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Engineering Construction Completion Report

D.C. Rollforms Site
Jamestown, New York
Site Code 907019

December 7, 2008

ARCADIS

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Our Ref.:
AY000219.0014

Date:
December 7, 2008

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Abbreviations

AC - air compressor

ACF - activated clay filter

ACFM - actual cubic feet per minute

AFU - advanced filtration unit

AP - auto pump

AS - air stripper

ASP - Analytical Services Protocol

B - regenerative blower

bgs - below ground surface

bls - below land surface

BPU - Board of Public Utilities

BTEX - Benzene, Toluene, Ethylbenzene, and Xylenes

BV - ball valve

CF - cartridge filters

cfm - cubic feet per minute

CFP - chemical feed pump

cfs - cubic feet per second

CLP - Contract Laboratory Program

COMP - composited in laboratory

COPC - Chemical of Potential Concern

cy - cubic yards

D - deep

DCE - Dichloroethene

DER - Division of Environmental Remediation

DNAPL - Dense Non-aqueous Phase Liquid

DO - Dissolved Oxygen

DRO - Diesel Range Organics

Abbreviations (continued)

ELAP - Environmental Laboratory Approval Program

EPA - Environmental Protection Agency

FSL - low flow alarm

FSP - Field Sampling Plan

ft - feet

ft amsl - feet above mean sea level

GP - Geoprobe point

gph - gallons per hour

gpm - gallons per minute

GRO - Gasoline Range Organics

HASP - Health and Safety Plan

HDPE - High Density Polyethylene

hp - horsepower

HX - heat exchanger

INT - interceptor/equalization tank

IW - injection well

JBPU - Jamestown Board of Public Utilities

JURA - Jamestown Urban Renewal Agency

KT - knockout tank

LAH - high liquid level alarm

LAHH - high-high liquid level alarm

lbs - pounds

LCD - Liquid Crystal Display

LCP - Local Control Panel

LEL - Lower Explosive Limit

LPGOC - liquid phase granular organically modified clay

LSHH - high-high liquid level sensor

Abbreviations (continued)

MCP - Main Control Panel

mg/L - millograms per liter

mm - millimeter

MW - monitoring well

NAPL - Non-aqueous Phase Liquid

ND - non-detect

NYCRR - New York Codes, Rules and Regulations

NYSDEC - New York State Department of Environmental Conservation

NYSDOH - New York State Department of Health

NYSDOH ELAP - New York State Department of Health Environmental Laboratory Accreditation Program

NYSDOT - New York State Department of Transportation

O&G - Oil and Grease

O&M - Operation and Maintenance

OM&M - Operation, Maintenance and Monitoring

ORP - Oxidation/Reduction Potential

OW - observation well

OWS - oil/water separator

PAH - high pressure alarm

PAHH - high-high pressure alarm

PAHs - Polycyclic Aromatic Hydrocarbons

PAL - low pressure alarm

PCBs - Polychlorinated Benzenes

PDM - Personal Dust Meter

PID - Photo Ionization Detector

PLC - Programmable Logic Control

POTW - Publicly Owned Treatment Works

Abbreviations (continued)

ppb - parts per billion

ppm - parts per million

psi - pounds per square inch

PT - pressure sensor/transmitter

PVC - Polyvinyl Chloride

QA/QC - Quality Assurance/Quality Control

QAPP - Quality Assurance Project Plan

RAOs - Remedial Action Objectives

RCRA - Resource Conservation and Recovery Act

RD/RA - Remedial Design/Remedial Action

RDWP - Remedial Design Work Plan

RI - Remedial Investigation

ROD - Record of Decision

RW - recovery well

S - shallow

SCADA - Supervisory Control and Data Acquisition

SCFM - standard cubic feet per minute

sch - schedule

SCOs - Soil Cleanup Objectives

SDR - Standard Dimension Ratio

SMP - Site Management Plan

SP - sample port

SSALs - Site Specific Action Limits

ST - storage tank

SV - solenoid valve

SVE - Soil Vapor Extraction

SVOCs - Semi-volatile Organic Compounds

Abbreviations (continued)

TAGM - Technical Administrative Guidance Memorandum

TAL - Target Analyte List

TCE - Trichloroethene

TCL - Target Compound List

TP - transfer pump or test point

TPH - Total Petroleum Hydrocarbons

TSS - Total Suspended Solids

ug/kg - micrograms per kilogram

ug/m^3 - micrograms per cubic meter

USACOE - United States Army Corps of Engineers

USEPA - United States Environmental Protection Agency

VC - Vinyl Chloride

VEP - Vacuum Enhanced Pumping

VEPOW - Vacuum Enhanced Pumping observation well

VER - Vacuum Enhanced Recovery

VOCs - Volatile Organic Compounds

VPGAC - vapor phase granular activated carbon

1. Introduction

ARCADIS of New York, Inc. (ARCADIS), on behalf of the Ingersoll Rand Company, has prepared this Final Engineering Construction Completion Report for the former D.C. Rollforms Site (referred to hereafter as the Site) located in Jamestown, Chautauqua County, New York (Figure 1). This report summarizes the final engineering design, construction activities associated with implementation of the remedial design, and includes "as-built" Record Drawings (Appendix A) for the groundwater collection and treatment system and riverbank excavation and re-construction. The work was performed pursuant to the Administrative Order on Consent (AOC) No. B9-0446-94-01A, Site# 907019, the Record of Decision (ROD, March 2003) for the D.C. Rollforms Inactive Hazardous Waste Site and in accordance with the New York State Department of Environmental Conservation (NYSDEC) approved Remedial Design Work Plan (ARCADIS 2006).

