Design Basis Summary
Dual Phase Recovery System
Gasoline Fueling Station – Royal Farms #96
500 Mechanics Valley Road
North East, Cecil County, Maryland 21901
OCP Case No. 2011-0729-CE
MDE Facility No. 13326

Introduction
Based on the July 27, 2011 enhanced fluid recovery (EFR) pilot study findings AEC has developed the following remediation system design criteria: Radius of influence (ROI) - 25 feet; Individual recovery well flow rate – 6 gallons per minute (gpm); Individual recovery well drawdown - 4 feet below static groundwater; and, Individual recovery well air flow rate - 50 cubic feet per minute (cfm). Based on a 10 recovery well use scenario the minimum treatment system equipment sizing criteria will be: 30 gpm water flow rate and 500 cfm air flow rate. Dual phase (vapor and liquid) recovery technology has been selected for use at this site. Dual phase recovery will be implemented using pneumatic submersible pumps for liquid removal and a positive displacement vacuum blower for vapor removal. This technology is similar to EFR in concept and application. The following provides a summary of the equipment to be used for the dual phase application at the site. Also provided are a Process and Instrumentation Diagram and Trench and Well Head Details.

Soil Vapor Extraction System
25 HP Positive displacement vapor extraction system, Tuthill 5009SL or equal
600 ACFM @ 10"Hg. Capacity
Temperature gauge
High temperature switch
Inlet filter and inlet silencer
Universal SD series or better discharge silencer
Universal SD series or better
Belt drive
Automatic and manual dilution valves with silencer

200 Gallon Vertical Air/water Separator
Conductivity probe level switches
10" diameter clean out ports with vacuum rated quick release lids
Clear PVC sight glass piping to liquid ring pump, to check for water carryover
Liquid filled vacuum gauge
Vacuum assist line
2" drain valves
Vacuum relief valves
Dilution valve with filter/silencer
Inlet screen

MK Coalescing Oil/Water Separator System
Model C85 with 85 GPM capacity

Coalescing separator with product skimming weir
Polypropylene coalescing pack with 1/2" spacing for efficient oil removal
Hopper bottom for sludge removal
Effluent chamber with stainless steel float level sensors

MK Low Profile Cascade Air Stripper System
0-150 GPM flow rating
800 CFM air flow rating
3-tray air stripper unit - Model LP150-3
Low profile air stripper with 7.5 hp AMCA Type B spark resistant aluminum blower
Nylon tube aeration air stripper for high mass removal rates with low maintenance
Low, high, and high-high sump conductivity probes
12" clean out hatch
Epoxy coated carbon steel construction
Sump level sight glass
99.8% Removal for BTEX @ 50 GPM, 60°F

Air Stripper Blower Silencer to Reduce Noise Level of the Stripper Blower

1.5 hp Transfer Pump
3450 rpm, TEFC motor
Cast Iron housing with bronze impeller, anti air lock design
Manual "Pump ON" button inside building for sampling

3 hp Transfer Pump (2)
3450 rpm, TEFC motor
Cast Iron housing with bronze impeller, anti air lock design
Manual "Pump ON" button inside building for sampling

Groundwater Inlet Manifold
Carbon steel with brass valves
2" main with (11) 1" points, with shut off valve, check valve, sample port, barb for each groundwater pump.

Vapor Inlet Manifold
PVC
6" main with (11) 2" points, with shut off valve, union and sample port for each well.

Air Compressor
15 HP rotary vane with continuous run option
90 gallon receiver tank
Air cooled after cooler
Low oil switch
Tank auto drain
1/2" filter regulator
1/2" 3 way Asco solenoid valve

Recovery Pumps - QED AP4 Long Top Fill Pneumatic Pumps (10)
10 GPM maximum flow rate
Down well hoses and support rope per well
Vacuum well seal
3/4" brass shut off at each well for groundwater
1/2" brass ball valve for compressed air at each well

Master Control Panel System
NEMA 3R control panel with blank front cover
Swing out sub panel for gauges, control operators, and switches
IEC Magnetic motor starters, safety switches, H-O-A controls
Control transformer
8 intrinsically safe relays, 8 alarm indicator LED's, 16 output channels
Hard wired relay logic
Exterior GFCI utility outlet
System run-time totalizing hour meter
Blower low pressure alarm
Anti-falsing alarm circuit to prevent nuisance tripping
Three phase voltage and phase monitor
Emergency E-stop LED red indicator light located on swing out sub panel

Telemetry System Model 570
16 analog inputs, expandable to 32
4 digital outputs
24 hour gel cell battery backup
10,000 line data logger
UL listed surge suppression
Manual or automatic control of outputs
8 number dial out list
Programmable dial out intervals
Site telephone with duplex RJ11 jack

Vacuum Transducer
Integrated into telemetry for real time monitoring
4-20mA

System Building
8.5'W x 28'L x 9.5'H aluminum/steel enclosure, fully insulated
Removable sliding wall panels for ease of maintenance
Exterior grade plywood floor, structural steel frame
Includes 100 watt XP interior light, and removable center grate for ease of maintenance
Breaker panel and control panel will be mounted on a vertical steel bracket attached to platform end.
10" structural steel base with 4" steel cross members
Steel corner posts and roof frame

Continuous sheet aluminum roof
2 XP heater with thermostat, 12,000 BTU each

Groundwater Flow Totalizer
Pulse output and flow calibration button

Equipment Electrical Installation
Includes XP wiring, XP seal off connectors, liquid tight flexible conduit
UL listed equipment.

