SITE CHARACTERIZATION REPORT
FORMER FARMLAND NITROGEN PLANT
LAWRENCE, KANSAS

Prepared
For:
FI Kansas Remediation Trust

By

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EXECUTIVE SUMMARY

Shaw Environmental and Infrastructure, Inc. (Shaw) was retained by the FI Kansas Remediation Trust to perform a Site Characterization (SC) of the former Farmland Industries Nitrogen Plant in Lawrence, Kansas (Property). Site Characterization field activities were completed as outlined in the KDHE-approved SC Work Plan from late March to early May 2005. Additional sampling activities were completed in June and July, 2005. The primary objective of the site characterization was to collect environmental data to identify the areal and vertical extent of the targeted analytes at the property. The targeted analytes of the SC were nitrates, ammonia, RCRA metals, TPHs, VOCs, and PCBs. In support of this objective, the site was classified into six areas based on former property use and/or natural site boundaries. These areas are:

- Area A: UAN Storage Area
- Area B: Northern Ponds
- Area C: Northwest Site Area
- Area D: Operations Area
- Area E: Southwest Site Area
- Area F: Southeast Site Area

Surface soil, subsurface soil, groundwater, and sediment samples were collected from the six designated areas and submitted for the appropriate analysis as described in the Work Plan. Analytes were selected based on past operational activities and previous site investigations.

In support of this effort, 404 sample locations were sampled, generating over 1,200 samples. These samples were submitted for analysis for the following constituents:

- 838 soils, 184 sediment and 29 groundwater samples were analyzed for Nitrate plus Nitrite and Ammonia as Nitrogen;
- 153 sediment samples were analyzed for TKN;
- 82 soils, 165 sediment and 1 groundwater samples were analyzed for RCRA metals;
- 54 sediment samples were analyzed for Hexavalent chromium;
- 33 soil and 3 sediment samples were analyzed for TPH;
- 22 soil and 19 sediment samples were analyzed for VOCs; and
- 4 soil samples were analyzed for PCBs.

Three areas were deemed to have not been impacted by former plant operations and require no further action. These areas are Area C, E, and F, which comprise 225 acres of the 467-acre site area. These areas are vegetated, and concentrations for total nitrate plus ammonia were below the Risk Based Standards for Kansas RSK Manual (RSK) threshold value of 200 mg/kg. Specific analytical results for these areas are summarized as follows:

Area C – Northwest Site Area

Analytical results for the 19 locations sampled across Area C support that this area was not adversely impacted by former plant operations. The 34 soil samples analyzed for nitrogen compounds and RCRA metals were unremarkable, with nitrate plus nitrite concentrations no greater than 12.7 mg/kg and ammonia concentrations no higher than 57.8 mg/kg. It was concluded that no further action is warranted for the 85 acres comprising Area C.

Area E – Southwest Site Area

Analytical results for the 13 locations sampled across the 50 acres comprising Area E support that this area was not adversely impacted by former plant operations. The 36 soil samples analyzed for nitrogen compounds and RCRA metals were unremarkable, with nitrate plus nitrite concentrations not detected. RCRA Metals analysis for one sample indicated the presence of arsenic at 8.61 mg/kg, barium at 233 mg/kg, chromium at 18.7 mg/kg, and lead at 21 mg/kg. It is proposed that no further action is warranted for Area E.

Area F –Southeast Site Area

Analytical results for the 29 soil boring and 14 sediment locations sampled across the 90 acres comprising Area F support that soils in this area were not adversely impacted by former plant operations. The 58 soil samples analyzed for nitrogen compounds and RCRA metals were unremarkable, with nitrate plus nitrite concentrations no greater than 6.2 mg/kg and ammonia concentrations no higher than 44.8 mg/kg. It is proposed that no further action is warranted for Area F.

The remaining site areas comprising the remaining 242 acres of the site were found to contain areas of interest that will require further evaluation in support of remediation activities. It is believed that sufficient data was collected during the SC to proceed to these project milestones. The areas of interest (AOIs) delineated are described below.

Area A - UAN Storage Area

Area A is comprised of what formerly had been designated as the UAN Storage Area, Ammonia Nitrate Processing Area, Nitrate Bulk Warehouse. This area comprises approximately 120 acres and lies in the north central area of the property. The estimated total area impacted in Area A is 30 acres. This area is topographically the highest area of the property. In support of site characterization activities, 473 surface and subsurface soil samples, 19 groundwater samples, and 7 sediment samples were collected from this area. Per the SC work plan, 201 samples had been planned to be collected. The additional samples were required due to the depth of the soil overlying bedrock at the northern and northeastern end of Area A.

The UAN Storage Area was found to contain elevated concentrations of total nitrogen with elevated ammonia concentrations located in subsurface soil samples to a depth of 30 feet in several areas adjacent to the Bag Warehouse, the French Drain sumps, and Nitrate Bulk Warehouses.

Central Ponds: Site characterization data obtained from and in the vicinity of the Central Ponds comprised of two intermittent, ponds indicates that total nitrogen contamination is limited to these pond

areas with total nitrogen concentrations measured in excess of 10,000 mg/kg. Samples collected outside of the pond area were observed to have total nitrogen concentrations at levels at less than 100 mg/kg. This is indicative that elevated total nitrogen compounds in this area are limited to the sediments in these ponds.

6,000,000-Gallon UAN AST Area: Analytical results indicated that the subsurface soils in this 12-acre area immediately adjacent to this AST and extending to the west have been impacted by former UAN production and storage activities. Total nitrogen concentrations are observed to increase at depth with levels in excess of 1,000 mg/kg. The AST was installed in the former area of two lined UAN storage lagoons that were removed in the late 1980s.

Bag Warehouse Area: A 2-acre area along the northern and eastern ends of the Bag Warehouse has been impacted by former nitrate production and storage activities. Total nitrogen concentrations are observed to increase with depth, with levels in excess of 1,000 mg/kg.

Northern Reach of Primary Drainage Ditch: Although Area C has been interpreted as not having been impacted by former plant operations, it was observed that the northern third of the primary drainage ditch for the site has received nitrogen-impacted sediment from Area A. Area A borders the western bank of this ditch, and Area B borders this drainage ditch as it extends east along the southern end of the Northern Ponds. Analytical results for these collected samples indicated total nitrogen levels greater than 1,000 mg/kg.

Area B - Northern Ponds

Area B consists of a series of ponds located in the far northeastern area of the site. These ponds are, in order from west to east, the Krehbiel Pond and West Pond, the West Extension Pond, the West Effluent Pond, the East Effluent Pond, the West Lime Pond, the Rundown Pond, the Overflow Pond, and the East Lime Pond. The latter six ponds are designated in this Site Characterization Report (SCR) as the primary ponds. The Krehbiel Pond, West Pond, and West Extension Pond are considered secondary ponds. This total area covers approximately 55 acres. The ponds were designed to receive different process waters and storm water runoff during plant operations.

Five of the six primary ponds have been evaluated as having pond sediments that have been impacted by ammonia and, to a lesser extent, chromium and arsenic. For comparison, the mean concentrations of the target analytes were calculated for the pond. It is noted that mean arsenic concentrations ranged from 6.24 mg/kg to 14.47 mg/kg in the six ponds, with arsenic at the highest mean concentration in the East Lime Pond. Mean barium levels ranged from 193 mg/kg to 526 mg/kg, with the highest mean for barium observed in the East Effluent Pond. Cadmium means were distributed from 0.069 mg/kg to 1.031 mg/kg. Mean total chromium levels were widely distributed, ranging from a low of 6 mg/kg in the East Lime Pond to 1,362 mg/kg in the East Effluent Pond. Hexavalent chromium analysis was completed for three of the ponds: The East Lime Pond, the Rundown Pond, and the West Lime Pond. Hexavalent chromium was only detected in six samples collected from the Rundown Pond at concentrations ranging from 1.49 mg/kg to 2.99 mg/kg. Lead was noted to have means ranging from 4.5 mg/kg to 29.8 mg/kg, with the highest mean noted in the Rundown Pond.

TKN had the highest concentration of 12,817 mg/kg in the Rundown Pond, which was almost double the 7,492 mg/kg mean level noted in the Overflow Pond. The East Lime Pond had the lowest TKN mean concentration at 435 mg/kg.

Similarly, ammonia also was noted to have the highest mean concentration in the Rundown Pond at 8,064 mg/kg, with the Overflow Pond at the second highest at 1,252 mg/kg. Ammonia was undetected in the East Lime Pond.

Results for NO_2 & NO_3 also strongly followed these results, with the Rundown and Overflow Ponds having the highest mean concentrations. The East Lime Pond again was the least impacted by nitrogen compounds of the six primary ponds.

Collectively the six primary ponds and three secondary ponds contain an estimated 226,000 cubic yards (cy) of sediment.

Area D - Operation Area

Area D is located in the south central area of the site and borders Highway K-10 to the north. This area covers approximately 65 acres and was the main plant area. This area is comprised of eleven sub-areas that have been designated as the Oil Pond; the Spill Pond; the Urea Area; the Chrome Reduction Area (CRS Unit); the Paint Shop Maintenance Area which consists of the Paint Shop, Garage, and Gravel Lot; the Ammonia Production - Primary Reformer Area; the Cooling Towers; the Nitric Acid Area; the Boiler Furnace and Fuel Oil Storage Area; the Old Ammonia Plant Area; and the Catalyst Landfill.

Specific areas of interest in Area D identified during the SC process are:

Urea Runoff Storage Vault and Urea Production Area: Although the majority of soil samples collected in the Urea Production Area indicated elevated total nitrogen concentrations, it was noted that total nitrogen concentrations increased with depth in the vicinity of the Urea Runoff Storage Vault. Total nitrogen concentrations in this area were measured in excess of 1,000 mg/kg.

Oil Pond: Three locations were sampled in the footprint of the Oil Pond that was formerly used for fire training activities. Waste oil was burned in this pond for the fire training exercises. Analytical results indicated that residual petroleum hydrocarbons are present in the soil contained in the pond area. The highest observed TPH concentration in the soil samples collected was 560 mg/kg.

Spill Pond: Three locations were sampled in the footprint of the Spill Pond that was used formerly for containing spilled #2 fuel oil. This fuel oil was contained in two ASTs and utilized for a backup energy source for on-site electrical generators. Analytical results indicated that residual petroleum hydrocarbons are present in the soil contained in the pond area. The range of TPH concentrations observed in sediment samples from this pond was 640 mg/kg to 4,500 mg/kg.

Catalyst Landfill: The location of the Catalyst Landfill was defined during site characterization activities. A sample of the catalyst material was retrieved at a depth interval of 4 to 8 feet at sample location A05-SS-05, and was submitted for analysis. Total chromium was detected in this sample at a concentration of 10,100 mg/kg. A second sample was retrieved in this general location and submitted for TCLP analysis with a reported result of non detect for this catalyst material for Arsenic, Cadmium, Chromium, Lead,

Mercury, Selenium, and Silver. Barium was detected at a concentration of 1.3 mg/l, which is well below the regulatory limit of 100 mg/l. The Catalyst Landfill covers approximately .04 acres.

Ammonia Production-Primary Reformer Area: A 0.8-acre area at the Primary Reformer was found to have total nitrogen concentrations between 100 and 1,000 mg/kg, with concentrations increasing with depth.

Extent of Impacted Groundwater

Impacted groundwater is present at the site. Groundwater samples from 39 groundwater monitoring wells and 29 groundwater samples collected using a Geoprobe® rig were analyzed for nitrogen compounds (nitrate, nitrite, and ammonia). Nitrate-nitrogen (Nitrate-N) was detected above U.S.E.P.A. Maximum Contaminant Level (MCL) of 10 mg/L in 21 of 39 groundwater monitoring wells and 23 of 29 Geoprobe® groundwater samples. High concentrations of ammonia-nitrogen (ammonia-N) were also detected in groundwater; however, there is no MCL for ammonia.

Groundwater samples from 14 groundwater monitoring wells were analyzed for RCRA metals (Arsenic, Barium, Cadmium, Chromium, Lead, Mercury, Selenium, and Silver). Arsenic was detected above the MCL of 10 µg/L in 12 of 14 wells. None of the other RCRA metals were detected at concentrations above the MCL.

Silty Clay Aquifer

Nitrate-N concentrations range from 0.15 to 33,310 mg/L in the Silty Clay Aquifer. Nitrate-N concentrations were highest near the former West Pond and Krehbiel Pond. An additional area of elevated nitrate-N concentrations is in the vicinity of the former No. 2 Urea Bulk Warehouse. The highest concentration of nitrate-N in any groundwater samples from this location was 33,310 mg/L in Geoprobe® sample A01NE-GW-16. Concentrations of less than 10 mg/L are found south of the former No. 2 Urea Bulk Warehouse and north of the railroad tracks forming the northern boundary of the site.

Ammonia-N concentrations range from less than 0.06 to 51,640 mg/L in the Silty Clay Aquifer. Ammonia-N concentrations were highest near the West Pond and Krehbiel Pond. The area around the #2 Urea Bulk Warehouse was observed to have Ammonia-N concentrations in excess of 1,000 mg/l. Concentrations of less than 10 mg/L are found south of the former No. 2 Urea Bulk Warehouse and north of the railroad tracks forming the northern boundary of the site.

Six wells screened in the Silty Clay Aquifer were analyzed for Arsenic. Arsenic concentrations range from 14.7 to 138 µg/L in the six groundwater samples collected from the Silty Clay Aquifer and analyzed for metals. All the wells sampled for arsenic are in the vicinity of the northern ponds. Arsenic concentrations were highest in monitoring well PSW-03A located north of the West Lime Pond.

Deep Alluvial Aquifer

Nitrate-N concentrations range from less than 0.06 to 24.2 mg/L in the Deep Alluvial Aquifer. Nitrate-N concentrations exceeded the MCL of 10 mg/L only in the northwest portion of the property in groundwater monitoring well PW-09 (24.2 mg/L).

Ammonia-N concentrations range from 0.2 to 31.9 mg/L in the Deep Alluvial Aquifer. Ammonia-N concentrations exceeded 10 mg/L only in the northwest portion of the property in groundwater monitoring well PW-09 (31.9 mg/L).

Six wells screened in the Deep Alluvial Aquifer were analyzed for arsenic. Arsenic concentrations range from less than 10 to 41.1 µg/L in the Lower Aquifer. Arsenic concentration was highest in monitoring well PSW-03B, located north of the West Lime Pond.

Bedrock Water Bearing Zone

Nitrate-N concentrations range from less than 0.06 to 1,780 mg/L in the Bedrock water bearing zone. Nitrate-N concentrations were highest in groundwater monitoring well PW-01 (1,780 mg/L) and in monitoring well N-02 (1,620 mg/L) on top of the sandstone hill at the former UAN lagoons and present location of the 6,000,000-gallon AST. Nitrate-N concentrations in wells in the Chrome Destruct Area ranged from less than 0.06 mg/L to 98.9 mg/L.

Ammonia-N concentrations range from less than 0.06 to 1,140 mg/L in the Bedrock Water Bearing Zone. Ammonia-N concentrations were greater than 10 mg/L only in groundwater monitoring wells PW-01 (900 mg/L) and N-02 (1,150 mg/L).

Two wells screened in the Bedrock Water Bearing Zone were analyzed for arsenic. Arsenic concentrations range from less than 10 to 21.6 µg/L. Arsenic concentrations were measured in monitoring well MW-06 at a concentration of 21.6 mg/L.

In summary, based on the well control across the site, impacted groundwater appears to be localized in several areas that are directly linked to past plant operations that produced ammonia, urea, or stored nitrogen containing materials. These areas are Area A and Area B with the highest concentrations of nitrate and ammonia observed along the north and northeastern perimeter of Area A and at the West Extension Pond and the Ammonia Plant. The West Extension Pond, West Pond, and Krehbiel Pond areas were observed to have the highest nitrate and ammonia concentrations in groundwater. Elevated Nitrate levels in groundwater directly correlated with areas of total nitrogen-impacted soil.

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ACRONYM LIST

Ag	Silver
Ammonia-N	Ammonia-nitrogen
AOCs	Areas of concern
ARARs	Applicable or relevant and appropriate requirements
As	Arsenic
AST	Above-ground storage tanks
Ba	Barium
bgs	Below ground surface
CAA	Clean Air Act
Cd	Cadmium
CI/CAS	Comprehensive Investigation/Corrective Action Study
CWA	Clean Water Act
CLP	Contract Laboratory Program
Cr	Chromium
CRS	Chromium reduction system
cy	Cubic yards
FDS	French Drain System
FS	Feasibility Study
FSP	Field and Sampling Plan
gpm	Gallons per minute
GPS	Global positioning system
Hg	Mercury
KDHE	Kansas Department of Health and Environment
KGS	Kansas Geological Society
LCS/LCSD	laboratory control samples/laboratory control sample duplicates
MCL	Maximum Contaminant Level
MCLG	Maximum Contaminant Level Goals
MEK	Methyl Ethyl Ketone
mg/L	Milligrams per liter
mg/kg	Milligrams per kilogram
MS/MSD	matrix spike/matrix spike duplicates
MSL	Mean sea level
NAD	North American Datum
NCP	National Contingency Plan
Nitrate-N	Nitrate-nitrogen
NPDES	National Pollutant Discharge Elimination System
µg/L	micrograms/liter
OSHA	Occupational Safety and Health Act
Pace	Pace Analytical Services, Inc.
Pb	Lead
PCBs	Polychlorinated Biphenyls
PID	Photoionization detector
ppmv	parts per million volume
Property	The former Farmland Nitrogen Manufacturing plant in Lawrence, Kansas

PVC	Polychlorinated biphenyl
QA	Quality Assurance
QC	Quality Control
RFA	RCRA Facility Assessment
RPD	Relative percent difference
RSK	Risk Based Standards for Kansas
SC	Site Characterization
SCR	Site Characterization Report
Se	Selenium
Shaw	Shaw Environmental and Infrastructure, Inc.
SM	Standard Method
STL	Severn Trent Laboratory
SWMUs	Solid Waste Management Units
TBC	To be considered
TCLP	Toxic Characteristic Leachate Procedure
TKN	Total Kjeldahl Nitrogen
Total Nitrogen	Nitrate plus Nitrite + Ammonia as Nitrogen
TPH	Total Petroleum Hydrocarbons
TPH as DRO	Total Petroleum Hydrocarbons as Diesel Range Organics
TPH as GRO	Total Petroleum Hydrocarbons as Gasoline Range Organics
TPH as FP	Total Petroleum Hydrocarbons as Fuel Product
UAN	Urea-ammonium nitrate
VOCs	Volatile Organic Compounds

1.0 INTRODUCTION

The former Farmland Nitrogen Manufacturing plant in Lawrence, Kansas ("Property") began operations in 1954, and produced over its operating period various nitrogen-containing chemicals that included ammonia, urea, nitric acid, ammonium nitrate, and urea-ammonium nitrate (UAN) solution. Not all of these chemicals were produced over the entire lifetime of the plant (1954-2001). All manufacturing operations were shut down in 2001 when the plant was closed due to the economic downturn of the agricultural fertilizer market, rising energy costs, and the eventual bankruptcy of Farmland Industries and plant shutdown. Subsequently, the Kansas Department of Health and Environment (KDHE) mandated a comprehensive site characterization (SC) of the property. The FI Kansas Remediation Trust, the current owner of the property, retained Shaw Environmental and Infrastructure, Inc. (Shaw) to perform the SC. This report presents the results. A significant portion of the Property has been found to be suitable for reuse in its present state.

All SC activities were performed in accordance with the KDHE-approved Site Characterization Work Plan. This work plan was originally submitted to the KDHE on January 7, 2005, and was approved with a re-submittal of the document on February 7, 2005. This work plan provided the strategy and approach for the characterization of the Property. The data collected in this characterization phase has been evaluated and the results presented and discussed in this Site Characterization Report (SCR). The data included the collection of over 1,200 samples of groundwater, soil and sediment. Based on the area where these samples were collected, they were submitted to an on-site laboratory, Pace Analytical Laboratory, Inc., or both for Nitrate plus Nitrite, Ammonia as Nitrogen, Total Kjeldahl Nitrogen, RCRA Metals, Hexavalent Chromium, Total Petroleum Hydrocarbons, Volatile Organic Compounds, Polychlorinated Biphenyls, and TCLP analysis. The analysis of these data was used to define the extent of site areas impacted by former operations, to determine if further investigations are required within a specific area of the site, to determine if supplemental groundwater response action is warranted, and to assist in the future evaluation and selection of corrective actions for areas of the Property requiring mitigation.

The Property was originally divided into 19 individual areas as described in the Site Characterization Work Plan for the field sampling effort. These areas were subsequently reclassified for the SCR based on use of the property and the results of the investigation.

The reclassification resulted in the designation of six site areas as follows:

- Area A: UAN Storage Area
- Area B: Northern Ponds
- Area C: Northwest Site Area
- Area D: Operations Area
- Area E: Southwest Site Area
- Area F: Southeast Site Area

The reclassification of the Property areas is described in greater detail in Section 4.1 of the SCR. The focus of the site characterization of each area was to gather the data necessary to address whether soils on site had been impacted by past plant operations and whether an impacted area is contributing environmental impacts to storm water and groundwater quality.

2.0 SITE DESCRIPTION AND HISTORY

2.1 SITE LOCATION

The 467-acre Property is located in Douglas County on the eastern edge of the City of Lawrence, Kansas, and approximately one half mile south of the Kansas River. The address of the site is 1608 North 1400 Road Lawrence, Kansas 66046. The site extends into Sections 4 and 5 of Township 13 South, Range 20 East (**Figure 2-1**).

2.2 SITE DESCRIPTION

The Property area encompasses 467 acres, and is bounded on the north by 15th Street and the Burlington Northern Santa Fe Railroad. The remaining property lines border undeveloped and developed commercial property on the east, mixed industrial and residential areas on the west, and State Highway K-10 on the south. The site has been inactive since its closure in 2001.

2.3 OPERATIONAL HISTORY

The Lawrence, Kansas, former Farmland plant began operations in 1954 as the Cooperative Farm Chemical Association. Through the years the plant had been expanded and updated to provide a variety of nitrogen fertilizer products to local cooperatives in the Midwest. The plant was acquired by Farmland Industries in 1984. Products produced at this facility have included anhydrous ammonia, nitric acid, granular urea, prilled ammonium nitrate, and UAN solution. Each of these production areas consisted of a wide variety of structures and buildings. In addition to the production areas, the facility had diverse support activities which were located across the plant grounds. **Figure 2-2** provides an aerial view of the property and the designated site characterization study areas (Areas A-F). **Figure 2-3** illustrates the plant production features with site characterization sample locations.

Ammonia Plant

The original ammonia plant, referred to as the "Old Ammonia Plant" operated from 1954 to 1971. The "Old Ammonia Plant" was located in the southwest portion of the site and adjacent to Highway K-10. The old Ammonia Plant is located in what is referred to as Area D, Operations Area, of the SCR.

The Old Ammonia Plant was taken out of service when it was considered obsolete, and it was more cost effective to replace the plant than to retrofit it with state-of-the-art equipment. From 1971 to 1981 the Old Ammonia Plant was dismantled. Process equipment was re-used on the site, relocated to other Farmland facilities, or sold as scrap metal.

Construction on a new ammonia plant was initiated and completed in 1971. The new ammonia production plant was located in the southwest portion of the Property between the No. 2 urea plant and the main cooling tower area. Farmland produced ammonia until operations ceased in 2001. The Ammonia Plant was auctioned and sold in 2004 to Oman Chemical and Pharmaceuticals LLC. The buyer intends to dismantle and ship the plant overseas. The dismantling and removal of the plant from the property is scheduled to be completed in 2006. The new Ammonia Plant is also located in Area D.

Nitric Acid Plant

Farmland produced nitric acid for use as an intermediate in the manufacture of ammonium nitrate. The nitric acid production area is located in the southwestern portion of the site and east of the cooling tower area. The nitric acid plants were also located in Area D. Six separate nitric acid production areas were located at the plant. Plants No. 1 and No. 2 began operation in 1954 and were shut down before 1990. Plants No. 3 and No. 4 were constructed in 1958 and 1960 respectively, and were shutdown in the early 1990s. Plants No. 5 and No. 6 were constructed in 1963 and 1968 respectively, and were operational up to 2001. On average 275,000 tons of nitric acid were produced each year.

Ammonium Nitrate Plant

Farmland operated two ammonium nitrate plants. Plant No. 1 began operations in 1954 and produced approximately 217,000 tons of ammonium nitrate per year. Plant No. 2 also began operations in 1954 but was shut down in 1978. Both plants are located in the north central portion of the plant property in Area A.

Urea Plant

Urea production commenced at the Farmland Lawrence, Kansas plant in 1974 with approximate production of 170,000 tons per year. The urea plant is located in the southwest portion of the Property north of the ammonia plant in what has been designated as Area D. Process waters resulting from the production of urea contain high concentrations of urea and ammonia. These waters were pumped to the Rundown Ponds for reuse in UAN production. The Urea Plant was auctioned and sold in 2004. The buyer intends to dismantle and ship the plant overseas. The dismantling and removal of the plant from the property is scheduled to be completed in 2006.

Urea Ammonium Nitrate (UAN) Plant

The UAN area is located in the north central portion of the Property, north of the ammonium nitrate plants. UAN production started in approximately 1959, and ended in 2001 with the cessation of manufacturing operations. The UAN Plant is located in what is designated as Area A, UAN Storage Area

Plant Process Water

During its years of operation the plant utilized water pollution control systems to reduce the amount of ammonia and nitrates that were discharged to an NPDES-permitted outfall. Process waste streams and stormwater runoff from the urea production area and ammonium nitrate area were collected in a series of lagoons/ponds located in the northern portion of the site. This area had been designated as Area B, Northern Ponds, in the SCR. This water was then concentrated in the nitrate area concentrator or ammonia plant area concentrator and then pumped to the

concentrate storage pond for use in UAN solutions blending. The concentrate storage ponds were replaced in 1988 with a 6-million-gallon capacity aboveground storage tank.

With the plant shutdown in 2001, the nitrate-impacted stormwater runoff could no longer be returned to the process. This nitrate-impacted runoff was subsequently directed to and stored in the Rundown Pond located in the northeastern portion of the property.

A water management plan, or land application plan, was submitted to KDHE on March 10, 2005, in support of application for a land application permit. The Land Application permit was received from KDHE on April 22, 2005. This plan outlines the steps that the FI Kansas Remediation Trust will take to beneficially use the water contained in the ponds for agricultural purposes. Land application activities are scheduled to commence in the fall of 2005.

Cooling tower blowdown water produced during the operational years of the plant was discharged to the effluent pond system also located in the northeastern portion of the property. The cooling tower blowdown water would have contained hexavalent and trivalent chromium prior to 1984. Pond sediments were analyzed for total chromium and selected samples for hexavalent chromium as part of site characterization activities.

The series of ponds, primarily the Rundown and Overflow Ponds, located in the northeastern portion of the property represent the primary site concern as a nitrate source area. Previously, surface water runoff from the areas of the site known to have nitrate-impacted soils was routed to the Rundown and Overflow Ponds. In the winter of 2004 water handling practices were revised, as approved by the KDHE, to minimize the amount of water directed to these ponds. Engineering controls have been put in place to re-direct clean surface water runoff to the effluent pond system. Recently additional modifications were made so that all surface water runoff that meets NPDES discharge limits is directed to the effluent pond system, and discharged. Currently the only water being directed to the Rundown Pond system is from the French drain portion of the groundwater containment system.

Since 1972, the plant has discharged waste water to the Kansas River under the authority of a NPDES permit issued by KDHE. These permits have periodically been revised and reissued with more restrictive limits on the amount of ammonia and nitrate that could be discharged. A new permit was approved by KDHE in January 2005 with the permit limits based on federal effluent guidelines and surface water quality standards. The permit allows for a daily average of 247 pounds nitrate-nitrogen to be discharged. The permit also allows an ammonia-nitrogen daily average concentration of 50 mg/l and a daily average of 530 pounds.

Since the shutdown of the production facilities, no process water has been discharged; however, storm runoff water is still processed through the effluent system and discharged to the river in accordance and in compliance with the current NPDES permit. The new permit is based on surface water quality standards and best professional judgment. These permit limits are presently the basis for all future planning for discharges from the property.

Confirmation sampling is periodically completed to monitor surface water chemical composition with respect to NPDES permit requirements.

2.4 PAST INVESTIGATIONS

Previous investigations of the Property have included a RCRA Facility Assessment (RFA) that was completed by PRC Environmental Management in September 1990. The RFA listed 21 solid waste management units (SWMUs) as areas requiring further investigation. Farmland and KDHE entered into a Consent Agreement (Consent Order Case No. 92-E-27) on January 27, 1993, to conduct a Comprehensive Investigation/Corrective Action Study (CI/CAS). This investigation was completed by Environmental & Safety Services Inc., with submittal of their CI report characterizing the 21 SWMUs and identifying areas of concern (AOCs) in January 1994. A supplemental report was completed in October 4, 1994. The CI investigations also included a groundwater investigation that identified three water-bearing zones impacted by nitrates. The CAS report was completed and approved on April 12, 1995.

Geraghty & Miller completed a RCRA Surface Impoundment Closure Certification Report in support of closure of the CRS unit on January 14, 1987.

Woodward Clyde Consultants has completed numerous studies at the site since 1974. Initial studies focused on characterizing groundwater quality at the northern boundary of the site. In November of 1985, Woodward Clyde Consultants completed the Revised Alternate Groundwater Monitoring Plan. This plan, which is currently in place, defined long-term groundwater monitoring requirements for the site.

3.0 PHYSICAL CHARACTERISTICS OF SITE AREA

3.1 SURFACE FEATURES/PHYSIOGRAPHY

The Former Farmland Nitrogen Plant (**Figure 3-1** – Topographic Map) lies near the boundary of the Dissected Till Plain and the Osage Plains sections of the Central Lowlands physiographic province. The major topographic features near the site are the east-trending Kansas River Valley and a series of north-south oriented upland cuestas formed by differential erosion of the bedrock. The Kansas River is located approximately ¾ mile north of the site and plant drainage is toward the river. Relief at the site is dominated by a sandstone bluff overlooking the Kansas River valley. The average elevation of the Kansas River valley is approximately 817 feet above mean sea level (MSL), while the top of the bluff within the plant site rises to just over 900 feet above MSL.

3.2 CLIMATE

The climate at the site is humid continental. In the Lawrence, Kansas area, annual extreme temperatures range from below zero to over 100°F. The average daily maximum temperature is 66.9°F and the average daily minimum temperature is 45.2°F, with a mean of 56.5°F (USDA, 1997).

Normal rainfall for the Lawrence area is 39.78 inches per year. Since 1999, annual rainfall totals have consistently been below normal on an annual basis (KSU, 2005). **Table 3-1** presents the monthly precipitation in Lawrence since January 1999.

The prevailing wind direction is southerly, but in January and February northerly winds are more frequent. Winds in March tend to be easterly (USDA, 1997). **Figure 3-2** shows the distribution of winds in Lawrence from 2000 to 2004 (KSU, 2005).

Table 3-1
Monthly Precipitation Data
Lawrence, Kansas
January 1999 through June 2005

Year	Month	Monthly Precipitation (inches)	Mean Monthly Precipitation [1] (inches)	Deviation from Mean (inches)
1999	January	1.72	1.24	0.48
	February	1.13	1.12	0.01
	March	1.17	2.80	-1.63
	April	8.93	3.46	5.47
	May	6.92	4.96	1.96
	June	6.33	5.82	0.51
	July	0.71	3.97	-3.26
	August	1.30	4.06	-2.76
	September	6.39	4.52	1.87
	October	0.78	3.35	-2.57
	November	1.80	2.24	-0.44
	December	1.82	1.74	0.08
2000	January	0.19	1.24	-1.05
	February	2.31	1.12	1.19
	March	3.16	2.80	0.36
	April	0.88	3.46	-2.58
	May	2.65	4.96	-2.31
	June	7.20	5.82	1.38
	July	2.38	3.97	-1.59
	August	0.70	4.06	-3.36
	September	4.61	4.52	0.09
	October	5.34	3.35	1.99
	November	2.69	2.24	0.45
	December	0.51	1.74	-1.23
2001	January	1.12	1.25	-0.13
	February	2.85	1.19	1.66
	March	2.17	2.74	-0.57
	April	4.49	3.54	0.95
	May	3.80	5.30	-1.50
	June	6.32	5.63	0.69
	July	2.91	4.01	-1.10
	August	5.15	3.81	1.34
	September	4.91	4.54	0.37
	October	2.63	3.40	-0.77
	November	0.36	2.57	-2.21
	December	0.51	1.80	-1.29
2002	January	0.03	1.25	-1.22
	February	0.66	1.19	-0.53
	March	0.92	2.74	-1.82
	April	5.76	3.54	2.22
	May	4.96	5.30	-0.34
	June	0.22	5.63	-5.41
	July	1.51	4.01	-2.50
	August	2.18	3.81	-1.63
	September	0.99	4.54	-3.55
	October	3.57	3.40	0.17
	November	0.23	2.57	-2.34
	December	0.07	1.80	-1.73

Table 3-1, Continued
Monthly Precipitation Data
Lawrence, Kansas
January 1999 through June 2005

Year	Month	Monthly Precipitation (inches)	Mean Monthly Precipitation [1] (inches)	Deviation from Mean (inches)
2003	January	0.03	1.25	-1.22
	February	0.87	1.19	-0.32
	March	1.61	2.74	-1.13
	April	4.34	3.54	0.80
	May	3.01	5.30	-2.29
	June	4.34	5.63	-1.29
	July	1.11	4.01	-2.90
	August	6.98	3.81	3.17
	September	2.26	4.54	-2.28
	October	0.74	3.40	-2.66
	November	0.75	2.57	-1.82
	December	2.36	1.80	0.56
2004	January	0.95	1.25	-0.30
	February	1.45	1.19	0.26
	March	3.90	2.74	1.16
	April	2.40	3.54	-1.14
	May	4.42	5.30	-0.88
	June	0.00	5.63	-5.63
	July	9.25	4.01	5.24
	August	0.00	3.81	-3.81
	September	1.02	4.54	-3.52
	October	4.69	3.40	1.29
	November	2.64	2.57	0.07
	December	0.03	1.80	-1.77
2005	January	2.75	1.25	1.50
	February	2.15	1.19	0.96
	March	0.71	2.74	-2.03
	April	1.94	3.54	-1.60
	May	5.69	5.30	0.39
	June	4.40	5.63	-1.23

Notes:
[1] The normal precipitation values were recalculated beginning in 2001.
Data provided by Weather Data Library, Manhattan, Kansas (http://www.oznet.ksu.edu/wld).
Mean Monthly Precipitation is based upon a 30-year average.
Deviation from Mean is the difference between the reported monthly precipitation and the average monthly precipitation.

3.3 SOILS

Nine different soil mapping units, representing seven soil series, are present within the boundaries of the site (**Figure 3-3** – Soils Distribution Map) These include: Kennebec soils, channeled (Kc); Pawnee clay loam, 3 to 7% slopes (Pc); Pawnee clay loam, 3 to 7% slopes (Ph); Sibleyville complex, 7 to 15% slopes (Sv); Vinland complex, 3 to 7% slopes (Vc); Wabash silty clay loam (Wc); Wabash silty clay (Wh); and Woodson silt loam, 1 to 3% slopes (Ws), (USDA, 1977). Details of soil characteristics for each soil mapping unit are provided in **Table 3-2**. This table also provides the soil types that are located in the six designated site areas.

The Kennebec Series consists of deep, well-drained to moderately-well-drained, nearly-level soils on floodplains, which are generally dissected by meandering stream channels and are subject to frequent flooding. The Kennebec soils mapped at the site are described as "channeled". The location of the Kennebec soil series on **Figure 3-3** corresponds to a buried bedrock channel that is evident on **Figure 3-13**. The Kimo series consists of deep, somewhat-poorly-drained, nearly-level soils on floodplains, subject to ponding, and has a high water table during periods of excessive rainfall. The Pawnee series consists of deep, moderately-well-drained, gently-sloping to sloping soils on uplands. The Sibleyville series consists of moderately-deep, well-drained, sloping to strongly-sloping soils on uplands.

The Vinland series consists of shallow, somewhat-excessively-drained, sloping to moderately-steep soils on uplands. The Wabash series consists of deep, poorly-drained to very-poorly-drained, nearly-level soils on bottomlands and terraces. The Woodson series consists of deep, somewhat-poorly-drained, nearly-level to gently-sloping soils on uplands (USDA, 1977).

Soils located in Areas C, D, E, and F are subject to flooding and depression storage. Permeabilities in the Total Nitrogen-impacted Property areas A, B, and D which as shown in this report are permeable soils have permeabilities ranging from 2.8×10^{-3} cm/sec to 8.5×10^{-5} cm/sec.

Table 3-2
Soil Series
Former Farmland Nitrogen Plant
Lawrence, Kansas

Soil series	Parent material	Native vegetation	Profile description	Permeability (cm/sec)	Water capacity	Topographic position	Property Area
Kennebec (Kc)	Loamy alluvium	Prairie grass, deciduous trees	0-22"- very dark brown and black silt loam and silty clay loam 22-38" – very dark grayish brown, friable silty clay loam 38"+ - very dark brown and very dark grayish brown silty clay loam	8.5×10^{-4} to 2.8×10^{-3}	High	Upland drainage ways and floodplains	C, D
Pawnee (Pc, Ph)	Fine textured glacial till and glaciofluvial deposits	Not described	0-14" - very dark gray and very dark grayish brown clay loam (Pc) or heavy clay loam (Ph) 14-24" - dark grayish brown very firm and firm clay 24-34" - yellowish brown very firm and firm clay 34-54" - mottled yellowish brown and reddish brown very firm and firm clay 54"+ - mottled light yellowish brown and dark brown sandy clay loam	8.5×10^{-5} to 8.5×10^{-4}	High	Pc: side slopes on uplands Ph: side slopes on uplands in areas along, and at the upper ends of, small drainageways	A, C, D, E, F
Sibleyville (Sv)	Weathered loamy shale and sandstone	Tall prairie grass and a combination of oak-hickory forest with tall prairie grasses	0-7" - very dark grayish brown loam 7-15" - dark brown, very friable loam 15"-27" - yellowish brown loam 27"+ - weathered sandstone	8.5×10^{-4} to 2.8×10^{-3}	Moderate	Convex side slopes, sometimes below limestone outcrops	A, C, F

Table 3-2, Continued
Soil Series
Former Farmland Nitrogen Plant
Lawrence, Kansas

Soil series	Parent material	Native vegetation	Profile description	Permeability (cm/sec)	Water capacity	Topographic position	Property Area
Vinland (Vc)	Weathered loamy shale	Tall prairie grass	0-7" - very dark gray silty clay loam 7-10" - dark gray and dark brown, firm silty clay loam 10-17" - grayish brown silty clay loam 17" + - olive brown to yellowish brown weathered shale	8.5×10^{-4} to 2.8×10^{-3}	Low	side slopes, generally below limestone or sandstone formations	A, C, D, F
Wabash (Wc, Wh)	Clayey alluvium	Water-tolerant prairie grasses, deciduous trees	Wh: 0-16" - black silty clay 16-52" - black, very firm silty clay 52" + - very dark gray silty clay Wc: 0-20" – silty clay loam 20-52" - black, very firm silty clay 52" + - very dark gray silty clay	8.5×10^{-5} to 2.8×10^{-4}	Moderate	Wc: – floodplains and stream terraces Wh: – bottoms and stream terraces	B
Woodson (Ws)	Fine textured sediment	Not described	0-11" - very dark gray silt loam and silty clay loam 11-33" - very dark gray, very firm silty clay 33-45" - mottled dark brown and grayish brown, very firm silty clay 45"+ - mottled grayish brown and dark brown clay loam	8.5×10^{-5} to 8.5×10^{-4}	high	ridges and old stream terraces	C (located only in a small area on far western portion of Area C)

Source: Soil Survey of Douglas County, Kansas, United States Department of Agriculture, 1977.

3.4 REGIONAL GEOLOGY

3.4.1 Stratigraphy

The stratigraphic units exposed in the northeast portion of Douglas County consist of Pleistocene and Recent alluvium and the Pennsylvanian-age Stranger Formation of the Douglas Group. The Stranger Formation consists of five members: a basal conglomerate, the Tonganoxie Sandstone, the Westphalia Limestone, the Vinland Shale, the Haskell Limestone, and the Robbins Shale (KGS, 1960). **Figure 3-4** is a geologic map of the site area as described on the geologic map of Douglas County (O'Connor, 1992). Underlying the Stranger Formation and encountered in deep borings are the Pennsylvanian-age Weston Shale of the Pedee Group. The Stanton Limestone of the Lansing Group underlies the Weston Shale.

Stanton Limestone

The Stanton Limestone comprises three limestone and two shale members and is a resistant cuesta-forming formation. The Captain Creek Limestone member is the lowermost member of the Stanton Limestone. It is gray or gray blue, dense, and fine grained. The Eudora Shale Member is approximately 7 feet thick. The middle lower part is typically a black, carbonaceous, fissile and thin-bedded shale. Commonly, about half a foot of gray or buff shale separates the dark shale from the top of the Captain Creek Limestone member. The upper part of the member consists of gray or greenish-gray thin-bedded shale. The Stoner Limestone member is a light-bluish gray, wavy-bedded limestone containing numerous thin shaly partings. The limestone is fossiliferous, fine grained, and contains abundant crystalline calcite. The Rock Lake Shale Member consists of a lower gray, blue, and green shale containing carbonized plant fossils, and locally, a thin coal less than one inch thick. The middle and upper parts consist of gray, buff, or dark brown thin-bedded to massive very-fine-grained micaceous sandstone. The South Bend Limestone Member is a medium-bedded, blocky, fine-grained to sandy gray fossiliferous limestone. Locally it is disconformably overlain by basal deposits of the Stranger Formation.

Weston Shale

The Weston Shale conformably overlies the Stanton Limestone and is overlain disconformably by the Stranger Formation and Lawrence Shale. The Weston Shale consists of slightly more than 100 feet of gray-blue and gray marine shale. The lower 50 to 60 feet is a hard medium-gray or bluish laminated and fissile clayey shale containing several zones of dense pinkish-gray clayey-ironstone concretions, which weather yellowish brown or reddish brown. The upper part of the formation is commonly more bluish than the lower part, is a slightly silty clayey shale, and at least locally has carbonized plant fragments at the bedding planes. The upper part also contains clay-ironstone concretions, but they are generally smaller and less numerous than those in the lower part.

Stranger Formation

The basal conglomerate consists of fragments of concretions derived from the underlying Weston Shale, fragments of limestone derived from the Stanton and Iatan Limestones, reworked invertebrate fossils, plant fragments, quartz sand and silt, and cementing material. The conglomerate is thickest and best developed where the Stranger Formation is in contact with parts of the Stanton Limestone. The conglomerate is not present everywhere, sandstone or sandy shale being the basal deposit locally. In areas of thin Tonganoxie overlying pre-Tonganoxie hills of Weston Shale, the basal deposits of the Tonganoxie may be represented by a thin zone of subrounded to subangular shale and siltstone pebbles.

The Tonganoxie Sandstone member is chiefly fine to very fine angular to subangular clear quartz, which is slightly cemented with calcite. Poorly sorted silty and shaly beds may contain as much as 20 percent mica by volume. Festooned crossbedded and massive sandstone is present in the lower part of the Tonganoxie Sandstone member in many places. The well-sorted channel sandstone deposits grade laterally and vertically into thin-bedded argillaceous sandstone, siltstone, and shale, which are more micaceous and carbonaceous than the massive sandstone. The upper and middle parts of the member contain the fairly persistent Upper and Lower Sibley coals, and locally, other thin coals.

On fresh exposures the sandstone is very light gray to dark gray, the darker sand containing more carbonaceous material, the lighter sand being better sorted and cleaner. Small amounts of disseminated pyrite and iron-bearing clay minerals cause the sandstone to become stained with iron and to weather to tan or yellow brown on outcrops. The siltstone and shale beds of the Tonganoxie Sandstone are gray to blue and weather tan to yellow brown. Ironstone and limonite concretions occur both in zones and scattered through the shaly parts of the member. Where the Westphalia Limestone cannot be recognized, the top of the Tonganoxie Sandstone is placed at the top of the Upper Sibley coal. The thickness of the Tonganoxie ranges from 0 to approximately 120 feet.

The Westphalia Limestone member is a medium gray, carbonaceous laminated limestone as much as 1.5 feet thick, but it is not continuous and hence not present at some outcrops. A zone of calcareous shale above the Upper Sibley coal marks its probable position where limestone is not present.

The Vinland Shale member is composed of gray clayey to sandy shale and sandstone beds, chiefly marine, ranging from about 6 to 25 feet in thickness. A zone of the pelecypod *Myalina* persists nearly everywhere in the shale and sandstone at the top of the member. Beds of sandstone in the upper part locally attain a thickness of about 12 feet. The sand is fine to very fine, slightly micaceous, and on outcrops is commonly well cemented with calcite. Most outcrops of the Vinland are gray, tan-weathering, silty to sandy shale. Septarian concretions occur locally in the upper part.

Overlying the Vinland Shale member is the gray to bluish-gray Haskell Limestone member, which weathers brownish gray. The lower part of the Haskell Limestone member may be silty or very sandy locally where it overlies, and is gradational into beds of sandstone in the Vinland Shale

member. The lower, sandy part contains abundant mollusks. Fusilinids, brachiopods, crinoids, and calcareous "Cryptozoon" type algae are common in the upper and middle parts, and locally the upper part is oolitic. The upper surface has numerous depressions containing small phosphatic nodules. The Haskell Limestone member is well exposed in and east of the City of Lawrence between the Kansas and Wakarusa Rivers, and in the Coal Creek drainage area. Its thickness ranges from 1.3 to 5 feet.

The Robbins Shale member is a gray marine clayey shale. In southern Douglas County, the Robbins Shale member ranges in thickness from 0 to about 12 feet and is directly overlain by massive beds of the Ireland Sandstone member, which are believed to be of non-marine origin. In the northern two-thirds of Douglas County, the Ireland Sandstone is not recognized and the sequence from the base of the Oread Limestone to the top of the Haskell Limestone member is chiefly silty and sandy shale. The Robbins Shale member exposed in the Baldwin area is a marine gray to blue argillaceous very thin-bedded shale that weathers yellow tan. A few inches above the base is an impure goethite bed about 2 to 3 inches thick containing a molluscan fauna. Sparse marine fossils also occur in the lower part of the shale.

Pleistocene and Recent Sediments

Overlying the Pennsylvanian rocks are Pleistocene and Recent (Holocene) sediments. Undifferentiated Pleistocene till and glaciofluvial deposits mantle the bedrock formations to the west and south of the site. Although glaciers from the most recent glaciation (Wisconsin Age) did not cover this area, they did drain through the Kansas River valley, deepening the valley up to 70 feet into the bedrock. Drilling logs from within the floodplain area shows that bedrock lies 55 to 60 feet below ground surface (bgs) near the plant. The subsequent filling of the valley resulted in a thick valley fill of coarse sediment in an active channel. The valley fill consists of unconsolidated sands and silts with minor clay. Often, a coarse gravel is present at the base.

The Pleistocene Newman terrace was deposited on the valley flanks at nearly the same time as the coarse valley fill was being deposited. The Newman terrace is present on the site as a relatively flat area slightly above the present alluvial valley floor and directly below the sandstone hill. The Newman Terrace deposits have been greatly dissected since Wisconsin time, and are now present only in discontinuous bands near the valley bluffs. The sediments of the Newman Terrace consist of silts and clays with occasional sand lenses.

Recent Kansas River valley sediments cover the coarse valley fill of Wisconsin Age with 10 to 30 feet of clays and silts with minor amounts of sand. An intermediate surface slightly below the Newman terrace and slightly above the modern floodplain has been mapped within the area of investigation by Dufford (1958). This intermediate surface is characterized by a more irregular surface with prominent fluvial scars. The modern floodplain is typically composed of fine-grained sediments and clay except in the active channel areas.

3.4.2 Structural Geology

The Prairie Plains Monocline is the dominant regional structure that affects Pennsylvanian rocks in Douglas County. The Pennsylvanian rocks dip westward and northwestward at about 20 feet per mile (0.004 ft/ft). This structure is primarily post-Permian in age. Superimposed on the regional structure are many smaller synclinal and anticlinal structures. The amount of structural deformation generally increases appreciably with depth from the surface rocks into the older Pennsylvanian and Mississippian rocks. Faulting and sharp flexing occur in rocks of the Douglas and Pedee Groups and the Oread Limestone in southern Douglas County and adjacent areas to the south and west. No faulting is described in northeastern Douglas County (KGS, 1960).

3.5 SITE STRATIGRAPHY

Bedrock occurs in outcrop and at depths ranging up to 56 feet bgs at the site. Outcropping bedrock at the site consists of the Pennsylvanian-age Stranger Formation of the Douglas Group. Deeper bedrock layers encountered in wells and borings at the site include the Weston Shale and members of the Stanton Limestone.

The immediate plant area is characterized by a sandstone bluff overlooking the valley of the Kansas River. The sandstone exposed in the hill is the Tonganoxie Sandstone member of the Stranger Formation. The uppermost exposed beds at the site are thin-bedded shaly sandstone probably equivalent to the Tonganoxie Sandstone. No massive sandstone was observed within the plant boundaries, but an outcrop was noted immediately west of the plant along 15th Street. The sandstone exposed on the plant site is typically thin bedded with interbeds of sandy shale.

One or two borings have encountered a lenticular limestone beneath sandstone beds that is likely the Westphalia Limestone member of the Stranger Formation. Typically, a blue shale that is not exposed but is encountered in several deep borings on the site is found below the Tonganoxie Sandstone. This shale is likely the Weston Shale. The uppermost rock unit present at the site appears to be the Vinland Shale member of the Stranger Formation, and wells have penetrated as deep as what is believed to be the Eudora Shale member of the Stanton Limestone.

The Pleistocene Kansas River Alluvium comprises the primary aquifer of the region. The alluvium is a thick valley fill consisting of unconsolidated sands and silts with minor clay. Often, a coarse gravel is present at the base.

The Pleistocene Newman terrace was deposited on the valley flanks at nearly the same time as the coarse valley fill was being deposited. The Newman terrace is present on the site as a relatively flat area slightly above the present alluvial valley floor and directly below the sandstone hill. The East and West Effluent Ponds are developed on these deposits.

Two geologic cross sections were developed for the site (see **Figure 3-5** - Cross Section Location Map) and are included as **Figures 3-6** and **3-7** (Site Stratigraphic Cross Sections). Cross section A-A' (**Figure 3-6**) begins at the southwest corner of the plant (Well MW-11) and trends northeastward to well PSW-09B.

The clay to silty clay unit is present throughout the cross section. The sandy lower unit is present only in the northern part and pinches out onto the sandstone hill in the northwest portion of the site. Bedrock lithologies include sandstone, shale, and limestone.

Cross section B-B' **(Figure 3-7)** begins near the western edge of the plant at well PSW-14 on the sandstone bluff and runs eastward to well PSW-10 south of the Rundown Pond. The subsurface soil at the top of the bluff consists of silty clay or clay overlying sandstone bedrock. Fill material from 4 to 8 feet thick is found at the base of the bluff (Wells PSW-13A/B to PSW-17). A dark brown or black organic silty clay soil zone is present on the west side of the hill. The Deep Alluvial sands are present only in wells PSW-13B and PW-08. Bedrock lithologies include sandstone, shale, and limestone.

3.6 REGIONAL HYDROGEOLOGY

3.6.1 Physical Hydrogeology

3.6.1.1 Recharge

Groundwater recharge is seasonal in Douglas County, as in other parts of the Midwest. Winter groundwater elevations are typically low during winter when the ground is frozen and precipitation is slight. During the spring, precipitation is fairly abundant, snowmelt occurs, the temperature is moderately cool, and evapotranspiration demands are low, resulting in considerable recharge. Recharge may occur in other seasons whenever precipitation is sufficient to overcome soil-moisture deficiency built up during a preceding dry period (KGS, 1960).

3.6.1.2 Kansas River Alluvial Aquifer

In Douglas County, fresh groundwater can be found in unconsolidated sediments locally to a depth of about 90 feet and in consolidated rocks to a depth of about 500 feet (KGS, 1960). The Kansas River alluvial aquifer supplies approximately 80 percent of the pumped groundwater used in Douglas County (USDA, 1977). The saturated alluvial deposits have a wide range of hydraulic conductivity values, but most are greater than 5×10^{-2} cm/sec, and in parts of the aquifer they are greater than 5.6×10^{-1} cm/sec. The average hydraulic gradient of the water table in this part of the Kansas River is approximately 0.0005.

3.6.1.3 Bedrock Aquifers

The Ireland and Tonganoxie Sandstones are the primary bedrock aquifers in Douglas County. Only small quantities of water are available from other bedrock aquifers in the county (USDA, 1977). In the outcrop area of the Tonganoxie Sandstone in the lower part of the Wakarusa River valley east and southeast of Lawrence, groundwater in the aquifer is chiefly unconfined, but west and southwest of Lawrence the aquifer is confined between relatively impermeable limestone and shale beds, and the water is artesian. The hydraulic conductivity is 7×10^{-4} to 7×10^{-3} cm/sec, but locally, well-sorted massive deposits are probably much more permeable. The hydraulic gradient

in the artesian part of the aquifer is likely 0.001. The groundwater is moving northeastward from southwestern Douglas County toward the Wakarusa River valley in the vicinity of Lawrence, where it discharges into alluvial deposits in the Wakarusa and Kansas River valleys. Recharge in the non-artesian parts of the Tonganoxie Sandstone member south and east of Lawrence is chiefly from local precipitation in the outcrop area.

3.6.2 Chemical Hydrogeology

The chemical character of the groundwater from the Kansas River alluvium is a very hard calcium bicarbonate water that contains much iron and has a pH range from 6.9 to 7.5 (KGS, 1960). Water from Quaternary deposits is generally good, except for carbonate hardness and locally excessive iron content. The Ireland and Tonganoxie Sandstones yield calcium and magnesium bicarbonate water of good quality in water table areas, and in the downdip or downgradient artesian areas, they will yield a sodium bicarbonate water that is generally soft but high in dissolved solids (USDA, 1977).

Chemical analyses were performed on groundwater samples collected in Douglas County (KGS, 1960). The amount of dissolved solids in 66 samples of groundwater collected from wells, test holes, and springs ranged from 135 to 21,400 ppm. Twenty-two samples, all from Pennsylvanian sandstone and limestone aquifers, contained more than 1,000 ppm.

The hardness of 97 samples of groundwater ranged from 19 to 2,590 ppm. The hardest and softest waters were from Pennsylvanian sandstones, but more than half of the samples collected from Pennsylvanian rocks had a hardness of less than 200 ppm. Almost all of the water samples collected from Quaternary deposits had a hardness range from 200 to 800 ppm, and, in general, were appreciably harder than water from Pennsylvanian sandstones.

The iron content of 96 samples of groundwater ranged from 0.03 to 49 ppm. Of the 96 samples, 69 contained 0.3 ppm or more of iron. The fluoride content of 97 samples of groundwater ranged from 0.0 to 12 ppm. Fifteen samples, all from Pennsylvanian sandstone aquifers, contained fluoride in amounts greater than 1.5 ppm. Of the 64 samples analyzed for nitrate, only four contained more than 90 ppm. Of these, three samples were from shallow dug wells. The nitrate content of the 64 samples ranged from 0.0 to 257 ppm. The chloride content of 112 samples ranged from 1.5 to 12,800 ppm.

3.7 SURFACE WATER HYDROLOGY

On-site surface water consists of 12 ponds, designated West Stormwater Pond, East Stormwater Pond, Central Stormwater Pond, East Lime Sludge Pond, West Lime Sludge Pond, Overflow Pond, Rundown Pond, East Effluent Pond, West Effluent Pond, an unnamed pond near the former North End Maintenance Shop, West Pond and West Pond Extension, and Krehbiel Pond. There is a drainage ditch located in the central portion of the plant that flows north toward the Kansas River.

Surface water runoff is generally to the north. Flow around the sandstone hill is generally to the east, toward the ponds located in the northeast part of the site. Flow from the main section of the former plant area is northward toward the East Effluent Pond. Flow from this pond is to the north-northwest toward the Kansas River.

Stormwater and sanitary sewer from the plant is discharged from a weir located approximately 1,500 meters north of the plant's administration building and on the south side of 15th Street. Discharge from the weir flows north through a culvert under 15th Street, then for 625 meters in a discharge ditch. The effluent then enters an unnamed tributary for storm water and flows another 450 meters into the Kansas River (Burns & McDonnell, 2001).

None of the site lies within the 100-year floodplain of the Kansas River and only the Lime Sludge Landfill area near the eastern boundary of the site, lies on the 500-year floodplain (NFIP, 1981).

3.8 SITE HYDROGEOLOGY

Two geologic cross sections were developed for the site and are included as **Figures 3-6** and **3-7** (Site Stratigraphic Cross Sections). Three hydrostratigraphic units are recognized: the Silty Clay Aquifer, consisting primarily of silty clays and clays (along with fill and native soil); the Deep Alluvial Aquifer (Kansas River alluvium), consisting of sandy clays, sands, and gravel; and the Bedrock Water-Bearing Unit, consisting of sandstone, limestone, and shale. The Bedrock Water-Bearing Unit produces only small amounts of groundwater and is most likely a perched zone. Previous reports on the Chrome Destruct Unit refer to the Bedrock Water-Bearing Unit as the "Perched Aquifer". Other reports call the Bedrock Water-Bearing Unit the "Sandstone Aquifer" even though water-bearing zones also include limestone and shale. The Silty Clay Aquifer is referred to as the "Perched Aquifer" in some of the Farmland Performance Evaluation Reports, but does not demonstrate characteristics of perched aquifers. Due to the poor quality of some boring log descriptions, along with lateral lithologic variation, the boundary between the Silty Clay and Deep Alluvial Aquifers may not be precisely defined in all wells. Additional data is required to accurately determine how the hydrologic units on site behave.

The Silty Clay Aquifer, referred to in some previous reports as the "Perched Aquifer", is presently believed to be unconfined. The Deep Alluvial Aquifer is generally confined, and the Bedrock Water-Bearing Unit can be either confined or unconfined depending on the overlying unconsolidated material. Clay and shale aquitard units are present within the aquifers and are the sites of surface seeps observed at the site as described in previous reports (Woodward-Clyde, 1975).

The Silty Clay and Deep Alluvial Aquifers are not uniform in thickness and are not present in all portions of the site. A thick zone of fill material is present in the Chromium Destruction Unit area (Area 9) and near well PW-1 in Area 1. Groundwater flow in the Silty Clay Aquifer is generally toward the north-northeast.

The Deep Alluvial Aquifer (Kansas River alluvium) is present only in the area surrounding the northeast ponds (Area 2) and along the north side of the sandstone hill. It increases in thickness onto the Kansas River floodplain. Groundwater flow in the Deep Alluvial Aquifer is generally toward the northeast.

The Bedrock Water-Bearing Unit underlies the unconsolidated aquifers. Overburden thickness ranges from 0 feet on top of the sandstone hill and in site outcrops to more than 60 feet north of the East Lime Pond and into the Kansas River floodplain (**Figure 3-8** – Depth of Unconsolidated Sediment Overlying Bedrock). The uppermost rock unit appears to be the Vinland Shale member of the Stranger Formation and wells have penetrated as deep as what is believed to be the Eudora Shale member of the Stanton Limestone.

There does not appear to be a hydraulic connection between the bedrock near the Chrome Destruct Unit and the bedrock on the sandstone hill. Groundwater flow in the Bedrock Water-Bearing Unit is generally toward the north-northeast.

Hydrologic conditions at the site are influenced along the northern boundary of the site by the active pumping wells, PSW-3B, PSW-6B, and PSW-7B that are pumped to the East Effluent Pond, and the French Drain system. This system is designed to prevent groundwater flow from the site to the north of the site. More detailed hydrogeologic analysis will be required to accurately evaluate the interconnection or lack thereof between the three identified water-bearing zones. In addition to the pumping wells and French Drain system, the six primary ponds locally impact groundwater flow.

Based on review of the existing data collected in April 2005 from monitoring wells around the perimeter of the primary ponds and the water elevations estimated in the primary ponds, it is noted that the water elevations in the six ponds are significantly greater than the water levels measured in the monitoring wells downgradient of the ponds. Water elevations to the south and west of the primary ponds (Wells PSW-17, PSW-08, and PSW-10) range from 837.8 feet to 832.3 feet MSL. Water elevations in the six ponds range from 823.5 feet to 829.25 feet MSL. These three wells are upgradient of the six primary ponds. Downgradient wells (PSW-05A, PSW-09A, PSW-03A, PSW-06A, PSW-07A, PSW-02A, and PSW-01A) had groundwater elevations ranging from 817.53 feet to 807.95 feet MSL. Again it is noted that wells PSW-03B, PSW-06B, and PSW-07B are actively pumping wells.

The pumping wells are noted to increase the slope of the water table, and therefore the movement of water contained in the ponds to the pumping wells, increasing pond-bed seepage. The steeper this slope, the greater the likelihood that pond-bed seepage will occur. The pumping wells are designed to prohibit the movement of nitrogen-impacted water from the site.

4.0 SITE CHARACTERIZATION

4.1 SITE CHARACTERIZATION APPROACH

In order to develop a manageable approach for characterizing the site, the site was initially subdivided into 19 Site Characterization Areas. The areas were delineated based on known or historical plant processes and operations. These 19 areas were identified in the Site Characterization Work Plan as summarized in **Table 4-1**. Subsequently on review of the data collected in support of the SC, these 19 areas were reclassified into six areas named Areas A, B, C, D, E, and F.