1.1 Site Location and Description

The Site is located at 583 Allen Street in Jamestown, Chautauqua County, New York (Figure 1). The site is approximately 2.38 acres in size, and is a vacant parcel. The vacant parcel is owned by Jamestown Allenco, LLC. and is bounded by Allen Street on the east, the Chadakoin River on the west and northwest, and the Weber Knapp and Jamestown Urban Renewal Agency properties on the south. The adjacent north parcel is owned by Heavy Press and Tool, Inc. This parcel contains a two story building and parking lot (Figure 2). The Site is located in a mixed residential and commercial area, which is served by a public water supply.

1.2 Site Classification

This site was listed in the registry of Inactive Hazardous Waste Disposal Sites in New York State in 1994. The site is currently classified as Class 2 site. Upon completion of the remedial activities, the site will be designated as a Class 4, which means a site that has been properly closed and requires continued management.

2. Remedial Construction

This section summarizes the remedial construction activities performed as part of the implementation of the selected remedy including the installation of a vertical barrier, soil removal from the riverbank area, and associated restoration activities, and installation of the groundwater collection and treatment system. The remedial construction was initiated in September 2006 and completed in June 2008 with final site restoration. A photograph log depicting various construction activities has been included in Appendix B.

2.1 Site Access and Security

Access to and from the Site was gained through the parking lot area located from Allen Street. This entrance, located at the northeastern corner of the Site, provided sufficient access and turnaround areas for truck traffic to and from the Site. Temporary on-site truck access from the parking lot to the soil load out and staging area was constructed by using imported clean gravel.

The site construction limits were establish with orange construction fencing prior to beginning remedial activities and was maintained during the entire project. Fencing and caution tape was also placed at points of access to the Site, roadway entrances, and open excavations during non-working hours.

2.2 Fugitive Dust Control and Air Monitoring

In accordance with the Remedial Design Work Plan (RDWP) and Health and Safety Plan (HASP), a water truck was utilized to control dust onsite during remedial construction operations. Additionally fugitive dust monitoring was performed using a PDM Mini-ram particulate meter during all site excavation and backfilling activities. The action level of 100 micrograms per cubic meter (ug/m^3), integrated over a fifteen minute period were never exceeded during site activities.

Continuous monitoring for volatile organic compounds (VOCs) using a portable photo ionization detector (PID) was also performed during all initial excavation activities which included the riverbank, outfall removal, and piping installation. The PID was set to alarm in the event that action levels as prescribed within the Work Plan and HASP were exceeded. The action levels of 5 parts per million (ppm), integrated over a five minute period for VOCs were never exceeded during site activities. Air monitoring logs are included in Appendix C.

2.3 Site Preparation

As part of the requirements for the site work portion of the remedial construction, a licensed surveyor located the proposed limits of the access road, treatment building, recovery wells, and vertical barrier wall prior to beginning site activities. Prior to commencing intrusive activities, the target excavation and surrounding support areas were cleared and grubbed, as necessary, to allow access to the proposed remedial construction areas. Trees and brush were removed to the ground surface using heavy construction equipment. The vegetative material was placed in on-site piles outside the limits of remedial construction areas.

A temporary decontamination pad was constructed near the exit of the site for the cleaning of heavy equipment and trucks prior to leaving the site. The decontamination pad was constructed with two (2) layers of 6-mil poly liner with perimeter berms sloped to a sump. The decontamination included washing trucks, machinery and heavy equipment with a high pressure hose, as needed, prior to exiting the site during construction. The decontamination pad was sized to fully contain the largest equipment used on-site. Water generated during decontamination activities was collected and transferred to an on-site frac tank which allowed for the settlement of sediment prior to treatment with the full-scale groundwater collection and treatment system (Section 2.7).

2.4 Vertical Barrier Wall Installation

As specified in the RDWP, a vertical barrier wall (e.g., interlocking steel Z-sheet pile wall) was installed adjacent to Chadakoin riverbank from the southern property line (concrete bulkhead wall) to approximately 236-feet downstream (Record Drawing G-1) during the period of November 15 to November 29, 2006. A total of 57 steel sheet piles (AZ-18, A572, Grade 50) were driven into the top of the riverbank. The vertical barrier wall was aligned approximately with the existing top of slope and keyed into the till layer located at a depth of approximately 10 feet below ground surface (bgs) (Record Drawing G-4). The vertical barrier was driven to the depths necessary to resist rotation and toe kick-out, as well as global slope stability during riverbank remedial activities. The total driven depths of the sheets ranged from 14 to 20 feet bgs. Each of the interlocking joints between each sheet pile was sealed with a liquid tight Adeka Ultra Seal KM-String sealant. The barrier wall installation is shown in Photos 1 and 2 of the photo log (Appendix B).

