the samples collected using pre-cleaned or pre-cleaned, disposable sampling equipment.

Trip blank samples, which are prepared by the laboratory and consist of organic-free water poured into the sample vials, will be included in each shipping cooler of VOC sample vials to be used for collecting groundwater samples. Trip blank samples will be handled in a manner consistent with actual field sample handling and will be shipped back to the laboratory with the samples. Trip blank samples will provide the means to assess potential cross-contamination of groundwater samples during shipment and handling. However, it should be noted that trip blanks will not be opened in the field.

The level of QC effort provided by the laboratories for analysis of the samples will be equivalent to the level of QC effort specified in the analytical methods identified in Table 8.1 and detailed in Section 9.0.

5.0 **SAMPLING PROCEDURES**

The procedures and protocols for collecting samples and for performing all related field activities are described in the SAP.

6.0 SAMPLE CUSTODY AND DOCUMENT CONTROL

Custody is one of several factors that is necessary for the admissibility of environmental data as evidence in a court of law. Custody procedures help to satisfy the two major requirements for admissibility: relevance and authenticity. Sample custody is addressed in three parts: field sample collection, laboratory analysis, and final evidence files.

A sample or evidence file is in a person's custody if:

- the item is in actual possession of a person; or
- the item is in the view of the person after being in actual possession of the person; or
- the item was in actual physical possession but is locked up to prevent tampering; or
- the item is in a designated and identified secure area.

6.1 FIELD CHAIN-OF-CUSTODY PROCEDURES

The sample packaging and shipping procedures summarized below will insure that the samples will arrive at the laboratory with the chain-of-custody intact. The protocol for specific sample numbering and other sample designations are included in the SAP.

The field logbook will provide the means of recording data collecting activities performed. As such, entries will be described in as much detail as possible so that persons going to the Site could reconstruct a particular situation solely from the logbook entries.

Field logbooks will be bound field survey books or notebooks. Logbooks will be assigned to field personnel and will be stored at CRA's Chicago, Illinois office when not in use. Each logbook will be identified by the project-specific document number (12559).

The title page of each logbook will contain the following information:

- project name;

- project start date; and
- end date.

Entries into the logbook will contain a variety of information. At the beginning of each day's logbook entry, the date, start time, weather, names of all sampling team members present, and the signature of the person making the entry will be entered.

All field measurements obtained and samples collected will be recorded. All logbook entries will be made in ink, signed, and dated with no erasures. If an incorrect logbook entry is made, the incorrect information will be crossed out with a single strike mark that is initialed by the person making the erroneous entry. The correct information will be entered into the logbook adjacent to the original entry.

Whenever a sample is collected or a measurement is made, a detailed description of the location will be recorded in the logbook. Photographs taken at a location, if any, will also be noted in the logbook. All equipment used to obtain field measurements will be recorded in the field logbook. In addition, the calibration data for all field measurement equipment will be recorded in the field logbook or on standard field forms.

Samples will be collected following the sampling procedures documented in the SAP. The equipment used to collect samples, time of sample collection, sample description, and volume and number of containers will be recorded in the field logbook. Documentation of field measurements obtained and samples collected will be consistent with the requirements of the SAP and the Work Plan.

The sample packaging and shipping procedures summarized below will ensure that the samples arrive at the laboratory with the chain-of-custody intact:

1. The field sampler is personally responsible for the care and custody of the samples until they are transferred to another person or the laboratory. As few people as possible will handle the samples.
2. All sample containers will be identified by using sample labels that include the unique sample identification number and date and time of collection.
3. Sample labels will be completed for each sample using waterproof ink unless prohibited by weather conditions. For example, a logbook entry would explain

that a pencil was used to fill out the sample label because the ball-point pen would not function in freezing weather.

4. Samples will be accompanied by a properly completed chain-of-custody form. The sample identification numbers, number of containers, requested analyses, and date and time of sample collection will be listed on the chain-of-custody form. When transferring the possession of samples, the individuals relinquishing and receiving the samples will sign and record the date and time on the form. The chain-of-custody form documents sample custody transfers from the sampler to another person, to the laboratory, or to/from a secure storage area.
5. Samples will be properly packaged for shipment and dispatched to the appropriate laboratory for analysis, with a separate signed chain-of-custody form enclosed in and secured to the inside top of each sample cooler. Table 6.1 presents the container, preservation, shipping, and packaging requirements for the samples. Shipping coolers will be secured with a custody seal for shipment to the laboratory. The custody seal is then covered with clear plastic tape to prevent accidental damage to the custody seal.
6. Whenever samples are collocated (i.e., split) with another entity, it will be the responsibility of the other entity to prepare its own chain-of-custody form. The identification numbers and locations of the split samples will be recorded in the field logbook.
7. All sample shipments will be accompanied by the chain-of-custody form identifying its contents. The chain-of-custody form is a four part carbonless-copy form. The form is completed by the sampling team which, after signing and relinquishing custody to the shipper, retains the bottom (goldenrod) copy. The shipper, if different than the sampling team members, retains the pink copy after relinquishing custody to the laboratory. The yellow copy is retained by the laboratory and the fully executed white copy is returned as part of the data deliverables package.
8. If the samples are sent by common carrier, a bill of lading will be used and copies will be retained as permanent documentation. Commercial carriers are not required to sign the chain-of-custody form as long as the form is sealed inside the sample cooler and the custody seal remains intact.
9. Samples usually will be transported or shipped to the laboratory the same day the samples are collected in the field.

6.2 LABORATORY CHAIN-OF-CUSTODY PROCEDURES

The sample custodian will assign a unique number to each incoming sample for use in the laboratory. The unique number and customer number will then be entered into the sample receiving log. The date and time of laboratory receipt and the condition of the samples will also be noted.

Sample custody procedures and document control for the laboratory will be consistent with the each laboratory's standard operating procedures for sample receiving and sample control.

6.3 STORAGE OF SAMPLES

All samples will be stored within an access-controlled location and will be maintained properly preserved (as defined in Table 6.1) until completion of all analytical work or, at a minimum, for 30 days after receipt of the final report by CRA.

6.4 FINAL EVIDENCE FILES CUSTODY PROCEDURES

Evidential files for the entire project will be maintained by CRA and will consist of the following:

1. project plan;
2. project log books;
3. field data records;
4. sample identification documents;
5. chain-of-custody records;
6. correspondence;
7. references, literature;
8. final data packages;

9. miscellaneous - photos, maps, drawings, etc.; and
10. final report.

The laboratories will be responsible for maintaining analytical log books and laboratory data. Raw laboratory data files will be inventoried and maintained by the laboratory for a period of 5 years, at which time CRA will advise the laboratory regarding the need for additional storage.