TABLE 4-1
Work Plan Site Characterization Areas
Former Farmland Nitrogen Plant
Lawrence, Kansas

Area	Primary Features Included in Area	Site Characterization Approach	Reclassification Area
1	UAN Storage Area, Ammonium Nitrate Processing Area, Nitrate Bulk Warehouse, Urea Bulk Warehouse, West Pond*, Krehbiel Pond*, 2 Unnamed Ponds	Potential source area for nitrate/ammonia impacts to surface water and groundwater. Surface and subsurface soil samples were collected throughout the area for nitrate and ammonia analysis. In addition, sediment samples were collected from the West Pond, Krehbiel Pond, and the two unnamed ponds for nitrate and ammonia analysis.	A
2	West Extension Pond, West Effluent Pond, East Effluent Pond, West Lime Pond, Rundown Pond, Overflow Pond, East Lime Pond	Primary storage area for controlling surface water runoff from the site. Pond sediment samples were collected from the West Effluent Pond, East Effluent Pond, West Lime Pond, Rundown Pond, Overflow Pond, and East Lime Pond for nitrate, ammonia, Total Kjeldahl Nitrogen, RCRA metals, hexavalent chromium and TCLP VOC analysis.	B
3	Lime Sludge Landfill	As this landfill is considered closed by KDHE, further characterization activities were not conducted in this area.	B
4	Central Storm Water Pond Watershed and Outlying Areas	No known historical processes were performed in this area; therefore potential impacts to this area are not likely. However, a representative number of surface and subsurface samples was collected from this area for nitrate and ammonia analysis.	C
5	Catalyst Landfill	Catalysts, including chromium oxide, were disposed of in this landfill. The chromium-containing catalysts were tested for EP Toxicity before disposal. However, the landfill was not investigated during the CI. Surface and subsurface soil samples were collected from the vicinity of this landfill for total RCRA metals analysis. A sample of the catalyst material was retrieved and submitted for TCLP analysis.	D
6	East Storm Water Pond Watershed, Solid Waste Landfill 1 & 2, Airco Facilities, Administration Building and Parking, Material Warehouse and Machine Shop	No known historical processes were performed in this area, and the two solid waste landfills are considered closed by KDHE; therefore potential impacts to this area are not likely. However, a representative number of surface and subsurface samples were collected from this area for nitrate and ammonia analysis to confirm the absence of impacts.	F

Area	Primary Features Included in Area	Site Characterization Approach	Reclassification Area
7	Oil Pond	The Oil Pond was used for fire control training with waste oil used as the ignitable medium. During the CI investigation samples were collected for metals, VOC, and semi-VOC analysis. Samples were not collected for petroleum-type hydrocarbon analysis. Therefore, surface and subsurface samples were collected in the vicinity of this pond for petroleum hydrocarbon analysis.	D
8	Spill Pond	The Spill Pond was constructed to contain potential spills from the unloading of No. 2 fuel oil which was used as a backup fuel source. This area was investigated during the CI; however, to confirm the absence of impacts, surface and subsurface samples were collected in the vicinity of this pond for petroleum hydrocarbon analysis.	D
9	#2 Urea Area	Urea was produced in this area, generating process waters high in concentrations of urea and ammonia. These process waters were pumped to the Rundown Pond for re-use. Surface and subsurface samples were collected in the vicinity of this plant process area for nitrate and ammonia analysis.	D
10	Chrome Reduction Area (CRS Unit)	As this area has been characterized during a RCRA closure process and is currently in post-closure monitoring, further characterization of this area was not performed. Monitoring wells MW-2 and MW-3 at this area were sampled during the groundwater investigation, with samples submitted for nitrate and ammonia analysis. A work plan is currently in development for remediation of the low (4-6) pH in groundwater in the vicinity of the former acid pond associated with the chrome reduction system.	D
11	Paint Shop, Garage, Gravel Lot	This area was used for the storage and use of paints and solvents, as well as the storage of used oil. This area was investigated during the CI and minor impacts were reported. Therefore, surface and subsurface samples were collected in this area for petroleum hydrocarbon, VOC, and total RCRA metals analysis.	D
12	Ammonia Production - Primary Reformer Area	This area was used for the storage and use of paints and solvents, as well as the storage of used oil. This unit has been sold and is scheduled to be removed from the site during calendar year 2005. Once the equipment has been removed, surface and subsurface samples may be collected from the area near the location of the used oil tote. However, based on visual inspection, visibly-impacted soils may be excavated without a pre-characterization investigation.	D
13	Cooling Towers	Several cooling towers are located around the site with the majority of the cooling towers located in this area. The cooling towers were investigated during the CI, and chromium concentrations were detected with the maximum concentration reported at 1,040 mg/kg. Therefore, surface soil samples were collected in this area for RCRA metals analysis to evaluate potential metals contamination associated with the cooling towers.	D
14	Nitric Acid Area	Nitric acid produced in this area was used in the production of ammonium nitrite. Surface and subsurface samples were collected from this area for nitrate and ammonia analysis.	D
15	Boiler Furnace and Fuel Oil Storage	Fuel oil was burned in the boiler furnaces, and the fuel oil was stored in aboveground tanks located just south of the furnaces. Surface and subsurface samples were collected in the vicinity of the furnaces and the aboveground tanks and submitted for petroleum hydrocarbon analysis.	D
16	Old Ammonia Area	The old ammonia plant was dismantled and taken out of service in 1971. This plant utilized large diesel compressors that contained oil, as well as using diesel as a fuel source. Surface and subsurface samples were collected from around the perimeter of the foundation of the former compressor building and submitted for petroleum hydrocarbon, nitrate, and ammonia analysis.	D

Area	Primary Features Included in Area	Site Characterization Approach	Reclassification Area
17	West Storm Water Pond Watershed and Outlying Areas	No known historical processes were performed in this area; therefore potential impacts to this area are not likely. However, a representative number of surface and subsurface samples were collected from this area for nitrate and ammonia analysis.	E
18	Imhoff Tank	The Imhoff Tank is used to settle solids from the plant's sanitary sewage and is still in use. The waste stream received may include small amounts of laboratory wastes. The sludge contained in the tank will be sampled for RCRA metals, VOCs, and semi-VOC analysis at a later date, after the tank is no longer in service, and therefore was not included in this investigation.	A
19	Drainage Ditch	The Drainage Ditch extends from the south end of the facility to the ponds located in the northeast corner of the facility. This ditch was investigated during the CI. However, to confirm the absence of environmental impacts, surface and subsurface samples were collected along the length of the ditch for analysis of nitrate and ammonia, with select samples also analyzed for RCRA metals. The Drainage Ditch was divided into two segments; Segment A-B and Segment B-C. Samples along Segment A-B were collected at approximately 500-foot intervals. Samples along Segment B-C were collected at approximately 250-foot intervals, as this stretch of the creek length is adjacent to potential ammonia and nitrate source areas.	F

*West Pond and Krehbiel Pond were reclassified as part of Area B.

As stated, the focus of characterization of each area was to gather the necessary data to address whether an area is contributing environmental impacts to storm water and groundwater quality.

As outlined in the *Site Characterization Work Plan, Former Farmland Nitrogen Plant, Lawrence, Kansas;* dated January 7, 2005, Revised February 7, 2005, the general approach used during the characterization of Areas A through F was the collection of surface and subsurface soil samples within each specific area using direct-push sampling and/or hand auger sampling techniques. Surface sediment and shallow sediment samples were also collected from the ponds. Sample collection was based on predetermined locations where potential contaminants are believed to be located or, in the absence of such areas, samples were collected in a non-targeted grid or modified grid pattern. These sample locations were field-modified as necessary based on the presence of on-site structures, terrain, and/or results obtained from adjacent sampling locations. All sample locations were logged and recorded using handheld Global Positioning System (GPS) units. The recorded coordinates were used to position the sample locations on **Figure 4-9** and the figures presented in Appendix C. There is a margin of error of approximately 15 feet, as recorded in the field during GPS locating of the samples.

Samples collected from a specific area were submitted either to the on-site laboratory (nitrate and ammonia) or fixed-base off-site laboratory for analysis of the chemicals that were specific to area operations. For areas where former processes were not performed, samples were analyzed for nitrate and ammonia only. The initial short term goal of the site characterization investigations is the collection of baseline data on the various areas of the site, to evaluate the contribution each area may have on surface water which is accumulated in the pond system at the Property. The long term goal of the site characterization investigation is to identify areas of the Property that are available, or can be made available with reasonable effort, for beneficial re-use.

A detailed summary of the field investigation activities performed is provided in the following sections.

4.1.1 Description of Areas A-F

The site was initially broken into 19 areas in support of the site characterization field effort. For reporting purposes and presentation of the data, these areas were reclassified into six areas ,Areas A, B, C, D, E, and F, based on former operations on site in a specific area of the property, and the analytical results for the samples collected. These areas are shown on **Figure 2-2**.

AREA A: UAN STORAGE AREA

Area A is comprised of what formerly had been designated as the UAN Storage Area, Ammonia Nitrate Processing Area, Nitrate Bulk Warehouse, and Urea Bulk Warehouse. This area comprises approximately 120 acres and lies in the north central area of the property (**Figure 2-2**). This area is topographically the highest area of the property. In support of site characterization activities, 473 surface and subsurface soil samples, 19 groundwater samples, and 7 sediment samples were collected from this area. Per the SC work plan, 201 samples had been planned to be collected. The additional samples were required due to the depth of the soil overlying bedrock at the northern and northeastern end of Area A. Locations for the samples collected in Area A are shown on **Figure 4-11**. All samples collected were retrieved using direct push sampling techniques.

AREA B: NORTHERN PONDS

Area B is comprised of a series of ponds located in the far northeastern area of the site. These ponds are in order from west to east are the Krehbiel Pond and West Pond, the West Extension Pond, the West Effluent Pond, the East Effluent Pond, the West Lime Pond, the Rundown Pond, the Overflow Pond, and the East Lime Pond. The latter six ponds are designated in this SCR as the primary ponds. This total area covers approximately 55 acres. The six primary ponds were designed to receive different process waters and storm water runoff. The approximate design dimensions of these ponds as obtained from historical as-built drawings are:

Table 4-2
Northern Pond Dimensions

Pond Name	Length	Width	Designed Depth
West Effluent Pond	1,250 feet	380 feet	8 feet
East Effluent Pond	1,025 feet	195 feet	10 feet
West Lime Pond	850 feet	212 feet	10 feet
Rundown Pond	950 feet	420 feet	17 feet
Overflow Pond	600 feet	350 feet	14.5 feet
East Lime Pond	550 feet	250 feet	10 feet
West Extension Pond (Triangular pond)	510 feet x 450 feet x 225 feet	NA	10 feet
Krehbiel Pond	450 feet	75 feet	Unknown
West Pond	300 feet	75 feet	Unknown

At the time of the site characterization investigation in April–May 2005, the six primary ponds contained an estimated 32.5 million gallons of water.

In support of characterization of the pond sediments, samples were collected from 84 locations in Area B. The SC work plan had 61 locations planned for sampling. Additional samples were collected for TCLP analysis and for re-sampling efforts at the West Lime Pond, the Rundown Pond, and the East Lime Pond.

AREA C: FORMER AREA 4

Area C is located in the northwest site area and is comprised of approximately 85 acres of grass and wooded land. This area has been designated as the Central Storm Water Pond Watershed. This area had not been used in the past for site operations. In support of site characterization activities, soil samples were collected from 49 locations in Area C. Nineteen (19) samples had been planned for this area per the SC work plan.

AREA D: OPERATIONS AREA

Area D is located in the south central area of the site and borders Highway K-10 to the north. This area covers approximately 65 acres and was the main plant area. This area is comprised of eleven sub-areas that have been designated as:

- Oil Pond: The Oil Pond was used for fire control training, with waste oil used as the ignitable medium.

- Spill Pond: The Spill Pond was constructed to contain potential spills from the unloading of No. 2 fuel oil which was used as a backup fuel source.

- Urea Area: Urea was produced in this area, generating process waters high in concentrations of urea and ammonia. These process waters were formerly pumped to the Rundown Pond for re-use.

- Chrome Reduction Area (CRS Unit): Although included in this report as an area of concern, the CRS Unit has been characterized during a RCRA closure process and is currently in post-closure monitoring, therefore further characterization of this area was not performed. All monitoring wells at this area were sampled during the groundwater investigation with samples submitted for nitrate and ammonia analysis. Samples from MW-2 and MW-3 were also submitted for RCRA metals analysis. A work plan is currently in development for remediation of the low pH in groundwater in the vicinity of the former acid pond associated with the chrome reduction system. The Kansas Bureau of Waste Management approved the first phase of this work plan on September 2, 2005. The CRS remediation work plan is intended to expedite the remediation of the low pH in this area.

- Paint Shop Maintenance Area: This consists of the Paint Shop, Garage, and Gravel Lot. This area was used for the storage and use of paints and solvents, as well as the storage of used oil.

- Ammonia Production - Primary Reformer Area: This area was used for the production of ammonia and also includes the primary reformer that was used to incinerate used oil. The

primary reformer has been sold, and is scheduled to be removed from the site during calendar year 2006.

- Cooling Towers: Several cooling towers are located on the facility property with the majority of the cooling towers located in this area.

- Nitric Acid Area: Nitric acid produced in this area was used in the production of ammonium nitrite.

- Boiler Furnace and Fuel Oil Storage: The Boiler Furnace used natural gas, but utilized #6 fuel oil as a backup fuel source. The fuel oil was stored in aboveground tanks located just south of the furnaces.

- Old Ammonia Plant: The old ammonia plant was dismantled and taken out of service in 1971. This plant utilized large diesel compressors that contained lubricant oil as well as using diesel as a fuel source.

- Catalyst Landfill: Catalysts, including chromium oxide, were disposed of in this landfill.

Eighty-six (86) sample locations had been planned to be collected form Area D per the SC work plan. Eighty-seven (87) sample locations were sampled from the subareas comprising Area D.

AREA E: FORMER AREA 17, Southwest Site Area

The Southwest Site Area consists of approximately 50 acres that border the western boundary of the site and extends south of the administration building and adjacent to the north of Highway K-10. This area of the Farmland property is vegetated with native grasses and has not been used for primary plant operations. Thirteen (13) sample locations were proposed in this area per the SC work plan. Thirty-six (36) locations were sampled in the execution of the work plan.

AREA F: FORMER AREA 6 AND 19, Southeastern Site Area

The Southeastern site area is undeveloped natural terrain that contains primarily grasslands, shrubs and natural drainage features. This 90-acre area was not utilized in facility operations. This area is bordered to the south by Highway K-10 and to the east by an industrial park. Forty-three (43) samples were collected from Area F. Forty-two (42) samples were planned for collection per the SC work plan. A total of 329 sample locations had been designated in the work plan for sampling. The final sample location number was 404.

The description of activities, and the results of the analyses performed in each of these six areas are discussed in the following sections.

4.2 MONITORING WELLS/GROUNDWATER CHARACTERIZATION AND FRENCH DRAIN SYSTEM

Groundwater characterization activities were performed as an initial site characterization activity utilizing the existing monitoring well network in accordance with the approved Work Plan. Groundwater characterization activities were conducted from February 2005 through April 2005 and included the following:

- Evaluation of the condition of the existing monitoring well network;
- Redevelopment of select monitoring wells;
- Gauging the monitoring wells deemed suitable for the collection of groundwater levels and total depth measurements; and
- Sampling select groundwater monitoring wells for laboratory analysis.

The original groundwater monitoring network identified in the Site Characterization Work Plan consisted of thirty-six (36) wells. Eleven (11) wells were installed into the sandstone aquifer, ten (10) wells were installed in the perched aquifer, and fifteen (15) wells were installed in the deep alluvial aquifer. During the site characterization an additional six wells were identified and included in this investigation, bringing the total number of wells to 42.

Table 4.3 presents the wells and identifies the zone/aquifer in which the well is screened.

Table 4-3
Monitoring Well Specifications
Former Farmland Nitrogen Plant
Lawrence, Kansas

Monitoring Well ID	Measured Total Depth (feet)	Screen Interval	Aquifer Designation
MW-01	28.08	15-25	Bedrock Water-Bearing Zone
MW-02	28.95	16-26	Bedrock Water-Bearing Zone
MW-03	24.33	16-26	Bedrock Water-Bearing Zone
MW-04	28.77	15-25	Bedrock Water-Bearing Zone
MW-05	31.84	20-30	Bedrock Water-Bearing Zone
MW-06	21.92	9.5-19.5	Silty Clay Aquifer & Bedrock Water-Bearing Zone
MW-07	25.86	13.5-23.5	Silty Clay Aquifer & Bedrock Water-Bearing Zone
MW-08	44.09	32.5-42.5	Bedrock Water-Bearing Zone
MW-09	36.46	24-36	Bedrock Water-Bearing Zone
MW-10	7.71	2.75-4.75	Silty Clay Aquifer
MW-11	10.02	5.75-7.75	Silty Clay Aquifer
N-01	24.92	4-20	Silty Clay Aquifer & Bedrock Water-Bearing Zone
N-02	22.26	4-20	Silty Clay Aquifer & Bedrock Water-Bearing Zone
OW-19	19.55	Not Known	Silty Clay Aquifer
PSW-01A	27.40	5-20	Silty Clay Aquifer
PSW-01B	62.14	39-59	Deep Alluvial Aquifer
PSW-02A	22.05	5-20	Silty Clay Aquifer
PSW-02B	57.46	40-55	Silty Clay & Deep Alluvial Aquifers
PSW-03A	26.08	5-25	Silty Clay Aquifer
PSW-03B	60.00	45-60	Deep Alluvial Aquifer
PSW-03B*	60.00	47-57	Deep Alluvial Aquifer
PSW-04	57.00	39-54	Deep Alluvial Aquifer
PSW-05A	28.41	5-25	Silty Clay Aquifer
PSW-05B	60.59	37-57	Deep Alluvial Aquifer
PSW-06A	27.66	5-25	Silty Clay Aquifer
PSW-06B	60.00	50-60	Deep Alluvial Aquifer
PSW-06B*	60.00	50-60	Deep Alluvial Aquifer
PSW-07A	21.97	5-20	Silty Clay Aquifer
PSW-07B	55.00	42-57	Deep Alluvial Aquifer & Bedrock Water-Bearing Zone
PSW-08	23.11	5-20	Silty Clay Aquifer & Bedrock Water-Bearing Zone
PSW-09A	23.18	5-20	Silty Clay Aquifer
PSW-09B	57.04	34.5-54.5	Deep Alluvial Aquifer
PSW-10	27.81	10-25	Silty Clay Aquifer & Bedrock Water-Bearing Zone
PSW-13A	24.02	5.5-20.5	Deep Alluvial Aquifer
PSW-13B	40.11	27-37	Bedrock Water-Bearing Zone
PSW-14	12.30	4.5-9.5	Silty Clay Aquifer
PSW-15	50.78	41-56	Deep Alluvial Aquifer
PSW-17	23.38	5.5-21.5	Silty Clay Aquifer
PSW-18	27.85	5-25	Silty Clay Aquifer

Table 4-3, Continued
Monitoring Well Specifications
Former Farmland Nitrogen Plant
Lawrence, Kansas

Monitoring Well ID	Measured Total Depth (feet)	Screen Interval	Aquifer Designation	
PW-01	70.00	45-65	Bedrock Water-Bearing Zone	
PW-04A	66.10	50-60	Deep Alluvial Aquifer & Bedrock Water-Bearing Zone	
PW-05	54.50	46-54	Deep Alluvial Aquifer & Bedrock Water-Bearing Zone	
PW-09	54.95	Not Known	Deep Alluvial Aquifer	
SW-10	64.00	50-60	Silty Clay Aquifer & Bedrock Water-Bearing Zone	

* Wells re-installed with same well ID.
Total Depth Measured during Site Characterization Investigation
Total Depth not measured on wells with submersible pumps (Wells 3B, 6B and 7B)

In addition to the monitoring well network, a total of seven groundwater interceptor trenches have been installed on site and are referred to as the French Drain system. It is located along the northern boundary of the site.

The French Drain system has been installed along and parallel to the BNSF railroad tracks along the northern property boundary. This French Drain system is designed to intercept shallow nitrate-impacted groundwater perched on a clayey alluvium below Farmland's industrial ponds. Groundwater accumulating in this French Drain had been pumped out from two sumps (Northwest and Northeast) and returned to the Rundown Pond to provide makeup water for operations at the facility during the time it was operational.

An addition to the French Drain system was installed in two areas. A west leg of approximately 1,040 feet was installed north of the Lime Sludge and Effluent Ponds connecting with an existing sump (Northwest). An East leg of approximately 870 feet was installed north of the closed sludge landfill and overlapping an existing French Drain on the north side of the Rundown and Overflow Ponds. This east leg was designed to drain into a new sump (Northeast). The French Drain system is depicted on **Figure 4-1**.

In addition, there are three segments of French Drain that run along the east, south and west sides of the Rundown/Overflow Ponds. The west segment drains to the north and accumulates in the Northwest sump. The south and east segments drain to the south and east, accumulate in the southeast sump and are pumped into the overflow pond.

In addition, an existing French Drain system consisting of two lines, each with a sump (North and South), located farther west and parallel to the base of a sandstone hill, has been cleaned out and

fitted with new pumps to recover nitrate-impacted groundwater in this vicinity. In 1975, in response to an identified problem of nitrate in the groundwater near the base of a sandstone hill north of the main process area of the facility, Farmland installed a system of two French Drains to intercept groundwater in the Silty Clay Aquifer Zone and Deep Alluvial Alluvial aquifer (Kansas River Alluvium). These two drains, designated North and South, each have a sump located in the center of two runs of vitrified clay pipe extending along and parallel to the base of the sandstone hill.

Each sump is equipped with a pump that is on level control using floats. As the water level increases in the sump, the float turns on the sump pump which then pumps the water into either the Rundown Pond, Overflow pond, or West Extension Pond.

Sump	Sump Depth	Flow Rate (gallons per minute)
NW	approx. 17.5'	approx. 4-5 gpm
NE	approx. 18'	approx. 1 gpm
N	approx. 15'	approx. 1 gpm
S	approx. 16.5'	approx. 2 gpm
SE	approx. 16.5'	approx. 3 gpm

4.2.1 Monitoring Well Evaluation and Redevelopment

The initial step in performing groundwater site characterization activities was to perform an evaluation of the existing monitoring well network and determine those monitoring wells that would provide representative groundwater samples without installing additional monitoring wells at this time. The locations of the existing monitoring wells are shown on **Figure 4-1**. A complete round of sampling of the available wells had not been completed for several years. The evaluation incorporated the following criteria:

- Apparent damage to the wellhead,
- Surface seal integrity,
- Current total well depth versus installed well depth, and
- Date last sampled.

Monitoring wells were deemed suitable for sampling if there was no apparent damage to the wellhead or surface seal, current total depth of the wells were within 5% of the installed total depth, and they were sampled within the last two (2) years. Wells that had not been sampled in the last two (2) years required redevelopment in order to determine well integrity.

Fourteen (14) monitoring wells (N-01, N-02, OW-19, 0W-27, PSW-08, PSW-10, PSW-13A, PSW-13B, PSW-14, PW-01, PW-03B, PW-05, PW-06 and SW-10) were selected for redevelopment as part of groundwater characterization activities.

Redevelopment activities were performed on nine (9) wells (N-01, N-02, OW-19, 0W-27, PSW-08, PSW-10, PSW-13A, PSW-13B, and PSW-14) using polyethylene disposable bailers. During

redevelopment activities, all wells except one were bailed dry. Redevelopment was attempted on five (5) wells (PW-01, PW-03B, PW-05, PW-06 and SW-10) using a submersible pump. Three of these five wells were successfully redeveloped. Two (2) wells (PW-03B and PW-06) were not able to be redeveloped using the pump due to well fouling problems.

Three wells were found to be unsuitable for sampling based on these redevelopment activities. Monitoring wells PW-03B and PW-06 had fouling issues, and well OW-27 had a broken casing approximately 3 feet below top of casing. The remaining eleven (11) wells that were redeveloped were added to the list of wells to be sampled as part of site characterization activities. Additional information regarding redevelopment activities is included in **Table 4.4**.

Table 4-4
Monitoring Well Redevelopment Activities
Former Farmland Nitrogen Plant
Lawrence, Kanas

Well ID	Total Depth (Well Log)[1]	Measured Total[2]	Redevelopment Required?	Current Measured Total Depth (February 2005)[3]		Measured Length of Casing Above Grade (February 2005)[4]	Screen Length (Well Log)	Well Installation Date	Notes
		8/94 CI Report		Before Redevelopment	After Redevelopment				
PSW-1A	21.0'	23.16'	No				15'	06/30/93	
PSW-1B	59.5'	61.29'	No				20'	06/30/93	
PSW-2A	20.0'	22.06'	No				15'	05/12/94	
PSW-2B	55.0'	58.24'	No				15'	05/12/94	
PSW-3A	25.5'	27.88'	No				20'	09/01/93	
PSW-3B	57.0'	63.02'	No				10'	05/11/94	
PSW-4			No						
PSW-5A	25.0'	28.51'	No				20'	09/09/93	
PSW-5B	57.0'	59.94'	No				20'	09/09/93	
PSW-6A	25.0'	27.66'	No				20'	09/02/93	
PSW-6B	60.0'	60.75'	No				10'	06/09/94	
PSW-7A	20.0'	21.90'	No				15'	05/10/94	
PSW-7B	57.0'	60.40'	No				15'	05/10/94	
PSW-8	20.0'	22.88'	Yes	22.87'	22.89'	2.65'	15'	08/31/93	Can be bailed dry. Water is very silty, but will probably clean up. Concrete pad needs repair.
PSW-9A	20.0'	22.91'	No				15'	09/01/93	
PSW-9B	55.0'	57.19'	No				20'	07/01/93	
PSW-10*	25.0'	27.61'	Yes	27.55'	27.58'	3.5'	15'	09/03/93	Bailed dry. Water is silty, but should clean up.
PSW-13A	21.0'	23.86'	Yes	23.73'	23.83'	2.83'	15'	06/29/93	Bailed dry. Water is silty, but should clean up.
PSW-13B			Yes	39.70'	39.68'	2.67'			This well above ground was reconstructed due to being run over. New casing installed from ground level up. Did not bail dry due to length of bailer. Water was silty.
PSW-14	9.5'	12.05'	Yes	12.04'	12.07	2.83'	5'	07/02/93	
PSW-15			No						
PSW-17	21.0'	23.39'	No				15'	06/29/93	

Table 4-4
Monitoring Well Redevelopment Activities
Former Farmland Nitrogen Plant
Lawrence, Kanas

Well ID	Total Depth (Well Log)[1]	Measured Total[2] 8/94 CI Report	Redevelopment Required?	Current Measured		Measured Length of Casing Above Grade	Screen Length (Well Log)	Well Installation Date	Notes
				Before Redevelopment	After Redevelopment				
PSW-18	25.0'	27.88'	No				20'	09/02/93	
OW-27	32.0'	32.00'	Yes	31.93'	32.85'	1.31'	6'	04/23/75	Casing has a break and offset approx. 3' below TOC. Able to get a bailer in. Bailed fairly quickly. Water silty. Should clean up.
MW-9	36.7'	36.70'	No				10'	09/17/85	
N-1	20.0'	20.00'	Yes	25.05'	25.00'	0.67'	16'		Casing is bent/bowed. Soil has been pushed around the casing/protective cover. At time of bailing, water was standing on surface around the well casing. Water silty.
N-2	20.0'	20.00'	Yes	22.05	22.15'	1.67'	16'		Bailed dry. Water was clean until right at end. Went silty. Should clean up.Bottom feels soft. Soil has been pushed up around this well. Concrete pad is covered.
PW-1	65.0'	65.67'	Yes	65.63'	65.72'	1.42'	20'	06/25/75	Pumped ~130 gallon water. Well went dry. A lot of silt in water. Should cleanup.
PW-2	58.0'	57.50'	Yes				4'	06/25/75	
PW-2A	63.0'	61.88'	Yes				10'	06/28/83	
PW-3B	59.0'	58.45'	Yes	60.51'	60.85'	1.67'	7'	06/28/83	Pumped very rusty water. Eventually plugged pump with rust. Pumped ~120 gallon before plugging pump. Water level dropped from 20.7' below TOC to 50.8' below TOC during pumping. Since it is an alluvial well, should not have dropped in level significantly. Indication of plugged screens.
PW-5	54.0'		Yes				8'		Not investigated yet. An old pump is in the well.
PW-6	54.0'	51.60'	Yes	53.11'		1.33'	8'	09/26/75	Tried to pump. Pump kept plugging with debris. Will need some other way to clean well that submersible pump.
SW-10	60.0'	63.44'	Yes	63.45'	63.50'	2.38'	10'	05/28/85	Pumped ~120 gallon water. Started silty and was pumping clean water at end. Water level did not decline during pumping.
OW-19			Yes	19.30'	19.30'	3.33'			Located west end of big bag whse along 15th Street fence. Close proximity to SW-10. 3" PVC casing.

1 - Based on total depth below grade as recorded on well log.
2- Measured from TOC
3 - Measured from TOC.
4 - Measured from ground surface to TOC.
* - Condition of PSW-10 has not yet been confirmed.

4.2.2 Groundwater Measurements

Following the monitoring well network evaluation, forty-two (42) monitoring wells were selected for groundwater measurement and sampling activities. Monitoring well locations are depicted on **Figure 4-1**.

Eleven (11) shallow monitoring wells, designated as "MW" and located in the southern portion of the plant in the vicinity of the former chromium reduction system (CRS) were selected for sampling activities (Area D). Twenty-one (21) deep and shallow monitoring wells located in the northern portion of the plant area (Areas A and B) and north of the plant boundary were selected for sampling activities. Monitoring wells designated for sampling and their respective aquifers are included in **Table 4-5**.

Depth to groundwater and/or total depth measurements were collected to within ±0.01 feet from the forty-one (41) monitoring wells using a Herron® electronic water level indicator. Measurements were recorded in feet in the Field Log Book. Groundwater level measurements or depth measurements were not able to be collected from monitoring well PSW-3B. The gauging port in the cap of the well was not large enough to allow access to the water level probe. Total depth measurements were not able to be collected from monitoring wells PSW-3B, PSW-6B and PSW-7B due to dedicated pumps. Total depth measurements were collected for the remaining thirty-seven (37) wells.

During groundwater gauging activities, the wells were evaluated for possible sampling for volatile organic compounds (VOCs). A photoionization detector (PID) was inserted into the top of the well casing immediately following removal of the well cap. PID readings were collected and recorded in the Field Log Book. All PID readings were 0.00 parts per million volume (ppmv) and therefore no VOC samples were collected during the groundwater characterization activities. The PID was calibrated daily and the calibration procedure and instrument readings were recorded in the calibration log for the unit.

Top of casing survey elevations were used in the calculations of groundwater elevations. Groundwater elevations were calculated by subtracting the measured depth to water in feet from the top of casing elevations on file. Groundwater elevations are included in **Table 4-6**.

Table 4-5
Sampled Monitoring Wells
Former Farmland Nitrogen Plant
Lawrence, Kansas

Well ID	Nitrate plus Nitrite	Ammonia as Nitrogen	RCRA Metals	Comments
PSW-01A	x	x	x	
PSW -01B	x	x	x	
PSW-02A	x	x	x	
PSW-02B	x	x	x	
PSW-03A	x	x	x	
PSW-03B	x	x	x	
PSW-04	x	x	x	
PSW-05A	x	x	x	
PSW-05B	x	x	x	Not Sampled due to damage in casing
PSW-06A	x	x	x	
PSW-06B	x	x	x	
PSW-07A	x	x	x	
PSW-07B	x	x	x	
PSW-08	x	x		
PSW-09A	x	x		
PSW-09B	x	x		
PSW-10	x	x		
PSW-13A	x	x		
PSW-13B	x	x		
PSW-14	x	x		Dry - Not Sampled
PSW-15	x	x		
PSW-17	x	x		
PSW-18	x	x		
PW-01	x	x		
PW-04A	x	x		
PW-05	x	x		
PW-09	x	x		
N-01	x	x		
N-02	x	x		
SW-10	x	x		
OW-19	x	x		
MW-01	x	x		
MW-02	x	x		
MW-03	x	x	x	
MW-04	x	x		
MW-05	x	x		
MW-06	x	x	x	
MW-07	x	x		
MW-08	x	x		
MW-09	x	x		
MW-10	x	x		Dry - Not Sampled
MW-11	x	x		

Table 4-6
Monitoring Well Groundwater Elevations
Former Farmland Nitrogen Plant
Lawrence, Kansas

SITE	DATE	MP ELEVATION (feet)	DEPTH TO WATER (feet)	WATER ELEVATION (feet)
MW-01	4/7/2005	867.14	24.14	843.00
MW-02	4/7/2005	864.86	19.65	845.21
MW-03	4/7/2005	866.05	24.33	841.72
MW-04	4/7/2005	867.14	8.03	859.11
MW-05	4/7/2005	872.27	10.57	861.70
MW-06	4/7/2005	862.42	9.85	852.57
MW-07	4/7/2005	859.48	11.69	847.79
MW-08	4/7/2005	859.59	13.15	846.44
MW-09	4/7/2005	862.17	13.90	848.27
MW-10	4/7/2005	865.96	D	NA
MW-11	4/7/2005	864.13	9.40	854.73
N-01	4/7/2005	889.83	15.61	874.22
N-02	4/7/2005	889.83	13.24	876.59
OW-19	4/7/2005	824.50	10.42	814.08
PSW-01A	4/7/2005	822.16	7.45	814.71
PSW-01B	4/7/2005	822.57	28.51	794.06
PSW-02A	4/7/2005	820.56	9.73	810.83
PSW-02B	4/7/2005	820.22	26.46	793.76
PSW-03A	4/7/2005	823.32	12.42	810.90
PSW-04	4/7/2005	822.01	28.68	793.33
PSW-05A	4/7/2005	823.18	5.65	817.53
PSW-05B	4/7/2005	823.06	28.20	794.86
PSW-06A	4/7/2005	823.30	8.31	814.99
PSW-06B	4/7/2005	824.34	43.15	781.19
PSW-07A	4/7/2005	821.31	7.73	813.58
PSW-07B	4/7/2005	822.89	29.51	793.38
PSW-08	4/7/2005	848.45	10.65	837.80
PSW-09A	4/7/2005	821.92	13.97	807.95
PSW-09B	4/7/2005	823.03	31.09	791.94
PSW-10	4/7/2005	842.97	9.10	833.87
PSW-13A	4/7/2005	844.06	6.65	837.41
PSW-13B	4/7/2005	844.31	9.56	834.75
PSW-14	4/7/2005	901.39	11.93	893.46
PSW-15	4/7/2005	822.34	30.59	791.75
PSW-17	4/7/2005	841.85	9.55	832.30
PSW-18	4/7/2005	823.14	6.35	816.79
PW-01	4/7/2005	842.85	28.40	814.45
PW-04A	4/7/2005	822.14	17.05	805.09
PW-05	4/7/2005	815.85	23.11	792.74
PW-09	4/7/2005	819.09	26.40	792.69
SW-10	4/7/2005	826.73	34.15	792.58

D = Dry

4.2.3 Groundwater Sampling

Groundwater sampling activities were performed in April 2005 following groundwater level measurement collection. Low flow groundwater sampling techniques were used to purge each monitoring well in order to minimize draw down of the water column during purging activities and reduce turbidity in the groundwater sample. Alternative sampling procedures were used for purging and sampling in four (4) monitoring wells (MW-11, PSW-03B, PSW-06B and PSW-07B) due to well conditions at the time of sampling.

Well purging was performed utilizing an adjustable rate Sample Pro® portable micro-purge bladder pump, Air Wizard air compressor and air pump controller. The bladder pump was slowly lowered into the well at a rate to minimize disturbance to the water column and positioned in the center of the saturated well screen length. The depth and position of the well screen was based on historical well logs.

Groundwater was then pumped from the monitoring wells at a rate of 0.100 to 0.350 liters per minute. The flow rate was calculated using a graduated cylinder (container volume divided by time to fill) and recorded in the Field Log Book. Indicator field parameters (temperature, specific conductivity, Eh, turbidity, dissolved oxygen and pH) were monitored during purging using an YSI 6920 water quality meter with a flow-through cell connected to the bladder pump with clean plastic tubing. The water quality meter was calibrated daily when in use and the calibration results were recorded in the Field Log Book.

Each monitoring well was purged until the indicator field parameters reached stabilization. The indicator field parameters were considered to be stable when specific conductivity readings were within +/- 3 percent, temperature readings were within +/- 10 percent and pH readings were within +/- 0.2 units for three (3) consecutive readings. Field parameters recorded for each well prior to sampling are presented in Table 4-7.

Upon stabilization of the indicator field parameters, the monitoring well was then sampled via the bladder pump. The effluent tubing from the pump was disconnected from the flow-through cell and the sample was collected at the same pumping rate as used during purging. The samples were collected in certified clean, pre-preserved laboratory containers.

Following sample collection, all non-disposable equipment was decontaminated using a tap-water alconox solution and a de-ionized triple water rinse. New tubing and bladders were used at each monitoring well. The tubing from each well was placed inside the well casing following sampling for potential future sampling events.

Collected decontamination and purge water was land-applied adjacent to the associated monitoring well.

Table 4-7
Monitoring Well Sampling Physical Parameters
Site Characterization Investigation
Farmland Industry Trust
Lawrence, Kansas

Monitoring Well	Date	Time	Pump Rate (L/min)	Temperature (°C)	pH	Specific Conductivity (uS/cm)	Dissolved Oxygen	Turbidity (NTU)
MW-01	4/19/2005	11:10	125	17.64	6.81	2,838	-3.9%	17.1
MW-02	4/19/2005	15:21	300	15.78	4.03	2,063	83.3%	0.8
MW-03	4/20/2005	10:52	100	25.84	4.30	2,220	80.7%	200.4
MW-04	4/14/2005	16:47	100	17.28	7.11	687	134.8%	0.6
MW-05	4/19/2005	16:27	100	17.83	7.05	742	38.6%	8.3
MW-06	4/20/2005	9:20	100	15.3	6.24	1,049	47.2%	19.5
MW-07	4/19/2005	13:27	100	20.04	6.55	1,802	9.7%	45.2
MW-08	4/19/2005	14:21	100	18.4	6.84	866	18.2%	87.2
MW-09	4/14/2005	9:05	100	13.19	6.89	333	101.3%	284.9
MW-10[a]	—	—	—	—	—	—	—	—
MW-11[b]	4/12/2005	—	—	—	—	—	—	—
N-01	4/8/2005	11:28	100	13.95	5.60	2,272	5.21 mg/l	3.5
N-02	4/8/2005	9:45	100	11.13	7.06	7,480	0.89 mg/l	5.3
OW-19	4/12/2005	11:17	100	10.81	7.15	507	7.84 mg/l	8.4
PSW-01A	4/13/2005	16:07	100	15.02	6.81	1,462	259.0%	41.2
PSW-01B	4/13/2005	15:27	300	15.10	6.81	517	88.5%	20.5
PSW-02A	4/13/2005	14:13	100	15.77	6.72	490	183.7%	10.27
PSW-02B	4/13/2005	13:34	300	14.61	6.75	482	14.24 mg/l	22.0
PSW-03A	4/8/2005	14:10	100	15.44	6.76	3,927	3.14 mg/l	9.8
PSW-03B[c]	4/8/2005	—	—	—	—	—	—	—
PSW-04	4/18/2005	14:24	200	17.43	7.24	522	10.0%	20.5
PSW-05A	4/18/2005	10:27	100	15.48	7.05	681	60.0%	15.4
PSW-05B[d]	—	—	—	—	—	—	—	—
PSW-06A	4/13/2005	10:08	100	12.03	7.33	1,486	10.26 mg/l	9.0
PSW-06B[e]	4/13/2005	9:35	NA	14.98	7.05	538	15.34 mg/l	1.6
PSW-07A	4/13/2005	11:33	100	11.97	6.37	2,317	15.79 mg/l	23.7
PSW-07B[e]	4/13/2005	10:50	NA	14.68	7.34	468	20.63 mg/l	3.0
PSW-08	4/8/2005	15:40	100	14.94	6.70	126	7.86 mg/l	180.9
PSW-09A	4/15/2005	10:15	100	13.82	6.83	247	92.8%	25.4
PSW-09B	4/15/2005	9:22	250	14.31	6.81	367	104.4%	7.8
PSW-10	4/19/2005	9:41	100	16.02	6.50	172	34.7%	82.8
PSW-13A	4/12/2005	14:10	100	13.22	6.52	5,636	3.3 mg/l	8.8
PSW-13B	4/12/2005	13:23	100	13.79	6.61	3,882	3.64 mg/l	20.6
PSW-14[a]	—	—	—	—	—	—	—	—
PSW-15	4/18/2005	13:28	250	17.53	7.19	500	10.7%	59.5
PSW-17	4/12/2005	15:05	100	12.06	6.75	1,970	8.33 mg/l	1.3
PSW-18	4/14/2005	15:35	100	15.54	5.11	122	68.1%	17.9
PW-01	4/12/2005	16:35	125	14.61	6.50	10,518	2.05 mg/l	4.3
PW-04A	4/14/2005	14:15	100	16.83	6.66	4,253	87.9%	7.8
PW-05	4/18/2005	11:25	100	15.48	7.19	733	46.3%	8.4
PW-09	4/18/2005	15:35	200	16.86	6.72	1,116	5.8%	29.6
SW-10	4/12/2005	10:25	150	13.43	6.40	711	2.42 mg/l	7.2

Parameters collected from a YSI 6920 flow-through cell

Dissolved oxygen readings were collected as mg/l in certain wells and percent in the remaining wells

[a] Monitoring wells were dry and no sample was collected

[b] MW-11 was hand bailed with a disposable PVC bailer, no parameters were taken

[c] Well contained a dedicated pump system, no parameters were taken

[d] MW-05B was damaged and no sample was collected

[e] Wells contained a dedicated pump system, one set of parameters were taken using the YSI 6920 after purge was complete

Low flow groundwater sampling techniques were not used for monitoring wells MW-11, PSW-03B, PSW-06B and PSW-07B. Monitoring well MW-11 yielded low volumes of water and was hand bailed dry using a new polyethylene disposable bailer. The sample was collected using the same bailer used in purging after the well was left to recharge for approximately 6 hours. Monitoring wells PSW-03B, PSW-06B and PSW-07B were unable to be sampled using low flow techniques due to dedicated submersible pumps. Groundwater from these wells was purged from the pump for approximately two (2) minutes prior to sampling.

Three (3) monitoring wells (PSW-14, MW-10 and PSW-05B) which were initially selected for groundwater characterization activities were not sampled. Monitoring wells PSW-14 and MW-10 had insufficient water volumes to sample. An attempt was made to sample well PSW-05B, however due to a bend in the casing approximately 4 feet below top of casing; the bladder pump became lodged in the well due to a bend in the PVC casing. The concrete well pad and top 4-5 feet of casing were destroyed while retrieving the bladder pump. This well was therefore not sampled. The well subsequently was repaired at the point of the break, duplicating original construction specifications. The bend in the casing could not be repaired to allow for sampling using low flow sampling equipment. This well would still be available for future sampling, but would require modified equipment from the Sample Pro® low flow sampling equipment used in support of this investigation.

Groundwater samples were collected for nitrate plus nitrite as nitrogen and ammonia analyses using Standard Method 4500 (SM-4500) in all thirty-nine (39) groundwater wells sampled. Nitrate plus nitrite as nitrogen and ammonia samples were collected in clean, plastic bottles pre-preserved with sulfuric acid. All samples were given unique identifiers, labeled, immediately placed on ice and submitted under chain of custody to FI Kansas Remediation Trust Lawrence Laboratory (on-site laboratory) for analysis.

Fourteen (14) groundwater samples were collected for RCRA metals (metals) analysis using USEPA Method 6010/7470. Metals samples were collected in clean, plastic bottles pre-preserved with nitric acid. All samples were given unique identifiers, labeled, immediately placed on ice and submitted under chain of custody to Pace Analytical Services, Inc. (Pace) for analysis.

Quality Control (QC) samples collected during groundwater sampling included field duplicates, field blanks, and rinsate blanks in accordance with the Work Plan. Field duplicate samples were collected at a rate of one in every ten (10) environmental samples for analysis by the same laboratory. Field duplicate confirmation samples were collected at a rate of one in every fifteen (15) environmental samples for analysis by different laboratories to evaluate the reproducibility of the on-site laboratory's data. Rinse blank samples were collected at a rate of one per day and one set of field blanks were collected to evaluate the source of de-ionized and tap water used during decontamination procedures. A complete summary of QA/QC samples is presented in Section 5.0 of this report.

Five (5) field duplicate samples were collected for analysis by the on-site laboratory for nitrate plus nitrite as nitrogen and ammonia. One (1) field duplicate was also collected and submitted to Pace for metals analysis. Three (3) field duplicate confirmation samples were collected for nitrate plus nitrite as nitrogen and ammonia analysis and submitted to Pace for analysis using USEPA Methods 353.2 and 350.1. These samples serve to confirm the on-site laboratory control.

4.2.4 Groundwater Sample Results

Thirty-nine (39) groundwater samples were collected from the groundwater monitoring well network during the groundwater characterization activities. Groundwater sample results indicated concentrations for nitrate plus nitrite as nitrogen in thirty-one (31) samples ranging from below laboratory detection limits (non-detect) to 1,780 mg/l reported in the sample collected from PW-01. Ammonia in groundwater was detected in twenty-two (22) samples ranging from non-detect to 1,140 mg/l reported in the sample collected from N-01.

Fourteen (14) groundwater samples collected during the site characterization activities were analyzed for metals. These monitoring wells were located in property areas where metals were believed to potentially impact local groundwater quality. Reported concentrations in the groundwater samples for arsenic in twelve (12) samples ranged from non-detect to 0.138 mg/l from PSW-03A. Barium in groundwater was detected in all fourteen (14) groundwater samples analyzed for metals and ranged in concentration from 0.0166 mg/l in well MW-03 to 1.99 mg/l in well PSW-03A. Chromium in groundwater was detected in three (3) wells ranging in concentration from non-detect to 0.0597 mg/l in well MW-03. Groundwater samples reported concentrations for selenium in four (4) wells ranging from non-detect to 0.0193 mg/l reported in the sample collected from well PSW-01B.

Metal concentrations were not reported above laboratory detection limits for cadmium, lead, mercury and silver in the 14 samples collected from the monitoring well network for metals analysis.

Groundwater results for the monitoring well network are presented in **Tables 4-8** and **4-9** and copies of the analytical laboratory reports from Pace and the on-site laboratory are included in **Appendix A** and **Appendix B**, respectively.

Table 4-8
Groundwater Analytical Results
Nitrate Plus Nitrite as Nitrogen and Ammonia
Former Farmland Nitrogen Plant
Lawrence, Kansas

Site	Date	Sample ID	Nitrate plus Nitrite (as N) (mg/l)	Nitrogen, Ammonia (mg/l)
MW-01	04/19/2005	MW-1	29.4	<0.06
MW-02	04/19/2005	MW-2	55.3	3.23
MW-03	04/20/2005	MW-3	16.1	<0.06
MW-04	04/14/2005	MW-4	26.9	<0.16J
MW-05	04/19/2005	MW-5	42.4	<0.06
MW-06	04/20/2005	MW-6	<0.06	5.97D
MW-07	04/19/2005	MW-7	98.9	<0.06
MW-08	04/19/2005	MW-8	<0.06	<0.06
MW-09	04/14/2005	MW-9	18.2	<0.24J
MW-11	04/12/2005	MW-11	0.86L	<0.10J
N-01	04/08/2005	N-1	414L	5.99
N-02	04/08/2005	N-2	1,620L	1,140
OW-19	04/12/2005	OW-19	1.96L	<0.11J
PSW-01A	04/13/2005	PSW-1A	111	<0.06
PSW-01B	04/13/2005	PSW-1B	<0.06	<0.46J
PSW-02A	04/13/2005	PSW-2A	3.03	<0.09J
PSW-02B	04/13/2005	PSW-2B	<0.06	<0.20J
PSW-03A	04/08/2005	PSW-3A	703L	<0.06
PSW-03B	04/08/2005	PSW-3B	<0.07JL	3.94
PSW-04	04/18/2005	PSW-4	<0.06	1.37
PSW-05A	04/18/2005	PSW-5A	5.34	0.36Z
PSW-06A	04/13/2005	PSW-6A	118	220
PSW-06B	04/13/2005	PSW-6B	2.80	4.94
PSW-07A	04/13/2005	PSW-7A	448	20.9
PSW-07B	04/13/2005	PSW-7B	<0.38J	1.59
PSW-08	04/08/2005	PSW-8	7.66L	0.13
PSW-09A	04/15/2005	PSW-9A	1.49	<0.80J
PSW-09B	04/15/2005	PSW-9B	6.58	<0.25J
PSW-10	04/19/2005	PSW-10	6.18	<0.06
PSW-13A	04/12/2005	PSW-13A	1,040L	426
PSW-13B	04/12/2005	PSW-13B	861L	7.12
PSW-15	04/18/2005	PSW-15	<0.15J	2.61
PSW-17	04/12/2005	PSW-17	280L	60
PSW-18	04/14/2005	PSW-18	5.98	1.21
PW-01	04/12/2005	PW-1	1,780L	900
PW-04A	04/14/2005	PW-4A	647	9.15D
PW-05	04/18/2005	PW-5	14.8	8.65
PW-09	04/18/2005	PW-9	24.2	31.9
SW-10	04/12/2005	SW-10	34.9L	4.99

D - Duplicate run with high duplicate result
F - Elevated MS/MSD RPD result
G - MS/MSD percent recovery outside reporting limit
J - Estimated concentration above the adjusted method detection limit and below the adjusted reporting limit
L - LCS percent recovery outside limits
U - Elevated reporting limit
Z - Lab duplicate recovery low

Table 4-9
Groundwater Analytical Results - RCRA Metals
Former Farmland Nitrogen Plant
Lawrence, KS

SITE	DATE	SAMPLE ID	Arsenic (mg/l)	Barium (mg/l)	Cadmium (mg/l)	Chromium (mg/l)	Lead (mg/l)	Mercury (mg/l)	Selenium (mg/l)	Silver (mg/l)
MW-03	04/20/2005	MW-3	<0.0100	0.0166	<0.00500	0.0597	<0.00500	<0.000200	<0.0150	<0.00700
MW-06	04/20/2005	MW-6	0.0216	0.0264	<0.00500	<0.00500	<0.00500	<0.000200	<0.0150	<0.00700
PSW-01A	04/13/2005	PSW-1A	0.0349	1.12	<0.00500	0.00865	<0.00500	<0.000200	<0.0150	<0.00700
PSW-01B	04/13/2005	PSW-1B	0.0164	0.341	<0.00500	<0.00500	<0.00500	<0.000200	0.0193	<0.00700
PSW-02A	04/13/2005	PSW-2A	0.0300	0.159	<0.00500	<0.00500	<0.00500	<0.000200	0.0187	<0.00700
PSW-02B	04/13/2005	PSW-2B	0.0152	0.301	<0.00500	<0.00500	<0.00500	<0.000200	0.0160	<0.00700
PSW-03A	04/08/2005	PSW-3A	0.138	1.99	<0.00500	0.00808	<0.00500	<0.000200	<0.0150	<0.00700
PSW-03B	04/08/2005	PSW-3B	0.0411	0.282	<0.00500	<0.00500	<0.00500	<0.000200	<0.0150	<0.00700
PSW-04	04/18/2005	PSW-4	<0.0100	0.333	<0.00500	<0.00500	<0.00500	<0.000200	<0.0150	<0.00700
PSW-05A	04/18/2005	PSW-5A	0.0147	0.222	<0.00500	<0.00500	<0.00500	<0.000200	<0.0150	<0.00700
PSW-06A	04/13/2005	PSW-6A	0.0281D	0.341	<0.00500	<0.00500	<0.00500	<0.000200	<0.0150	<0.00700
PSW-06B	04/13/2005	PSW-6B	0.0222	0.245	<0.00500	<0.00500	<0.00500	<0.000200	<0.0150	<0.00700
PSW-07A	04/13/2005	PSW-7A	0.0246	0.788	<0.00500	<0.00500	<0.00500	<0.000200	0.0165	<0.00700
PSW-07B	04/13/2005	PSW-7B	0.0118	0.322	<0.00500	<0.00500	<0.00500	<0.000200	<0.0150	<0.00700

4.2.5 Extent of Impacted Groundwater

Groundwater in all three aquifers at the site has been impacted by nitrates, ammonia, and/or RCRA metals. Wells and Geoprobe® sample points are listed by aquifer designation in **Table 4-10**.

Groundwater samples from 39 groundwater monitoring wells and 29 groundwater samples collected using a Geoprobe® rig were analyzed for nitrogen compounds (nitrate, nitrite, and ammonia). Nitrate-nitrogen (Nitrate-N) was detected above U.S.E.P.A. Maximum Contaminant Level (MCL) of 10 mg/L in 21 of 39 groundwater monitoring wells and 23 of 29 Geoprobe® groundwater samples. High concentrations of ammonia-nitrogen (ammonia-N) were also detected in groundwater; however, there is no MCL for ammonia. It should be noted that groundwater samples collected from the Geoprobe® borings may not be indicative of actual groundwater quality.

Groundwater samples from 14 groundwater monitoring wells were analyzed for RCRA metals (Arsenic, Barium, Cadmium, Chromium, Lead, Mercury, Selenium, and Silver). Arsenic was detected above the MCL of 10 µg/L in 12 of 14 wells. None of the other RCRA metals were detected at concentrations above the MCL.

4.2.5.1 Silty Clay Aquifer

Wells interpreted to be screened solely in the Silty Clay Aquifer include MW-10, MW-11, OW-19, PSW-01A, PSW-02A, PSW-03A, PSW-05A, PSW-06A, PSW-07A, PSW-09A, PSW-13A, PSW-14, PSW-17, and PSW-18. Geoprobe® groundwater samples collected from what was believed to be the Silty Clay Aquifer include A01NE-GW-02, A01NE-GW-03, A01NE-GW-07, A01NE-GW-08, A01NE-GW-09, A01NE-GW-14, A01NE-GW-16, A01NE-GW-21, A01NE-GW-26, A01NE-GW-27, A01NE-GW-28, A01NE-GW-33, A01SE-GW-07, A01SE-GW-09, A01W-GW-02, A01-W-GW-03, A01W-GW-06, A01W-GW-10, A01W-GW-13, A09-GW-04, A09-GW-06, A09-GW-07, A09-GW-08, A09-GW-09, A09-GW-10, A14-GW-03, A14-GW-07, and A14-GW-13.

Nitrate - Nitrogen

Nitrate-N concentrations range from 0.15 to 33,310 mg/L in the Silty Clay Aquifer. Nitrate-N concentrations were highest near the former West Pond and Krehbiel Pond. Another area of high (>100 mg/L) nitrate-N concentrations is in the vicinity of the former No. 2 Urea Bulk Warehouse. The highest concentration of nitrate-N in any groundwater samples collected from the Silty Clay Aquifer was 33,310 mg/L in Geoprobe® sample A01NE-GW-16. Concentrations of less than 10 mg/L are found south of the former No. 2 Urea Bulk Warehouse and north of the railroad tracks forming the northern boundary of the site. Nitrate-N concentrations in the Silty Clay Aquifer are shown on **Figure-4-2**.

Table 4-10
Groundwater Monitoring Wells and Geoprobe® Sample Points By Aquifer

Aquifer	Groundwater Monitoring Wells and Geoprobe® Sample IDs
Silty Clay	MW-10, MW-11, OW-19, PSW-01A, PSW-02A, PSW-03A, PSW-05A, PSW-06A, PSW-07A, PSW-09A, PSW-10, PSW-13A, PSW-17, PSW-18 A01NE-GW-02, A01NE-GW-03, A01NE-GW-07, A01NE-GW-08, A01NE-GW-09, A01NE-GW-14, A01NE-GW-16, A01NE-GW-21, A01NE-GW-26, A01NE-GW-27, A01NE-GW-28, A01NE-GW-33, A01SE-GW-07, A01SE-GW-09, A01W-GW-02, A01-W-GW-03, A01W-GW-06, A01W-GW-10, A01W-GW-13, A09-GW-04, A09-GW-06, A09-GW-07, A09-GW-08, A09-GW-09, A09-GW-10, A14-GW-03, A14-GW-07, A14-GW-08, A14-GW-13
Deep Alluvial	PSW-01B, PSW-02B, PSW-03B, PSW-04, PSW-06B, PSW-09B, PSW-15, A01W-GW-01
Bedrock and Silty Clay[1]	MW-06, MW-07, N-01, N-02, SW-10
Bedrock and Deep Alluvial[1]	PW-04A, PW-05, PSW-07B, PSW-08
Bedrock	MW-01, MW-02, MW-03, MW-04, MW-05, MW-08, MW-09, PW-01, PSW-13B

[1] Wells are screened across aquifer boundaries

Ammonia-Nitrogen

Ammonia-N concentrations range from less than 0.06 to 51,640 mg/L in the Silty Clay Aquifer. Ammonia-N concentrations were highest near the West Pond and Krehbiel Pond. The area around the #2 Urea Bulk Warehouse was observed to have Ammonia-N concentrations in excess of 1,000 mg/l. Concentrations of less than 10 mg/L are found south of the former No. 2 Urea Bulk Warehouse and north of the railroad tracks forming the northern boundary of the site. Ammonia-N concentrations in the Silty Clay Aquifer are shown on **Figure 4-3**.

Arsenic

Six wells screened in the Silty Clay Aquifer were analyzed for Arsenic. Arsenic concentrations range from less than 10 µg/L to 138 µg/L in the six groundwater samples collected from the Silty Clay Aquifer and analyzed for metals. Arsenic concentrations were highest in monitoring well PSW-03A located north of the West Lime Pond. Arsenic concentrations in the Silty Clay Aquifer are shown on **Figure 4-4**.

4.2.5.2 Deep Alluvial Aquifer

Wells interpreted to be screened solely in the Deep Alluvial Aquifer include PSW-01B, PSW-02B, PSW-03B, PSW-04, PSW-06B, and PSW-09B. Groundwater monitoring well PSW-02B is screened in both the Silty Clay Aquifer and the Deep Alluvial Aquifer.

Nitrate - Nitrogen

Nitrate-N concentrations range from less than 0.06 to 24.2 mg/L in the Deep Alluvial Aquifer. Nitrate-N concentrations exceeded the MCL of 10 mg/L only in the northwest portion of the property in groundwater monitoring well PW-09 (24.2 mg/L). Nitrate-N concentrations in the Deep Alluvial Aquifer are shown on **Figure 4-5**. Geoprobe® groundwater sample results are provided but are not considered to be representative of true groundwater quality.

Ammonia-Nitrogen

Ammonia-N concentrations range from 0.2 to 31.9 mg/L in the Deep Alluvial Aquifer. Ammonia-N concentrations exceeded 10 mg/L only in the northwest portion of the property in groundwater monitoring well PW-09 (31.9 mg/L). Ammonia-N concentrations in the Deep Alluvial Aquifer are shown on **Figure 4-6**. Geoprobe® groundwater sample results are provided but are not considered to be representative of true groundwater quality.

Arsenic

Six wells screened in the Deep Alluvial Aquifer were analyzed for arsenic. Arsenic concentrations range from less than 10 to 41.1 µg/L in the Deep Alluvial Aquifer. The arsenic concentration was highest in monitoring well PSW-03B, located north of the West Lime Pond. Arsenic was also detected in monitoring wells PSW-01B (16.4 µg/L), PSW-02B (15.2 µg/L), PSW-06B (22.2 µg/L), and PSW-07B (11.8 µg/L). Arsenic was not detected in monitoring well PSW-04.

4.2.5.3 Bedrock Water-Bearing Unit

Groundwater wells interpreted to be screened in the bedrock generally have low yields and bail dry. It appears that this water occurs in perched zones. Currently available data suggests that the Bedrock Water-Bearing Unit in the Chrome Destruct Unit is not hydraulically connected to the bedrock unit on top of the sandstone hill.

Wells screened solely in the Bedrock Water-Bearing Unit include MW-01, MW-02, MW-03, MW-04, MW-05, MW-08, MW-09, PW-01, and PSW-13B. Wells screened in the Silty Clay Aquifer and the Bedrock Water-Bearing Unit include MW-06, MW-07, N-01, N-02, PSW-10, and SW-10. Wells screened in the Deep Alluvial Aquifer and the Bedrock Water-Bearing Unit include PW-04A, PW-05, and PSW-08.

Nitrate - Nitrogen

Nitrate-N concentrations range from less than 0.06 to 1,780 mg/L in the Bedrock Water-Bearing Unit. Nitrate-N concentrations were highest in groundwater monitoring well PW-01 (1,780 mg/L) east of the UAN bulk warehouse in Area A, and in monitoring well N-02 (1,620 mg/L) on top of the sandstone hill at the former UAN lagoons and present location of the 6,000,000-gallon AST. Nitrate-N concentrations in wells in the Chrome Destruct Area ranged from less than 0.06 mg/L to 98.9 mg/L. Nitrate-N concentrations in the Bedrock Water-Bearing Unit are shown on **Figure 4-7**.

Ammonia-Nitrogen

Ammonia-N concentrations range from less than 0.06 to 1,140 mg/L in the Bedrock Water-Bearing Unit. Ammonia-N concentrations were greater than 10 mg/L only in groundwater monitoring wells PW-01 (900 mg/L), N-02 (1,150 mg/L), and MW-02 (55.3 mg/L). Ammonia-N concentrations in the Bedrock Aquifer are shown on **Figure 4-8.**

Arsenic

Two wells screened in the Bedrock Water-Bearing Unit were analyzed for arsenic. Arsenic concentrations range from less than 10 µg/L (in MW-03) to 21.6 µg/L (in MW-06) As of January 23, 2006, the new EPA drinking water MCL for arsenic is 10 µg/L.

Arsenic mobility in soil and groundwater are strongly influenced by pH and Eh. As pH changes from acidic to basic conditions, arsenic mobility increases. Arsenic mobility also increases under reducing environmental conditions. Field measurements indicate that pH levels in the wells where arsenic was detected were near neutral, with pH ranging from 6.24 to 7.34. Dissolved oxygen levels indicate a non-reducing environment. pH/Eh conditions in the vicinity of these wells indicate that arsenic mobility would not be increased due to the observed subsurface environmental conditions. Additional groundwater sampling and analysis is planned to further evaluate the occurrence of arsenic in groundwater in the site area.

