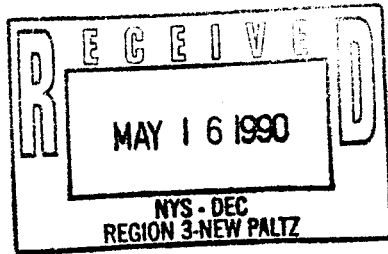




COMMAND AIRWAYS



May 15, 1990

Mr. David Traver
Principal Engineering Technician
New York State Department of Environmental
Conservation
21 South Putt Corners Road
New Paltz, New York 12561

Dear Mr. Traver:

As you and Mr. John Omana requested, I have enclosed the results from the soil gas survey conducted on Command's lease hold. In addition, I have also enclosed Dames and Moore's monitor well installation plan.

The soil gas survey illustrates more than one potential source of contamination. However, the parking lot tank was identified as one source of the contamination. As I have indicated, this tank is being evaluated further. I am working on this task.

As stated at IBM's meeting on April 23, 1990, I (Command) will forward a copy of this soil gas survey to Mr. Lopuch (IBM) in the interest of mutual cooperation and further addressing this site. I feel that Command's positive approach to this problem is clearly illustrated with our speedy responses to the issues, under the circumstances.

If you have any questions, please do not hesitate to contact me at (914) 462-6100, Ext. 325.

Regards,

A handwritten signature in cursive script that reads 'Bill Pulling'.

William Pulling
Manager Safety & Audits

WP:nj
Encl.

Acts like an air stripper
Packer

STATEMENT OF QUALIFICATIONS
VACUUM EXTRACTION SOIL REMEDIATION TECHNOLOGIES
DAMES & MOORE
WILLOW GROVE, PENNSYLVANIA

APRIL 9, 1990

 **DAMES & MOORE**

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- IV. RESUMES OF KEY PERSONNEL

REPRESENTATIVE PROJECTS

<u>Location</u>	<u>Project</u>
Virginia	Removal of Tetrachloroethylene from Fractured Bedrock
New York State	Soil Remediation and Enhanced Groundwater Recovery
Illinois	Removal of Chlorinated Solvents and Mineral Spirits from Clay
Tennessee	Remediation of Trichloroethylene and Tetrachloroethylene Contamination in Soil
Shreveport, LA	Remediation of Silty Clay Contaminated with Trichloroethylene
Arizona	Remediation of Silty Sand Contaminated with Gasoline
Merritt Island, FL	Emergency Response to Gasoline Spill
Delray Beach, FL	Remediation of Tetrachloroethylene Contamination
Compton City, CA	Gasoline Remediation Pilot Study
New Jersey	Trichloroethylene Remediation Pilot Study

REPRESENTATIVE PROJECTS
(Continued)

<u>Location</u>	<u>Project</u>
Michigan	Remediation of Trichloroethylene in Sand and Gravel
Welwyn Garden City, U.K.	Xylene/Toluene Vacuum Extraction Pilot Study
Port Melbourne, Victoria, Aus	Vacuum Extraction Pilot Study
Santa Maria, CA	Vapor Extraction of Hydrocarbons
San Jose, CA	Vapor Extraction of Hydrocarbons
Fresno, CA	Vapor Extraction of Hydrocarbons
Modesto, CA	Vapor Extraction of Hydrocarbons

INTRODUCTION

I. VACUUM EXTRACTION SYSTEM

Dames & Moore is pleased to introduce you to our Vacuum Extraction System (VES) services for remediation of soil and ground water contaminated with volatile organic compounds (VOCs). Dames & Moore's VES services were developed in, and are headquartered out of the Willow Grove, Pennsylvania, office.

Dames & Moore has developed VES services to deal directly with VOCs encountered in soil, or stockpile materials, and ground water. This effective treatment method saves time and money compared to excavation, transportation, and disposal of contaminated soils, or pumping and treatment of contaminated ground water.

The VES can be used to treat VOC-contaminated soils in the unsaturated zone in conjunction with other clean-up methods to reduce overall treatment costs at multi-media contamination sites. Our vacuum extraction system can eliminate VOC contamination in unsaturated soils before a costly ground water contamination problem develops. Our systems have provided complete VOC contaminant remediation at operating facilities with minimal interference to ongoing operations, avoiding costly shutdowns and disruption of business. The Dames & Moore VES has been accepted for use at hazardous waste sites by Federal and State regulating agencies.