7.0 CALIBRATION PROCEDURES AND FREQUENCY

This section describes procedures for maintaining the accuracy for all the instruments and measuring equipment which are used for conducting field tests and laboratory analyses. These instruments and equipment will be calibrated prior to each use or according to a periodic schedule.

7.1 FIELD INSTRUMENTS/EQUIPMENT

Instruments and equipment used to gather, generate, or measure environmental data will be calibrated with sufficient frequency and in such a manner that accuracy and reproducibility of results are consistent with the manufacturer's specification.

Equipment to be used during field sampling will be examined to confirm that it is in operating condition. This includes checking the manufacturer's operating manual for each instrument to ensure that all maintenance requirements are being observed. Individual calibration records for each field instrument that will be used for the project will be reviewed to ensure that any prior equipment problems have not been overlooked and all necessary repairs to equipment have been completed.

7.2 LABORATORY INSTRUMENTS

Calibration of laboratory equipment will be based on approved written procedures. Records of calibration, repairs, or replacement will be filed and maintained by the designated laboratory personnel performing quality control activities. These records will be filed at the location where the work is performed and will be subject to QA audit.

The records of calibration will be kept as follows:

1. If possible, each instrument will have record of calibration permanently affixed with an assigned record number.
2. A logbook will be assigned to each instrument showing description, manufacturer, model numbers, date of last calibration, and the signature of the person who

calibrated the instrument, due date of next calibration, and compensation or correction figures, as appropriate.

3. A written stepwise calibration procedure will be available for each piece of test and measurement equipment.
4. Any instrument that is not calibrated to the manufacturer's original specification will display a warning tag or will otherwise be removed from service, as appropriate.

Specific calibration procedures are detailed in the analytical methods provided in Section 8.0.

8.0 ANALYTICAL PROCEDURES

The samples collected during the supplemental investigations will be analyzed using the methods presented in Table 8.1.

9.0 INTERNAL QUALITY CONTROL CHECKS AND FREQUENCY

This section presents the internal quality control (QC) checks and the frequency at which they will be employed for field and laboratory measurements.

9.1 FIELD QC

QC procedures for field measurements will be limited to checking the reproducibility of the measurement in the field by obtaining multiple readings and by calibrating the instruments in accordance with the appropriate instrument manual.

QC of field sampling will involve collecting field duplicate, field blank, and trip blank samples in accordance with the applicable procedures and frequencies described in Section 4.6, and the level of QC effort indicated in Table 2.1.

9.2 LABORATORY QC

Specific procedures related to internal laboratory QC samples are detailed in the following subsections. The internal laboratory QC checks for the analyses will follow the appropriate methods specified in Table 8.1 and are summarized in the following subsections.

9.2.1 INSTRUMENT PERFORMANCE CHECKS

Performance checks ensure that the mass resolution, identification, and sensitivity of the gas chromatography/mass spectrometry (GC/MS) instruments used for analyzing VOCs and SVOCs are achieved. Prior to use, each instrument must be successfully "tuned" using 4-bromofluorobenzene and decafluorotriphenylphosphine, respectively. The tuning acceptance criteria will be as specified in the methods identified in Table 8.1.

9.2.2 INITIAL AND CONTINUING CALIBRATION CHECKS

The requirements for instrument calibration ensure that the instrument is capable of producing acceptable quantitative data. Initial calibration demonstrates that the instrument is capable of acceptable performance at the beginning of an analysis sequence. Continuing calibration checks document that the initial calibration is still valid and that satisfactory maintenance and adjustment of the instrument on a day-to-day basis is achieved. The specific control criteria and corrective action requirements for initial and continuing calibration will be as specified in the methods presented in Table 8.1.

9.2.3 INTERNAL STANDARDS PERFORMANCE

Internal standards area and retention time data are evaluated to ensure that mass spectrometer sensitivity and response is stable during every run. Acceptance criteria and corrective action requirements will be as specified in the methods for VOC and SVOC analysis presented in Table 8.1. The response of internal standards in the samples are required to be within -50 to +100 percent of the response of the corresponding internal standards from the continuing calibration standard. The retention times of internal standards in the samples are required to be within ± 0.50 minutes of the retention time of the corresponding internal standards from the continuing calibration standard.

9.2.4 METHOD BLANK SAMPLES

Method blank samples will be prepared and analyzed at a frequency of one per 20 samples or, in the event that an analytical batch consists of less than 20 samples, one method blank sample will be analyzed. The method blank sample, an aliquot of analyte-free water or suitable solid material (sodium sulfate, Ottawa sand), will be carried through the entire analytical procedure. The method blank sample acceptance criteria requires that no target analytes to be detected in the method blank sample at a concentration greater than five times the reporting limit [ten times for common laboratory contaminants (e.g., acetone, methylene chloride, toluene, 4-methyl-2-pentanone, 2-butanone, and phthalate esters)].

9.2.5 MATRIX SPIKE/MATRIX SPIKE DUPLICATES

A matrix spike and matrix spike duplicate (MS/MSD) sample set will be analyzed at a minimum frequency of one per 20 or fewer investigative groundwater or soil samples for all analyses except microbiological and geotechnical analyses. Percent spike recoveries will be used to evaluate accuracy and the presence of matrix interference. The relative percent difference (RPD) between the spike and spike duplicate will be used to assess analytical precision relative to the sample matrix. Percent recovery and RPD control limits are summarized in Table 4.1.

9.2.6 SURROGATE COMPOUNDS

Surrogate compounds (surrogates) are added to all samples designated for VOC and SVOC analysis prior to analysis. In addition, all method blank samples, standards, and MS/MSD samples will be spiked with surrogates prior to analysis.

Surrogates will be spiked into samples according to the appropriate analytical methods. Surrogate spike recoveries will fall within the control limits specified in Table 4.2 for all analyte concentrations that are within the quantitation limits without dilution. Dilution of samples to bring the analyte concentration into the linear range of calibration may dilute the surrogates below the instrumental quantitation range.

9.2.7 CALIBRATION STANDARDS

All primary standard reference materials will be traceable to U.S. EPA or National Institute of Standards and Technology (NIST) reference standards, if possible. Each calibration standard will receive a reference number that is traceable to the lot number from the primary reference standard from which it was prepared. The procedures for preparing calibration standards are contained within the methods of analysis in Table 8.1.

9.2.8 REAGENT CHECKS

Reagents prepared for instrumental methods of analysis will be monitored by method blank samples and QC check samples, where appropriate. The acceptance criteria and corrective action criteria for reagent checks are the same as the criteria for method blank samples.