Location	Monitoring Well	Aquifer	Arsenic Concentration	pH
Upgradient Lime Sludge L.F.	PSW-01A	Silty Clay	34.9 µg/L	6.81
	PSW-01B	Alluvial	16.4 µg/L	6.81
Downgradient Lime Sludge L.F.	PSW-02A	Silty Clay	30.0 µg/L	6.72
	PSW-02B	Silty Clay/Alluvial	15.2 µg/L	6.75
Downgradient West Lime Pond	PSW-03A	Silty Clay	138 µg/L	6.76
	PSW-03B	Alluvial	41.1 µg/L	--
Downgradient Rundown Pond	PSW-06A	Silty Clay	28.8 µg/L	7.33
	PSW-06B	Alluvial	22.2 µg/L	7.05
Downgradient East Lime Pond	PSW-07A	Silty Clay	24.6 µg/L	6.37
	PSW-07B	Alluvial and Bedrock	11.8 µg/L	7.34
Downgradient West Extension Pond	PSW-05A	Silty Clay	14.7 µg/L	7.05
CRS Unit	MW-6	Silty Clay and Bedrock	21. 6 µg/L	6.24

4.3 SOIL AND SEDIMENT SAMPLING PROCEDURES AND ANALYTICAL RESULTS

Subsurface field activities were performed according to the procedures detailed in the KDHE-approved Work Plan. Subsurface field activities were conducted from March 2005 through May 2005 and included:

- marking boring locations based on the pre-determined sample locations specified in the Work Plan;
- sampling soils with a Geoprobe® unit or other hand coring tool for laboratory analysis;
- sampling sediments with a Geoprobe® unit or other hand coring tool for laboratory analysis;
- collecting and analyzing groundwater samples from the boreholes, if encountered;
- describing the lithology of each borehole; and
- collecting GPS coordinates for each borehole.

The soil boring locations were divided into areas based on historical utilization and processes and presented in the approved Work Plan. The areas were then assigned specific sampling depths, contaminants of concern and a sampling priority schedule. The priority schedule was used as a guidance but accessibility and field conditions determined the actual area sampling order.

The initiation of field activities began with locating and marking the soil boring locations. Generally, the boring locations were approximately spaced, by area, using a 200-foot or 400-foot grid as specified in the Work Plan. In some areas, specifically the operations area, grid spacing was not always practical for boring spacing. In these areas, the locations were chosen based on access and process history. Each location was marked using a 3-foot-tall wooden stake bearing the unique location identifier or environmentally safe water-based marking paint in areas where the ground cover prevented staking (i.e. concrete or gravel). All soil sample locations are depicted on **Figure 4-9**.

Once all the boring locations were marked, soil boring and sampling activities began. The direct-push soil borings were advanced by D-Tech utilizing a Geoprobe® unit under the supervision of Shaw personnel. In the event the Geoprobe® unit was unable to access a location due to field conditions, a hand auger or other hand coring tools were used to install the boring and obtain the required samples.

The lithology from each boring location was visually described for type and color using the Unified Soil Classification System under the supervision of a Shaw geologist and recorded in the Field Log Book. The lithology of the soil was described prior to sampling activities in order to minimize the disturbance of the color and texture of the soil. Boring coordinates were collected from each location using a hand-held Garmin brand GPS unit and recorded in the Field Log Book. Coordinates were recorded in latitude and longitude in North American Datum (NAD) 83 for the easting and northing and in feet for the elevation.

Generally, soil sampling intervals were determined based on ground cover and analytes in accordance with the approved Work Plan. Soil samples that were analyzed for Nitrates plus Nitrites and Ammonia were sampled as follows:

- *Vegetative Cover*: Composite soil samples were collected from a surface depth of 0–2 feet below ground surface (bgs) and a subsurface soil depth of 2–3 feet bgs intervals.
- *Non-Vegetative Cover (i.e. bare ground, gravel, etc.):* Composite soil samples were collected from a surface depth of 0–8 inches bgs and a subsurface depth of 8–36 inches bgs intervals.
- Subsurface samples collected from below 3 feet bgs were sampled in 3-foot composite intervals.

If a surface cover (i.e. gravel or concrete) was present at the sampling location, an attempt was made to remove the surface cover prior to boring and the interval was considered to start at the soil surface beneath any remaining cover material.

Soil samples that were analyzed for VOCs, SVOCs, and/or petroleum hydrocarbons were sampled as follows:

- *Surface:* Grab soil samples were collected from a depth of 0 – 6 inches bgs.
- *Subsurface:* Grab soil samples were collected from a depth of 6 – 36 inches bgs.

Generally, soil samples that were analyzed for metals were composited in the same intervals as the VOCs. However, when sampled in conjunction with Nitrate plus Nitrite and Ammonia, the samples analyzed for metals were collected from the same composite interval due to the necessary sample volume needed to fill both containers.

Sediment samples were collected in 2-foot composite intervals until bedrock was encountered or equipment refusal, whichever came first. Sediment samples collected in Area B and along the drainage ditch in Area F had different sampling methodology and will be discussed in their respective sections.

Groundwater samples were collected from soil boring locations, if encountered in accordance with the Work Plan. The samples were collected from the same borehole as the soil samples. Groundwater was pumped from the boring utilizing a peristaltic pump (with new tubing) directly into a clean, unpreserved 4 oz. glass jar. All groundwater samples were given unique identifiers according to the Work Plan, labeled and immediately placed on ice for preservation.

Non-disposable equipment was decontaminated using a tap water-alconox solution mix. The equipment was then rinsed using tap water before receiving a triple de-ionized water rinse. Water used during the decontamination process was land applied in the area around the borehole.

Soil and sediment waste generated during sampling activities was land-applied in the vicinity of the borehole from which it was collected.

Quality Control (QC) samples were collected during soil, sediment and groundwater sampling including field duplicates, field blanks, and rinsate blanks in accordance with the SC Work Plan. Field

duplicate samples were collected at a rate of one in every ten (10) environmental samples for analysis by the same laboratory. Field duplicate confirmation samples were collected at a rate of one in every fifteen (15) environmental samples for analysis by different laboratories to evaluate the on-site laboratory control. Rinse blank samples were collected at a rate of one per day and one set of field blanks were collected to evaluate the de-ionized and tap water used in the decontamination procedures. Trip blanks were included in each cooler containing samples for volatile organic compound (VOC) analysis (including TPH as GRO).

4.3.1 Area A - UAN Storage Area Subsurface Sampling

Subsurface sampling activities in support of the site characterization were initiated in Area A, (Area 1 of the Work Plan). Soil boring locations for this area were spaced on a 200-foot grid. Some locations were adjusted slightly in the field due to access.

Borings in Area A were sampled to bedrock or equipment refusal in most locations. In locations where the depth to bedrock was greater than 30 feet below ground surface (bgs), it was noted that sampling at depths below fifteen (15) to twenty (20) feet bgs was time consuming with little soil recovery. In order to capitalize on obtaining the most useful information at each location, borings were only installed to approximately 30 feet below ground surface (bgs) in the northern and eastern portions of the site where bedrock is deeper.

Following discussions between Shaw and the KDHE on April 21, 2005, sampling protocols were revised for the deeper soils. The sampling depth in deeper soils was altered to between 15-20 feet bgs. Once the samples were collected, the Geoprobe® unit would continue to push until bedrock was encountered or equipment refusal. This new protocol allowed bedrock or refusal to be determined without overextending Geoprobe® sampling capabilities.

4.3.1.1 Area A – Field Sampling Methodology

Ninety-eight (98) soil and seven (7) sediment locations were sampled in Area A. If groundwater was encountered, an attempt to sample the groundwater was made. Nineteen (19) groundwater samples were collected from soil borings in Area A.

Each soil and sediment sample interval was composited in a decontaminated stainless steel bowl utilizing decontaminated stainless steel tools prior to collection in a clean, unpreserved 4 oz. glass sampling jar. All samples were given unique identifiers according to the Work Plan, labeled and immediately placed on ice for preservation.

Soil Sampling

All soil boring locations in Area A were installed using Geoprobe® direct-push technology. Soil sampling intervals followed the procedure outlined in the approved Work Plan and as detailed above.

All soil samples collected in Area A were sampled for Nitrate plus Nitrite and Ammonia and submitted to the on-site laboratory under chain of custody for analysis using method SM-4500.

Selected surface soil samples were submitted to Pace laboratory for RCRA metals analysis using EPA Method 6010/7471. Due to the amount of soil needed for both analyses, the surface soil samples were composited in the same intervals and manner as the nitrogen samples.

Two sample locations in Area A were located on an outcrop of bedrock. Surface samples were collected in these locations in order to ascertain the extent of contamination on the surface of the bedrock outcrop. The sample locations were A01W-SS-28 and A01W-SS-49.

Thirty-one (31) field duplicates were collected for analysis by the on-site laboratory and Pace for comparison and labeled using the same identifier as the original sample with a "D" at the end signifying the duplicate sent to the off-site laboratory. Forty-six (46) field duplicate samples were collected and submitted blind to the same laboratory (Pace). Rinsate blanks were collected at a rate of one per day and one set of field blanks were collected.

Sediment Sampling

Sediment locations in Area A were sampled using either Geoprobe® direct-push technology when access was possible or hand boring techniques. Sediment samples were collected at 2-foot composite intervals until bedrock was encountered or equipment refusal in accordance with the Work Plan.

All sediment locations in Area A were sampled and analyzed for Nitrate plus Nitrite and Ammonia and submitted, under chain of custody, either to the on-site laboratory for analysis using method SM-4500 or Pace for analysis using EPA Method 353.2 and 350.1, respectively. RCRA metals analysis was also performed on all sediment samples in Area A by Pace. One (1) sediment sample in Area A (A01NE-SED-15) was submitted to Pace laboratory for Total Kjeldahl Nitrogen analysis using EPA Method 351.2.

Borehole Groundwater Sampling

Groundwater samples were collected from nineteen (19) boring locations in Area A. The samples were collected from the same borehole as the soil samples as specified above.

All groundwater samples were given unique identifiers according to the Work Plan, labeled and immediately placed on ice for preservation. Groundwater samples were submitted to the on-site laboratory and analyzed for Nitrate plus Nitrite and Ammonia using method SM-4500.

4.3.1.2 Area A – Soil Sample Results

A total of four hundred seventy-three (473) soil samples, excluding QC samples, were collected in Area A during the subsurface characterization activities.

Surface Soils

Ninety-eight (98) surface soil samples were collected in Area A for Nitrate plus Nitrite analysis and submitted under chain of custody to the on-site laboratory. Nitrate plus Nitrite was detected in seventy-five (75) surface soil samples ranging from non-detect to 2,520 mg/kg as detected in sample A01SE-SS-04-0-0.67'. Forty (40) samples displayed concentrations of ammonia above laboratory detection limits ranging from non-detect to 1,520 mg/kg in sample A01SE-SS-04-0-0.67'.

A surface soil isoconcentration map for the 0–2 foot bgs interval depicting Total Nitrogen concentrations across the site is included as **Figure 4-10**. This figure was created using contour intervals of powers of 10 (0, 10 mg/kg, 100 mg/kg, 1,000 mg/kg, etc.). In the following discussions of the soil data, the 100 mg/kg contour interval has been selected as indicative of an elevated total nitrogen concentration. **Figures ANE-1, ASE-1** and **AW-1** included in **Appendix C** show surface Nitrogen concentrations for Area A. **Table 4-11** summarizes analytical results for nitrogen concentrations for surface soil samples.

Four (4) surface soil samples in Area A (A01NE-SS-29, A01NE-SS-34, A01NE-SS-35 and A01SE-SS-01) were analyzed for RCRA metals by Pace Labs. Metal concentrations were detected for arsenic, barium, chromium, lead, and selenium. The highest concentrations detected were reported for sample A01NE-SS-29 for arsenic (7.30 mg/kg), barium (137 mg/kg), lead (11.5 mg/kg) and selenium (2.81 mg/kg). Sample A01SE-SS-01 had the highest concentration of chromium (106 mg/kg). There were no reported concentrations above laboratory detection limits for cadmium, mercury and silver in the surface soils for Area A analyzed for metals.

Figures ANE-1, ASE-1 and **AW-1** in **Appendix C** show all metal concentrations, and **Table 4-12** includes all surface metal results in Area A.

Table 4-11
Nitrogen Concentrations 0-2' BGS
Area A
Former Farmland Nitrogen Plant
Lawrence, Kansas

Site	Date	Starting Depth (feet)	Ending Depth (feet)	Nitrate plus Nitrite (as N) (mg/kg)	Nitrogen, Ammonia (mg/kg)	Total Nitrate plus Ammonia (mg/kg)
A01NE-SS-01	04/07/2005	0.00	2.00	12.3	<1.3>	13.6
A01NE-SS-02	04/08/2005	0.00	0.67	26.9	54	80.9
A01NE-SS-03	04/08/2005	0.00	2.00	1,780	460	2,240
A01NE-SS-05	04/27/2005	0.00	2.00	6	<2	6
A01NE-SS-06	04/07/2005	0.00	0.67	5.3	<4.6J	5.3
A01NE-SS-07	04/11/2005	0.00	0.67	31.7L	97.3	129
A01NE-SS-08	04/15/2005	0.00	0.67	1,690	1,220	2,910
A01NE-SS-09	04/14/2005	0.00	0.67	83.5	<4.9J	83.5
A01NE-SS-11	04/27/2005	0.00	1.00	<2.6J	<2	0
A01NE-SS-12	04/27/2005	0.00	0.25	<1.9>	<2.7J	1.9
A01NE-SS-13	04/07/2005	0.00	0.67	47.1	252	299.1
A01NE-SS-14	04/11/2005	0.00	0.67	34.8	495	529.8
A01NE-SS-16	04/14/2005	0.00	0.67	1,650	995	2,645
A01NE-SS-18	04/27/2005	0.00	0.67	12	17.1	29.1
A01NE-SS-19	04/27/2005	0.00	1.00	<1.5>	<2	1.5
A01NE-SS-20	04/11/2005	0.00	0.67	30.7	<2	30.7
A01NE-SS-21	04/21/2005	0.00	0.67	12.7	<1.9>	14.6
A01NE-SS-22	04/15/2005	0.00	0.67	134	5.3	139.3
A01NE-SS-24	04/22/2005	0.00	0.67	186	826	1,012
A01NE-SS-25	04/22/2005	0.00	0.67	26.7	310	336.7
A01NE-SS-26	04/27/2005	0.00	0.67	10.1	<1.4>	11.5
A01NE-SS-27	04/21/2005	0.00	0.67	6	<3.8J	6
A01NE-SS-28	04/14/2005	0.00	0.67	10.6	9.8	20.4
A01NE-SS-29	04/22/2005	0.00	0.67	132	1,110	1,242
A01NE-SS-30	04/22/2005	0.00	0.67	26.4	132	158.4
A01NE-SS-31	04/27/2005	0.00	0.67	3.7	347	350.7
A01NE-SS-32	04/21/2005	0.00	0.67	12.7	38.2	50.9
A01NE-SS-33	04/21/2005	0.00	0.67	83.8	4.7	88.5
A01NE-SS-34	04/22/2005	0.00	0.67	26.1	597	623.1
A01NE-SS-35	04/22/2005	0.00	0.67	16.9	<10.8G	16.9
A01NE-SS-36	04/27/2005	0.00	0.67	418	600	1,018
A01NE-SS-37	04/27/2005	0.00	0.67	199	22.9	221.9
A01NE-SS-38	04/22/2005	0.00	2.00	<1>	<1.8>	2.8
A01SE-SS-01	04/27/2005	0.00	2.00	18.3	<1.6>	19.9
A01SE-SS-02	04/28/2005	0.00	2.00	<2	<2	0
A01SE-SS-03	04/29/2005	0.00	0.67	120	290	410
A01SE-SS-04	04/29/2005	0.00	0.67	2,520	1,550	4,070
A01SE-SS-05	04/29/2005	0.00	2.00	7.1	<4.4J	7.1
A01SE-SS-06	04/28/2005	0.00	2.00	46.3	141	187.3

Table 4-11, Continued
Nitrogen Concentrations 0-2' BGS
Area A
Former Farmland Nitrogen Plant
Lawrence, Kansas

Site	Date	Starting Depth (feet)	Ending Depth (feet)	Nitrate plus Nitrite (as N) (mg/kg)	Nitrogen, Ammonia (mg/kg)	Total Nitrate plus Ammonia (mg/kg)
A01SE-SS-07	05/02/2005	0.00	0.67	3.6	5.7	9.3
A01SE-SS-08	05/02/2005	0.00	0.67	48.7	31.6	80.3
A01SE-SS-09	05/02/2005	0.00	0.67	64.4	<2	64.4
A01SE-SS-10	04/28/2005	0.00	0.67	<2	6.6	6.6
A01SE-SS-11	04/28/2005	0.00	0.67	4.6	54.3	58.9
A01SE-SS-12	05/02/2005	0.00	2.00	728	317	1,045
A01SE-SS-13	04/28/2005	0.00	0.67	45.6	<3.3J	45.6
A01SE-SS-14	04/28/2005	0.00	2.00	5.7	<1.8>Z	7.5
A01W-SS-01	03/30/2005	0.00	2.00	<2.4J	<2.5J	0
A01W-SS-02	04/06/2005	0.00	0.67	<2.2J	<1.8>	1.8
A01W-SS-03	04/07/2005	0.00	2.00	<2.3J	<2	0
A01W-SS-04	03/30/2005	0.00	2.00	<1.5>	<1.9>	3.4
A01W-SS-05	04/05/2005	0.00	0.67	<2.8J	<1.7>	1.7
A01W-SS-06	04/06/2005	0.00	0.67	<1.5>	<3J	1.5
A01W-SS-07	03/30/2005	0.00	0.50	<2.3J	<2.6J	0
A01W-SS-08	03/30/2005	0.00	2.00	4	<4.7J	4
A01W-SS-09	04/05/2005	0.00	2.00	<2.2J	<1.3>	1.3
A01W-SS-10	04/06/2005	0.00	0.67	6	<1.4>	7.4
A01W-SS-11	03/30/2005	0.00	1.33	3	<2.9J	3
A01W-SS-12	03/30/2005	0.00	2.00	<1.6>	<2.9J	1.6
A01W-SS-13	04/04/2005	0.00	2.00	13.1	<1.8>	14.9
A01W-SS-14	04/05/2005	0.00	2.00	<1.3>	<1.1>	2.4
A01W-SS-15	04/06/2005	0.00	2.00	<1.1>	<0.5>	1.6
A01W-SS-16	03/31/2005	0.00	2.00	<0.9>	<2	0.9
A01W-SS-17	03/31/2005	0.00	2.00	<1.2>	<2	1.2
A01W-SS-18	04/04/2005	0.00	2.00	4.5	<1.1>	5.6
A01W-SS-19	04/04/2005	0.00	2.00	43	<2.8J	43
A01W-SS-20	04/04/2005	0.00	1.75	4.4	<1.1>	5.5
A01W-SS-21	04/04/2005	0.00	1.50	<2.3J	<1.1>	1.1
A01W-SS-22	03/31/2005	0.00	0.67	<1.6>	<1.6>	3.2
A01W-SS-23	03/31/2005	0.00	1.50	11.2D	<2	11.2
A01W-SS-24	04/04/2005	0.00	2.00	174	170D	344
A01W-SS-25	04/04/2005	0.00	1.75	3	<0.8>	3.8
A01W-SS-26	04/04/2005	0.00	2.00	4.6	<2J	4.6
A01W-SS-27	04/04/2005	0.00	0.67	16.4	63.5	79.9
A01W-SS-28	04/04/2005	0.00	0.67	<2.1J	<2	0
A01W-SS-29	03/31/2005	0.00	2.00	3.2	<2	3.2
A01W-SS-30	03/31/2005	0.00	1.25	3.4	<1.1>	4.5
A01W-SS-31	04/01/2005	0.00	2.00	247	298	545

Table 4-11, Continued
Nitrogen Concentrations 0-2' BGS
Area A
Former Farmland Nitrogen Plant
Lawrence, Kansas

Site	Date	Starting Depth (feet)	Ending Depth (feet)	Nitrate plus Nitrite (as N) (mg/kg)	Nitrogen, Ammonia (mg/kg)	Total Nitrate plus Ammonia (mg/kg)
A01W-SS-32	04/01/2005	0.00	2.00	1,090	899	1,989
A01W-SS-33	04/04/2005	0.00	1.00	9.8	<1.9>	11.7
A01W-SS-34	04/04/2005	0.00	2.00	28.5	<1.5>	30
A01W-SS-35	04/05/2005	0.00	2.00	280	243	523
A01W-SS-36	03/31/2005	0.00	2.00	105	<2.6J	105
A01W-SS-37	04/01/2005	0.00	2.00	967	462	1,429
A01W-SS-38	04/01/2005	0.00	2.00	1,300	581D	1,881
A01W-SS-39	04/05/2005	0.00	0.67	3.6	<2	3.6
A01W-SS-40	04/04/2005	0.00	2.00	329	82	411
A01W-SS-41	04/05/2005	0.00	2.00	<1.7>	<2	1.7
A01W-SS-42	03/31/2005	0.00	2.00	6.9	<1.1>	8
A01W-SS-43	04/01/2005	0.00	2.00	759	409	1,168
A01W-SS-44	04/01/2005	0.00	2.00	154	219D	373
A01W-SS-45	04/01/2005	0.00	2.00	75.5	<3.6J	75.5
A01W-SS-46	04/05/2005	0.00	2.00	45.9	<3.1J	45.9
A01W-SS-47	04/05/2005	0.00	2.00	12.2	<1.7>	13.9
A01W-SS-48	04/01/2005	0.00	2.00	15.1	<1.6>	16.7
A01W-SS-49	04/01/2005	0.00	2.00	20.1	23.1	43.2
A01W-SS-52	04/05/2005	0.00	2.00	3.6	<2	3.6
A01W-SS-53	04/05/2005	0.00	0.67	162	820	982
A01NE-SED-04	4/27/2005	0.00	1.92	375	2.2	377.2
A01NE-SED-10	4/27/2005	0.00	0.83	327	718	1,045
A01NE-SED-15	3/29/2005	0.00	2	7,500	10,900	18,400
A01NE-SED-17	4/22/2005	0.00	0.5	1,330	2,020	3,350

<x>=Less than Reporting Limit

D - Duplicate run with high duplicate result

F - Elevated MS/MSD RPD result

G - MS/MSD percent recovery outside reporting limit

J - Estimated concentration above the adjusted method detection limit and below the adjusted reporting limit

L - LCS percent recovery outside limits

U - Elevated reporting limit

Table 4-12
RCRA Metals Concentrations in 0-2' BGS Samples
Area A
Former Farmland Nitrogen Plant
Lawrence, Kansas

Site	Date	Starting Depth (feet)	Ending Depth (feet)	Arsenic (mg/kg)	Barium (mg/kg)	Cadmium (mg/kg)	Chromium (mg/kg)	Lead (mg/kg)	Mercury (mg/kg)	Selenium (mg/kg)	Silver (mg/kg)
A01NE-SS-29	04/22/2005	0.00	0.67	7.30	137	<0.538	19.6	11.5	<0.157	2.81	<0.753
A01NE-SS-34	04/22/2005	0.00	0.67	2.74	74.8	<0.554	10.4	5.53	<0.171	<1.66	<0.776
A01NE-SS-35	04/22/2005	0.00	0.67	2.89	20.4	<0.499	15.4	8.95	<0.138	<1.50	<0.698
A01SE-SS-01	04/27/2005	0.00	2.00	6.09	44.3	<0.530	106	8.11	<0.153	<1.59	<0.742
A01NE-SED-04	04/27/2005	0.00	1.92	9.57	175	<0.664	21.7	21.5	<0.202	<1.99	<0.929
A01NE-SED-10	04/27/2005	0.00	0.83	10.8	165	0.653	24.5	21.5	<0.217FG	<1.68	<0.783
A01NE-SED-15	03/29/2005	0.00	2.00	<1.62	145	<0.809	126	41.0	<0.306	3.86	<1.13
A01NE-SED-17	04/22/2005	0.00	0.50	6.07	140G	0.764	23.5	19.8	<0.175	1.62	<0.602

D - Duplicate run with high duplicate result

F - Elevated MS/MSD RPD result

G - MS/MSD percent recovery outside reporting limit

J - Estimated concentration above the adjusted method detection limit and below the adjusted reporting limit

L - LCS percent recovery outside limits

U - Elevated reporting limit

Subsurface Soils

Seventy-eight (78) subsurface soil samples were collected in Area A for Nitrate plus Nitrite analysis and submitted under chain of custody to the on-site laboratory. Nitrate plus Nitrite concentrations were detected in sixty-seven (67) subsurface soil samples ranging from non-detect to 4,190 mg/kg reported in sample A01NE-SS-08-0.67-3'. Forty-nine (49) samples reported concentrations of Ammonia above laboratory detection limits ranging from non-detect to 7,830 mg/kg also reported in sample A01NE-SS-08-0.67-3'

Figures ANE-1, ASE-1 and **AW-1** in **Appendix C** and **Table 4-13** show subsurface nitrogen concentrations for Area A for the 2-3 foot bgs interval. **Figure 4-11** illustrates the Total Nitrogen concentrations for the 2-3 feet bgs depth across the site.

Subsurface Soils (Greater than 3 feet)

Two hundred ninety-seven (297) subsurface soil samples were collected in Area A for Nitrate plus Nitrite analysis and submitted under chain of custody to the on-site laboratory. Nitrate plus Nitrite concentrations were detected in two-hundred fifty-five (255) subsurface soil samples ranging from non-detect to 9,050 mg/kg reported in sample A01NE-SS-16-16-18'. Two-hundred thirty-six (236) samples reported concentrations of Ammonia above laboratory detection limits ranging from non-detect to 16,680 mg/kg reported in sample A01NE-SS-08-3-6'.

Figures ANE-1, ASE-1 and **AW-1** in **Appendix C** and **Table 4-14** shows subsurface nitrogen concentrations for Area A for samples collected at a depth of 3 feet or greater.

4.3.1.3 Area A – Sediment Sample Results

Seven (7) sediment samples, excluding QC samples, were collected in Area A for Nitrate plus Nitrite analysis and submitted under chain of custody to the on-site laboratory or Pace. Nitrate plus Nitrite concentrations were detected in all seven (7) surface soil samples ranging from 327 mg/kg in sample A01NE-SED-10 to 10,600 mg/kg in sample A01NE-SED-23'. All seven (7) samples reported concentrations of Ammonia above laboratory detection limits ranging from 2.2 mg/kg in sample A01NE-SED-04 to 18,000 mg/kg in sample A01NE-SED-23.

Sediment sample results for nitrogen are included in **Table 4-11** and **Appendix C** as **Figures ANE-1, ASE-1** and **AW-1**.

All sediment samples in Area A were analyzed for RCRA metals by Pace. The sediment samples were composited in the same intervals and manner as the nitrogen samples. Metal concentrations were detected for arsenic, barium, cadmium, chromium, lead, mercury and selenium. The highest detectable concentrations were reported in sample A01NE-SED-10 for arsenic (10.8 mg/kg), in sample A01W-SED-50 for barium (206 mg/kg), and in sample A01NE-SED-17 for cadmium (0.764 mg/kg). Sample A01NE-SED-23 had detectable concentration for mercury (0.466 mg/kg) in Area A. Sample A01NE-SED-15 had the highest detectable concentration for chromium (126 mg/kg), lead (41.0 mg/kg) and selenium (3.86 mg/kg).

Sediment sample results for metals are included in **Table 4-12** and in **Appendix C** as **Figures ANE-1, ASE-1** and **AW-1.**

4.3.1.4 Area A – Borehole Groundwater Sample Results

As stated earlier, additional groundwater samples were collected independently from the monitoring well sampling activity. All nineteen (19) groundwater samples collected from Area A had detectable concentrations for Nitrate plus Nitrite and seventeen (17) groundwater samples had detectable concentrations for Ammonia.

Nineteen (19) groundwater samples were collected from the soil borings installed in Area A during the Site Characterization activities. All groundwater samples were collected at or below four (4) feet bgs. Groundwater samples reported concentrations for Nitrate plus Nitrite ranging from 5.9 mg/L (A01NE-GW-21-10') to 33,310 mg/L reported in sample A01NE-GW-16-15'. Ammonia in groundwater ranged from non-detect to 51,640 mg/L reported in sample A01NE-GW-08-5'. It should be noted that analytical results for groundwater samples collected from Geoprobe® borings may not be truly representative of actual groundwater quality. The data is provided for consideration.

Groundwater sample results are included in **Table 4-15.**

Table 4-13
Subsurface Nitrogen Concentrations 2-3' BGS
Area A
Former Farmland Nitrogen Plant
Lawrence, Kansas

Site	Date	Starting Depth (feet)	Ending Depth (feet)	Nitrate plus Nitrite (as N) (mg/kg)	Nitrogen, Ammonia (mg/kg)	Total Nitrate plus Ammonia (mg/kg)
A01NE-SS-01	04/07/2005	2.00	3.00	171	225	396
A01NE-SS-02	04/08/2005	0.67	3.00	9.6	254	263.6
A01NE-SS-03	04/08/2005	2.00	3.00	636	246	882
A01NE-SS-06	04/07/2005	0.67	3.00	3.2	<1.9>	5.1
A01NE-SS-07	04/11/2005	0.67	3.00	4.4L	319D	323.4
A01NE-SS-08	04/15/2005	0.67	3.00	4190	7,830	12,020
A01NE-SS-09	04/14/2005	0.67	3.00	144	<2	144
A01NE-SS-13	04/07/2005	0.67	3.00	230	664	894
A01NE-SS-14	04/11/2005	0.67	3.00	10.7	686	696.7
A01NE-SS-16	04/14/2005	0.67	3.00	2,490	3,760	6,250
A01NE-SS-18	04/27/2005	0.67	1.17	14.2	46.8	61
A01NE-SS-20	04/11/2005	0.67	3.00	151	154	305
A01NE-SS-21	04/21/2005	0.67	3.00	5.9	11.3	17.2
A01NE-SS-22	04/15/2005	0.67	3.00	108	<3.7J	108
A01NE-SS-24	04/22/2005	0.67	3.00	592	1,370	1,962
A01NE-SS-25	04/22/2005	0.67	3.00	125	982	1,107
A01NE-SS-26	04/27/2005	0.67	3.00	104	715	819
A01NE-SS-27	04/21/2005	0.67	3.00	45.4	18.1	63.5
A01NE-SS-28	04/14/2005	0.67	3.00	3.9	<3.6J	3.9
A01NE-SS-29	04/22/2005	0.67	3.00	1,010	1,530	2,40
A01NE-SS-30	04/22/2005	0.67	3.00	136	1,070	1,206
A01NE-SS-31	04/27/2005	0.67	3.00	109	1,600	1,709
A01NE-SS-32	04/21/2005	0.67	3.00	243	1,430	1,673
A01NE-SS-33	04/21/2005	0.67	3.00	180	13.2	193.2
A01NE-SS-34	04/22/2005	0.67	3.00	188	1,170	1,358
A01NE-SS-35	04/22/2005	0.67	2.50	73.2	504	577.2
A01NE-SS-36	04/27/2005	0.67	3.00	422	768	1,190
A01NE-SS-37	04/27/2005	0.67	3.00	560	83.8	643.8
A01NE-SS-38	04/22/2005	2.00	3.00	<1.2>	<1.5>	2.7
A01SE-SS-01	04/27/2005	2.00	3.00	89.1	30.6	119.7
A01SE-SS-03	04/29/2005	0.67	3.00	189	1,630	1,819
A01SE-SS-04	04/29/2005	0.67	3.00	1,340	1,520	2,860
A01SE-SS-05	04/29/2005	2.00	3.00	35.7	9.1	44.8
A01SE-SS-06	04/28/2005	2.00	3.00	148	420	568
A01SE-SS-07	05/02/2005	0.67	3.00	48.6	478	526.6
A01SE-SS-08	05/02/2005	0.67	3.00	705	25	730
A01SE-SS-09	05/02/2005	0.67	3.00	545	307	852
A01SE-SS-10	04/28/2005	0.67	3.00	<2	16.7	16.7
A01SE-SS-11	04/28/2005	0.67	3.00	7.8	545	552.8
A01SE-SS-12	05/02/2005	2.00	3.00	592	131	723
A01SE-SS-13	04/28/2005	0.67	3.00	76.7	<1>	77.7
A01SE-SS-14	04/28/2005	2.00	3.00	6.2	<2	6.2
A01W-SS-01	03/30/2005	2.00	3.00	<2.6J	<1.6>	1.6
A01W-SS-02	04/06/2005	0.67	3.00	<0.7>	267D	267.7

Table 4-13, Continued
Subsurface Nitrogen Concentrations 2-3' BGS
Area A
Former Farmland Nitrogen Plant
Lawrence, Kansas

Site	Date	Starting Depth (feet)	Ending Depth (feet)	Nitrate plus Nitrite (as N) (mg/kg)	Nitrogen, Ammonia (mg/kg)	Total Nitrate plus Ammonia (mg/kg)
A01W-SS-03	04/07/2005	2.00	3.00	16.8	<4.3J	16.8
A01W-SS-04	03/30/2005	2.00	3.00	<1.2>	<1.3>	2.5
A01W-SS-05	04/05/2005	0.67	3.00	3.1	<1.5>	4.6
A01W-SS-06	04/06/2005	0.67	3.00	3.4	<1.2>	4.6
A01W-SS-08	03/30/2005	2.00	3.00	3.9	<3.5J	3.9
A01W-SS-09	04/05/2005	2.00	2.50	3.1	<1>	4.1
A01W-SS-10	04/06/2005	0.67	3.00	2.8	<1.2>	4
A01W-SS-12	03/30/2005	2.00	3.00	<1.7>	<1.9>	3.6
A01W-SS-13	04/04/2005	2.00	3.00	12.4	<1.2>	13.6
A01W-SS-14	04/05/2005	2.00	3.00	<2.1J	<1.2>	1.2
A01W-SS-15	04/06/2005	2.00	3.00	<1.4>	<2	1.4
A01W-SS-16	03/31/2005	2.00	3.00	<1.1>	<0.6>	1.7
A01W-SS-17	03/31/2005	2.00	3.00	<2J	<0.9>	0.9
A01W-SS-19	04/04/2005	2.00	3.00	93.2	21.3	114.5
A01W-SS-24	04/04/2005	2.00	3.00	486	735	1221
A01W-SS-26	04/04/2005	2.00	2.25	7.7	<2.8J	7.7
A01W-SS-29	03/31/2005	2.00	3.00	<2.1J	<0.8>	0.8
A01W-SS-32	04/01/2005	2.00	3.00	2,000	2,330	4,330
A01W-SS-34	04/04/2005	2.00	3.00	18.5	<1.7>	20.2
A01W-SS-35	04/05/2005	2.00	3.00	319	237	556
A01W-SS-36	03/31/2005	2.00	3.00	271	25.9	296.9
A01W-SS-37	04/01/2005	2.00	3.00	1,890	2,680	4,570
A01W-SS-38	04/01/2005	2.00	3.00	2,190	2,630	4,820
A01W-SS-39	04/05/2005	0.67	1.17	4.3	<2	4.3
A01W-SS-40	04/04/2005	2.00	3.00	563	695	1,258
A01W-SS-42	03/31/2005	2.00	3.00	27.1	<3.2J	27.1
A01W-SS-43	04/01/2005	2.00	3.00	606	1,300	1,906
A01W-SS-44	04/01/2005	2.00	3.00	752	2,340	3,092
A01W-SS-45	04/01/2005	2.00	3.00	172	<2.8J	172
A01W-SS-46	04/05/2005	2.00	3.00	141	109	250
A01W-SS-47	04/05/2005	2.00	2.67	13.5	<2.2J	13.5
A01W-SS-48	04/01/2005	2.00	3.00	25.4	32.3	57.7
A01W-SS-52	04/05/2005	2.00	3.00	4.5	<2	4.5
A01W-SS-53	04/05/2005	0.67	3.00	187	1,290D	1477

<x>=Less than Reporting Limit

D - Duplicate run with high duplicate result

F - Elevated MS/MSD RPD result

G - MS/MSD percent recovery outside reporting limit

J - Estimated concentration above the adjusted method detection limit and below the adjusted reporting limit

L - LCS percent recovery outside limits

U - Elevated reporting limit

Table 4-14
Subsurface Nitrogen Concentrations >3' BGS
Area A
Former Farmland Nitrogen Plant
Lawrence, Kansas

Site	Date	Starting Depth (feet)	Ending Depth (feet)	Nitrate plus Nitrite (as N) (mg/kg)	Nitrogen, Ammonia (mg/kg)	Total Nitrate plus Ammonia (mg/kg)
A01NE-SS-01	04/07/2005	3.00	6.00	163	1,310	1,473
A01NE-SS-01	04/07/2005	6.00	9.00	132	3,020	3,152
A01NE-SS-01	04/07/2005	9.00	12.00	114	2,260	2,374
A01NE-SS-02	04/08/2005	3.00	6.00	<0.8>	139	139.8
A01NE-SS-02	04/08/2005	6.00	9.00	<0.8>	89.6	90.4
A01NE-SS-02	04/08/2005	9.00	10.00	<0.9>	116	116.9
A01NE-SS-02	04/08/2005	16.00	18.00	49.6	<1.5>	51.1
A01NE-SS-02	04/08/2005	18.00	21.00	72.1	5.4	77.5
A01NE-SS-02	04/08/2005	25.00	27.00	384	34.2	418.2
A01NE-SS-02	04/08/2005	21.00	23.00	123	<2	123
A01NE-SS-02	04/08/2005	27.00	30.00	698	117	815
A01NE-SS-02	04/08/2005	30.00	31.00	1,080	113	1,193
A01NE-SS-03	04/08/2005	3.00	5.00	354	181	535
A01NE-SS-03	04/08/2005	7.00	9.00	508	224	732
A01NE-SS-03	04/08/2005	9.00	12.00	213	105	318
A01NE-SS-03	04/08/2005	12.00	15.00	120	21.2	141.2
A01NE-SS-03	04/08/2005	15.00	18.00	74.9	<1.5>	76.4
A01NE-SS-03	04/08/2005	18.00	21.00	49.7	5.5	55.2
A01NE-SS-03	04/08/2005	21.00	23.00	36.2	<3.2J	36.2
A01NE-SS-03	04/08/2005	24.00	27.00	<1.3>	71.6	72.9
A01NE-SS-03	04/08/2005	27.00	30.00	<1>	131	132
A01NE-SS-03	04/08/2005	30.00	31.00	<1.3>	145	146.3
A01NE-SS-06	04/07/2005	3.00	6.00	<2.4J	<1.8>	1.8
A01NE-SS-06	04/07/2005	6.00	8.00	3.1	5.6	8.7
A01NE-SS-07	04/11/2005	3.00	6.00	<1.4>	299	300.4
A01NE-SS-07	04/11/2005	6.00	9.00	233L	358	591
A01NE-SS-07	04/11/2005	9.00	12.00	601L	1,970	2,571
A01NE-SS-07	04/11/2005	12.00	13.50	841L	3,730	4,571
A01NE-SS-07	04/11/2005	16.00	18.00	1,010L	4,950	5,960
A01NE-SS-07	04/11/2005	18.00	21.00	970L	5,500	6470
A01NE-SS-07	04/11/2005	21.00	23.00	965L	6,440	7,405
A01NE-SS-07	04/11/2005	24.00	27.00	1,930L	4,870	6,800
A01NE-SS-07	04/11/2005	28.00	30.00	2,270L	2,010	4,280
A01NE-SS-07	04/11/2005	30.00	31.00	1,660L	838	2,498
A01NE-SS-08	04/15/2005	3.00	6.00	6,450	16,680	23,130
A01NE-SS-08	04/15/2005	6.00	9.00	6,720	15,160	21,880
A01NE-SS-08	04/15/2005	9.00	12.00	5,490	10,280	15,770
A01NE-SS-08	04/15/2005	12.00	14.00	3,760D	3,570	7,330
A01NE-SS-08	04/15/2005	16.00	18.00	958	33.6	991.6
A01NE-SS-08	04/15/2005	18.00	21.00	527	14.1	541.1

Table 4-14, Continued
Subsurface Nitrogen Concentrations >3' BGS
Area A
Former Farmland Nitrogen Plant
Lawrence, Kansas

Site	Date	Starting Depth (feet)	Ending Depth (feet)	Nitrate plus Nitrite (as N) (mg/kg)	Nitrogen, Ammonia (mg/kg)	Total Nitrate plus Ammonia (mg/kg)
A01NE-SS-08	04/15/2005	21.00	23.00	332	17.4	349.4
A01NE-SS-08	04/15/2005	24.00	27.00	303	97.5	400.5
A01NE-SS-08	04/15/2005	28.00	30.00	12.7Z	177	189.7
A01NE-SS-08	04/15/2005	30.00	31.00	16.7	196	212.7
A01NE-SS-09	04/14/2005	3.00	6.00	66.1	<2	66.1
A01NE-SS-09	04/14/2005	6.00	7.00	7.9	<2	7.9
A01NE-SS-09	04/14/2005	11.00	12.00	8.6	<2	8.6
A01NE-SS-09	04/14/2005	12.00	15.00	3.2	<2	3.2
A01NE-SS-09	04/14/2005	16.00	18.00	29.4	<1.5>	30.9
A01NE-SS-09	04/14/2005	20.00	21.00	496	<0.8>	496.8
A01NE-SS-09	04/14/2005	21.00	23.00	402	<2.9J	402
A01NE-SS-09	04/14/2005	24.00	27.00	159	<2	159
A01NE-SS-09	04/14/2005	28.00	30.00	124	<2	124
A01NE-SS-09	04/14/2005	30.00	31.00	59.6	<2	59.6
A01NE-SS-13	04/07/2005	3.00	6.00	572	1,380	1,952
A01NE-SS-13	04/07/2005	6.00	9.00	632	2,630	3,262
A01NE-SS-13	04/07/2005	9.00	12.00	351	2,830	3,181
A01NE-SS-13	04/07/2005	12.00	13.00	317	2,500	2,817
A01NE-SS-14	04/11/2005	3.00	6.00	58.1	1,800	1,858.10
A01NE-SS-14	04/11/2005	6.00	9.00	353	4,010	4,363
A01NE-SS-14	04/11/2005	9.00	11.00	1,280	6,750	8,030
A01NE-SS-14	04/11/2005	12.00	15.00	1,090	2,830D	3,920
A01NE-SS-14	04/11/2005	16.00	18.00	1,090	3,930	5,020
A01NE-SS-14	04/11/2005	18.00	20.00	827	2,190	3,017
A01NE-SS-14	04/11/2005	28.00	30.00	1,270	420	1,690
A01NE-SS-14	04/11/2005	30.00	31.00	1,120	180	1,300
A01NE-SS-16	04/14/2005	3.00	6.00	4,530	8,020	12,550
A01NE-SS-16	04/14/2005	6.00	9.00	5,060	10,970	16,030
A01NE-SS-16	04/14/2005	9.00	11.00	8,080	14,490	22,570
A01NE-SS-16	04/14/2005	12.00	15.00	7,870	15,950	23,820
A01NE-SS-16	04/14/2005	16.00	18.00	9,050	16,520	25,570
A01NE-SS-16	04/14/2005	18.00	21.00	8,360	13,990	22,350
A01NE-SS-16	04/14/2005	21.00	24.00	7,380	12,800	20,180
A01NE-SS-16	04/14/2005	24.00	27.00	5,300	4,580	9,880
A01NE-SS-16	04/14/2005	28.00	30.00	3,850	5,280	9,130
A01NE-SS-16	04/14/2005	30.00	31.00	6,940	9,370	16,310
A01NE-SS-20	04/11/2005	3.00	6.00	90.8	356	446.8
A01NE-SS-20	04/11/2005	6.00	8.00	106	51.1	157.1
A01NE-SS-21	04/21/2005	3.00	6.00	<2.4J	427	427

Table 4-14, Continued
Subsurface Nitrogen Concentrations >3' BGS
Area A
Former Farmland Nitrogen Plant
Lawrence, Kansas

Site	Date	Starting Depth (feet)	Ending Depth (feet)	Nitrate plus Nitrite (as N) (mg/kg)	Nitrogen, Ammonia (mg/kg)	Total Nitrate plus Ammonia (mg/kg)
A01NE-SS-21	04/21/2005	6.00	9.00	<1.4>	955	956.4
A01NE-SS-21	04/21/2005	9.00	12.00	35	853	888
A01NE-SS-21	04/21/2005	12.00	15.00	65.4	788	853.4
A01NE-SS-21	04/21/2005	15.00	17.00	188	2160	2348
A01NE-SS-22	04/15/2005	3.00	6.00	11.2	130	141.2
A01NE-SS-22	04/15/2005	6.00	9.00	7.2	342	349.2
A01NE-SS-22	04/15/2005	9.00	12.00	35.8	718	753.8
A01NE-SS-22	04/15/2005	12.00	15.00	173	1,190	1,363
A01NE-SS-22	04/15/2005	15.00	18.00	551	1,620	2,171
A01NE-SS-22	04/15/2005	18.00	21.00	1,510	134	1,644
A01NE-SS-22	04/15/2005	21.00	23.00	1,480	16.4	1,496.40
A01NE-SS-22	04/15/2005	24.00	27.00	1,700	<2	1,700
A01NE-SS-22	04/15/2005	30.00	31.00	1,330	18.7	1,348.70
A01NE-SS-22	04/15/2005	28.00	30.00	1,570	6	1,576
A01NE-SS-24	04/22/2005	3.00	6.00	1,250	2,720	3,970
A01NE-SS-24	04/22/2005	6.00	9.00	783	3,460	4,243
A01NE-SS-24	04/22/2005	9.00	12.00	967D	3,060	4,027
A01NE-SS-25	04/22/2005	3.00	5.00	173	1,100	1,273
A01NE-SS-26	04/27/2005	3.00	6.00	28.6	1,080	1,108.60
A01NE-SS-26	04/27/2005	6.00	9.00	86.5	2,580	2,666.50
A01NE-SS-26	04/27/2005	9.00	11.00	155	2,940	3,095
A01NE-SS-26	04/27/2005	12.00	14.50	165	2,470	2,635
A01NE-SS-27	04/21/2005	3.00	6.00	104	480	584
A01NE-SS-27	04/21/2005	6.00	9.00	356	1,860	2,216
A01NE-SS-27	04/21/2005	9.00	12.00	609	781	1,390
A01NE-SS-27	04/21/2005	12.00	14.00	512	1,860	2,372
A01NE-SS-27	04/21/2005	16.00	18.00	356	2,520	2,876
A01NE-SS-28	04/14/2005	3.00	6.00	50.4	55.8	106.2
A01NE-SS-28	04/14/2005	6.00	9.00	85.3	45.7	131
A01NE-SS-28	04/14/2005	9.00	12.00	62.9	<4.1J	62.9
A01NE-SS-28	04/14/2005	12.00	15.00	15.8	32.9	48.7
A01NE-SS-28	04/14/2005	20.00	21.00	113	<2.1J	113
A01NE-SS-28	04/14/2005	21.00	23.00	292	<2	292
A01NE-SS-28	04/14/2005	24.00	27.00	253	<20	253
A01NE-SS-28	04/14/2005	28.00	30.00	64.5	<2	64.5
A01NE-SS-28	04/14/2005	30.00	31.00	34	14.4	48.4
A01NE-SS-29	04/22/2005	3.00	5.50	371	1,410	1,781
A01NE-SS-30	04/22/2005	3.00	6.00	260	2,150	2,410
A01NE-SS-30	04/22/2005	6.00	9.00	734	4,230	4,964
A01NE-SS-30	04/22/2005	9.00	12.00	1,120	4,290	5,410

Table 4-14, Continued
Subsurface Nitrogen Concentrations >3' BGS
Area A
Former Farmland Nitrogen Plant
Lawrence, Kansas

Site	Date	Starting Depth (feet)	Ending Depth (feet)	Nitrate plus Nitrite (as N) (mg/kg)	Nitrogen, Ammonia (mg/kg)	Total Nitrate plus Ammonia (mg/kg)
A01NE-SS-30	04/22/2005	12.00	15.00	901	2,960	3,861
A01NE-SS-30	04/22/2005	15.00	18.00	346	627	973
A01NE-SS-31	04/27/2005	3.00	6.00	264	1,630	1,894
A01NE-SS-31	04/27/2005	6.00	9.00	646	2,710	3,356
A01NE-SS-31	04/27/2005	9.00	12.00	781	1,850	2,631
A01NE-SS-31	04/27/2005	12.00	15.00	945	1,760	2,705
A01NE-SS-31	04/27/2005	15.00	17.00	1,050	1,450	2,500
A01NE-SS-32	04/21/2005	3.00	6.00	731	3,330	4,061
A01NE-SS-32	04/21/2005	6.00	9.00	1,080	4,130	5,210
A01NE-SS-32	04/21/2005	9.00	12.00	1,130	1,560	2,690
A01NE-SS-32	04/21/2005	12.00	15.00	1,180	2,760	3,940
A01NE-SS-32	04/21/2005	15.00	17.00	1,170	2,100	3,270
A01NE-SS-33	04/21/2005	3.00	6.00	<2.3J	24	24
A01NE-SS-33	04/21/2005	6.00	9.00	<2.5J	46.2	46.2
A01NE-SS-33	04/21/2005	9.00	12.00	10.2	23.3	33.5
A01NE-SS-33	04/21/2005	12.00	15.00	10.7	32.6	43.3
A01NE-SS-33	04/21/2005	15.00	18.00	473	1,130	1,603
A01NE-SS-33	04/21/2005	18.00	21.00	789	2,820	3,609
A01NE-SS-33	04/21/2005	21.00	23.00	913	3,060	3,973
A01NE-SS-33	04/21/2005	24.00	27.00	1,040	2,170	3,210
A01NE-SS-33	04/21/2005	28.00	29.50	895	1,010	1,905
A01NE-SS-34	04/22/2005	3.00	5.75	195	433	628
A01NE-SS-36	04/27/2005	3.00	6.00	708	754	1,462
A01NE-SS-36	04/27/2005	6.00	9.00	1,950	3,650	5,600
A01NE-SS-36	04/27/2005	9.00	12.00	3,370	7,070	10,440
A01NE-SS-36	04/27/2005	12.00	13.00	3,590	5,640	9,230
A01NE-SS-37	04/27/2005	3.00	6.00	509	222	731
A01NE-SS-37	04/27/2005	6.00	9.00	180	455	635
A01NE-SS-37	04/27/2005	9.00	12.00	371	480	851
A01NE-SS-37	04/27/2005	12.00	15.00	319	572	891
A01NE-SS-37	04/27/2005	15.00	17.00	280	273D	553
A01NE-SS-38	04/22/2005	3.00	6.00	<0.8>	<3.2J	0.8
A01NE-SS-38	04/22/2005	6.00	9.00	28	8.9	36.9
A01NE-SS-38	04/22/2005	9.00	12.00	17.4	35.5	52.9
A01NE-SS-38	04/22/2005	12.00	15.00	306	18.3	324.3
A01NE-SS-38	04/22/2005	15.00	18.00	491	58.8	549.8
A01SE-SS-01	04/27/2005	3.00	6.00	112	458D	570
A01SE-SS-01	04/27/2005	6.00	8.00	102	399	501
A01SE-SS-03	04/29/2005	3.00	6.00	217	907	1,124
A01SE-SS-04	04/29/2005	3.00	6.00	1,200	2,200	3,400

Table 4-14, Continued
Subsurface Nitrogen Concentrations >3' BGS
Area A
Former Farmland Nitrogen Plant
Lawrence, Kansas

Site	Date	Starting Depth (feet)	Ending Depth (feet)	Nitrate plus Nitrite (as N) (mg/kg)	Nitrogen, Ammonia (mg/kg)	Total Nitrate plus Ammonia (mg/kg)
A01SE-SS-04	04/29/2005	6.00	9.00	1,500	1,280	2,780
A01SE-SS-04	04/29/2005	9.00	12.00	578	209	787
A01SE-SS-04	04/29/2005	12.00	15.00	1,020	236	1,256
A01SE-SS-05	04/29/2005	3.00	6.00	97.4	91.2	188.6
A01SE-SS-05	04/29/2005	6.00	9.00	262	35.8	297.8
A01SE-SS-05	04/29/2005	9.00	12.00	253	22.4	275.4
A01SE-SS-05	04/29/2005	12.00	15.00	209	44.3	253.3
A01SE-SS-05	04/29/2005	15.00	17.00	313	19.8	332.8
A01SE-SS-06	04/28/2005	3.00	5.00	120	134D	254
A01SE-SS-07	05/02/2005	3.00	5.00	19.9	921	940.9
A01SE-SS-07	05/02/2005	7.00	9.00	10.9	786	796.9
A01SE-SS-07	05/02/2005	9.00	12.00	35.2	763	798.2
A01SE-SS-07	05/02/2005	12.00	13.00	178	449	627
A01SE-SS-07	05/02/2005	16.00	18.00	68.7	<3.3J	68.7
A01SE-SS-07	05/02/2005	18.00	19.00	17.7	<3.9J	17.7
A01SE-SS-08	05/02/2005	3.00	6.00	734	9.3	743.3
A01SE-SS-08	05/02/2005	6.00	9.00	93.2	29.1	122.3
A01SE-SS-08	05/02/2005	9.00	12.00	<2.2J	47.8	47.8
A01SE-SS-08	05/02/2005	12.00	15.00	3.5	43.4	46.9
A01SE-SS-08	05/02/2005	15.00	16.00	<1.3>	86.8	88.1
A01SE-SS-09	05/02/2005	3.00	6.00	595	1,70D	1,665
A01SE-SS-09	05/02/2005	6.00	9.00	43.4	1,170	1,213.40
A01SE-SS-09	05/02/2005	9.00	12.00	34.8	1,010	1,044.80
A01SE-SS-09	05/02/2005	12.00	14.00	74.3	850	924.3
A01SE-SS-09	05/02/2005	19.00	21.00	297	8.2	305.2
A01SE-SS-09	05/02/2005	21.00	23.00	65.5	43.6	109.1
A01SE-SS-10	04/28/2005	3.00	6.00	12.1	5	17.1
A01SE-SS-10	04/28/2005	6.00	8.50	17.8	<2	17.8
A01SE-SS-11	04/28/2005	3.00	6.00	24.6	777	801.6
A01SE-SS-11	04/28/2005	6.00	9.00	29.4	524	553.4
A01SE-SS-11	04/28/2005	9.00	12.00	6.3	498	504.3
A01SE-SS-11	04/28/2005	12.00	15.00	40.3	187	227.3
A01SE-SS-11	04/28/2005	15.00	16.00	63	<2.5J	63
A01SE-SS-11	04/28/2005	18.00	21.00	6.8	5.7	12.5
A01SE-SS-11	04/28/2005	24.00	27.00	<2	98.1	98.1
A01SE-SS-11	04/28/2005	28.00	30.00	<2	106	106
A01SE-SS-11	04/28/2005	30.00	31.00	<2	108	108
A01SE-SS-12	05/02/2005	3.00	6.00	578	424	1,002
A01SE-SS-12	05/02/2005	6.00	9.00	477	282	759
A01SE-SS-12	05/02/2005	9.00	12.00	158	296	454

Table 4-14, Continued
Subsurface Nitrogen Concentrations >3' BGS
Area A
Former Farmland Nitrogen Plant
Lawrence, Kansas

Site	Date	Starting Depth (feet)	Ending Depth (feet)	Nitrate plus Nitrite (as N) (mg/kg)	Nitrogen, Ammonia (mg/kg)	Total Nitrate plus Ammonia (mg/kg)
A01SE-SS-12	05/02/2005	12.00	15.00	25.1	28.6	53.7
A01SE-SS-13	04/28/2005	3.00	6.00	<2.5J	5.6	5.6
A01SE-SS-13	04/28/2005	6.00	9.00	3.5	<2	3.5
A01SE-SS-13	04/28/2005	9.00	12.00	7.1	<1.2>	8.3
A01SE-SS-13	04/28/2005	12.00	15.00	13.9	<2	13.9
A01SE-SS-13	04/28/2005	15.00	17.00	8.9	<2	8.9
A01SE-SS-14	04/28/2005	3.00	6.00	<2.8J	35	35
A01SE-SS-14	04/28/2005	6.00	9.00	<2	58.5	58.5
A01SE-SS-14	04/28/2005	9.00	12.00	<2	27.3	27.3
A01SE-SS-14	04/28/2005	12.00	15.00	<2	15.7	15.7
A01SE-SS-14	04/28/2005	15.00	17.00	<2	47.9	47.9
A01W-SS-01	03/30/2005	3.00	6.00	66.6	<1.9>	68.5
A01W-SS-01	03/30/2005	6.00	9.00	23.3	315	338.3
A01W-SS-01	03/30/2005	9.00	12.00	22.5	567	589.5
A01W-SS-01	03/30/2005	12.00	15.00	30.9	524	554.9
A01W-SS-01	03/30/2005	15.00	18.00	75.6	89	164.6
A01W-SS-01	03/30/2005	18.00	21.00	78.8	55.9	134.7
A01W-SS-01	03/30/2005	21.00	24.00	46	69.6	115.6
A01W-SS-02	04/06/2005	3.00	6.00	<0.6>	211	211.6
A01W-SS-02	04/06/2005	6.00	9.00	<1.9>	517	518.9
A01W-SS-02	04/06/2005	9.00	12.00	<1.6>	510	511.6
A01W-SS-02	04/06/2005	16.00	18.00	<1.1>	167	168.1
A01W-SS-02	04/06/2005	18.00	21.00	<1.1>	250	251.1
A01W-SS-02	04/06/2005	21.00	24.00	<1.3>	181	182.3
A01W-SS-02	04/06/2005	24.00	27.00	<1>	54	55
A01W-SS-03	04/07/2005	3.00	6.00	79.6	272	351.6
A01W-SS-03	04/07/2005	6.00	9.00	71.4	620	691.4
A01W-SS-03	04/07/2005	9.00	12.00	83.7	782	865.7
A01W-SS-03	04/07/2005	12.00	15.00	132	1,310	1,442
A01W-SS-03	04/07/2005	15.00	18.00	139	768	907
A01W-SS-03	04/07/2005	18.00	21.00	136	369	505
A01W-SS-03	04/07/2005	21.00	23.00	206	31.7	237.7
A01W-SS-03	04/07/2005	26.00	27.00	45.7	85.4	131.1
A01W-SS-03	04/07/2005	27.00	28.00	8	102	110
A01W-SS-05	04/05/2005	3.00	6.00	<2.6J	<1.2>	1.2
A01W-SS-05	04/05/2005	6.00	9.00	3.4	<1.4>	4.8
A01W-SS-05	04/05/2005	9.00	12.00	3.1	<1>	4.1
A01W-SS-05	04/05/2005	12.00	15.00	3.5	<1>	4.5
A01W-SS-06	04/06/2005	3.00	6.00	3.6	114	117.6
A01W-SS-06	04/06/2005	6.00	9.00	5.7	438	443.7

Table 4-14, Continued
Subsurface Nitrogen Concentrations >3' BGS
Area A
Former Farmland Nitrogen Plant
Lawrence, Kansas

Site	Date	Starting Depth (feet)	Ending Depth (feet)	Nitrate plus Nitrite (as N) (mg/kg)	Nitrogen, Ammonia (mg/kg)	Total Nitrate plus Ammonia (mg/kg)
A01W-SS-06	04/06/2005	9.00	12.00	6.5	532	538.5
A01W-SS-06	04/06/2005	12.00	15.00	11.4	515	526.4
A01W-SS-06	04/06/2005	15.00	18.00	37.7	142	179.7
A01W-SS-06	04/06/2005	18.00	19.00	50.7	19.5	70.2
A01W-SS-08	03/30/2005	3.00	6.00	<1.9>	<2.2J	1.9
A01W-SS-08	03/30/2005	6.00	7.00	<1.3>	<1.6>	2.9
A01W-SS-10	04/06/2005	3.00	6.00	<2.1J	<2	0
A01W-SS-10	04/06/2005	6.00	9.00	2.9	<2	2.9
A01W-SS-10	04/06/2005	9.00	10.00	3.8	<0.9>	4.7
A01W-SS-10	04/06/2005	13.00	15.00	11.5	12.3	23.8
A01W-SS-10	04/06/2005	15.00	18.00	17.5	7.2	24.7
A01W-SS-10	04/06/2005	18.00	20.00	34.2	5.2	39.4
A01W-SS-12	03/30/2005	3.00	6.00	<1.7>	<2.3J	1.7
A01W-SS-13	04/04/2005	3.00	6.00	8.9	<0.9>	9.8
A01W-SS-13	04/04/2005	6.00	9.00	24	<3.2J	24
A01W-SS-13	04/04/2005	9.00	12.00	36	<2.1J	36
A01W-SS-14	04/05/2005	6.00	9.00	4.3	<1.2>	5.5
A01W-SS-14	04/05/2005	3.00	6.00	<1.9>	<1>	2.9
A01W-SS-14	04/05/2005	9.00	9.50	8.7	<1.1>	9.8
A01W-SS-15	04/06/2005	3.00	6.00	<1.6>	<2	1.6
A01W-SS-15	04/06/2005	6.00	9.00	86	<2	86
A01W-SS-15	04/06/2005	9.00	12.00	95.9	<2	95.9
A01W-SS-15	04/06/2005	12.00	13.00	21.1	<2	21.1
A01W-SS-17	03/31/2005	3.00	6.00	<0.9>	<1.8>	2.7
A01W-SS-17	03/31/2005	6.00	9.00	<1.1>	<0.7>	1.8
A01W-SS-17	03/31/2005	9.00	12.00	<1.6>	<0.6>	2.2
A01W-SS-17	03/31/2005	12.00	15.00	<2.5J	<2	0
A01W-SS-17	03/31/2005	15.00	17.00	30.1	<1.1>	31.2
A01W-SS-19	04/04/2005	3.00	6.00	127	26.1	153.1
A01W-SS-19	04/04/2005	6.00	9.00	145	97.7D	242.7
A01W-SS-19	04/04/2005	9.00	9.50	140	135	275
A01W-SS-23	03/31/2005	3.50	6.00	224	212	436
A01W-SS-23	03/31/2005	7.00	10.00	191	1,790	1,981
A01W-SS-23	03/31/2005	10.00	11.50	289	976	1,265
A01W-SS-24	04/04/2005	3.00	6.00	622	1,050	1,672
A01W-SS-24	04/04/2005	6.00	7.00	862	1,250	2,112
A01W-SS-29	03/31/2005	3.00	4.00	3.2	<2	3.2
A01W-SS-31	04/01/2005	3.50	6.00	2,590	4,160	6,750
A01W-SS-32	04/01/2005	3.00	6.00	1,280	3,000	4,280
A01W-SS-32	04/01/2005	6.00	6.50	810	2,260	3,070

Table 4-14, Continued
Subsurface Nitrogen Concentrations >3' BGS
Area A
Former Farmland Nitrogen Plant
Lawrence, Kansas

Site	Date	Starting Depth (feet)	Ending Depth (feet)	Nitrate plus Nitrite (as N) (mg/kg)	Nitrogen, Ammonia (mg/kg)	Total Nitrate plus Ammonia (mg/kg)
A01W-SS-34	04/04/2005	3.00	4.00	21.2	11.3	32.5
A01W-SS-35	04/05/2005	3.00	6.00	287	77.9	364.9
A01W-SS-35	04/05/2005	6.00	8.50	83.6	535	618.6
A01W-SS-36	03/31/2005	3.00	3.50	276	47.3	323.3
A01W-SS-37	04/01/2005	3.00	6.00	1,280	2,270	3,550
A01W-SS-38	04/01/2005	3.00	6.00	1,140	3,410	4,550
A01W-SS-38	04/01/2005	6.00	7.00	883	2,950	3,833
A01W-SS-40	04/04/2005	3.00	6.00	898	1,800	2,698
A01W-SS-40	04/04/2005	6.00	7.00	862	1,280	2,142
A01W-SS-42	03/31/2005	3.00	6.00	8.9	<1.2>	10.1
A01W-SS-43	04/01/2005	3.00	6.00	238	2,090D	2,328
A01W-SS-43	04/01/2005	6.00	6.50	152	1,660	1,812
A01W-SS-44	04/01/2005	3.00	4.00	944	2,570	3,514
A01W-SS-45	04/01/2005	3.00	4.00	178	<1.6>	179.6
A01W-SS-48	04/01/2005	3.00	4.00	41.6	108	149.6
A01W-SS-52	04/05/2005	3.00	6.00	4.4	<2	4.4
A01W-SS-52	04/05/2005	6.00	7.00	4.5	<2	4.5
A01W-SS-53	04/05/2005	3.00	3.50	140	1,280	1,420

<x>=Less than Reporting Limit

D - Duplicate run with high duplicate result

F - Elevated MS/MSD RPD result

G - MS/MSD percent recovery outside reporting limit

J - Estimated concentration above the adjusted method detection limit and below the adjusted reporting limit

L - LCS percent recovery outside limits

U - Elevated reporting limit

Table 4-15
Area A Groundwater Nitrogen Results
Former Farmland Nitrogen Plant
Lawrence, Kansas

Site	Date	Depth	Nitrate plus Nitrite (as N) (mg/l)	Nitrogen, Ammonia (mg/l)
A01NE-GW-02	04/08/2005	27.00	2,550L	265
A01NE-GW-03	04/08/2005	27.00	892L	31.8
A01NE-GW-07	04/11/2005	23.00	3,050	5,420L
A01NE-GW-08	04/15/2005	5.00	25,420	51,640
A01NE-GW-09	04/14/2005	27.00	356	<0>
A01NE-GW-14	04/11/2005	5.00	555L	1040
A01NE-GW-16	04/14/2005	15.00	33,310	47,250
A01NE-GW-21	04/21/2005	10.00	5.9	96.5
A01NE-GW-26	04/27/2005	4.00	157	70
A01NE-GW-27	04/21/2005	8.00	428	571
A01NE-GW-28	04/14/2005	14.00	427	31.1
A01NE-GW-33	04/21/2005	25.00	3,920	2,740
A01SE-GW-07	05/02/2005	15.00	80.2	92.9
A01SE-GW-09	05/02/2005	15.00	200	149
A01W-GW-01	04/07/2005	12.00	790	1,055
A01W-GW-02	04/06/2005	23.00	11L	16.7
A01W-GW-03	04/07/2005	18.00	478L	205
A01W-GW-06	04/06/2005	9.00	17.2L	32.1
A01W-GW-10	04/06/2005	9.00	7.13L	<0.92J

<x>=Less than Reporting Limit

D - Duplicate run with high duplicate result

F - Elevated MS/MSD RPD result

G - MS/MSD percent recovery outside reporting limit

J - Estimated concentration above the adjusted method detection limit and below the adjusted reporting limit

L - LCS percent recovery outside limits

U - Elevated reporting limit

4.4 IDENTIFIED AREAS OF INTEREST FOR AREA A

Review and evaluation of the data collected in Area A indicates that there are five (5) areas of interest (AOIs) for Total Nitrogen in Area A. These areas are believed to be major contributors to the elevated levels of Ammonia and Nitrates observed in local groundwater.

