Case Study: Vienna Tetrachloroethene Superfund Site and Ravenswood PCE Ground Water Plume Superfund Site.	
Site Overview	In Vienna, West Virginia, two tetrachloroethene (PCE) plumes from former dry cleaners had led to the shutdown of six City drinking water wells, with two more downgradient City wells at risk. CDM Federal Programs Corporation (CDM Smith), as a contractor to EPA Region 3 for the Vienna Tetrachloroethene Superfund Site, designed an air sparge (AS) and soil vapor extraction (SVE) system to remove PCE from the subsurface, coupled with a hydraulic control well strategically placed to maintain the hydraulic gradient of the larger PCE plume away from the City's wells. At the nearby, smaller Ravenswood PCE Ground Water Plume Superfund site, PCE from undefined sources was detected in five municipal drinking wells. CDM Smith conducted an AS/SVE pilot study for EPA Region 3 using a decommissioned treatment unit from the Vienna Site.
GSR Project Outcome	- Pulsing system optimization following initial system start up reduced power usage by over 30% from baseline conditions. - Individual solenoid valves on each well combined with a Programmable Logic Controller (PLC) allowed for the creation of multiple pulsing networks, which are modified periodically to optimize PCE removal while reducing the size of the compressors and blowers; further reducing system electrical demand. - Asphalt from road cuts was recycled rather than being disposed at an offsite landfill. Additionally, high quality excavated material (sand and road base) was segregated during excavation and reused as pipe bedding and road base. - A decommissioned treatment unit from the Vienna Site was relocated to the Ravenswood Site for a pilot study, eliminating the need for the fabrication and shipment of a new pilot study treatment unit. - Air sparge compressor exhaust was modified to decrease heating costs in the winter and cooling costs in the winter - Local labor was used for treatment system construction and is used for system maintenance and compliance monitoring, reducing travel-related impacts. - A small existing treatment shed was donated to the City government for reuse at another location rather than requiring offsite disposal.

Background & Drivers	While the primary consideration in treatment system design was system effectiveness, the systems were also designed for operational flexibility (pulsing networks using a PLC) and system reuse (self-contained, skid-mounted treatment units). Drivers during system construction (material recycling, local labor, etc.) were sustainability, waste minimization, and cost effectiveness. The reuse of available, on-site material reduced the need for imported fill. The reuse of the skid-mounted treatment unit from one site eliminated the need to fabricate a new treatment unit for the pilot study at the other site. The use of local labor ensures that federal Superfund program funding have the largest possible positive impact on the local economy.
Regulatory Program	Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) , EPA Region 3 Lead
Site End Use	The public drinking water in both cities is protected for residential use. Municipal, residential, and commercial users are not impacted, as the treatment/pilot study system footprints are limited to several small treatment units and associated trenching / well heads.
Contaminants of Concern and Impacted Media	PCE impacted groundwater
Key Stakeholders in Project	- EPA Region 3, West Virginia Department of Environmental Protection (WVDEP), CDM Smith - Citizens and local governments of Vienna and Ravenswood
Cleanup Objectives	- The cleanup objective at both sites is the maximum contaminant level (MCL) for PCE. - Ensure public water supplies are protected.
Remediation Strategy	- Address groundwater plumes using a combination of air sparge and soil vapor extraction coupled with a hydraulic control system - Implement institutional controls to prevent the installation/use of private drinking water wells - Target higher areas of PCE concentrations with multiple pulsing cycles - Evaluate system efficiency and effectiveness on ongoing basis and modify/optimize as needed to address changing plume conditions.

GSR Strategy/Best Management Practices (BMPs)	- Energy efficient hydraulic control system (VFD) - Energy efficient AS/SVE systems (multiple localized pulsing networks allowed for smaller sized blowers and compressor motors) - PLC system and individual solenoid valves enables remote monitoring and adjustment of system operation by CDM Smith engineers to address changing plume conditions - Local CDM Smith technician hired to perform periodic equipment maintenance and compliance monitoring - Reusable treatment units - Optimized treatment system flow rates (SVE systems) - Groundwater modeling used to appropriately size hydraulic control system. - Reuse of excavated material (where appropriate) and recycling of material not suitable for reuse - Donation of surplus shed to City government, reducing volume/cost of disposed material. - Use of local labor during construction and operation reduces environmental impacts of travel and ensures that federal Superfund program funding has the largest possible positive impact on the local economy.
GSR Metrics and/or Footprinting Tool(s)	None used
Lessons Learned [Optional]	Implementation of GSR BMPs and ongoing system optimization resulted in an overall cost savings during construction and ongoing cost savings during operation, without sacrificing system operational effectiveness.
GSR Project Contact	Anthony Iacabone, EPA Region 3 Remedial Project Manager Iacobone.Anthony@epa.gov Eric Kenney, P.E., CFM Environmental Engineer, CDM Smith Ph.: 703-691-6576 KenneyED@cdmsmith.com
Relevant Links [Optional]	
References [Optional]	