9.2.9 LCS SAMPLES

LCS samples (also known as QC Check Samples) will be analyzed to determine the accuracy of the analytical methods. LCS samples generally are prepared from standards that are from a different source than the calibration standards or are standard reference materials. The percent recoveries will be calculated and compared to the acceptance criteria. In most cases, sample analyses cannot proceed if the LCS acceptance criteria is not achieved. Corrective actions for outlying LCS data will be consistent with those specified in the methods.

10.0 DATA REDUCTION, VALIDATION, AND REPORTING

All data generated during field and laboratory activities will be reduced and validated prior to reporting. No field or laboratory data will be disseminated until they have been subjected to the procedures which are summarized in the subsections below.

10.1 DATA REDUCTION

10.1.1 FIELD DATA REDUCTION PROCEDURES

Field data reduction procedures will be minimal in scope compared to those implemented for laboratory data. Only direct reading instrumentation will be employed in the field. The use of field instrument meters will generate data read directly from the meters following calibration. These data will be recorded into field logbooks immediately after the measurements are taken. If errors are made, results will be legibly crossed out, initialed by the field sampler and corrected in a space adjacent to the original (erroneous) entry. Data transcribed from the field logbook into summary tables

for reporting purposes will be verified for correctness by the Field QA Officer or his designee.

10.1.2 LABORATORY DATA REDUCTION PROCEDURES

Laboratory data reduction procedures typically will be followed according to the following general protocol:

1. Raw data produced and checked by the responsible analyst is turned over for independent review by another analyst.
2. The area supervisor or senior chemist reviews the data for attainment of quality control acceptance criteria.
3. The area supervisor will decide whether any sample re-analysis is required.
4. Upon completion of all reviews and acceptance of the raw data by the area supervisor, a report will be generated and sent to the laboratory Project Manager.
5. The laboratory Project Manager will complete a thorough inspection of all reports.
6. Following review and approval of the preliminary report by the laboratory Project Manager, final reports will be generated and signed by the laboratory Project Manager.

TA's data reduction procedures will adhere to the requirements of the analytical methods. Specific equations used for data reduction are contained in the methods.

10.2 DATA REPORTING

Data reporting procedures will be conducted for field and laboratory analyses as described in the following subsections.

10.2.1 FIELD DATA REPORTING

Field data generally will be reported within technical reports and memoranda generated throughout the duration of the project.

10.2.2 LABORATORY DATA REPORTING

The task of reporting laboratory data begins after the laboratory's data reduction procedure has been concluded. The laboratory Project Manager will perform a final review of the report summaries and case narratives to determine whether the report meets the project requirements.

The laboratory reports for chemical analyses will consist of the following deliverables:

1. Case Narrative
 - i) date of issuance;
 - ii) any deviations from intended analytical strategy;
 - iii) laboratory batch number;
 - iv) number of samples and respective matrices;
 - v) project name and number;
 - vi) condition of samples upon receipt;
 - vii) discussion of whether or not sample holding times were met;
 - viii) discussion of technical problems or other observations that may have created analytical difficulties; and
 - ix) discussion of any internal laboratory quality control checks that failed to meet the acceptance criteria.
2. Chemistry Data Package
 - i) dates of sample collection, receipt, preparation, and analysis;
 - ii) cross-reference of laboratory to project sample identification numbers;
 - iii) description of data qualifiers used;
 - iv) methods of sample preparation and analysis;
 - v) sample results in tabular format;
 - vi) MS/MSD data, laboratory duplicate data, LCS data, surrogate compound percent recovery data; and
 - vii) fully executed chain-of-custody document.

10.3 DATA VALIDATION

Data validation procedures will be performed for both field and laboratory operations as described in the following subsections.

10.3.1 PROCEDURES USED TO EVALUATE FIELD DATA

Procedures to evaluate field data for this project primarily consist of checking for transcription errors and review of field logbooks. This task will be the responsibility of the Field QA Officer or his designee.

10.3.2 PROCEDURES TO VALIDATE LABORATORY DATA

Validation of the chemistry data will be performed by CRA's QA Officer or his designee based on the relevant and applicable evaluation criteria outlined in "USEPA Contract Laboratory Program National Functional Guidelines for Organic Data Review", EPA540/R-99/008, October 1999.

The evaluation and action criteria specified in these documents (referred to hereafter as the National Functional Guidelines) will be used for validating the data. However, the acceptance criteria for QC data will be the control limits determined statistically by the laboratory. Qualifiers assigned to the data will be consistent with the data qualifiers specified in the National Functional Guidelines.

The following QC data deliverables will be evaluated on 100 percent of the data.

Organic Analyses

1. Technical Holding Times;
2. Blanks;
3. Surrogate Spikes;
4. MS/MSD Results;
5. Laboratory Control Samples;

6. Field Duplicates; and
7. Trip Blank Samples.

The results of the data validation process will be documented in a memorandum that specifies all limitations on the usability of the analytical data.

11.0 PERFORMANCE AND SYSTEM AUDITS

Performance and system audits of both field and laboratory activities will be conducted to verify that sampling and analysis are performed in accordance with the procedures established in the SAP and QAPP. The audits of field and laboratory activities include two separate, independent parts: internal and external audits.

11.1 FIELD PERFORMANCE AND SYSTEM AUDITS

11.1.1 INTERNAL FIELD AUDIT RESPONSIBILITIES

Internal audits of field activities, including sampling and field measurements, will be conducted by the Field QA Officer or his designee.

11.1.2 INTERNAL FIELD AUDIT FREQUENCY

These audits will verify that all established procedures are being followed. Internal field audits will be conducted at the beginning of sample collection activities to identify deficiencies in the field sampling and documentation procedures. Any deficiencies identified will be documented and corrective actions will be taken to rectify the deficiencies. Follow-up audits will be performed as necessary to verify that deficiencies have been corrected, and that QA procedures are maintained throughout the project.

11.1.3 INTERNAL FIELD AUDIT PROCEDURES

Internal field audits will include the examination of field sampling records, field instrument operating records, field instrument calibration records, and chain-of-custody documentation. In addition, sample collection, handling, and packaging in compliance with the established procedures will be reviewed during field audits.

11.1.4 EXTERNAL FIELD AUDIT RESPONSIBILITIES

External field audits may be conducted by the KDHE.

11.1.5 EXTERNAL FIELD AUDIT FREQUENCY

External field audits may be conducted any time during the field operations. These audits may or may not be announced and are at the discretion of the KDHE.

11.1.6 OVERVIEW OF THE EXTERNAL FIELD AUDIT PROCESS

External field audits will include reviewing the field activity information presented in the SAP and this QAPP.