2.5 Outfall Abandonment

Eight (8) former plant outfalls along the Chadakoin River were abandoned in place following the vertical barrier wall installation (Record Drawing G-5) during the period of November 29, 2006 to January 3, 2007. Each of the former outfalls was excavated behind (i.e. upgradient) the vertical barrier wall to expose the outfall pipe. Upon excavating each outfall pipe, the exposed pipe end was plugged with a minimum 1-foot thick concrete and/or grout/bentonite plug. During the abandonment of the former outfalls, approximately 3 cubic yards (cy) of pipe bedding materials from Outfall No. 004 were excavated and stockpiled separately due to the presence of petroleum impacts. This material was temporarily stockpiled and subsequently disposed of off-site at the Chautauqua County Landfill during the riverbank excavation and load out in from June 5 to 21, 2007. The abandonment of Outfall 004 is shown in Photo 3 (Appendix B).

2.6 Riverbank Excavation and Re-Construction Stabilization

This portion of the remedy included the excavation of the riverbank soils, sediment, and the removal of the eight (8) former outfalls on the down-gradient side of the vertical barrier wall. The riverbank excavation and re-construction activities were completed during the period of June 5 to June 27, 2007. The riverbank excavation and re-construction activities were completed under a United States Army Corps of Engineers (USACOE) Nationwide Permit #38, Application No. 2000-00778(2) (Appendix D).

2.6.1 Installation of the Temporary Dam and Dewatering

A temporary portable dam (Port-A-Dam™) was utilized to facilitate the excavation of the riverbank soils and sediment in the Chadakoin River. The temporary dam was installed within the Chadakoin River over a length of approximately 325-feet adjacent to the riverbank at the terminal of the sheet pile wall. The temporary dam was keyed into the riverbank at the downstream location at the terminus of the sheet pile wall and was secured to the concrete bulkhead wall at the upstream location to allow for the effective dewatering of the riverbank and riverbed without flow circumventing the ends of the dam. The temporary dam was placed approximately 6-feet from the existing riverbank toe in order to expose the previously determined sediment excavation areas.

The temporary dam installation was coordinated with the Jamestown Board of Public Utilities Washington Street dam operator to reduce flow in the Chadakoin River and to controlled flow in the river during the intrusive riverbank remedial activities. River flow during the temporary dam installation was maintained at approximately 75 cubic feet per second (cfs). During the riverbank excavation and reconstruction the flow ranged from 100 cfs to 400 cfs.

Following the installation of the temporary dam, a 12-inch centrifugal trash pump was utilized to remove river water within the dam limits. The pump discharge was directed to a wooden splash pad and a silt screen to minimize silt migration and turbidity in the river. Following the initial dewatering, reinforced silt fencing was installed on the inside edge of the temporary dam just beyond the proposed excavation limits. Additionally 4-inch trash pumps were placed between the temporary dam and silt fence to remove river water seepage under the dam to maintain dry working conditions. Temporary collection sumps, which were backfilled with gravel around a vertical segment of perforated pipe, were constructed in between the silt fence and the vertical barrier wall. These collection sumps were used to collect any water that may have come into contact with the impacted riverbank soils. Trash pumps were used in these sumps to dewater the riverbank during excavation. Water accumulated from these collection sumps during riverbank excavation operations was pumped to two (2) 21,000 gallon frac tanks. A total of approximately 32,000 gallons of water was collected during the riverbank excavation portion of the project. This water was stored onsite in the frac tanks and subsequently pumped to the full-scale constructed treatment system (Section 2.7) for treatment and was discharged to the City of Jamestown publically owned treatment works (POTW) under Industrial Wastewater Discharge Permit Number 037 (Appendix D). Photos 4 and 5 (Appendix B) depict the installation of the temporary dam and subsequent dewatering of the riverbank.

2.6.2 Riverbank Excavation

Riverbank soils were removed via mechanical excavation. Approximately 1,075 cy (1,733 tons) of material in front of the sheet pile wall was excavated. Photo 6 in Appendix B provides a view of the riverbank following excavation. The horizontal limits of the riverbank excavation were as the following: to the north approximately 18 feet north of sheet pile wall, to the south ending at the existing concrete bulkhead wall, to the east terminating at newly installed sheet pile wall, and to the west at the toe of the existing riverbank. The vertical limit of the excavation was terminated at the top of the till formation which was found at 7-10 feet below the top of the bank/sheet pile. All excavated soils that were not directly loaded out were temporarily stockpiled onsite at one of two designated soil handling/staging areas. One staging area was located on the northern end of the site, while the other staging area was located in the approximate middle of the site. The staged soil was placed on and covered with 6 millimeter (mm) thick polyethylene sheeting throughout the stockpiling process. The soil staging areas were constructed with earthen berms along the perimeter, covered with a layer of polyethylene sheeting. Samples were collected from the stockpiled soils in accordance with the waste characterization analytical requirements of the Chautauqua County Landfill; the designated off-site permitted disposal facility. The soils were disposed of as non-hazardous material and loaded offsite from June 11 to June 27, 2008. A copy of the laboratory analytical report has been included in Appendix E.

In addition to the riverbank soils, approximately 948 tons of concrete from the vertical barrier wall area and pre-trenching activities was removed and disposed off-site. Samples were collected from the stockpiled concrete soils in accordance with the waste profile analytical requirements of the Chautauqua County Landfill. The concrete was disposed of as non-hazardous material and loaded offsite from June 11 to June 27, 2008. A copy of the concrete bill of ladings has been included in Appendix F.