In addition to using the VES to treat VOCs in unsaturated soils, Dames & Moore has developed a two-phase VES to treat VOCs in both soil and ground water. Our two-phase VES can provide complete remediation at a VOC site in less time, and at lower costs than using conventional pump and treat/air stripping methods. In Section II, the advantages of the two-phase VES over conventional ground water and soil remediation systems are outlined.

In conjunction with our vacuum extraction equipment, Dames & Moore has the experience and technical expertise to provide turnkey services for applications ranging from pilot scale studies to complete site remediation. We can provide services to address the client's environmental regulatory and community concerns and design an overall remedial plan to handle these issues effectively.



II. TWO-PHASE VACUUM EXTRACTION SYSTEM

Dames & Moore's two-phase vacuum extraction system cleans contaminated soils in the unsaturated zone, while recovering contaminated ground water at rates up to ten times greater than through the use of conventional pumping methods. This system has proven to be highly effective in units of low permeability. As a result of the high rate of ground water recovery, the ground water contaminant capture zone is increased compared to conventional remediation systems. An illustration of the two-phase and conventional vacuum extraction is presented on Figure 1.

Dames & Moore's two-phase vacuum extraction process, which is patent-pending, has won an Honor Award for Engineering Excellence from the Pennsylvania Consulting Engineers Council. The system removes volatile organic compounds from the soil in the unsaturated zone and also, simultaneously, removes VOC-contaminated ground water by way of a single extraction well. It remediates sites faster and at substantially less cost than conventional single-phase vacuum extraction combined with pumping and treatment of ground water.

In our two-phase system, up to 99 percent of contaminants are volatilized and stripped from ground water while it is still in the extraction well. Further treatment using an aboveground air stripper, a common component of conventional pump and treat methodology, is typically not necessary at sites where our two-phase vacuum extraction system is used. Eliminating air stripping reduces the volume of air discharge requiring treatment, resulting in less oxygenation of recovered water, and, consequently, less biological fouling of equipment components. Simplified equipment requirements minimize disruption to ongoing business operations.

Advantages of the two-phase VES as compared to conventional systems are:

- o Simplifies Equipment Requirements for Addressing Multiple Phase Subsurface Contamination

Standard vacuum extraction systems are designed to clean only the vadose zone by applying a vacuum device to draw air through soil by way of wells that do not extend below the water table. Ground water requiring treatment is removed by pumping from separate conventional water wells. In situations where water does flow into a vacuum extraction well, a second, liquid phase pump is placed either in the well or at the surface to remove the water by way of a second conduit. With two-phase vacuum extraction, a single piece of equipment removes contaminants from both the water and soil by way of a single well.



o Increases Rate of Ground Water Recovery

A major benefit of the two-phase system is that the rate of ground water recovery is significantly increased compared to conventional pumping. This is particularly advantageous in subsurface formations through which natural recharge is slow. The low water pressure created inside the well by the vacuum device makes it a low point in the hydraulic system, so that water flows to it more readily.

o Increased Ground Water Capture Zone

Two-phase vacuum extraction increases the ground water capture zone around a well compared to conventional pump and treat technology. By depressing the water table, the vadose zone subject to cleanup by vacuum extraction is also expanded.

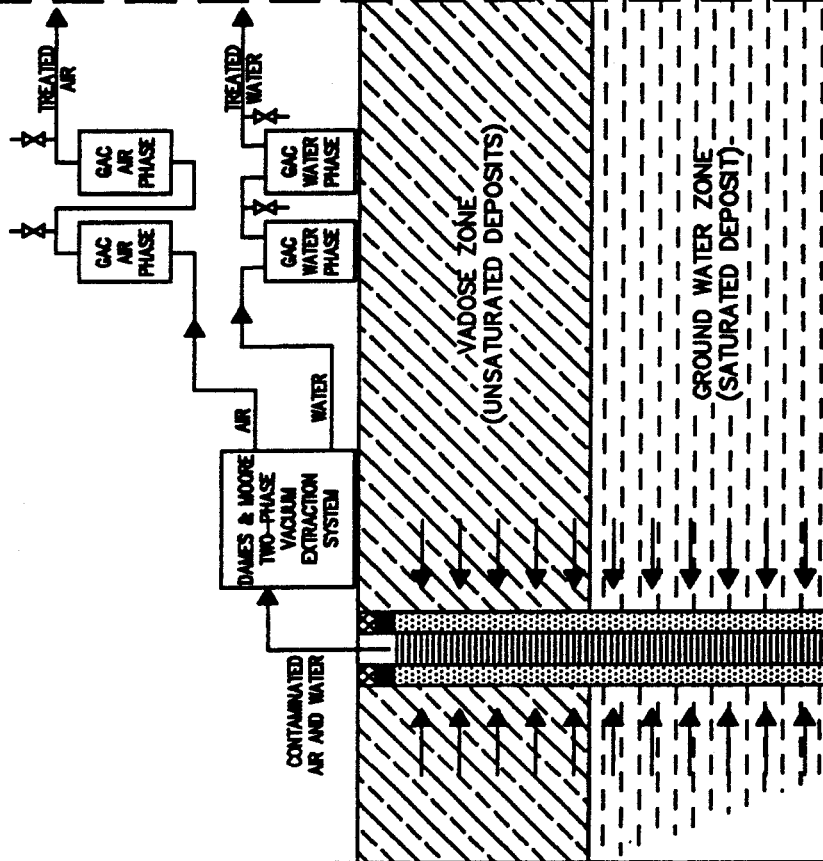
o Eliminates Major Disruptions to On-Site Business Operations