4.4.1 Area A – UAN Storage Area

Area A contains the majority of sample locations with high concentrations of Total Nitrogen. Five (5) AOIs for Total Nitrogen have been identified in Area A for possible corrective measures. The following are the AOIs for Area A:

- AOI 1 – Northeast production area and railcar loading area;
- AOI 2 – Southeast production area;
- AOI 3 – Central area around the existing 6,000,000-gallon tank (former lagoon area);
- AOI 4 – Central ponds; and
- AOI 5 – Area north and east of the warehouse along the property line.

4.4.1.1 AOI 1 – Northeast Production and Railcar Loading Area

The majority of the surface soil contamination in this area has concentrations of Total Nitrogen ranging from 100 mg/kg to 1,000 mg/kg with a few locations with Total Nitrogen concentrations higher than 1,000 mg/kg. There is, however, an increase in concentrations to over 1,000 mg/kg in the subsurface soils as depths increase. For example, at sample location A01NE-SS-33 concentrations for Total Nitrogen increased from 193.2 mg/kg at the 0-3 foot bgs interval to 3,973 mg/kg at the 21-23 foot bgs inverval (**Figure 4-12**). This area covers approximately 8.6 acres of the 120 acres comprising Area A.

4.4.1.2 AOI 2 – Southeast Production Area

This area covers approximately 4 acres of the 120 acres of Area A with Total Nitrogen contamination extending to 31 feet bgs and likely to bedrock. The surface and shallow subsurface soil contamination in the area has concentrations ranging from 100 mg/kg to 1,000 mg/kg. Two locations had concentrations above 1,000 mg/kg. Again it is observed that there is a rise in the number of locations with concentrations greater than 1,000 mg/kg in the deeper subsurface soils. **Figure 4-12** illustrates the location of the southeast production area. Total Nitrogen contamination increases with depth, with a high concentration of 23,130 mg/kg at sample location A01NE-SS-08 at a depth of 6 feet bgs.

4.4.1.3 AOI 3 Former UAN Lagoon Area

The majority of the surface soil contamination in the area has concentrations ranging from 100 mg/kg to 1,000 mg/kg with a few locations with Total Nitrogen concentrations greater than 1,000 mg/kg. Total Nitrogen concentrations are noted to increase with depth. The Former UAN Lagoon Area is located in the vicinity of a 6,000,000-gallon AST that had been used to store UAN. This tank is now used to store water from the Rundown Pond. This area covers approximately 11.7 acres of the 120 acres comprising Area A. **(Figure 4-12)**

4.4.1.4 AOI 4 – Central Ponds

Total Nitrogen concentrations in the sediment samples from the two small ponds in the central part of Area A were greater than 10,000 mg/kg. However, the concentrations in the surface soils of the two locations adjoining the ponds were less than 100 mg/kg. The data indicates that the contamination in this area may be limited to the ponds. This area was sampled to bedrock using the Geoprobe® so further delineation under the sediment layer should not be necessary. This area covers approximately 0.6 acres of the 120 acres comprising Area A. **(Figure 4-12)**

4.4.1.5 AOI 5 – Adjacent to Bag Warehouse

Surface soil concentrations in the areas to the north and east of the Bag Warehouse in this source area were below 10 mg/kg, but concentrations increased with depth. Subsurface soil samples in one location in this area ranged from 100 mg/kg to 1,000 mg/kg in the shallow subsurface, to greater than 1,000 mg/kg in two locations in deeper soils. This area covers approximately 2 acres of the 120 acres comprising Area A. **(Figure 4-12)**

4.4.2 Area B – Northern Ponds

Nutriject Systems LLC of Hudson, Iowa was subcontracted by Shaw to perform pond sediment sampling of the six primary ponds. Nutriject mobilized to the site on March 28, 2005 and initiated tasked activities to determine the depth of water in each of the six ponds, determine the top of the pond sediment that had accumulated in each pond, determine the total thickness of the pond sediment by penetrating the sediment interval to the native clay material at the base of each pond, and calculate based on these measurement the volume of pond sediment in each pond. In addition Nutriject was tasked to provide a continuous core of the retrieved sediment material so that a grab sample could be taken at 2-foot intervals and submitted for laboratory analysis per the KDHE-approved work plan.

Nutriject utilized one field person, a small boat and a sludge judge to complete the tasked field activities. Pond characterization activities were completed from March 28, 2005 through April 6, 2005.

Upon completion of this sampling activity and review of the preliminary results provided by Nutriject to Shaw it was determined that the sludge judge and sampling technique employed by Nutriject was not capable of penetrating the pond sediments contained in the West Lime Pond , the Rundown Pond, and the East Lime Pond. These three ponds were re-sampled at identical sampling locations

by Shaw personnel utilizing a mini pontoon boat, 4-inch diameter PVC casing for use as a caisson at each sample location, and a manual hand auger to retrieve samples. Following standard sampling protocols as outlined in the Field Sampling Plan the required samples were collected with the exception of the Rundown Pond. Due to the nature of the compacted sediment in this pond, and the deeper design depth of this pond, the entire sediment interval to the base of the pond (native clay liner) could not be penetrated. Sampling activities for these three ponds were completed for June 13, 2005, through June 22, 2005. All QA/QC protocols, decontamination procedures, and required QA/QC samples were collected as outlined in the site characterization work plan.

Cross sections of the six ponds were constructed using the historical, physical and chemical data gathered during the pond characterization sampling and are presented in **Figures 4-13,** through **4-18**. These cross sections depict the general dimensions of the ponds, the designed depths of the ponds, the estimated actual depths of the ponds, the sampling locations, the depth of pond sediment penetrated and sampled, a description of the pond sediment material, the depth of water at the time of the sampling event, and the analytical results for each retrieved sample. It was noted that the ponds' actual depths varied across each pond as compared to the ponds' original designs. Discussions with former plant operations personnel indicated that the ponds had been dredged or partially dredged during their operational life, resulting in the observed variation from the original design.

4.4.2.1 West Effluent Pond

Analytical Results

A total of 18 samples were collected from the West Effluent Pond and are believed to accurately represent the composition, the amount, and the concentrations of the targeted analytes. Accumulated sediments in this pond were generally described as brown to gray clay, with native clay identified as dark gray to black. Pond sediments were submitted for RCRA metals analysis by EPA Method 3050/6010B , Mercury analysis using EPA Method 7471, Ammonia analysis by EPA Method 350.1, TKN analysis by EPA Method 351.2, Nitrate, and Nitrite analysis by EPA Method 353.2. Selected samples were also submitted for TCLP analysis and volatile organic analysis by EPA Method 8260. Pace Labs was subcontracted for performing the chemical analysis on all pond samples collected as part of this investigation.

Laboratory analysis indicated that Arsenic was present in the pond sediments at a mean concentration of 7.76 mg/kg with a low concentration of 4.06 mg/kg and a high concentration of 11.4 mg/kg. Barium was present at a mean concentration of 361.4 mg/kg with an observed low concentration of 219 mg/kg and a high concentration of 487 mg/kg. Cadmium was present at a mean concentration of 0.64 mg/kg with a low concentration of undetected to a high concentration of 1.17 mg/kg. Total Chromium was present at a mean concentration of 433.02 mg/kg with a high concentration of 1,230 mg/kg and a low concentration of 45.5 mg kg. Hexavalent chromium analysis was not performed on samples collected from the West Effluent Pond. Lead was present at a mean concentration of 18.79 mg/kg with a high concentration of 37.9 mg/kg and a low concentration of 8.73 mg kg. Selenium was not found in any of the sediment samples collected and Silver was noted in one sample at a concentration of 1.22 mg/kg. Mercury was present at a mean concentration of 0.24 mg/kg with a high concentration of 0.699 mg/kg and a low concentration of undetected.

Metal concentrations appear to be randomly distributed throughout the pond sediments of the West Effluent Pond without any apparent trends related to depth or a region of the pond.

With respect to nitrogen compounds ammonia was detected in the collected pond sediments at a mean concentration of 199.1 mg/kg with concentrations ranging from undetected to 857 mg/kg. The highest ammonia concentrations were noted to be in the northwest and western area of the pond. TKN analysis indicated a mean TKN of 1,878.6 mg/kg with a distribution range of 896 mg/kg to 4,050 mg/kg. Again the highest concentrations for TKN were located in the northwestern region of the pond. Nitrites were not detected in any of the samples collected and nitrates were only reported in one sample at a concentration of 9.1 mg/kg.

Volatile organic analysis was performed on four samples collected from the West Effluent Pond with only acetone and methyl ethyl ketone (MEK) being detected in one sample at respective concentrations of 500 ug/kg and 44 ug/kg. The origin of VOCs in these samples is uncertain, but may be partially attributed to laboratory-introduced artifacts. Acetone is a common laboratory contaminant. The presence of VOCs in these samples may be the result of the use of a weed control product around the perimeters of the primary ponds.

TCLP analysis was performed on a representative composite sample from the West Effluent Pond. All RCRA metal results were reported as non detected with the exception of Barium with a reported concentration of 1.99 mg/l which is well below the regulatory limit of 100 mg/l.

Pond Specifications

From the physical data collected during characterization of the West Effluent Pond it was determined that the pond had an original design depth of 822 feet above mean sea level (MSL) with a dike elevation of 830 feet above MSL. In the early 1990s an additional 2 feet in height was added to the dike. Based on the pond dimensions listed in **Table 4-2** and the actual pond sediment profiling data obtained during this site characterization it was estimated that 32,000 cubic yards of sediment reside in the West Effluent Pond.

Table 4-16
West Effluent Pond
Analytical Results

Sediment Sample	As mg/kg	Ba mg/kg	Cd mg/kg	Total Cr mg/kg	Hexavalent Cr mg/kg	Pb mg/kg	Se mg/kg	Ag mg/kg	Hg mg/kg	Ammonia mg/kg	TKN mg/kg	NO2 +NO3 mg/kg	Nitrite mg/kg	Nitrate mg/kg	VOA µg/kg
A02-SED-01 0-2'	4.68	356	ND	506	NA	20.5	ND	ND	ND	857	3,770	ND	ND	ND	NA
A02-SED-01 2-4'	6.43	326	1.01	600	NA	18.2	ND	ND	0.463	565	4,050	ND	ND	ND	NA
A02-SED-02 0-2'	9.97	367	ND	99.9	NA	19.6	ND	ND	ND	521	3,660	ND	ND	ND	NA
A02-SED-03-0-2'	4.06	219	ND	465	NA	13.4	ND	ND	ND	184	2,340	ND	ND	ND	ND
A02-SED-04 0-2'	9.6	385	0.949	62.7	NA	19.8	ND	ND	0.294	75.4	1,180	ND	ND	ND	ND
A02-SED-05 0-2'	10.1	353	0.808	58.8	NA	19.7	ND	ND	0.331	75.3	1,200	ND	ND	ND	NA
A02-SED-06 0-2'	8.1	451	0.796	45.5	NA	12.2	ND	ND	ND	60.3	1,210	ND	ND	ND	NA
A02-SED-07 0-2'	5.24	265	ND	47.5	NA	19	ND	ND	ND	60.5	1,810	ND	ND	ND	NA
A02-SED-08 0-2'	7.02	318	0.866	57.3	NA	21.3	ND	ND	0.406	ND	1,610	10.8	ND	9.1	ND
A02-SED-09 0-2.5'	6.46	282	1.12	172	NA	23.3	ND	ND	ND	115	2,220	ND	ND	ND	NA
A02-SED-09 2.5-5'	8.76	341	1.17	280	NA	21.5	ND	ND	ND	219	3,030	ND	ND	ND	NA
A02-SED-10 0-2'	9.13	384	0.782	682	NA	15.8	ND	ND	0.266	138	1,170	ND	ND	ND	NA
A02-SED-10 2-4'	8.93	487	0.801	1,230	NA	8.73	ND	1.22	0.699	154	1,150	ND	ND	ND	NA
A02-SED 10 4-5'	7.71	418	0.906	1,000	NA	14.9	ND	ND	0.289	241	1,480	ND	ND	ND	NA
A02-SED=11 0-2'	11.4	449	0.879	874	NA	37.9	ND	ND	0.416	108	909	ND	ND	ND	NA
A02-SED-11 2-4'	7.85	377	0.713	645	NA	14.9	ND	ND	0.404	106	896	ND	ND	ND	NA
A02-SED-11 4-5'	6.55	383	0.74	922	NA	23.2	ND	ND	0.346	78.2	899	ND	ND	ND	NA
A02-SED-12 0-2'	7.72	345	ND	46.7	NA	14.2	ND	ND	0.381	25.8	1,230	ND	ND	ND	Acetone 500, MEK 44
Mean	**7.76**	**361**	**0.641**	**433.0**	**NA**	**18.8**	**0**	**0.07**	**0.239**	**199**	**1,879**	**0.6**	**0**	**0.5**	

NA = Not Analyzed
ND = Not Detected

4.4.2.2 East Effluent Pond

Analytical Results

A total of 22 samples were collected from the East Effluent Pond and are believed to accurately represent the composition, the amount, and the concentrations of the targeted analytes. Accumulated sediments in this pond were generally described as an olive brown silty clay and greenish gray clay with identified native clay as black in color. Pond sediments were submitted for RCRA metals analysis by EPA Method 3050/6010B , Mercury analysis using EPA Method 7471, Ammonia analysis by EPA Method 350.1, TKN analysis by EPA Method 351.2, Nitrate, and Nitrite analysis by EPA Method 353.2. Selected samples were submitted for TCLP analysis and volatile organic analysis by EPA Method 8260. Pace Labs was subcontracted for performing the chemical analysis on all pond samples collected as part of this investigation.

Laboratory analysis indicated that Arsenic was present in the East Effluent Pond sediments at a mean concentration of 6.55 mg/kg with concentrations ranging from non detected to a high concentration of 11.4 mg/kg. Barium was present at a mean concentration of 525.7 mg/kg with an observed low concentration of 280 mg/kg and a high concentration of 899 mg/kg. Cadmium was present at a mean concentration of 0.68 mg/kg with a low concentration of undetected to a high concentration of 0.79 mg/kg. It should be noted that Cadmium was observed in only two samples. Total Chromium was present at a mean concentration of 1,362.6 mg/kg with a high concentration of 3,400 mg/kg and a low concentration of 63 mg/kg. Hexavalent chromium analysis was not performed on samples collected from the East Effluent Pond. Lead was present at a mean concentration of 18.95 mg/kg with a high concentration of 35.2 mg/kg and a low concentration of 12.1 mg/ kg. Selenium was not found in any of the sediment samples collected and Silver was noted in six samples at a mean concentration of 0.39 mg/kg. Mercury was present at a mean concentration of 0.83 mg/kg with a high concentration of 4.53mg/kg and a low concentration of undetected.

Metal concentrations also appear to be randomly distributed throughout the pond sediments of the East Effluent Pond without any apparent trends related to depth or a region of the pond.

With respect to nitrogen compounds ammonia was detected in the collected pond sediments at a mean concentration of 187.7 mg/kg with concentrations ranging from 59.9 mg/kg to 315 mg/kg. The highest ammonia concentrations were noted to be in the central area of the pond. TKN analysis indicated a mean TKN of 1,149.4 mg/kg with a distribution range of 554 mg/kg to 2,290 mg/kg. The highest concentrations for TKN were located in the north region of the pond. Nitrites were detected in one only one of the samples collected at a concentration of 13.4 mg/kg. No nitrates were reported in any of the 22 samples collected.

Volatile organic analysis was performed on three samples collected from the East Effluent Pond with only acetone and MEK being detected in the three samples at respective high concentrations of 430 ug/kg and 69 ug/kg. The origin of VOCs in these samples is uncertain, but may be partially attributed to laboratory-introduced artifacts. Acetone is a common laboratory contaminant. The presence of VOCs in these samples may be the result of the use of a weed control product around the perimeters of the primary ponds.

TCLP analysis was performed on a representative composite sample from the East Effluent Pond. All RCRA metal results were reported as non detected with the exception of Barium with a reported concentration of 2.45 mg/l which is well below the regulatory limit of 100 mg/l.

Pond Specifications

From the physical data collected during characterization of the East Effluent Pond it was determined that the pond had an original design depth of 820 feet above MSL with a dike elevation of 830 feet above MSL. In the early 1990s an additional 2 feet in height was added to the dike. Based on the pond dimensions listed in **Table 4-2** and the pond sediment profiling activities completed during this site characterization it was estimated that 27,000 cubic yards of sediment reside in the East Effluent Pond.

Table 4-17
East Effluent Pond
Analytical Results

Sediment	As	Ba	Cd	Total Cr	Hexavalent Cr	Pb	Se	Ag	Hg	Ammonia	TKN	NO2 +NO3	Nitrite	Nitrate	VOA
Sample	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	µg/kg
A02-SED-13 0-2'	8.25	516	ND	1,250	NA	17.4	ND	ND	1.11	190	1,310	ND	ND	ND	NA
A02-SED-13 2-4'	6.76	375	ND	745	NA	13.2	ND	ND	ND	146	1,200	ND	ND	ND	NA
A02-SED-14 0-2'	8.4	442	ND	1,220	NA	21	ND	ND	0.743	216	1,660	ND	ND	ND	NA
A02-SED-14 2-4'	11.4	744	ND	2,050	NA	20.2	ND	ND	1.9	208	1,910	ND	ND	ND	NA
A02-SED-14 4-5'	5.3	426	ND	1,020	NA	14.5	ND	ND	ND	134	1,200	ND	ND	ND	NA
A02-SED-15 0-2.5'	11.3	525	ND	1,550	NA	21.7	ND	ND	0.833	252	2,230	ND	ND	ND	Acetone 430, MEK 69
A02-SED-15 2.5 5'	10.7	899	ND	2,640	NA	26.2	ND	ND	1.29	283	2,290	13.4	13.4	ND	NA
A02-SED-16 0-2'	4.21	421	ND	1,020	NA	14.9	ND	1.13	ND	125	965	ND	ND	ND	NA
A02-SED-17 0-2'	7.15	391	ND	1,010	NA	20.5	ND	ND	0.546	59.9	768	ND	ND	ND	NA
A02-SED-18 0-2'	8.04	679	0.79	1,500	NA	23	ND	1.24	0.903	186	684	ND	ND	ND	Acetone 290, MEK 23
A02-SED-18 2-4'	6.1	491	ND	895	16.8	NA	ND	ND	0.786	143	792	ND	ND	ND	NA
A02-SED-18 4-5'	4.93	467	ND	881	NA	17	ND	1.03	0.617	129	742	ND	ND	ND	NA
A02-SED-19 0-2'	7.84	561	ND	1,550	NA	25.8	ND	ND	1.44	309	1,210	ND	ND	ND	NA
A02-SED-19 2-4'	ND	661	ND	2,170	NA	13.2	ND	1.56	4.53	147	490	ND	ND	ND	NA
A02-SED-19 4-5'	10.8	794	ND	2,690	NA	35.2	ND	ND	1.07	277	1,530	ND	ND	ND	NA
A02-SED-20 0-2'	8.15	280	0.72	63	NA	26	ND	ND	0.29	230	739	ND	ND	ND	NA
A02-SED-20 2-4'	6.92	508	ND	70	NA	18.2	ND	ND	ND	315	1,040	ND	ND	ND	NA
A02-SED-21 0-2'	2.92	614	ND	3,400	NA	12.5	ND	1.42	0.728	158	554	ND	ND	ND	NA
A02-SED-21 2-4'	5.32	503	ND	2,010	NA	18.7	ND	ND	0.518	194	909	ND	ND	ND	NA
A02-SED-22 0-2'	1.64	498	ND	1,200	NA	12.1	ND	1.1	ND	119	861	ND	ND	ND	NA
A02-SED-22 2-4'	2.38	450	ND	793	NA	13.2	ND	1.16	0.523	148	843	ND	ND	ND	Acetone 95
A02-SED-23 0-2'	5.57	321	ND	251	NA	15.7	ND	ND	0.378	160	1,360	ND	ND	ND	NA
Mean	**6.55**	**526**	**0.07**	**1,362.6**	**0.8**	**18.2**	**ND**	**0.39**	**0.828**	**188**	**1,149**	**0.6**	**0.6**	**0**	

NA = Not Analyzed
ND = Not Detected

4.4.2.3 West Lime Pond

Analytical Results

A total of 56 samples were collected from the West Lime Pond and are believed to accurately represent the composition of the sediment and the concentrations of the targeted analytes. Accumulated sediments in this pond were generally described as reddish yellow clay material (lime sludge) to dark yellowish brown clay, with black native clay identified at the base of the pond. All pond sediment samples were submitted to Pace Labs for RCRA metals analysis by EPA Method 3050/6010B , Mercury analysis using EPA Method 7471, Ammonia analysis by EPA Method 350.1, TKN analysis by EPA Method 351.2, and Nitrate, and Nitrite analysis by EPA Method 353.2. Selected samples were submitted for TCLP analysis, hexavalent chromium analysis, and volatile organic analysis by EPA Method 8260. Pace Labs was subcontracted for performing the chemical analysis on all pond samples collected as part of this investigation.

Laboratory analysis indicated that Arsenic was present in the West Lime Pond sediments at a mean concentration of 6.54 mg/kg with concentrations ranging from non detected to a high concentration of 23.5 mg/kg. Barium was present at a mean concentration of 410.15mg/kg with an observed low concentration of 12 mg/kg and a high concentration of 685 mg/kg. Cadmium was present at a mean concentration of 0.168 mg/kg with a low concentration of undetected to a high concentration of 0.123 mg/kg. It should be noted that Cadmium was observed in only nine of the 56 samples. Total Chromium was present at a mean concentration of 207.6 mg/kg with a high concentration of 1,020 mg/kg and a low concentration of 1.16 mg/kg. Hexavalent chromium analysis was performed on 31 of the samples collected from the West Lime Pond and all were reported as non detects. Lead was present at a mean concentration of 19.71 mg/kg with a high concentration of 72.6 mg/kg and a low concentration of non detect. Selenium was observed in only three of the 56 samples at a mean concentration of 0.13 mg/kg. Silver was noted in 23 samples at a mean concentration of 0.56 mg/kg. Mercury was present at a mean concentration of 0.13 mg/kg with a high concentration of 0.925 g/kg and a low concentration of undetected.

Metal concentrations appear to be randomly distributed throughout the West Lime Pond sediments without any apparent trends related to depth or a region of the pond.

With respect to nitrogen compounds ammonia was detected in the collected pond sediments at a mean concentration of 772 mg/kg with concentrations ranging from non-detect to 5,590 mg/kg. The highest ammonia concentrations were noted to be in the northern area of the pond. Total Kjeldahl (TKN) analysis indicated a mean TKN of 1,973.5 mg/kg with a distribution range of non-detect to 9,230 mg/kg. The highest concentrations for TKN were also located in the northern region of the pond. Nitrites were detected in one only five of the 56 samples collected at a mean concentration of 6.43 mg/kg. Nitrates were observed at a mean concentration of 695.04 mg/kg with a reported range of non-detect to 2,740 mg/kg. Highest nitrate concentrations were also located in the northern area of the pond.

Volatile organic analysis was performed on one sample collected from the West Lime Pond. Several VOCs were identified. These VOCS and their respective concentrations in ug/kg are: sec-butylbenzene (17), n-butylbenzene (65), naphthalene (100), n-propylbenzene (23), 1,2,4 trimethylbenzene (190), 1,3,5, trimethylbenzene (58), and Xylenes (150). The origin of VOCs

in these samples is uncertain, but may be partially attributed to laboratory-introduced artifacts. The presence of VOCs in these samples may be the result of the use of a weed control product around the perimeters of the primary ponds.

TCLP analysis was performed on a representative composite sample from the West Lime Pond. All RCRA metal results were reported as non detected with the exception of Barium with a reported concentration of 1.29 mg/l which is well below the regulatory limit of 100 mg/l.

Pond Specifications

From the physical data collected during characterization of the West Lime Pond it was determined that the pond had an original design depth of 820 feet above MSL with a dike elevation of 830 feet above MSL. In the early 1990s an additional 2 feet in height was added to the dike. Based on the pond dimensions listed in **Table 4-2** and the pond sediment profiling activities completed during this site characterization it was estimated that 61,000 cubic yards of sediment reside in the West Lime Pond.

Table 4-18
West Lime Pond
Analytical Results

Sediment Sample	As mg/kg	Ba mg/kg	Cd mg/kg	Total Cr mg/kg	Hexavalent Cr mg/kg	Pb mg/kg	Se mg/kg	Ag mg/kg	Hg mg/kg	Ammonia mg/kg	TKN mg/kg	NO2 +NO3 mg/kg	Nitrite mg/kg	Nitrate mg/kg	VOA µg/kg
A02-SED-24 0-2'	9.06	267	0.91	235	NA	48.5	ND	ND	ND	ND	1,380	117	ND	115	NA
A02-SED-24A 0-2'	13.5	211	1.13	254	ND	70.7	ND	ND	0.656	48.6	2,640	92.9	11.6	81.4	NA
A02-SED-24A 2-4'	10.8	218	0.91	207	ND	56	ND	ND	0.612	104	2,980	230	ND	217	NA
A02-SED-25 0-2'	8.52	322	ND	305	NA	35.5	ND	ND	ND	589	3,510	795	ND	783	NA
A02-SED-25A 0-2'	14.6	224	ND	215	ND	43.7	ND	ND	0.343	1,830	4,920	717	ND	698	NA
A02-SED-25A 2-4'	14.4	186	1.54	198	ND	72.6	ND	ND	ND	1,580	7,900	630	ND	627	NA
A02-SED-25A 4-6'	13.2	362	ND	197	ND	48.4	ND	ND	0.33	3,510	9,230	2,780	ND	2,740	NA
A02-SED-25A 6-7'	6.03	198	ND	95.5	ND	20.2	ND	ND	ND	1,910	2,270	580	ND	577	NA
A02-SED-26 0-2'	8.83	127	1.13	137	NA	48.3	2.07	ND	0.261	5,030	8,610	1,650	ND	1,640	see below for detected VOAs
A02-SED-26A 0-2 '	12.6	217	1.23	227	ND	64.8	3.69	ND	ND	1,410	3,910	450	ND	451	NA
A02-SED-26A 2-4"	9.52	409	ND	44.7	ND	15.5	ND	1.18	ND	5,590	6,920	1,370	ND	1,370	NA
A02-SED-26A 4-6'	6.42	385	ND	548	ND	18.4	ND	ND	0.597	4,080	6,000	1,270	ND	1,260	NA
A02-SED-26A 6-7'	6.61	197	ND	36.7	ND	15.2	ND	ND	ND	2,280	2,890	432	ND	431	NA
A02-SED-27 0-2'	8	522	ND	1,020	NA	31.7	ND	ND	0.541	128	2,250	1,120	147	973	NA
A02-SED-27A 0-2'	10.8	184	1.13	191	ND	60.9	ND	ND	0.537	303	3,380	358	ND	353	NA
A02-SED-27A 2-4'	9.78	534	ND	34.2	ND	20.8	ND	1.77	ND	432	1,880	805	ND	801	NA
A02-SED-27A 4-6'	7.41	473	ND	57.7	ND	24.2	ND	1.2	0.331	318	2,190	507	ND	509	NA
A02-SED-27A 6-8'	6.99	462	ND	28.5	ND	15.2	ND	1.89	ND	727	2,090	715	ND	697	NA
A02-SED-27A 8-10'	5.88	459	ND	12.2	ND	10.4	ND	1.84	ND	715	2,120	781	ND	748	NA
A02-SED-27A 10-12'	7.96	465	ND	24.1	ND	9.77	ND	2	ND	792	1,260	903	ND	862	NA
A02-SED-27A 12-14'	8.05	473	ND	128	ND	14.1	ND	1.79	ND	1,210	3,010	827	ND	783	NA
A02-SED-28 0-2'	ND	462	ND	38.5	NA	9.5	ND	1.54	ND	ND	189	387	ND	387	NA
A02-SED-28A 0-2'	4.79	385	ND	235	ND	28.5	ND	ND	ND	81	1,160	1,140	ND	1,120	NA
A02-SED-28A 2-4'	6.13	511	ND	207	ND	15	ND	ND	ND	146	932	2,030	ND	1,920	NA
A02-SED-28A 4-6'	7.37	573	ND	849	ND	16.8	ND	ND	0.44	2,310	3,020	1,270	ND	1,240	NA
A02-SED-28A 6-8'	6.26	387	ND	288	ND	27.6	ND	ND	ND	3,050	3,660	780	ND	781	NA

Detected VOAs = sec-butylbenzene 17, n-butylbenzene 65, , napthalene 100, n-propylbenzene 23, 1,2,4 -trimethylbenzene, 190, 1,3.5-trimethylbenzene 58, xylene 150.
NA = Not Analyzed
ND = Not Detected

Table 4-18, Continued
West Lime Pond
Analytical Results

Sediment Sample	As mg/kg	Ba mg/kg	Cd mg/kg	Total Cr mg/kg	Hexavalent Cr mg/kg	Pb mg/kg	Se mg/kg	Ag mg/kg	Hg mg/kg	Ammonia mg/kg	TKN mg/kg	NO2 +NO3 mg/kg	Nitrite mg/kg	Nitrate mg/kg	VOA µg/kg
A02-SED-29 0-2'	4.24	422	ND	514	NA	17.3	ND	0.961	0.352	ND	780	152	ND	151	NA
A02-SED-29A 0-2'	6.51	566	ND	41.2	ND	5.14	ND	ND	ND	30	805	1,580	ND	1,530	NA
A02-SED-29A 2-4'	4.56	521	ND	26.2	ND	1.72	ND	ND	ND	365	754	1,960	ND	1,870	NA
A02-SED-29A 4-6'	3.98	479	ND	51.3	ND	2.55	ND	ND	ND	263	657	1,450	ND	1,390	NA
A02-SED-30 0-2'	5.81	12	0.698	873	NA	22.7	ND	0.991	0.469	ND	849	428	ND	427	ND
A02-SED-30A 0-2'	5.4	525	ND	532	ND	10.1	ND	ND	ND	ND	276	264	ND	264	NA
A02-SED-30A 2-4'	5.74	530	ND	109	ND	1.88	ND	ND	ND	ND	281	734	ND	705	NA
A02-SED-30A 4-6'	5.32	561	ND	29.9	ND	ND	ND	ND	ND	194	673	1,060	96	960	NA
A02-SED-30A 6-8'	6.81	571	ND	633	ND	7.65	ND	ND	ND	377	711	974	ND	884	NA
A02-SED-31 0-2'	3.3	437	ND	403	NA	17.1	ND	1.07	0.528	ND	678	65.7	ND	65.7	NA
A02-SED-31A 0-2'	6.87	498	ND	661	ND	18.6	ND	ND	0.925	30.9	1,730	1,030	ND	1,030	NA
A02-SED-31A 2-4'	6.96	544	ND	2.94	ND	ND	ND	ND	ND	1,030	1,560	1,970	ND	1,930	NA
A02-SED-31A 10-12'	3.07	243	ND	78.1	ND	9.09	ND	ND	ND	1,340	2,210	531	ND	512	NA
A02-SED-32 0-2'	7.77	309	ND	199	NA	16.4	ND	ND	0.182	142	690	ND	ND	ND	NA
A02-SED-32 2-4'	23.5	603	0.899	218	NA	37.4	1.96	ND	ND	116	581	ND	ND	ND	NA
A02-SED-32 4-6'	5.25	303	ND	237	NA	5.73	ND	0.795	ND	123	803	ND	ND	ND	NA
A02-SED-32 6-8'	6.05	455	ND	134	NA	2.41	ND	1.31	ND	167	391	ND	ND	ND	NA
A02-SED-32 8-10'	6.41	533	ND	26	NA	ND	ND	1.52	ND	145	237	ND	ND	ND	NA
A02-SED-32 10-12'	10.1	505	ND	51.9	NA	11.7	ND	1.14	ND	150	548	ND	ND	ND	NA
A02-SED-33 0-2'	4.07	292	ND	120	NA	16.1	ND	ND	0.263	ND	538	93.8	ND	93.6	NA
A02-SED-33 2-4	ND	520	ND	327	NA	11.5	ND	1.4	ND	ND	1,320	766	ND	761	NA
A02-SED-33 4-6'	ND	531	ND	1.16	NA	8.14	ND	1.56	ND	ND	ND	655	ND	647	NA
A02-SED-33 6-8'	ND	430	ND	168	NA	11.5	ND	1.1	ND	ND	499	559	ND	545	NA
A02-SED-33 8-10'	6.08	527	ND	103	ND	0.881	ND	1.17	ND	73.4	571	655	52.5	603	NA
A02-SED-33 10-12'	7.43	535	ND	40.7	NA	ND	ND	1.35	ND	385	596	626	59.8	566	NA
A02-SED-33 12-13'	7.02	624	ND	208	NA	ND	ND	1.21	ND	484	886	1,410	ND	1,410	NA
A02-SED-34 0-2"	3.32	344	ND	184	NA	20.5	ND	ND	ND	ND	589	ND	ND	ND	NA
A02-SED-34 2-4'	ND	685	ND	16.7	NA	9.3	ND	1.53	ND	ND	963	84.1	ND	83.9	NA
A02-SED-34 8-10'	ND	558	ND	17.8	NA	8.54	ND	1.61	ND	38.3	280	318	ND	297	NA
A02-SED-34 10-11'	2.02	503	ND	11.8	NA	7.33	ND	ND	ND	401	732	730	ND	728	NA
Mean	**6.54**	**410**	**0.168**	**207.6**	**0**	**19.711**	**0.14**	**0.560**	**0.129**	**772.4**	**1,973**	**716.4**	**6.4**	**695.0**	

Detected VOAs = sec-butylbenzene 17, n-butylbenzene 65, , napthalene 100, n-propylbenzene 23, 1,2,4 -trimethylbenzene, 190, 1,3.5-trimethylbenzene 58, xylene 150.
NA = Not Analyzed
ND = Not Detected

4.4.2.4 Rundown Pond

Analytical Results

A total of 27 samples were collected from the Rundown Pond and are believed to accurately assess the composition of the sediment and the concentrations of the targeted analytes. Accumulated sediments in this pond were generally described as brown to dark brown silty clay. Refusal was encountered typically at a depth from 3 to 6 feet below the top of the sediment. Pond sediment is believed, based on as-built drawings, to extend to a depth of 10 feet. All pond sediment samples were submitted for RCRA metals analysis by EPA Method 3050/6010B , Mercury analysis using EPA Method 7471, Ammonia analysis by EPA Method 350.1, TKN analysis by EPA Method 351.2, and Nitrate and Nitrite analysis by EPA Method 353.2. Selected samples were submitted for TCLP analysis, hexavalent chromium analysis, and volatile organic analysis by EPA Method 8260. Pace Labs was subcontracted for performing the chemical analysis on all pond samples collected as part of this investigation.

Laboratory analysis indicated that Arsenic was present in the Rundown Pond sediments at a mean concentration of 8.87 mg/kg with concentrations ranging from non detected to a high concentration of 33.9 mg/kg. Barium was present at a mean concentration of 198.75 mg/kg with an observed low concentration of 69.2 mg/kg and a high concentration of 391 mg/kg. Cadmium was present at a mean concentration of 0.93 mg/kg with a low concentration of undetected to a high concentration of 10.3 mg/kg. It should be noted that Cadmium was observed in only 15 of the 27 samples. Total Chromium was present at a mean concentration of 96.47 mg/kg with a high concentration of 264 mg/kg and a low concentration of 14 mg/kg. Hexavalent chromium analysis was performed on 13 of the samples collected from the Rundown Pond. The Rundown Pond was the only pond that was noted to contain hexavalent chromium at a mean concentration for the 13 samples of 0.49 mg/kg. The highest concentration of hexavalent chromium was reported at 2.99 mg/kg. Lead was present at a mean concentration of 29.8 mg/kg with a high concentration of 67.3 mg/kg and a low concentration of 9.17 mg/kg. Selenium was observed in only one of the 27 samples at a concentration of 5.69 mg/kg. Silver was also only observed in one sample at a concentration of 7.15 mg/kg. Mercury was not detected in any of the 27 samples collected.

Metal concentrations appear to be randomly distributed throughout the pond sediments of the Rundown Pond without any apparent trends related to depth or a region of the pond.

Nitrogen compounds were reported in the Rundown Pond with ammonia detected in the collected pond sediments at a mean concentration of 8,063.85 mg/kg with concentrations ranging from 604 mg/kg to 23,700 mg/kg. The highest ammonia concentrations were noted to be in the northeastern area of the pond at depths greater than 3 feet. TKN analysis indicated a mean TKN of 12,816.67 mg/kg with a distribution range of 3,940 mg/kg to 33,200 mg/kg. The highest concentrations for TKN were also located in the northeastern region of the pond at depths greater then 3 feet. Nitrites were not detected in any of the collected samples. Nitrates were observed at a mean concentration of 5,590.93 mg/kg with a reported range of 154 mg/kg to 16,900 mg/kg. The highest nitrate concentrations were located in the east central region of the pond.

Volatile organic analysis was performed on three samples collected from the Rundown Pond. Two VOCs were identified. These VOCS and their respective concentrations in µg/kg are: 1,2,4 trimethylbenzene (20) and Xylenes (32) in samples A02-SED-46 0-2'. The origin of VOCs in these samples is uncertain, but may be partially attributed to laboratory-introduced artifacts. The presence of VOCs in these samples may be traced to the use of herbicides used for weed control around the perimeters of the primary ponds.

TCLP analysis was performed on a representative composite sample from the Rundown Pond. All RCRA metal results were reported as non detected with the exception of Barium with a reported concentration of 0.668 mg/l which is well below the regulatory limit of 100 mg/l.

Pond Specifications

From the physical data collected during characterization of the Rundown Pond it was determined that the pond had an original design depth of 812 feet above MSL with a dike elevation of 829 feet above MSL. In the early 1990s an additional 2 feet in height was added to the dike. Based on the pond dimensions listed in **Table 4-2** and the pond sediment profiling activities completed during this site characterization it was estimated that 50,000 cubic yards of sediment reside in the Rundown Pond.

Table 4-19
Rundown Pond
Analytical Results

Sediment Sample	As mg/kg	Ba mg/kg	Cd mg/kg	Total Cr mg/kg	Hexavalent Cr mg/kg	Pb mg/kg	Se mg/kg	Ag mg/kg	Hg mg/kg	Ammonia mg/kg	TKN mg/kg	NO2 +NO3 mg/kg	Nitrite mg/kg	Nitrate mg/kg	VOA µg/kg
A02-SED-35 0-2'	17.9	189	1.22	34	NA	49.2	ND	ND	ND	3,980	10,600	3,360	ND	3,340	NA
A02-SED-35 2-4'	14.5	178	1.24	206	NA	35.1	ND	ND	ND	4,070	7,050	3,290	ND	3,270	NA
A02-SED-35A 8-10'	7.93	272	1.21	163	2.65	37.5	ND	ND	ND	6,820	8,140	4,840	ND	4,830	NA
A02-SED-36 0-2'	ND	183	ND	207	NA	24.4	ND	ND	ND	15,600	23,300	13,400	ND	13,400	NA
A02-SED-36 2-4'	21.3	159	1.01	264	NA	61.7	ND	ND	ND	17,200	21,100	11,600	ND	11,600	NA
A02-SED-36A 4-5'	11.4	259	1.11	178	2.99	36.2	ND	ND	ND	9,920	10,900	9,450	ND	9,430	NA
A02-SED-37 0-2'	5.52	148	1.01	176	NA	35.3	ND	ND	ND	3,300	8,100	1,440	ND	1,430	ND
A02-SED-37A 0-2'	4.1	166	0.632	65.1	ND	22.8	ND	ND	ND	4,180	14,900	154	ND	154	NA
A02-SED-37A 4-5'	3.28	213	ND	193	ND	37.4	ND	ND	ND	23,700	33,200	901	ND	902	NA
A02-SED-38 0-2'	24.2	188	ND	209	NA	50	ND	ND	ND	14,900	19,800	13,600	ND	13,600	NA
A02-SED-39 0-2'	7.8	306	0.849	19.2	NA	20.1	ND	ND	ND	1,270	4,240	509	ND	489	NA
A02-SED-39A 4-5'	10.1	391	1.09	50.6	ND	32.2	5.69	ND	ND	5,230	8,170	3,130	ND	3,120	NA
A02-SED-40 0-2'	4.27	203	1.65	37.3	NA	21.8	ND	ND	ND	604	12,000	535	ND	500	NA
A02-SED-41 0-2'	4.32	202	ND	32.1	ND	11	ND	ND	ND	1,850	7,280	1,140	ND	1,080	NA
A02-SED-41A 4-5'	3	157	ND	20	1.74	12.4	ND	ND	ND	4,730	8,520	2,760	ND	2,740	NA
A02-SED-42 0-2'	16.9	147	ND	273	NA	67.3	ND	ND	ND	21,900	27,300	16,900	ND	16,900	ND
A02-SED-42A 2-3'	6.39	178	ND	42.7	ND	21.9	ND	ND	ND	12,800	18,200	7,280	ND	7,280	NA
A02-SED-43 0-2'	3.73	151	ND	25.9	NA	11.2	ND	ND	ND	2,260	6,920	2,220	ND	2,220	NA
A02-SED-43A 4-5'	11.4	210	ND	35.6	ND	16.8	ND	ND	ND	8,100	9,940	6,250	ND	6,240	NA
A02-SED-44 0-2'	4.46	327	0.747	28.1	NA	9.17	ND	ND	ND	1,300	3,940	631	ND	596	NA
A02-SED-44A 0-2'	3.66	133	ND	28.5	1.96	25.2	ND	ND	ND	5,810	11,500	5,050	ND	5,010	NA
A02-SED-44A 2-4'	33.9	202	0.933	80	2.37	36.4	ND	ND	ND	16,000	17,500	14,300	ND	14,200	NA
A02-SED-44A 4-6'	ND	133	10.3	14	1.49	30	ND	7.15	ND	6,520	7,680	5,930	ND	5,860	NA
A02-SED-45 0-2'	4.56	189	0.921	31.6	NA	18.1	ND	ND	ND	1,190	4,370	737	ND	704	NA
A02-SED-45A 0-2'	1.57	204	ND	23.1	ND	10.8	ND	ND	ND	9,510	12,400	5,680	ND	5,670	NA
A02-SED-46 0-2'	3.87	69.2	ND	45	NA	27.5	ND	ND	ND	4,480	10,500	5,610	ND	5,590	*1,2,4, Trimethylbenzene 20, Xylene 32*
A02-SED-47 0-2'	9.54	209	1.1	123	NA	43.1	ND	ND	ND	10,500	18,500	10,800	ND	10,800	NA
Mean	**8.87**	**199**	**0.927**	**96.5**	**0.49**	**29.8**	**0.21**	**0.26**	**0**	**8,064**	**12,817**	**5,611**	**0**	**5,591**	

NA = Not Analyzed
ND = Not Detected

4.4.2.5 Overflow Pond

Analytical Results

A total of 8 samples were collected from the Overflow Pond and are believed to accurately represent the composition of the sediment and the concentrations of the targeted analytes. Accumulated sediments in this pond were generally described as being less than a foot in thickness and consisting of a dark gray and greenish gray clay. Native clay that indicates the base of the pond was observed to be a black clay. All pond sediment samples were submitted for RCRA metals analysis by EPA Method 3050/6010B , Mercury was analyzed using EPA Method 7471, Ammonia was analyzed by EPA Method 350.1, TKN was analyzed by EPA Method 351.2, Nitrate, and Nitrite analysis by EPA Method 353.2 were performed on all samples. Selected samples were submitted for TCLP analysis and volatile organic analysis by EPA Method 8260. Pace Labs was subcontracted for performing the chemical analysis on all pond samples collected as part of this investigation.

Laboratory analysis indicated that Arsenic was present in the Overflow Pond sediments at a mean concentration of 6.24 mg/kg with concentrations ranging from 2.78 mg/kg to a high concentration of 9.72 mg/kg. Barium was present at a mean concentration of 193.12 mg/kg with an observed low concentration of 147 mg/kg and a high concentration of 294 mg/kg. Cadmium was present at a mean concentration of 1.03 mg/kg with a low concentration of undetected to a high concentration of 1.79 mg/kg. Total chromium was present at a mean concentration of 62.07 mg/kg with a high concentration of 175 mg/kg and a low concentration of 31.7 mg/kg. Hexavalent chromium analysis was not performed on the samples collected from the Overflow Pond. Lead was present at a mean concentration of 26.37 mg/kg with a high concentration of 72.7 mg/kg and a low concentration of 15.7 mg/kg. Selenium and silver were not observed in any of the samples collected. Mercury was detected in one sample at a concentration of 0.285 mg/kg.

Metal concentrations appear to be randomly distributed throughout the pond sediments of the Overflow Pond without any apparent trends related to depth or a region of the pond.

Nitrogen compounds were reported in the Overflow Pond with ammonia detected in the collected pond sediments at a mean concentration of 1,252.37 mg/kg with concentrations ranging from 403 mg/kg to 2,090 mg/kg. TKN analysis indicated a mean TKN of 7,428.75 mg/kg with a distribution range of 3,570 mg/kg to 22,700 mg/kg. Nitrites were not detected in any of the collected samples. Nitrates were observed at a mean concentration of 1,071 mg/kg with a reported range of 349 mg/kg to 2,120 mg/kg.

Volatile organic analysis was performed on two samples collected from the Overflow Pond. One VOC was identified, 1,2,4 trimethylbenzene at a concentration of 38 ug/kg. The origin of VOCs in these samples is uncertain, but may be partially attributed to laboratory-introduced artifacts. The presence of VOCs in these samples may be the result of the use of weed control products around the perimeters of the primary ponds.

TCLP analysis was performed on a representative composite sample from the Overflow Pond. All RCRA metal results were reported as non detected with the exception of Barium with a reported concentration of 1.1 mg/l which is well below the regulatory limit of 100 mg/l.

Pond Specifications

From the physical data collected during characterization of the Overflow Pond it was determined that the pond had an original design depth of 814.5 feet above MSL with a dike elevation of 829 feet above MSL. In the early 1990s an additional 2 feet in height was added to the dike. Based on the pond dimensions listed in **Table 4-2** and the pond sediment profiling activities completed during this site characterization it was estimated that 5,000 cubic yards of sediment reside in the Overflow Pond.

Table 4-20
Overflow Pond
Analytical Results

Sediment	As	Ba	Cd	Total Cr	Hexavalent Cr	Pb	Se	Ag	Hg	Ammonia	TKN	NO2 +NO3	Nitrite	Nitrate	VOA
Sample	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	µg/kg
A02-SED-48 0-2'	6.9	163	1.79	175	NA	72.7	ND	ND	0.285	1,590	6,080	2,130	ND	2,120	*1,2,4 Trimethylbenzene 38*
A02-SED-49 0-2'	5.98	193	1.13	67.1	NA	24.7	ND	ND	ND	916	22,700	712	ND	660	NA
A02-SED-50 0-2'	4.73	147	0.833	33.5	NA	15.7	ND	ND	ND	403	3,570	381	ND	349	NA
A02-SED-51 0-2'	7.27	189	1.21	55	NA	20.4	ND	ND	ND	2,090	3,950	1,750	ND	1,690	NA
A02-SED-52 0-2'	5.31	197	1.06	38.1	NA	15.3	ND	ND	ND	1,800	6,440	1,320	ND	1,270	NA
A02-SED-53 0-2'	2.78	151	ND	63.5	NA	19.5	ND	ND	ND	1,720	7,840	1,300	ND	1,260	NA
A02-SED-54 0-2'	9.72	294	0.991	31.7	NA	21.9	ND	ND	ND	535	4,480	513	ND	478	NA
A02-SED-55 0-2'	7.21	211	1.23	32.3	NA	20.8	ND	ND	ND	965	4,370	777	ND	741	ND
Mean	**6.24**	**193**	**1.031**	**62.025**	**0**	**26.4**	**0**	**0**	**0.036**	**1,252**	**7,429**	**1,110**	**0**	**1,071**	

NA = Not Analyzed
ND = Not Detected

4.4.2.6 East Lime Pond

Analytical Results

A total of 20 samples were collected from the East Lime Pond and are believed to accurately characterize the composition of the sediment and the concentrations of the targeted analytes. Accumulated sediments in this pond were generally described as pale brown clay to yellowish clay (lime sludge). Native clay was encountered at a greater depth than the designed bottom of the pond. All pond sediment samples were submitted for RCRA metals analysis by EPA Method 3050/6010B , Mercury analysis using EPA Method 7471, Ammonia analysis by EPA Method 350.1, TKN analysis by EPA Method 351.2, and Nitrate and Nitrite analysis by EPA Method 353.2. Selected samples were submitted for TCLP analysis, hexavalent chromium analysis, and volatile organic analysis by EPA Method 8260. Pace Labs was subcontracted for performing the chemical analysis on all pond samples collected as part of this investigation.

Laboratory analysis indicated that Arsenic was present in the East Lime Pond sediments at a mean concentration of 14.47 mg/kg with concentrations ranging from non detected to a high concentration of 40.8 mg/kg. Barium was present at a mean concentration of 411.83 mg/kg with an observed low concentration of 187 mg/kg and a high concentration of 491 mg/kg. Cadmium was present at a mean concentration of 0.13 mg/kg with a low concentration of undetected to a high concentration of 1.16 mg/kg. It should be noted that Cadmium was only reported in 3 of the 20 samples collected. Total chromium was present at a mean concentration of 6.02 mg/kg with a high concentration of 22.3 mg/kg and a low concentration of not detected. Hexavalent chromium analysis was performed on nine of the samples collected from the East Lime Pond with no reported concentrations of this analyte. Lead was present at a mean concentration of 4.24 mg/kg with a range of not detected to a concentration of 16.1 mg/kg. Selenium was reported with a mean of 6.44 mg/kg with a range of not detected to 22.1 mg/kg. Silver was observed at a mean concentration of 0.67 mg/kg with a reported range of not detected to 1.87 mg/kg. Mercury was not detected in any of the samples collected.

Again metal concentrations appear to be randomly distributed throughout the pond sediments of the East Lime Pond without any apparent trends related to depth or a region of the pond.

Nitrogen compounds were almost absent in the East Lime Pond with no ammonia reported in the East Lime Pond. TKN levels were observed at a mean concentration of 434.72 mg/kg with a range of 105 mg/kg to 1,210 mg/kg. Nitrites were not detected in any of the collected samples. Nitrates were observed in four samples ranging in concentration from 8.48 mg/kg to 35.7 mg/kg.

Volatile organic analysis was performed on five samples collected from the East Lime Pond. Acetone was observed in three of these samples with a range of 87-91 ug/kg. The origin of VOCs in these samples is uncertain, but may be partially attributed to laboratory-introduced artifacts. Acetone is a common laboratory contaminant. The presence of VOCs in these samples may be the result of the use of a weed control product around the perimeters of the primary ponds.

TCLP analysis was performed on a representative composite sample from the East Lime Pond. All RCRA metal results were reported as non detected with the exception of Barium with a reported concentration of 3.24 mg/l which is well below the regulatory limit of 100 mg/l.

Pond Specifications

From the physical data collected during characterization of the East Lime Pond it was determined that the pond had an original design depth of 820 feet above MSL with a dike elevation of 830 feet above MSL. In the early 1990s an additional 2 feet in height was added to the dike. Based on the pond dimensions listed in **Table 4-2** and the pond sediment profiling activities completed during this site characterization it was estimated that 31,000 cubic yards of sediment reside in the East Lime Pond.

Table 4-21
East Lime Pond
Analytical Results

Sediment Sample	As mg/kg	Ba mg/kg	Cd mg/kg	Total Cr mg/kg	Hexavalent Cr mg/kg	Pb mg/kg	Se mg/kg	Ag mg/kg	Hg mg/kg	Ammonia mg/kg	TKN mg/kg	NO2 +NO3 mg/kg	Nitrite mg/kg	Nitrate mg/kg	VOA µg/kg
A02-SED-56 0-2'	20.2	418	ND	8.84	NA	6.74	ND	ND	ND	ND	946	ND	ND	ND	NA
A02-SED-56A 0-2'	5.31	236	0.59	22.3	ND	13.5	ND	ND	ND	ND	549	10.6	8.48	ND	NA
A02-SED-57 0-2'	11.7	353	nd	16.1	NA	16.1	4.83	ND	ND	ND	1060	ND	ND	ND	*Acetone 91*
A02-SED-57A 0-2'	3.84	249	1.16	20.3	ND	14	ND	ND	ND	ND	399	11.6	8.92	ND	NA
A02-SED-58A 0-2'	3.52	187	0.579	17.5	ND	13	ND	ND	ND	ND	1210	12.8	9.71	ND	NA
A02-SED-59 0-2'	22.7	474	ND	ND	NA	4.83	19	1.87	ND	ND	184	ND	ND	ND	*Acetone 89*
A02-SED-59 2-4'	34.7	475	ND	ND	NA	5	5.53	1.79	ND	ND	156	ND	ND	ND	*Acetone 87,*
A02-SED-60 0-2'	32.8	454	ND	ND	NA	ND	22.1	1.84	ND	ND	105	ND	ND	ND	*ND*
A02-SED-60A 0-2'	2.75	464	ND	ND	ND	ND	ND	ND	ND	ND	251	ND	ND	ND	NA
A02-SED-60A 2-4'	3.65	537	ND	0.925	ND	ND	ND	ND	ND	ND	275	ND	ND	ND	NA
A02-SED-60A 6-8'	2.3	293	ND	1.15	ND	ND	ND	ND	ND	ND	481	ND	ND	ND	NA
A02-SED-61 0-2'	ND	355	ND	ND	NA	ND	12.2	1.52	ND	ND	468	ND	ND	ND	ND
A02-SED-61 2-4'	24.5	345	ND	1.53	NA	ND	14.7	1.52	ND	ND	128	ND	ND	ND	NA
A02-SED-61 4-6'	40.8	457	ND	0.77	NA	ND	18.2	1.67	ND	ND	124	ND	ND	ND	NA
A02-SED-61 6-8'	38.2	436	ND	ND	NA	ND	17	1.79	ND	ND	111	ND	ND	ND	NA
A02-SED-61 8-10'	11.4.	313	ND	15.8	NA	8.19	2.37	ND	ND	ND	691	ND	ND	ND	NA
A02-SED-61A 0-2'	4.02	443	ND	0.726	ND	ND	ND	ND	ND	ND	161	ND	ND	ND	NA
A02-SED-61A 2-4'	4.66	491	ND	0.784	ND	ND	ND	ND	ND	ND	257	ND	ND	ND	NA
A02-SED-61A 8-10'	4.82	433	ND	1.64	ND	ND	ND	ND	ND	ND	269	37.4	ND	35.7	NA
Mean	**14.47**	**412**	**0.129**	**6.020**	**ND**	**4.52**	**6.44**	**0.67**	**0**	**0**	**435**	**4**	**1.51**	**2.0**	

NA = Not Analyzed
ND = Not Detected

4.4.2.7 West Extension Pond, West Pond and Krehbiel Pond

Elevated total nitrogen levels (greater than 100 mg/kg) in soil and sediment were also found in the area of the West Extension Pond, West Pond, and Krehbiel Pond. Higher concentrations of Total Nitrogen (greater than 1,000 mg/kg) are confined to the sediment in the ponds and locations directly north (A01NE-SS-08) and east (A01NE-SS-16) of the West Extension Pond.

Pond sediment samples had elevated concentrations of nitrogen as follows:

Samples A01-NE-SED-04 and A01-NE-SED-10 collected from the Krehbiel Pond, respectively had reported concentrations of ammonia of 2l.2 mg/kg and 377.2 mg/kg and total nitrogen of 718 mg/kg and 1,045 mg;kg.

Sample A01-NE-SED-15 collected from the West Extension Pond had reported concentrations of ammonia of 10,900 mg/kg and total nitrogen of 18,400 mg/kg.

Samples A01-NE-SED-17 and A01-NE-SED-23 collected from the West Pond had measured concentrations of ammonia of 2,020 mg/kg and 18,00 mg/kg respectively, and total nitrogen of 3,350 mg/kg and 28,600 mg/kg.

4.4.2.8 Summary Pond Sediment Data – Six Primary Ponds

For comparison, the mean concentrations and the maximum concentrations of the target analytes are presented in **Table 4-22** for the six primary ponds. It is noted that mean arsenic concentrations ranged from 6.24 mg/kg to 14.47 mg/kg in the six ponds, with arsenic at the highest mean concentration in the East Lime Pond. Mean barium levels ranged from 193 mg/kg to 526 mg/kg, with the highest mean for barium observed in the East Effluent Pond. Cadmium means were distributed from 0.069 mg/kg to 1.031 mg/kg. Mean total chromium levels were widely distributed, ranging from a low of 6 mg/kg in the East Lime Pond to 1,362 mg/kg in the East Effluent Pond. Hexavalent chromium analysis was only completed for three of the ponds: The West Lime Pond, the Rundown Pond, and the East Lime Pond. Hexavalent chromium was only detected in the Rundown Pond, at a mean concentration of 0.49 mg/kg.. Lead was noted to have means ranging from 4.5 mg/kg to 29.8 mg/kg, with the highest mean noted in the Rundown Pond.