2.6.3 Sediment Excavation

In addition to the riverbank soils, two areas of sediment along the riverbank were also removed via mechanical excavation. The two subject areas that were of concern were the sediment sample locations SED-1/5 and SED-6 (Record Drawing G-1). These locations were established during the remedial investigation. The sediment removal area encompassed a total of approximately 98 linear feet adjacent to the riverbank. The width and depth of the sediment removed was approximately 4 and 0.4 feet, respectively. The horizontal and vertical limits of the sediment removal areas were based upon the area defined in the “Remedial Design Work Plan” (ARCADIS 2006). A total of approximately six (6) cy of sediment was excavated and temporarily stockpiled in a separate designated staging area onsite. The dewatered and stabilized sediment was sampled and characterized in accordance with the analytical requirements of the Chautauqua County Landfill. A copy of the laboratory analytical report has been included in Appendix E. The sediment was also profiled as non-hazardous material and loaded out with the riverbank materials and is included in the total tonnage mentioned above in Section 2.6.2.

A summary of the quantities of excavated soils, sediment, and concrete disposed off-site is provided in Appendix F.

2.6.4 Riverbank Stabilization and Restoration

The re-constructed riverbank was backfilled and re-constructed with imported, clean fill, New York State Department of Transportation (NYSDOT) Item# 304.14M gravel, compacted in 12 inch lifts, and graded and compacted at a one and a half to two horizontal to one vertical (1.5:1 to 2:1) slope. A laboratory analytical report for the fill material is provided in Appendix G. Following placement and compaction of fill material for the riverbank re-construction, stabilization and erosion control measures were constructed along the riverbank to prevent possible erosion of fill material into the Chadakoin River. The riverbank was re-constructed and stabilized from the area of the concrete bulkhead at the upstream extent of the site to approximately 297-feet downstream at the limits of the riverbank removal (Record Drawing G-1). During the riverbank reconstruction activities stabilization and erosion control measures (e.g. silt fencing and straw bales) were utilized along the riverbank to prevent the possible erosion of fill material into the Chadakoin River. TerraTex GS geotextile fabric was then placed over the backfilled and graded slope, and anchored to the riverbank by keying the geotextile fabric into trenches located along the top and bottom of the riverbank (Record Drawing G-5). The bottom portion of geotextile fabric was keyed into the underlying till soils within the river bed using 6 to 8-inch nominal size (NYSDOT Medium Stone Fill) riprap; the top portion was keyed in using trench spoils from the recovery well piping installation. Following placement of the geotextile fabric, two (2) rows of 30-inch nominal size (NYSDOT Heavy Stone Fill) riprap were placed at the bottom of the slope to provide bank stabilization. The upper portion of the bank was also covered with an approximate 2-foot thick layer of 6 to 8-inch size riprap to prevent erosion of the riverbank during higher river stages and flows. The northern and southern ends of the restored riverbank were armored heavily with 30-inch riprap along the entire extent of the slope to provide additional stabilization from seasonal high river flows (Record Drawing G-5). Riverbank stabilization activities are shown in Photos 7, 8, and 11 (Appendix B).

Following the completion of the riverbank restoration, live stake planting were planted within the upper portion of the riprap covered slope and also the top of the riverbank in November 2007. Thirty (30) Black Willow live stakes were planted along the historical high water level (approximately 1290 feet above mean sea level [ft amsl]) of the riverbank to provide additional stabilization and to create a riparian zone between the site and the Chadakoin River. The Black Willow stakes were spaced approximately 10-15 feet apart. Thirty (30) of both Red Osier Dogwood and Elderberry live stakes were planted at the top of the riverbank on the up-gradient side of the riprap. The spacing for these plantings ranged from 5 to 7 feet in a staggered offset pattern from the top of the riverbank. These plantings were chosen based on the geologic conditions of the restored riverbank and historical weather conditions observed at the site (Record Drawing G-5). Photo 10 in Appendix B depicts Black Willow growth along the riverbank roughly six months after planting.

2.6.5 Wingwall Structure (Fish Habitat Enhancement)

As part of the riverbank stabilization, the NYSDEC Division of Fish and Wildlife requested that additional stream enhancements be incorporated into the design of the bank cover. The stream enhancement implemented during riverbank restoration was a single-winged deflector composed of riprap ranging in size from 6 to 30-inches

(NYSDOT Medium to Heavy Stone Fill). The purpose of the single-winged deflector is to enhance fish habitat along the shore of the site and assist in the propagation of warm water fish species present in the river.

The exact location and final construction of the wing deflector was determined in the field with concurrence from the onsite NYSDEC personnel from the Division of Fish, Wildlife, and Marine Resources. The wing deflector was constructed along the concrete bulkhead wall near the southern property line (Record Drawing G-1). The downstream (north) side of the deflector was a double row of 30-inch nominal size stones, trenched into the river bottom approximately 3 to 6-inches. Immediately upgradient from the two keyed in rows, an additional row of 30-inch stones was placed on top of the stream bottom. The wing deflector was constructed at a roughly 70 degree angle from the upgradient side of the concrete bulkhead wall. Both sides of the 30-inch stone rows were filled in with 6 to 8-inch nominal size stones to ensure tight compacting and structural stability. The length of the wing deflector extends into the river approximately 10 feet. The deflector height is approximately 18-inches from the river bottom, representing approximately 6-inches above the river depth during normal seasonal flows (approximately 400 cfs). The deflector as-built construction details are shown on Record Drawing G-5. Photo 9 in Appendix B shows the wing deflector immediately following its construction.