The two-phase VE system's reduced equipment requirements and the need for fewer wells to complete site clean-up allows normal business/manufacturing operations to continue with minimal disruption during on-site operations.

o Reduces Clean-Up Time and Costs

The increased rate of ground water recovery compared to conventional ground water pumping systems and the reduced VE equipment requirements, compared to conventional soil and ground water treatment systems, will reduce the time and costs of site remediation.

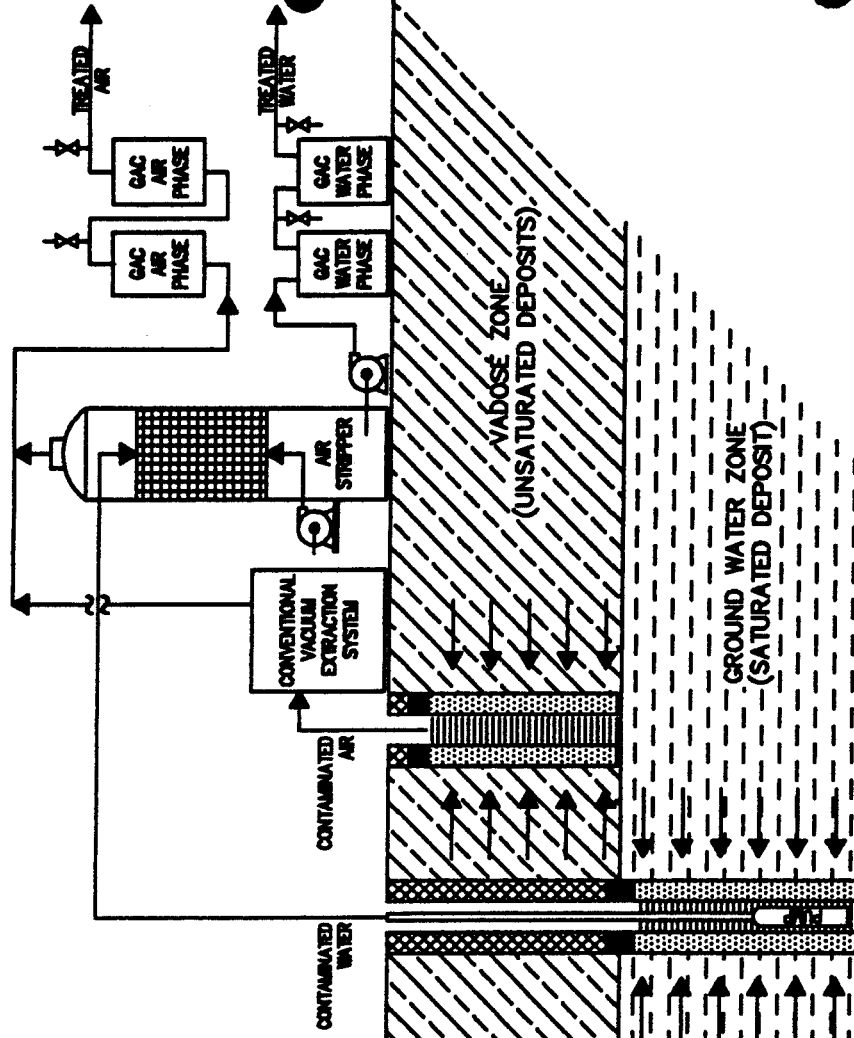
**TWO-PHASE VACUUM EXTRACTION SYSTEM
DAMES & MOORE/XEROX CORPORATION
PATENT PENDING**



