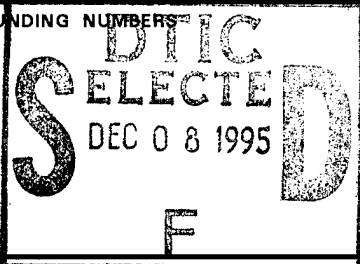


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A Partnership to Improve the Environment

Naval Facilities Engineering Service Center
Port Hueneme, California 93043-4328

Demonstration of Hot Air Vapor Extraction for Fuel Hydrocarbon Cleanup

INTRODUCTION

Hot air vapor extraction (HAVE) is a fast-track, innovative environmental cleanup technology that uses a combination of thermal, heap pile, and vapor extraction techniques to remove and destroy hydrocarbon contamination in soil. This technology is very effective in cleaning soils contaminated with gasoline, diesel, heavy oil, and polycyclic aromatic hydrocarbons (PAH).

PURPOSE OF THE DEMONSTRATION

The HAVE system demonstration is designed to yield:

1. Performance capability of the system in cleaning fuel hydrocarbon contaminants in soil.
2. Cost data for use in implementation of the system.
3. Optimized design parameters for the system by using computer modeling.
4. Operational test report and other technology transfer documents to assist Government agencies in using the technology.

ADVANTAGES OF HOT AIR VAPOR EXTRACTION TECHNOLOGY

The HAVE technology has the following distinct advantages:

- *A simple but expeditious cleanup process.* The entire HAVE system is trailer-mounted and is ready for deployment once the heap pile is constructed. Cleanup time for 500 cubic yards of a diesel fuel contaminated pile is approximately 7 days.

- *An effective cleanup technology.* Capable of cleaning soils to below the regulatory required limits or to non-detectable levels.

- *A low cost alternative.* The treatment costs may be one third lower than those of the conventional thermal technologies.

- *Fuel hydrocarbon cleanup.* The contaminants removed are completely destroyed.

- *Clean air emissions.* The exhausts from the HAVE system are cleaner than most automobiles' exhausts.

DESCRIPTION

The HAVE system is an off-site thermal treatment technology for the remediation of hydrocarbon contaminants in soils, including gasoline, diesel, heavy oil, and polyaromatic hydrocarbon (PAH).

As with other off-site technologies, the contaminated soil needs to be excavated before treatment. The excavated soil is then built into a pile containing ducts for hot air distribution and vapor extraction. The soil

pile is covered and sealed with a sheet of heavy duty silicone membrane.

After the soil pile is constructed, the ducts are connected to the HAVE system, which is mounted in a trailer. The main components of the HAVE system include a:

- Burn chamber
- Vapor blower
- Hot air blower
- Catalytic oxidizer
- Control panels for displaying and recording various monitoring parameters

The burner is fueled by propane or natural gas to heat the air. The hot air coming out of the burner is fed into the soil pile through the distribution ducts to volatilize the contaminants and is removed from the pile through the extraction ducts back into the burner. The hydrocarbon vapor that is removed from the pile is destroyed in the burner through the combustion process. Due to the heating values contained in the hydrocarbon, the contaminants in the vapor become a secondary fuel for the combustion in the burner, thus reducing the amounts of propane or natural gas required to feed the burner.

The burner was designed to retain the vapor for approximately 0.7 second, long enough to completely de-

stroy the contaminants. The cleaned hot air is then fed back into the soil pile to continue the cycle. Since the oxygen available in the burner for combustion is depleted as the process progresses, fresh air is drawn into the burner to supply the necessary oxygen for combustion. The excess air built up in the system (approximately 15%) is vented through a bank of catalytic converters to remove the residual vapor contaminants before being released into the atmosphere. These exhausts are cleaner than those from most automobiles. Also, the operating temperature within the pile ranges between 200 and 350°F although the temperature in the burner can be as high as 1,800°F.

The HAVE system is equipped with various sensors to monitor the temperatures, air and vapor flow rates, hydrocarbon vapor, and the air emissions.

During the demonstrations, soil samples will be collected and analyzed daily to monitor the cleanup progress. After achieving the prevailing regulatory cleanup standards, the soils can be back-filled into the original sites.

For more information about the HAVE system, contact Mr. Jeff Heath, Manager, Technology Application Branch, Code ESC414, at (805) 982-1657 or DSN: 551-1657, or call our 24-hour number: (805) 982-4070 or DSN: 551-4070.

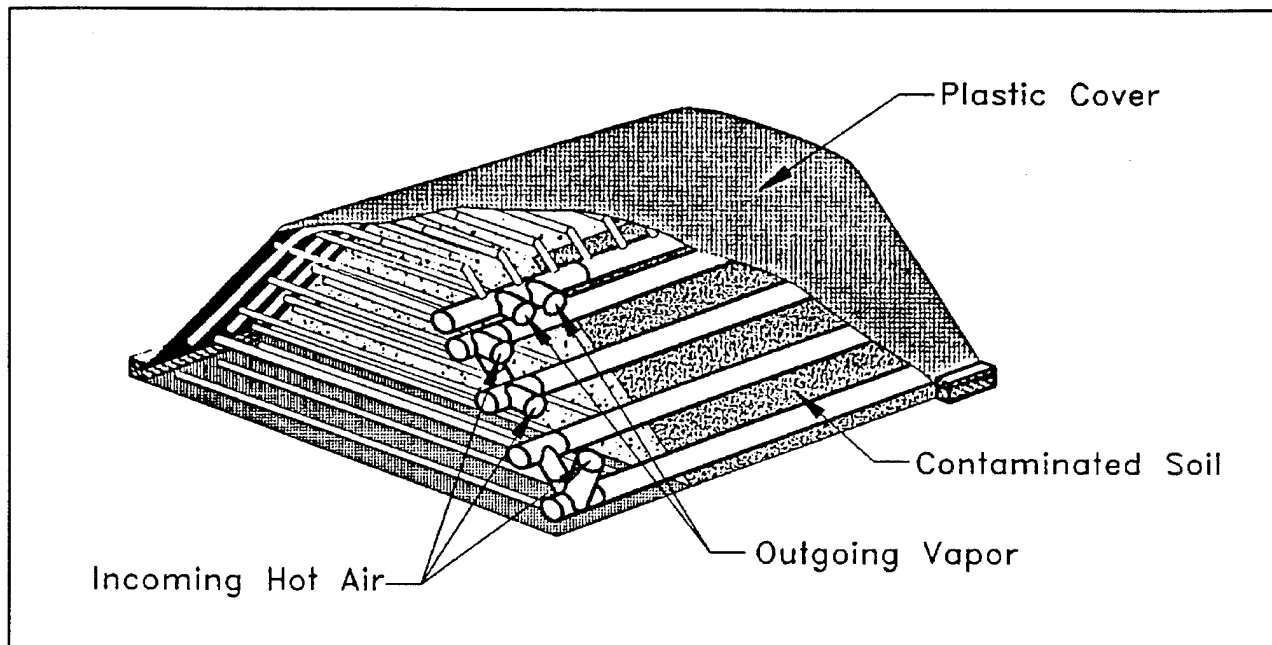


Figure 1. Hot air vapor extraction system.