SECTION 3
SOURCE CHARACTERIZATION AND POTENTIAL EXPOSURE

Over the past decade, a total of 84 sites, including 39 SWMUs, 40 AOCs, and 5 Range Management Units (RMUs) have been identified at CSSA. The scale of the sites ranges from localized areas of surficial debris or burn areas to multi-acre disposal trenches. Analytical data suggest that PCE, TCE, and *cis*-1,2-DCE are the primary contaminants of concern (COC) in groundwater, and metals are the primary COCs in soil. Figure 3.1 depicts locations of currently identified SWMUs, AOCs, and RMUs.

As of December 2004, a total of 23 sites have been closed, with another 20 sites with closures pending. The remaining sites are being evaluated under the Texas Risk Reduction Rules and the Texas Risk Reduction Program (TRRP). Thus far, a total of 68 sites have been investigated, and remediation is currently being conducted at 34 sites. However, only a few sites investigated are considered to be likely sources for the VOC contamination within the Middle Trinity aquifer. These include two SWMUs (B-3 and O-1) located near Well CS-16 and AOC-65 located near the SW corner of the post.

3.1. SWMU B-3

3.1.1 B-3 Background

Presumably during the 1980's, SWMU B-3 was a landfill area thought to have been used primarily for garbage disposal and trash burning. The trench areas were reportedly closed in 1990-1991. In 1991, chlorinated hydrocarbons were detected in groundwater from Well CS-16 approximately 500 ft north-northwest of SWMU B-3. The VOC concentrations, which were above drinking water standards, prompted several investigations aimed at identifying possible source areas that could have contributed to the contamination.

Background information regarding the location, size, and known historical use of the site is included in the CSSA Environmental Encyclopedia (**Volume 1-2, SWMU B-3)**. This volume includes a Chronology of Actions and a Site-Specific Work Plans for SWMU B-3. Results for a geophysical survey, soil gas survey, soil boring investigation, groundwater sampling, and a treatability study are also included as part of the CSSA Environmental Encyclopedia **(Volume 3-1, SWMU B-3)**.

3.1.2 B-3 Characterization Activities

Source characterization began with surface geophysical surveys performed during January through March 1995 at seven potential source areas. Two large anomalous areas were detected at SWMU B-3 during the EM survey as discussed in the technical memorandum (Parsons ES, 1995b). Based on this geophysical data, soil borings were drilled at potential areas including SWMU B-3 to investigate the portions of each area exhibiting geophysical anomalies. A subsequent soil gas survey of SWMU B-3 identified PCE and TCE associated with the geophysical anomalies, with occasional detection of *cis*-1,2-DCE. The presence of these chlorinated hydrocarbons implicated SWMU B-3 as a likely source area for the contamination detected in well CS-16. Figure 3.2 is the 1996 Soil Gas Plume Map.

A soil vapor extraction (SVE) pilot test was recommended at SWMU B-3 for removal of soil VOC contamination. The primary objectives of the pilot test were to determine if SVE is a viable remediation alternative and to collect data to design a full-scale SVE system. Borings drilled for construction of the SVE pilot test system were also used to collect soil samples in the soil gas "hot spots" to determine VOC concentrations. These samples were also tested for total metals and soil physical characteristics to assist in evaluating potential remedial options. SVE was the primary treatment technology selected for the pilot study because of the volatility of PCE, TCE, and cis-1,2-DCE.

3.1.3 B-3 Interim Measures

Excavation and off-site disposal was selected as an interim measure (IM) at SWMU B-3. The area at SWMU B-10 formerly occupied by the Phosphate-Induced Metals Stabilization (PIMS) pilot scale field demonstration project was used to stage and stockpile waste from SWMU B-3. The removal and stockpiling of cover soil at SWMU B-3 began on August 28, 2002. Samples were collected to characterize the soil media in the SWMU B-3 west trench on September 12, 2002, and larger volumes of potential waste material were encountered. Results indicated some portions of the media within the west trench contained lead (D008) and TCE (D039) above RCRA hazardous waste criteria. Additional testing will be necessary to delineate the extent of contamination at this part of the site.