11.2 LABORATORY PERFORMANCE AND SYSTEM AUDITS

11.2.1 INTERNAL LABORATORY AUDIT RESPONSIBILITIES

Internal laboratory audits are conducted by the laboratory QA Officers or their designee.

11.2.2 INTERNAL LABORATORY AUDIT FREQUENCY

Internal laboratory system audits are performed on an annual basis, and internal laboratory performance audits are conducted on a quarterly basis.

11.2.3 INTERNAL LABORATORY AUDIT PROCEDURES

The internal laboratory system audits will include examining laboratory documentation regarding sample receiving, sample log-in, sample storage, chain-of-custody procedures, sample preparation and analysis, and instrument operating records. Performance audits will involve analyzing performance evaluation samples provided through external performance evaluation programs (e.g., APG's WP Study). The laboratory QA Officer will evaluate the results of the systems and performance audits and provide a final report to section managers and the Operations Manager that includes any deficiencies and/or noteworthy observations.

11.2.4 EXTERNAL LABORATORY AUDIT RESPONSIBILITIES

External laboratory audits will be conducted by the KDHE, the National Environmental Laboratory Accreditation Program, Canadian Association for Environmental Analytical Laboratories, or other accreditation authority.

11.2.5 EXTERNAL LABORATORY AUDIT FREQUENCY

External laboratory audits generally are conducted on an annual basis, but the audit frequency is at the discretion of the accreditation authority.

11.2.6 OVERVIEW OF THE EXTERNAL LABORATORY AUDIT PROCESS

External laboratory audits will include, but not be limited to, review of laboratory analytical procedures, laboratory on-site audits, and/or submitting performance evaluation samples to the laboratory for analysis.

12.0 PREVENTIVE MAINTENANCE

12.1 FIELD INSTRUMENT PREVENTIVE MAINTENANCE

The field equipment for this project includes pH/temperature, dissolved oxygen, oxidation-reduction potential, and conductivity meters. Specific preventive maintenance procedures to be followed for field equipment are those recommended by the manufacturer. Field instruments will be checked and calibrated daily before use. The maintenance schedule and trouble-shooting procedures for field instruments are presented in Table 12.1.

12.2 LABORATORY INSTRUMENT PREVENTIVE MAINTENANCE

As part of their QA/QC program, the laboratories conduct routine preventive maintenance program to minimize the occurrence of instrument failure and other system malfunctions. Designated laboratory employees will regularly perform routine scheduled maintenance and repair of (or coordinate with the instrument manufacturer for the repair of) instruments. Maintenance that is performed will be documented in the laboratory's maintenance logbooks. Laboratory instruments are maintained in accordance with manufacturer's specifications.

Table 12.1 provides examples of the frequency at which components of key analytical instruments or equipment will be maintained.

13.0 **SPECIFIC ROUTINE PROCEDURES USED TO ASSESS DATA PRECISION, ACCURACY AND COMPLETENESS**

The following sections include the procedures and formulae utilized to assess the levels of precision, accuracy, and completeness achieved for the project.

13.1 **PRECISION ASSESSMENT**

Precision of measurements will be assessed by determining the RPD between the data from either duplicate spiked sample analyses or duplicate sample analyses. RPD is calculated by dividing the absolute value of the difference between two numbers by their arithmetic mean and multiplying by 100. RPD data is used to evaluate the analytical precision of two replicate measurements (e.g., matrix spike/matrix spike duplicate). RPD data control charts are developed and maintained on a matrix and analyte-specific basis. RPD is calculated using the following simplified formula:

$$RPD = \frac{|R_1 - R_2|}{R_1 + R_2} \times 200$$

where:

$$\begin{aligned} R_1 &= \text{value of first result} \\ R_2 &= \text{value of second result} \end{aligned}$$

13.2 **ACCURACY ASSESSMENT**

Accuracy of measurements will be assessed by determining the percent recovery (%R) of analytes spiked into samples or blank matrix materials. The %R of a parameter is calculated by dividing the amount recovered by the known amount added and multiplying by 100. The %R data are evaluated to establish the analytical accuracy of a measurement. Percent recovery control charts are developed and maintained on a matrix and analyte-specific basis. Percent recovery is calculated using the following formula:

$$\%R = \frac{SSR - SR}{SA} \times 100$$

where:

SSR = Spiked Sample Result
SR = Sample Result or Background
SA = Spike Added

13.3 COMPLETENESS ASSESSMENT

Completeness will be assessed by comparing the number of valid (usable) sample results to the total possible number of results within a specific sample matrix and/or analysis. Percent completeness will be calculated using the following formula:

$$\% \text{ Completeness} = \frac{\text{Number of Valid (usable) measurements}}{\text{Number of Measurements Planned}} \times 100$$

14.0 CORRECTIVE ACTION

Corrective action is the process of identifying, recommending, approving, and implementing measures to counter unacceptable procedures or out of quality control performance that can affect data quality. Corrective action can occur during field activities, laboratory analyses, and data validation and assessment. All corrective action proposed and implemented will be documented.

14.1 FIELD CORRECTIVE ACTION

Corrective action in the field may be necessary when the sample network is changed (i.e., more/less samples, sampling locations other than those specified in the QAPP) or sampling procedures and/or field analytical procedures require modification due to unexpected conditions. In general, the field sampling team may identify the need for corrective action. The field sampling team, in consultation with the Field QA Officer, will recommend a corrective action. The Field QA Officer will approve the corrective action that will be implemented by the field team. It will be the responsibility of the Field QA Officer to ensure the corrective action has been implemented.

Corrective action resulting from internal field audits will be implemented immediately if data may be adversely affected due to unapproved or improper use of approved methods. The Field QA Officer will identify deficiencies and recommended corrective action to the Project Manager. Implementation of corrective actions will be performed by the Field QA Officer and field team. Corrective action will be documented in the field logbook and/or the project file.

14.2 LABORATORY CORRECTIVE ACTION

Corrective action in the laboratory may occur prior to, during, and after initial analyses. A number of conditions such as broken sample containers, multiple phases, low/high pH readings, or potentially high concentration samples may be identified during sample log-in or just prior to analysis. Following consultation with analysts and section leaders, it may be necessary for the laboratory QA Officer to approve the implementation of corrective action. The analytical methods specify some conditions during or after

analysis that may automatically trigger corrective action or optional procedures. These conditions may include dilution of samples, additional sample extract cleanup, or automatic re-injection/re-analysis when certain QC criteria are not met.

The bench chemist will identify the need for corrective action. The Operations Manager or section leaders, in consultation with the laboratory supervisor and staff, will approve the required corrective action to be implemented by the laboratory staff. The laboratory QA Officer will ensure implementation and documentation of the corrective action.

