

Santa Susana Field Laboratory

GROUNDWATER PILOT STUDY

Enhanced In Situ Bioremediation (EISB)

NASA continues to prepare for groundwater cleanup at the Santa Susana Field Laboratory (SSFL). NASA is working closely with the Department of Toxic Substances Control (DTSC) under the 2007 Consent Order for Corrective Action to develop final groundwater cleanup plans. NASA is conducting pilot and treatability studies to identify cleanup strategies that will be most effective, and aid in the development of cleanup plans. NASA's latest pilot study will test the effectiveness of enhanced in situ bioremediation (EISB) to clean up groundwater beneath SSFL.

NASA's EISB Pilot Study

NASA is committed to using natural treatment technologies wherever possible to minimize impacts to the unique ecosystem at SSFL. NASA is working on a pilot study that will test the effectiveness of a natural groundwater treatment method, EISB. EISB uses naturally occurring microbes to remove trichloroethylene (TCE) and other volatile organic compounds (VOCs) from the groundwater beneath NASA areas at SSFL. NASA's pilot study will evaluate whether EISB is an effective treatment at SSFL, given the site's unique conditions where the groundwater and contaminants have seeped through fractures into the bedrock.



NASA is constructing a treatment system for a groundwater pilot study near the spillway of Alfa Test Stand 1. NASA selected this location because it is a high concentration source area with some already available well infrastructure. The entire above ground extraction recirculation system will take up an area about the size of a basketball court.

Understanding In Situ Bioremediation

Bioremediation refers to the use of very small, naturally occurring organisms called microbes to degrade environmental contaminants into harmless byproducts. With EISB, an 'amendment' is used to enhance the growth of the naturally occurring microbes, resulting in greater contaminant degradation. In this study, the amendment will be a food-grade emulsified vegetable oil (EVO), along with other nutrients and vitamins that are California approved for injection. The EVO will ferment and produce electron donors: hydrogen and acetate. The microbes will use the electron donors to sequentially reduce the groundwater contaminants through a process called reductive dechlorination. The reductive dechlorination process for TCE, the primary chemical of concern in NASA-administered areas at SSFL, is shown simplified in the illustration below.



Note: Additional byproducts of EISB include hydrogen ions, water, carbon dioxide, methane, and chloride ions.

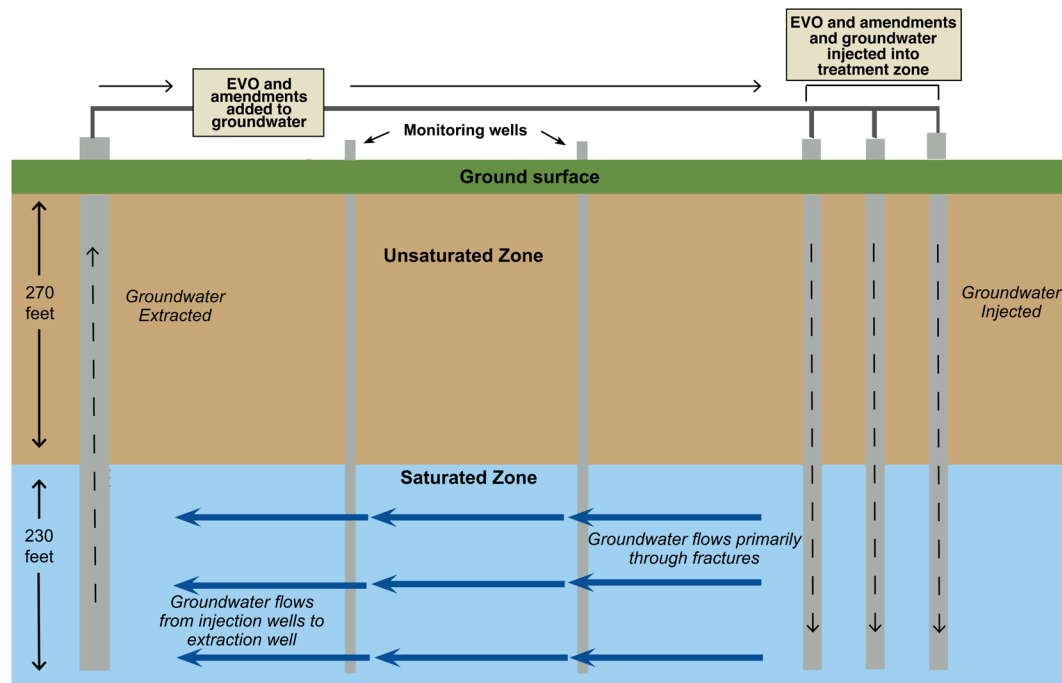
Santa Susana Field Laboratory

Enhanced in situ bioremediation pilot study

NASA's EISB Treatment System

To test the effectiveness of EISB at SSFL, NASA is working closely with the DTSC and the Los Angeles Regional Water Quality Control Board (LARWQCB) as it plans the construction of a small, closed-loop extraction-recirculation system in the aquifer below the ground surface near Alfa Test Stand 1.

The system will extract groundwater from the aquifer and carry it through a pipeline to the surface where EVO and amendments are added. The amended water will then be piped into three injection wells and injected back into the aquifer directly beneath SSFL per a LARWQCB Waste Discharge Requirements (WDR) permit. The recirculation loop will help distribute the amended groundwater and enhance in situ treatment of



Cross section view of NASA's EISB treatment system and the groundwater recirculation zone.

the groundwater within the area between the extraction well and injection wells. A dye tracer will give NASA a greater understanding of how the groundwater migrates through the treatment zone.

Evaluating EISB Treatment Success

NASA will carry out a robust monitoring plan to track the effectiveness of the EVO, nutrients, and microbes at reducing contaminants in the groundwater treatment zone given the specific site conditions. If the reductive dechlorination occurs as expected, and contaminant reduction is sufficient, NASA will consider the use of EISB to clean up groundwater in other source areas. In addition to evaluating the large-scale application of EISB across SSFL, the system has the potential to accelerate cleanup by achieving contaminant removal while NASA waits for DTSC to complete the California Environmental Quality Act (CEQA) process and approve final cleanup plans.

For further information, please contact

Lori Manes

NASA SSFL Community Outreach

Phone: 818.806.8834

Email: lori.manes@nasa.gov

Visit the NASA SSFL website and subscribe to our E-list to receive updates at <https://ssfl.msfc.nasa.gov>