The SWMU B-3 east trench investigation and excavation was initiated September 16, 2002. Waste material, including three drums of unknown origin, were removed and placed in a lined waste accumulation area. Excavated wastes from the east trench were characterized according to the established data quality objectives (DQO). Waste characterization results of the excavated east trench material indicated the material exceeded RCRA hazardous waste criteria levels for PCE (D040) and TCE (D039). In addition, analytical results of several sidewall samples from the east trench were above established inorganic background criteria (non-detect for organic compounds). Over-excavation of the affected portions of the east trench was performed. Partial backfilling of the east trench was initiated on September 25, 2002 in those portions of the excavation where data indicated no contaminants above background.

A total of 22 confirmation samples were collected from the east trench at SWMU B-3. The established waste characterization DQOs for SWMU B-3 were followed in determining the proper characterization of contaminated and cover soils. A total of 22 waste characterization samples were collected, and 10 backfill samples were collected and analyzed for COCs. Five additional samples of the cover material were analyzed for total zinc and mercury to determine if it was appropriate for use as backfill. Additionally, six of the waste characterization samples were reanalyzed for COCs to confirm that the soil could be used as backfill.

A total of 732 loose cubic yards (LCY) (916 tons) of D039/D040 hazardous media from the east trench were transported to Onyx Environmental Services (Onyx), Port Arthur, TX facility for treatment and disposal (EPA ID# TXD000838896 and TCEQ ID# 50212). Approximately 1,242 LCY of Class 2 non-hazardous materials were transported to the Waste Management Covel Gardens (TCEQ ID#2093) facility for disposal. In addition, over 5,500 LCY of cover soil were properly characterized and stockpiled for use as backfill. The unanticipated size of SWMU B-3 increased the estimated in-place volume of waste and presence of hazardous waste correspondingly increased the analytical and data management costs. Additional work was suspended pending necessary funding.

3.1.4 B-3 Soil Vapor Extraction

SWMU B-3 consists of multiple trenches that cover approximately one-half acre. Tests identified PCE and TCE in the trench area, indicating this is a likely source for the VOCs detected in Well CS-16. CSSA installed 18 SVE wells to cleanup VOCs in the soils and limestone in 1995.

After installation, a limited, 2-week initial pilot test demonstrated that an SVE system operated at the site could reduce the VOC concentrations present in the trench area. The results also indicated that the subsurface soils at the site are very complex, and that it would be difficult to extrapolate pilot test results across the entire site without the collection of additional data. Some of this complexity was uncovered during an interim removal action and pre-excavation investigation of the SWMU B-3 trenches conducted in 2002 (Foster Wheeler Corporation, 2003), which discovered that the west trench is actually composed of multiple trenches aligned parallel to each other.

Beginning in December 2001, groundwater samples have been collected from site VEWs after periods of heavy rainfall has collected groundwater in the perched wells. Results from these sampling events have indicated the presence of *cis*-1,2-DCE in excess of 24,000 µg/L, and trace amounts of vinyl chloride. The results indicate that presence of contaminated media with B-3 may continue as a persistent source area for the continual development of Plume 1.

In addition, CSSA initiated further cleanup actions at SWMU B-3 in August 2002 to remove source areas of contaminated soil and debris in the east trench of the former disposal area. The B-3 SVE system was taken out of service during the removal action to facilitate excavation of the contaminated material. The impacts of the actual configuration of the multiple trenches on the SVE performance were not evaluated during the 1995 study.

Based on the initial pilot test and the first 12 months of operations and maintenance (O&M), operation of the SVE system at SWMU B-3 resulted in the removal of approximately 290 pounds of VOCs. Based on these findings, SVE appears to be an effective method for removing VOCs from the SWMU B-3 trenches. Additionally, SVE has been identified as a possible remedial alternative to reduce levels of residual contaminant in bedrock.