These corrective actions are performed prior to release of the data from the laboratory. The corrective action will be documented in the laboratory's corrective action report or analytical logbook and the case narrative report sent from the laboratory.

The need for corrective action may also be identified during systems or performance audits. In these cases, the need for corrective action will be identified by the auditor and the corrective action taken to resolve the problem will be documented by the laboratory QA Officer. The corrective action taken will depend upon the QA/QC criteria that was violated. All problems requiring corrective action and the corrective action taken will be reported to the laboratory Project Manager.

14.3 CORRECTIVE ACTION DURING DATA VALIDATION AND DATA ASSESSMENT

CRA's QA Officer may identify the need for corrective action during either data validation or data assessment. Potential types of corrective action may include resampling by the field team or reanalysis of samples by the laboratory.

The corrective actions taken are dependent upon the ability to mobilize the field team and whether the data to be collected is necessary to meet the required quality assurance objectives (e.g., the holding time for samples is not exceeded). Should CRA's QA Officer identify a situation requiring corrective action, CRA's Project Manager will be responsible for approving the implementation of corrective action.

15.0 QUALITY ASSURANCE REPORTING

Reports on data quality will be prepared following each sampling round or at the conclusion of the project. These reports will include an assessment of measurement quality indicators (i.e., data accuracy, precision, and completeness) and QA problems, corrective action taken, and resolutions.

CRA's QA Officer will be responsible within the organizational structure for preparing these reports. CRA's Project Manager will be provided with these reports for inclusion in the Supplemental Investigations Report. This report will also include a separate QA/QC section that will summarize data quality information and details an overall assessment of the data based on the objectives outlined in this QAPP.

TABLE 2.1

**SUMMARY OF SAMPLING AND ANALYSIS PROGRAM
FORMER FAIRFAX I SITE
KANSAS CITY, KANSAS**

<i>Sampling Program</i>	<i>Sample Matrix</i>	<i>Laboratory Parameters</i>	<i>Number of Samples</i>	<i>QC Samples</i>			
				<i>Field Blanks</i>	<i>Trip Blanks</i>	<i>Field Duplicates</i>	<i>MS/MSD</i>
AOC Investigation	Groundwater	TCL VOCs	8	1	1	1	1
AOC Investigation	Soil	TCL VOCs	10	1	0	1	1
Background Information	Soil	TOC	2	1	0	0	1
Comprehensive Groundwater Program	Groundwater	TCL VOCs	40	2	4	2	2
		TCL SVOCs	8	1	0	1	1
		TPH-DRO	8	1	0	1	1
		TPH-GRO	8	1	1	1	1

Notes:

AOC - Area of Concern

TCL VOCs - Target Compound List Volatile Organic Compounds

TOC - Total Organic Carbon

TPH-DRO - Total Petroleum Hydrocarbons as Diesel Range Organics

TPH-GRO - Total Petroleum Hydrocarbons as Gasoline Range Organics

MS/MSD - Matrix Spike/Matrix Spike Duplicate

**TARGETED QUANTITATION LIMITS FOR SOIL SAMPLES
FORMER FAIRFAX I SITE
KANSAS CITY, KANSAS**

<i>Parameter</i>	<i>Targeted Quantitation Limit¹</i>
Volatile Organic Compounds (µg/kg)	
Acetone	20
Benzene	5
Bromodichloromethane	5
Bromoform	5
Bromomethane	5
2-Butanone	20
Carbon disulfide	5
Carbon tetrachloride	5
Chlorobenzene	5
Dibromochloromethane	5
Chloroethane	5
Chloroform	5
Chloromethane	5
1,1-Dichloroethane	5
1,2-Dichloroethane	5
cis-1,2-Dichloroethene	2.5
trans-1,2-Dichloroethene	2.5
1,1-Dichloroethene	5
1,2-Dichloropropane	5
cis-1,3-Dichloropropene	5
trans-1,3-Dichloropropene	5
Ethylbenzene	5
2-Hexanone	20
Methylene chloride	5
4-Methyl-2-pentanone	20
Styrene	5
1,1,2,2-Tetrachloroethane	5
Tetrachloroethene	5
Toluene	5
1,1,1-Trichloroethane	5
1,1,2-Trichloroethane	5
Trichloroethene	5
Vinyl chloride	5
Xylenes (total)	10
Total Organic Carbon (mg/kg)	100

¹ The targeted quantitation and detection limits for soil are based on wet weight. The limits calculated by the laboratory on a dry weight basis will be higher.

**TARGETED QUANTITATION LIMITS FOR GROUNDWATER SAMPLES
FORMER FAIRFAX I SITE
KANSAS CITY, KANSAS**

<i>Parameter</i>	<i>Targeted Quantitation Limit</i> ¹
<i>Volatile Organic Compounds (µg/L)</i>	
Acetone	10
Benzene	1
Bromodichloromethane	1
Bromoform	1
Bromomethane	1
2-Butanone	10
Carbon disulfide	1
Carbon tetrachloride	1
Chlorobenzene	1
Dibromochloromethane	1
Chloroethane	1
Chloroform	1
Chloromethane	1
1,1-Dichloroethane	1
1,2-Dichloroethane	1
cis-1,2-Dichloroethene	0.5
trans-1,2-Dichloroethene	0.5
1,1-Dichloroethene	1
1,2-Dichloropropane	1
cis-1,3-Dichloropropene	1
trans-1,3-Dichloropropene	1
Ethylbenzene	1
2-Hexanone	10
Methylene chloride	1
4-Methyl-2-pentanone	10
Styrene	1
1,1,2,2-Tetrachloroethane	1
Tetrachloroethene	1
Toluene	1
1,1,1-Trichloroethane	1
1,1,2-Trichloroethane	1
Trichloroethene	1
Vinyl chloride	1
Xylenes (total)	1

