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Characterization of Contaminated Groundwater and Remediation Plans in Namphu and Rangbua Subdistricts, Ratchaburi, Thailand

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Abstract

Volatile organic compounds (VOCs) and nickel concentration were detected higher than standards in groundwater monitoring wells and domestic wells located nearby the landfill area of an industrial waste recycling company in 2014. The groundwater quality monitoring results from 2015-2019 also indicated that there has been the presence of cis-1,2-dichloroethylene, trichloroethylene, benzene, vinyl chloride, manganese, and nickel in the area. The project aims to identify the presence and characteristics of contaminants in the sub-surface, propose the potential remediation plans, and provide guidance for the community and environmental agencies in terms of groundwater management in contaminated areas.

The hydrogeology of the area includes unconfined and confined aquifers. The unconfined aquifer consists of clay, sandy clay, silty sand, and weathered rock with 3-8 meters thick. Depth to groundwater is approximately 1-6 meters. The confined aquifer is occupied in bedrock consisting of massive limestone, meta-sandstone, mudstone, and quartzite which is 20-80 meters below the surface. Groundwater flow appears to follow the topography from the high plain in the northwestern side of the area to the river plain in the southeast. The field investigation comprised the geophysical survey using a resistivity method, a direct push drilling technology which is the Membrane Interface Probe and Hydraulic Profiling Tool (MiHPT),

Results of the MiHPT investigation indicated that significant VOCs contamination exists in the landfill area and the private property which is located within 1 kilometer from the landfill. The analytical results of groundwater reported that vinyl chloride and benzene were detected in shallow wells located in the southeast of the landfill area. A mathematical model performed using the Visual MODFLOW Flex program is then used to confirm the flow direction, define the distribution of the contaminate plume, and identify the possible hotspot of pollutants where the contaminants were leaked from surface to groundwater system.The potential remediation methods from the analytical data are to construct the permeable reactive barrier with zero- valent iron or activated carbon. Further investigation and continued monitoring are required in order to design remediation measures.

Keyword: Contaminated groundwater, Membrane Interface Probe, Mathematical Model