3.2 SWMU O-1

3.2.1 O-1 Background

The oxidation pond, also referred to as SWMU O-1, was reportedly constructed in 1975 (CSSA, 1992). The pond, measuring approximately 42 ft by 60 ft by 2.5 ft deep, was lined with vinyl butyl plastic. Wastes from Building 90-1 (spillage, change-out, *etc.*) were trucked to the oxidation pond from an exterior 1,000-gallon settling tank. The frequency of delivery to the pond varied upon the level of bluing activity. In 1982, an estimated 24,000 gallons were contained in the pond (CSSA, 1992).

During Fall 1985, the pond liner was damaged during bulldozing. No records are available to indicate whether or not disposal of the sludge or residue contained in the oxidation pond occurred before destruction of the liner. A chronology of activities at SWMU O-1 is provided in **Volume 1-2, SWMU O-1**.

3.2.2 O-1 Characterization Activities

Results of previous studies are discussed in the Environmental Encyclopedia **(Volume 1-2, SWMU O-1)**, and in **(Volume 5-2, Groundwater and Associated Source Characterization Report)**. A general overview is presented below.

Due to its proximity to contaminated well CS-16, investigations were initiated at SWMU O-1 in 1995. Surface geophysical surveys were performed during January through March 1995 at potential source areas. A large anomalous area was detected at SWMU O-1 during the EM and GPR surveys.

Based on this geophysical data, four soil borings were drilled within SWMU O-1 to investigate the portions of each area exhibiting apparent geophysical anomalies. Results of analytical data gathered from the investigation indicated levels of PCE, chromium, and cadmium above background level concentrations.

A subsequent soil gas survey of SWMU O-1 during Summer and Fall 1995 identified PCE concentrations as high as 80,000 parts per billion volume (ppbv). Depths of sampling were 1.0 to 3.5 ft bgs. Additional surface soil sampling was accomplished during subsequent periods after 1995.

A liner investigation was initiated in January 1996. The investigation was designed to use a backhoe to dig a test pit above the existing liner, without disturbing the liner. However, it became apparent that the liner had been previously destroyed. A decision was made in the field to excavate to the limestone bedrock in order to find visual evidence of any potential limestone fractures. Approximately 80 cubic yards (CY) of soil material were excavated during the liner investigation.

The soils excavated during the liner investigation were replaced in their original location and an additional soil gas survey was completed to identify “hot spots” for which to perform an electrokenitic treatability study. The study was designed to test the efficacy of contaminant removal via electroosmosis, electromigration and electrophoresis effects. The field treatability study on SWMU O-1 soils were initiated in September 1997 and completed in December 1997. Test methods employed and results of the treatability study are included in the Environmental Encyclopedia (**Volume 4.1-2, Electrokinetic Treatability Study**). In general, use of the electrokinetic remedial technology was found not to be cost effective due to the large buffering capacity of the soils.

Soils in the oxidation pond area are predominantly fill, consisting of gravelly clay with marly limestone and caliche fragments, along with an identified sand layer, presumably liner bedding. Based on excavation activities associated with the liner integrity investigation, depth to limestone was approximately 3.5 to 4 ft. Clayey gravel soil in the fill material is similar to logged surrounding soils.

The most recent investigations provide data that indicate COCs for the SWMU O-1 area are PCE, cadmium, and chromium, at 1,390 milligrams per kilogram (mg/kg), 4.8 mg/kg, and

1,300 mg/kg, respectively. Samples collected at 26.5 to 27.5 ft bgs contained trace concentrations of PCE, toluene, and xylene above laboratory detection limits.

3.2.3 O-1 Interim Measures

The objective of IMs was to ensure corrective actions were designed to control or abate threats to human health and/or the environment. The other objective of the IM was to prevent or minimize the further spread of contamination while long-term remedies were being pursued. The goals of the IM activities were to define the lateral and vertical extent of contamination, remove those contaminated soils, and backfill and cap the excavation with clay. IM activities were initiated in November 1999 which included defining the lateral and vertical extents of contaminants and removal of surface soils to the defined lateral extent for off-post disposal.