**TARGETED QUANTITATION LIMITS FOR GROUNDWATER SAMPLES
FORMER FAIRFAX I SITE
KANSAS CITY, KANSAS**

<i>Parameter</i>	<i>Targeted Quantitation Limit</i> ¹
<i>Semi-Volatile Organic Compounds (ug/L)</i>	
Phenol	10
bis(2-Chloroethyl) ether	10
2-Chlorophenol	10
1,3-Dichlorobenzene	10
1,4-Dichlorobenzene	10
1,2-Dichlorobenzene	10
2-Methylphenol	10
2,2'-Oxybis(1-chloropropane)	10
4-Methylphenol	10
n-Nitroso-di-n-propylamine	10
Hexachloroethane	10
Nitrobenzene	10
Isophorone	10
2-Nitrophenol	10
2,4-Dimethylphenol	10
bis(2-Chloroethoxy)methane	10
2,4-Dichlorophenol	10
1,2,4-Trichlorobenzene	10
Naphthalene	10
4-Chloroaniline	10
Hexachlorobutadiene	10
4-Chloro-3-methylphenol	10
2-Methylnaphthalene	10
Hexachlorocyclopentadiene	10
2,4,6-Trichlorophenol	10
2,4,5-Trichlorophenol	25
2-Chloronaphthalene	10
2-Nitroaniline	25
Dimethyl phthalate	10
Acenaphthylene	10
2,6-Dinitrotoluene	10
3-Nitroaniline	25
Acenaphthene	10
2,4-Dinitrophenol	25
4-Nitrophenol	25
Dibenzofuran	10
2,4-Dinitrotoluene	10
Diethylphthalate	10
4-Chlorophenyl phenyl ether	10
<i>Semi-Volatile Organic Compounds (ug/L) continued</i>	
Fluorene	10

**TARGETED QUANTITATION LIMITS FOR GROUNDWATER SAMPLES
FORMER FAIRFAX I SITE
KANSAS CITY, KANSAS**

<i>Parameter</i>	<i>Targeted Quantitation Limit</i> ¹
4-Nitroaniline	25
4,6-Dinitro-2-methylphenol	25
n-Nitrosodiphenylamine	10
4-Bromophenyl phenyl ether	10
Hexachlorobenzene	10
Pentachlorophenol	25
Phenanthrene	10
Anthracene	10
Carbazole	10
Di-n-butyl phthalate	10
Fluoranthene	10
Pyrene	10
Butyl benzyl phthalate	10
3,3'-Dichlorobenzidine	10
Benzo(a)anthracene	10
Chrysene	10
bis(2-Ethylhexyl)phthalate	10
Di-n-octyl phthalate	10
Benzo(b)fluoranthene	10
Benzo(k)fluoranthene	10
Benzo(a)pyrene	10
Indeno(1,2,3-cd)pyrene	10
Dibenzo(a,h)anthracene	10
Benzo(g,h,i)perylene	10
Total Petroleum Hydrocarbons (mg/L)	
TPH-GRO	50
TPH-DRO	100

¹ The targeted quantitation limits are presented for guidance and may not be achievable for all samples.

**PERCENT RECOVERY AND RELATIVE PERCENT DIFFERENCE CONTROL LIMITS
FORMER FAIRFAX I SITE
KANSAS CITY, KANSAS**

<i>Analyses</i>	<i>% Recovery Control Limits¹</i>					
	<i>LCS%</i>	<i>LCS%</i>	<i>LCS%</i>	<i>MS%</i>	<i>MS%</i>	<i>MS%</i>
	<i>LCL</i>	<i>UCL</i>	<i>RPD</i>	<i>LCL</i>	<i>UCL</i>	<i>RPD</i>
<i>Volatile Organic Compounds</i>						
<i>(Groundwater)</i>						
Acetone	22	200	95	45	128	30
Benzene	80	116	20	78	118	20
Bromodichloromethane	87	130	30	80	146	30
Bromoform	76	150	30	58	176	30
Bromomethane	64	129	30	55	145	30
2-Butanone	28	237	65	71	123	30
Carbon disulfide	73	139	30	69	138	41
Carbon tetrachloride	75	149	30	63	176	30
Chlorobenzene	76	117	20	76	117	20
Dibromochloromethane	81	138	30	71	158	30
Chloroethane	66	126	30	59	142	30
Chloroform	84	128	30	83	141	30
Chloromethane	48	123	30	40	137	39
1,1-Dichloroethane	86	123	30	88	127	30
1,2-Dichloroethane	79	136	30	71	160	30
cis-1,2-Dichloroethene	85	113	30	87	114	30
trans-1,2-Dichloroethene	80	120	30	85	116	30
1,1-Dichloroethene	63	130	20	62	130	20
1,2-Dichloropropane	82	115	30	87	114	30
cis-1,3-Dichloropropene	84	130	30	82	130	30
trans-1,3-Dichloropropene	84	130	30	73	147	30
Ethylbenzene	86	116	30	86	132	30
2-Hexanone	35	200	52	81	128	30
Methylene chloride	78	118	30	82	115	30
4-Methyl-2-pentanone	78	141	32	82	135	30
Styrene	85	117	30	83	120	30
1,1,2,2-Tetrachloroethane	85	118	30	88	116	30
Tetrachloroethene	88	113	30	85	121	30
Toluene	74	119	20	70	119	20
1,1,1-Trichloroethane	78	140	30	71	162	30
1,1,2-Trichloroethane	83	122	30	86	129	30
Trichloroethene	75	122	20	62	130	20
Vinyl chloride	61	120	30	88	126	30
Xylenes (total)	87	116	30	89	121	30
<i>Semi-Volatile Organic Compounds</i>						
<i>(Groundwater)</i>						
Acenaphthene	40	110	30	36	110	30
Acenaphthylene	43	110	30	39	110	30
Acetophenone	50	130	30	50	130	30
<i>Semi-Volatile Organic Compounds</i>						
<i>(Groundwater)</i>						