Equipment Mechanical Installation
Includes mounting, piping and connectors
Brass fittings, sample ports, pressure gauges and sight glasses
400 Amp meter base and (2) 200 amp fused disconnects or breakers for the system and oxidizer
Weatherhead with extension pole and bracket support
Electric meter socket base installed

MKE Model 500E Electric Oxidizer with 50% Effective Heat Exchanger
500 CFM capacity 99% destruction efficiency; flame arrestor
Watlow controls
First out detector
Honeywell 2-pen chart recorder
Located outside system enclosure
Includes 200 amp circuit breaker in main panel

Air/water Separator Knock Out Tank
Located prior to oxidizer to minimize condensed liquids from entering burner or vapor phase carbon bed.

VF-400 Vapor Phase Carbon Vessels
Filled with activated carbon for odor control and vapor capture when the oxidizer is off, during remote restart conditions

Air/water Separator Knock Out Tank
Located prior to oxidizer to minimize condensed liquids from entering vapor phase carbon bed for air stripper

500 Gallon Product Holding Tank
UL listed with emergency vents
Stainless steel high-level float switch and intrinsically safe channel in the control panel

Electrical Service Installation
200 amp 3/60/460 volt 3 wire plus ground electrical service to NEMA 3R control panel
Interior electrical will comply with NEC requirements for Class 1, Division 2, Group D Hazardous locations

Motors will be TEFC construction

Nationally Recognized Testing Laboratory (NRTL) Approvals
MET Labs certified manufacturer

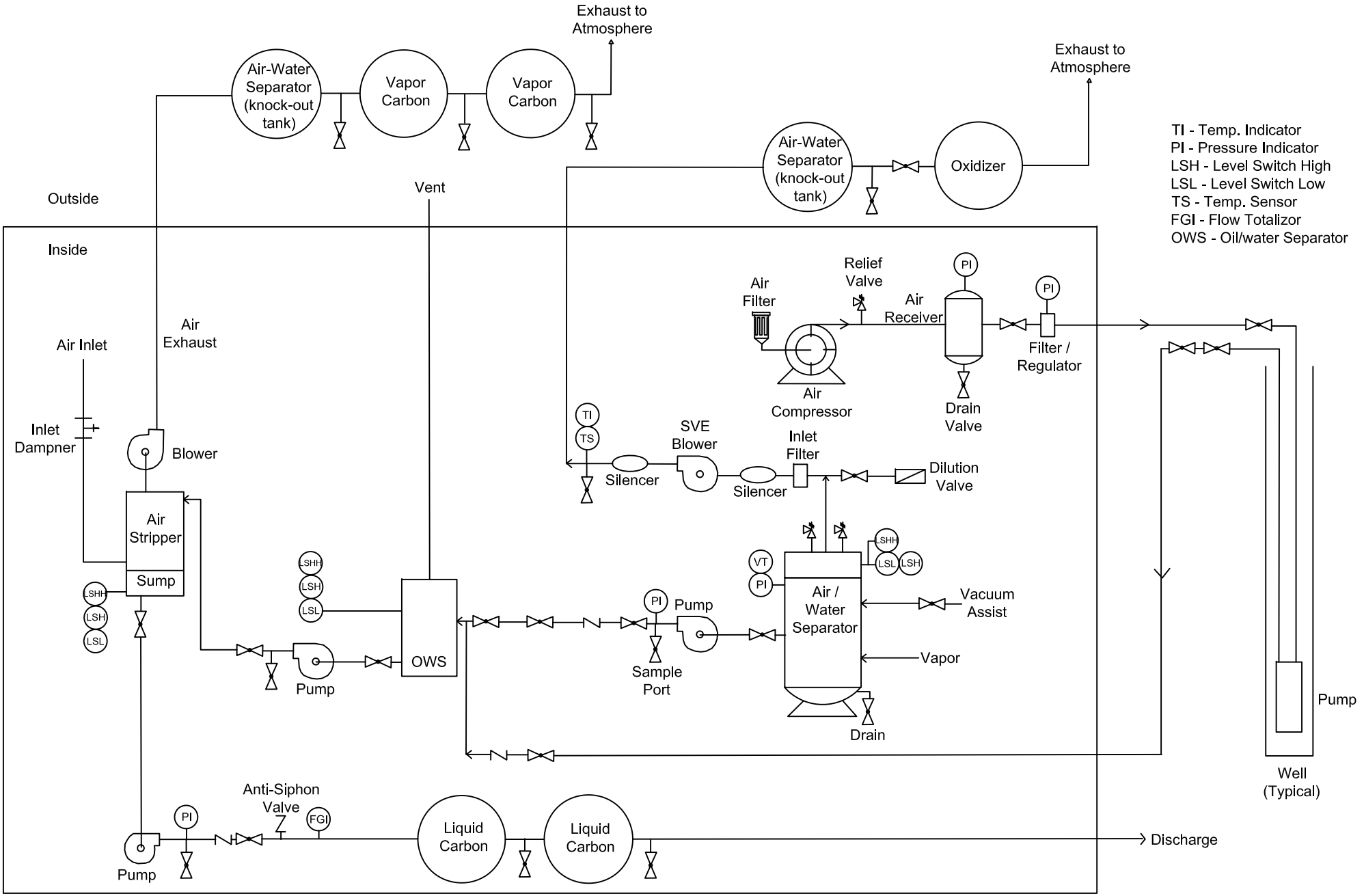
Recovery Well Vaults
2’ by 2’ by 18” side skirt traffic rated well vaults with hydraulic arms

