

Multi-Faceted Approach to the Remediation of a Petroleum Hydrocarbon Plume at an Active Retail Service Station

Barry Rakewich (rakewich@nicholsenvironmental.com) and Kyle Jackson (Nichols Environmental (Canada) Ltd., Edmonton, Alberta, Canada)
Trevor Carlson (Federated Co-operatives Limited, Saskatoon, Saskatchewan, Canada)

Background/Objectives: In 2012, the detection of benzene in the potable water supply for a kiosk at a retail service station led to a subsoil and groundwater investigation, which identified the presence of a hydrocarbon plume beneath the kiosk and fuel service infrastructure and surrounding area. Twenty-eight boreholes/monitoring wells were completed to delineate the extent of impacts both on and off-site. Several petroleum hydrocarbon parameters within the fine grained, clay soil were reported to exceed the regulatory guidelines at an average depth of 2.25 metres below grade (mbg), which was at the approximate groundwater interface. Groundwater modelling indicated that groundwater was flowing from east to west across the site, with an average hydraulic gradient of 0.02 m/m. A multi-faceted remedial approach was required that would provide timely in-situ remediation, while allowing the retail service station to remain operational. Our objective for this site was to install infrastructure that would allow for several in-situ methods to be utilized independently or simultaneously towards the overall remediation of the site, while allowing for the retail service station to remain 100% operational. The remediation system was designed to allow for several options including mechanical extraction of hydrocarbons through groundwater recovery and treatment, air sparging, nutrient amendment to promote in-situ bioremediation and oxidant amendment to promote chemical decomposition.

Approach: Prior to installation of the remediation infrastructure, the potable water line servicing the kiosk was replaced and an in-line carbon filtration system was installed. Two 0.4 m wide by 30 m long trenches were excavated to a depth of 0.4 mbg, downgradient and perpendicular to groundwater flow direction. Within these trenches, 18 boreholes were completed using a hydro-excavator, with 14 extraction wells and 4 injection wells installed to a depth of 3.4 mbg. Each well was constructed with 50.8-mm, 0.010-mm slotted PVC screen and Tiger-Flex hose, which was placed in the trench and connected to either a dual phase vacuum extraction (DPVE) system or an air sparge (AS) system. The DPVE system consisted of a 59 HP vacuum which worked to enhance the natural groundwater gradient by pulling groundwater across the site to the west, and mechanically removing the contaminated groundwater for on-site treatment and discharge to the local sewer system. The AS system consisted of a 26.7 HP blower, which introduced oxygen into the groundwater to promote aerobic degradation of the petroleum hydrocarbons. The AS system was also designed to allow for nutrient and oxidant amendment to be delivered to the sub-surface. The amendments would be injected directly through the injection wells and then pulled across the site, beneath the retail service station by the DPVE system.

Results: The installation of the remedial system infrastructure was completed by the end of October 2014. The effectiveness of the remediation system installation will be evaluated over the next several months through regular site monitoring, including the collection of groundwater samples to document trends in groundwater petroleum hydrocarbon concentrations and other key indicator parameters including dissolved oxygen, oxygen reduction potential, headspace carbon dioxide, oxygen and organic vapour concentrations. We anticipate several monitoring events worth of data will be available at the time of the presentation.