**PERCENT RECOVERY AND RELATIVE PERCENT DIFFERENCE CONTROL LIMITS
FORMER FAIRFAX I SITE
KANSAS CITY, KANSAS**

<i>Analyses</i>	<i>% Recovery Control Limits¹</i>					
	<i>LCS%</i>	<i>LCS%</i>	<i>LCS%</i>	<i>MS%</i>	<i>MS%</i>	<i>MS%</i>
	<i>LCL</i>	<i>UCL</i>	<i>RPD</i>	<i>LCL</i>	<i>UCL</i>	<i>RPD</i>
Anthracene	54	114	30	46	110	30
Atrazine	50	130	30	50	130	30
Benzaldehyde	10	130	30	10	130	30
Benzo(a)anthracene	55	115	30	52	110	30
Benzo(b)fluoranthene	43	122	30	33	114	30
Benzo(k)fluoranthene	43	124	30	32	121	30
Benzo(ghi)perylene	45	120	30	34	116	30
Benzo(a)pyrene	43	116	30	33	110	30
1,1'-Biphenyl	50	130	30	50	130	30
bis(2-Chloroethoxy)methane	39	110	30	35	110	30
bis(2-Chloroethyl) ether	34	113	30	27	110	30
bis(2-Ethylhexyl) phthalate	36	163	30	40	140	30
4-Bromophenyl phenyl ether	51	114	30	42	113	30
Butyl benzyl phthalate	53	126	30	51	121	30
Caprolactam	50	130	30	50	130	30
Carbazole	53	120	30	49	114	30
4-Chloroaniline	10	110	30	10	110	30
4-Chloro-3-methylphenol	39	110	30	33	110	30
2-Chloronaphthalene	39	110	30	34	110	30
2-Chlorophenol	27	110	30	26	110	30
4-Chlorophenyl phenyl ether	50	115	30	43	113	30
Chrysene	55	115	30	52	111	30
Dibenz(a,h)anthracene	46	122	30	35	118	30
Dibenzofuran	46	111	30	41	110	30
Di-n-butyl phthalate	55	122	30	50	117	30
3,3'-Dichlorobenzidine	19	110	30	10	110	30
2,4-Dichlorophenol	33	110	30	30	110	30
Diethyl phthalate	33	134	30	33	130	30
2,4-Dimethylphenol	12	110	30	11	110	30
Dimethyl phthalate	15	143	30	36	124	30
4,6-Dinitro-2-methylphenol	28	112	30	25	110	30
2,4-Dinitrophenol	17	112	30	11	119	30
2,4-Dinitrotoluene	52	123	30	46	119	30
2,6-Dinitrotoluene	52	119	30	48	115	30
Di-n-octyl phthalate	44	128	30	36	124	30
Fluoranthene	54	122	30	53	111	30
Fluorene	47	112	30	43	110	30
Hexachlorobenzene	51	112	30	40	113	30
Hexachlorobutadiene	13	110	30	14	110	30
Hexachlorocyclopentadiene	10	110	30	10	110	30
<i>Semi-Volatile Organic Compounds (Groundwater)</i>						
Hexachloroethane	12	110	30	10	110	30
Indeno(1,2,3-cd)pyrene	46	121	30	36	116	30

**PERCENT RECOVERY AND RELATIVE PERCENT DIFFERENCE CONTROL LIMITS
FORMER FAIRFAX I SITE
KANSAS CITY, KANSAS**

<i>Analyses</i>	<i>% Recovery Control Limits¹</i>					
	<i>LCS%</i>	<i>LCS%</i>	<i>LCS%</i>	<i>MS%</i>	<i>MS%</i>	<i>MS%</i>
	<i>LCL</i>	<i>UCL</i>	<i>RPD</i>	<i>LCL</i>	<i>UCL</i>	<i>RPD</i>
Isophorone	44	128	30	34	125	30
2-Methylnaphthalene	35	110	30	35	110	30
2-Methylphenol	30	110	30	26	110	30
4-Methylphenol	32	110	30	25	110	30
Naphthalene	31	110	30	32	110	30
2-Nitroaniline	43	130	30	31	129	30
3-Nitroaniline	45	116	30	23	112	30
4-Nitroaniline	45	120	30	26	115	30
Nitrobenzene	37	115	30	26	118	30
2-Nitrophenol	29	110	30	30	110	30
4-Nitrophenol	12	130	30	13	127	30
N-Nitrosodiphenylamine	53	113	30	28	118	30
N-Nitrosodi-n-propylamine	37	121	30	25	119	30
2,2'-oxybis(1-Chloropropane)	25	128	30	0	0	0
Pentachlorophenol	26	110	30	23	110	30
Phenanthrene	52	114	30	47	110	30
Phenol	14	112	30	16	110	30
Pyrene	55	120	30	54	115	30
2,4,5-Trichlorophenol	39	110	30	36	110	30
2,4,6-Trichlorophenol	35	110	30	34	110	30
<i>Total Petroleum Hydrocarbons</i>						
<i>(Groundwater)</i>						
GRO as gasoline	70	143	33	49	161	33
DRO as diesel	57	132	41	30	140	41
<i>Volatile Organic Compounds</i>						
<i>(Soil)</i>						
Acetone	58	130	30	10	200	66
Benzene	75	129	20	55	138	20
Bromodichloromethane	72	125	30	47	131	51
Bromoform	43	149	30	26	141	64
Bromomethane	24	152	30	15	152	72
2-Butanone	27	200	46	21	195	60
Carbon disulfide	50	137	30	27	149	73
Carbon tetrachloride	57	137	30	32	143	68
Chlorobenzene	75	127	22	49	139	22
Dibromochloromethane	49	135	30	44	135	61
<i>Volatile Organic Compounds</i>						
<i>(Soil)</i>						
Chloroethane	31	144	30	32	140	66
Chloroform	73	115	30	59	128	46
Chloromethane	15	136	30	28	130	81
1,1-Dichloroethane	77	119	30	56	130	54

**PERCENT RECOVERY AND RELATIVE PERCENT DIFFERENCE CONTROL LIMITS
FORMER FAIRFAX I SITE
KANSAS CITY, KANSAS**

<i>Analyses</i>	<i>% Recovery Control Limits¹</i>					
	<i>LCS%</i>	<i>LCS%</i>	<i>LCS%</i>	<i>MS%</i>	<i>MS%</i>	<i>MS%</i>
	<i>LCL</i>	<i>UCL</i>	<i>RPD</i>	<i>LCL</i>	<i>UCL</i>	<i>RPD</i>
1,2-Dichloroethane	78	121	30	56	126	38
cis-1,2-Dichloroethene	77	114	30	48	127	52
trans-1,2-Dichloroethene	68	117	30	47	127	58
1,1-Dichloroethene	55	142	27	43	147	27
1,2-Dichloropropane	78	116	30	54	125	43
cis-1,3-Dichloropropene	71	125	30	30	138	49
trans-1,3-Dichloropropene	67	125	30	34	134	57
Ethylbenzene	79	114	30	36	133	72
2-Hexanone	29	200	41	20	190	70
Methylene chloride	58	130	30	45	129	49
4-Methyl-2-pentanone	68	142	60	42	143	60
Styrene	80	114	30	23	136	65
1,1,2,2-Tetrachloroethane	70	133	30	33	162	90
Tetrachloroethene	72	120	30	31	137	81
Toluene	71	130	24	46	147	24
1,1,1-Trichloroethane	67	123	30	48	132	57
1,1,2-Trichloroethane	82	116	30	58	128	52
Trichloroethene	70	131	23	46	143	23
Vinyl chloride	24	152	30	30	136	80
Xylenes (total)	80	114	30	33	135	78

Notes:

LCS-Laboratory Control Sample

MS-Matrix Spike

LCL-Lower Control Limit

RPD-Relative Percent Difference

UCL-Upper Control Limit

- 1 Laboratory control limits are updated on a periodic basis and the control limits in effect when the samples are analyzed will be used for data validation purposes.

