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Project Summary

Testing Truck-Mounted Vacuum and Air Conveyor Systems for Oil Spill Recovery

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Two types of vacuum oil recovery systems were performance tested at the U.S. Environmental Protection Agency (EPA) Oil and Hazardous Materials Simulated Environmental Test Tank (OHMSETT) in September 1980. A Vactor Model 2045* air conveyor made by the Meyers-Sherman Company and a straight vacuum truck made by Coleman Environmental and Pollution Control Equipment Co., Inc., were evaluated for oil recovery performance using recovery efficiency and oil recovery rate. Changes in recovery efficiency and oil recovery rate were found with varying oil slick thickness, oil viscosity, hose length, and blower speed. The air conveyor was also tested using different distances between the slick and the suction hose.

Air conveyor results showed a mean recovery rate of 7.2 m^3/hr with a 61% oil recovery efficiency (4.4 m^3 oil/hr). Efficient recovery of thin oil slicks is the main advantage of air conveyors. Vacuum truck tests produced a mean oil recovery rate of 13.3 m^3/hr of an 18% oil fluid (2.4 m^3 oil/hr). Vacuum trucks seem particularly suited for use with thick slicks and with skimmers to increase recovery efficiency. Vacuum trucks would also be effective for transferring recovered oil from primary recovery devices to final storage or reclamation sites.

*Mention of trade names or commercial products does not constitute endorsement or recommendation for use

This Project Summary was developed by EPA's Municipal Environmental Research Laboratory, Cincinnati, OH, to announce key findings of the research project that is fully documented in a separate report of the same title (see Project Report ordering information at back).

Introduction

Vacuum systems are one of the most commonly used pieces of equipment at oil spills. They are mobile, simple to operate, complete skimming systems. Two types of vacuum systems are available — air conveyors and vacuum trucks. Air conveyors use a large-diameter hose (typically greater than 15 cm) and a high volume of air to convey material into a tank. A schematic drawing of an air conveyor system is shown in Figure 1. Air conveyors require that the suction hose inlet remain above the material being picked up so that an adequate air flow can be maintained. Vacuum trucks use a smaller-diameter hose (typically 7.6 cm) and a low-volume blower to evacuate a truck-mounted tank (Figure 2) The hose inlet must be placed in or on top of the material being recovered, as the air flow in the hose is not sufficient to air-convey material up the hose.

Each of these systems was tested at the U.S. Environmental Protection Agency (EPA) Oil and Hazardous Material Simulated Environmental Test Tank (OHMSETT) during the period September 19 to 26, 1980. The project used a

Vactor Model 2045 manufactured by Meyers-Sherman Company, Streator, Illinois, and operated by the owner, Axxon Industrial Corporation, Iselin, New Jersey. Olsen & Hassold, Inc., of Paterson, New Jersey, supplied a vacuum truck made by Coleman Environmental & Pollution Control Equipment Co., Inc., East Patchogue, New York.

Twenty-four calm water tests were performed during a 5½-day period (13 air conveyor tests and 11 vacuum truck tests). System performance was evaluated using recovery efficiency (RE) and oil recovery rate (ORR). These values are calculated as follows:

$$RE = \frac{\text{Oil volume recovered}}{\text{oil and water volume recovered}} \times 100$$

$$ORR = \frac{\text{oil volume recovered}}{\text{recovery time}}$$

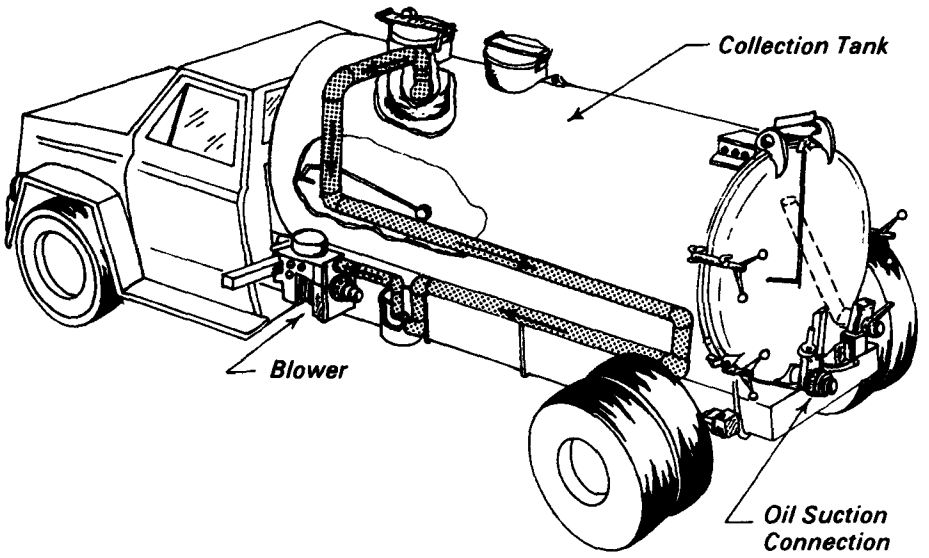

Figure 2. Vacuum truck illustration.