Twenty-one shallow subsurface soil borings, generally to a depth of 4 ft or until limestone was encountered, were drilled in locations surrounding the known geophysical anomaly in the SWMU O-1 area. Composite samples from the shallow subsurface soil borings were collected and analyzed to determine the lateral extent of contamination. Upon review of the results in combination with previous investigation results, it was determined that the lateral extent of contamination could be accurately defined.

Five borings were drilled in the center of SWMU O-1 to a depth of approximately 27 ft bgs, identified as O1-SB5 through O1-SB9. Grab samples were collected at the soil/rock interface and at total depth. Analytical results of the vertical extent investigation indicated that PCE and , toluene were present at depths greater that 27 ft bgs (see Environmental Encyclopedia **Volume 3.1-7 SWMU Oxidation Pond**) . Therefore, the vertical extent of contamination is not currently defined. No further investigations of the vertical extent of contamination were performed, and the remaining IM activities were associated with the surface soils at SWMU O-1.

Excavation of the subsurface soils from the known extent of contamination within SWMU O-1 began on July 24, 2000. Excavation and removal of contaminated soils were completed with approximately 1,515 CY of soil material transported and disposed in Waste Management Inc.'s Covel Gardens facility. The area of excavation encompassed approximately 7,000 square feet (ft^2). Excavation was continued until all soils were removed within and slightly beyond the lateral extent of contamination to a depth where bedrock was encountered. The resulting excavation was approximately 5 ft deep.

After confirmation samples had been collected, backfilling was performed to fill the excavation and to create a solid foundation for the overlying clay cover. The backfill material was a dense, clay-rich soil, placed in 1-foot lifts and compacted. A low-permeability clay liner was constructed over the site. The clay liner was a minimum of 2 ft thick at all locations and constructed in 6-inch lifts to a slope of approximately 4 percent. Six inches of topsoil were placed on top of the clay liner, and a vegetative surface was established on the topsoil.

CSSA sought a partial facility closure of the surface soil zone located within the boundaries of SWMU O-1. The underlying limestone and the groundwater bearing zones were not included as part of that partial facility closure. The limestone/groundwater zone is to be addressed when a final remedy solution is available for those operable units. The cover will serve to prevent infiltration of precipitation into and through the bedrock and remaining contaminated groundwater, thereby serving to mitigate, control, abate, and minimize spread of contamination in the groundwater below. The partial facility closure was approved by the TCEQ in April 2002.

3.3 AOC-65

3.3.1 AOC-65 Background

AOC-65 includes two sub-slab, concrete-lined vaults, one on the west side and one in the middle of the interior of Building 90. A metal vat was installed in the western vault prior to 1966 and removed in 1995. This vat was used for cleaning ordnance materials inside Building 90 with chlorinated liquid solvents, such as PCE and TCE. In 1995, after removal of the former solvent vat, a metal plate was welded over the concrete vault, and PCE and TCE solvents were replaced with a citrus-based cleaner system located on top of the metal plate. Uses of the second vault, located within the middle of the interior of Building 90, are not known. It was backfilled and capped with concrete at an unknown date. Building 90 continues to be used for weapons cleaning and maintenance. AOC-65 also includes the area extending outside Building 90 along the associated building drain lines and ditches. Initially, AOC-65 was limited to the confines of the former solvent vault housed within Building 90; however, investigations (**Soil Gas Survey Technical Report**, Parsons ES, August 2001) suggested that the AOC-65 boundaries should be expanded to include affected areas. Background information regarding the location, size, and known historical use of the site is also included in the Environmental Encyclopedia (**Volume 1-3, AOC-65**).

Through a records search and questioning of long-term staff involved with AOC-65, CSSA has made a substantial effort to determine the source of contamination. A potential PCE/TCE source area associated with AOC-65 is a drain line from Building 90. The drain line is currently tied in to the building storm gutter system. Floor cleanings and wash-down wastes, such as those from steam cleaning, are potentially the cause of contamination observed near the drain line outfall located to the west of Building 90. The potential COCs are: VOC, semivolatile organic compounds (SVOC), total petroleum hydrocarbons (TPH), polychlorinated biphenyls (PCB), and metals.