TABLE 4.2

**SURROGATE COMPOUND PERCENT RECOVERY CONTROL LIMITS
FORMER FAIRFAX I SITE
KANSAS CITY, KANSAS**

<i>Analysis</i>	<i>Surrogate Compound</i>	<i>% Recovery Control Limits</i>	
		<i>Water</i>	<i>Soil</i>
<i>Volatile Organic Compounds</i>	4-Bromofluorobenzene	76-116	47-158
	1,2-Dichloroethane-d4	61-128	61-130
	Toluene-d8	76-110	60-143
	Dibromofluoromethane	73-122	59-138
<i>Semi-Volatile Organic Compounds</i>	2-Fluorobiphenyl	28-110	-
	2-Fluorophenol	10-110	-
	2,4,6-Tribromophenol	22-120	-
	Nitrobenzene-d5	27-111	-
	Phenol-d5	10-110	-
	Terphenyl-d14	37-119	-
<i>Gasoline Range Organics</i>	a,a,a-Trifluorotoluene	60-150	-
<i>Diesel Range Organics</i>	o-Terphenyl	53-140	-

Notes:

Laboratory control limits are updated on a periodic basis and the control limits in effect when the samples are analyzed will be used for data validation purposes.

TABLE 6.1

**CONTAINER, PRESERVATION, SHIPPING AND PACKAGING REQUIREMENTS
FORMER FAIRFAX I SITE
KANSAS CITY, KANSAS**

<i>Matrix Analyses</i>	<i>Sample Containers¹</i>	<i>Preservation²</i>	<i>Maximum Holding Time from Sample Collection³</i>	<i>Volume of Sample</i>	<i>Shipping</i>	<i>Normal Packaging</i>
Groundwater						
TCL VOCs	Three 40-mL septum top vials	Iced HCl to pH<2	14 days for analysis	Fill completely	Federal Express Priority 1 or Courier	Bubble Wrap or Foam Chips
TCL SVOCs	Two 1L amber glass	Iced	7 days for extraction 40 days for analysis	Fill completely	Federal Express Priority 1 or Courier	
TPH-GRO	Three 40-mL septum top vials	Iced HCl to pH<2	14 days for analysis	Fill completely	Federal Express Priority 1 or Courier	
TPH-DRO	Two 1L amber glass	Iced	7 days for extraction 40 days for analysis	Fill completely	Federal Express Priority 1 or Courier	
Soil						
TCL VOCs	Three 5-g En Core Samplers	Iced	48 hours for preparation 14 days for analysis	Fill completely	Federal Express Priority 1 or Courier	Bubble Wrap or Foam Chips
TOC	One 2-oz glass	Iced	28 days for analysis	Fill to shoulder of jar	Federal Express Priority 1 or Courier	Bubble Wrap or Foam Chips

¹ Where possible, analyses will be combined into the minimum number of sample containers with respect to sample preservation requirements.

² Samples requiring refrigeration will be shipped in coolers containing bagged, cubed ice. Following laboratory receipt and log-in, these samples will be stored at 4° ± 2°C.

³ Maximum holding times presented are technical holding times and are based on the time elapsed from sample collection.

TABLE 8.1

SUMMARY OF ANALYTICAL METHODS
FORMER FAIRFAX I SITE
KANSAS CITY, KANSAS

<i>Parameter</i>	<i>Preparation/Analysis Method</i>
<i>Groundwater</i>	
TCL VOCs	SW-846 5030B/8260B
TCL SVOCs	SW-846 8270
TPH-GRO	OA-1
TPH-DRO	OA-2
<i>Soil</i>	
TCL VOCs	SW-846 5035/8260B
Total Organic Carbon	Walkley-Black

Notes:

TCL - Target Compound Lists

VOCs - Volatile Organic Compounds

TPH-GRO - Total Petroleum Hydrocarbons as Gasoline Range Organics

TPH-DRO - Total Petroleum Hydrocarbons as Diesel Range Organics

SW-846 - "Test Methods for Evaluation Solid Waste, Physical/Chemical Methods", EPA SW-846, 3rd Edition.

Walkley-Black - "Methods of Soil Analysis", American Society of Agronomy, 1965.

**ROUTINE PREVENTIVE MAINTENANCE
PROCEDURES AND SCHEDULES
FORMER FAIRFAX I SITE
KANSAS CITY, KANSAS**

<i>Instrument</i>	<i>Maintenance Procedures/Schedule</i>	<i>Spare Parts in Stock</i>
Gas Chromatograph/Mass Spectrometer	1. Replace pump oil as needed. 2. Change septa weekly or as often as needed. 3. Change gas line dryers as needed. 4. Replace electron multiplier as often as needed. 5. Replace gas jet splitter as needed. 6. Replace GC injector glass liner weekly or as often as needed. 7. Replace GC column as needed. 8. Check to ensure that gas supply is sufficient for the day's activity and the delivery pressures are set as described in the SOP. 9. Check to ensure the pressure on the primary regulator never falls below 100 psi.	1. Syringes 2. Septa 3. Various electronic components 4. Glass jet splitters 5. GC columns 6. Glass liners
Purge and Trap Sample Concentrator	1. Replace trap as needed. 2. Decontaminate the system after running high concentration samples or as required by blank analysis. 3. Leak check system daily and as often as needed. 4. Check to ensure the gas supply is sufficient for the day's activity and the delivery pressures are set as described in the SOP. 5. Check to ensure the pressure on the primary regulator never run below 100 psi.	1. Traps 2. Spargers 3. Various electronic components/circuits 4. Plumbing supplies - tubing, fittings

**ROUTINE PREVENTIVE MAINTENANCE
PROCEDURES AND SCHEDULES
FORMER FAIRFAX I SITE
KANSAS CITY, KANSAS**

<i>Instrument</i>	<i>Maintenance Procedures/Schedule</i>	<i>Spare Parts in Stock</i>
Gas Chromatograph	1. Change septa weekly or as often as needed. 2. Change gas line dryers as needed. 3. Replace GC injector glass liner weekly or as often as needed. 4. Replace GC column as needed. 5. Check to ensure that gas supply is sufficient for the day's activity and the delivery pressures are set as described in the SOP.	1. Syringes 2. Septa 3. Various electronic components 4. GC columns 5. Glass liners
pH Meter	1. Check battery and replace if discharged. 2. After use in samples containing free oil, wash the electrode in soap and rinse thoroughly in water. Rinse thoroughly with water. 3. Keep electrode properly filled with appropriate filling electrolyte solution.	1. Standard pH buffer solutions 2. Electrolyte filling solution 3. Electrodes
Conductivity Meter	1. Check battery and replace if discharged. 2. After use in samples containing free oil, wash the electrode in soap and rinse thoroughly with water.	1. Standard conductance solutions 2. Electrodes