2.6.6 Riverbank Design Modifications

The following design modifications were made in the field with concurrence from the NYSDEC on June 1, 2007. Additionally notifications of these modifications were made previously in writing by letter to the NYSDEC dating December 22, 2006 (see Appendix I).

- The size of the riprap at the toe of the riverbank slope was increased from 6-8 inch to 30-inch diameter. This modification was made due to the river flows observed during pre-construction activities.

- The upper portion of the riverbank was also modified with the addition of 6-8-inch riprap versus the originally designed vegetative plantings. This modification was made due to the higher river flows observed during pre-construction activities, as described above.

- The opposite bank structure related to the wingwall deflector was removed from the design. It was determined that this structure was not needed based on the final placement and construction of the wingwall deflector.

2.7 Groundwater Collection and Treatment System

The as-built remedial system layout is shown on Record Drawing G-1. The groundwater collection and treatment system includes 14 vacuum enhanced pumping wells (VEP-1 through VEP-14).

2.7.1 General Process

Groundwater and non-aqueous phase liquid (NAPL) from the vacuum enhanced pumping (VEP) wells is conveyed via underground piping to an on-site treatment building. Prior to reaching the first component of the treatment system (i.e., the oil/water separator OWS-200) a sequestering agent is injected into the process stream. The purpose of the sequestering agent is to prevent iron and manganese related fouling downstream in the system (e.g. process piping, cartridge filters and the air stripper). The groundwater and NAPL is then pumped directly into the oil/water separator (OWS-200) for removal of residual non-emulsified NAPL.

Once the groundwater has passed through the oil/water separator, the water flows by gravity to the storage tank (ST-300). The water is then transferred in batch mode by transfer pump TP-300 through two cartridge filters housings (CF-400 and CF-401) arranged in parallel for removal of residual suspended solids. Following the cartridge filters, groundwater and residual emulsified NAPL is pumped through a liquid phase granular organically modified clay (LPGOC) filter vessel for the removal of emulsified NAPL.

Groundwater is pumped through a low-profile air stripper (AS-700) series for the removal of dissolved phase organic compounds. Treated groundwater is then discharged to the local POTW sanitary sewer manhole 3T6 via a single 2-inch standard dimension ratio (SDR) 11 high density polyethylene (HDPE) below grade pipe.

Soil vapors are collected from each VEP well via a regenerative blower (B-900). The recovered soil gas is treated via two (2) vapor-phase granular activated carbon units (VPGAC) arranged in series (ASC-501 and ASC-502).

The process and instrumentation diagram is shown on Record Drawings M-1 and M-1. The equipment layout plan is shown on Record Drawing M-3.

The system has been designed to monitor the operational status of critical systems on a continual basis during operation. The system is interlocked with sensors, which can temporarily shutdown the system in the event the system malfunctions. A system component failure results in a system shutdown to assure that the discharge of untreated groundwater or soil vapor is prevented and also to protect system operators.

2.7.2 System Design Modifications

Three (3) recovery wells were installed in the area of monitoring well MW-8D as specified in the RDWP. The dual phase extraction system that was proposed in the 100% Remedial Design Report (ARCADIS, 2006) was not installed. A further evaluation of the results of the vacuum enhanced recovery (VER) pilot test that was performed in September 2006 indicated that utilizing a high vacuum dual phase pump could interfere with remedial efforts in the overlying fill zone by causing downward movement of impacts into the till. Field parameters recorded during the VER pilot test included drawdown and induced vacuum at surrounding wells, as well as concentrations of VOCs removed using a photoionization detection (PID) meter. Groundwater and vapor samples were collected during the VER pilot test. A memo summarizing the pilot test, tables summarizing laboratory results and field parameters, and a copy of the analytical results for the VER pilot test has been included in Appendix H. The area of monitoring well MW-8D will continue to be monitored during the remediation of the shallow fill zone. It is anticipated that once remediation of the fill zone has achieved acceptable levels, a pumping system will be installed in the till recovery wells in order to recover the groundwater and dense non-aqueous phase liquid (DNAPL) from the till zone. It should be noted that an additional VEP well (VEP-2) was installed in this area to address shallow zone impacts above the MW-8D area.

In addition to the VER system modifications the originally proposed interceptor/equalization tank INT-200 and transfer pump TP-200 were removed from treatment process and was replaced with a larger oil water separator (OWS-200) which gravity drains to storage tank ST-300. Also the originally proposed advanced filtration units AFU-400 and 401 were also replaced by activated clay bed vessel ACF-400. The treatment system modifications were noted in a letter to the NYSDEC dating December 22, 2006 (see Appendix I).