ADVANTAGES

- NO IN-WELL PUMP
- HIGHER GROUND WATER FLOW RATES
- VOLATILES ARE EFFECTIVELY SEPARATED FROM WATER
- ELIMINATION OF AIR STRIPPER
- REDUCED AIR FLOW
- LESS OXYGENATION OF PRODUCED WATER (LESS BACTERIA GROWTH/FOULING AND CORROSION OF PROCESS COMPONENTS)
- REDUCED SPACE REQUIREMENTS
- LOWER COST

**CONVENTIONAL GROUND WATER AND
SOIL REMEDIATION SYSTEMS**



DISADVANTAGES

- REQUIRES TWO WELLS
- REQUIRES SEPARATE WATER PUMP
- INCLUSION OF AIR STRIPPER
- INCREASED AIR-PHASE TREATMENT
- MORE OXYGENATION OF PRODUCED WATER (BIOFOULING)
- ADDITIONAL SPACE REQUIREMENTS
- ADDITIONAL COST

**III. DAMES & MOORE VACUUM EXTRACTION PROJECT EXPERIENCE**

<u>Location</u>	<u>Project</u>
Virginia	Removal of Tetrachloroethylene from Fractured Bedrock
New York State	Soil Remediation and Enhanced Groundwater Recovery
Illinois	Removal of Chlorinated Solvents and Mineral Spirits from Clay
Tennessee	Remediation of Trichloroethylene and Tetrachloroethylene Contamination in Soil
Shreveport, LA	Remediation of Silty Clay Contaminated with Trichloroethylene
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San Jose, CA	Vapor Extraction of Hydrocarbons
Fresno, CA	Vapor Extraction of Hydrocarbons
Modesto, CA	Vapor Extraction of Hydrocarbons

**III. DAMES & MOORE VACUUM EXTRACTION PROJECT EXPERIENCE**
(Continued)

PROJECT: Removal of Tetrachloroethylene from Fractured Bedrock

LOCATION: Virginia

CLIENT: Confidential

DESCRIPTION: A high-vacuum extraction system is being applied to wells installed to a depth of 200 feet to remove chlorinated solvents from bedrock. One hundred fifty-nine gallons of PCE have been removed during 64 days of operation. The influence of vacuum was observed more than 150 feet from a single extraction well. The unit being applied incorporates a refrigerated condensing system to reduce the relative humidity of the extracted soil gases prior to treatment with activated carbon. An 8-percent reduction in carbon costs has resulted.

PROJECT: Soil Remediation and Enhanced Ground Water Recovery

LOCATION: New York State

CLIENT: Confidential

DESCRIPTION: A two-phase vacuum extraction system designed to recover soil gases and ground water contaminated with VOCs is being utilized during a limited-area remediation. A total of 900 pounds of trichloroethylene and dichloroethylene has been removed from the soil and ground water during one year of operation. In addition, the system has removed 9 pounds of water-soluble hexavalent chromium.

The two-phase vacuum extraction system eliminated the need for an air stripper to treat the ground water by stripping the ground water within the well. Ninety-eight percent of the VOCs in the ground water were transferred to the vapor phase before reaching the ground surface. The Dames & Moore system has increased ground water recovery from 0.5 gallon per minute (gpm) achievable utilizing a submersible pump to 5 gpm by applying dual-phase vacuum extraction. Because of this recovery rate increase, the vacuum system has removed 310% more VOCs than conventional submersible pump system would have removed in the same time period.



III. DAMES & MOORE VACUUM EXTRACTION PROJECT EXPERIENCE (Continued)

PROJECT: Removal of Chlorinated Solvents and Mineral Spirits from Clay

LOCATION: Illinois

DESCRIPTION: A pilot recovery system employing very high vacuum was applied to remove contaminants from depths as great as 20 feet in a very stiff clay (10^{-7} cm/sec) under the floor of a building. The cumulative removal of volatile organic compounds in 19 weeks of operation was more than 1,500 pounds from a single extraction well. Cleanup concentrations established by the Illinois Environmental Protection Agency have been achieved within a 20-foot radius of the well.

PROJECT: Remediation of Trichloroethylene and Tetrachloroethylene Contamination of Soil

LOCATION: Tennessee

DESCRIPTION: Approximately 7,600 cubic yards of soil was estimated by other consultants to contain 1,000 pounds of chlorinated solvents. Dames & Moore has been applying vacuum extraction to remediate the contamination. The initial removal rate was 27 pounds per day. An estimated 1,300 pounds of VOCs were removed from the soil. The cleanup goals of 26.0 ppm of trichloroethylene and 8.5 ppm of tetrachloroethylene were achieved after 9 weeks of operation.