Recovery Well Trenches
Trenches will be saw-cut in asphalt and/or concrete
Trenches will be installed 24” wide and 30” deep
Pipes will be bedded in pea-gravel
Trenches will be backfilled in one foot lifts with crush and run gravel or removed fill
Disturbed areas will be placed back to its original condition i.e. asphalt, concrete, soil

Soil Vapor Extraction System Lines
Recovery wells will have independent SVE lines
Lines will be installed using 2" diameter PVC conduit from treatment building to recovery wells

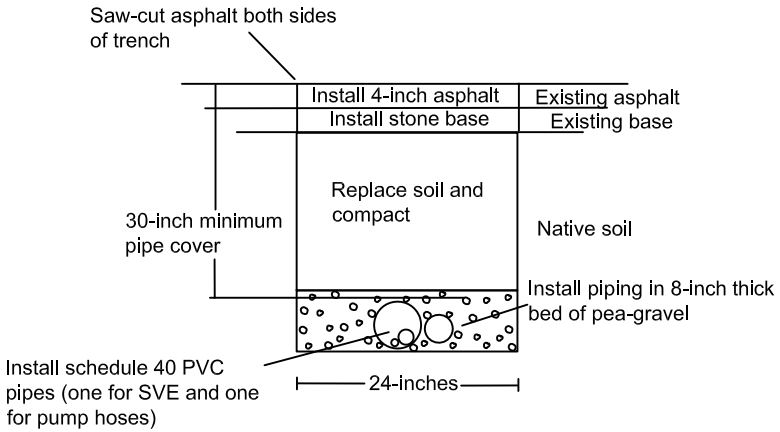
Recovery Pump Air Line and Discharge Line
Recovery wells will have independent air and discharge lines
Lines will be installed within 4" diameter PVC conduit from treatment building to recovery wells
Air lines to recovery pumps will be 1/2" diameter
Discharge lines from recovery pumps will be 3/4" diameter
Due to the number of 90 degree turns, PVC "sweeps" will be used so that the air/water lines can be easily installed and removed for maintenance

Treated Effluent Discharge Line
Discharged approximately 85 feet to the northeast to the sanitary sewer drain
Effluent line will be 1.5” diameter black PE plastic
Installed three feet below grade

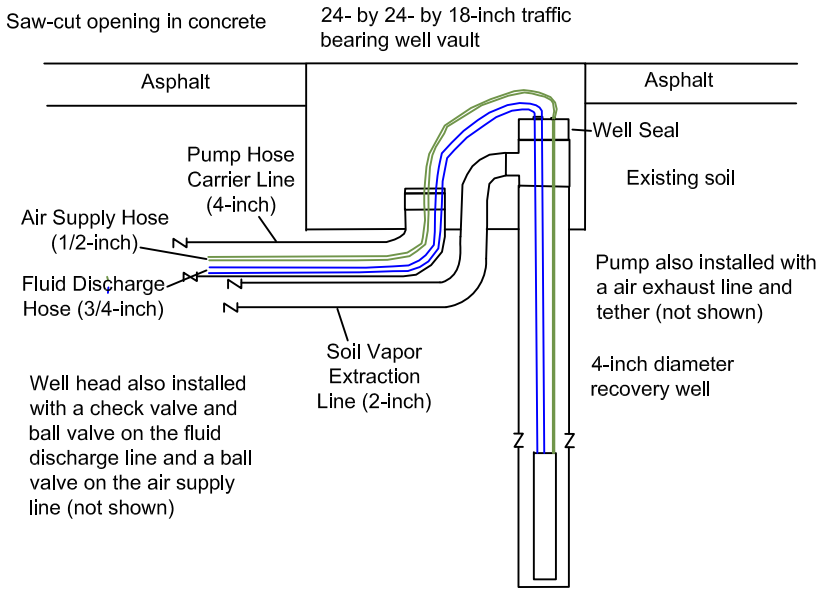


Advantage Environmental Consultants, LLC 8610 Washington Boulavard, Suite 217 Jessup, Maryland 20794 301-776-0500	Drawn by: JSS	Checked by: JSS	Process & Instrumentation Diagram Royal Farms No. 96 500 Mechanics Valley Road North East, Maryland
	Date: 9-13-11	Revision: First	

Trench Section (Typical)



Well Head Set Up (Typical)



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Vault and Trench Details
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