Selenium was only detected in the Rundown Pond, the East Lime Pond and the West Lime Pond with respective mean concentrations of 0.21, 6.44, and 0.14 mg/kg. Silver was detected in five of the ponds at mean concentrations ranging from 0.07 to 0.67 mg/kg. Silver was not detected in the Overflow Pond. Mercury was detected in four of the ponds at mean concentrations of 0.036 to 0.828 mg/kg. Mercury was not found in the Rundown Pond or the East Lime Pond.

TKN had the highest mean concentration of 12,817 mg/kg in the Rundown Pond, which was almost double the 7,492 mg/kg mean level noted in the Overflow Pond. The East Lime Pond had the lowest TKN mean concentration at 435 mg/kg.

Similarly, ammonia also was noted to have the highest mean concentration in the Rundown Pond at 8,064 mg/kg, with the Overflow Pond at the second highest at 1,252 mg/kg. Ammonia was undetected in the East Lime Pond.

Results for NO_2 & NO_3 and Nitrate also strongly followed these results, with the Rundown and Overflow Ponds having the highest mean concentrations. The East Lime Pond again was the least impacted by nitrogen compounds of the six primary ponds.

Collectively the six primary ponds and the three secondary ponds contain an estimated 226,000 cubic yards (cy) of sediment. This is distributed among the six ponds as follows:

West Effluent Pond	32,000 cy
East Effluent Pond	27,000 cy
West Lime Pond	61,000 cy
Rundown Pond	50,000 cy
Overflow Pond	5,000 cy
East Lime Pond	31,000 cy
Krehbiel Pond	5,000 cy
West Extension Pond	10,000 by
West Pond	5,000 cy

Table 4-22
Summary Table - Pond Sampling
Mean and Maxium of Analytical Results

Pond	As mg/kg	Ba mg/kg	Cd mg/kg	Total Cr mg/kg	Hexavalent Cr mg/kg	Pb mg/kg	Se mg/kg	Ag mg/kg	Hg mg/kg	Ammonia mg/kg	TKN mg/kg	NO2 +NO3 mg/kg	Nitrite mg/kg	Nitrate mg/kg	VOA µg/kg [Actual Concentrations]
West Effluent Pond															
Mean Concentration	7.76	361	0.641	433.0	NA	18.8	0	0.07	0.239	199	1,879	0.6	0	0.5	Acetone = 500
Maximum Concentration	11.4	487	1.17	1,230		37.9		1.22	0.699	857	4,050	10.8		9.1	MEK = 44
East Effluent Pond															
Mean Concentration	6.55	526	0.069	1,362.6	NA	19.0	0	0.39	0.828	188	1,149	0.6	0.6	0	Acetone = 430
Maximum Concentration	11.4	899	0.79	3,400		35.2		1.42	4.53	315	2,290	13.4	13.4		MEK = 69
Rundown Pond															
Mean Concentration	8.87	199	0.927	96.5	0.49	29.8	0.21	0.26	0	8,064	12,817	5,611.0	0.0	5,590.9	1,2,4 Trimethylbenzene = 20
Maximum Concentration	33.9	391	1.65	273	2.99	67.3	5.69	7.15		23,700	33,200	16,900		16,900	Xylene = 32
East Lime Pond															
Mean Concentration	14.47	412	0.129	6.0	0	4.5	6.44	0.67	0	0	435	4.0	1.5	2.0	Acetone = 91
Maximum Concentration	40.8	537	1.16	22.3		16.1	22.1	1.87	9		1,210	37.4	9.7	35.7	
Overflow Pond															
Mean Concentration	6.24	193	1.031	62.0	NA	26.4	0	0	0.036	1,252	7,429	1,110.4	0	1,071.0	1,2,4 Trimethylbenzene = 38
Maximum Concentration	9.72	294	1.79	175	72.7				0.285	2,090	22,700	2,130		2,120	
West Lime Pond															
Mean Concentration	6.54	410	0.168	207.6	0	19.7	0.14	0.56	0.129	772	1,973	716.4	6.4	695.0	Sec Butylbenzene = 17
Maximum Concentration	23.5	685	1.54	1,020		78.6	3.69	1.89	0.925	5,590	9,230	2,780	96	1,930	n-Butylbenzene = 65
															Napthalene = 100
															n-Propylbenzene = 23
															1,2,4 Trimethylbenzene = 190
															1,3,5 Trimethylbenzene = 58
															Xylene = 150

NA = Not Analyzed

4.4.3 Area C – North Central Site Area

Generally, soil boring locations for Area C, formerly Area 4 in the Work Plan, were spaced on a 400-foot grid. Three (3) boring locations (A04-SS-15, A04-SS-19, and A04-SS-18) were placed outside of the grid to define contamination within the Central Stormwater Pond. Some locations were adjusted slightly in the field due to access.

Seven (7) borings in Area C were sampled to bedrock or equipment refusal at locations A04-SS-01, A04-SS-03, A04-SS-06, A04-SS-08, A04-SS-10, A04-SS-15 and A04-SS-17. The remaining twelve (12) borings were sampled to three (3) feet bgs or bedrock if encountered prior to 3 feet.

Groundwater was not encountered in any of the soil borings in Area C.

4.4.3.1 Area C – Field Sampling Methodology

A total of nineteen (19) soil boring locations were installed in Area C using Geoprobe® direct-push technology. Soil sampling intervals followed the procedure outlined in the approved Work Plan and as described earlier in this report.

All soil samples collected in Area A were sampled for Nitrate plus Nitrite and Ammonia and submitted, under chain of custody, to the on-site laboratory for analysis using method SM-4500 or Pace for analysis using EPA Methods 353.2 and 350.1, respectively. Three (3) surface soil samples located within the Central Stormwater Pond were submitted to Pace laboratory for RCRA metals analysis using EPA Method 6010/7471. Due to the amount of soil needed for both analyses, the surface soil samples were composited in the same intervals and manner as the nitrogen samples.

Two (2) field duplicates were collected for analysis by the on-site laboratory and Pace for comparison and labeled using the same identifier as the original sample with a "D" at the end signifying the duplicate sent to the Pace. Four (4) field duplicate samples were collected and submitted blind to the same laboratory. Rinsate blanks were collected at a rate of one per day.

4.4.3.2 Area C – Soil Sample Results

Thirty-four (34) soil samples, excluding QC samples, were collected in Area C during subsurface soil sampling. All locations, except A04-SS-11, were located in vegetative cover and sampled on a 0-2 foot and 2-3 foot interval. The one (1) sample location located in non-vegetative cover (A04-SS-11) was sampled on a 0–8 inch and 8–36 inch interval.

Surface Soils

Thirty-four (34) surface soil samples were collected in Area C for Nitrate plus Nitrite analysis and submitted under chain of custody to the on-site laboratory. Nitrate plus Nitrite concentrations were detected in five (5) surface soil samples ranging from non-detect to 12.7 mg/kg reported in sample

A04-SS-10-0-0.33'. One (1) sample reported concentrations of Ammonia above laboratory detection limits ranging from non-detect to 57.8 mg/kg also reported in sample A04-SS-10-0-0.33'.

A surface soil isoconcentration map for the 0–2 foot bgs interval depicting total nitrogen concentrations across the site are included as **Figure 4-12. Figure C-1** included in **Appendix C** and **Table 4-23** show all nitrogen concentrations for Area C for the 0-2' bgs sample interval.

Three (3) surface soil samples in Area C were analyzed for RCRA metals by Pace. Metal concentrations were detected for arsenic, barium, chromium, and lead. The highest detectable concentrations were reported for sample A04-SS-19 for arsenic (9.77 mg/kg), barium (196 mg/kg) and chromium (24.8 mg/kg). Sample A04-SS-15 had the highest detectable concentration of lead (22.2 mg/kg). There were no reported concentrations above laboratory detection limits for cadmium, mercury, selenium and silver in surface soils for Area C.

Figure C-2, included in **Appendix C,** and **Table 4-24** show all metal concentrations for Area C.

Subsurface Soils

Fifteen (15) subsurface soil samples were collected in Area C for Nitrate plus Nitrite analysis and submitted under chain of custody to the on-site laboratory. Nitrate plus Nitrite concentrations were detected in four (4) subsurface soil samples ranging from non-detect to 5.9 mg/kg reported in sample A04-SS-13-2-3'. All soil sample concentrations were reported below laboratory detection limits for Ammonia.

Figures C-1 in **Appendix C** and **Table 4-25** show all subsurface nitrogen concentrations for Area C.

4.4.3.3 Area C – Extent of Contamination

All locations in Area C reported Total Nitrogen concentrations below 10 mg/kg in surface and subsurface soils, except one (1) surface location (A04-SS-17). The surface concentration for A04-SS-17 reported concentrations less than 100 mg/kg. Based on the analytical results for the samples collected in the 85-acre area, this area is not considered to have been impacted by plant operations.

Table 4-23
Area C Soil Nitrogen Results 0-2' BGS
Former Farmland Nitrogen Plant
Lawrence, Kansas

Site	Date	Starting Depth (feet)	Ending Depth (feet)	Nitrate plus Nitrite (as N) (mg/kg)	Nitrogen, Ammonia (mg/kg)	Total Nitrate plus Ammonia (mg/kg)
A04-SS-01	05/02/2005	2.00	2.50	5.7	<2	5.7
A04-SS-02	05/02/2005	2.00	2.67	<1.1>	<2	1.1
A04-SS-04	05/03/2005	2.00	2.67	<1.2>	<2	1.2
A04-SS-05	05/02/2005	2.00	3.00	<1.2>	<2	1.2
A04-SS-06	05/03/2005	2.00	3.00	<1.2>	<2	1.2
A04-SS-07	05/03/2005	2.00	3.00	<0.9>	<2	0.9
A04-SS-08	05/03/2005	2.00	3.00	<1.2>	<2	1.2
A04-SS-09	05/03/2005	2.00	3.00	<1.2>	<2	1.2
A04-SS-11	05/03/2005	0.67	3.00	<0.8>	<2	0.8
A04-SS-12	05/03/2005	2.00	3.00	<0.9>	<2	0.9
A04-SS-13	05/03/2005	2.00	3.00	5.9	<2	5.9
A04-SS-16	05/03/2005	2.00	3.00	<2	<2	0
A04-SS-17	05/03/2005	2.00	3.00	<2.1J	<2	0
A04-SS-18	05/03/2005	2.00	2.33	3.2	<2	3.2
A04-SS-19	05/03/2005	2.00	2.50	5.7	<2	5.7

<x>=Less than Reporting Limit

D - Duplicate run with high duplicate result

F - Elevated MS/MSD RPD result

G - MS/MSD percent recovery outside reporting limit

J - Estimated concentration above the adjusted method detection limit and below the adjusted reporting limit

L - LCS percent recovery outside limits

U - Elevated reporting limit

Table 4-24
Area C Soil RCRA Metals Results 0-2' BGS
Former Farmland Nitrogen Plant
Lawrence, Kansas

Site	Date	Starting Depth (feet)	Ending Depth (feet)	Arsenic (mg/kg)	Barium (mg/kg)	Cadmium (mg/kg)	Chromium (mg/kg)	Lead (mg/kg)	Mercury (mg/kg)	Selenium (mg/kg)	Silver (mg/kg)
A04-SS-15	05/03/2005	0.00	0.50	8.95	90.8	<0.507	15.7	22.2	<0.166	<1.52	<0.709
A04-SS-18	05/03/2005	0.00	2.00	7.46	120	<0.536	16.4	14.9	<0.149	<1.61	<0.750
A04-SS-19	05/03/2005	0.00	2.00	9.77	196	<0.644	24.8	17.2	<0.169	<1.93	<0.902

Table 4-25
Area C Soil Nitrogen Results 2-3' BGS
Former Farmland Nitrogen Plant
Lawrence, Kansas

Site	Date	Starting Depth (feet)	Ending Depth (feet)	Nitrate plus Nitrite (as N) (mg/kg)	Nitrogen, Ammonia (mg/kg)	Total Nitrate plus Ammonia (mg/kg)
A04-SS-01	05/02/2005	2.00	2.50	5.7	<2	5.7
A04-SS-02	05/02/2005	2.00	2.67	<1.1>	<2	1.1
A04-SS-04	05/03/2005	2.00	2.67	<1.2>	<2	1.2
A04-SS-05	05/02/2005	2.00	3.00	<1.2>	<2	1.2
A04-SS-06	05/03/2005	2.00	3.00	<1.2>	<2	1.2
A04-SS-07	05/03/2005	2.00	3.00	<0.9>	<2	0.9
A04-SS-08	05/03/2005	2.00	3.00	<1.2>	<2	1.2
A04-SS-09	05/03/2005	2.00	3.00	<1.2>	<2	1.2
A04-SS-11	05/03/2005	0.67	3.00	<0.8>	<2	0.8
A04-SS-12	05/03/2005	2.00	3.00	<0.9>	<2	0.9
A04-SS-13	05/03/2005	2.00	3.00	5.9	<2	5.9
A04-SS-16	05/03/2005	2.00	3.00	<2	<2	0
A04-SS-17	05/03/2005	2.00	3.00	<2.1J	<2	0
A04-SS-18	05/03/2005	2.00	2.33	3.2	<2	3.2
A04-SS-19	05/03/2005	2.00	2.50	5.7	<2	5.7

<x>=Less than Reporting Limit

J - Estimated concentration above the adjusted method detection limit and below the adjusted reporting limit

4.4.4 Area D – Operations Area

Subsurface sampling activities in Area D, formerly Areas 5, 7, 8, 9, 11, 12, 13, 14, 15, and 16 in the Work Plan, were spaced according to access and historical processes. Some locations were adjusted slightly in the field from those depicted in the Work Plan due to access.

Soil borings in Area D were sampled to bedrock or equipment refusal in all locations in the #2 Urea Area, the Paint Shop Area, the Ammonia Production - Primary Reformer Area, and the Boiler Furnace and Fuel Oil Storage Area. In the Oil Pond area and the Spill Pond Area borings were installed to 3 feet bgs and in Cooling Tower Area borings were installed to 6 inches bgs. The Catalyst Landfill, Boiler Furnace and Oil Storage and Old Ammonia Plant Area had most of the boring locations installed to 3 feet bgs with a few installed to bedrock or equipment refusal.

4.4.4.1 Area D – Field Sampling Methodology

Eighty-four (84) soil and three (3) sediment locations were sampled in Area D. If groundwater was encountered, an attempt to sample the groundwater was made. Eleven (11) groundwater samples were collected in Area D.

Fourteen (14) field duplicates were collected for analysis by the on-site laboratory and Pace for comparison and labeled using the same identifier as the original sample with a "D" at the end signifying the duplicate sent to the off-site laboratory. Thirty (30) field duplicate samples were collected and submitted blind to the same laboratory. Rinsate blanks were collected at a rate of one per day. Trip Blanks were included in all coolers containing samples for TPH analysis.

Generally, all soil boring locations in Area D were installed using Geoprobe® direct-push technology except for six (6) boring locations in the Cooling Tower Area (A13-SS-01, A13-SS-02, A13-SS-03, A13-SS-04, A13-SS-05 and A13-SS-06) and three (3) boring locations in the Spill Pond (A08-SS-01, A08-SS-02 and A08-SS-03). Soil sampling intervals followed the procedure outlined in the approved Work Plan and as detailed above, unless otherwise noted below.

4.4.4.2 Area D – Catalyst Landfill Sampling Methodology and Sampling Results

The exact location of the Catalyst Landfill was unknown by former plant personnel available on site, and therefore it was necessary to advance exploratory borings to identify the former landfill location. Borings began in the area believed to be the approximate landfill area and moved approximately 10 feet in every direction until the landfill material or bedrock was encountered.

Once landfill material was encountered, borings were installed in each direction (approximately 5-10 feet from the previous borehole) until no catalyst material was encountered. Using this approach the boundary of the landfill was defined. This continued on all sides until the north, south, east and west boundaries were established. The location of the Catalyst Landfill is shown on **Figures 2-2** and **4-9**.

Six (6) soil boring locations were advanced in the Catalyst Landfill using Geoprobe® direct-push technology to delineate the landfill area. Two (2) soil borings to the north (A05-SS-01) and south

(A05-SS-03) of the landfill were installed to bedrock or equipment refusal and two (2) soil borings to the east (A05-SS-02) and west (A05-SS-04) of the landfill were installed to 3 feet bgs. Borings A05-SS-05 and A05-SS-06 were installed within the boundary of the landfill and extended through the landfill material until native soil was encountered. In these locations, landfill material was encountered at approximately 4 feet bgs and extended to approximately 6.5 feet bgs in location A05-SS-06 and approximately 8.5 feet bgs in location A06-SS-05 where native soils were encountered.

All soil samples collected in the Catalyst Landfill were located in vegetative cover and composite samples were collected from the 0–2 foot and 2–3 foot intervals for RCRA metals with the exception of the two (2) boring locations within the landfill. Samples collected from borings A05-SS-05 and A05-SS-06 were sampled following standard procedures until the fill material was encountered. One (1) sample within the fill material at each location was composited across the entire interval until natural soils were encountered. The samples were submitted to Pace under chain of custody for analysis using EPA Method 6010/7471.

Groundwater was encountered at one (1) location (A05-SS-04) at approximately 12 feet bgs in the Catalyst Landfill and sampled for total RCRA metals. The groundwater sample was collected in a clean plastic container pre-preserved with nitric acid and submitted to Pace, under chain of custody, for analysis using EPA Method 6010/7470.

Three (3) field duplicate samples were collected from the Catalyst Landfill and submitted blind to Pace Labs. Rinsate blanks were collected at a rate of one per day. Since none of the samples were analyzed by the on-site laboratory, field confirmation duplicates were not collected in this area.

Catalyst Landfill Soil Sample Results

Twenty-seven (27) soil samples, excluding QC samples, were collected from the Catalyst Landfill for analysis by Pace for RCRA metals.

Surface Soils

Six (6) surface soil samples were collected in the Area D – Catalyst Landfill for RCRA metals analysis. Arsenic, barium, chromium and lead were detected in all six (6) surface samples. Concentrations for arsenic were reported ranging from 7.55 mg/kg in sample A05-SS-03-0-2' to 12.3 mg/kg in sample A05-SS-02-0-2' and barium reported concentrations ranging from 82.3 in sample A05-SS-01-0-2' to 203 mg/kg in sample A05-SS-04-0-2'. Chromium concentrations were reported ranging from 16.5 mg/kg in sample A05-SS-03-0-2' to 202 mg/kg in sample A05-SS-05-0-2' and lead was reported in concentrations ranging from 12.0 mg/kg in sample A05-SS-05-0-2' to 24.0 mg/kg in sample A06-SS-0-2'. Mercury, selenium and silver were not detected at concentrations above the laboratory detection limits in any of the surface soil samples.

Figure D-2 in **Appendix C** summarizes all RCRA metals concentrations and **Table 4-26** includes all surface soil results for RCRA Metals analysis in Area D.

Subsurface Soils

Four (4) subsurface soil samples were collected in Area D – Catalyst Landfill for RCRA metals analysis. Arsenic, barium, chromium and lead were also detected in all subsurface samples. Concentrations for arsenic were reported ranging from 8.07 mg/kg in sample A05-SS-03-2-3' to 15.7 mg/kg in sample A05-SS-02-2-3' and chromium was reported in concentrations ranging from 18.7 mg/kg in sample A05-SS-03-2-3' to 98.6 mg/kg in sample A05-SS-01-2-3'. Sample A05-SS-01-2-3' reported the lowest concentrations and sample A05-SS-04-2-3' reported the highest concentrations for barium and lead. Barium was reported in concentrations ranging from 106 mg/kg to 243 mg/kg and lead was reported in concentrations ranging from 16.1 mg/kg to 23.1 mg/kg. Mercury, selenium and silver were not detected at concentrations above the laboratory detection limits in any of the subsurface soil samples.

Subsequent to the March-May sampling activities, a second sample was retrieved on August 4, 2005, from the greater-than-3-feet depth soils at the Catalyst Landfill for TCLP analysis. Utilizing the GPS sample location coordinates, a hand auger was used to retrieve a sample at A05-SS-05 from a depth of 6 feet. A sample of the buried catalyst material was obtained and submitted for TCLP analysis for RCRA metals. Analytical results were non-detect for Arsenic, Cadmium, Chomium, Lead, Selenium, Silver and Mercury. Barium was detected at 1.3 mg/l.

Figure D-2 in **Appendix C** summarizes all RCRA metals concentrations and **Table 4-26** includes all subsurface RCRA metals results in Area D.

Table 4-26
Area D Surface Soil RCRA Metals Results 0-2' BGS
Catalyst Landfille
Former Farmland Nitrogen Plant
Lawrence, Kansas

Site	Date	Starting Depth (feet)	Ending Depth (feet)	Arsenic (mg/kg)	Barium (mg/kg)	Cadmium (mg/kg)	Chromium (mg/kg)	Lead (mg/kg)	Mercury (mg/kg)	Selenium (mg/kg)	Silver (mg/kg)
A05-SS-01	05/04/2005	0.00	2.00	8.72	82.3	<0.456	39.4	12.9	<0.145	<1.37	<0.638
A05-SS-02	05/05/2005	0.00	2.00	12.3	110	<0.480	42.5	18.4	<0.156	<1.44	<0.672
A05-SS-03	05/04/2005	0.00	2.00	7.55	132	<0.498	16.5	14.2	<0.159	<1.49	<0.697
A05-SS-04	05/05/2005	0.00	2.00	9.00	203	<0.513	24.3	15.6	<0.151	<1.54	<0.719
A05-SS-05	05/04/2005	0.00	2.00	8.11	93.7	<0.517	202D	12.0	<0.155	<1.55	<0.724
A05-SS-06	05/04/2005	0.00	2.00	11.5	163	<0.509	29.4	24.0	<0.157	<1.53	<0.713

Table 4-27
Area D Subsurface Soil RCRA Metals Results 0.67-3' BGS
Catalyst Landfill
Former Farmland Nitrogen Plant
Lawrence, Kansas

Site	Date	Starting Depth (feet)	Ending Depth (feet)	Arsenic (mg/kg)	Barium (mg/kg)	Cadmium (mg/kg)	Chromium (mg/kg)	Lead (mg/kg)	Mercury (mg/kg)	Selenium (mg/kg)	Silver (mg/kg)
A05-SS-01	05/04/2005	2.00	3.00	9.92	106	<0.397	98.6	16.1	<0.161	<1.19	<0.556
A05-SS-02	05/05/2005	2.00	3.00	15.7	241	<0.560	29.7	19.4	<0.191	<1.68	<0.784
A05-SS-03	05/04/2005	2.00	3.00	8.07	156	<0.559	18.7	18.5	<0.151	<1.68	<0.783
A05-SS-04	05/05/2005	2.00	3.00	11.8	243	<0.495	20.1	23.1	<0.194	<1.48	<0.693

Subsurface Soils (Greater than 3 feet bgs)

Seventeen (17) subsurface soil samples were collected below 3 feet bgs in Area D – Catalyst Landfill for RCRA metals analysis. Arsenic, barium and chromium were detected in all seventeen (17) subsurface samples. Cadmium was detected in two (2) samples and lead was detected in sixteen (16) samples. Concentrations for arsenic were reported ranging from 1.84 mg/kg in sample A05-SS-02-9-10.5' to 12.3 mg/kg in sample A05-SS-03-3-6' and barium was reported in concentrations ranging from 23.4 mg/kg in sample A05-SS-06-4-6.5' to 289 mg/kg in sample A05-SS-04-12-13.5'. Cadmium and lead reported concentrations ranging from non-detect to 19.5 mg/kg in sample A05-SS-4-8.5' for cadmium and 22.2 mg/kg in sample A05-SS-03-3-6' for lead. Chromium was reported in concentrations ranging from 8.36 mg/kg in sample A05-SS-02-9-10.5' to 10,100 mg/kg in sample A05-SS-05-4-8.5' which was collected from the landfill material. Mercury, selenium and silver were not detected at concentrations above the laboratory detection limits in any of the subsurface soil samples.

Figure D-2 in **Appendix C** summarizes all RCRA metals concentrations, and **Table 4-27** includes all subsurface soil RCRA metals results in the Catalyst Landfill Area D for samples below 3 feet bgs.

Catalyst Landfill Groundwater Sample Results

One (1) groundwater sample was collected from a borehole installed at the Catalyst Landfill for analysis by Pace for RCRA metals. Sample A05-GW-04-12' reported detectable concentrations for arsenic (0.144 mg/l), barium (18.8 mg/l), chromium (0.82 mg/l), lead (0.283 mg/l) and mercury (0.000545 mg/l). It was reported that cadmium, selenium and silver were below laboratory detection limits. The occurrence of groundwater in only one of the six borehole locations used to characterize and define the boundary of the Catalyst Landfill indicates that the sample was retrieved from a small isolated perched water-bearing zone. As this interval is non-continuous, it is not considered an aquifer.

Table 4-28
Area D Subsurface Soil RCRA Metals Results >3' BGS
Catalyst Landfill
Former Farmland Nitrogen Plant
Lawrence, Kansas

Site	Date	Starting Depth (feet)	Ending Depth (feet)	Arsenic (mg/kg)	Barium (mg/kg)	Cadmium (mg/kg)	Chromium (mg/kg)	Lead (mg/kg)	Mercury (mg/kg)	Selenium (mg/kg)	Silver (mg/kg)
A05-SS-01	05/04/2005	3.00	6.00	9.40	138	<0.475	20.6	14.8	<0.168	<1.42	<0.664
A05-SS-01	05/04/2005	6.00	8.50	5.82	103	<0.467	15.9	10.4	<0.155	<1.40	<0.654
A05-SS-02	05/05/2005	3.00	6.00	8.50	154	<0.579	16.4	20.7	<0.180	<1.74	<0.811
A05-SS-02	05/05/2005	6.00	9.00	7.08	138	<0.578	16.0	11.4	<0.163	<1.74	<0.810
A05-SS-02	05/05/2005	9.00	10.50	1.84	71.0	<0.560	8.36	3.03	<0.158	<1.68	<0.784
A05-SS-03	05/04/2005	3.00	6.00	12.3	179	<0.564	24.6	22.2	<0.174	<1.69	<0.789
A05-SS-03	05/04/2005	6.00	9.00	8.55	145	<0.472	16.7	13.0	<0.163	<1.41	<0.660
A05-SS-03	05/04/2005	9.00	12.00	9.50	204	<0.597	19.5	13.8	<0.193	<1.79	<0.835
A05-SS-03	05/04/2005	12.00	15.00	8.05	181	<0.537	17.4	15.0	<0.164	<1.61	<0.752
A05-SS-03	05/04/2005	15.00	18.00	7.40	155	<0.483	17.6	13.2	<0.194	<1.45	<0.677
A05-SS-03	05/04/2005	18.00	19.00	3.93	130	<0.541	18.6	9.16	<0.193	<1.62	<0.758
A05-SS-04	05/05/2005	3.00	6.00	9.81	174	<0.544	22.2	20.3	<0.187	<1.63	<0.762
A05-SS-04	05/05/2005	6.00	9.00	8.94	159	<0.551	18.3	14.8	<0.177	<1.65	<0.772
A05-SS-04	05/05/2005	9.00	12.00	7.12	267	<0.516	15.9	10.6	<0.162	<1.55	<0.722
A05-SS-04	05/05/2005	12.00	13.50	8.09	289	<0.555	16.4	10.2	<0.195	<1.66	<0.777
A05-SS-05	05/04/2005	4.00	8.50	33.1	26.5	19.5	10,100	<0.415	<0.147	<12.5	<0.582
A05-SS-06	05/04/2005	4.00	6.50	23.3	23.4	11.0	5,000	0.516	<0.168	<12.1	<0.565

4.4.4.3 Area D – Cooling Tower Area Sampling Methodology and Sampling Results

A total of six (6) soil boring locations were installed in the Cooling Tower Area using hand augering sampling techniques. Soil sampling intervals followed the procedure outlined in the approved Work Plan and as described earlier in this report.

Soil boring locations in the Cooling Tower Area were sampled to 6 inches bgs. All six (6) locations in this area were located in non-vegetative cover (gravel) and sampled in composite intervals of 0 – 6 inches bgs.

All six (6) soil locations in the Cooling Tower Area were sampled for RCRA metals and submitted, under chain of custody, to Pace for analysis using EPA Method 6010/7471.

One (1) field duplicate sample was collected and submitted blind to the same laboratory. Rinsate blanks were collected at a rate of one per day.

Cooling Tower Area Soil Results

A total of six (6) samples, excluding QC samples, were collected and analyzed by Pace for RCRA metals. Arsenic, Barium, cadmium, chromium and lead concentrations were reported above laboratory detection limits in all six (6) samples. Five (5) samples reported detected selenium results above laboratory detection limits. Sample A13-SS-01-0.5' reported the highest concentrations of arsenic (13.4 mg/kg) and cadmium (0.913 mg/kg). Sample A13-SS-02-0-0.5' reported the highest concentrations of barium (215 mg/kg) and samples A13-SS-05-0-0.5' reported the highest concentrations for chromium (51.8 mg/kg) and selenium (5.04 mg/kg). Sample A13-SS-06-0-0.5' reported the highest concentration of lead at 25.8 mg/kg. Mercury and silver were not detected above laboratory detection limits for the Cooling Tower Area.

Figure D-2 in **Appendix C** summarizes all RCRA metals concentrations and **Table 4-29** includes all surface RCRA metals results in Area D Cooling Tower Area.

Table 4-29
Area D Surface RCRA Soils Metal Results
Former Area 13 - Cooling Tower Area
Former Farmland Nitrogen Plant
Lawrence, Kansas

Site	Date	Starting Depth (feet)	Ending Depth (feet)	Arsenic (mg/kg)	Barium (mg/kg)	Cadmium (mg/kg)	Chromium (mg/kg)	Lead (mg/kg)	Mercury (mg/kg)	Selenium (mg/kg)	Silver (mg/kg)
A13-SS-01	04/13/2005	0.00	0.50	13.4	124	0.913	28.9	16.4	<0.176	4.23	<0.757
A13-SS-02	04/13/2005	0.00	0.50	10.1	215	0.795	28.7	23.1	<0.189	1.85	<0.711
A13-SS-03	04/13/2005	0.00	0.50	6.30	136	0.790	20.5	19.7	<0.176	<1.63	<0.759
A13-SS-04	04/13/2005	0.00	0.50	7.24	133	0.697	24.5	14.9	<0.158	3.39	<0.826
A13-SS-05	04/13/2005	0.00	0.50	13.1	170	0.840	51.8	19.3	<0.159	5.04D	<0.733
A13-SS-06	04/13/2005	0.00	0.50	7.61	204	0.780	30.2	25.8	<0.168	2.18	<0.732

4.4.4.4 Area D – Oil Pond and Spill Pond Areas Sampling Methodology and Sampling Results

A total of three (3) soil boring locations were installed in the Oil Pond and two (2) soil boring locations were installed in the Spill Pond Area using Geoprobe® direct-push technology. Three (3) sediment borings located within the Spill Pond were installed using hand coring techniques due to inaccessibility for the Geoprobe® unit. Soil sampling intervals followed the procedure outlined in the approved Work Plan.

Soil and sediment boring locations in the Oil Pond and Spill Pond were sampled to 3 feet bgs or until bedrock was encountered or equipment refusal. All three (3) locations in the Oil Pond were located in vegetative cover, however only one grab sample was collected from each location from the 0–3 foot bgs interval. Both soil locations in the Spill Pond were located in non-vegetative cover and were sampled in composite intervals from 0–8 inches bgs and 8–36 inches bgs. All three (3) sediment locations in the Spill Pond were sampled in one composite interval between 0–2 foot bgs.

Two (2) soil locations in the Spill Pond (A08-SS-04 and A08-SS-05) were sampled for Nitrate plus Nitrite and Ammonia and submitted, under chain of custody, to the on-site laboratory for analysis using SM-4500 or to Pace for analysis using EPA Method 353.2 and 350.1. Surface samples from locations A08-SS-04 and A08-SS-05 were also submitted to Pace for RCRA metals analysis using EPA Method 6010/7471. All soil samples collected in the Oil Pond and three (3) sediment samples (A08-SS-01, A08-SS-02 and A08-SS-03) collected in the Spill Pond were sampled for total petroleum hydrocarbons (TPH) using EPA Method 8015 and Iowa Method OA-2.

One (1) field duplicates was collected for analysis by the on-site laboratory and Pace for comparison from the Spill Pond and labeled using the same identifier as the original sample with a "D" at the end signifying the duplicate sent to the Pace. Rinsate blanks were collected at a rate of one per day.

The Oil Pond and Spill Pond Soil Sample Results

Four (4) soil samples, excluding QC samples, were collected from the Spill Pond for analysis by the on-site laboratory and Pace for Nitrate plus Nitrite and Ammonia. Two (2) soil samples from the Spill Pond were collected for analysis by Pace for RCRA metals. Six (6) soil and three (3) sediment samples were collected from the Oil Pond and the Spill Pond for analysis by Pace for TPH as GRO and TPH as DRO analysis.

Total Petroleum Hydrocarbons (TPH) were analyzed for gasoline range hydrocarbons (TPH as GRO) by Method 8015 and diesel range hydrocarbons (TPH as DRO) by Method OA-2. The laboratory was able to identify multiple constituents within the diesel range hydrocarbon analysis. The constituents were reported as: mineral spirits, jet fuel, kerosene, diesel fuel, fuel oil and motor oil. During the analysis of some of the samples an undistinguishable fuel product constituent was detected that did not correspond to one of the constituents listed above, but is within the organic diesel range. This constituent was reported as Total Petroleum Hydrocarbons in the laboratory reports and reported as TPH as fuel product or TPH as FP in the tables and figures. TPH as FP is

only reported in the laboratory reports if it is detected, otherwise it is not included in the constituent list. The only TPH as DRO that was detected in the samples collected was diesel fuel and the only other diesel range organics detected was TPH as FP.

Surface Soils

Two (2) surface soil samples were collected in Area D – Spill Pond and submitted to Pace for Nitrate plus Nitrite and Ammonia analysis using EPA Method 353.2 and 350.1, respectively, and RCRA metals analysis using EPA Method 6010/7471. Nitrate plus Nitrite and Ammonia were reported below laboratory detection limits in both surface soil samples.

Arsenic, barium, cadmium, chromium and lead were detected in both surface samples. Concentrations for arsenic were reported ranging from 8.87 mg/kg in sample A08-SS-04-0-0.67' to 9.92 mg/kg in sample A08-SS-05-0-0.67'. Sample A08-SS-05-0-0.67' reported the highest concentrations of barium (110 mg/kg), cadmium (2.83 mg/kg), chromium (94.6 mg/kg) and lead (26.6 mg/kg). Mercury, selenium and silver were not detected at concentrations above the laboratory detection limits in any of the surface soil samples.

Three (3) surface soil samples in the Oil Pond were analyzed for TPH by Pace. TPH as fuel product was the only TPH constituent detected above laboratory detection limits for all surface soil samples in the Oil Pond. Samples from the Oil Pond reported TPH as fuel product (a constituent of TPH as DRO) ranging from non-detect to 560 mg/kg in sample A07-SS-02-0-3'.

Figure D-1 in **Appendix C** shows all nitrogen concentrations, **Figure D-2** shows all metals concentrations and **Figure D-3** shows detectable TPH concentrations in the Oil Pond and Spill Pond Area. **Table 4-30** summarizes all analytical results for the Oil Pond (A07 sample series) and Spill Pond (A08 sample series).

Subsurface Soils

Two (2) subsurface soil samples were collected in the Spill Pond area and submitted, under chain of custody, to the on-site laboratory for Nitrate plus Nitrite and Ammonia analysis by method SM-4500. Nitrate plus Nitrite concentrations were detected in both samples ranging from 3.5 mg/kg in sample A08-SS-04-0.67-3' to 16 mg/kg in sample A08-SS-05-0.67-3'. Ammonia was not reported above laboratory detection limits for either sample. **(Table 4-30)**

Figure D-1 in **Appendix C** shows all nitrogen results for Area D.

The Spill Pond Sediment Sample Results

Three (3) sediment samples in the Spill Pond were analyzed for TPH by Pace. TPH as fuel product was the only TPH constituent detected above laboratory detection limits for all sediment samples in the Spill Pond. Samples from the Spill Pond reported TPH as fuel product ranging from 640 mg/kg in sample A08-SS-03-0-0.83' to 4500 mg/kg in sample A08-SS-01-0-1.33'. **(Table 4-29)**

Figure D-3 in **Appendix C** shows all detected TPH concentrations.

Table 4-30
Area D Soil Results 0-0.67' BGS
Former Areas 7&8 - Oil Pond and Spill Pond Areas
Former Farmland Nitrogen Plant
Lawrence, Kansas

Site	Date	Starting Depth (feet)	Ending Depth (feet)	TPH as FP (mg/kg)
A08-SS-01	05/04/2005	0.00	1.33	4,500
A08-SS-02	05/04/2005	0.00	0.75	1,900
A08-SS-03	05/04/2005	0.00	0.83	640
A07-SS-01	05/04/2005	0.00	3.00	---
A07-SS-02	05/04/2005	0.00	3.00	560
A07-SS-03	05/04/2005	0.00	3.00	140

Site	Date	Starting Depth (feet)	Ending Depth (feet)	Nitrate plus Nitrite (as N) (mg/kg)	Nitrogen, Ammonia (mg/kg)	Total Nitrate plus Ammonia (mg/kg)
A08-SS-04	05/04/2005	0.00	0.67	<5.63	<11.3	0
A08-SS-05	05/04/2005	0.00	0.67	<5.49	<11.0	0
A08-SS-04	5/4/2005	0.67	3	3.5	<2.3J	3.5
A08-SS-05	5/4/2005	0.67	3	16	<1.1>	17.1

Site	Date	Starting Depth (feet)	Starting Depth (feet)	Ending Depth (feet)	Arsenic (mg/kg)	Barium (mg/kg)	Cadmium (mg/kg)	Chromium (mg/kg)	Lead (mg/kg)	Mercury (mg/kg)	Selenium (mg/kg)	Silver (mg/kg)
A08-SS-04	05/04/2005	0.00	0.00	0.67	8.87	110	2.83	94.6	26.6	<0.144	<3.25	<0.758
A08-SS-05	05/04/2005	0.00	0.00	0.67	9.92	89.1	0.888	18.5	19.8	<0.141	<4.57	<0.711

J - Estimated concentration above the adjusted method detection limit and below the adjusted reporting limit

4.4.4.5 Area D –#2 Urea Area, Ammonia Production - Primary Reformer Area, and Nitric Acid Area –Sampling Methodology and Sampling Results

A total of thirty-six (36) soil boring locations were installed in the #2 Urea Area, Ammonia Production - Primary Reformer Area, and Nitric Acid Area using Geoprobe® direct-push technology. Twelve (12) borings were located in the #2 Urea Area, nine (9) borings were located in the Ammonia Production - Primary Reformer Area, and fifteen (15) borings were located in the Nitric Acid Area. Soil sampling intervals followed the procedure outlined in the approved Work Plan.

Soil boring locations in the #2 Urea Area, Ammonia Production - Primary Reformer Area, and Nitric Acid Area were installed to bedrock or equipment refusal. All thirty-six (36) locations were located in non-vegetative cover and were sampled in composite intervals from 0–8 inches bgs and 8–36 inches bgs.

All soil boring locations were sampled for Nitrate plus Nitrite and Ammonia and submitted, under chain of custody, to the on-site laboratory for analysis using method SM-4500 or to Pace for analysis using EPA Method 353.2 and 350.1, respectively.

A total of fourteen (14) surface soil locations were also submitted to Pace laboratory for RCRA metals analysis using EPA Method 6010/7471. Two (2) locations in the Ammonia Production - Primary Reformer Area (A12-SS-01 and A12-SS-07) were not originally selected for RCRA metals analysis according to the Work Plan.

- Three (3) locations in the #2 Urea Area - A09-SS-03, A09-SS-07 and A09-SS-11;
- Six (6) locations in the Ammonia Production - Primary Reformer Area – A12-SS-01, A12-SS-03, A12-SS-05, A12-SS-06, A12-SS-07 and A12-SS-08; and
- Seven (7) locations in the Nitric Acid Area – A14-SS-01, A14-SS-02, A14-SS-03, A14-SS-07, A14-SS-09, A14-SS-11 and A14-SS-13).

Two (2) soil borings in the Ammonia Production - Primary Reformer Area (A12-SS-03 and A12-SS-04) located around a used oil tote were also submitted to Pace for analysis for TPH as gasoline range organics (TPH as GRO) and TPH as diesel range organics (TPH as DRO) using EPA Method 8015 and Iowa Method OA-2, respectively. Grab samples were collected at a 0–6 inch and 6–36 inch intervals for TPH analysis according to the Work Plan.

Groundwater was encountered at ten (10) locations in the #2 Urea Area and the Nitric Acid Area and sampled for Nitrate plus Nitrite and Ammonia. The groundwater samples were collected in a clean unpreserved 4 oz. jar and submitted to the on-site laboratory, under chain of custody, for analysis using method SM-4500.

Sixteen (16) field duplicates were collected for analysis by the on-site laboratory and Pace for comparison and labeled using the same identifier as the original sample with a "D" at the end signifying the duplicate sent to the Pace. Twelve (12) field duplicate samples were collected and submitted blind to the same laboratory. Trip blanks were included in each cooler containing VOC analysis (TPH as GRO) and rinsate blanks were collected at a rate of one per day.

The #2 Urea Area *Soil Sample Results*

Sixty-eight (68) soil samples, excluding QC samples, were collected from the #2 Urea Area for analysis by the on-site laboratory and Pace for Nitrate plus Nitrite and Ammonia. Three (3) soil samples from the #2 Urea Area were collected for analysis by Pace for RCRA metals.

Surface Soils

Twelve (12) surface soil samples were collected in Area D – the #2 Urea Area and submitted to either the on-site laboratory or Pace for Nitrate plus Nitrite and Ammonia analysis. Nitrate plus Nitrite concentrations were detected in seven (7) surface soil samples ranging from non-detect to 392 mg/kg in sample A09-SS-06-0-0.67'. Three (3) samples reported concentrations of Ammonia above laboratory detection limits ranging from non-detect to 1520 mg/kg in sample A09-SS-09-0-0.67'. **(Table 4-31)**

Three (3) surface soil samples were collected in the #2 Urea Area and submitted to Pace for RCRA metals analysis. Two (2) samples reported concentrations of arsenic ranging from non-detect to 7.26 mg/kg and one (1) sample reported concentrations of silver above laboratory detection limits ranging from non-detect to 1.03 mg/kg. Barium, chromium and lead were detected above laboratory detection limits in all three (3) samples. Barium concentrations ranged from 25.0 mg/kg in sample A09-SS-070-0.67' to 142 mg/kg in sample A09-SS-11-0-0.67'. Chromium concentrations ranged from 17.7 mg/kg in sample A09-SS-11-0-0.67' to 41.3 mg/kg in sample A09-SS-07-0-0.67' and lead concentrations ranged from 10.8 mg/kg in sample A09-SS-03-0-0.67' to 29.2 mg/kg in sample A09-SS-11-0-0.67'. Cadmium, mercury and selenium were not detected at concentrations above the laboratory detection limits in any of the surface soil samples. **(Table 4-32)**

Subsurface Soils

Twelve (12) subsurface soil samples were collected in Area D – the #2 Urea Area and submitted to the on-site laboratory for Nitrate plus Nitrite and Ammonia analysis. Nitrate plus Nitrite concentrations were detected in nine (9) subsurface soil samples ranging from non-detect to 379 mg/kg in sample A09-SS-06-0.67-3'. Eight (8) samples reported concentrations of Ammonia above laboratory detection limits ranging from non-detect to 1,790 mg/kg in sample A09-SS-09-0.67-3'. **(Table 4-33)**

Subsurface Soils (Greater than 3 Feet)

Forty-five (45) subsurface soil samples were collected in Area D – the #2 Urea Area and submitted to the on-site laboratory Nitrate plus Nitrite and Ammonia analysis. Nitrate plus Nitrite concentrations were detected in twenty-three (23) subsurface soil samples ranging from non-detect to 394 mg/kg in sample A09-SS-10-9-12'. Thirty-seven (37) samples reported concentrations of Ammonia above laboratory detection limits ranging from non-detect to 10,730 mg/kg in sample A09-SS-10-15-18'. **(Table 4-34)**

Figure D-1 in **Appendix D** shows total nitrogen concentrations.

Table 4-31
Area D Surface Soil Nitrogen Results 0-0.67' BGS
#2 Urea Area
Former Farmland Nitrogen Plant
Lawrence, Kansas

Site	Date	Starting Depth (feet)	Ending Depth (feet)	Nitrate plus Nitrite (as N) (mg/kg)	Nitrogen, Ammonia (mg/kg)	Total Nitrate plus Ammonia (mg/kg)
A09-SS-01	05/02/2005	0.00	0.67	<1.1>	<3.3J	1.1
A09-SS-02	05/02/2005	0.00	0.67	8.1	111	119.1
A09-SS-03	05/02/2005	0.00	0.67	331	<2	331
A09-SS-04	05/02/2005	0.00	0.67	30.1	<2	30.1
A09-SS-05	05/02/2005	0.00	0.67	<1.1>	<1.1>	2.2
A09-SS-06	04/29/2005	0.00	0.67	392	<2.2J	392
A09-SS-07	05/02/2005	0.00	0.67	<5.46	<10.9	0
A09-SS-08	05/03/2005	0.00	0.67	<2.2J	123	123
A09-SS-09	05/03/2005	0.00	0.67	<2	1,520	1,520
A09-SS-10	05/02/2005	0.00	0.67	38.9	<2.3J	38.9
A09-SS-11	05/03/2005	0.00	0.67	11.3	<11.1	11.3
A09-SS-12	05/02/2005	0.00	0.67	7.7	<2.9J	7.7

<x>=Less than Reporting Limit

J - Estimated concentration above the adjusted method detection limit and below the adjusted reporting limit

Table 4-32
Area D Surface Soil RCRA Metals Results 0-0.67' BGS
#2 Urea Area
Former Farmland Nitrogen Plant
Lawrence, Kansas

Site	Date	Starting Depth (feet)	Ending Depth (feet)	Arsenic (mg/kg)	Barium (mg/kg)	Cadmium (mg/kg)	Chromium (mg/kg)	Lead (mg/kg)	Mercury (mg/kg)	Selenium (mg/kg)	Silver (mg/kg)
A09-SS-03	05/02/2005	0.00	0.67	7.26	37.6	<0.550	23.1	10.8	<0.188	<1.65	<0.771
A09-SS-07	05/02/2005	0.00	0.67	<1.77	25.0	<0.444	41.3	16.4	<0.160	<6.65	1.03
A09-SS-11	05/03/2005	0.00	0.67	6.79	142.	<0.525	17.7	29.2	<0.149	<1.57	<0.734

Table 4-33
Area D Surface Soil Nitrogen Results 0.67-3' BGS
#2 Urea Area
Former Farmland Nitrogen Plant
Lawrence, Kansas

Site	Date	Starting Depth (feet)	Ending Depth (feet)	Nitrate plus Nitrite (as N) (mg/kg)	Nitrogen, Ammonia (mg/kg)	Total Nitrate plus Ammonia (mg/kg)
A09-SS-01	05/02/2005	0.67	2.50	3.5	16.2	19.7
A09-SS-02	05/02/2005	0.67	2.50	4.5	118	122.5
A09-SS-03	05/02/2005	0.67	3.00	154	<2	154
A09-SS-04	05/02/2005	0.67	3.00	46.4	<1.1>	47.5
A09-SS-05	05/02/2005	0.67	3.00	19.7	235	254.7
A09-SS-06	04/29/2005	0.67	3.00	379	55	434
A09-SS-07	05/02/2005	0.67	3.00	<1.1>	<3.3J	1.1
A09-SS-08	05/03/2005	0.67	3.00	<1.2>	643	644.2
A09-SS-09	05/03/2005	0.67	3.00	<1.2>	1,790	1,791.20
A09-SS-10	05/02/2005	0.67	3.00	115	1,530	1645
A09-SS-11	05/03/2005	0.67	3.00	37.4	131	168.4
A09-SS-12	05/02/2005	0.67	3.00	50.9	<2	50.9

<x>=Less than Reporting Limit

J - Estimated concentration above the adjusted method detection limit and below the adjusted reporting limit

Table 4-34
Area D Subsurface Soil Nitrogen Results >3' BGS
#2 Urea Area
Former Farmland Nitrogen Plant
Lawrence, Kansas

Site	Date	Starting Depth (feet)	Ending Depth (feet)	Nitrate plus Nitrite (as N) (mg/kg)	Nitrogen, Ammonia (mg/kg)	Total Nitrate plus Ammonia (mg/kg)
A09-SS-04	05/02/2005	3.00	6.00	6	295	301
A09-SS-04	05/02/2005	6.00	9.00	3.5	188	191.5
A09-SS-04	05/02/2005	9.00	12.00	17.4	24.9	42.3
A09-SS-04	05/02/2005	12.00	15.00	56.8	<0.8>	57.6
A09-SS-04	05/02/2005	15.00	18.00	94.1	<2	94.1
A09-SS-04	05/02/2005	19.00	22.00	118D	<2	118
A09-SS-05	05/02/2005	3.00	4.50	17.5	218	235.5
A09-SS-06	04/29/2005	3.00	6.00	123	1,700	1823
A09-SS-06	04/29/2005	6.00	9.00	42.4	3,500	3,542.40
A09-SS-06	04/29/2005	9.00	12.00	85.3	4,760	4,845.30
A09-SS-06	04/29/2005	12.00	15.00	38.2	4,880	4,918.20
A09-SS-06	04/29/2005	15.00	18.00	21.9	5,070	5,091.90
A09-SS-06	04/29/2005	18.00	21.00	18.8	4,950	4,968.80
A09-SS-06	04/29/2005	21.00	24.00	12.5	5,640	5,652.50
A09-SS-06	04/29/2005	24.00	27.00	<2	1,760	1,760
A09-SS-07	05/02/2005	3.00	6.00	<0.7>	<5.1J	0.7
A09-SS-07	05/02/2005	6.00	9.00	<0.8>	<3.5J	0.8
A09-SS-07	05/02/2005	9.00	12.00	<0.8>	<4.2J	0.8
A09-SS-07	05/02/2005	12.00	15.00	<1.8>	<1.3>	3.1
A09-SS-07	05/02/2005	15.00	18.00	<0.8>	<4.3J	0.8
A09-SS-07	05/02/2005	18.00	21.00	<2.7J	6.8	6.8
A09-SS-07	05/02/2005	21.00	23.00	9.9	11.1	21
A09-SS-08	05/03/2005	3.00	6.00	<0.6>	431	431.6
A09-SS-08	05/03/2005	6.00	9.00	<0.7>	192	192.7
A09-SS-08	05/03/2005	9.00	12.00	<2	198	198
A09-SS-08	05/03/2005	12.00	15.00	<0.9>	153	153.9
A09-SS-08	05/03/2005	15.00	18.00	<2	147	147
A09-SS-08	05/03/2005	18.00	21.00	<1.2>	49	50.2
A09-SS-08	05/03/2005	21.00	24.00	<2.2J	7.8	7.8
A09-SS-08	05/03/2005	24.00	26.00	<2.4J	22.8	22.8
A09-SS-09	05/03/2005	3.00	6.00	<2	976	976
A09-SS-09	05/03/2005	6.00	9.00	<1.3>	1,000	1,001.30
A09-SS-09	05/03/2005	9.00	12.00	<2	167	167
A09-SS-09	05/03/2005	12.00	15.00	<2	4,050	4,050
A09-SS-09	05/03/2005	15.00	18.00	<1.2>	7.2	8.4
A09-SS-09	05/03/2005	18.00	21.00	<0.6>	17.1	17.7
A09-SS-09	05/03/2005	21.00	22.00	<0.9>	128	128.9
A09-SS-10	05/02/2005	3.00	6.00	17.6	912	929.6
A09-SS-10	05/02/2005	6.00	9.00	21.4	2,940	2,961.40
A09-SS-10	05/02/2005	9.00	12.00	394	6,990	7384
A09-SS-10	05/02/2005	12.00	15.00	33.2	9,770	9,803.20
A09-SS-10	05/02/2005	15.00	18.00	24.2	10,730	10,754.20
A09-SS-10	05/02/2005	18.00	21.00	16	7,870	7,886
A09-SS-10	05/02/2005	21.00	23.00	28.1	4,600	4,628.10
A09-SS-11	05/03/2005	3.00	5.00	6	276	282

<x>=Less than Reporting Limit

J - Estimated concentration above the adjusted method detection limit and below the adjusted reporting limit

#2 Urea Area Groundwater Sample Results

Groundwater was encountered at six (6) locations (A09-SS-04, A09-SS-06, A09-SS-07, A09-SS-08, A09-SS-09 and A09-SS-10) in the #2 Urea Area and sampled for Nitrate plus Nitrite and Ammonia. The groundwater samples were collected in a clean unpreserved 4 oz. jar and submitted to the on-site laboratory, under chain of custody, for analysis using SM-4500.

Nitrate plus Nitrite concentrations were detected in five (5) of the six groundwater samples ranging from non-detect to 299 mg/l in sample A09-GW-06. All six (6) groundwater samples reported concentrations of Ammonia above laboratory detection limits ranging from 11.8 mg/l in sample A09-GW-04-8' to 2990 mg/l in sample A09-GW-10-8'. **(Table 4-35)**

The Ammonia Production - Primary Reformer Area Soil Sample Results

Thirty (30) soil samples, excluding QC samples, were collected from the Ammonia Production - Primary Reformer Area for analysis by the on-site laboratory and Pace for Nitrate plus Nitrite and Ammonia. Four (4) soil samples from the Ammonia Production - Primary Reformer Area (A12-SS-03, A12-SS-05, A12-SS-06 and A12-SS-08) were collected for analysis by Pace for RCRA metals and two (2) soil samples (A12-SS-03 and A12-SS-04) were collected for analysis by Pace for TPH as GRO and TPH as DRO. Two (2) additional surface soil samples (A12-SS-01 and A12-SS-07) were collected for RCRA metals analysis.

Groundwater was not encountered in any soil borings in the Ammonia Production - Primary Reformer Area of Area D.

Surface Soils

Nine (9) surface soil samples were collected in the Ammonia Production - Primary Reformer Area and submitted to the on-site laboratory or Pace for Nitrate plus Nitrite and Ammonia analysis. Nitrate plus Nitrite concentrations were detected above laboratory detection limits in two (2) surface soil samples ranging from non-detect to 18.5 mg/kg in sample A12-SS-09-0-0.67'. Four (4) surface soil samples reported concentrations above laboratory detection limits for Ammonia ranging from non-detect to 213 mg/kg also in sample A12-SS-09-0-0.67'. **(Table 4-36)**

Six (6) surface soil samples were collected in the Ammonia Production - Primary Reformer Area and submitted to Pace for RCRA metals analysis. Arsenic, barium, chromium and lead reported detected concentrations in all six (6). Cadmium and silver reported detectable concentrations in two (2) surface soil samples. Sample A12-SS-08-0-0.67' reported the highest concentrations for arsenic (31.0 mg/kg), barium (1010 mg/kg), cadmium (0.850 mg/kg) and silver (2.40 mg/kg). Sample A12-SS-03-0-0.67' reported the highest concentrations for chromium (39.1 mg/kg) and lead (23.3 mg/kg). **(Table 4-37)**

Two (2) soil samples were collected in the Ammonia Production - Primary Reformer Area and submitted to Pace for TPH as GRO and TPH as DRO analysis. TPH as GRO was detected in

one (1) sample (A12-SS-04-0-0.5') at concentrations ranging from non-detect to 18 mg/kg. Both samples collected in the Ammonia Production - Primary Reformer Area for TPH as DRO had detected concentrations for TPH as fuel product ranging from 1,500 mg/kg to 4,600 mg/kg in sample A12-SS-04-0-0.5'.

Table 4-35
Area D Groundwater Nitrogen Results
#2 Urea Area
Former Farmland Nitrogen Plant
Lawrence, Kansas

Site	Date	Depth (feet)	Nitrate plus Nitrite (as N) (mg/kg)	Nitrogen, Ammonia (mg/kg)
A09-GW-04	05/02/2005	8.00	54	11.8
A09-GW-06	04/29/2005	0.00	299	2,780
A09-GW-07	05/02/2005	0.00	10.4	2.39
A09-GW-08	05/03/2005	0.00	0.6	16.1
A09-GW-09	05/03/2005	16.00	<1.5	108
A09-GW-10	05/02/2005	8.00	120	2,990

Table 4-36
Area D Surface Soil Nitrogen Results 0-.67' BGS
Ammonia Production - Primary Reformer Area
Former Farmland Nitrogen Plant
Lawrence, Kansas

Site	Date	Starting Depth (feet)	Starting Depth (feet)	Ending Depth (feet)	Nitrate plus Nitrite (as N) (mg/kg)	Nitrogen, Ammonia (mg/kg)	Total Nitrate plus Ammonia (mg/kg)
A12-SS-01	05/06/2005	0.00	0.00	0.67	<5.71	<11.4	0
A12-SS-02	05/06/2005	0.00	0.00	0.67	4.3	<1.1>	5.4
A12-SS-03	05/06/2005	0.00	0.00	0.67	<6.06	<12.1	0
A12-SS-04	05/06/2005	0.00	0.00	0.67	<2	11.5	11.5
A12-SS-05	05/06/2005	0.00	0.00	0.67	<6.19	<12.4	0
A12-SS-06	05/06/2005	0.00	0.00	0.67	<6.10	<12.2	0
A12-SS-07	05/06/2005	0.00	0.00	0.67	<5.98	12.1	12.1
A12-SS-08	05/06/2005	0.00	0.00	0.67	<6.28	134	134
A12-SS-09	05/06/2005	0.00	0.00	0.67	18.5	213	231.5

<x>=Less than Reporting Limit

Table 4-37
Area D Surface Soil Metal Results 0-0.67' BGS
Ammonia Production - Primary Reformer Area
Former Farmland Nitrogen Plant
Lawrence, Kansas

Site	Date	Starting Depth (feet)	Ending Depth (feet)	Arsenic (mg/kg)	Barium (mg/kg)	Cadmium (mg/kg)	Chromium (mg/kg)	Lead (mg/kg)	Mercury (mg/kg)	Selenium (mg/kg)	Silver (mg/kg)
A12-SS-01	05/06/2005	0.00	0.67	1.75	87.9	0.457	18.1	19.6	<0.147	<13.5	1.02
A12-SS-03	05/06/2005	0.00	0.67	17.2	147	<0.566	39.1	23.3	<0.170	<3.40	<0.793
A12-SS-05	05/06/2005	0.00	0.67	14.4	229	<0.601	35.9	11.2	<0.166	<1.80	<0.841
A12-SS-06	05/06/2005	0.00	0.67	11.9	160	<0.462	21.0	14.8	<0.163	<1.39	<0.647
A12-SS-07	05/06/2005	0.00	0.67	6.13	129	<0.544	21.5	5.41	<0.154	<1.63	<0.762
A12-SS-08	05/06/2005	0.00	0.67	31.0	1,010	0.850	22.0	14.4	<0.176	<8.05	2.40

Subsurface Soils

Nine (9) subsurface soil samples were collected in the Ammonia Production - Primary Reformer Area and submitted to the on-site laboratory for Nitrate plus Nitrite and Ammonia analysis. Nitrate plus Nitrite concentrations were detected in two (2) samples ranging from non-detect to 66.3 mg/kg in sample A12-SS-09-0.67-3'. Three (3) subsurface soil samples reported concentrations above laboratory detection limits for Ammonia ranging from non-detect to 566 mg/kg also found in sample A12-SS-09-0.67-3'. **(Table 4-38)**

Two (2) soil samples were collected in the Ammonia Production - Primary Reformer Area and submitted to Pace for TPH as GRO and TPH as DRO analysis. TPH as GRO was detected in one (1) sample (A12-SS-03-0.5-3') at a concentration of 7.7 mg/kg. This sample also contained a high concentration of TPH as fuel product of 560 mg/kg.

Subsurface Soils (Greater than 3 feet)

Seven (7) subsurface soil samples were collected in the Ammonia Production - Primary Reformer Area and submitted to the on-site laboratory for Nitrate plus Nitrite and Ammonia analysis. Nitrate plus Nitrite reported detected concentrations in three (3) samples ranging from non-detect to 262 mg/kg in sample A12-SS-09-3-6'. Four (4) samples reported concentrations of Ammonia above laboratory detection limits ranging from non-detect to 1560 mg/kg in sample A12-SS-09-6-9'. **(Table 4-39)**

One (1) subsurface soil sample was collected in the Ammonia Production - Primary Reformer Area and submitted to Pace for TPH as GRO and TPH as DRO analysis. TPH as DRO was detected in one (1) sample in the form of TPH as fuel product at a concentration of 610 mg/kg in sample A12-SS-03-3-4.25'.

The Nitric Acid Area Soils Results (Area 14)

Sixty-six (66) soil samples were collected in Area D – the Nitric Acid Area and submitted to the on-site laboratory for Nitrate plus Nitrite and Ammonia analysis by method SM-4500 or Pace to be analyzed using EPA Methods 353.2 and 350.1, respectively. Seven (7) surface soil samples (A14-SS-01, A14-SS-02, A14-SS-03, A14-SS-07, A14-SS-09, A14-SS-11 and A14-SS-13) were collected and submitted to Pace for analysis of RCRA metals by EPA Method 6010/7471.

One (1) subsurface soil sample was collected (A14-SS-03-2.5') in the Nitric Acid Area and sampled for TPH as GRO and TPH as DRO by Pace using EPA Method 8015 and Iowa Method OA-2. This sample was added due to a strong petroleum odor noticed by the sampling team.