3.3.2 AOC-65 Characterization Activities

<u>*Soil Gas Survey Results*</u>

A soil gas survey, performed in January and February 2001, revealed a PCE plume in the soils beneath and to the south and west of Building 90. The highest PCE concentrations were recorded in the vicinity of the former metal vault. A smaller TCE plume near the same area in Building 90 was also defined. In 2001, 14 borings were advanced in and around Building 90. Four of those borings were completed as five monitoring wells. Groundwater samples were collected from borings and monitoring wells, as available.

A total of 203 samples were collected around the exterior of Building 90. Sampling depths ranged from 0.5 to 4.5 ft with depth determined by refusal. Compounds detected outside Building 90 included *trans*-1,2-DCE, *cis*-1,2-DCE, TCE, and PCE. TCE concentrations ranged from 0.04 to 8.56 micrograms per liter (µg/L). PCE was detected in 67 samples at concentrations ranging from 0.08 to 1590 µg/L. The highest readings measured outside Building 90 correlate with the highest PCE levels measured inside the building near the former southern solvent vat. Identification of the PCE plume extending to the NE and SE of

Building 90 suggests that PCE is present in the air-filled porosity of the fill material underlying the entire building, and that PCE has likely spread from the building into underlying soil, rock, and groundwater.

A total of 40 samples were collected inside Building 90. Soil gas samples were collected at depths of 1.0 to 2.5 ft with the depth of sampling determined by refusal. TCE and PCE were both detected inside the building. The sampling grid concentrated around the former metal solvent vault, the metal tank areas, and associated drainage lines. TCE was detected in five samples at concentrations ranging from 0.14 to 0.44 μg/L.

Confirming the conclusion that PCE is present in soil gas underlying the entire building, PCE was detected in every sample at concentrations ranging from 1.77 to 24,820 μg/L with maximum results concentrated around sample locations near the former metal solvent tank in the southern portion of the building. The highest levels of PCE inside matches the locations of contaminants in the plume area identified outside Building 90, particularly in the outside grid points closest to the building near the southern solvent vat location. PCE results measured near the inactive northern solvent vat location suggest that the potential for releases from this area were unlikely and that the fill material underlying this portion of the building contains similar levels of PCE as other non-impacted areas of the building.

An additional 77 samples were collected south of Building 90. Sampling depths ranged from 1 to 4 ft, with depth determined by refusal. No target VOCs were detected in this portion of the site.

The most significant finding of the soil gas survey was the detection of a PCE contaminant plume underlying Building 90 and extending primarily to the west and SW from the building. The detection of TCE and *cis*-1,2-DCE and *trans*-1,2-DCE at significantly lower levels than PCE suggest that some natural degradation of the PCE had already begun near the southern solvent vat, which has been identified as the most likely source area for the VOC contamination. PCE levels exceeded 24,000 μg/L inside the building near the former solvent vat, decreased to 1,590 μg/L approximately 25 ft from the building, and were not detected above 5 μg/L in any of the grid points located more than 50 ft from the building. Based on this result, it appears the lateral extent of the PCE plume in the soil gas is generally confined to the immediate vicinity of Building 90.

<u>*Soil/Bedrock Investigation*</u>

Investigations at the site began in 2000 when soil samples were collected underneath the former solvent vat area in Building 90, and a soil boring was advanced 15 ft down gradient of the building drain line terminus extending from Building 90. Surface samples collected beneath the former vat indicated the presence of PCE ranging from 1.74-3.74 mg/kg beneath the concrete slab.

In 2001, 14 borings were advanced in and around Building 90. Four of those borings were completed as monitoring wells. Groundwater samples were collected from borings and monitoring wells, as available. Soils in the area where the drainage line from Building 90 meets the drainage ditch and where borings were advanced contain the highest soil COC concentrations from the samples collected in this field effort. PCE, TCE, TPH-DRO (diesel-range organics), TPH-GRO (gasoline-range organics), Arochlor, and several metals (chromium, copper, zinc, lead, and cadmium) in the soils all significantly exceeded soil Risk Reduction Standard 1 (RRS1) concentrations. However, in the bedrock sample (21.0 to 21.5 ft), lead, barium, chromium, and nickel only slightly exceeded background, suggesting that COCs are limited to the soil.