2.7.3 Treatment Building

All process related mechanical equipment and electrical controls are housed within a 25-foot by 30-foot pre-engineered single slope metal building (Record Drawing S-1). A 12-foot by 13-foot control room was constructed in the northeast corner of the treatment building to house non-explosion proof components of the treatment system. The remaining footprint of the building houses the remaining process equipment. All of the equipment in the equipment room has an explosion proof rating and or is intrinsically safe. This electrical classification was utilized due to the potential presence of vapor concentrations in the process stream approaching the lower explosive limit (LEL) of select VOCs found at the site. It should be noted that during the startup shakedown of the treatment system that the atmosphere in the equipment room, head spaces in the oil/water separator (OWS-200) and storage tank (ST-300), and influent vapor stream from the Soil Vapor Extraction (SVE) system were monitored for vapor concentrations approaching the LELs. None of the vapor concentrations exceeded the LEL.

The treatment building has one (3 foot by 7 foot) entry door for personnel and one 8-foot by 10-foot overhead door to allow for access of mechanical equipment during construction and maintenance activities. There is also a personnel door allowing access between the control room and equipment room. In addition, the building contains two ceiling unit heaters, one roof ventilator, two wall louvers, and lighting to adequately maintain the environment for proper operation of the remediation system. All building, mechanical, and electrical components have been installed in strict conformance with local, New York State, and Federal building code requirements.

The treatment building was erected and anchored to an 8-inch thick reinforced concrete slab that was subsequently anchored to the existing 8-inch slab left in place from the former building facility. A 4-inch high 6-inch wide concrete berm was installed with Green Streak polyvinyl chloride (PVC) water stop around the entire perimeter of the building to act as a secondary containment and also to maintain a water tight seal from the elements. A 2-foot by 2-foot grated floor sump was installed in the building slab in order to collect any process groundwater that may accidentally spill due to a sensor or equipment failure. Photos 12 thru 15 (Appendix B) depict the construction and completion of the treatment building.

2.7.4 Recovery Wells and Piping

The VEP system utilizes fourteen (14) groundwater and vapor recovery wells. The locations of these wells are shown on Record Drawing G-1. The construction details of these wells are as shown on Record Drawings G-2. The VEP wells were constructed of 6-inch diameter schedule 40 PVC and installed to a total depth of approximately 13-14 feet below land surface (bls) with the screened interval from approximately 5 to 11 feet bls within the fill (higher permeable) layer. A typical VEP wellhead cap construction is shown in Photo 17 (Appendix B).

Each VEP wellhead has been enclosed with an 18-inch diameter bolted flushmount protective casing. The extracted groundwater from each well is conveyed below grade via 1-inch SDR 11 HDPE pipe to the treatment building. The fourteen 1-inch SDR 11 HDPE water pipe lines are located approximately 4-feet bls. The area around and above the pipes was backfilled and compacted with imported, certified-clean gravel (Appendix G).

A Rotron Model# EN858BD72WL regenerative blower (B-900) is used to recover soil vapors from each VEP well. The cumulative soil vapors extracted from all of the VEP wells are conveyed via a 4-inch SDR 11 HDPE pipe approximately 3 feet below grade. The soil vapor extraction piping was embedded in imported, certified-clean gravel to a depth of approximately 6 inches above the top of the pipe. A metal-detectable marking tape was then placed as a warning for future earthwork activities of the presence of underground piping. The soil vapor extraction piping was successfully pressure tested to assure efficient system operation. Record Drawing G-1 shows the locations of recovery pipe trenches. Further details including VEP wellhead construction, pumps, and trenching specifications are provided on Record Drawing G-2. Photo 16 (Appendix B) depicts installation of the soil vapor extraction piping.

Three recovery wells (RW-1, RW-2, and RW-3) were installed during the remedial construction phase in the area of VOC impacts within the till near well MW-8D. The locations of the recovery wells are shown on Record Drawing G-1. The construction details of the recovery wells are shown on Record Drawings G-3. The recovery wells were constructed of 4-inch diameter schedule 40 PVC and installed to a total depth of approximately 22 feet bls. The screened interval is from approximately 12 to 22 feet bls into the till. Additionally a 1-inch SDR 11 HDPE total fluids pipe was installed from each recovery well to the treatment building for future use. The recovery well piping was placed on native material roughly 3 feet below grade. The area around and above the recovery well piping was filled with imported, certified-clean gravel to a depth of roughly

6 inches above the top of the pipe. Record Drawing G-1 shows the locations of recovery pipe trenches. Further details including recovery wellhead construction and trenching specifications are provided on Record Drawing G-3.

All process piping was successfully pressure tested following installation to assure the highest efficiency for system operation.

2.7.5 Process Equipment

The following section describes each major component of the treatment process equipment. A layout of the process equipment in the treatment building is provided on Record Drawing M-3.

Groundwater Recovery Pumps and Air Compressor

Groundwater is recovered from each VEP well using Severn Trent's QED special AP-4 short top loading submersible pneumatic groundwater pump. These pumps are specifically manufactured for total fluids recovery, including NAPL and groundwater. Compressed air is supplied to each pump from an Ingersoll Rand Model# UP6-10-125TAS rotary screw air compressor (AC-600) via a ¾-inch aluminum and HDPE composite pipe located approximately 4-feet bls. The air compressor is equipped with a low pressure sensor (PT-601). The low level switch will both alert system operators and shutdown the system if reached. The air compressor is shown in Photo 18 (Appendix B).