**III. DAMES & MOORE VACUUM EXTRACTION PROJECT EXPERIENCE**
(Continued)

PROJECT: Remediation of Silty Clay Contaminated with Trichloroethylene

LOCATION: Shreveport, Louisiana

CLIENT: AT&T

DESCRIPTION: Vacuum extraction technology was applied to trenches installed just above the water table. Vacuum extraction was operated concurrently with ground water recovery and treatment. A total of 275 pounds of TCE was removed. Soil-gas TCE concentrations fell from 3,700 ppm to less than 5 ppm.

PROJECT: Remediation of Silty Sand Contaminated with Gasoline

LOCATION: Arizona

CLIENT: Confidential

DESCRIPTION: Vacuum extraction technology was applied to the soils beneath a former gasoline service station. Initial removal concentrations ranged from 4,000 to 8,000 ppm of volatile organic compounds. The removal rate was limited to 40 pounds per day of gasoline due to air emission regulations. However, Dames & Moore demonstrated that more than 100 pounds per day could be removed by a single extraction system. After 13 months of operation, the average removal rate has been reduced to 6 pounds per day and an estimated 6,300 pounds of total hydrocarbons (based on an average o/molecular weight of 72) have been removed. Cleanup criteria are expected to be achieved after approximately 1 year of continuous operation.



III. DAMES & MOORE VACUUM EXTRACTION PROJECT EXPERIENCE (Continued)

PROJECT: Emergency Response to Gasoline Spill

LOCATION: Merritt Island, Florida

CLIENT: J.C. Penney

DESCRIPTION: Dames & Moore installed a 100-foot horizontal vacuum recovery trench to intercept gasoline that was migrating off-site and causing vegetation stress along the property boundary of a shopping mall. Dames & Moore's Vacuum Extraction and Recovery Trailer System was employed to remove gasoline vapors from the shallow vadose zone by taking suction on a buried pipe. Benzene, toluene, and xylene (BTX) concentrations in the sandy soil 10 feet from the trench were reduced from 54 ppm to 0.05 ppm after 10 days of operations.

PROJECT: Remediation of Tetrachloroethylene Contamination

LOCATION: Delray Beach, Florida

CLIENT: Aero-Dri

DESCRIPTION: Approximately 1,000 cubic yards of sandy soil was estimated to contain 1,000 pounds of tetrachloroethylene (PCE). Dames & Moore applied vacuum extraction to remediate the contamination. The initial removal rate was 200 pounds per day. After 10 weeks of continuous operation, the concentration of PCE in the soil had dropped from 500 ppm to below the detection limit of 0.005 ppm.

**III. DAMES & MOORE VACUUM EXTRACTION PROJECT EXPERIENCE**
(Continued)

PROJECT: Xylene/Toluene Vacuum Extraction Pilot Study

LOCATION: Welwyn Garden City, United Kingdom

CLIENT: Rank Xerox

DESCRIPTION: A pilot extraction system capable of attaining a high volume was used to remove xylene and toluene from sandy and gravelly clays at a former solvent recovery unit area. Granular activated carbon was used on the suction of the vacuum system to collect the contaminants. After 40 days of operation, confirmatory soil borings indicated up to 100-percent removal of VOCs. A total of 115 pounds of toluene and xylene was removed. A radius of influence of 30 feet was observed. A full-scale remediation system design is underway.

PROJECT: Vacuum Extraction Pilot Study

LOCATION: Port Melbourne, Victoria, Australia

CLIENT: Victorian Government Major Project Unit

DESCRIPTION: Approximately 330,000 cubic yards of soil is contaminated with volatile hydrocarbons at the Bayside Development Site. A pilot vacuum system was applied to remove the hydrocarbons via a horizontal trench and vertical well. After 14 hours of operation, soil gas measurements were reduced by two orders of magnitude. A radius of influence greater than 100 feet was observed. A full-scale remedial system is currently being designed.

