Using NSZD in the Development of Sustainable NAPL Remediation Strategies at Active Oil and Gas Facilities

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Management and remediation of petroleum nonaqueous phase liquid (NAPL) plumes can be difficult under even the most favourable conditions. The complexity is amplified at active oil and gas facilities due to the widespread presence of multi-owner above- and below-ground infrastructure that hinders investigative and remedial efforts. Compliance with facility health and safety requirements and ground disturbance protocols, including the extensive use of hydrovac excavation to advance boreholes and install monitoring wells diminishes the quality of soil data, in particular. This often results in critical gaps in the understanding of the NAPL source and distribution. Proceeding to remedial options analysis without closing these data gaps has often led to the implementation of ineffective and/or costly remedial measures and seemingly perpetual groundwater monitoring.

To address this issue of data gaps, carbon dioxide (CO_2) efflux surveys were incorporated into the investigation of environmental risk at two Alberta facilities. Monitoring CO_2 efflux is a cost-effective, minimally intrusive way to refine the understanding of NAPL source area extents associated with historical releases. Natural source zone depletion (NSZD) rates are estimated from the CO_2 efflux surveys and are another critical element in the effective and strategic management of risk at active facilities. When NSZD rates are used in combination with plume stability analyses and qualitative and quantitative risk assessment, they become true benchmarks to determine the effectiveness of remedial approaches.

Because of the relatively large volume of product stored and distributed at active oil and gas facilities, the potential for releases is ever-present. Remedial objectives for an onsite NAPL plume must be carefully and individually defined for any project but doing so can become complicated when potentially dealing with multiple plumes within a single property boundary. Given indeterminate timeframe for operation at many of these facilities, decision-making for release remediation versus management/containment must be based on more than the presence of NAPL in monitoring wells or simple comparison of soil or groundwater contaminant concentrations to generic regulatory guidelines.

Incorporation of these elements (i.e., CO_2 efflux survey, NSZD, and consideration of remediation versus risk management) into holistic management plans provides facility operators with a road map for decision-making, balancing corporate expenditures with environmental risk and acceptance by provincial and/or federal regulators.

This presentation will identify:

- Site conditions that are conducive to CO_2 efflux monitoring and NSZD evaluation.
- How NSZD fits into conceptual site models and can be used as a basis for risk assessment and remedial design.
- How to make decisions for remediation and risk management strategies incorporating NSZD.

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Andrea Hachkowski is a Professional Engineer with over 20 years of experience in the development and implementation of risk management and remedial strategies for large-scale complex contaminated sites. Her focus is incorporation of qualitative and quantitative human health and ecological risk assessment to optimize remedial designs. She has used this approach to achieve regulatory closure for sites throughout Canada, including manufactured gas plants, mines, chemical manufacturing facilities, and oil and gas facilities.