Sequestering Agent

The sequestering agent Aries Chemical 2925 contains a blend of organic sequestering agents and polymer based dispersant. The sequestering agent is injected into the liquid phase influent process manifold pipe. The sequestering agent is injected with a LMI Model# E70XP electronic chemical feed pump (CFP-100). The chemical feed rate is based on the maximum designed flowrate and the site groundwater chemistry.

Oil/Water Separator

The oil/water separator (OWS-200) is a Hydro-Flo EVS-036-SS34P oil/water separator. The unit is a 364-gallon capacity and is rated for a process flow rate of 70 gallons per minute (gpm). In addition to the standard specifications, the unit will also be equipped with an additional petro-coalescing screen to enhance the remove of both light non-aqueous phase liquid (LNAPL) and DNAPL. The unit also features an 81-gallon sludge/DNAPL and 19-gallon LNAPL collection chamber. As described previously, groundwater and residual NAPL is pumped into oil/water separator OWS-200 for removal of residual non-emulsified NAPL. The OWS-200 performance specification for the total NAPL in the effluent is less than 10 mg/L. The head space in the oil/water separator is passively vented outside of the treatment building to the atmosphere.

The oil/water separator is equipped with high and high-high liquid level switches which have been integrated into the system control logic. The high level sensor (H-201) will alert system operators that the level in the effluent chamber of the oil/water separator is high, either due to unexpectedly high flow into the unit or to a lack of storage capacity downstream from the unit. The high-high level sensor will both alert system operators and shutdown the system if reached.

The oil/water separator is also equipped with a high LNAPL level sensor which has been integrated into the system logic. This sensor alerts operators that the product level in the oil collection reservoir is near capacity and must be emptied into a dedicated product drum. The high product level switch will result in a system shutdown if reached and alerts a system operator. The oil/water separator is shown in Photo 19 (Appendix B).

Storage Tank

Following the oil/water separator, groundwater flows by gravity to a 1,300-gallon capacity, cylindrical, horizontal storage tank (ST-300). The storage tank, Chem-Tainer Model# TA13003LC/LA is used to store pre-treated groundwater prior to the filtering and air-stripping process. This allows for a more control of the flow (i.e. steady state operation) going through the air-stripper. Operating the treatment system process in batch mode will prevent slugs of water going to the air-stripper and also pre-vent the air-stripper from operating on and off due to unsteady seasonal flows. The head space in the storage tank is passively vented outside of the treatment building to the atmosphere. The storage tank was fitted with low, high, and high-high level switches. The low and high level sensors are the operational switches for transfer pump TP-300. The high-high level sensor is reached if the transfer pump is either malfunctioning or pumping against a high pressure head due to clogged filters downstream. Activation of the high-high level sensor results in a system shutdown and alerts system operators.

Cartridge Filters

Two (2) cartridge filters CF-400 and CF-401 were installed downstream of the storage tank, groundwater is pumped via transfer pump TP-300 through cartridge filters. These units are arranged in parallel, but operated only one at a time to allow for continuous system operation while replacing spent filters. The cartridge filters are Harmsco Model# HIF-14SS filter housings containing 20 and 50-micron filters. As described previously, these units are designed for the removal of residual suspended solids prior to discharge to the clay filtration unit. A high pressure sensor (PT-301) located between the transfer pump and the cartridge filters has been integrated into the system programming to indicate the amount of fouling occurring in the downstream filtration units. The cartridge filters are shown in Photo 20 (Appendix B).

Clay Filtration Unit

As designed, a clay filtration was installed after the cartridge filters. The clay filtration unit ACF-400 is a US Filter Model# PV-500 tank filled with 400 pounds (lbs) of activated clay media. This unit serves for the removal of residual emulsified NAPL. The clay filtration unit is shown in Photo 20 (Appendix B).

Low Profile Air Stripper

A QED Air Stripper EZ-4.4SS low profile air stripper (AS-700) (see Photo 21, Appendix B) accompanied by a 5.0 hp New York Blower (B-700) was installed to provide final treatment of the groundwater prior to discharge to the POTW. Ambient air utilized to strip the VOCs is forced vertically upward via the blower through 3/16-inch diameter holes in the aeration trays. The function of the aeration trays is to enhance the opportunity for air/water mixing. The dissolved-phase VOCs are driven out of the water stream via the concentration gradient between the water and the air (volatilization). The air stripper off-gas is piped to the atmosphere via the air discharge stack which penetrates the building roof line located 17 ft above the ground surface. The treated water trickles to the sump at the bottom of the low-profile air stripper and is discharged by transfer pump (TP-700) to the local POTW.

Regenerative Blower Unit

A 10-horse power (hp) Rotron regenerative blower (B-900) (see Photo 19) was installed to extract soil vapors via induced vacuum at each VEP wellhead. Soil Vapor Extraction (SVE) involves inducing airflow in the subsurface with an applied vacuum, and thus enhancing the in-situ volatilization of contaminants. The SVE process takes advantage of the volatility of the contaminants to allow mass transfer from adsorbed and free phases in the soil to the vapor phase, where it is removed under vacuum and treated above ground. Additionally the induced vacuum enhances the NAPL recovery at each VEP well location by creating a negative pressure gradient. The SVE skid is also equipped with a moisture separator (knock-out tank KT-900) to collect any condensation or liquid extracted from the wells. A transfer pump (TP-900) operating on two liquid level switches (high level and low level sensors) on the knock-out tank pumps any liquid generated into the oil/water separator to undergo the liquid-phase treatment aspect of the system. A high-high level sensor activates a system shutdown, as it indicates either the malfunctioning of the transfer pump TP-900 or an unwanted flow of groundwater into the SVE portion of the system.