Changes in RE and ORR were found with varying slick thickness, oil viscosity, hose length, and blower speed for both air conveyor and vacuum trucks. Air conveyors were also evaluated for various hose distances above the oil slick.

Conclusions and Recommendations

The air conveyors proved to recover oil spills at roughly twice the rate of the vacuum truck and with three time the efficiency. Air conveyors are also two to three times as costly as vacuum trucks. Use of air conveyors is especially recommended with thin slicks or with highly viscous products. The vacuum truck seemed more suited for recovery at spills with thick slicks or for transporting recovered products from temporary storage at the spill to a final disposal site. These conclusions are based on the results reported. Additional testing will be required to confirm the results and to provide additional data to confirm trends.

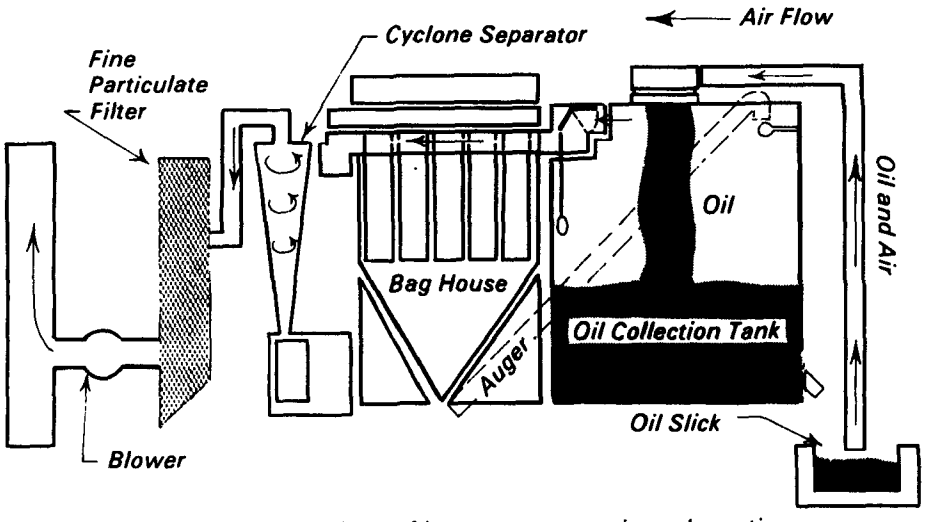

Figure 1. Air conveyor operation schematic.

Air Conveyor

Air conveyor results show a mean recovery rate for all tests of 7.2 m^3/hr of a 61% oil fluid. No significant performance effects were found as a result of viscosity changes. Low blower speeds produced the best RE on thin slicks, and high blower speeds worked best on thick slicks. Blower speed variations did not affect ORR values. Increasing slick thickness increased ORR without affecting RE.

Addition of an outlet in the tanks of air conveyors to allow for removal of the free water and oil is recommended. Many of the trucks observed were equipped only with valves for removing liquid above solids that had settled on the tank bottom. Addition of sight gauges in the tank would aid operators in determining the volume of oil and water in the tank. Development and testing of skimming heads is needed to increase the RE of air conveyors further. These heads will also be needed to effectively recover oil slicks in waves.

Vacuum System

Mean oil recovery rate for all vacuum truck tests was 13.3 m^3/hr of an 18% oil fluid. Recovery efficiency increased with blower speed, but no significant changes were found for various hose lengths, oil viscosities, or slick thicknesses. Oil recovery rate was unaffected

by blower speed or hose length. ORR was slightly decreased by increased oil viscosity, and increasing the slick thickness. Placing simple, weir-type skimmers at the end of the inlet hose doubled the RE without affecting ORR.

Vacuum trucks seem particularly suited for use with thick slicks and with skimmers attached to the inlet for increased RE. Testing with additional skimmers is recommended to determine applicability and performance. Addition of sight gauges to the storage tanks would aid operators in determining the volumes of water and oil recovered.

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The complete report, entitled "Testing Truck-Mounted Vacuum and Air Conveyor Systems for Oil Spill Recovery," (Order No. PB 83-114 538; Cost: $8.50, subject to change) will be available only from:
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