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TOTAL PETROLEUM

Alma Soil Farm

Preliminary Report

Hydrogeological Investigation

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INTRODUCTION

Fishbeck, Thompson, Carr & Huber, Inc., consulting engineers, has been retained by Total Petroleum, Inc. to conduct an expanded hydrogeological study of their Alma, Michigan soil farm. Previous water samples collected from monitor wells, in compliance with RCRA regulations, indicated degradation in water quality in the soil farm area. The nature, extent, and direction of movement of these contaminants has been investigated. Additionally, the representativeness of the well previously used to determine background water quality was assessed.

The Total Petroleum soil farm is used to dispose of oily sludges from the refinery. These wastes are disposed directly onto the ground and disked into the soil for microbial decomposition. Surface water drains to a sump and an underdrain system captures water infiltrating the soil zone, effectively draining the soil farm area. This captured water is then pumped to the refinery wastewater treatment system.

The soil farm operation is situated in an area formerly used to dispose of solid salts and other refinery wastes. These earlier wastes were placed in pits. Subsequently, attempts were made to mix these wastes with soil and cover them with soil for the current operations. Prior to placement of the soil cover, much of the pit wastes were spread across the general area.

This investigation indicates that groundwater is moving in a northeasterly direction through a zone of low permeability sands. Degraded water quality is found along this flow path in several monitor wells.

From the nature of the wastes disposed in the soil farm area and the elevated constituents found in the groundwater, it does not appear as though the current soil farm operations are the source of the contaminants. These contaminants originate more likely from previous disposal of wastes into pits located at the site.

DISCUSSION

Six wells and seven soil borings were installed in the soil farm area to augment information from ten previously installed wells at the facility. Each of these auger borings was drilled to depths between 15 and 30 feet. When geologic conditions permitted, wells were installed within the permeable interval of each boring. Where soil conditions precluded well installation, the borings were filled with bentonite grout and native materials.

The site lithology is highly variable ranging from permeable sands and gravel in the vicinity of monitor well 18 to dense impermeable silt and clay found throughout most of the remainder of the site. Permeable materials are of a limited extent. The coarse sand and gravel in monitor well 18 extends to monitor well 17 but is absent in other monitor wells.

In the soil farm area, a fine sand layer was encountered below the water table in monitor wells MW-2, MW-5, MW-6, MW-15, MW-16, MW-19, MW-21, MW-22, and MW-23. This sand is considered the primary conduit for groundwater flow across the site. All monitor wells were screened within this sand interval. In soil borings SB-1 through SB-7, this fine sand lens was not encountered and soil conditions precluded the installation of monitor wells. This indicates that the extent of this sand zone is confined to a narrow zone in the center of the soil farm. The silt and clay surrounding the sand zone restricts the westerly and southeasterly groundwater movement from the permeable area.

On September 12, 1983, Total Petroleum conducted an aquifer test to determine soil permeabilities. Monitor well 19 was pumped for approximately 170 minutes while water levels in monitor well 6 were measured. From this test, the transmissivity of the aquifer was calculated as 1150 gallons per day per foot. Assuming an average aquifer thickness of 8 feet, the permeability of the sands is approximately 140 gallons per square foot per day. Monitor well 19 produces the greatest quantity of water and therefore the hydraulic constants most likely represent a value at or near the maximum permeability for the aquifer.

Water levels were measured in each monitor well and used to prepare a groundwater contour map by Total Petroleum. The direction of groundwater flow was found to be toward the northeast within the sand strata. Some radial flow is also evident from water levels measured in monitor wells 17 and 18. In the southwest corner, groundwater flows toward the ditch located along the southern border of the soil farm.

Water samples were collected from monitor wells and analyzed by Total Petroleum. These samples indicated elevated values for specific conductance and total organic carbon (TOC) within wells downgradient of the soil farm area. The cause of these elevated values appear to most likely be materials disposed in pits on the property prior to the soil farm operations. It is reported that previous practices included salt and oil residue disposal below the ground surface. Leaching of these salts and oil residues into the groundwater are most likely providing the elevated conductivity and TOC values. Current disposal is restricted to the near surface materials with mixing to ensure proper decomposition of wastes. The current practices do not include the disposal of salts.

The extent of contamination toward the west is limited due to the highly impermeable nature of the soils. The eastern extent of contamination is located between monitor wells 21 and 5. The specific conductance for monitor well 15 indicates an intermediary zone of contamination. The extent to which contaminants have migrated to the northeast is undefined. Monitor well 23 indicates elevated levels of specific conductance although less than those seen in monitor wells 6, 19, and 21, the wells with the greatest specific conductance values.

Monitor well 18 has lower specific conductance and TOC levels than in well 17. The values found in well 18 also approximate those seen in monitor well 4, which was considered the downgradient well for RCRA monitoring. Because of its geographical location and water chemistry, monitor well 18 can be considered representative of background water quality more than monitor wells 4 and 17.

The cause of elevated TOC levels is currently being further investigated by Total Petroleum. The results of this analysis will be submitted as soon as they are available.

CONCLUSIONS

Previously existing and recently installed monitor wells have further defined the extent of contamination at the Total Petroleum soil farm. In the farm area, groundwater movement is restricted to a fine sand zone located in the center of the facility. This sand lens, with a maximum permeability of approximately 140 gallons per day per square foot, serves as a conduit for groundwater contaminated by salts and other petroleum wastes previously disposed in pits located beneath the soil farm facility. Migration beyond this zone of permeable sands is restricted by low permeability silt and clay encountered in soil borings.

The direction of groundwater flow is toward the northeast through this lens. The full extent of contaminants downgradient of the site remains undefined. The eastern lateral extent of migration is situated between monitor wells 21 and 15 while movement to the west is halted by low permeability silts and clays.

Recommendations on remedial action for Total's soil farm will be made following review of analyses being done to identify the cause of elevated total organic carbon levels.