Groundwater was encountered at four (4) boring locations (A14-SS-03, A14-SS-07, A14-SS-08 and A14-SS-13) and was sampled for Nitrate plus Nitrite and Ammonia. The groundwater samples were collected in a clean unpreserved 4 oz. jar and submitted to the on-site laboratory, under chain of custody, for analysis using method SM-4500.

Table 4-38
Area D Surface Soil Nitrogen Results 0.67-3' BGS
Ammonia Production - Primary Reformer Area
Former Farmland Nitrogen Plant
Lawrence, Kansas

Site	Date	Depth (feet)	Starting Depth (feet)	Ending Depth (feet)	Nitrate plus Nitrite (as N) (mg/kg)	Nitrogen, Ammonia (mg/kg)	Total Nitrate plus Ammonia (mg/kg)
A12-SS-01	05/06/2005	0.67	0.67	3.00	<1.9>	<2	1.9
A12-SS-02	05/06/2005	0.67	0.67	2.33	<2	<2	0
A12-SS-03	05/06/2005	0.67	0.67	3.00	<2.4J	<2	0
A12-SS-04	05/06/2005	0.67	0.67	3.00	<2	<2	0
A12-SS-05	05/06/2005	0.67	0.67	1.58	<2	<2	0
A12-SS-06	05/06/2005	0.67	0.67	3.00	<2.5J	24.1	24.1
A12-SS-07	05/06/2005	0.67	0.67	3.00	6	<1.2>	7.2
A12-SS-08	05/06/2005	0.67	0.67	3.00	<2	7.8	7.8
A12-SS-09	05/06/2005	0.67	0.67	3.00	66.3	566	632.3

<x>=Less than Reporting Limit

J - Estimated concentration above the adjusted method detection limit and below the adjusted reporting limit

Table 4-39
Area D Subsurface Soil Nitrogen Results >3' BGS
Ammonia Production - Primary Reformer Area
Former Farmland Nitrogen Plant
Lawrence, Kansas

Site	Date	Depth (feet)	Starting Depth (feet)	Ending Depth (feet)	Nitrate plus Nitrite (as N) (mg/kg)	Nitrogen, Ammonia (mg/kg)	Total Nitrate plus Ammonia (mg/kg)
A12-SS-01	5/6/2005	3.00	3.00	6.00	<2	<2	0
A12-SS-03	5/6/2005	3.00	3.00	4.25	<2.4J	<2	0
A12-SS-06	5/6/2005	3.00	3.00	6.00	<2.4J	96.9	96.9
A12-SS-06	5/6/2005	6.00	6.00	8.00	<2.4J	56.2	56.2
A12-SS-07	5/6/2005	3.00	3.00	4.00	4.2	<2	4.2
A12-SS-09	5/6/2005	3.00	3.00	6.00	262	977	1,239
A12-SS-09	5/6/2005	6.00	6.00	9.00	133	1,560	1,693

<x>=Less than Reporting Limit

J - Estimated concentration above the adjusted method detection limit and below the adjusted reporting limit

Surface Soils

Fifteen (15) surface soil samples were collected in the Nitric Acid Area and submitted to either the on-site laboratory or Pace for Nitrate plus Nitrite and Ammonia. Nitrate plus Nitrite was detected in seven (7) of the surface soils collected and ranged from non-detect to 35.4 mg/kg in sample A14-SS--09-0-0.67'. One (1) sample reported detected concentrations of Ammonia at a concentration of 63 mg/kg in sample A14-SS-06-0-0.67'. **(Table 4-40)**

Seven (7) surface soil samples were collected in the Nitric Acid Area and submitted to Pace for RCRA metals analysis. Barium, chromium and lead concentrations were reported above laboratory detection limits in all seven (7) samples. Two (2) samples reported detected arsenic results, one (1) sample reported detected concentrations of cadmium and mercury, and five (5) samples reported detected results for silver. Sample A14-SS-03-0-0.67' reported the highest concentrations of cadmium (0.506 mg/kg), chromium (106 mg/kg) and lead (61.7 mg/kg). Sample A14-SS-13-0-0.67' reported the highest concentrations of arsenic (10.1 mg/kg) and barium (151 mg/kg). Mercury was reported in sample A14-SS-01-0-0.67' ranging from non-detect to 0.264 mg/kg and silver was reported in sample A14-SS-09-0-0.67' ranging from non-detect to 1.25 mg/kg. **(Table 4-41)**

Subsurface Soils

Fifteen (15) subsurface soil samples were collected in the Nitric Acid Area and submitted to the on-site laboratory for Nitrate plus Nitrite and Ammonia analysis. Nitrate plus Nitrite was detected in nine (9) samples with concentrations ranging from non-detect to 154 mg/kg in sample A14-SS-10-0.67-3'. Nine (9) samples reported detected concentrations of Ammonia ranging from non-detect to 58.1 mg/kg in sample A14-SS-06-0.67-3'. **(Table 4-42)**

One (1) subsurface soil sample (A14-SS-03-2.5') was collected in the Nitric Acid Area and submitted to Pace for TPH as GRO and TPH as DRO analysis using EPA Method 8015 and OA-2, respectively. TPH as GRO was reported at 140 mg/kg and TPH as DRO reported (as TPH as fuel product) at 80 mg/kg.

Subsurface Soils (Greater than 3 Feet)

Thirty-five (35) subsurface soil samples were collected in the Nitric Acid Area and submitted to the on-site laboratory for Nitrate plus Nitrite and Ammonia analysis. Nitrate plus Nitrite was detected in twelve (12) subsurface samples with concentrations ranging from non-detect to 806 mg/kg in sample A14-SS-14-3-6'. Eighteen (18) samples reported detected concentrations of Ammonia ranging from non-detect to 90.8 mg/kg in sample A14-SS-06-7.5-9'. **(Table 4-43)**

The Nitric Acid Area Groundwater Results

Four (4) groundwater samples were collected from soil borings in the Nitric Acid Area and submitted to the on-site laboratory for Nitrate plus Nitrite and Ammonia analysis. Nitrate plus Nitrite was detected in three (3) samples with concentrations ranging from non-detect to 21 mg/l in sample A14-GW-13. Two (2) samples reported detected concentrations of Ammonia ranging from non-

detect to 0.83 mg/l in sample A14-GW-08-4'. Analytical results for Geoprobe® groundwater samples are provided for consideration, but may not be truly representative of actual groundwater quality

Table 4-40
Area D Soil Nitrogen Results 0-.67' BGS
Nitric Acid Area
Former Farmland Nitrogen Plant
Lawrence, Kansas

Site	Date	Depth (feet)	Starting Depth (feet)	Ending Depth (feet)	Nitrate plus Nitrite (as N) (mg/kg)	Nitrogen, Ammonia (mg/kg)	Total Nitrate plus Ammonia (mg/kg)
A14-SS-01	05/03/2005	0.00	0.00	0.67	20.2	<11.5	20.2
A14-SS-02	05/05/2005	0.00	0.00	0.67	<5.28	<10.6	0
A14-SS-03	05/05/2005	0.00	0.00	0.67	<5.46	<10.9	0
A14-SS-04	05/05/2005	0.00	0.00	0.67	<2.2J	<1.1>	1.1
A14-SS-05	05/05/2005	0.00	0.00	0.67	8.5	<1.1>	9.6
A14-SS-06	05/09/2005	0.00	0.00	0.67	<2.3J	63	63
A14-SS-07	05/06/2005	0.00	0.00	0.67	16.0	<11.3	16
A14-SS-08	05/06/2005	0.00	0.00	0.67	<2	<2	0
A14-SS-09	05/06/2005	0.00	0.00	0.67	35.4	<10.6	35.4
A14-SS-10	05/05/2005	0.00	0.00	0.67	<1>	<1>	2
A14-SS-11	05/06/2005	0.00	0.00	0.67	<5.20	<10.4	0
A14-SS-12	05/06/2005	0.00	0.00	0.67	<1>	<2	1
A14-SS-13	05/05/2005	0.00	0.00	0.67	25.5	<12.4	25.5
A14-SS-14	05/05/2005	0.00	0.00	0.67	6.6	.<1.1>	7.7
A14-SS-15	05/09/2005	0.00	0.00	0.67	4.2	<2	4.2

<x>=Less than Reporting Limit

J - Estimated concentration above the adjusted method detection limit and below the adjusted reporting limit

Table 4-41
Area D Surface Soil RCRA Metals Results 0-0.67' BGS
Nitric Acid Area
Former Farmland Nitrogen Plant
Lawrence, Kansas

Site	Date	Starting Depth (feet)	Ending Depth (feet)	Arsenic (mg/kg)	Barium (mg/kg)	Cadmium (mg/kg)	Chromium (mg/kg)	Lead (mg/kg)	Mercury (mg/kg)	Selenium (mg/kg)	Silver (mg/kg)
A14-SS-01	05/03/2005	0.00	0.67	<4.99	36.8	<0.499	47.9	19.4	0.264	<7.48	1.16
A14-SS-02	05/05/2005	0.00	0.67	<1.03	44.6	<0.513	46.3	19.6	<0.148	<1.54	1.24
A14-SS-03	05/05/2005	0.00	0.67	<0.993	82.4	0.506	106	61.7	<0.153	<14.9	1.18
A14-SS-07	05/06/2005	0.00	0.67	7.23	148	<0.534	22.6	15.4	<0.174	<1.60	<0.748
A14-SS-09	05/06/2005	0.00	0.67	<4.98	51.3	<0.498	97.3	38.1	<0.163	<7.47	1.25
A14-SS-11	05/06/2005	0.00	0.67	<3.71	28.7	<0.464	19.4	12.7	<0.152	<5.57	0.716
A14-SS-13	05/05/2005	0.00	0.67	10.1	151	<0.585	76.1	17.4	<0.166	<1.75	<0.819

Table 4-42
Area D Subsurface Soil Nitrogen Results 0.67-3' BGS
Nitric Acid Area
Former Farmland Nitrogen Plant
Lawrence, Kansas

Site	Date	Depth (feet)	Starting Depth (feet)	Ending Depth (feet)	Nitrate plus Nitrite (as N) (mg/kg)	Nitrogen, Ammonia (mg/kg)	Total Nitrate plus Ammonia (mg/kg)
A14-SS-01	05/03/2005	0.67	0.67	2.00	4.7	<4J	4.7
A14-SS-02	05/05/2005	0.67	0.67	3.00	12.9	<2	12.9
A14-SS-03	05/05/2005	0.67	0.67	3.00	<2.4J	21.7	21.7
A14-SS-04	05/05/2005	0.67	0.67	3.00	6.9	8.1	15
A14-SS-05	05/05/2005	0.67	0.67	1.50	14.9	<1.1>	16
A14-SS-06	05/09/2005	0.67	0.67	3.00	<1.2>	58.1	59.3
A14-SS-07	05/06/2005	0.67	0.67	3.00	<1.2>	45.3	46.5
A14-SS-08	05/06/2005	0.67	0.67	3.00	<2	<2	0
A14-SS-09	05/06/2005	0.67	0.67	3.00	23.8	<2	23.8
A14-SS-10	05/05/2005	0.67	0.67	3.00	154	16.7	170.7
A14-SS-11	05/06/2005	0.67	0.67	3.00	<1.2>	48	49.2
A14-SS-12	05/06/2005	0.67	0.67	3.00	3.5	<2	3.5
A14-SS-13	05/05/2005	0.67	0.67	3.00	<2	7.1	7.1
A14-SS-14	05/05/2005	0.67	0.67	3.00	153	15.3	168.3
A14-SS-15	05/09/2005	0.67	0.67	3.00	3.1	19.9	23

<x>=Less than Reporting Limit

J - Estimated concentration above the adjusted method detection limit and below the adjusted reporting limit

Table 4-43
Area D Subsurface Soil Nitrogen Results >3' BGS
Nitric Acid Area
Former Farmland Nitrogen Plant
Lawrence, Kansas

Site	Date	Depth (feet)	Starting Depth (feet)	Ending Depth (feet)	Nitrate plus Nitrite (as N) (mg/kg)	Nitrogen, Ammonia (mg/kg)	Total Nitrate plus Ammonia (mg/kg)
A14-SS-01	05/03/2005	6.00	6.00	8.00	<2.6J	68.4	68.4
A14-SS-01	05/03/2005	9.00	9.00	12.00	<1.2>	11.7	12.9
A14-SS-01	05/03/2005	12.00	12.00	15.00	<2	<2.4J	0
A14-SS-01	05/03/2005	15.00	15.00	18.00	<1.2>	<2.4J	1.2
A14-SS-01	05/03/2005	18.00	18.00	21.00	<2.4J	<2	0
A14-SS-01	05/03/2005	21.00	21.00	24.00	13.3	<2	13.3
A14-SS-01	05/03/2005	24.00	24.00	25.00	56.3	<2	56.3
A14-SS-02	05/05/2005	3.00	3.00	6.00	<1.2>	5.8	7
A14-SS-03	05/05/2005	4.50	4.50	6.00	<2.5J	37.1	37.1
A14-SS-03	05/05/2005	6.00	6.00	9.00	<2	<2.4J	0
A14-SS-03	05/05/2005	10.00	10.00	12.00	<2.4J	<2	0
A14-SS-03	05/05/2005	12.00	12.00	15.00	<2.4J	<2	0
A14-SS-03	05/05/2005	15.00	15.00	18.00	4.2	<2	4.2
A14-SS-03	05/05/2005	18.00	18.00	20.00	<2.4J	<2	0
A14-SS-04	05/05/2005	4.00	4.00	5.00	12.2	19.5	31.7
A14-SS-06	05/09/2005	3.00	3.00	6.00	3	11.8	14.8
A14-SS-06	05/09/2005	7.50	7.50	9.00	<2	90.8	90.8
A14-SS-06	05/09/2005	9.00	9.00	10.00	<1.2>	33.8	35
A14-SS-07	05/06/2005	3.00	3.00	6.00	<1.2>	44.8	46
A14-SS-07	05/06/2005	6.00	6.00	9.00	<1.2>	18.6	19.8
A14-SS-07	05/06/2005	9.00	9.00	12.00	<2	<1.1>	1.1
A14-SS-08	05/06/2005	3.00	3.00	6.00	<2	<4.6J	0
A14-SS-08	05/06/2005	6.00	6.00	9.00	<2	17.9	17.9
A14-SS-08	05/06/2005	9.00	9.00	11.50	3.5	<2	3.5
A14-SS-09	05/06/2005	3.00	3.00	6.00	9.3	9.9	19.2
A14-SS-09	05/06/2005	6.00	6.00	9.00	24.9	<2	24.9
A14-SS-09	05/06/2005	9.00	9.00	12.00	24.2	<2	24.2
A14-SS-10	05/05/2005	3.00	3.00	6.00	216	39	255
A14-SS-10	05/05/2005	6.00	6.00	7.00	250	20	270
A14-SS-11	05/06/2005	3.00	3.00	6.00	<2	50.4	50.4
A14-SS-11	05/06/2005	6.00	6.00	8.00	<1.1>	6.2	7.3
A14-SS-12	05/06/2005	3.00	3.00	5.00	<2	<2	0
A14-SS-13	05/05/2005	3.00	3.00	6.00	<1.3>	5.2	6.5
A14-SS-14	05/05/2005	3.00	3.00	6.00	806	10.6	816.6
A14-SS-15	05/09/2005	3.00	3.00	5.00	<1.2>	<2	1.2

<x>=Less than Reporting Limit

J - Estimated concentration above the adjusted method detection limit and below the adjusted reporting limit

4.4.4.6 Area D – Paint Shop Area Sampling Methodology and Sampling Results

A total of ten (10) soil boring locations were installed in the Paint Shop Area using Geoprobe® direct-push technology. One (1) sample location (A11-SS-10) was added during field activities due to apparent staining on the gravel. Soil sampling intervals followed the procedure outlined in the approved Work Plan.

Soil boring locations in the Paint Shop Area were installed to bedrock or equipment refusal. All locations were located in non-vegetative cover and were sampled in composite intervals from 0-8 inches bgs and 8–36 inches bgs for Nitrate plus Nitrite, Ammonia and RCRA metals analysis. Grab samples were collected for volatile organic compound (VOC) analysis at intervals of 0–6 inches and 6–36 inches as specified in the Work Plan.

All soil boring locations were sampled for Nitrate plus Nitrite and Ammonia and submitted, under chain of custody, to the on-site laboratory for analysis using method SM-4500 or to Pace for analysis using EPA Method 353.2 and 350.1, respectively.

All ten (10) surface soil locations were also submitted to Pace laboratory for RCRA metals analysis using EPA Method 6010/7471

All soil boring locations were sampled for VOCs and submitted, under chain of custody, to Pace for analysis using EPA Method 8260B.

Groundwater was not encountered in soil boring installed in the Paint Shop Area.

Two (2) field duplicates were collected for analysis by the on-site laboratory and Pace for comparison and labeled using the same identifier as the original sample with a "D" at the end signifying the duplicate sent to the Pace. One (1) field duplicate samples was collected and submitted blind to the same laboratory. Trip blanks were included in each cooler containing VOC and rinsate blanks were collected at a rate of one per day.

The Paint Shop Area Soil Sampling Results

Twenty-two (22) soil samples were collected in Area D – the Paint Shop Area and submitted to the on-site laboratory for Nitrate plus Nitrite and Ammonia analysis by method SM-4500 or Pace to be analyzed using EPA Methods 353.2 and 350.1, respectively. VOC analysis provided by Pace using EPA Method 8260B was also conducted on all soil samples. Ten (10) surface soil samples were collected and submitted to Pace for analysis of RCRA metals by EPA Method 6010/7471.

Surface Soils

Ten (10) surface soil samples were collected in the Paint Shop Area and submitted to either the on-site laboratory or Pace for Nitrate plus Nitrite and Ammonia. Nitrate plus Nitrite was detected in four (4) of the surface soils collected and ranged from non-detect to 30.6 mg/kg in sample A1-SS-06-0-0.67'. One (1) sample reported detected concentrations of Ammonia ranging from non-detect to 16.6 mg/kg in sample A11-SS-07-0-0.67'. **(Table 4-44)**

Ten (10) surface soil samples were collected in the Paint Shop Area and submitted to Pace for RCRA metals analysis. Arsenic, Barium, and lead concentrations were reported above laboratory detection limits in all ten (10) samples. Two (2) samples reported detected cadmium and chromium results above laboratory detection limits. Sample A11-SS-01-0-0.67' reported the highest concentrations of arsenic (22.1 mg/kg) and cadmium (0.746 mg/kg). Sample A11-SS-02-0-0.67' reported the highest concentrations of chromium (36.4 mg/kg) and lead (89.5 mg/kg). Sample A11-SS-07-0-0.67' reported the highest concentration for barium at 231 mg/kg. Mercury, selenium and silver were not detected above laboratory detection limits for the Paint Shop Area. **(Table 4-45)**

Ten (10) surface soil samples were collected in the Paint Shop Area and submitted to Pace for VOC analysis. Five (5) samples reported at least one detected concentration for Acetone, 1,2,4-trimethylbenzene, 1,2,5-trimethylbenzene, 1-methylethylbenzene, Ethylbenzene, x,p-xylene, MEK, n-Butylbenzene, n-Propylbenzene, o-xylene, p-Cymene, sec-Butylbenzene, Tetracholoroethene (PCE) and/or xylene. Sample A11-SS-03-0-0.5' reported the highest concentrations for Acetone (160 µg/kg) and MEK (31 µg/kg). Sample A11-SS-06-0-0.5' reported the highest concentrations for 1,2,4-trimethylbenzene (70 µg/kg), 1,2,5-trimethylbenzene (42 µg/kg), 1-methylethylbenzene (80 µg/kg), Ethylbenzene (840 µg/kg), x,p-xylene (30 µg/kg), n-Butylbenzene (22 µg/kg), n-Propylbenzene (32 µg/kg), o-xylene (6.9 µg/kg), p-Cymene (12 µg/kg), sec-Butylbenzene (15 µg/kg) and xylene (37 µg/kg). Sample A11-SS-04-0-0.5' reported the highest concentration for PCE at 39 µg/kg. The remaining constituents and samples were reported below laboratory detection limits. **(Table 4-46)**

Subsurface Soils

Nine (9) subsurface soil samples were collected in the Paint Shop Area and submitted to the on-site laboratory for Nitrate plus Nitrite and Ammonia analysis. Nitrate plus Nitrite was detected in five (5) samples with concentrations ranging from non-detect to 17.1 mg/kg in sample A11-SS-10-0.67-1.33'. Five (5) samples reported detected concentrations of Ammonia ranging from non-detect to 105 mg/kg in sample A11-SS-03-0.67-2.5'. **(Table 4-47)**

Nine (9) subsurface soil samples were collected in the Paint Shop Area and submitted to Pace for VOC analysis. Five (5) samples reported at least one detected concentration for Acetone, MEK and/or PCE. Sample A11-SS-03-0.5-2.5' reported the highest concentrations for Acetone (660 µg/kg) and MEK (140 µg/kg). Sample A11-SS-04-0.5-3' reported the highest concentration for PCE (35 µg/kg). **(Table 4-48)**

Table 4-44
Area D Surface Soil Nitrogen Results 0-0.67' BGS
Paint Shop Area
Former Farmland Nitrogen Plant
Lawrence, Kansas

Site	Date	Starting Depth (feet)	Ending Depth (feet)	Nitrate plus Nitrite (as N) (mg/kg)	Nitrogen, Ammonia (mg/kg)	Total Nitrate plus Ammonia (mg/kg)
A11-SS-01	05/10/2005	0.00	0.67	9.47G	<11.6	9.47
A11-SS-02	05/10/2005	0.00	0.67	<5.51	<11.0	0
A11-SS-03	05/10/2005	0.00	0.67	<6.52	<13.0	0
A11-SS-04	05/10/2005	0.00	0.67	<6.57	<13.1	0
A11-SS-05	05/10/2005	0.00	0.67	<5.85	<11.7	0
A11-SS-06	05/10/2005	0.00	0.67	16.0	30.6	46.6
A11-SS-07	05/10/2005	0.00	0.67	16.6	<11.6	16.6
A11-SS-08	05/10/2005	0.00	0.67	<5.71	<11.4	0
A11-SS-09	05/10/2005	0.00	0.67	<5.99	<12.0	0
A11-SS-10	05/10/2005	0.00	0.67	11.8	<11.9	11.8

Table 4-45
Area D Surface Soil RCRA Metals Results 0-0.67' BGS
Paint Shop Area
Former Farmland Nitrogen Plant
Lawrence, Kansas

Site	Date	Starting Depth (feet)	Ending Depth (feet)	Arsenic (mg/kg)	Barium (mg/kg)	Cadmium (mg/kg)	Chromium (mg/kg)	Lead (mg/kg)	Mercury (mg/kg)	Selenium (mg/kg)	Silver (mg/kg)
A11-SS-01	05/10/2005	0.00	0.67	22.1	104	0.746	27.6	65.8	<0.163	<1.35	<0.632
A11-SS-02	05/10/2005	0.00	0.67	14.2	125	0.490	36.4	89.5	<0.142	<1.33	<0.622
A11-SS-03	05/10/2005	0.00	0.67	9.52	184	<0.552	19.8	19.0	<0.183	<1.66	<0.773
A11-SS-04	05/10/2005	0.00	0.67	15.0	79.5	<0.625	21.0	57.6	<0.169	<1.88	<0.875
A11-SS-05	05/10/2005	0.00	0.67	9.17	99.0	<0.460	12.4	16.6	<0.171	<1.38	<0.644
A11-SS-06	05/10/2005	0.00	0.67	9.34	139	<0.497	25.8	84.1	<0.160	<1.49	<0.696
A11-SS-07	05/10/2005	0.00	0.67	14.8	231	<0.523	25.9	22.1	<0.179	<1.57	<0.732
A11-SS-08	05/10/2005	0.00	0.67	11.2	105	<0.529	15.3	30.2	<0.167	<3.17	<0.740
A11-SS-09	05/10/2005	0.00	0.67	10.1	139	<0.544	19.8	16.9	<0.168	<1.63	<0.762
A11-SS-10	05/10/2005	0.00	0.67	8.59	87.7	<0.596	23.6	12.7	<0.175	<1.79	<0.835

Table 4-46
Area D Surface Soil Detected VOC Results 0-0.5' BGS
Paint Shop Area
Former Farmland Nitrogen Plant
Lawrence, Kansas

Site	Date	Start Depth (feet)	End Depth (feet)	Acetone (ug/kg)	Benzene, 1,2,4-trimethyl (ug/kg)	Benzene, 1,3,5-trimethyl (ug/kg)	Benzene, 1-methyl ethyl (ug/kg)	Ethyl benzene (ug/kg)	m/p-xylene (ug/kg)	Methyl ethyl ketone (ug/kg)	n-Butyl benzene (ug/kg)	n-Propyl benzene (ug/kg)	o-Xylene (ug/kg)	p-Cymene (ug/kg)	sec-Butyl benzene (ug/kg)	Tetra chloro ethylene (ug/kg)	Xylene (total) (ug/kg)
A11-SS-01	5/10/05	0.00	0.50	<23.	<5.9	<5.9	<5.9	<5.9	<5.9	<12.	<5.9	<5.9	<5.9	<5.9	<5.9	<5.9	<5.9
A11-SS-02	5/10/05	0.00	0.50	<22.	<5.6	<5.6	<5.6	<5.6	<5.6	<11.	<5.6	<5.6	<5.6	<5.6	<5.6	<5.6	<5.6
A11-SS-03	5/10/05	0.00	0.50	160	<7.3	<7.3	<7.3	<7.3	<7.3	31	<7.3	<7.3	<7.3	<7.3	<7.3	<7.3	<7.3
A11-SS-04	5/10/05	0.00	0.50	<34.	<8.6	<8.6	<8.6	<8.6	<8.6	<17.	<8.6	<8.6	<8.6	<8.6	<8.6	39	<8.6
A11-SS-05	5/10/05	0.00	0.50	<20.	<4.9	<4.9	<4.9	<4.9	<4.9	<9.8	<4.9	<4.9	<4.9	<4.9	<4.9	6.7	<4.9
A11-SS-06	5/10/05	0.00	0.50	95	70	42	80	840	30	28	22	32	6.9	12	15	<5.6	37
A11-SS-07	5/10/05	0.00	0.50	<20.	<5.1	<5.1	<5.1	<5.1	<5.1	<10.	<5.1	<5.1	<5.1	<5.1	<5.1	<5.1	<5.1
A11-SS-08	5/10/05	0.00	0.50	<25.	<6.3	<6.3	<6.3	<6.3	<6.3	<13.	<6.3	<6.3	<6.3	<6.3	<6.3	10	<6.3
A11-SS-09	5/10/05	0.00	0.50	<20.	<5.1	<5.1	<5.1	<5.1	<5.1	<10.	<5.1	<5.1	<5.1	<5.1	<5.1	<5.1	<5.1
A11-SS-10	5/10/05	0.00	0.50	<22.	<5.5	<5.5	<5.5	<5.5	<5.5	<11.	<5.5	<5.5	<5.5	<5.5	<5.5	<5.5	<5.5

Table 4-47
Area D Subsurface Soil Nitrogen Results 0.67-3' BGS
Paint Shop Area
Former Farmland Nitrogen Plant
Lawrence, Kansas

Site	Date	Starting Depth (feet)	Ending Depth (feet)	Nitrate plus Nitrite (as N) (mg/kg)	Nitrogen, Ammonia (mg/kg)	Total Nitrate plus Ammonia (mg/kg)
A11-SS-01	05/10/2005	0.67	3.00	<2	5.9	5.9
A11-SS-02	05/10/2005	0.67	3.00	<2	11.7	11.7
A11-SS-03	05/10/2005	0.67	2.50	<2	105D	105
A11-SS-05	05/10/2005	0.67	3.00	8.5	<2	8.5
A11-SS-06	05/10/2005	0.67	3.00	4.9	77.5	82.4
A11-SS-07	05/10/2005	0.67	3.00	13.2	<2	13.2
A11-SS-08	05/10/2005	0.67	3.00	<2	58.4	58.4
A11-SS-09	05/10/2005	0.67	2.83	<0.6>	<0.6>	1.2
A11-SS-10	05/10/2005	0.67	1.33	17.1	<2	17.1

<x> = Less than Reporting Limit

D = Duplicate run with high duplicate result

Table 4-48
Area D Subsurface Soil Detected VOC Results .5-3' BGS
Paint Shop Area
Former Farmland Nitrogen Plant
Lawrence, Kansas

Site	Date	Start Depth (feet)	End Depth (feet)	Acetone (ug/kg)	Benzene, 1,2,4-trimethyl (ug/kg)	Benzene, 1,3,5-trimethyl (ug/kg)	Benzene, 1-methyl ethyl (ug/kg)	Ethyl benzene (ug/kg)	m/p-xylene (ug/kg)	Methyl ethyl ketone (ug/kg)	n-Butyl benzene (ug/kg)	n-Propyl benzene (ug/kg)	o-Xylene (ug/kg)	p-Cymene (ug/kg)	sec-Butyl benzene (ug/kg)	Tetra chloro ethylene (ug/kg)	Xylene (total) (ug/kg)
A11-SS-01	5/10/05	0.50	3.00	<23.	<5.7	<5.7	<5.7	<5.7	<5.7	<11.	<5.7	<5.7	<5.7	<5.7	<5.7	<5.7	<5.7
A11-SS-02	5/10/05	0.50	3.00	<22.	<5.5	<5.5	<5.5	<5.5	<5.5	<11.	<5.5	<5.5	<5.5	<5.5	<5.5	<5.5	<5.5
A11-SS-03	5/10/05	0.50	2.50	660	<5.6	<5.6	<5.6	<5.6	<5.6	140	<5.6	<5.6	<5.6	<5.6	<5.6	<5.6	<5.6
A11-SS-04	5/10/05	0.50	0.67	<18.	<4.5	<4.5	<4.5	<4.5	<4.5	<9.1	<4.5	<4.5	<4.5	<4.5	<4.5	35	<4.5
A11-SS-05	5/10/05	0.50	3.00	<24.	<5.9	<5.9	<5.9	<5.9	<5.9	<12.	<5.9	<5.9	<5.9	<5.9	<5.9	12	<5.9
A11-SS-06	5/10/05	0.50	3.00	<1,600	<400	<400	<400	<400	<400	<800	<400	<400	<400	<400	<400	<400	<400
A11-SS-07	5/10/05	0.50	3.00	<20.	<5.0	<5.0	<5.0	<5.0	<5.0	<10.	<5.0	<5.0	<5.0	<5.0	<5.0	32	<5.0
A11-SS-08	5/10/05	0.50	3.00	110	<6.2	<6.2	<6.2	<6.2	<6.2	34	<6.2	<6.2	<6.2	<6.2	<6.2	<6.2	<6.2
A11-SS-09	5/10/05	0.50	2.83	<21.	<5.3	<5.3	<5.3	<5.3	<5.3	<11.	<5.3	<5.3	<5.3	<5.3	<5.3	<5.3	<5.3
A11-SS-10	5/10/05	0.50	1.33	<24.	<6.1	<6.1	<6.1	<6.1	<6.1	<12.	<6.1	<6.1	<6.1	<6.1	<6.1	<6.1	<6.1

Subsurface Soils (Greater than 3 Feet)

Three (3) subsurface soil samples were collected in the Paint Shop Area and submitted to the on-site laboratory for Nitrate plus Nitrite and Ammonia analysis. Nitrate plus Nitrite was detected in one (1) sample with concentrations ranging from non-detect to 4.7 mg/kg in sample A11-SS-06-3-4'. Two (2) samples reported detected concentrations of Ammonia ranging from non-detect to 38.1 mg/kg in sample A11-SS-01-3-5'. **(Table 4-49)**

Three (3) subsurface soil samples were collected in the Paint Shop Area and submitted to Pace for VOC analysis. Two (2) samples reported detectable concentrations for Acetone and MEK. Sample A11-SS-02-3-5.75' reported the highest concentrations for both Acetone (170 µg/kg) and MEK (29 µg/kg). **(Table 4-50)**

Table 4-49
Area D Subsurface Soil Nitrogen Results >3' BGS
Paint Shop Area
Former Farmland Nitrogen Plant
Lawrence, Kansas

Site	Date	Starting Depth (feet)	Ending Depth (feet)	Nitrate plus Nitrite (as N) (mg/kg)	Nitrogen, Ammonia (mg/kg)	Total Nitrate plus Ammonia (mg/kg)
A11-SS-01	05/10/2005	3.00	5.00	<2	38.1	38.1
A11-SS-02	05/10/2005	3.00	5.75	<2	37.9	37.9
A11-SS-06	05/10/2005	3.00	4.00	4.7	<2	4.7

Table 4-50
Area D Subsurface Soil Detected VOC Results >3' BGS
Paint Shop Area
Former Farmland Nitrogen Plant
Lawrence, Kansas

Site	Date	Start Depth (feet)	End Depth (feet)	Acetone (ug/kg)	Benzene, 1,2,4-trimethyl (ug/kg)	Benzene, 1,3,5-trimethyl (ug/kg)	Benzene, 1-methyl ethyl (ug/kg)	Ethyl benzene (ug/kg)	m/p-xylene (ug/kg)	Methyl ethyl ketone (ug/kg)	n-Butyl benzene (ug/kg)	n-Propyl benzene (ug/kg)	o-Xylene (ug/kg)	p-Cymene (ug/kg)	sec-Butyl benzene (ug/kg)	Tetra chloro ethylene (ug/kg)	Xylene (total) (ug/kg)
A11-SS-01	5/10/05	3.00	5.00	91	<5.4	<5.4	<5.4	<5.4	<5.4	18	<5.4	<5.4	<5.4	<5.4	<5.4	<5.4	<5.4
A11-SS-02	5/10/05	3.00	5.75	170	<5.6	<5.6	<5.6	<5.6	<5.6	29	<5.6	<5.6	<5.6	<5.6	<5.6	<5.6	<5.6
A11-SS-06	5/10/05	3.00	4.00	<22.	<5.5	<5.5	<5.5	<5.5	<5.5	<11.	<5.5	<5.5	<5.5	<5.5	<5.5	<5.5	<5.5

4.4.4.7 Area D – Boiler Furnace and Fuel Oil Storage Area and the Old Ammonia Plant – Sampling Methodology and Sampling Results

A total of twenty-one (21) soil boring locations were installed in the Boiler Furnace and Fuel Oil Storage Area and the Old Ammonia Plant using Geoprobe® direct-push technology. Eleven (11) borings were located in the Boiler Furnace and Fuel Oil Storage Area and ten (10) borings were located in the Old Ammonia Plant. Soil sampling intervals followed the procedure outlined in the approved Work Plan and as detailed above.

Four (4) soil boring locations in the Boiler Furnace and Fuel Oil Storage Area (A15-SS-01, A15-SS-09, A15-SS-10, and A15-SS-11) and two (2) locations in the Old Ammonia Plant (A16-SS-02 and A16-SS-07) were installed to bedrock or equipment refusal. The remaining fifteen (15) boring locations were installed to 3 feet bgs or bedrock if encountered prior to 3 feet.

Samples collected for TPH and RCRA metals in the Boiler Furnace and Fuel Oil Storage Area and TPH samples collected from the Old Ammonia Plant were sampled on a 0–0.5 foot and 0.5–3 foot interval according to the guidelines stipulated in the Work Plan. TPH samples were collected as grab samples and RCRA metals samples were collected as composite samples.

Nine (9) locations were located in vegetative cover in the Old Ammonia Plant and were sampled in composite intervals from 0–2 feet and 2–3 feet bgs for Nitrate plus Nitrite, Ammonia and RCRA metals analysis. One (1) location in the Old Ammonia Plant was located in non-vegetative cover and was sampled in composite intervals from 0–8 inches and 8–36 inches bgs for Nitrate plus Nitrite, Ammonia and RCRA metals analysis. Poly-chlorinated biphenyl (PCB) samples were collected as grab samples from the same surface intervals as described in the work plan.

All soil boring locations in the Boiler Furnace and Fuel Oil Storage Area and the Old Ammonia Plant were sampled for TPH as GRO and TPH as DRO and submitted, under chain of custody, to Pace for analysis using EPA Method 8015 and Iowa Method OA-2.

All soil boring locations in the Old Ammonia Plant were sampled for Nitrate plus Nitrite and Ammonia and submitted, under chain of custody, to the on-site laboratory for analysis using method SM-4500 or to Pace for analysis using EPA Method 353.2 and 350.1, respectively.

PCB samples were collected from four (4) surface soil locations in the Old Ammonia Plant (A16-SS-01, A16-SS-04, A16-SS-06 and A16-SS-09) and submitted, under chain of custody to Pace for analysis using EPA Method 8082.

A total of fourteen (14) surface soil locations were also submitted to Pace laboratory for RCRA metals analysis using EPA Method 6010/7471. Four (4) locations in area the Boiler Furnace and Fuel Oil Storage Area (A15-SS-01, A15-SS-03, A15-SS-05 and A15-SS-08) were sampled for RCRA metals. Only four (4) locations in the Old Ammonia Plant were selected for RCRA metals analysis according to the Work Plan, however all ten (10) locations were sampled for RCRA metals.

Groundwater was not encountered in any boring locations in the Boiler Furnace and Fuel Oil Storage Area or the Old Ammonia Plant.

Eight (8) field duplicate samples were collected and submitted blind to the same laboratory. Trip blanks were included in each cooler containing VOC analysis (TPH as GRO) and rinsate blanks were collected at a rate of one per day.

The Boiler Furnace (Area 15) and Fuel Oil Storage Area (Area 16) Soil Sampling Results

Twenty-five (25) soil samples, excluding QC samples, were collected in Area D – Boiler Furnace and Fuel Oil Storage Area and submitted, under chain of custody, to Pace for TPH as GRO and TPH as DRO analysis using EPA Method 8015 and Iowa Method OA-2. Four (4) surface soil samples were collected and submitted to Pace for analysis of RCRA metals by EPA Method 6010/7471.

Surface Soils

Four (4) surface soil samples were collected in the Boiler Furnace and Fuel Oil Storage Area and submitted to Pace for RCRA metals analysis. Arsenic, Barium, chromium and lead concentrations were reported above laboratory detection limits in all four (4) samples. One (1) sample reported detected cadmium results above laboratory detection limits. Two (2) samples reported detected mercury and silver results above laboratory detection limits. Sample A15-SS-05-0-0.5' reported the highest concentrations of cadmium (2.35 mg/kg), lead (76.2 mg/kg), mercury (0.867 mg/kg) and silver (1.01 mg/kg). Sample A15-SS-08-0-0.5' reported the highest concentrations of arsenic (7.04 mg/kg) and barium (208 mg/kg). Samples A15-SS-05-0-0.5' and A15-SS-08-0-0.5' both reported the highest concentration for chromium at 23.0 mg/kg. Selenium was not detected above laboratory detection limits for the Boiler Furnace and Fuel Oil Storage Area. **(Table 4-51)**

Eleven (11) surface soil samples were collected in the Boiler Furnace and Fuel Oil Storage Area and submitted to Pace for TPH as GRO and TPH as DRO analysis. TPH as fuel product (a constituent of TPH as DRO) reported detected concentrations in five (5) samples ranging from non-detect to 450 mg/kg. **(Table 4-52)**

Total Petroleum Hydrocarbons (TPH) were analyzed for gasoline range hydrocarbons (TPH as GRO) by Method 8015 and diesel range hydrocarbons (TPH as DRO) by Method OA-2. The laboratory was able to identify multiple constituents within the diesel range hydrocarbon analysis. The constituents were reported as: mineral spirits, jet fuel, kerosene, diesel fuel, fuel oil and motor oil. During the analysis of some of the samples an undistinguishable fuel product constituent was detected that did not correspond to one of the constituents listed above, but is within the organic diesel range. This constituent was reported as Total Petroleum Hydrocarbons in the laboratory reports and reported as TPH as fuel product or TPH as FP in the tables and figures. TPH as FP is only reported in the laboratory reports if it is detected, otherwise it is not included in the constituent list. The only TPH as DRO that was detected in the samples collected was diesel fuel and the only other diesel range organics detected was TPH as FP.

Subsurface Soils

Eleven (11) subsurface soil samples were collected in the Boiler Furnace and Fuel Oil Storage Area and submitted to Pace for TPH as GRO and TPH as DRO analysis. TPH as GRO and TPH as DRO concentrations were not reported above laboratory detection limits in any of the samples collected with the exception of Sample A15-SS-07, which was observed to contain 470 mg/kg of THP as FP.

Subsurface Soils (Greater than 3 Feet)

Two (2) subsurface soil samples were collected in the Boiler Furnace and Fuel Oil Storage Area and submitted to Pace for TPH as GRO and TPH as DRO analysis. TPH as GRO and TPH as DRO concentrations were not reported above laboratory detection limits in any of the samples collected.

Table 4-51
Area D Surface Soil RCRA Metals Results 0-0.5' BGS
Boiler Furnace and Fuel Storage Area
Former Farmland Nitrogen Plant
Lawrence, Kansas

Site	Date	Starting Depth (feet)	Ending Depth (feet)	Arsenic (mg/kg)	Barium (mg/kg)	Cadmium (mg/kg)	Chromium (mg/kg)	Lead (mg/kg)	Mercury (mg/kg)	Selenium (mg/kg)	Silver (mg/kg)
A15-SS-01	05/11/2005	0.00	0.50	1.87	154	<0.461	16.7	20.8	0.250	<1.38	0.734
A15-SS-03	05/11/2005	0.00	0.50	5.42	144	<0.540	18.1	29.0	<0.163	<1.62	<0.756
A15-SS-05	05/11/2005	0.00	0.50	4.97	86.4	2.35	23.0	76.2	0.867	<1.48	1.01
A15-SS-08	05/11/2005	0.00	0.50	7.04	208	<0.517	23.0	37.1	<0.170	<1.55	<0.724

Table 4-52
Area D Surface Soil TPH Results 0-0.5' BGS
Boiler Furnace and Fuel Storage Area
Former Farmland Nitrogen Plant
Lawrence, Kansas

Site	Date	Starting Depth (feet)	Ending Dept (feet)	Diesel (mg/kg)	Fuel Oil (mg/kg)	Gasoline Range Organic Compounds (mg/kg)	Jet fuels (mg/kg)	Kerosene (mg/kg)	Mineral spirits (mg/kg)	TPH as FP (mg/kg)	Motor Oil (mg/kg)
A15-SS-01	5/11/05	0.00	0.50	<23.	<23.	<5.9	<23.	<23.	<23.	450	<23.
A15-SS-02	5/11/05	0.00	0.50	<22.	<22.	<5.6	<22.	<22.	<22.	85	<22.
A15-SS-03	5/11/05	0.00	0.50	<11.	<11.	<5.8	<11.	<11.	<11.	---	<11.
A15-SS-04	5/11/05	0.00	0.50	<11.	<11.	<5.7	<11.	<11.	<11.	---	<11.
A15-SS-05	5/11/05	0.00	0.50	<23.	<23.	<5.7	<23.	<23.	<23.	---	<23.
A15-SS-06	5/11/05	0.00	0.50	<21.	<21.	<5.4	<21.	<21.	<21.	330	<21.
A15-SS-07	5/11/05	0.00	0.50	<22.	<22.	<5.6	<22.	<22.	<22.	160	<22.
A15-SS-08	5/11/05	0.00	0.50	<11.	<11.	<5.5	<11.	<11.	<11.	---	<11.
A15-SS-09	5/11/05	0.00	0.50	<13.	<13.	<6.5	<13.	<13.	<13.	270	<13.
A15-SS-10	5/11/05	0.00	0.50	<11.	<11.	<5.5	<11.	<11.	<11.	---	<11.
A15-SS-11	5/11/05	0.00	0.50	<11.	<11.	<5.3	<11.	<11.	<11.	---	<11.

The Old Ammonia Plant Soil Sampling Results

Forty-two (42) soil samples, excluding QC samples, were collected in Area D – Old Ammonia Plant for Nitrate plus Nitrite and Ammonia analysis and submitted, under chain of custody, to the on-site laboratory by method SM-4500 or to Pace by EPA Methods 353.2 and 350.1, respectively. Four (4) surface soil samples were collected and submitted to Pace for analysis of PCBs by EPA Method 8082 and RCRA metals by EPA Method 6010/7471.

Surface Soils

Ten (10) surface soil samples were collected in the Old Ammonia Plant and submitted to either the on-site laboratory or Pace for Nitrate plus Nitrite and Ammonia. Nitrate plus Nitrite was detected in one (1) of the surface soil samples collected and ranged from non-detect to 137 mg/kg in sample A16-SS-08-0-2'. One (1) sample reported detected concentrations of Ammonia ranging from non-detect to 15.0 mg/kg also in sample A16-SS-08-0-2'. **(Table 4-53)**

Ten (10) surface soil samples were collected in the Old Ammonia Plant and submitted to Pace for RCRA metals analysis. Arsenic, Barium, chromium and lead concentrations were reported above laboratory detection limits in all ten (10) samples. One (1) sample reported detected mercury results above laboratory detection limits. Sample A16-SS-09-0-2' reported the highest concentrations of arsenic (25.5 mg/kg) and barium (307 mg/kg). Sample A16-SS-08-0-2' reported the highest concentration of chromium (114 mg/kg. Sample A16-SS-05-0-2' reported the highest concentration of lead (203 mg/kg) and A16-SS-05-0-2' reported the highest concentration for mercury at 0.251 mg/kg. Cadmium, selenium and silver were not detected above laboratory detection limits for the Old Ammonia Plant. **(Table 4-54)**

Four (4) surface soil samples were collected in the Old Ammonia Plant and submitted to Pace for PCB analysis. Aroclor 1254 was the only constituent of PCBs detected in two (2) samples. Sample A16-SS-01-0-2' reported the highest concentration of Aroclor 1254 at 1.8 mg/kg. **(Table 4-55)**

Subsurface Soils

Eight (8) subsurface soil samples were collected in the Old Ammonia Plant for Nitrate plus Nitrite and Ammonia analysis by the on-site laboratory. Nitrate plus Nitrite was detected in two (2) of the subsurface soil samples collected and ranged from non-detect to 30.1 mg/kg in sample A16-SS-08-2-3'. Three (3) samples reported detected concentrations of Ammonia ranging from non-detect to 204 mg/kg also in sample A16-SS-08-2-3'. **(Table 4-56)**

Subsurface Soils (Greater than 3 Feet)

Two (2) subsurface soil samples were collected in the Old Ammonia Plant for Nitrate plus Nitrite and Ammonia analysis by the on-site laboratory. Nitrate plus Nitrite and Ammonia results were reported below laboratory detection limits for all subsurface samples collected.

Table 4-53
Area D Surface Soil Nitrogen Results 0-2' BGS
Old Ammonia Plant
Former Farmland Nitrogen Plant
Lawrence, Kansas

Site	Date	Starting Depth (feet)	Ending Depth (feet)	Nitrate plus Nitrite (as N) (mg/kg)	Nitrogen, Ammonia (mg/kg)	Total Nitrate plus Ammonia (mg/kg)
A16-SS-01	05/09/2005	0.00	2.00	<5.95	<11.9	0
A16-SS-02	05/09/2005	0.00	0.67	<5.77	<11.5	0
A16-SS-03	05/09/2005	0.00	2.00	<5.56	<11.1	0
A16-SS-04	05/09/2005	0.00	2.00	<6.89	<13.8	0
A16-SS-05	05/09/2005	0.00	2.00	<5.50	<11.0	0
A16-SS-06	05/09/2005	0.00	2.00	<5.73	<11.5	0
A16-SS-07	05/09/2005	0.00	1.00	<5.65	<11.3	0
A16-SS-08	05/09/2005	0.00	2.00	137	15.0	152
A16-SS-09	05/09/2005	0.00	2.00	<7.76	<15.5	0
A16-SS-10	05/09/2005	0.00	2.00	<5.64	<11.3	0

Table 4-54
Area D Surface Soil RCRA Metals Results 0-2' BGS
Old Ammonia Plant
Former Farmland Nitrogen Plant
Lawrence, Kansas

Site	Date	Starting Depth (feet)	Ending Depth (feet)	Arsenic (mg/kg)	Barium (mg/kg)	Cadmium (mg/kg)	Chromium (mg/kg)	Lead (mg/kg)	Mercury (mg/kg)	Selenium (mg/kg)	Silver (mg/kg)
A16-SS-01	5/9/05	0.00	2.00	14.7	280	<0.405	33.7	26.3	<0.175	<2.43	<0.567
A16-SS-02	5/9/05	0.00	0.67	6.45	213	<0.515	19.3	18.3	<0.148	<1.55	<0.722
A16-SS-03	5/9/05	0.00	2.00	9.25	184	<0.484	24.1	26.9	<0.163	<1.45	<0.677
A16-SS-04	5/9/05	0.00	2.00	14.2	270	<0.663	33.3	17.7	<0.202	<1.99	<0.928
A16-SS-05	5/9/05	0.00	2.00	8.10	128	<0.491	45.0	203	0.251	<4.42	<0.687
A16-SS-06	5/9/05	0.00	2.00	11.1	210	<0.556	38.2	20.9	<0.160	<1.67	<0.779
A16-SS-07	5/9/05	0.00	1.00	12.2	258	<0.518	24.9	23.1	<0.151	<1.56	<0.726
A16-SS-08	5/9/05	0.00	2.00	7.43	103	<0.421	114	32.3	<0.143	<3.79	<0.589
A16-SS-09	5/9/05	0.00	2.00	25.5F	307G	<0.739F	33.0FG	27.3F	<0.217	<2.22F	<1.04F
A16-SS-10	5/9/05	0.00	2.00	7.94	241	<0.548	53.3	29.2	<0.145	<1.64	<0.767

D - Duplicate run with high duplicate result

F - Elevated MS/MSD RPD result

G - MS/MSD percent recovery outside reporting limit

J - Estimated concentration above the adjusted method detection limit and below the adjusted reporting limit

L - LCS percent recovery outside limits

U - Elevated reporting limit

Table 4-55
Area D Surface Soil PCB Results 0-2' BGS
Old Ammonia Plant
Former Farmland Nitrogen Plant
Lawrence, Kansas

Site	Date	Starting Depth (feet)	Ending Depth (feet)	Aroclor 1016 (ug/kg)	Aroclor 1221 (ug/kg)	Aroclor 1232 (ug/kg)	Aroclor 1242 (ug/kg)	Aroclor 1248 (ug/kg)	Aroclor 1254 (ug/kg)	Aroclor 1260 (ug/kg)
A16-SS-01	5/9/05	0.00	2.00	<390	<390	<390	<390	<390	1,800	<390
A16-SS-04	5/9/05	0.00	2.00	<45.	<45.	<45.	<45.	<45.	<45.	<45.
A16-SS-06	5/9/05	0.00	2.00	<38.	<38.	<38.	<38.	<38.	120	<38.
A16-SS-09	5/9/05	0.00	2.00	<51.	<51.	<51.	<51.	<51.	<51.	<51.

Table 4-56
Area D Subsurface Soil Nitrogen Results 0.67-3' BGS
Old Ammonia Plant
Former Farmland Nitrogen Plant
Lawrence, Kansas

Site	Date	Starting Depth (feet)	Ending Depth (feet)	Nitrate plus Nitrite (as N) (mg/kg)	Nitrogen, Ammonia (mg/kg)	Total Nitrate plus Ammonia (mg/kg)
A16-SS-01	05/09/2005	2.00	2.33	<2	<2Z	0
A16-SS-02	05/09/2005	0.67	3.00	<2	8.2	8.2
A16-SS-03	05/09/2005	2.00	3.00	<2	<1.2>	1.2
A16-SS-04	05/09/2005	2.00	2.75	<2	<2	0
A16-SS-05	05/09/2005	2.00	2.33	<2	14	14
A16-SS-06	05/09/2005	2.00	3.00	<2	<2	0
A16-SS-08	05/09/2005	2.00	3.00	30.1	204	234.1
A16-SS-09	05/09/2005	2.00	3.00	4.4	<2	4.4

4.4.4.8 Area D – Summary of Findings

Area D is the only other area in addition to Area A and Area B which contains soil and/or sediment with concentrations of Total Nitrogen greater than 100 mg/kg. This benchmark was selected for data comparison as explained in earlier in this report. Two (2) potential AOIs have been identified for Total Nitrogen in Area D. These areas are:

- AOI 1 – Central area in the former Urea Production Area including the Urea Runoff Storage Vault, and
- AOI 2 – Southern portion of the Ammonia Production - Primary Reformer Area.

Area D also was found to exhibit locations with concentrations of chromium in soil that were elevated with respect to what is presently considered a background level for the site. This level is 32 mg/kg, which was established in the CRA unit closure process. Two samples collected from the landfill material in the Catalyst Landfill were found to contain concentrations of chromium above 5,000 mg/kg. An additional sample of this material was collected on June 2005 and submitted for TCLP analysis. The sample passed TCLP limits with leachable chromium undetected in the sample submitted for TCLP analysis. AOI 3 is the Catalyst Landfill.

Area D is the only area within the site with positive results for total petroleum hydrocarbons. These results were, however, below Kansas RSK values for non-residential scenarios for the soil pathway for DRO and GRO, which are 450 mg/kg and 20,000 mg/kg respectively. One (1) soil location in the Urea production area reported concentrations of TPH as GRO, and two (2) locations in Area D reported concentrations of TPH as DRO. Three (3) AOIs have been identified for TPH in Area D:

- AOI 4 – Northwestern portion of the Nitric Acid plant;
- AOI 5 – Oil Pond and Spill Pond; and
- AOI 6 – Ammonia Production - Primary Reformer Area south of the used oil tote.

4.4.4.9 AOI 1

The majority of the surface soil samples collected in the Urea Production Area were found to contain concentrations of Total Nitrogen of 100 mg/kg to 1,000 mg/kg with one sample found to contain a concentration greater than 1,000 mg/kg. As the sample depths increased, the number of locations with concentrations greater than 1,000 mg/kg increased in the area adjacent to and south of the Urea Runoff Storage Vault.

4.4.4.10 AOI 2

Two (2) surface soil locations in the southern portion of the Ammonia Production - Primary Reformer Area reported concentrations of Total Nitrogen between 100 mg/kg and 1,000 mg/kg. One (1) location (A12-SS-09) continued to show high concentrations of Total Nitrogen as the depth of the samples increased. Sample location A12-SS-09 also reported concentrations greater than 1,000 mg/kg in the deeper subsurface samples.

4.4.4.11 AOI 3

Two (2) subsurface soil samples reported high concentrations of chromium (greater than 5,000 mg/kg) within the Catalyst Landfill material in Area D. The concentrations of the surface and subsurface soil above the landfill material in those locations were an order of magnitude less, indicating that the contamination is primarily contained within the deposited landfill material.

4.4.4.12 AOI 4

One (1) sample location in the Nitric Acid plant was selected for TPH analysis due to the observation of a gasoline-type odor during sampling. The subsurface sample collected from location A14-SS-03 was the only sample analyzed for TPH as GRO with a reported concentration of 140 mg/kg, which is less than the RSK values for both residential and non-residential scenarios, which are respectively 220 mg/kg and 450 mg/kg. No other samples in this area were selected for TPH analysis.

4.4.4.13 AOI 5

One (1) sediment sample in the northern portion of the Oil Pond and Spill Pond reported concentrations of TPH as DRO constituents, with the highest measured concentration of 4,500 mg/kg. This concentration is, however, below the RSK non-residential scenario for the soil pathway of 20,000 mg/kg. TPH as Fuel Product (TPH as FP) was detected in the surface sediment sample of A08-SS-01 at a concentration of 4,500 mg/kg. The remaining sediment locations within the Spill Pond were reported below 3,000 mg/kg.

4.4.4.14 AOI 6

One (1) surface soil sample (A12-SS-04) collected south of the used oil tote in the Ammonia Production - Primary Reformer Area reported concentrations of TPH constituents, with a high concentration noted of 4,600 mg/kg, which is below RSK non-residential use scenario goals.

4.4.5 Area E – Southwestern Site Area

Soil boring locations for Area E, formerly Area 17 in the Work Plan, were spaced on a 400-foot grid. Three (3) boring locations (A17-SS-03, A17-SS-05, and A17-SS-09) were placed outside of the grid to define contamination within the West Stormwater Pond. Some locations were adjusted slightly in the field due to access.

Four (4) borings in Area E were sampled to bedrock or equipment refusal at locations A17-SS-01, A17-SS-03, A17-SS-07 and A17-SS-13. The remaining nine (9) borings were sampled to three (3) feet bgs or bedrock if encountered prior to 3 feet.

Groundwater was not encountered in any of the soil borings in Area E.

4.4.5.1 Area E – Field Sampling Methodology

A total of thirteen (13) soil boring locations were installed using Geoprobe® direct-push technology. Soil sampling intervals followed the procedure outlined in the approved Work Plan and as detailed above.

All soil samples collected in Area E were sampled for Nitrate plus Nitrite and Ammonia and submitted to the on-site laboratory under chain of custody for analysis using method SM-4500. Three (3) surface soil samples located within the West Stormwater Pond were submitted to Pace laboratory for RCRA metals analysis using EPA Method 6010/7471.

Two (2) field duplicates were collected for analysis by the on-site laboratory and Pace for comparison and labeled using the same identifier as the original sample with a "D" at the end signifying the duplicate sent to the Pace. Three (3) field duplicate samples were collected and submitted blind to the same laboratory. Rinsate blanks were collected at a rate of one per day.

4.4.5.2 Area E – Soil Sample Results

Thirty-six (36) soil samples, excluding QC samples, were collected in Area E during subsurface soil sampling. All locations were located in vegetative cover and sampled on a 0-2 foot and 2-3 foot interval.

Surface Soils

Thirteen surface soil samples were collected in Area E for Nitrate plus Nitrite and Ammonia. All soil sample concentrations were reported below laboratory detection limits for Nitrate plus Nitrite and Ammonia.

Three (3) surface soil samples in Area E were analyzed for RCRA metals by Pace. Due to the amount of soil needed for both analyses, the surface soil samples were composited in the same intervals and manner as the nitrogen samples. One sample (A17-SS-05) had detected metal concentrations for arsenic, barium, chromium, and lead. Sample A17-SS-05 reported concentrations of arsenic (8.61 mg/kg), barium (233 mg/kg), chromium (18.7 mg/kg) and lead (21.0 mg/kg). There were no reported concentrations above laboratory detection limits for cadmium, mercury, selenium and silver in surface soils for Area E. **(Table 4-57)**

Subsurface Soils

Thirteen (13) subsurface soil samples were collected in Area E and submitted to the on-site laboratory for Nitrate plus Nitrite and Ammonia analysis. All soil sample concentrations were reported below laboratory detection limits for Nitrate plus Nitrite and Ammonia.

Table 4-57
Area E Surface Soil RCRA Metals Results 0-2' BGS
West Stormwater Pond Watershed
Former Farmland Nitrogen Plant
Lawrence, Kansas

Site	Date	Starting Depth (feet)	Ending Depth (feet)	Arsenic (mg/kg)	Barium (mg/kg)	Cadmium (mg/kg)	Chromium (mg/kg)	Lead (mg/kg)	Mercury (mg/kg)	Selenium (mg/kg)	Silver (mg/kg)
A17-SS-03	04/28/2005	0.00	2.00	<0.904	<0.904	<0.452	<0.452	<0.452	<0.155	<1.36	<0.633
A17-SS-05	04/28/2005	0.00	2.00	8.61	233G	<0.542	18.7	21.0	<0.162	<1.63	<0.759
A17-SS-09	04/28/2005	0.00	2.00	<1.14	<1.14	<0.570	<0.570	<0.570	<0.204	<1.71	<0.798

Subsurface Soils (Greater than 3 feet)

A total of ten (10) soil samples were collected from the three-feet subsurface interval in Area E and submitted to the on-site laboratory for Nitrate plus Nitrite and Ammonia analysis. Two (2) subsurface soil samples reported detectable concentrations for Nitrate plus Nitrite. All soil sample concentrations were reported below laboratory detection limits for Ammonia.

Soil samples collected below 3 feet reported concentrations for Nitrate plus Nitrite ranging from non-detect to 10.9 mg/kg reported in sample A17-SS-03-9-10'. **(Table 4-58)**

4.4.5.3 Area E – Summary of Findings

All locations in Area E reported Total Nitrogen concentrations below 10 mg/kg in surface and subsurface soils and chromium concentrations below 300 mg/kg. Area E, based on the reviewed analytical results, does not appear to have been adversely impacted by former Plant operations.

4.4.6 Area F – Southeastern Site Area

Soil boring locations for Area F, formerly Area 6 in the Work Plan, were spaced on a 400-foot grid. Four (4) locations (A06-SS-07, A06-SS-06, A06-SS-12 and A06-SS-13) were placed outside of the grid. Three (3) boring locations (A06-SS-07, A06-SS-06 and A06-SS-12) were placed outside of the grid to define contamination within the East Stormwater Pond. Some locations were adjusted slightly in the field due to access.

Twelve (12) borings in Area F were sampled to bedrock or equipment refusal at locations A06-SS-01, A06-SS-03, A06-SS-04, A06-SS-06, A06-SS-08, A06-SS-10, A06-SS-13, A06-SS-15, A06-SS-17, A06-SS-20, A06-SS-26 and A06-SS-29. The remaining seventeen (17) borings were sampled to three (3) feet bgs or bedrock if encountered prior to 3 feet.

Sediment boring locations for Area F, formerly Area 19 in the Work Plan, were spaced on a 500-foot and a 250-foot interval. Locations within segment A-B were spaced 500 feet apart along the drainage ditch and locations within segment B-C were spaced approximately 250 feet apart. The northern section of the drainage ditch branches into two separate ditches. The sampling locations along this area were alternated between the two branches. The sediment sampling locations are depicted on **Figure 4-9**.