Vapor Phase Granular Activated Carbon Units

Vapor phase granular activated carbon (VPGAC) units ASC-501 and ASC-502 are US Filter VSC-2000 vessels containing 2,000-pounds of coconut shell based virgin or regenerated carbon in each unit. As described previously, these units are used for the removal of vapor phase VOCs below the NYS Air Guide 1 effluent standards prior to final discharge to the atmosphere through a 6-inch diameter, 17-foot high, PVC exhaust stack. Piping to the VPGAC units established through a combination of both flexible hose connections and rigid piping allows the operation of the units in parallel, series, or as single units. However, it is anticipated that these units will normally operate in a series configuration. The results of system performance monitoring and sampling will be used to establish a suitable carbon change-out schedule during initial operation of the system. In general, the VPGAC units will be replaced when effluent samples from the VPGAC units indicate breakthrough of the second vapor phase vessel. The effluent side of the VPGAC is equipped with a high pressure sensor (PT-501). The high pressure alarm will result in a system shutdown if reached and will notify the system operator.

2.8 Utility Service

Electric service to the site was obtained from an existing utility pole located across Allen Street at the corner of Scioto Street. The power is transferred via overhead to the treatment building. A 480 volt, three phase, 200 amp electric service was specified and installed to satisfy the power requirements of the groundwater collection and treatment system. The service was installed with a power disconnect located outside of the building in case of an emergency.

Phone service was provided to treatment building for the operation of the supervisory control and data acquisition (SCADA) remote monitoring equipment.

2.9 Site Final Cover

Upon completing all site related construction activities a foot of virgin screened bank run gravel was placed over all surficial soils in disturbed areas of the site. The limits of the soil cover placement are shown on Record Drawing G-1. The site was then seeded with a mine seed mix comprised of the following species; Fawn, Annual, Timothy Common, Ryegrass, Birds Foot Trefoil, Alsike Clover, Medium Red Clover, and Redtop.

2.10 Site Survey

As specified in the remedial design a professional surveyor was employed to survey the "as-built" construction of the treatment building, treatment building access road, recovery wells, and vertical barrier wall location. Also the site property lines, electric lines, sanitary manhole, and other pertinent site features were located. The site survey and property description can be found in the Site Management Plan.

3. Construction Permits

To construct the remedial system, the following permits were obtained.

- USACOE Nationwide Permit #38;
- City of Jamestown Industrial Wastewater Discharge Permit; and,
- City of Jamestown Building Permit.

The work related to the construction in and along the Chadakoin River was conducted under the USACOE Nationwide Permit # 38, application No. 2000-00778 issued by the USACOE Buffalo, NY branch. The permit is provided in Appendix D.

An Industrial Wastewater Discharge permit was obtained from the City of Jamestown to discharge the water, as well as to make the connection to the local sanitary sewer manhole #3T6. The Industrial Wastewater Discharge permit is provided in Appendix D.

A local building permit was obtained prior to starting any construction activities onsite. Additionally prior to energizing the treatment building and any electrical equipment an electrical inspection was performed to insure that all local, state, and government electrical codes were followed.

Technical approval to construct and a certificate to operate a process, exhaust, or ventilation system was not required according to Section 201-2 (Air Resources Document of NYSDEC) as the site is not considered as a major source (major source is defined as having emissions of 10 tons per year or more). It is considered as a trivial source according to 201-3.3 (item 29). According to 201-3.1 and 201-3.3, trivial activities are exempt from permitting requirements. Pursuant to the Department's approval of the 30% design submittal (August 23, 2004 approval letter), an air discharge permit will not be required for the remedial treatment system since the site work is being conducted under the state Superfund program.

4. Site Management Plan

A site management plan (SMP) has been prepared and is provided under a separate cover. The SMP defines and summarizes the access agreements, institutional controls, soil management plan, operation and maintenance, and monitoring plan.

5. Construction Completion Certification

This is to certify that the Engineering Construction Completion Report for the D.C. Rollforms Site in Jamestown, New York, Site Code #907019 was prepared in accordance with the Remedial Design Work Plan (ARCADIS 2006) approved by the NYSDEC and the Order on Consent, Index # B9-0446-94-01A, as entered into by Ingersoll-Rand and the NYSDEC.

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ARCADIS
Moh Mohiuddin, Ph.D., P.E., DEE
Principal Engineer-Engineer of Record
NY PE License #074527

6. References

ARCADIS G&M, 2006. 100% Remedial Design Report, D.C. Rollforms, Ingersoll Rand Site, Jamestown, New York, Site Code 907019. August 6, 2006.

Administration Order on Consent Index #B9-0446-94-01A, DC Rollforms site, Site #907019, Ingersoll Rand Company, Jamestown, New York, September 21, 2004.

Record of Decision, D.C. (Dow Craft) Rollforms Inactive Hazardous Waste Site, Jamestown, Chautauqua County, New York, Site No. 9-07-019. March 31, 2003.