**III. DAMES & MOORE VACUUM EXTRACTION PROJECT EXPERIENCE**
(Continued)

- PROJECT:** Vapor Extraction of Hydrocarbons
- LOCATION:** Santa Maria, California
- CLIENT:** Avis Rent-A-Car System, Inc.
- DESCRIPTION:** Dames & Moore designed, assisted in permitting, constructed, and operated an in-situ vapor extraction and treatment system to remediate a 1,000-gallon gasoline spill. This spill had contaminated 20,000 cubic yards of soil to a depth of approximately 90 feet. Two extraction wells were used to access the sandy soils. One well extended to 60 feet and the other to 90 feet. Extracted vapor was treated by activated carbon canisters prior to atmospheric discharge. Canister uptake of hydrocarbons was enhanced by cooling extracted gases to lower temperatures and reducing absolute humidity, which reduced the competition between gasoline and water for adsorption sites on the carbon. Direct ventilation of extracted vapors occurred after benzene and TPH concentrations in the extracted vapor were reduced to levels acceptable to the local Air Quality Control Board.
- PROJECT:** Vapor Extraction of Hydrocarbons
- LOCATION:** San Jose, California
- CLIENT:** Avis Rent-A-Car System, Inc.
- DESCRIPTION:** Dames & Moore has designed and permitted an in-situ vapor extraction and treatment system to remediate hydrocarbon-contaminated soils at a service center in San Jose, California. Several small-diameter wells will be used to access the silty soils and sandy lenses beneath the site. Extracted vapor will be treated in a thermal oxidation unit (incinerator) prior to atmospheric discharge. Reinjection of warm discharge air is being considered to enhance volatilization. Direct ventilation of extracted vapors is proposed after benzene and TPH concentrations in the extracted vapor have been reduced to the satisfaction of the local Air Quality Control Board. Dames & Moore is currently coordinating construction of the system and will participate in its operation during the remedial effort.



III. DAMES & MOORE VACUUM EXTRACTION PROJECT EXPERIENCE (Continued)

PROJECT: Vapor Extraction of Hydrocarbons

LOCATION: Fresno, California

CLIENT: Chevron, USA

DESCRIPTION: Dames & Moore has designed and assisted in the permitting of an in-situ vapor extraction and treatment system to remediate granular soils containing petroleum hydrocarbons at a service station in Fresno, California. Approximately 150 gallons of gasoline are present. Remediation will proceed by vacuum extraction from one well installed at the center of the spill to a depth of 50 feet. Extracted vapor will be treated by thermal oxidation (incineration) prior to atmospheric discharge. Direct ventilation of extracted vapors is proposed after benzene and TPH concentrations in the extracted vapor have been reduced to levels acceptable to the local Air Quality Control Board.

PROJECT: Vapor Extraction of Hydrocarbons

LOCATION: Modesto, California

CLIENT: Chevron, USA

DESCRIPTION: Dames & Moore has designed and assisted in the permitting of an in-situ vapor extraction and treatment system to remediate hydrocarbon- contaminated soils at a service station in Modesto, California. Four extraction wells will be used to access the alternating layers of contaminated sand and silt below the site. The deepest well will extend to a depth of 60 feet. Extracted vapor will be treated in a thermal oxidation unit (incinerator) prior to atmospheric discharge. Thermal enhancement of volatilization by reinjection of the hot exhaust air from the incinerator will be attempted. Direct ventilation of extracted vapors is proposed after benzene and TPH concentrations in the extracted vapor have been reduced to levels acceptable to the local Air Quality Control Board.

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III. DAMES & MOORE VACUUM EXTRACTION PROJECT EXPERIENCE
(Continued)

- PROJECT:** Gasoline Remediation Pilot Study
- LOCATION:** Compton City, California
- CLIENT:** Southern California Edison
- DESCRIPTION:** A short-term pilot study was conducted to determine the feasibility of removing gasoline from soil. The gasoline also occurred in the liquid phase, floating on ground water. Vapor-phase concentrations of 100,000 ppm were measured. Design of full-scale site remediation incorporating a unique two step incineration system is underway.
-
- PROJECT:** Trichloroethylene Remediation Pilot Study
- LOCATION:** New Jersey
- CLIENT:** Confidential
- DESCRIPTION:** Silty sands contaminated with trichloroethylene are being remediated by vacuum extraction technology. Approximately 300 pounds of TCE were removed during the first 18 days of operation. A radius of influence greater than 500 feet was observed. The large radius of influence was obtained by using the naturally occurring clay cap to prevent short-circuiting of air from the surface.
-
- PROJECT:** Remediation of Trichloroethylene in Sand and Gravel
- LOCATION:** Michigan
- CLIENT:** Confidential
- DESCRIPTION:** Vacuum extraction is being applied to sands and gravel contaminated with trichloroethylene. An estimated 225 pounds of TCE has been removed during the first 40 days of operation. A radius of influence of 150 was observed.