Other borings around AOC-65 contain considerably lower concentrations of the COCs than those encountered in the drainage line soil samples. Therefore, the lateral extent of PCE and the other COCs may be limited to the portion of the drain line, and the vertical extent appears to be limited to the near surface.

The presence of PCE in the subsurface, initially identified by the soil-gas survey, is confirmed and further defined by the surface, subsurface, and groundwater samples collected at AOC-65 and under Building 90. PCE is reported in excess of reporting limits (RLs) for soils under the former solvent vat area inside Building 90, along the drain line that runs from the former vat area to the drainage ditch, and in the soils south of the drainage line. These borings are within the limits of the PCE plume delineated by the soil gas survey.

The analyses of samples collected from bedrock generally reveal that VOCs are found only in soils above bedrock. The noted exception is adjacent to the former vat, where PCE was detected in limestone at 0.0499 mg/kg at 8.5 ft. This boring is located immediately outside of Building 90 adjacent to the area that contained the vat. This is the same area that recorded the highest concentrations of PCE in the soil gas plume.

Groundwater samples collected from both inside and outside the soil-gas survey plume contained PCE. Groundwater samples from MW-2A, located outside the soil gas survey plume and screened 9-19 ft in the bedrock, have contained PCE at levels ranging from 950-3,400 µg/L after a rainfall events, suggesting that PCE migration from near surface source areas into groundwater is a likely cause of the continued presence of VOCs in deeper groundwater samples collected at CSSA.

Geophysical Surveys

Geophysical investigations were performed to identify subsurface features such as fractures, faults, and karst dissolution that may be controlling the migration of contaminants. Identification of these features was used to direct installation of PZs and an SVE system near Building 90. The geophysical methods utilized at AOC-65 include electrical resistivity, microgravity, very low frequency (VLF), EM, shear-wave seismic reflection, induced polarization (IP), and spontaneous potential (SP). These methods were selected based on their ability to detect changes in physical properties associated with fractures, faults, and karst features. The surveys were implemented in a phased approach with the results of one phase providing direction for subsequent phases.

Of the methods utilized, electrical resistivity and seismic reflection provided the best results. The SP and VLF methods proved to be ineffective due to site conditions and distance from source signals. Microgravity did not identify significant features at the site and, based on subsequent drilling activities, it is believed the karst features present are too small to be detected using this method. The IP method did not produce useful results; however; some equipment problems during the surveys complicated the evaluation of this method.

Results of the resistivity surveys identified several anomalies in the area; however, subsurface conditions in the area complicated interpretation of the resistivity data and limited effectiveness of the method. Several anomalies detected were believed to be the result of faults present in the area.

Results of the high-resolution seismic survey identified several fault locations in the area. Several reflecting events on the seismic sections were correlated to known geologic contacts: Glen Rose/BS, BS/CC, and the CC/Hammett Shale. In addition several normal faults were interpreted at the depth of these horizons, based on offsets in the mapped horizons.

3.3.3 AOC-65 Interim Measures

IMs were implemented during 2002 to abate and reduce the amount of VOC contamination emanating from AOC-65. These activities included identification and removal of near-surface contamination and installation of two SVE systems. The investigative portion of the work focused on characterizing geologic conditions of the upper 150 ft of bedrock and included installation of six PZs, seven vapor extraction wells (VEW), seven vapor monitoring points (VMP) outside Building 90, and 12 VEWs inside the building. Drilling activities also included drilling 12 soil borings to characterize the extent of impacted soils west of the building and two 150-foot deep angle coreholes to gain further knowledge of geologic conditions west of the building.

