Title: Characterization of Groundwater Impacts at an Above Ground Petroleum Storage Terminal (Study No. 40)

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Objectives: To evaluate the groundwater impacts from condensate at a petroleum storage facility.

Background/Need: This study was initiated to study the effectiveness of oil/water separators as a method of petroleum condensate treatment. Condensate is wastewater from petroleum storage tanks which is discharged to diked areas adjacent to the storage tank or to an oil/water separator. Oil/water separators typically discharge to drainage ditches or other surface waters, though at some facilities they discharge into diked areas.

Methods: Water table wells and piezometers were installed at a petroleum storage facility. Soil samples were taken for particle size analysis and volatile organic compound (VOC) analysis at locations which correlated with monitoring wells. Condensate drainage and separator discharge were each sampled on two occasions. A computerized plotting program was used to construct water table maps. Hydraulic conductivities were estimated and groundwater velocities were calculated. Groundwater grab samples were taken from wells and analyzed using gas chromatography. Field pH and specific conductivity measurements were obtained on all groundwater samples.

Results: The computed groundwater contours indicate a westerly direction of groundwater movement. Hydraulic conductivity values lie within the normal range for clean to silty sand. Groundwater velocity calculations indicate an existing velocity capable of producing contaminant transport from the separator to the monitoring wells. VOCs were present in condensate, separator discharge and groundwater samples. The major volatile constituents detected were benzene, xylene, ethylbenzene and toluene. Most of the VOC detections occurred near the point of separator discharge. Soil analysis showed only one VOC detection of a low concentration of ethylbenzene.

Conclusions: The results indicate that VOCs are entering groundwater below the separator discharge point. This contamination appears to result from the dissolved gasoline in the condensate discharged near the oil/water separator, though the extent of contamination is unknown. A leak in the separator may also add to contamination which would directly reach groundwater. Oil/water separators do not provide conditions which optimize dissolved VOC removal. Floating single roof storage tanks pose a greater risk of ground or surface water pollution due to the high volume of condensate production.

Recommendations/ Implications: Investigators suggest periodic separator cleaning and inspection at this facility to compensate for any leakage of the oil/water separator. Improvement of VOC removal equipment and exposure of discharges to air to enhance volatilization are also recommended. Continued monitoring of this site is needed to observe results from changes in condensate handling. VOC reduction from biological degradation, soil evaporation and surface evaporation also warrant evaluation of practical levels for surface discharges. Further study is recommended of condensate discharges from tank farms on a wider geographical basis, as well as the effectiveness of treatment of oil/water separators.

Availability of Report: This report is available for viewing and loan at:

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Key Words: Benzene, ethylbenzene, hydrocarbons, oil/water separator, toluene, volatile organic compounds, xylene

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