Table 4-58
Area E Subsurface Soil Nitrogen Results >3' BGS
West Stormwater Pond Watershed
Former Farmland Nitrogen Plant
Lawrence, Kansas

Site	Date	Depth (feet)	Starting Depth (feet)	Ending Depth (feet)	Nitrate plus Nitrite (as N) (mg/kg)	Nitrogen, Ammonia (mg/kg)	Total Nitrate plus Ammonia (mg/kg)
A17-SS-01	04/28/2005	3.00	3.00	4.50	<2	<2	0
A17-SS-03	04/28/2005	3.00	3.00	6.00	<2	<2.5J	0
A17-SS-03	04/28/2005	6.00	6.00	9.00	8.7	<1.9>	10.6
A17-SS-03	04/28/2005	9.00	9.00	10.00	10.9	<2	10.9
A17-SS-07	04/28/2005	4.00	4.00	6.00	<2	<2	0
A17-SS-07	04/28/2005	6.00	6.00	9.00	<2	<2	0
A17-SS-07	04/28/2005	9.00	9.00	12.00	<2	<2	0
A17-SS-13	04/28/2005	3.00	3.00	6.00	<2	<2	0
A17-SS-13	04/28/2005	6.00	6.00	9.00	<2	<2	0
A17-SS-13	04/28/2005	9.00	9.00	12.00	<2	<2	0

<x>=Less than Reporting Limit

4.4.6.1 Area F – Field Sampling Methodology

Twenty-nine soil boring locations and fourteen (14) sediment boring locations were sampled in Area F. Groundwater was not encountered in any of the soil borings in Area F.

Four (4) soil and two (2) sediment field duplicates were collected for analysis by the on-site laboratory and Pace for comparison and labeled using the same identifier as the original sample with a "D" at the end signifying the duplicate sent to the Pace. Six (6) soil and one (1) sediment field duplicate samples were collected and submitted blind to the same laboratory. Rinsate blanks were collected at a rate of one per day.

Soil Sampling Methodology

A total of twenty-nine (29) soil boring locations were installed using Geoprobe® direct-push technology. Soil sampling intervals followed the procedure outlined in the approved Work Plan and as detailed above.

Five (5) locations (A06-SS-01, A06-SS-04, A06-SS-09, A06-SS-15 and A06-SS-19) were located within non-vegetative cover and composited on a 0–8 inch and 8–36 inch sampling interval. The remaining Twenty-four (24) locations were located within vegetative cover and composited on a 0–2 foot and 2–3 foot sampling interval.

All soil samples collected in Area F were sampled for Nitrate plus Nitrite and Ammonia and submitted to the on-site laboratory under chain of custody for analysis using method SM-4500. Three (3) surface soil samples located within the East Stormwater Pond were submitted to Pace for RCRA metals analysis using EPA Method 6010/7471. Due to the amount of soil needed for both analyses, the surface soil samples were composited in the same intervals and manner as the nitrogen samples.

Sediment Sampling Methodology

A total of fourteen (14) sediment boring locations were installed within the drainage ditch using hand auguring tools. A PVC bucket with the bottom cut out was used as a temporary casing around the borehole in order to prevent the backflow of surface water into the borehole during auguring and sampling procedures. A disposable plastic cup was used to bail the water from the temporary casing prior to auguring. Once the casing was in place, the borings were installed to bedrock or equipment refusal, whichever occurred first.

The sediment sample locations were composited on a 0–8 inch and 8–36 inch sampling interval due to the location of the drainage ditch (similar to the rest of the area). All sediment samples collected in Area F were sampled for Nitrate plus Nitrite and Ammonia and submitted, under chain of custody, to either the on-site laboratory for analysis using method SM-4500 or Pace for analysis using EPA Methods 353.2 and 350.1, respectively. Six (6) surface sediment samples were submitted to Pace for RCRA metals analysis using EPA Method 6010/7471.

4.4.6.2 Area F – Soil Sample Results

Fifty-eight (58) soil samples, excluding QC samples, were collected in Area F during subsurface soil sampling.

Surface Soils

Twenty-nine (29) surface soil samples were collected in Area F for Nitrate plus Nitrite and Ammonia analysis. All soil sample concentrations were reported below laboratory detection limits for Nitrate plus Nitrite, except for sample A06-SS-02-0-0.67' which reported 6.2 mg/kg. Ammonia was detected in five (5) surface soil samples with concentrations ranging from non-detect to 44.8 mg/kg in sample A06-SS-19-0-0.67 mg/kg. **(Table 4-59)**

Three (3) surface soil samples in Area F were analyzed for RCRA metals by Pace. Arsenic, barium, chromium and lead were detected in all three (3) samples. The highest concentrations for arsenic and lead were found in sample A06-SS-07-0-0.5' at concentrations of 10.7 mg/kg and 16.8 mg/kg, respectively. Barium and chromium had the highest reported concentrations in sample A06-SS-12 at 218 mg/kg and 20.8 mg/kg, respectively. There were no reported concentrations above laboratory detection limits for cadmium, mercury, selenium and silver in surface soils for Area F. **(Table 4-60)**

Subsurface Soils

Twenty-six (26) subsurface soil samples were collected in Area F and submitted to the on-site laboratory for Nitrate plus Nitrite and Ammonia analysis. Detectable concentrations above laboratory reporting limits were reported in two (2) subsurface samples, ranging from non-detect to 4.2 mg/kg in sample A06-SS-05-2-3'. Ammonia was detected in four (4) subsurface samples at concentrations ranging from non-detect to 448 reported in sample A06-SS-04-0.67-3'. **(Table 4-61)**

4.4.6.3 Area F – Sediment Sample Results

Twenty-five (25) soil samples, excluding QC samples, were collected in Area F during drainage ditch sediment sampling activities.

Surface Sediment

Fourteen (14) surface soil samples were collected in Area F for Nitrate plus Nitrite and Ammonia analysis. Eight (8) samples reported detectable concentrations above laboratory reporting limits ranging from non-detect to 514 mg/kg in sample A19-SED-09-0-0.67'. Ammonia was detected in nine (9) surface soil samples with concentrations ranging from non-detect to 1,190 mg/kg also in sample A19-SED-090-0.67. **(Table 4-62)**

Table 4-59
Area F Surface Soil Nitrogen Results 0-2' BGS
Eastern Site Area
Former Farmland Nitrogen Plant
Lawrence, Kansas

Site	Date	Starting Depth (feet)	Ending Depth (feet)	Nitrate plus Nitrite (as N) (mg/kg)	Nitrogen, Ammonia (mg/kg)	Total Nitrate plus Ammonia (mg/kg)
A06-SS-01	05/05/2005	0.00	0.67	<2	34.5	34.5
A06-SS-02	05/05/2005	0.00	1.50	<2	<2	0
A06-SS-03	05/05/2005	0.00	2.00	<1.2>	<1.2>	2.4
A06-SS-04	05/04/2005	0.00	0.67	6.2	5.7	11.9
A06-SS-05	05/05/2005	0.00	2.00	<1.1>	<2	1.1
A06-SS-06	05/05/2005	0.00	2.00	<2	<1.2>	1.2
A06-SS-07	05/05/2005	0.00	2.00	<1.2>	<2	1.2
A06-SS-08	05/05/2005	0.00	2.00	<0.8>	<2.3J	0.8
A06-SS-09	05/04/2005	0.00	0.67	<2	7.6	7.6
A06-SS-10	05/05/2005	0.00	2.00	<2	<2	0
A06-SS-11	05/05/2005	0.00	2.00	<2.1J	<2	0
A06-SS-12	05/05/2005	0.00	2.00	<2	<2	0
A06-SS-13	05/05/2005	0.00	2.00	<2	<2	0
A06-SS-14	05/05/2005	0.00	2.00	<2	<2	0
A06-SS-15	05/04/2005	0.00	0.67	<2	8.3	8.3
A06-SS-16	05/05/2005	0.00	2.00	<2	<2	0
A06-SS-17	05/05/2005	0.00	2.00	<2	<2	0
A06-SS-18	05/05/2005	0.00	2.00	<2	<2	0
A06-SS-19	05/04/2005	0.00	0.67	<2	44.8	44.8
A06-SS-20	05/05/2005	0.00	2.00	<2	<1.3>	1.3
A06-SS-21	05/05/2005	0.00	2.00	<2	<2	0
A06-SS-22	05/05/2005	0.00	2.00	<2	<2	0
A06-SS-23	05/04/2005	0.00	2.00	<2	<1.1>	1.1
A06-SS-24	05/05/2005	0.00	2.00	<2	<0.8>	0.8
A06-SS-25	05/05/2005	0.00	2.00	<1.2>	<0.8>	2
A06-SS-26	05/04/2005	0.00	2.00	<1.3>	<3.9J	1.3
A06-SS-27	05/04/2005	0.00	2.00	<1.2>	<1.2>	2.4
A06-SS-28	05/05/2005	0.00	2.00	<2	<2.3J	0
A06-SS-29	05/05/2005	0.00	2.00	<2	<1.2>	1.2

<x>=Less than Reporting Limit

D - Duplicate run with high duplicate result

F - Elevated MS/MSD RPD result

G - MS/MSD percent recovery outside reporting limit

J - Estimated concentration above the adjusted method detection limit and below the adjusted reporting limit

L - LCS percent recovery outside limits

U - Elevated reporting limit

Table 4-60
Area F Surface Soil RCRA Metals Results, 0-0.5' BGS
Eastern Site Area
Former Farmland Nitrogen Plant
Lawrence, Kansas

Site	Date	Starting Depth (feet)	Ending Depth (feet)	Arsenic (mg/kg)	Barium (mg/kg)	Cadmium (mg/kg)	Chromium (mg/kg)	Lead (mg/kg)	Mercury (mg/kg)	Selenium (mg/kg)	Silver (mg/kg)
A06-SS-06	05/05/2005	0.00	0.50	9.51	179	<0.532	18.7	16.1	<0.164	<1.60	<0.745
A06-SS-07	05/05/2005	0.00	0.50	10.7	188	<0.521	19.8	16.8	<0.145	<1.56	<0.730
A06-SS-12	05/05/2005	0.00	0.50	9.41	218	<0.618	20.8	15.7	<0.163	<1.85	<0.866

Table 4-61
Area F Subsurface Soil Nitrogen Results 0.67-3' BGS
Eastern Site Area
Former Farmland Nitrogen Plant
Lawrence, Kansas

Site	Date	Starting Depth (feet)	Ending Depth (feet)	Nitrate plus Nitrite (as N) (mg/kg)	Nitrogen, Ammonia (mg/kg)	Total Nitrate plus Ammonia (mg/kg)
A06-SS-01	05/05/2005	0.67	3.00	<2	128	128
A06-SS-03	05/05/2005	2.00	3.00	<0.6>Z	<1.8>	2.4
A06-SS-04	05/04/2005	0.67	3.00	<2	448	448
A06-SS-05	05/05/2005	2.00	3.00	4.2	<2	4.2
A06-SS-07	05/05/2005	2.00	3.00	3.5	<2	3.5
A06-SS-08	05/05/2005	2.00	3.00	<1.2>	<2	1.2
A06-SS-09	05/04/2005	0.67	3.00	<2	62.3	62.3
A06-SS-10	05/05/2005	2.00	3.00	<2	<2	0
A06-SS-11	05/05/2005	2.00	2.33	<1.4>	<2.1J	1.4
A06-SS-12	05/05/2005	2.00	3.00	<2	<2	0
A06-SS-13	05/05/2005	2.00	3.00	<2	<2	0
A06-SS-14	05/05/2005	2.00	3.00	<2	<1.8>	1.8
A06-SS-15	05/04/2005	0.67	3.00	<2	62.8	62.8
A06-SS-16	05/05/2005	2.00	2.50	<2	<2	0
A06-SS-17	05/05/2005	2.00	2.67	<2	<2	0
A06-SS-18	05/05/2005	2.00	3.00	<2	<2	0
A06-SS-19	05/04/2005	0.67	3.00	<0.8>	<1.7>	2.5
A06-SS-20	05/05/2005	2.00	3.00	<2	<2	0
A06-SS-21	05/05/2005	2.00	3.00	<2	<0.6>	0.6
A06-SS-22	05/05/2005	2.00	3.00	<2	<2	0
A06-SS-23	05/04/2005	2.00	3.00	<2	<2.5J	0
A06-SS-24	05/05/2005	2.00	3.00	<2	<2	0
A06-SS-25	05/05/2005	2.00	3.00	<2	<2.4J	0
A06-SS-27	05/04/2005	2.00	3.00	<2	<1.3>	1.3
A06-SS-28	05/05/2005	2.00	3.00	<2	<2	0
A06-SS-29	05/05/2005	2.00	3.00	<2	<2	0

<x>=Less than Reporting Limit

D - Duplicate run with high duplicate result

F - Elevated MS/MSD RPD result

G - MS/MSD percent recovery outside reporting limit

J - Estimated concentration above the adjusted method detection limit and below the adjusted reporting limit

L - LCS percent recovery outside limits

U - Elevated reporting limit

Z - Lab duplicate recovery low

Table 4-62
Area F Sediment Nitrogen Results 0-0.67' BGS
Eastern Site Area
Former Farmland Nitrogen Plant
Lawrence, Kansas

Site	Date	Starting Depth (feet)	Starting Depth (feet)	Ending Depth (feet)	Nitrate plus Nitrite (as N) (mg/kg)	Nitrogen, Ammonia (mg/kg)	Total Nitrate plus Ammonia (mg/kg)
A19-SED-01	04/20/2005	0.00	0.00	0.67	<8.16	<16.3	0
A19-SED-02	04/21/2005	0.00	0.00	0.67	<0.9>	<2.3J	0.9
A19-SED-03	04/21/2005	0.00	0.00	0.67	<6.53	<13.1	0
A19-SED-04	04/21/2005	0.00	0.00	0.25	<1.2>	10.3	11.5
A19-SED-05	04/21/2005	0.00	0.00	0.67	<6.75	<13.5	0
A19-SED-06	04/21/2005	0.00	0.00	0.67	75.7	48.9	124.6
A19-SED-07	04/21/2005	0.00	0.00	0.67	<1>	10.1	11.1
A19-SED-08	04/22/2005	0.00	0.00	0.67	103	57.5	160.5
A19-SED-09	04/22/2005	0.00	0.00	0.67	514D	1,190D	1704
A19-SED-10	04/22/2005	0.00	0.00	0.67	23.7	287	310.7
A19-SED-11	04/22/2005	0.00	0.00	0.67	231	256	487
A19-SED-12	04/22/2005	0.00	0.00	0.67	139	98.3	237.3
A19-SED-13	04/22/2005	0.00	0.00	0.67	198	151D	349
A19-SED-14	04/22/2005	0.00	0.00	0.67	28.4	<2.1J	28.4

<x>=Less than Reporting Limit

D - Duplicate run with high duplicate result

F - Elevated MS/MSD RPD result

G - MS/MSD percent recovery outside reporting limit

J - Estimated concentration above the adjusted method detection limit and below the adjusted reporting limit

L - LCS percent recovery outside limits

U - Elevated reporting limit

Six (6) surface sediment samples in Area F were analyzed for RCRA metals by Pace. Arsenic, barium, cadmium, chromium, lead and selenium were detected in sediment samples. The highest concentrations for arsenic, barium, cadmium and lead were found in sample A19-SED-01-0-0.67' at concentrations of 18.8 mg/kg, 407 mg/kg, 1.44 mg/kg and 53.5 mg/kg, respectively. Sample A19-SED-13-0-0.67' reported the highest concentration for chromium at 99.0 mg/kg and sample A19-SED-09-0-0.67' had the only detectable concentration of selenium of 2.06 mg/kg. There were no reported concentrations above laboratory detection limits for mercury and silver in surface sediment for Area F. **(Table 4-63)**

Subsurface Sediment

Eleven (11) subsurface sediment samples were collected in Area F and submitted to the on-site laboratory for Nitrate plus Nitrite and Ammonia analysis. Detectable concentrations above laboratory reporting limits were reported in eight (8) subsurface samples, ranging from non-detect to 462 mg/kg in sample A19-SED-09-0.67-2'. Ammonia was detected in nine (9) subsurface samples at concentrations ranging from non-detect to 1750 mg/kg reported in sample A19-SED-13-0.67-3'. **(Table 4-64)**

4.4.6.4 Area F – Summary of Findings

The majority of the soil locations in Area F reported Total Nitrogen concentrations below 10 mg/kg in surface and subsurface soils. A few locations reported surface and shallow subsurface soil concentrations between 10 mg/kg and 100 mg/kg. Only one location (A06-SS-01) reported a concentration greater than 100 mg/kg in subsurface soil.

Surface and subsurface sediment sample locations in Area F located in the southern half of the drainage ditch reported concentrations of Total Nitrogen below 100 mg/kg. The majority of locations in the northern half of the drainage ditch reported surface and subsurface concentrations ranging from 100 mg/kg to 1,000 mg/kg with several locations reporting Total Nitrogen concentration greater than 1,000 mg/kg. The northern half of the drainage ditch has been identified as an area of interest (AOI 1, **Figure 4-12**).

Figure 4-12 shows the areas designated as areas with elevated concentrations of one or more of the targeted analytes.

Table 4-63
Area F Sediment RCRA Metals Results 0-0.67' BGS
Eastern Site Area
Former Farmland Nitrogen Plant
Lawrence, Kansas

Site	Date	Starting Depth (feet)	Ending Depth (feet)	Arsenic (mg/kg)	Barium (mg/kg)	Cadmium (mg/kg)	Chromium (mg/kg)	Lead (mg/kg)	Mercury (mg/kg)	Selenium (mg/kg)	Silver (mg/kg)
A19-SED-01	04/20/2005	0.00	0.67	18.8	407	1.44	26.2	53.5	<0.209	<2.22	<1.04
A19-SED-03	04/21/2005	0.00	0.67	10.8	168	<0.568	19.5	17.3	<0.175	<1.70	<0.795
A19-SED-05	04/21/2005	0.00	0.67	12.5	185	1.05	19.6	18.1	<0.189	<1.41	<0.657
A19-SED-07	04/21/2005	0.00	0.67	<0.855	8.88	<0.428	9.04	4.60	<0.168	2.06	<0.599
A19-SED-09	04/22/2005	0.00	0.67	5.52	74.1	<0.556	24.2	13.9	<0.206	<1.67	<0.779
A19-SED-13	04/22/2005	0.00	0.67	14.2	285	<0.606	99.0	29.2	<0.183	<1.82	<0.849

Table 4-64
Area F Subsurface Sediment Nitrogen Results 0.67-3' BGS
Eastern Site Area
Former Farmland Nitrogen Plant
Lawrence, Kansas

Site	Date	Depth (feet)	Starting Depth (feet)	Ending Depth (feet)	Nitrate plus Nitrite (as N) (mg/kg)	Nitrogen, Ammonia (mg/kg)	Total Nitrate plus Ammonia (mg/kg)
A19-SED-01	04/20/2005	0.67	0.67	1.67	<1.3>	28.9	30.2
A19-SED-02	04/21/2005	0.67	0.67	3.00	<1>	<1.5>	2.5
A19-SED-03	04/21/2005	0.67	0.67	3.00	3.5	6.9	10.4
A19-SED-05	04/21/2005	0.67	0.67	2.67	<0.9>	9.3	10.2
A19-SED-06	04/21/2005	0.67	0.67	2.00	14.2	52.4	66.6
A19-SED-07	04/21/2005	0.67	0.67	3.00	4.6	5.2	9.8
A19-SED-08	04/22/2005	0.67	0.67	3.00	57.6	70.2	127.8
A19-SED-09	04/22/2005	0.67	0.67	2.50	462	996	1,458
A19-SED-10	04/22/2005	0.67	0.67	3.00	4.2	323	327.2
A19-SED-13	04/22/2005	0.67	0.67	3.00	251	1,750	2001
A19-SED-14	04/22/2005	0.67	0.67	3.00	24.4	<1.1>	25.5

<x>=Less than Reporting Limit

5.0 DATA SUMMARY AND QA/QC

Sixty-six (66) analytical data deliverable packages for soil, groundwater and quality control samples were provided by the on-site laboratory. Fifty-two (52) reports contained soil and field duplicate samples and six (6) reports contained only soil samples. Twenty-four (24) of the soil reports also contained groundwater samples. Five (5) reports contained groundwater and field duplicate samples and three (3) reports contained only groundwater samples. Forty (40) reports contained rinse blank samples and one (1) report contained field blank samples.

Fifty-six (56) analytical data deliverable packages for soil, groundwater and quality control samples were provided by Pace Analytical Inc. (Pace), Lenexa, Kansas. Pace was the primary laboratory for off-site analysis. Sixteen (16) reports contained only inter-laboratory duplicate samples. Thirteen (13) reports contained primary soil and field duplicate samples and eight (8) reports contained only primary soil samples. Twelve (12) reports contained primary soil and inter-laboratory field duplicate samples and one (1) report contained primary soil, field duplicate and inter-laboratory duplicate samples. One (1) report contained primary soil, primary water, field duplicate and inter-laboratory field duplicate samples. Two (2) reports contained primary groundwater and inter-laboratory duplicate samples. One (1) report contained only primary groundwater samples and one (1) report contained primary groundwater, field duplicate and inter-laboratory duplicate samples. Thirty-five (35) reports contained rinsate blank samples.

One (1) analytical data deliverable package for soil inter-laboratory field duplicate samples, where the primary laboratory was Pace, was provided by Severn Trent Laboratory, Inc, Valparaiso, Indiana (STL).

Tables 5-1 and **5-2** include the laboratory package number and number of samples per package.

Soil samples were analyzed for the following compounds by Pace using the methods as presented in the approved Work Plan:

- 191 Nitrate plus Nitrite and Ammonia as Nitrogen analysis by modified EPA Method 353.2 and 350.1, respectively;
- 254 for RCRA Metals analysis by EPA Method 6010 and 7471 (7470 for water matrix);
- 153 for Total Kjeldahl Nitrogen (TKN) analysis by EPA Method 351.2;
- 46 for volatile organic compounds (VOC) analysis by EPA Method 8260B;
- 4 for polychlorinated biphenyls (PCB) analysis by EPA Method 8082;
- 54 for hexavalent chromium analysis by EPA Method 7196;
- 51 for total petroleum hydrocarbons gasoline range organics (TPH-GRO) and TPH diesel range organics (TPH-DRO) analysis by EPA Method 8015 and Iowa Method OA-2, respectively;
- 4 for toxicity characteristic leachate procedure (TCLP) metals analysis by EPA Method 6010 and 1311, respectively;
- 99 for pH analysis by EPA Method 9045; and,
- 153 for percent solids analysis by EPA Method 160.3.

Table 5-1
Data Package Summary Table
Site Characterization Investigation
Farmland Industry Trust
Lawrence, Kansas

Data Package Number	Number of Environmental Samples (Soil)	Number of Environmental Samples (GW)	Number of Field Duplicate Samples	Quality Control Samples (Blanks)
Soil Rpt 1	9			
Soil Rpt 2	11		2	1
Soil Rpt 3	14		1	
Soil Rpt 4	10		1	1
Soil Rpt 5	20		2	
Soil Rpt 6	7			1
Soil Rpt 7	12		2	
Soil Rpt 8	20		2	1
Soil Rpt 9	18		1	
Soil Rpt 10	13		2	1
Soil Rpt 11	14	1	1	
Soil Rpt 12	17	2	2	1
Soil Rpt 13	11	1	1	
Soil Rpt 14	15	1	1	1
Soil Rpt 15	11	1	1	
Soil Rpt 16	12	1	1	1
Soil Rpt 17	12	1	1	
Soil Rpt 18	14	1	1	1
Soil Rpt 19	18	1	1	
Soil Rpt 20	17	2	2	3
Soil Rpt 21	12	1	2	
Soil Rpt 22	12		1	1
Soil Rpt 23	1			1
Soil Rpt 24	3			
Soil Rpt 25	14	2	2	
Soil Rpt 26	6			1
Soil Rpt 27	18	1	1	1
Soil Rpt 28	20		3	1
Soil Rpt 29	12		1	1
Soil Rpt 30	8			
Soil Rpt 31	14	1	2	
Soil Rpt 32	24		2	1
Soil Rpt 33	21		2	
Soil Rpt 34	22		2	
Soil Rpt 35	11		2	1
Soil Rpt 36	15		1	1
Soil Rpt 37	10	1	1	1
Soil Rpt 38	16		1	1
Soil Rpt 39	19	2	2	
Soil Rpt 40	21	1	2	
Soil Rpt 41	15	1	2	1
Soil Rpt 42	17	1	2	1
Soil Rpt 43	19	2	2	

Data Package Number	Number of Environmental Samples (Soil)	Number of Environmental Samples (GW)	Number of Field Duplicate Samples	Quality Control Samples (Blanks)
Soil Rpt 44	18		1	1
Soil Rpt 45	8		2	
Soil Rpt 46	10		1	1
Soil Rpt 47	15		2	1
Soil Rpt 48	9	1	1	
Soil Rpt 49	24		2	1
Soil Rpt 50	14	1	2	1
Soil Rpt 51	18		2	
Soil Rpt 52	9	1	1	
Soil Rpt 53	13		1	1
Soil Rpt 54	6		1	
Soil Rpt 55	10	1	1	1
Soil Rpt 56	11		1	
Soil Rpt 57	7		1	1
Soil Rpt 58	12		2	1
GW Rpt 1		5		1
GW Rpt 2		7	1	1
GW Rpt 3		8		1
GW Rpt 4		4	1	1
GW Rpt 5		2	1	1
GW Rpt 6		5		1
GW Rpt 7		6	1	1
GW Rpt 8		2	1	1
Total:	**789**	**68**	**84**	**42**

Table 5-2
Data Package Summary Table
Site Characterization Investigation
Farmland Industry Trust
Lawrence, Kansas

Data Package Number	Number of EnvironmentalSamples (Soil)	Number of Environmental Samples (GW)	Number of Field Duplicate Samples	Number of Interlab Field Duplicate Samples	Quality Control Samples (Blanks)
6093301	11		1		1
6093359				1	
6093364	10		1		2
6093449	13		2		2
6093448	9		1		1
6093463				2	
6093466				1	
6093505	9		1		1
6093522	2		2		1
6093555	25		2		3
6093577				2	
6093624	16		2		1
6093625				2	
6093684				2	
6093730				1	
6093731		2			1
6093828				2	
6093849	6				1
6093915		8	1	1	1
6093925	6		1		1
6093983				2	
6094007				2	
6094063		2		1	1
6094158	1				1
6094159		2		1	1
6094209	3				1
6094210				2	
6094226	2				
6094227	3			2	1
6094228	2			2	1
6094419	3			3	1
6094499				2	
6094502	3			2	1
6094506				1	
6094507				1	
6094551				2	
6094553	2			2	1
6094584*				2	
6094611	2			2	1
6094614	3			2	1
6094702	8			2	2
6094704	16		2		1
6094743	15	1	1	2	1

Data Package Number	Number of EnvironmentalSamples (Soil)	Number of Environmental Samples (GW)	Number of Field Duplicate Samples	Number of Interlab Field Duplicate Samples	Quality Control Samples (Blanks)
6094744	3			3	1
6094774	11			2	1
6094779	3			2	1
6094860	32		1	1	2
6094890	33			1	3
6094998	25		7		2
6096528	12		1		
6096060	4				1
6096149	14				
6096330	14		1		
6096399	10				1
6096481					1
6097619	4				
507683 (STL)				10	
Total:	**335**	**15**	**27**	**68**	**44**

* Sample run for difference in extraction methods

Table 5-2
Data Package Summary Table
Site Characterization Investigation
Farmland Industry Trust
Lawrence, Kansas

Data Package Number	Number of EnvironmentalSamples (Soil)	Number of Environmental Samples (GW)	Number of Field Duplicate Samples	Number of Interlab Field Duplicate Samples	Quality Control Samples (Blanks)
6093301	11		1		1
6093359				1	
6093364	10		1		2
6093449	13		2		2
6093448	9		1		1
6093463				2	
6093466				1	
6093505	9		1		1
6093522	2		2		1
6093555	25		2		3
6093577				2	
6093624	16		2		1
6093625				2	
6093684				2	
6093730				1	
6093731		2			1
6093828				2	
6093849	6				1
6093915		8	1	1	1
6093925	6		1		1
6093983				2	
6094007				2	
6094063		2		1	1
6094158	1				1
6094159		2		1	1
6094209	3				1
6094210				2	
6094226	2				
6094227	3			2	1
6094228	2			2	1
6094419	3			3	1
6094499				2	
6094502	3			2	1
6094506				1	
6094507				1	
6094551				2	
6094553	2			2	1
6094584*				2	
6094611	2			2	1
6094614	3			2	1
6094702	8			2	2
6094704	16		2		1
6094743	15	1	1	2	1

Data Package Number	Number of EnvironmentalSamples (Soil)	Number of Environmental Samples (GW)	Number of Field Duplicate Samples	Number of Interlab Field Duplicate Samples	Quality Control Samples (Blanks)
6094744	3			3	1
6094774	11			2	1
6094779	3			2	1
6094860	32		1	1	2
6094890	33			1	3
6094998	25		7		2
6096528	12		1		
6096060	4				1
6096149	14				
6096330	14		1		
6096399	10				1
6096481					1
6097619	4				
507683 (STL)				10	
Total:	**335**	**15**	**27**	**68**	**44**

* Sample run for difference in extraction methods

The on-site laboratory provided analytical analysis for seven hundred eighty-nine (789) soil samples for Nitrate plus Nitrite and Ammonia as Nitrogen by modified Standard Method 4500 (SM-4500). Sixty-three (63) groundwater samples were analyzed for Nitrate plus Nitrite and Ammonia as Nitrogen by modified method SM-4500 by the on-site laboratory and fifteen (15) groundwater samples were analyzed for RCRA Metals by EPA Method 6010/7470 by Pace.

There are no approved EPA methods for the analysis of nitrate and ammonia in soils. The methods used were modified to incorporate a leaching procedure for the soil matrix and then analyzing the resulting leachate as a water sample for nitrate and/or ammonia. The use of a leaching procedure to analyze for nitrate and ammonia in soil is standard practice in the agricultural industry. There are two accepted leaching procedures used by agricultural laboratories in analysis of nitrate and ammonia. The two leaching procedures are the use of de-ionized water as the leaching fluid and the use of a potassium chloride solution as a leaching fluid. Both procedures are routinely used to leach nitrate and ammonia from soil. The choice of procedure is dependent upon the ability of the soil to sorb nitrate and ammonia. The potassium chloride solution would be the appropriate choice for soils with either strong anion or cation exchange capacity while de-ionized water would be the choice for soils with limited anion or cation exchange capacity. Since the anion/cation exchange capacity of the soils is unknown, either leaching procedure would be acceptable. The two different leaching procedures could provide differing results for a specific soil samples if there are widely varying differences in anion/cation exchange capacity. Pace used the de-ionized water leaching except for those samples where the field duplicate samples were sent to STL. In this case, Pace was directed to use the potassium chloride leaching procedure. For those ammonia samples, Pace used the potassium chloride leaching procedure. The on-site laboratory and STL used the potassium chloride leaching procedure.

Each laboratory package consists of the analytical data and associated quality control data. Field QC samples were also reviewed for compliance with criteria specified in the Field and Sampling Plan (FSP). Each data deliverable package consisted of the following information for the analytical report:

- Laboratory ID numbers;
- Site ID numbers;
- Sample ID number;
- Date sampled;
- Date analyzed;
- Parameters measured;
- Units in which each parameter is reported;
- Analytical methods used; and,
- Reporting limits.

The associated QC data deliverables for laboratory deliverables included:

- Copies of signed chain-of-custody records; and,
- Analytical results for laboratory matrix spike/matrix spike duplicates (MS/MSD), laboratory matrix spikes, laboratory duplicates, laboratory control samples/laboratory control sample duplicates (LCS/LCSD), method blanks and surrogate recoveries.

The quality control (QC) guidelines for each method as listed in SW-846 and Drinking Water Methods were used as the primary guidance when reviewing data. The Contract Laboratory Program (CLP) Data Validation Guidelines were used as a supplement to the SW-846 and Drinking Water guidelines when appropriate.

All data deliverable packages were reviewed for the following:

- correct analytical methodology and proper reporting units;
- compliance with holding times;
- field duplicates, confirmation duplicates and laboratory duplicates within relative percent difference (RPD) criterion;
- rinse blanks, field blanks, trip blanks less than reporting limits;
- method blanks less than reporting limits;
- matrix spike/matrix spike duplicates (MS/MSD) within control limits; and,
- laboratory control samples (LCS) within limits.

A summary of the qualified data for laboratory results is presented in the **Table 5-3**. Data were qualified for the following reasons: holding times, high RPD for field duplicates, high RPD for confirmation samples, high RPD for laboratory duplicates, blank contamination (including field blanks, rinse blanks, and method blanks), high MS/MSD RPD, MS/MSD percent recovery outside of QC limits, and LCS outside of QC limits. The following paragraphs summarize data validation activities.

One hundred percent of the samples were reviewed for the QC data listed above. All samples were analyzed using the correct analytical methodology. All data was reported using the correct method number and reporting units. Eleven (11) soil samples were "J" coded with an "H" qualifier as estimated based on exceeded holding times. The soil samples were extracted outside of the FSP specified holding time of 30 days for nitrogen analysis. The samples were analyzed post extraction within the Drinking Water method holding time of 48 hours. Since there is no method specific holding time for extraction for Nitrate plus Nitrite, Ammonia, and TKN in soils, the sample results are usable.

Precision and accuracy criteria were met by the laboratory based on either MS/MSD or LCS/LCSD except where noted in the qualified data tables.

Table 5-3

Sample Data with Data Review and Validation Qualifiers

Site Characterization Investigation

Former Farmland Nitrogen Plant

Lawrence, Kansas

Laboratory Work Order #	Sample Identifier	Duplicate ID	Sample Type	Analyte	Results	Units	Data Validation Qualifier	Qualifier Code	Reason	Bias Code
6096528	A02-SED-39A-4.5-4.5'		Primary	Arsenic	10.1	mg/kg	J	D	Field Duplicate	
6096528	A02-SED-39A-4.5-4.5'	A02-SED-39A'D	Duplicate	Arsenic	4.51	mg/kg	J	D	Field Duplicate	
6093915	PSW-06A		Primary	Arsenic	0.0281	mg/l	J	D	Field Duplicate	
6093915	PSW-06A	GW Duplicate 1	Duplicate	Arsenic	0.0198	mg/l	J	D	Field Duplicate	
6096330	A02-SED-31A-10-12'		Primary	Arsenic	3.07	mg/kg	J	D	Pace/STL Duplicate	
507683	A02-SED-31A-10-12'		Duplicate	Arsenic	6	mg/kg	J	D	Pace/STL Duplicate	
6096528	A02-SED-37A-4-6'		Primary	Arsenic	3.28	mg/kg	J	D	Pace/STL Duplicate	
507683	A02-SED-37A-4-6'		Duplicate	Arsenic	12.6	mg/kg	J	D	Pace/STL Duplicate	
6096528	A02-SED-41A-4-6'		Primary	Arsenic	3	mg/kg	J	D	Pace/STL Duplicate	
507683	A02-SED-41A-4-6'		Duplicate	Arsenic	6.3	mg/kg	J	D	Pace/STL Duplicate	
6093448	A02-SED-36-2-4'		Primary	Barium	159	mg/kg	J	D	Field Duplicate	
6093448	A02-SED-36-2-4'	Duplicate 5	Duplicate	Barium	309	mg/kg	J	D	Field Duplicate	
6096528	A02-SED-39A-4.5-4.5'		Primary	Barium	391	mg/kg	J	D	Field Duplicate	
6096528	A02-SED-39A-4.5-4.5'	A02-SED-39A'D	Duplicate	Barium	169	mg/kg	J	D	Field Duplicate	
6096528	A02-SED-41A-4-6'		Primary	Barium	157	mg/kg	J	D	Pace/STL Duplicate	
507683	A02-SED-41A-4-6'		Duplicate	Barium	622	mg/kg	J	D	Pace/STL Duplicate	
6093555	A02-SED-13-2-4'		Primary	Chromium	745	mg/kg	J	D	Field Duplicate	
6093555	A02-SED-13-2-4'	Duplicate 7	Duplicate	Chromium	1280	mg/kg	J	D	Field Duplicate	
6093624	A02-SED-28-0-2'		Primary	Chromium	38.5	mg/kg	J	D	Field Duplicate	
6093624	A02-SED-28-0-2'	Duplicate 9	Duplicate	Chromium	142	mg/kg	J	D	Field Duplicate	
6096330	A02-SED-30A-0-2'		Primary	Chromium	532	mg/kg	J	D	Field Duplicate	
6096330	A02-SED-30A-0-2'	A02-SED-30A-20-22'	Duplicate	Chromium	12.8	mg/kg	J	D	Field Duplicate	
6093448	A02-SED-36-2-4'		Primary	Chromium	264	mg/kg	J	D	Field Duplicate	
6093448	A02-SED-36-2-4'	Duplicate 5	Duplicate	Chromium	479	mg/kg	J	D	Field Duplicate	
6096528	A02-SED-39A-4.5-4.5'		Primary	Chromium	50.6	mg/kg	J	D	Field Duplicate	
6096528	A02-SED-39A-4.5-4.5'	A02-SED-39A'D	Duplicate	Chromium	30	mg/kg	J	D	Field Duplicate	
6094704	A05-SS-05-0-2'		Primary	Chromium	202	mg/kg	J	D	Field Duplicate	
6094704	A05-SS-05-0-2'	Soil Duplicate L	Duplicate	Chromium	64.3	mg/kg	J	D	Field Duplicate	
6096060	A02-SED-26A-4-6'		Primary	Chromium	548	mg/kg	J	D	Pace/STL Duplicate	
507683	A02-SED-26A-4-6'		Duplicate	Chromium	1280	mg/kg	J	D	Pace/STL Duplicate	

D - Duplicate run with high duplicate result

F - Elevated MS/MSD RPD result

G - MS/MSD percent recovery outside reporting limit

J - Estimated concentration above the adjusted method detection limit and below the adjusted reporting limit

L - LCS percent recovery outside limits

U - Elevated reporting limit

Table 5-3, Continued
Sample Data with Data Review and Validation Qualifiers
Site Characterization Investigation
Former Farmland Nitrogen Plant
Lawrence, Kansas

Work Order	Sample Identifier	Duplicate ID	Sample Type	Analyte	Results	Units	Validation	Qualifier Code	Reason	Bias Code
6096330	A02-SED-30A-0-2'		Primary	Chromium	532	mg/kg	J	D	Pace/STL Duplicate	
507683	A02-SED-30A-0-2'		Duplicate	Chromium	59.6	mg/kg	J	D	Pace/STL Duplicate	
6096330	A02-SED-31A-10-12'		Primary	Chromium	78.1	mg/kg	J	D	Pace/STL Duplicate	
507683	A02-SED-31A-10-12'		Duplicate	Chromium	35.6	mg/kg	J	D	Pace/STL Duplicate	
6096399	A02-SED-61A-8-10'		Primary	Chromium	1.64	mg/kg	J	D	Pace/STL Duplicate	
507683	A02-SED-61A-8-10'		Duplicate	Chromium	6.4	mg/kg	J	D	Pace/STL Duplicate	
6093624	A02-SED-28-0-2'		Primary	Lead	9.5	mg/kg	J	D	Field Duplicate	
6093624	A02-SED-28-0-2'	Duplicate 9	Duplicate	Lead	1.94	mg/kg	J	D	Field Duplicate	
6093624	A02-SED-33-8-10'		Primary	Lead	0.881	mg/kg	J	D	Field Duplicate	
6093624	A02-SED-33-8-10'	Duplicate 10	Duplicate	Lead	2.03	mg/kg	J	D	Field Duplicate	
6096528	A02-SED-39A-4.5-4.5'		Primary	Lead	32.2	mg/kg	J	D	Field Duplicate	
6096528	A02-SED-39A-4.5-4.5'	A02-SED-39A'D	Duplicate	Lead	16.2	mg/kg	J	D	Field Duplicate	
Soil Rpt 4	A01W-SS-23-0-1.5'		Primary	Nitrate plus Nitrtite as Nitrogen	11.2	mg/kg	J	D	Field Duplicate	
Soil Rpt 4	A01W-SS-23-0-1.5'	Soil Duplicate 4	Duplicate	Nitrate plus Nitrtite as Nitrogen	85.5	mg/kg	J	D	Field Duplicate	
Soil Rpt 21	A01NE-SS-08-12-14'		Primary	Nitrate plus Nitrtite as Nitrogen	3760	mg/kg	J	D	Pace Duplicate	
6094007	A01NE-SS-08-12-14'D		Duplicate	Nitrate plus Nitrtite as Nitrogen	1870	mg/kg	J	D	Pace Duplicate	
Soil Rpt 28	A01NE-SS-24-9-12'		Primary	Nitrate plus Nitrtite as Nitrogen	967	mg/kg	J	D	Pace Duplicate	
6094227	A01NE-SS-24-9-12'D		Duplicate	Nitrate plus Nitrtite as Nitrogen	113	mg/kg	J	D	Pace Duplicate	
Soil Rpt 42	A09-SS-04-19-22'		Primary	Nitrate plus Nitrtite as Nitrogen	118	mg/kg	J	D	Pace Duplicate	
6094553	A09-SS-04-19-22'D		Duplicate	Nitrate plus Nitrtite as Nitrogen	334	mg/kg	J	D	Pace Duplicate	
Soil Rpt 29	A19-SED-09-0-0.67'		Primary	Nitrate plus Nitrtite as Nitrogen	514	mg/kg	J	D	Pace Duplicate	
6094228	A19-SED-09-0-0.67'D		Duplicate	Nitrate plus Nitrtite as Nitrogen	291	mg/kg	J	D	Pace Duplicate	
6096330	A02-SED-28A-2-4'		Primary	Nitrate plus Nitrtite as Nitrogen	2030	mg/kg	J	D	Pace/STL Duplicate	
507683	A02-SED-25A-2-4'		Duplicate	Nitrate, as Nitrogen	1300	mg/kg	J	D	Pace/STL Duplicate	
6096149	A02-SED-25A-2-4'		Primary	Nitrate plus Nitrite as Nitrogen	630	mg/kg	J	D	Pace/STL Duplicate	
507683	A02-SED-28A-2-4'		Duplicate	Nitrate, as Nitrogen	1100	mg/kg	J	D	Pace/STL Duplicate	
Soil Rpt 5	A01W-SS-44-0-2'		Primary	Nitrogen, Ammonia	219	mg/kg	J	D	Field Duplicate	
Soil Rpt 5	A01W-SS-44-0-2'	Soil Duplicate 6	Duplicate	Nitrogen, Ammonia	420	mg/kg	J	D	Field Duplicate	
GW Rpt 4	PW-04A		Primary	Nitrogen, Ammonia	9.15	mg/l	J	D	Field Duplicate	
GW Rpt 4	PW-04A	GW Duplicate 2	Duplicate	Nitrogen, Ammonia	1.91	mg/l	J	D	Field Duplicate	

D - Duplicate run with high duplicate result

F - Elevated MS/MSD RPD result

G - MS/MSD percent recovery outside reporting limit

J - Estimated concentration above the adjusted method detection limit and below the adjusted reporting limit

L - LCS percent recovery outside limits

U - Elevated reporting limit

Table 5-3, Continued
Sample Data with Data Review and Validation Qualifiers
Site Characterization Investigation
Former Farmland Nitrogen Plant
Lawrence, Kansas

Work Order	Sample Identifier	Duplicate ID	Sample Type	Analyte	Results	Units	Validation	Qualifier Code	Reason	Bias Code
Soil Rpt 31	A01NE-SED-10-0-0.83'		Primary	Nitrogen, Ammonia	718	mg/kg	J	D	Pace Duplicate	
6094419	A01NE-SED-10-0-0.83'D		Duplicate	Nitrogen, Ammonia	153	mg/kg	J	D	Pace Duplicate	
Soil Rpt 17	A01NE-SS-07-0.67-3'		Primary	Nitrogen, Ammonia	319	mg/kg	J	D	Pace Duplicate	
6093828	A01NE-SS-07-0.67-3'D		Duplicate	Nitrogen, Ammonia	75.1	mg/kg	J	D	Pace Duplicate	
Soil Rpt 18	A01NE-SS-14-12-15'		Primary	Nitrogen, Ammonia	2830	mg/kg	J	D	Pace Duplicate	
6093828	A01NE-SS-14-12-15'D		Duplicate	Nitrogen, Ammonia	1200	mg/kg	J	D	Pace Duplicate	
Soil Rpt 32	A01NE-SS-37-15-17'		Primary	Nitrogen, Ammonia	273	mg/kg	J	D	Pace Duplicate	
6094419	A01NE-SS-37-15-17'D		Duplicate	Nitrogen, Ammonia	124	mg/kg	J	D	Pace Duplicate	
Soil Rpt 32	A01SE-SS-01-3-6'		Primary	Nitrogen, Ammonia	458	mg/kg	J	D	Pace Duplicate	
6094419	A01SE-SS-01-3-6'D		Duplicate	Nitrogen, Ammonia	33.2	mg/kg	J	D	Pace Duplicate	
Soil Rpt 34	A01SE-SS-06-3-5'		Primary	Nitrogen, Ammonia	134	mg/kg	J	D	Pace Duplicate	
6094499	A01SE-SS-06-3-5'D		Duplicate	Nitrogen, Ammonia	41	mg/kg	J	D	Pace Duplicate	
Soil Rpt 41	A01SE-SS-09-3-6'		Primary	Nitrogen, Ammonia	1070	mg/kg	J	D	Pace Duplicate	
6094551	A01SE-SS-09-3-6'D		Duplicate	Nitrogen, Ammonia	550	mg/kg	J	D	Pace Duplicate	
Soil Rpt 12	A01W-SS-02-0.67-3'		Primary	Nitrogen, Ammonia	267	mg/kg	J	D	Pace Duplicate	
6093625	A01W-SS-02-0.67-3'D		Duplicate	Nitrogen, Ammonia	91	mg/kg	J	D	Pace Duplicate	
Soil Rpt 8	A01W-SS-19-6-9'		Primary	Nitrogen, Ammonia	97.7	mg/kg	J	D	Pace Duplicate	
6093522	A01W-SS-19-6-9'D		Duplicate	Nitrogen, Ammonia	36.1	mg/kg	J	D	Pace Duplicate	
Soil Rpt 7	A01W-SS-24-0-2'		Primary	Nitrogen, Ammonia	170	mg/kg	J	D	Pace Duplicate	
6093522	A01W-SS-24-0-2'D		Duplicate	Nitrogen, Ammonia	34.5	mg/kg	J	D	Pace Duplicate	
Soil Rpt 5	A01W-SS-38-0-2'		Primary	Nitrogen, Ammonia	581	mg/kg	J	D	Pace Duplicate	
6093463	A01W-SS-38-0-2'D		Duplicate	Nitrogen, Ammonia	216	mg/kg	J	D	Pace Duplicate	
Soil Rpt 5	A01W-SS-43-3-6'		Primary	Nitrogen, Ammonia	2090	mg/kg	J	D	Pace Duplicate	
6093463	A01W-SS-43-3-6'D		Duplicate	Nitrogen, Ammonia	340	mg/kg	J	D	Pace Duplicate	
Soil Rpt 9	A01W-SS-53-0.67-3'		Primary	Nitrogen, Ammonia	1290	mg/kg	J	D	Pace Duplicate	
6093577	A01W-SS-53-0.67-3'D		Duplicate	Nitrogen, Ammonia	139	mg/kg	J	D	Pace Duplicate	
Soil Rpt 58	A11-SS-03-0.67-2.5'		Primary	Nitrogen, Ammonia	105	mg/kg	J	D	Pace Duplicate	
6094890	A11-SS-03-0.67-2.5'D		Duplicate	Nitrogen, Ammonia	27.7	mg/kg	J	D	Pace Duplicate	
Soil Rpt 29	A19-SED-09-0-0.67'		Primary	Nitrogen, Ammonia	1190	mg/kg	J	D	Pace Duplicate	
6094228	A19-SED-09-0-0.67'D		Duplicate	Nitrogen, Ammonia	657	mg/kg	J	D	Pace Duplicate	

D - Duplicate run with high duplicate result

F - Elevated MS/MSD RPD result

G - MS/MSD percent recovery outside reporting limit

J - Estimated concentration above the adjusted method detection limit and below the adjusted reporting limit

L - LCS percent recovery outside limits

U - Elevated reporting limit

Table 5-3, Continued
Sample Data with Data Review and Validation Qualifiers
Site Characterization Investigation
Former Farmland Nitrogen Plant
Lawrence, Kansas

Work Order	Sample Identifier	Duplicate ID	Sample Type	Analyte	Results	Units	Validation	Qualifier Code	Reason	Bias Code
Soil Rpt 29	A19-SED-13-0-0.67'		Primary	Nitrogen, Ammonia	151	mg/kg	J	D	Pace Duplicate	
6094228	A19-SED-13-0-0.67'D		Duplicate	Nitrogen, Ammonia	46.3	mg/kg	J	D	Pace Duplicate	
6094159	MW-06		Primary	Nitrogen, Ammonia	5.97	mg/l	J	D	Pace Duplicate	
6094159	MW-06D		Duplicate	Nitrogen, Ammonia	<4.39	mg/l	J	D	Pace Duplicate	
6096149	A02-SED-25A-2-4'		Primary	Nitrogen, Ammonia	1580	mg/kg	J	D	Pace/STL Duplicate	
507683	A02-SED-25A-2-4'		Duplicate	Nitrogen, Ammonia	5500	mg/kg	J	D	Pace/STL Duplicate	
6096330	A02-SED-28A-2-4'		Primary	Nitrogen, Ammonia	146	mg/kg	J	D	Pace/STL Duplicate	
507683	A02-SED-28A-2-4'		Duplicate	Nitrogen, Ammonia	290	mg/kg	J	D	Pace/STL Duplicate	
6093925	A13-SS-05-0-0.5'		Primary	Selenium	5.04	mg/kg	J	D	Field Duplicate	
6093925	A13-SS-05-0-0.5'	Soil Duplicate 23	Duplicate	Selenium	1.52	mg/kg	J	D	Field Duplicate	
6093624	A02-SED-28-0-2'		Primary	Total Kjeldahl Nitrogen	189	mg/kg	J	D	Field Duplicate	
6093624	A02-SED-28-0-2'	Duplicate 9	Duplicate	Total Kjeldahl Nitrogen	343	mg/kg	J	D	Field Duplicate	
6093449	A02-SED-52-0-2'		Primary	Total Kjeldahl Nitrogen	6440	mg/kg	J	D	Field Duplicate	
6093449	A02-SED-52-0-2'	Duplicate 4	Duplicate	Total Kjeldahl Nitrogen	3470	mg/kg	J	D	Field Duplicate	
6093301	A02-SED-61-0-2'		Primary	Total Kjeldahl Nitrogen	468	mg/kg	J	D	Field Duplicate	
6093301	A02-SED-61-0-2'	Duplicate 1	Duplicate	Total Kjeldahl Nitrogen	153	mg/kg	J	D	Field Duplicate	
6096528	A02-SED-37A-4-6'		Primary	Total Kjeldahl Nitrogen	33200	mg/kg	J	D	Pace/STL Duplicate	
507683	A02-SED-37A-4-6'		Duplicate	Total Kjeldahl Nitrogen	14000	mg/kg	J	D	Pace/STL Duplicate	
6094419	A01NE-SED-10-0-0.83'		Primary	Mercury	<0.217	mg/kg	J	F	MS/MSD RPD	
6093364	A02-SED-12-0-2'		Primary	Arsenic	7.718	mg/kg	J	F	MS/MSD RPD	
6093364	A02-SED-12-0-2'		Primary	Lead	14.15	mg/kg	J	F	MS/MSD RPD	
6096149	A02-SED-27A-6-8'		Primary	Silver	1.89	mg/kg	J	F	MS/MSD RPD	
6094860	A16-SS-09-0-2'		Primary	Chromium	33	mg/kg	J	F	MS/MSD RPD	
6093364	A02-SED-12-0-2'		Primary	Cadmium	<0.799	mg/kg	J	F	MS/MSD RPD	
6093364	A02-SED-12-0-2'		Primary	Chromium	46.7	mg/kg	J	F	MS/MSD RPD	
6093364	A02-SED-12-0-2'		Primary	Selenium	<7.19	mg/kg	J	F	MS/MSD RPD	
6093555	A02-SED-21-2-4'		Primary	Arsenic	5.32	mg/kg	J	F	MS/MSD RPD	
6093555	A02-SED-21-2-4'		Primary	Cadmium	<0.748	mg/kg	J	F	MS/MSD RPD	
6093555	A02-SED-21-2-4'		Primary	Lead	18.7	mg/kg	J	F	MS/MSD RPD	
6093555	A02-SED-21-2-4'		Primary	Selenium	<2.24	mg/kg	J	F	MS/MSD RPD	

D - Duplicate run with high duplicate result

F - Elevated MS/MSD RPD result

G - MS/MSD percent recovery outside reporting limit

J - Estimated concentration above the adjusted method detection limit and below the adjusted reporting limit

L - LCS percent recovery outside limits

U - Elevated reporting limit

Table 5-3, Continued
Sample Data with Data Review and Validation Qualifiers
Site Characterization Investigation
Former Farmland Nitrogen Plant
Lawrence, Kansas

Work Order	Sample Identifier	Duplicate ID	Sample Type	Analyte	Results	Units	Validation	Qualifier Code	Reason	Bias Code
6093555	A02-SED-21-2-4'		Primary	Silver	<1.05	mg/kg	J	F	MS/MSD RPD	
6096149	A02-SED-27A-6-8'		Primary	Arsenic	6.99	mg/kg	J	F	MS/MSD RPD	
6096149	A02-SED-27A-6-8'		Primary	Cadmium	<0.659	mg/kg	J	F	MS/MSD RPD	
6096149	A02-SED-27A-6-8'		Primary	Lead	15.2	mg/kg	J	F	MS/MSD RPD	
6096149	A02-SED-27A-6-8'		Primary	Selenium	<5.93	mg/kg	J	F	MS/MSD RPD	
3093505	A02-SED-39-0-2'		Primary	Arsenic	7.8	mg/kg	J	F	MS/MSD RPD	
3093505	A02-SED-39-0-2'		Primary	Cadmium	0.849	mg/kg	J	F	MS/MSD RPD	
3093505	A02-SED-39-0-2'		Primary	Chromium	19.2	mg/kg	J	F	MS/MSD RPD	
3093505	A02-SED-39-0-2'		Primary	Lead	20.1	mg/kg	J	F	MS/MSD RPD	
3093505	A02-SED-39-0-2'		Primary	Selenium	<3.56	mg/kg	J	F	MS/MSD RPD	
3093505	A02-SED-39-0-2'		Primary	Silver	<0.830	mg/kg	J	F	MS/MSD RPD	
6096399	A02-SED-60A-6-8'		Primary	Mercury	<0.244	mg/kg	J	F	MS/MSD RPD	
6094860	A16-SS-09-0.5-3'		Primary	GRO	<6.0	mg/kg	J	F	MS/MSD RPD	
6094860	A16-SS-09-0-2'		Primary	Arsenic	25.5	mg/kg	J	F	MS/MSD RPD	
6094860	A16-SS-09-0-2'		Primary	Cadmium	<0.739	mg/kg	J	F	MS/MSD RPD	
6094860	A16-SS-09-0-2'		Primary	Lead	27.3	mg/kg	J	F	MS/MSD RPD	
6094860	A16-SS-09-0-2'		Primary	Selenium	<2.22	mg/kg	J	F	MS/MSD RPD	
6094860	A16-SS-09-0-2'		Primary	Silver	<1.04	mg/kg	J	F	MS/MSD RPD	
6094419	A01NE-SED-10-0-0.83'		Primary	Mercury	<0.217	mg/kg	J	G	MS/MSD % REC	L
6094226	A01NE-SED-17-0-0.5'		Primary	Barium	140	mg/kg	J	G	MS/MSD % REC	H
6093983	A01NE-SS-16-3-6'D		Duplicate	Nitrate plus Nitrtite as Nitrogen	4710	mg/kg	J	G	MS/MSD % REC	L
6093983	A01NE-SS-16-3-6'D		Duplicate	Nitrogen, Ammonia	5620	mg/kg	J	G	MS/MSD % REC	H
6094227	A01NE-SS-35-0-0.67'		Primary	Nitrogen, Ammonia	<10.8	mg/kg	J	G	MS/MSD % REC	L
6093364	A02-SED-12-0-2'		Primary	Total Kjeldahl Nitrogen	1230	mg/kg	J	G	MS/MSD % REC	L
6093555	A02-SED-16-0-2'	Duplicate 8	Duplicate	Nitrogen, Ammonia	147	mg/kg	J	G	MS/MSD % REC	L
6093555	A02-SED-19-4-5'		Primary	Mercury	<1.07	mg/kg	J	G	MS/MSD % REC	H
6096060	A02-SED-26A-0-2'		Primary	Total Kjeldahl Nitrogen	3910	mg/kg	J	G	MS/MSD % REC	L
6096060	A02-SED-26A-0-2'		Primary	Barium	217	mg/kg	J	G	MS/MSD % REC	H
6096060	A02-SED-26A-0-2'		Primary	Chromium	227	mg/kg	J	G	MS/MSD % REC	H
6096149	A02-SED-27A-6-8'		Primary	Barium	462	mg/kg	J	G	MS/MSD % REC	H

D - Duplicate run with high duplicate result
F - Elevated MS/MSD RPD result
G - MS/MSD percent recovery outside reporting limit
J - Estimated concentration above the adjusted method detection limit and below the adjusted reporting limit
L - LCS percent recovery outside limits
U - Elevated reporting limit

Table 5-3, Continued
Sample Data with Data Review and Validation Qualifiers
Site Characterization Investigation
Former Farmland Nitrogen Plant
Lawrence, Kansas

Work Order	Sample Identifier	Duplicate ID	Sample Type	Analyte	Results	Units	Validation	Qualifier Code	Reason	Bias Code
6096149	A02-SED-27A-6-8'		Primary	Silver	1.89	mg/kg	J	G	MS/MSD % REC	H
6096330	A02-SED-29A-0-2'		Primary	Barium	566	mg/kg	J	G	MS/MSD % REC	H
6096330	A02-SED-29A-0-2'		Primary	Chromium	41.2	mg/kg	J	G	MS/MSD % REC	H
6093624	A02-SED-30-0-2'		Primary	Total Kjeldahl Nitrogen	849	mg/kg	J	G	MS/MSD % REC	L
6093849	A02-SED-32-0-2'		Primary	Total Kjeldahl Nitrogen	690	mg/kg	J	G	MS/MSD % REC	L
6093849	A02-SED-32-0-2'		Primary	Chromium	199	mg/kg	J	G	MS/MSD % REC	L
6096528	A02-SED-35A-9.5-10'		Primary	Total Kjeldahl Nitrogen	8140	mg/kg	J	G	MS/MSD % REC	H
3093505	A02-SED-39-0-2'		Primary	Barium	306	mg/kg	J	G	MS/MSD % REC	L
6093449	A02-SED-53-0-2'		Primary	Barium	151	mg/kg	J	G	MS/MSD % REC	H
6093301	A02-SED-60-0-2'		Primary	Arsenic	32.8	mg/kg	J	G	MS/MSD % REC	L
6093301	A02-SED-60-0-2'		Primary	Barium	454	mg/kg	J	G	MS/MSD % REC	L
6094890	A11-SS-01-0-0.67'		Primary	Nitrate plus Nitrtite as Nitrogen	9.47	mg/kg	J	G	MS/MSD % REC	L
6094860	A16-SS-09-0-2'		Primary	Barium	307	mg/kg	J	G	MS/MSD % REC	H
6094860	A16-SS-09-0-2'		Primary	Chromium	33	mg/kg	J	G	MS/MSD % REC	H
6094502	A17-SS-05-0-2'		Primary	Barium	233	mg/kg	J	G	MS/MSD % REC	L
6094228	A19-SED-09-0-0.67'D		Duplicate	Nitrate plus Nitrtite as Nitrogen	291	mg/kg	J	G	MS/MSD % REC	H
507683	A02-SED-24A-0-2'		Duplicate	Nitrate, as Nitrogen	110	mg/kg	J	H	Holding Time	
507683	A02-SED-24A-0-2'		Duplicate	Nitrogen, Ammonia	380	mg/kg	J	H	Holding Time	
507683	A02-SED-25A-2-4'		Duplicate	Nitrate, as Nitrogen	1300	mg/kg	J	H	Holding Time	
507683	A02-SED-25A-2-4'		Duplicate	Nitrogen, Ammonia	5500	mg/kg	J	H	Holding Time	
507683	A02-SED-26A-4-6'		Duplicate	Nitrate, as Nitrogen	1900	mg/kg	J	H	Holding Time	
507683	A02-SED-26A-4-6'		Duplicate	Nitrogen, Ammonia	4800	mg/kg	J	H	Holding Time	
507683	A02-SED-26A-4-6'		Duplicate	Total Kjeldahl Nitrogen	8100	mg/kg	J	H	Holding Time	
6094228	A19-SED-09-0-0.67'D		Duplicate	Nitrate plus Nitrtite as Nitrogen	291	mg/kg	J	H	Holding Time	
6094228	A19-SED-09-0-0.67'D		Duplicate	Nitrogen, Ammonia	657	mg/kg	J	H	Holding Time	
6094228	A19-SED-13-0-0.67'D		Duplicate	Nitrate plus Nitrtite as Nitrogen	152	mg/kg	J	H	Holding Time	
6094228	A19-SED-13-0-0.67'D		Duplicate	Nitrogen, Ammonia	46.3	mg/kg	J	H	Holding Time	
Soil Rpt 16	A01NE-SS-03-21-23'		Primary	Nitrogen, Ammonia	<3.2	mg/kg	U	J	Field Blank	
Soil Rpt 14	A01NE-SS-06-0-0.67'		Primary	Nitrogen, Ammonia	<4.6	mg/kg	U	J	Field Blank	
Soil Rpt 14	A01NE-SS-06-3-6'		Primary	Nitrate plus Nitrtite as Nitrogen	<2.4	mg/kg	U	J	Field Blank	

D - Duplicate run with high duplicate result

F - Elevated MS/MSD RPD result

G - MS/MSD percent recovery outside reporting limit

J - Estimated concentration above the adjusted method detection limit and below the adjusted reporting limit

