



FieldNOTE

AUGUST 2014

An Update on NASA's Cleanup Efforts at Santa Susana Field Laboratory

This edition of FieldNOTE focuses on NASA's treatability study using **BEDROCK VAPOR EXTRACTION BVE**

Groundwater Treatability Studies at SSFL

NASA, Boeing and the Department of Energy (DOE) are coordinating efforts to perform treatability studies at Santa Susana Field Laboratory (SSFL) on selected groundwater remediation technologies.

[See list to right.]

Treatability studies are performed both in the field and in the laboratory to evaluate how effective a technology is and whether or not it is possible to use on a larger scale at sites with similar conditions. The goal of these treatability studies is to determine if a treatment technology being tested is feasible to use as a full-scale cleanup option for the SSFL site. Any final groundwater remedy must be able to meet the requirements under the 2007 Consent Order for Corrective Action.

Groundwater Treatability Studies at SSFL include:

LABORATORY STUDIES

Microbial characterization of rock core, pore water (NASA, Boeing & DOE)

Bio-Stimulation (NASA, Boeing & DOE)

Thermal heating of rock core (DOE)

FIELD STUDIES

Bedrock vapor extraction (NASA)

Chemical oxidation by injecting permanganate in the groundwater (Boeing)

NASA's Bedrock Vapor Extraction Treatability Study

Bedrock vapor extraction (BVE) – like its better known cousin soil vapor extraction (SVE) – is a remediation technology that can remove contaminants, especially those that evaporate such as volatile organic compounds (VOCs), from below the ground surface. Vapor extraction technologies have been implemented effectively at hazardous waste sites across the country. NASA is looking at whether BVE will work in the site conditions beneath the NASA-administered property at Santa Susana Field Laboratory. The BVE field test is being conducted in the Bravo Test Area located in Area II at SSFL. Site investigations confirm the presence of VOC concentrations in Bravo Test Area, which operated from 1956 to 2005 to test rocket engines.

Site investigations have shown that SSFL has an underlying fractured sandstone bedrock matrix that can trap VOCs in the pore space and fractures of the rock. NASA's BVE treatability study also looks at whether groundwater containing VOCs is releasing vapors (with VOCs) into the bedrock fractures of the vadose zone. "We want to know if BVE can be implemented in the bedrock at SSFL, said NASA Program Director Allen Elliott, "and if so, how effective is it in removing the VOCs." NASA's work plan, approved by the California Department of Toxic Substances Control (DTSC), identifies the five primary BVE treatability study objectives.

[See below.]

BVE Treatability Study Objectives

NASA is evaluating:

1. Air production from a groundwater extraction well
2. What happens when vacuum is applied in bedrock fractures and in the rock matrix
3. Effects of air flow paths over changes in rock makeup (shale, sandstone, solid and unconsolidated bedrock) and in fractures in the rock
4. VOC concentrations reduced over a period of time
5. Whether VOCs are completely removed from bedrock or residual VOCs remain after completing the BVE test



How BVE Works

BVE is a treatment system that applies a vacuum on wells and draws vapors from fractures in bedrock.

NASA is using an existing well (HAR-19) in the Bravo Skim Pond area to conduct the treatability study because it is located in an area known to have extensive fractures and flow paths in the bedrock. [See map.] Well HAR-19, will be reconfigured to accommodate BVE vacuum equipment, to pull air and vapors through the soil and up the well to the ground surface.

Groundwater treatment will occur above ground. The vapors will be separated from the extracted air by pumping them through containers of activated carbon. VOCs will be captured by the carbon filter, which when full the filters will be disposed of at a licensed facility and replaced, and the treated air will exit to the atmosphere.

Conducting the BVE Field Test

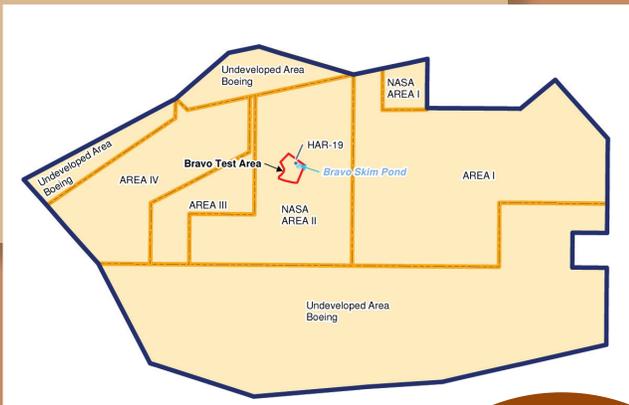
NASA has begun the BVE treatability study by verifying the presence of VOCs in the bedrock using field measurements followed up by a laboratory analysis of rock core samples. Results confirmed VOC concentrations in the locations identified for field testing. NASA's next step was to install four new piezometers (smaller wells used to measure groundwater level, flow, and direction). These along with several existing piezometers in the Bravo Skim Pond area are positioned at multiple depths and at various distances from the HAR-19 extraction well. During the field test, this network of wells will be used to take samples and measure the effects from operating the BVE system. NASA will collect vapor samples to estimate the total VOC mass in the vadose zone (above groundwater) and look for the influences on vapor extraction (such as vacuum pressure) and changes in the area due to vapor extraction (such as water levels). NASA will also measure the distances from HAR-19 that vapors are being pulled, called the Radius of Influence (ROI). "Having this kind of data enables us to extrapolate the use of BVE at other locations on a larger scale over a longer period of time," said Elliott.

Next Steps

NASA installed new piezometers in July. The BVE system will be installed in August and operate on weekdays for three weeks with NASA taking samples on Mondays and Fridays. (The weekend shutdown is to allow the water and air in the sampling area to equilibrate.) Then after six weeks, NASA will conduct a so-called rebound test where the BVE system will be operated for one day to take measurements and collect vapor samples. "By comparing rebound test results with all previous samplings, we can measure the longer term effectiveness of VOC removal and thus evaluate the technology's feasibility for use at SSFL," said Elliott.

When the study is completed NASA will submit a report to DTSC for review that includes a systematic evaluation of the test objectives and the effectiveness of the treatment technology.

Based on the treatability findings, NASA will make recommendations to DTSC on whether BVE is a viable groundwater remediation technology for SSFL. Results will be shared with Boeing and DOE and be posted on the SSFL Cleanup website at ssfl.msfc.nasa.gov.



NASA is using an existing extraction well (HAR-19) in the Bravo Skim Pond area to conduct the treatability study.

NASA is evaluating whether BVE will work in the site conditions beneath SSFL.

FOR MORE INFORMATION CONTACT **Allen Elliott** NASA SSFL Program Director
SANTA SUSANA FIELD LABORATORY
Email allen.elliott@nasa.gov