<u>*Source Area Vapor Extraction System*</u>

From April 19-21, 2002, Parsons installed 12 VEWs inside Building 90 as sub-slab ventilation wells. Between April 26 and April 29, 2002, the 12 sub-slab ventilation wells were manifolded for eventual hookup to the SVE blower system located on the west dock outside Building 90. Initial soil gas screening data were obtained from VEWs installed inside Building 90 on December 3, 2002. A second round of soil gas screening and pressure response readings were taken on December 4, 2002, shortly after the SVE system was started. This was done to determine if there was any influence or response in the sub-slab VEWs. After these initial readings were taken, the sub-slab blower system inside Building 90 was started and soil gas changes were monitored over the initial hours following system startup. The air emission results from the sub-slab system indicated that the SVE system was operating within limits of the standard air exemption.

<u>*Exterior Soil Vapor Extraction System*</u>

On May 13, 2002 a subsurface investigation was performed at AOC-65 in conjunction with the SVE treatability study conducted to evaluate effectiveness of the SVE at reducing the volatile contaminants present in the subsurface materials at the site. Rock coring and borehole geophysical surveys were conducted to assist in characterizing subsurface conditions. Upon completion of coring and logging activities, seven VEWs, seven VMPs, and six PZs were installed in the boreholes. Borehole geophysical surveys were completed at some locations to aid in characterization of geologic conditions. In addition, two exploratory angle borings were completed to intercept fractures and faults in the area.

Selection of the locations for the VEWs, VMPs, and PZs were determined based on results of the geophysical surveys, primarily the electrical resistivity imaging data. Drilling locations were selected to intercept anomalies believed to represent potential fracture and fault locations identified in the geophysical data. The seven VEWs were piped and manifolded into a blower system (blowers, moister separator, vapor phase carbon treatment unit, and electrical controls) to extract soil gas from the subsurface.

Results of the rock coring and borehole geophysical surveys were used to characterize geology in the AOC-65 area. Based on drilling and borehole information, it was determined that approximately 30-40 ft of UGR Limestone material is present in the area. The UGR deposits consist primarily of limestone and marl layers with one distinct marl layer exhibiting dissolution features resulting from removal of anhydrite/gypsum material from the layer. The LGR Limestone underlies the UGR material and consists of a sequence of limestone deposits that include fossiliferous and vuggy zones of relatively high permeability at a depth of approximately 105 to 110 ft.

Geologic correlations from the core records and geophysical logs indicate at least three faults in the AOC-65 area between wells CS-MW06-CC to the north of Bldg 90 and CS-MW08-LGR to the south. The faults are believed to be normal faults associated with the BFZ with the upthrown block on the northern side of the fault. One fault, located north of Building 90, has an estimated 5-foot offset. A second, smaller fault was intersected during drilling at location AOC65-PZ05-LGR and exhibits an approximate 2-3 foot offset. Additionally, an approximate 15-foot offset was present between locations AOC65-PZ05-LGR and CS-MW08-LGR indicating that at least one fault is present between these two locations.

AOC-65 Soil Removal and Construction Upgrades

The IM activities also included removal of near-surface contamination identified during RCRA Facility Investigation (RFI) activities on the west side of Building 90. The objective was to remove the source area contamination associated with the former drain line and storm water conveyance within the AOC. Specific activities included defining the source area with several of shallow borings, excavation and removal of contaminated soils, and engineering controls to minimize the amount of precipitation recharge that infiltrates within the source zone.

Drilling outside Building 90 (maximum depth of 4 ft) to delineate the extent of shallow contamination was initiated May 6, 2002. Results of the boring program defined a small area associated with the drain line to be contaminated in addition to near-surface soils within the stormwater conveyance. These impacted soils were removed to mitigate the total contaminant mass available for transport from the source zone.

Approximately 1,000 tons (600 CY) of impacted soil were excavated from along a drain line and drainage ditch west of Building 90. Soil samples were collected from the excavation for verification analysis to document concentrations remaining in the soils. The excavation in the parking lot was backfilled with gravel and re-surfaced with asphalt. The drainage ditch north and west of the building was rebuilt with a concrete liner to prevent water from infiltrating he suspected source area. In addition, roof gutters along the west side of the building were reconfigured to divert water away from the building and the source area.