L - LCS percent recovery outside limits

U - Elevated reporting limit

Table 5-3, Continued
Sample Data with Data Review and Validation Qualifiers
Site Characterization Investigation
Former Farmland Nitrogen Plant
Lawrence, Kansas

Work Order	Sample Identifier	Duplicate ID	Sample Type	Analyte	Results	Units	Validation	Qualifier Code	Reason	Bias Code
Soil Rpt 19	A01NE-SS-09-0-0.67'		Primary	Nitrogen, Ammonia	<4.9	mg/kg	U	J	Field Blank	
Soil Rpt 19	A01NE-SS-09-21-23'		Primary	Nitrogen, Ammonia	<2.9	mg/kg	U	J	Field Blank	
Soil Rpt 19	A01NE-SS-09-28-30'	Soil Duplicate 24	Duplicate	Nitrogen, Ammonia	<4	mg/kg	U	J	Field Blank	
Soil Rpt 31	A01NE-SS-11-0-1'		Primary	Nitrate plus Nitrtite as Nitrogen	<2.6	mg/kg	U	J	Field Blank	
Soil Rpt 30	A01NE-SS-12-0-0.25'		Primary	Nitrogen, Ammonia	<2.7	mg/kg	U	J	Field Blank	
Soil Rpt 25	A01NE-SS-21-3-6'		Primary	Nitrate plus Nitrtite as Nitrogen	<2.4	mg/kg	U	J	Field Blank	
Soil Rpt 22	A01NE-SS-22-0.67-3'		Primary	Nitrogen, Ammonia	<3.7	mg/kg	U	J	Field Blank	
Soil Rpt 25	A01NE-SS-27-0-0.67'		Primary	Nitrogen, Ammonia	<3.8	mg/kg	U	J	Field Blank	
Soil Rpt 20	A01NE-SS-28-0.67-3'		Primary	Nitrogen, Ammonia	<3.6	mg/kg	U	J	Field Blank	
Soil Rpt 20	A01NE-SS-28-20-21'		Primary	Nitrogen, Ammonia	<2.1	mg/kg	U	J	Field Blank	
Soil Rpt 20	A01NE-SS-28-9-12'		Primary	Nitrogen, Ammonia	<4.1	mg/kg	U	J	Field Blank	
Soil Rpt 27	A01NE-SS-33-3-6'		Primary	Nitrate plus Nitrtite as Nitrogen	<2.3	mg/kg	U	J	Field Blank	
Soil Rpt 27	A01NE-SS-33-6-9'		Primary	Nitrate plus Nitrtite as Nitrogen	<2.5	mg/kg	U	J	Field Blank	
Soil Rpt 30	A01NE-SS-38-3-6'		Primary	Nitrogen, Ammonia	<3.2	mg/kg	U	J	Field Blank	
Soil Rpt 38	A01SE-SS-05-0-2'		Primary	Nitrogen, Ammonia	<4.4	mg/kg	U	J	Field Blank	
Soil Rpt 40	A01SE-SS-07-16-18'		Primary	Nitrogen, Ammonia	<3.3	mg/kg	U	J	Field Blank	
Soil Rpt 40	A01SE-SS-07-18-19'		Primary	Nitrogen, Ammonia	<3.9	mg/kg	U	J	Field Blank	
Soil Rpt 40	A01SE-SS-08-9-12'		Primary	Nitrate plus Nitrtite as Nitrogen	<2.2	mg/kg	U	J	Field Blank	
Soil Rpt 40	A01SE-SS-08-9-12'	Soil Duplicate 45	Duplicate	Nitrate plus Nitrtite as Nitrogen	<2	mg/kg	U	J	Field Blank	
Soil Rpt 34	A01SE-SS-10-6-8.5'	Soil Duplicate 40	Duplicate	Nitrogen, Ammonia	<2.4	mg/kg	U	J	Field Blank	
Soil Rpt 35	A01SE-SS-11-15-16'		Primary	Nitrogen, Ammonia	<2.5	mg/kg	U	J	Field Blank	
Soil Rpt 34	A01SE-SS-13-0-0.67'		Primary	Nitrogen, Ammonia	<3.3	mg/kg	U	J	Field Blank	
Soil Rpt 34	A01SE-SS-13-3-6'		Primary	Nitrate plus Nitrtite as Nitrogen	<2.5	mg/kg	U	J	Field Blank	
Soil Rpt 34	A01SE-SS-14-3-6'		Primary	Nitrate plus Nitrtite as Nitrogen	<2.8	mg/kg	U	J	Field Blank	
Soil Rpt 11	A01W-GW-10-9'		Primary	Nitrogen, Ammonia	<0.92	mg/l	U	J	Field Blank	
Soil Rpt 1	A01W-SS-01-0-2'		Primary	Nitrate plus Nitrtite as Nitrogen	<2.4	mg/kg	U	J	Field Blank	
Soil Rpt 1	A01W-SS-01-0-2'		Primary	Nitrogen, Ammonia	<2.5	mg/kg	U	J	Field Blank	
Soil Rpt 1	A01W-SS-01-2-3'		Primary	Nitrate plus Nitrtite as Nitrogen	<2.6	mg/kg	U	J	Field Blank	
Soil Rpt 12	A01W-SS-02-0-0.67		Primary	Nitrate plus Nitrtite as Nitrogen	<2.2	mg/kg	U	J	Field Blank	
Soil Rpt 13	A01W-SS-03-0-2'		Primary	Nitrate plus Nitrtite as Nitrogen	<2.3	mg/kg	U	J	Field Blank	

D - Duplicate run with high duplicate result

F - Elevated MS/MSD RPD result

G - MS/MSD percent recovery outside reporting limit

J - Estimated concentration above the adjusted method detection limit and below the adjusted reporting limit

L - LCS percent recovery outside limits

U - Elevated reporting limit

Table 5-3, Continued
Sample Data with Data Review and Validation Qualifiers
Site Characterization Investigation
Former Farmland Nitrogen Plant
Lawrence, Kansas

Work Order	Sample Identifier	Duplicate ID	Sample Type	Analyte	Results	Units	Validation	Qualifier Code	Reason	Bias Code
Soil Rpt 13	A01W-SS-03-2-3'		Primary	Nitrogen, Ammonia	<4.3	mg/kg	U	J	Field Blank	
Soil Rpt 10	A01W-SS-05-0-0.67		Primary	Nitrate plus Nitrtite as Nitrogen	<2.8	mg/kg	U	J	Field Blank	
Soil Rpt 10	A01W-SS-05-3-6'		Primary	Nitrate plus Nitrtite as Nitrogen	<2.6	mg/kg	U	J	Field Blank	
Soil Rpt 10	A01W-SS-05-3-6'	Soil Duplicate 12	Duplicate	Nitrate plus Nitrtite as Nitrogen	<2.7	mg/kg	U	J	Field Blank	
Soil Rpt 12	A01W-SS-06-0-0.67'		Primary	Nitrogen, Ammonia	<3	mg/kg	U	J	Field Blank	
Soil Rpt 2	A01W-SS-07-0-0.5'		Primary	Nitrate plus Nitrtite as Nitrogen	<2.3	mg/kg	U	J	Field Blank	
Soil Rpt 2	A01W-SS-07-0-0.5'		Primary	Nitrogen, Ammonia	<2.6	mg/kg	U	J	Field Blank	
Soil Rpt 2	A01W-SS-07-0-0.5'	Soil Duplicate 1	Duplicate	Nitrate plus Nitrtite as Nitrogen	<2.8	mg/kg	U	J	Field Blank	
Soil Rpt 2	A01W-SS-07-0-0.5'	Soil Duplicate 1	Duplicate	Nitrogen, Ammonia	<2.5	mg/kg	U	J	Field Blank	
Soil Rpt 2	A01W-SS-08-0-2'		Primary	Nitrogen, Ammonia	<4.7	mg/kg	U	J	Field Blank	
Soil Rpt 2	A01W-SS-08-2-3'		Primary	Nitrogen, Ammonia	<3.5	mg/kg	U	J	Field Blank	
Soil Rpt 2	A01W-SS-08-3-6'		Primary	Nitrogen, Ammonia	<2.2	mg/kg	U	J	Field Blank	
Soil Rpt 10	A01W-SS-09-0-2'		Primary	Nitrate plus Nitrtite as Nitrogen	<2.2	mg/kg	U	J	Field Blank	
Soil Rpt 11	A01W-SS-10-0.67-3'	Soil Duplicate 14	Duplicate	Nitrate plus Nitrtite as Nitrogen	<2.7	mg/kg	U	J	Field Blank	
Soil Rpt 11	A01W-SS-10-3-6'		Primary	Nitrate plus Nitrtite as Nitrogen	<2.1	mg/kg	U	J	Field Blank	
Soil Rpt 2	A01W-SS-11-0-1.33'		Primary	Nitrogen, Ammonia	<2.9	mg/kg	U	J	Field Blank	
Soil Rpt 2	A01W-SS-12-0-2'		Primary	Nitrogen, Ammonia	<2.9	mg/kg	U	J	Field Blank	
Soil Rpt 2	A01W-SS-12-3-6'		Primary	Nitrogen, Ammonia	<2.3	mg/kg	U	J	Field Blank	
Soil Rpt 2	A01W-SS-12-3-6'	Soil Duplicate 2	Duplicate	Nitrate plus Nitrtite as Nitrogen	<2.3	mg/kg	U	J	Field Blank	
Soil Rpt 2	A01W-SS-12-3-6'	Soil Duplicate 2	Duplicate	Nitrogen, Ammonia	<2.2	mg/kg	U	J	Field Blank	
Soil Rpt 8	A01W-SS-13-6-9'		Primary	Nitrogen, Ammonia	<3.2	mg/kg	U	J	Field Blank	
Soil Rpt 8	A01W-SS-13-9-12'		Primary	Nitrogen, Ammonia	<2.1	mg/kg	U	J	Field Blank	
Soil Rpt 8	A01W-SS-13-9-12'	Soil Duplicate 9	Duplicate	Nitrogen, Ammonia	<3.1	mg/kg	U	J	Field Blank	
Soil Rpt 10	A01W-SS-14-2-3'		Primary	Nitrate plus Nitrtite as Nitrogen	<2.1	mg/kg	U	J	Field Blank	
Soil Rpt 3	A01W-SS-17-12-15'		Primary	Nitrate plus Nitrtite as Nitrogen	<2.5	mg/kg	U	J	Field Blank	
Soil Rpt 3	A01W-SS-17-2-3'		Primary	Nitrate plus Nitrtite as Nitrogen	<2	mg/kg	U	J	Field Blank	
Soil Rpt 8	A01W-SS-19-0-2'		Primary	Nitrogen, Ammonia	<2.8	mg/kg	U	J	Field Blank	
Soil Rpt 7	A01W-SS-21-0-1.5'		Primary	Nitrate plus Nitrtite as Nitrogen	<2.3	mg/kg	U	J	Field Blank	
Soil Rpt 3	A01W-SS-22-0-0.67'	Soil Duplicate 3	Duplicate	Nitrogen, Ammonia	<3.1	mg/kg	U	J	Field Blank	
Soil Rpt 7	A01W-SS-26-0-2'		Primary	Nitrogen, Ammonia	<2	mg/kg	U	J	Field Blank	

D - Duplicate run with high duplicate result

F - Elevated MS/MSD RPD result

G - MS/MSD percent recovery outside reporting limit

J - Estimated concentration above the adjusted method detection limit and below the adjusted reporting limit

L - LCS percent recovery outside limits

U - Elevated reporting limit

Table 5-3, Continued
Sample Data with Data Review and Validation Qualifiers
Site Characterization Investigation
Former Farmland Nitrogen Plant
Lawrence, Kansas

Work Order	Sample Identifier	Duplicate ID	Sample Type	Analyte	Results	Units	Validation	Qualifier Code	Reason	Bias Code
Soil Rpt 7	A01W-SS-26-2-2.25		Primary	Nitrogen, Ammonia	<2.8	mg/kg	U	J	Field Blank	
Soil Rpt 7	A01W-SS-28-0-0.67'		Primary	Nitrate plus Nitrtite as Nitrogen	<2.1	mg/kg	U	J	Field Blank	
Soil Rpt 3	A01W-SS-29-2-3'		Primary	Nitrate plus Nitrtite as Nitrogen	<2.1	mg/kg	U	J	Field Blank	
Soil Rpt 4	A01W-SS-36-0-2'		Primary	Nitrogen, Ammonia	<2.6	mg/kg	U	J	Field Blank	
Soil Rpt 4	A01W-SS-42-2-3'		Primary	Nitrogen, Ammonia	<3.2	mg/kg	U	J	Field Blank	
Soil Rpt 6	A01W-SS-45-0-2'		Primary	Nitrogen, Ammonia	<3.6	mg/kg	U	J	Field Blank	
Soil Rpt 6	A01W-SS-45-2-3'		Primary	Nitrogen, Ammonia	<2.8	mg/kg	U	J	Field Blank	
Soil Rpt 9	A01W-SS-46-0-2'		Primary	Nitrogen, Ammonia	<3.1	mg/kg	U	J	Field Blank	
Soil Rpt 9	A01W-SS-47-2-2.67'		Primary	Nitrogen, Ammonia	<2.2	mg/kg	U	J	Field Blank	
Soil Rpt 41	A04-SS-02-0-2'	Soil Duplicate 48	Duplicate	Nitrogen, Ammonia	<3.3	mg/kg	U	J	Field Blank	
Soil Rpt 44	A04-SS-17-0-2'		Primary	Nitrogen, Ammonia	<3.7	mg/kg	U	J	Field Blank	
Soil Rpt 44	A04-SS-17-2-3'		Primary	Nitrate plus Nitrtite as Nitrogen	<2.1	mg/kg	U	J	Field Blank	
Soil Rpt 51	A06-SS-08-0-2'		Primary	Nitrogen, Ammonia	<2.3	mg/kg	U	J	Field Blank	
Soil Rpt 49	A06-SS-11-0-2'		Primary	Nitrate plus Nitrtite as Nitrogen	<2.1	mg/kg	U	J	Field Blank	
Soil Rpt 49	A06-SS-11-2-2.33'		Primary	Nitrogen, Ammonia	<2.1	mg/kg	U	J	Field Blank	
Soil Rpt 47	A06-SS-23-2-3'		Primary	Nitrogen, Ammonia	<2.5	mg/kg	U	J	Field Blank	
Soil Rpt 51	A06-SS-25-2-3'		Primary	Nitrogen, Ammonia	<2.4	mg/kg	U	J	Field Blank	
Soil Rpt 47	A06-SS-26-0-2'		Primary	Nitrogen, Ammonia	<3.9	mg/kg	U	J	Field Blank	
Soil Rpt 51	A06-SS-28-0-2'		Primary	Nitrogen, Ammonia	<2.3	mg/kg	U	J	Field Blank	
Soil Rpt 47	A08-SS-04-0.67-3'		Primary	Nitrogen, Ammonia	<2.3	mg/kg	U	J	Field Blank	
Soil Rpt 42	A09-SS-01-0-0.67'		Primary	Nitrogen, Ammonia	<3.3	mg/kg	U	J	Field Blank	
Soil Rpt 37	A09-SS-06-0-0.67'		Primary	Nitrogen, Ammonia	<2.2	mg/kg	U	J	Field Blank	
Soil Rpt 39	A09-SS-07-0.67-3'		Primary	Nitrogen, Ammonia	<3.3	mg/kg	U	J	Field Blank	
Soil Rpt 39	A09-SS-07-15-18'		Primary	Nitrogen, Ammonia	<4.3	mg/kg	U	J	Field Blank	
Soil Rpt 39	A09-SS-07-18-21'		Primary	Nitrate plus Nitrtite as Nitrogen	<2.7	mg/kg	U	J	Field Blank	
Soil Rpt 39	A09-SS-07-3-6'		Primary	Nitrogen, Ammonia	<5.1	mg/kg	U	J	Field Blank	
Soil Rpt 39	A09-SS-07-3-6'	Soil Duplicate F	Duplicate	Nitrogen, Ammonia	<4.3	mg/kg	U	J	Field Blank	
Soil Rpt 39	A09-SS-07-6-9'		Primary	Nitrogen, Ammonia	<3.5	mg/kg	U	J	Field Blank	
Soil Rpt 39	A09-SS-07-9-12'		Primary	Nitrogen, Ammonia	<4.2	mg/kg	U	J	Field Blank	
Soil Rpt 43	A09-SS-08-0-0.67'		Primary	Nitrate plus Nitrtite as Nitrogen	<2.2	mg/kg	U	J	Field Blank	

D - Duplicate run with high duplicate result

F - Elevated MS/MSD RPD result

G - MS/MSD percent recovery outside reporting limit

J - Estimated concentration above the adjusted method detection limit and below the adjusted reporting limit

L - LCS percent recovery outside limits

U - Elevated reporting limit

Table 5-3, Continued
Sample Data with Data Review and Validation Qualifiers
Site Characterization Investigation
Former Farmland Nitrogen Plant
Lawrence, Kansas

Work Order	Sample Identifier	Duplicate ID	Sample Type	Analyte	Results	Units	Validation	Qualifier Code	Reason	Bias Code
Soil Rpt 43	A09-SS-08-21-24'		Primary	Nitrate plus Nitrtite as Nitrogen	<2.2	mg/kg	U	J	Field Blank	
Soil Rpt 43	A09-SS-08-24-26'		Primary	Nitrate plus Nitrtite as Nitrogen	<2.4	mg/kg	U	J	Field Blank	
Soil Rpt 39	A09-SS-10-0-0.67'		Primary	Nitrogen, Ammonia	<2.3	mg/kg	U	J	Field Blank	
Soil Rpt 39	A09-SS-12-0-0.67'		Primary	Nitrogen, Ammonia	<2.9	mg/kg	U	J	Field Blank	
Soil Rpt 53	A12-SS-01-0.67-3'	Soil Duplicate 58	Duplicate	Nitrogen, Ammonia	<2.4	mg/kg	U	J	Field Blank	
Soil Rpt 53	A12-SS-03-0.67-3'		Primary	Nitrate plus Nitrtite as Nitrogen	<2.4	mg/kg	U	J	Field Blank	
Soil Rpt 53	A12-SS-03-3-4.25'		Primary	Nitrate plus Nitrtite as Nitrogen	<2.4	mg/kg	U	J	Field Blank	
Soil Rpt 54	A12-SS-06-0.67-3'		Primary	Nitrate plus Nitrtite as Nitrogen	<2.5	mg/kg	U	J	Field Blank	
Soil Rpt 54	A12-SS-06-3-6'		Primary	Nitrate plus Nitrtite as Nitrogen	<2.4	mg/kg	U	J	Field Blank	
Soil Rpt 54	A12-SS-06-6-8'		Primary	Nitrate plus Nitrtite as Nitrogen	<2.4	mg/kg	U	J	Field Blank	
Soil Rpt 46	A14-SS-01-0.67-2'		Primary	Nitrogen, Ammonia	<4	mg/kg	U	J	Field Blank	
Soil Rpt 46	A14-SS-01-12-15'		Primary	Nitrogen, Ammonia	<2.4	mg/kg	U	J	Field Blank	
Soil Rpt 46	A14-SS-01-15-18'		Primary	Nitrogen, Ammonia	<2.4	mg/kg	U	J	Field Blank	
Soil Rpt 46	A14-SS-01-18-21'		Primary	Nitrate plus Nitrtite as Nitrogen	<2.4	mg/kg	U	J	Field Blank	
Soil Rpt 46	A14-SS-01-6-8'		Primary	Nitrate plus Nitrtite as Nitrogen	<2.6	mg/kg	U	J	Field Blank	
Soil Rpt 46	A14-SS-01-9-12'	Soil Duplicate K	Duplicate	Nitrate plus Nitrtite as Nitrogen	<2.1	mg/kg	U	J	Field Blank	
Soil Rpt 48	A14-SS-03-0.67-3'		Primary	Nitrate plus Nitrtite as Nitrogen	<2.4	mg/kg	U	J	Field Blank	
Soil Rpt 48	A14-SS-03-0.67-3'	Soil Duplicate O	Duplicate	Nitrate plus Nitrtite as Nitrogen	<2.5	mg/kg	U	J	Field Blank	
Soil Rpt 48	A14-SS-03-10-12'		Primary	Nitrate plus Nitrtite as Nitrogen	<2.4	mg/kg	U	J	Field Blank	
Soil Rpt 48	A14-SS-03-12-15'		Primary	Nitrate plus Nitrtite as Nitrogen	<2.4	mg/kg	U	J	Field Blank	
Soil Rpt 48	A14-SS-03-18-20'		Primary	Nitrate plus Nitrtite as Nitrogen	<2.4	mg/kg	U	J	Field Blank	
Soil Rpt 48	A14-SS-03-4.5-6'		Primary	Nitrate plus Nitrtite as Nitrogen	<2.5	mg/kg	U	J	Field Blank	
Soil Rpt 48	A14-SS-03-6-9'		Primary	Nitrogen, Ammonia	<2.4	mg/kg	U	J	Field Blank	
Soil Rpt 50	A14-SS-04-0-0.67'		Primary	Nitrate plus Nitrtite as Nitrogen	<2.2	mg/kg	U	J	Field Blank	
Soil Rpt 56	A14-SS-06-0-0.67'		Primary	Nitrate plus Nitrtite as Nitrogen	<2.3	mg/kg	U	J	Field Blank	
Soil Rpt 52	A14-SS-08-3-6'		Primary	Nitrogen, Ammonia	<4.6	mg/kg	U	J	Field Blank	
Soil Rpt 57	A16-SS-02-3-6'		Primary	Nitrogen, Ammonia	<2.3	mg/kg	U	J	Field Blank	
Soil Rpt 36	A17-SS-02-0-2'	Soil Duplicate C	Duplicate	Nitrogen, Ammonia	<2.5	mg/kg	U	J	Field Blank	

D - Duplicate run with high duplicate result

F - Elevated MS/MSD RPD result

G - MS/MSD percent recovery outside reporting limit

J - Estimated concentration above the adjusted method detection limit and below the adjusted reporting limit

L - LCS percent recovery outside limits

U - Elevated reporting limit

Table 5-3, Continued
Sample Data with Data Review and Validation Qualifiers
Site Characterization Investigation
Former Farmland Nitrogen Plant
Lawrence, Kansas

Work Order	Sample Identifier	Duplicate ID	Sample Type	Analyte	Results	Units	Validation	Qualifier Code	Reason	Bias Code
Soil Rpt 36	A17-SS-03-0-2'		Primary	Nitrogen, Ammonia	<2.4	mg/kg	U	J	Field Blank	
Soil Rpt 36	A17-SS-03-3-6'		Primary	Nitrogen, Ammonia	<2.5	mg/kg	U	J	Field Blank	
Soil Rpt 36	A17-SS-08-2-3'		Primary	Nitrogen, Ammonia	<2.3	mg/kg	U	J	Field Blank	
Soil Rpt 33	A17-SS-10-0-2'		Primary	Nitrogen, Ammonia	<2.6	mg/kg	U	J	Field Blank	
Soil Rpt 24	A19-SED-02-0-0.67'		Primary	Nitrogen, Ammonia	<2.3	mg/kg	U	J	Field Blank	
Soil Rpt 29	A19-SED-14-0-0.67'		Primary	Nitrogen, Ammonia	<2.1	mg/kg	U	J	Field Blank	
Soil Rpt 29	Equipment Rinse Blank 10		Primary	Nitrogen, Ammonia	<0.25	mg/l	U	J	Field Blank	
Soil Rpt 26	Equipment Rinse Blank 9		Primary	Nitrate plus Nitrtite as Nitrogen	<0.10	mg/l	U	J	Field Blank	
Soil Rpt 26	Equipment Rinse Blank 9		Primary	Nitrate plus Nitrtite as Nitrogen	<.07	mg/l	U	J	Field Blank	
6094159	MW-06D		Primary	Nitrogen, Ammonia	<4.39	mg/l	U	J	Field Blank	
GW Rpt 1	PSW-03B		Primary	Nitrate plus Nitrite as Nitrogen	<0.07	mg/l	U	J	Field Blank	
GW Rpt 3	PSW-07B		Primary	Nitrate plus Nitrite as Nitrogen	<0.38	mg/l	U	J	Field Blank	
GW Rpt 6	PSW-15		Primary	Nitrate plus Nitrite as Nitrogen	<0.15	mg/l	U	J	Field Blank	
Soil Rpt 1	Soil Rinse Blank 1		Primary	Nitrate plus Nitrtite as Nitrogen	<0.43	mg/l	U	J	Field Blank	
Soil Rpt 20	Soil Rinse Blank 11		Primary	Nitrogen, Ammonia	<0.09	mg/l	U	J	Field Blank	
Soil Rpt 20	Soil Rinse Blank 11		Primary	Nitrate plus Nitrtite as Nitrogen	<0.18	mg/l	U	J	Field Blank	
Soil Rpt 27	Soil Rinse Blank 13		Primary	Nitrate plus Nitrtite as Nitrogen	<0.61	mg/l	U	J	Field Blank	
Soil Rpt 27	Soil Rinse Blank 13		Primary	Nitrogen, Ammonia	<0.15	mg/l	U	J	Field Blank	
Soil Rpt 28	Soil Rinse Blank 14		Primary	Nitrate plus Nitrtite as Nitrogen	<0.21	mg/l	U	J	Field Blank	
Soil Rpt 28	Soil Rinse Blank 14		Primary	Nitrogen, Ammonia	<0.21	mg/l	U	J	Field Blank	
Soil Rpt 32	Soil Rinse Blank 15		Primary	Nitrate plus Nitrtite as Nitrogen	<0.88	mg/l	U	J	Field Blank	
Soil Rpt 32	Soil Rinse Blank 15		Primary	Nitrogen, Ammonia	<0.08	mg/l	U	J	Field Blank	
Soil Rpt 4	Soil Rinse Blank 2		Primary	Nitrate plus Nitrtite as Nitrogen	<0.11	mg/l	U	J	Field Blank	
Soil Rpt 22	Soil Rinse Blank 22		Primary	Nitrate plus Nitrtite as Nitrogen	<0.07	mg/l	U	J	Field Blank	
Soil Rpt 6	Soil Rinse Blank 3		Primary	Nitrate plus Nitrtite as Nitrogen	<0.14	mg/l	U	J	Field Blank	
Soil Rpt 8	Soil Rinse Blank 4		Primary	Nitrate plus Nitrtite as Nitrogen	<0.09	mg/l	U	J	Field Blank	
Soil Rpt 10	Soil Rinse Blank 5		Primary	Nitrate plus Nitrtite as Nitrogen	<0.39	mg/l	U	J	Field Blank	
Soil Rpt 14	Soil Rinse Blank 7		Primary	Nitrogen, Ammonia	<0.09	mg/l	U	J	Field Blank	
Soil Rpt 14	Soil Rinse Blank 7		Primary	Nitrate plus Nitrtite as Nitrogen	<0.16	mg/l	U	J	Field Blank	
Soil Rpt 16	Soil Rinse Blank 8		Primary	Nitrate plus Nitrtite as Nitrogen	<0.06	mg/l	U	J	Field Blank	

D - Duplicate run with high duplicate result

F - Elevated MS/MSD RPD result

G - MS/MSD percent recovery outside reporting limit

J - Estimated concentration above the adjusted method detection limit and below the adjusted reporting limit

L - LCS percent recovery outside limits

U - Elevated reporting limit

Table 5-3, Continued
Sample Data with Data Review and Validation Qualifiers
Site Characterization Investigation
Former Farmland Nitrogen Plant
Lawrence, Kansas

Work Order	Sample Identifier	Duplicate ID	Sample Type	Analyte	Results	Units	Validation	Qualifier Code	Reason	Bias Code
Soil Rpt 16	Soil Rinse Blank 8		Primary	Nitrogen, Ammonia	<0.11	mg/l	U	J	Field Blank	
Soil Rpt 18	Soil Rinse Blank 9		Primary	Nitrate plus Nitrtite as Nitrogen	<0.23	mg/l	U	J	Field Blank	
Soil Rpt 18	Soil Rinse Blank 9		Primary	Nitrogen, Ammonia	<0.13	mg/l	U	J	Field Blank	
Soil Rpt 37	Soil Rinse Blank A		Primary	Nitrogen, Ammonia	<0.20	mg/l	U	J	Field Blank	
GW Rpt 1	Water Rinse Blank 1		Primary	Nitrate plus Nitrite as Nitrogen	<0.05	mg/l	U	J	Field Blank	
GW Rpt 4	Water Rinse Blank 4		Primary	Nitrate plus Nitrite as Nitrogen	<0.08	mg/l	U	J	Field Blank	
GW Rpt 5	Water Rinse Blank 5		Primary	Nitrate plus Nitrite as Nitrogen	<0.06	mg/l	U	J	Field Blank	
6097619	A02-SED-27A-TCLP		Primary	Barium TCLP	<1.29	mg/kg	U	J	Method Blank	
6097619	A02-SED-35A TCLP		Primary	BariumTCLP	<0.668	mg/kg	U	J	Method Blank	
6093849	Equipment Rinse Blank 7		Primary	Barium	<14.3	mg/kg	U	J	Method Blank	
GW Rpt 2	MW-11		Primary	Nitrogen, Ammonia	<0.10	mg/l	U	J	Method Blank	
GW Rpt 2	OW-19		Primary	Nitrogen, Ammonia	<0.11	mg/l	U	J	Method Blank	
GW Rpt 2	Water Rinse Blank 2		Primary	Nitrogen, Ammonia	<0.14	mg/l	U	J	Method Blank	
6093364	A02-SED-03-0-2'		Primary	Acetone	<0.140	mg/kg	U	J	Rinsate Blank	
6093555	A02-SED-13-0-2'		Primary	Mercury	<1.11	mg/kg	U	J	Rinsate Blank	
6093555	A02-SED-13-2-4'	Duplicate 7	Duplicate	Mercury	<0.748	mg/kg	U	J	Rinsate Blank	
6093555	A02-SED-14-0-2'		Primary	Mercury	<0.743	mg/kg	U	J	Rinsate Blank	
6093555	A02-SED-14-2-4'		Primary	Mercury	<1.90	mg/kg	U	J	Rinsate Blank	
6093555	A02-SED-15-0-2.5'		Primary	Mercury	<0.833	mg/kg	U	J	Rinsate Blank	
6093555	A02-SED-15-2.5-5'		Primary	Mercury	<1.29	mg/kg	U	J	Rinsate Blank	
6093555	A02-SED-17-0-2'		Primary	Mercury	<0.546	mg/kg	U	J	Rinsate Blank	
6093555	A02-SED-18-0-2'		Primary	Mercury	<0.903	mg/kg	U	J	Rinsate Blank	
6093555	A02-SED-18-2-4'		Primary	Mercury	<0.786	mg/kg	U	J	Rinsate Blank	
6093555	A02-SED-18-4-5'		Primary	Mercury	<0.617	mg/kg	U	J	Rinsate Blank	
6093555	A02-SED-19-0-2'		Primary	Mercury	<1.44	mg/kg	U	J	Rinsate Blank	
6093555	A02-SED-19-4-5'		Primary	Mercury	<1.07	mg/kg	U	J	Rinsate Blank	
6093555	A02-SED-20-0-2'		Primary	Mercury	<0.290	mg/kg	U	J	Rinsate Blank	
6093555	A02-SED-21-0-2'		Primary	Mercury	<0.728	mg/kg	U	J	Rinsate Blank	
6093555	A02-SED-21-2-4'		Primary	Mercury	<0.518	mg/kg	U	J	Rinsate Blank	
6093555	A02-SED-22-2-4'		Primary	Mercury	<0.523	mg/kg	U	J	Rinsate Blank	

D - Duplicate run with high duplicate result

F - Elevated MS/MSD RPD result

G - MS/MSD percent recovery outside reporting limit

J - Estimated concentration above the adjusted method detection limit and below the adjusted reporting limit

L - LCS percent recovery outside limits

U - Elevated reporting limit

Table 5-3, Continued
Sample Data with Data Review and Validation Qualifiers
Site Characterization Investigation
Former Farmland Nitrogen Plant
Lawrence, Kansas

Work Order	Sample Identifier	Duplicate ID	Sample Type	Analyte	Results	Units	Validation	Qualifier Code	Reason	Bias Code
6093555	A02-SED-23-0-2'		Primary	Mercury	<0.378	mg/kg	U	J	Rinsate Blank	
6093555	A02-SED-26-0-2'		Primary	Mercury	<0.261	mg/kg	U	J	Rinsate Blank	
6093448	A02-SED-48-0-2'		Primary	Mercury	<0.285	mg/kg	U	J	Rinsate Blank	
GW Rpt 4	MW-04		Primary	Nitrogen, Ammonia	<0.16	mg/l	U	J	Rinsate Blank	
GW Rpt 4	MW-09		Primary	Nitrogen, Ammonia	<0.24	mg/l	U	J	Rinsate Blank	
GW Rpt 3	PSW-01B		Primary	Nitrogen, Ammonia	<0.46	mg/l	U	J	Rinsate Blank	
GW Rpt 3	PSW-02A		Primary	Nitrogen, Ammonia	<0.09	mg/l	U	J	Rinsate Blank	
GW Rpt 3	PSW-02B		Primary	Nitrogen, Ammonia	<0.20	mg/l	U	J	Rinsate Blank	
GW Rpt 5	PSW-09A		Primary	Nitrogen, Ammonia	<0.80	mg/l	U	J	Rinsate Blank	
GW Rpt 5	PSW-09B		Primary	Nitrogen, Ammonia	<0.25	mg/l	U	J	Rinsate Blank	
GW Rpt 5	PSW-09B	GW Duplicate 3	Duplicate	Nitrogen, Ammonia	<0.35	mg/l	U	J	Rinsate Blank	
Soil Rpt 15	A01NE-GW-02-27'		Primary	Nitrate plus Nitrite as Nitrogen	2550	mg/l	J	L	LCS % REC	H
Soil Rpt 16	A01NE-GW-03-27'		Primary	Nitrate plus Nitrite as Nitrogen	892	mg/l	J	L	LCS % REC	H
Soil Rpt 17	A01NE-GW-07-23'		Primary	Nitrogen, Ammonia	5420	mg/l	J	L	LCS % REC	H
Soil Rpt 18	A01NE-GW-14		Primary	Nitrate plus Nitrite as Nitrogen	555	mg/l	J	L	LCS % REC	H
Soil Rpt 17	A01NE-SS-07-0.67-3'		Primary	Nitrate plus Nitrtite as Nitrogen	4.4	mg/kg	J	L	LCS % REC	H
Soil Rpt 17	A01NE-SS-07-0-0.67'		Primary	Nitrate plus Nitrtite as Nitrogen	31.7	mg/kg	J	L	LCS % REC	H
Soil Rpt 17	A01NE-SS-07-12-13.5'		Primary	Nitrate plus Nitrtite as Nitrogen	841	mg/kg	J	L	LCS % REC	H
Soil Rpt 17	A01NE-SS-07-16-18'		Primary	Nitrate plus Nitrtite as Nitrogen	1010	mg/kg	J	L	LCS % REC	H
Soil Rpt 17	A01NE-SS-07-18-21'		Primary	Nitrate plus Nitrtite as Nitrogen	970	mg/kg	J	L	LCS % REC	H
Soil Rpt 17	A01NE-SS-07-21-23'		Primary	Nitrate plus Nitrtite as Nitrogen	965	mg/kg	J	L	LCS % REC	H
Soil Rpt 17	A01NE-SS-07-24-27'		Primary	Nitrate plus Nitrtite as Nitrogen	1930	mg/kg	J	L	LCS % REC	H
Soil Rpt 17	A01NE-SS-07-28-30'		Primary	Nitrate plus Nitrtite as Nitrogen	2270	mg/kg	J	L	LCS % REC	H
Soil Rpt 17	A01NE-SS-07-30-31'		Primary	Nitrate plus Nitrtite as Nitrogen	1660	mg/kg	J	L	LCS % REC	H
Soil Rpt 17	A01NE-SS-07-6-9'		Primary	Nitrate plus Nitrtite as Nitrogen	233	mg/kg	J	L	LCS % REC	H
Soil Rpt 17	A01NE-SS-07-6-9'	Soil Duplicate 21	Duplicate	Nitrate plus Nitrtite as Nitrogen	216	mg/kg	J	L	LCS % REC	H
Soil Rpt 17	A01NE-SS-07-9-12'		Primary	Nitrate plus Nitrtite as Nitrogen	601	mg/kg	J	L	LCS % REC	H
Soil Rpt 12	A01W-GW-02-23'		Primary	Nitrate plus Nitrite as Nitrogen	11	mg/l	J	L	LCS % REC	H
Soil Rpt 13	A01W-GW-03-18'		Primary	Nitrate plus Nitrite as Nitrogen	478	mg/l	J	L	LCS % REC	H
Soil Rpt 12	A01W-GW-06-9'		Primary	Nitrate plus Nitrite as Nitrogen	17.2	mg/l	J	L	LCS % REC	H

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F - Elevated MS/MSD RPD result

G - MS/MSD percent recovery outside reporting limit

J - Estimated concentration above the adjusted method detection limit and below the adjusted reporting limit

L - LCS percent recovery outside limits

U - Elevated reporting limit

Table 5-3, Continued
Sample Data with Data Review and Validation Qualifiers
Site Characterization Investigation
Former Farmland Nitrogen Plant
Lawrence, Kansas

Work Order	Sample Identifier	Duplicate ID	Sample Type	Analyte	Results	Units	Validation	Qualifier Code	Reason	Bias Code
Soil Rpt 11	A01W-GW-10-9'		Primary	Nitrate plus Nitrite as Nitrogen	7.13	mg/l	J	L	LCS % REC	H
6094890	A11-SS-01-0.5-3'		Primary	Hexachlorobutadiene	<5.7	mg/kg	J	L	LCS % REC	L
6094890	A11-SS-01-0-0.5'		Primary	Hexachlorobutadiene	<5.9	mg/kg	J	L	LCS % REC	L
6094890	A11-SS-01-3-5'		Primary	Hexachlorobutadiene	<5.4	mg/kg	J	L	LCS % REC	L
6094890	A11-SS-02-0.5-3'		Primary	Hexachlorobutadiene	<5.5	mg/kg	J	L	LCS % REC	L
6094890	A11-SS-02-0-0.5'		Primary	Hexachlorobutadiene	<5.6	mg/kg	J	L	LCS % REC	L
6094890	A11-SS-02-3-5.75'		Primary	Hexachlorobutadiene	<5.6	mg/kg	J	L	LCS % REC	L
6094890	A11-SS-03-0.5-2.5'		Primary	Hexachlorobutadiene	<5.6	mg/kg	J	L	LCS % REC	L
6094890	A11-SS-03-0-0.5'		Primary	Hexachlorobutadiene	<7.3	mg/kg	J	L	LCS % REC	L
6094890	A11-SS-04-0.5-0.67'		Primary	Hexachlorobutadiene	<4.5	mg/kg	J	L	LCS % REC	L
6094890	A11-SS-04-0-0.5'		Primary	Hexachlorobutadiene	<8.6	mg/kg	J	L	LCS % REC	L
6094890	A11-SS-10-0.5-1.33'		Primary	Hexachlorobutadiene	<6.1	mg/kg	J	L	LCS % REC	L
6094890	A11-SS-10-0-0.5'		Primary	Hexachlorobutadiene	<5.5	mg/kg	J	L	LCS % REC	L
6093505	Equipment Rinse (4/14/05)		Primary	tert-butyl Alcohol	<0.010	mg/l	J	L	LCS % REC	L
GW Rpt 2	MW-11		Primary	Nitrate plus Nitrite as Nitrogen	0.86	mg/l	J	L	LCS % REC	H
GW Rpt 1	N-01		Primary	Nitrate plus Nitrite as Nitrogen	414	mg/l	J	L	LCS % REC	H
GW Rpt 1	N-02		Primary	Nitrate plus Nitrite as Nitrogen	1620	mg/l	J	L	LCS % REC	H
GW Rpt 2	OW-19		Primary	Nitrate plus Nitrite as Nitrogen	1.96	mg/l	J	L	LCS % REC	H
GW Rpt 1	PSW-03A		Primary	Nitrate plus Nitrite as Nitrogen	703	mg/l	J	L	LCS % REC	H
GW Rpt 1	PSW-08		Primary	Nitrate plus Nitrite as Nitrogen	7.66	mg/l	J	L	LCS % REC	H
GW Rpt 2	PSW-13A		Primary	Nitrate plus Nitrite as Nitrogen	1040	mg/l	J	L	LCS % REC	H
GW Rpt 2	PSW-13B		Primary	Nitrate plus Nitrite as Nitrogen	861	mg/l	J	L	LCS % REC	H
GW Rpt 2	PSW-17		Primary	Nitrate plus Nitrite as Nitrogen	280	mg/l	J	L	LCS % REC	H
GW Rpt 2	PW-01		Primary	Nitrate plus Nitrite as Nitrogen	1780	mg/l	J	L	LCS % REC	H
GW Rpt 2	PW-01	GW Duplicate 1a	Duplicate	Nitrate plus Nitrite as Nitrogen	1780	mg/l	J	L	LCS % REC	H
GW Rpt 2	SW-10		Primary	Nitrate plus Nitrite as Nitrogen	34.9	mg/l	J	L	LCS % REC	H
6094890	Trip Blank 1		Primary	Hexachlorobutadiene	<0.005	mg/l	J	L	LCS % REC	L
GW Rpt 1	PSW-03B		Primary	Nitrate plus Nitrite as Nitrogen	<0.07	mg/l	J	L	LCS % REC	H
Soil Rpt 21	A01NE-SS-08-28-30'		Primary	Nitrate plus Nitrtite as Nitrogen	12.7	mg/kg	J	Z	LAB DUP RPD	
Soil Rpt 34	A01SE-SS-14-0-2'		Primary	Nitrogen, Ammonia	[1.8]	mg/kg	J	Z	LAB DUP RPD	

D - Duplicate run with high duplicate result

F - Elevated MS/MSD RPD result

G - MS/MSD percent recovery outside reporting limit

J - Estimated concentration above the adjusted method detection limit and below the adjusted reporting limit

L - LCS percent recovery outside limits

U - Elevated reporting limit

Table 5-3, Continued
Sample Data with Data Review and Validation Qualifiers
Site Characterization Investigation
Former Farmland Nitrogen Plant
Lawrence, Kansas

Work Order	Sample Identifier	Duplicate ID	Sample Type	Analyte	Results	Units	Validation	Qualifier Code	Reason	Bias Code
6096528	A02-SED-45A-0-2'		Primary	Chromium (Hexavalent)	<1.46	mg/kg	J	Z	LAB DUP RPD	
6093301	A02-SED-59-2-4'		Primary	Total Kjeldahl Nitrogen	156	mg/kg	J	Z	LAB DUP RPD	
Soil Rpt 51	A06-SS-03-2-3'		Primary	Nitrate plus Nitrtite as Nitrogen	[0.6]	mg/kg	J	Z	LAB DUP RPD	
Soil Rpt 57	A16-SS-01-2-2.33'		Primary	Nitrogen, Ammonia	<2	mg/kg	J	Z	LAB DUP RPD	
Soil Rpt 33	A17-SS-10-0-2'		Primary	Nitrogen, Ammonia	<2.6	mg/kg	J	Z	LAB DUP RPD	
GW Rpt 8	MW-06		Primary	Nitrate plus Nitrite as Nitrogen	<0.06	mg/l	J	Z	LAB DUP RPD	
GW Rpt 1	PSW-03B		Primary	Nitrate plus Nitrite as Nitrogen	<0.07	mg/l	J	Z	LAB DUP RPD	
GW Rpt 5	PSW-05A		Primary	Nitrogen, Ammonia	0.36	mg/l	J	Z	LAB DUP RPD	
Soil Rpt 38	Soil Rinse Blank 17		Primary	Nitrate plus Nitrtite as Nitrogen	<0.06	mg/l	J	Z	LAB DUP RPD	
Soil Rpt 53	Soil Rinse Blank 24		Primary	Nitrogen, Ammonia	<0.06	mg/l	J	Z	LAB DUP RPD	

D - Duplicate run with high duplicate result

F - Elevated MS/MSD RPD result

G - MS/MSD percent recovery outside reporting limit

J - Estimated concentration above the adjusted method detection limit and below the adjusted reporting limit

L - LCS percent recovery outside limits

U - Elevated reporting limit

Field duplicate samples were to be collected as specified in the Work Plan at a frequency of one per ten environmental samples. Confirmation (inter-laboratory duplicate) samples were to be collected for verification of on-site laboratory analysis by the off-site laboratory at the frequency of one per 15 environmental samples. One hundred seventy-seven (177) field duplicates were collected in the form of inter-laboratory duplicate samples (68 samples) and field duplicates (109 samples) during field investigation activities. Twelve (12) laboratory duplicates, forty (40) field duplicates and sixty-eight (68) inter-laboratory duplicate confirmation sample results exhibited high RPD results. As stated in CLP Data Validation Guidelines duplicate sample analysis will be qualified based on if the results of the duplicate fall outside the acceptable RPD. If the RPD for the field duplicate and associated sample is outside an acceptable limit (50% for soils, 20% for water, or associated laboratory limit) the samples results and reporting limit for the constituent will be coded as estimated. Additional samples may be coded if the reviewer considers the samples sufficiently similar to the duplicate sample. Seven (7) soil and five groundwater samples were "J" coded with a "Z" qualifier as estimated data based on high laboratory duplicate RPD results. The following constituents were coded:

- Hexavalent Chromium – 1 soil sample;
- TKN – 1 soil sample;
- Ammonia as Nitrogen – 2 water and 3 soil samples; and,
- Nitrate plus Nitrite – 3 water and 2 soil samples.

Thirty-six (36) soil and four (4) groundwater results were coded "J" with a "D" qualifier as estimated data based on high field duplicate RPD results. The following constituents were coded:

- Selenium – 2 soil samples;
- Nitrate plus Nitrite – 2 soil samples;
- Arsenic – 2 soil and 2 groundwater samples;
- Ammonia as Nitrogen – 2 soil and 2 groundwater samples;
- Barium – 4 soil samples;
- Lead – 6 soil samples;
- TKN – 6 soil samples; and
- Chromium – 12 soil samples.

Sixty-six (66) soil and two (2) groundwater samples were "J" coded with a "D" qualifier as estimated data based on high confirmation sample RPD results. The following constituents were coded:

- Barium – 2 soil samples;
- TKN – 2 soil samples;
- Arsenic – 6 soil samples
- Chromium – 8 soil samples;
- Nitrate plus Nitrite – 12 soil samples; and
- Ammonia as Nitrogen – 2 groundwater and 36 soil samples.

Rinse blanks were to be collected one per day and a field blank was to be collected from the primary water sources at the site. Trip blanks were to be submitted one per cooler containing samples for VOC analysis. Two (2) field blanks, seventy-five (75) rinse blanks and nine (9) trip blanks were collected for analysis during field investigation activities. However, several field and rinse blanks reported detectable concentrations of the contaminant of concern. As stated in CLP Data Validation

Guidelines, any type of field blank (rinseate, field and/or trip) is evaluated the same as the laboratory method blank. For common laboratory contaminants ten times the value in the blank is used to qualify the associated data. For all other contaminants five times the value in the blank is used to qualify the associated data. The procedure states that concentrations in primary samples are evaluated by comparing the reported concentration (if any) to the value of five or ten times the value in the blank considering which contaminant it is. The data validation guidelines state that if the reported concentration is less than five/ten times the value of the blank then the data is qualified by changing the reported result to less than ("U code") with an elevated reporting limit. Because of field blank contamination, one hundred twenty-six (126) soil samples and thirty-two (32) groundwater samples were "U" coded with an elevated reporting limit including a "J" qualifier. Based on rinse blank contamination nineteen (19) soil and nine (9) groundwater samples were "U" coded with an elevated reporting limit including a "J" qualifier. Using the guidelines provided above three (3) soil and three (3) groundwater samples were U" coded with an elevated reporting limit including a "J" qualifier due to method blank contamination. Eight (8) of the required trip blanks were included in the sample coolers but not analyzed by the laboratory however no compounds were detected in those trip blanks that were analyzed indicating cross-contamination during shipment is not an issue. Three of the required (3) rinsate blanks were not collected during sediment sampling activities however it was determined that the root cause of field/rinsate blank contamination was due to the water source rather than field procedures. Therefore, the lack of rinsate blank results for the sediment sample does not adversely impact the results obtained.

Twenty-eight (28) soil samples were "J" coded with a "G" qualifier due to MS/MSD percent recovery outside limits. Fourteen (14) of the samples were coded biased high and fourteen (14) as biased low. Thirty soil samples were "J" coded with an "F" qualifier based on a high MS/MSD RPD result. Twenty-four soil and twenty-three groundwater samples were "J" coded with an "L" qualifier due to LCS percent recovery outside limits. Thirty-three of the samples were coded biased high and 14 as biased low.

KDHE Split Samples

During the course of SC field activities, a representative from KDHE was on site to observe sampling activities and to collect split samples. These events are summarized below:

- On April 19 and 20, 2005, Mr. Kurt Limesand of the KDHE collected split groundwater samples from monitoring wells MW-03, MW-05 and MW-06. The groundwater samples were analyzed for nitrate plus nitrite as nitrogen using USEPA Method 300.0, ammonia using USEPA Method 350.1, and metals using USEPA Method 200.7. Relative percent difference (RPD) calculations were performed on the data between the on-site laboratory results and the results obtained by the KDHE Laboratory. The RPD were within twenty (20) percent for all analytes in the split samples, except for Chromium in MW-03 and nitrate plus nitrite as nitrogen in MW-05. The KDHE split sample for MW-05 was analyzed for metals, however the original MW-05 sample submitted to the on-site laboratory was not. Therefore no comparison could be made between these samples.

- On March 29, 2005, Mr. Kurt Limesand with the KDHE collected a split sediment sample from location A01NE-SED-15-0-2'. The sample was analyzed by the Division of Health and

Environmental Laboratories (KDHE laboratory) for total metals using EPA Method 6010. On April 6, 2005, Mr. Limesand collected a groundwater split sample from location A01W-GW-06-9'. The sample was analyzed by the KDHE laboratory for Ammonia using EPA Method 350.1. Relative percent difference was calculated between the results from the original samples and the split sample results. All RPDs for the samples were below fifty (50) percent in soil and twenty (20) percent in groundwater.

- On May 4, 2005, Mr. Kurt Limesand with the KDHE collected a split soil samples from locations A05-SS-05-4-8.5' and A05-SS-06-4-6.5'. The samples were analyzed by the KDHE laboratory for total metals using EPA Method 6010 and 245.1. Relative percent difference was calculated between the results from original samples and the split sample results. All RPDs for the samples were below fifty (50) percent in soil except for arsenic, cadmium and chromium in sample A05-SS-05-4-8.5' and arsenic, barium, chromium and lead in sample A05-SS-06-4-6.5'. Both samples were collected within the fill material of the Catalyst Landfill.

Summary

The data review indicates that with a few exceptions the data can be used as intended for the project. Sample results that are coded as estimated are still useable to achieve the project objectives. The completeness criterion of 100 percent for primary samples has been achieved for the project because all primary samples were collected as specified in the Work Plan during field investigation activities. All primary data can be used as intended to achieve the project objectives stated in the Work Plan.

6.0 CONCLUSIONS

Site Characterization activities for the Property were completed as outlined in the KDHE-approved SC Work Plan. Field activities were completed from late March to early May 2005, with additional sampling events occurring in June and July 2005. The primary objective of the site characterization was to collect environmental data to identify the aerial and vertical extent of the targeted analytes at the property. To achieve this objective the site was classified into six site areas based on former property use or natural site boundaries. These areas are:

- Area A: UAN Storage Area
- Area B: Northern Ponds
- Area C: Northwest Site Area
- Area D: Operations Area
- Area E: Southwest Site Area
- Area F: Southeast Site Area

The targeted analytes of the SC were nitrates, ammonia, RCRA metals, TPHs, VOC, and PCBs. These were targeted per the specific site areas based on past operational activities and previous site investigations.

In support of this effort 404 sample locations were sampled, generating over 1,200 samples. These samples were submitted for analysis for the following constituents:

- 838 soils, 184 sediment and 29 groundwater samples were analyzed for Nitrate plus Nitrite and Ammonia as Nitrogen;
- 153 sediment samples were analyzed for TKN;
- 82 soils, 165 sediment and 1 groundwater samples were analyzed for RCRA metals;
- 54 sediment samples were analyzed for Hexavalent Chromium;
- 33 soil and 3 sediment samples were analyzed for TPH;
- 22 soil and 19 sediment samples were analyzed for VOCs; and
- 4 soil samples were analyzed for PCBs.

Three site areas were deemed to have not been impacted by former plant operations and require no further action. These areas are Areas C, E, and F which comprise 225 acres of the 467 acre site area. These areas are vegetated, and concentrations for total nitrate plus ammonia were below the RSK threshold value of 200 mg/kg.

The remaining site areas comprising the remaining 242 acres of the site were found to contain areas of interest. Some of these areas will be considered for interim measures. The AOIs identified are:

Area A

Central Ponds: Site Characterization data obtained from and in the vicinity of the Central Ponds indicates that total nitrogen contamination is limited to the pond area, with total nitrogen concentrations measured in excess of 10,000 mg/kg. Samples collected outside of the pond area were observed to have total nitrogen concentrations at levels of less than 100 mg/kg. It is recommended that the Central Ponds, which are intermittently full of surface water runoff (depression storage), be allowed to dry sufficiently and the sediment material contained within the ponds be excavated to bedrock and the area re-graded to eliminate the possibility of depression storage from occurring.

6,000,000-Gallon UAN AST Area: Analytical results indicated that the subsurface soils in this 12-acre area immediately adjacent to this tank and extending to the west have been impacted by former UAN production and storage activities. Total nitrogen concentrations are observed to increase at depth with levels in excess of 1,000 mg/kg

Bag Warehouse Area: A 2-acre area along the northern and eastern ends of the Bag Warehouse has been impacted by former UAN production and storage activities. Total nitrogen concentrations are observed to increase with depth, with levels in excess of 1,000 mg/kg.

Northern Reach of Primary Drainage Ditch: Although Area C has been interpreted as not having been impacted by former plant operations, it was observed that the northern third of the primary drainage ditch for the site has received nitrogen-impacted sediment from Area A. Area A borders the western bank of this ditch, and as it extends east along the southern end of the Northern Ponds. Analytical results for these collected samples indicated total nitrogen levels greater than 1,000 mg/kg.

Area D

Urea Runoff Storage Vault and Urea Production Area: Although the majority of samples collected in the Urea Production Area indicated total nitrogen concentrations in soils in excess of 100 mg/kg, it was noted that total nitrogen concentrations increased with depth in the vicinity of the Urea Runoff Storage Vault. Total nitrogen concentrations in this area were measured in excess of 1,000 mg/kg.

Oil Pond: Three locations were sampled in the footprint of the Oil Pond that was formerly used for fire training activities. Waste oil was burned in this pond for the fire training exercises. Analytical results indicated that residual petroleum hydrocarbons are present in the soil contained in the pond area. The highest observed TPH concentration in the soil samples collected was 560 mg/kg.

Spill Pond: Three locations were sampled in the footprint of the Spill Pond that was used formerly for containing spilled # 2 fuel oil. This fuel oil was contained in two ASTs and utilized for a

backup energy source for on-site electrical generators. Analytical results indicated that residual petroleum hydrocarbons are present in the soil contained in the pond area. The range of TPH concentrations observed in sediment samples from this pond was 640 mg/kg to 4,500 mg/kg.

Catalyst Landfill: The location of the Catalyst Landfill was defined during site characterization activities. A sample of the catalyst material was retrieved at a depth of approximately 4 to 8 feet at sample location A05-SS-05 and was submitted for analysis. Total chromium was detected in this sample at a concentration of 10,100 mg/kg. A second sample was retrieved in this general location and submitted for TCLP analysis with a reported result of non detect for this catalyst material for Arsenic, Cadmium, Chromium, Lead, Mercury, Selenium, and Silver. Barium was detected at a concentration of 1.3 mg/l, which is well below the regulatory limit of 100 mg/l. The Catalyst Landfill covers approximately .04 acres.

Ammonia Production-Primary Reformer Area: A 0.8-acre area at the Primary Reformer was found to have total nitrogen concentrations between 100 and 1,000 mg/kg with concentrations increasing with depth.

It is also recommended that additional background concentration information be collected via limited sampling efforts. Based on the SC data, it is apparent that ammonia and nitrates, chromium, arsenic, and TPHs are present on site at levels of interest. As TPHs are not naturally occurring, background levels for comparative purposes would be zero. It was also suspected that ammonia and nitrate levels would be elevated in areas on site due to the past manufacture of nitrogen-containing compounds on site, and that appropriate cleanup levels would need to be determined based on background concentrations in soils and groundwater.

In addition, background concentrations for arsenic and chromium in native soils and groundwater will need to be established. Based on the results of this investigation, it is recommended that additional background samples be collected upgradient of the site in areas that would not have been impacted by property operations. These data are necessary to complete background environmental quality characterization for the identified analytes and to support the development of appropriate cleanup goals. It is also recommended that select monitoring wells north of the six primary ponds be re-sampled, and the samples be submitted for arsenic analysis to confirm the arsenic levels observed during SC sampling activities.

Extent of Impacted Groundwater

Impacted groundwater is present at the site. Groundwater samples from 39 groundwater monitoring wells and 29 groundwater samples collected using a Geoprobe® rig were analyzed for nitrogen compounds (nitrate, nitrite, and ammonia). Nitrate-nitrogen (Nitrate-N) was detected above U.S.E.P.A. Maximum Contaminant Level (MCL) of 10 mg/L in 21 of 39 groundwater monitoring wells and 23 of 29 Geoprobe® groundwater samples. High concentrations of ammonia-nitrogen (ammonia-N) were also detected in groundwater; however, there is no MCL for ammonia.

Groundwater samples from 14 groundwater monitoring wells were analyzed for RCRA metals (Arsenic, Barium, Cadmium, Chromium, Lead, Mercury, Selenium, and Silver). Arsenic was detected above the MCL of 10 µg/L in 12 of 14 wells. None of the other RCRA metals were detected at concentrations above the MCL.

Silty Clay Aquifer

Nitrate-N concentrations range from 0.15 to 33,310 mg/L in the Silty Clay Aquifer. Nitrate-N concentrations were highest near the former West Pond and Krehbiel Pond. Another area of high (>100 mg/L) nitrate-N concentrations is in the vicinity of the former No. 2 Urea Bulk Warehouse. The highest concentration of nitrate-N in any groundwater samples from this location was 33,310 mg/L in Geoprobe® sample A01NE-GW-16. Concentrations of less than 10 mg/L are found south of the former No. 2 Urea Bulk Warehouse and north of the railroad tracks forming the northern boundary of the site.

Ammonia-N concentrations range from less than 0.06 to 51,640 mg/L in the Silty Clay Aquifer. Ammonia-N concentrations were highest near the West Pond and Krehbiel Pond. The area around the #2 Urea Bulk Warehouse was observed to have Ammonia-N concentrations in excess of 1,000 mg/l. Concentrations of less than 10 mg/L are found south of the former No. 2 Urea Bulk Warehouse and north of the railroad tracks forming the northern boundary of the site.

Six wells screened in the Silty Clay Aquifer were analyzed for Arsenic. Arsenic concentrations range from 14.7 to 138 µg/L in the six groundwater samples collected from the Silty Clay Aquifer and analyzed for metals. All the wells sampled for arsenic are in the vicinity of the northern ponds. Arsenic concentrations were highest in monitoring well PSW-03A located north of the West Lime Pond.

Deep Alluvial Aquifer

Nitrate-N concentrations range from less than 0.06 to 24.2 mg/L in the Deep Alluvial Aquifer. Nitrate-N concentrations exceeded the MCL of 10 mg/L only in the northwest portion of the property in groundwater monitoring well PW-09 (24.2 mg/L).

Ammonia-N concentrations range from 0.2 to 31.9 mg/L in the Deep Alluvial Aquifer. Ammonia-N concentrations exceeded 10 mg/L only in the northwest portion of the property in groundwater monitoring well PW-09 (31.9 mg/L).

Six wells screened in the Deep Alluvial Aquifer were analyzed for arsenic. Arsenic concentrations range from less than 10 to 41.1 µg/L in the Lower Aquifer. Arsenic concentration was highest in monitoring well PSW-03B, located north of the West Lime Pond.

Bedrock Water Bearing Zone

Nitrate-N concentrations range from less than 0.06 to 1,780 mg/L in the Bedrock water bearing zone. Nitrate-N concentrations were highest in groundwater monitoring well PW-01 (1,780 mg/L) and in monitoring well N-02 (1,620 mg/L) on top of the sandstone hill at the former UAN lagoons

and present location of the 6,000,000-gallon AST. Nitrate-N concentrations in wells in the Chrome Destruct Area ranged from less than 0.06 mg/L to 98.9 mg/L.

Ammonia-N concentrations range from less than 0.06 to 1,140 mg/L in the Bedrock Water Bearing Zone. Ammonia-N concentrations were greater than 10 mg/L only in groundwater monitoring wells PW-01 (900 mg/L) and N-02 (1,150 mg/L).

Two wells screened in the Bedrock Water Bearing Zone were analyzed for arsenic. Arsenic concentrations range from less than 10 to 21.6 µg/L. Arsenic concentrations were measured in monitoring well MW-06 at a concentration of 21.6 mg/L.

In summary, based on the well control across the site, impacted groundwater appears to be localized in several areas that are directly linked to past plant operations that produced ammonia, urea, or stored nitrogen containing materials. These areas are Area A and Area B with the highest concentrations of nitrate and ammonia observed along the north and northeastern perimeter of Area A and at the West Extension Pond and the Ammonia Plant. The West Extension Pond, West Pond, and Krehbiel Pond areas were observed to have the highest nitrate and ammonia concentrations in groundwater. Elevated Nitrate levels in groundwater directly correlated with areas of total nitrogen-impacted soil.

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