Abstract: Migration to Indoor Air Calculations for Use in the Hydrocarbon Risk Calculator Technical Background Document and Recommendations

Fuel hydrocarbon vapors in soil have the potential to migrate to indoor air at concentrations that may present an unacceptable inhalation hazard. This report describes the migration-to-indoor air route (also known as the vapor intrusion route), and documents the approach used in the "hydrocarbon risk calculator" to assess human health risk associated with the migration-to-indoor air route. The indoor air route may often be the highest risk exposure pathway at fuel hydrocarbon spill sites (because it seems that occupied buildings exist at spill sites more often than contaminated drinking water wells). Including the migration-to-indoor air risks in cumulative risk calculations, and in current and future land use and land management decisions, is recommended.

The migration-to-indoor air route involves the partitioning of volatile contaminants from the non-aqueous-phase liquid (NAPL) source or groundwater into soil vapor, transport by diffusion to near a building, and advection of the vapors into the under-pressurized building through cracks or seams in the building floor. This document briefly describes the EPA tiered approach addressing the vapor intrusion route and provides a sensitivity analysis for the Johnson and Ettinger model, which is used to calculate risk through the vapor intrusion route. (The sensitivity analysis is borrowed from an EPA document.) The "hydrocarbon risk calculator" uses the Johnson and Ettinger model, as is done in the "EPA advanced soil gas model." The model input soil gas concentration(s) can be:

1. Based on the vapor concentration derived from the four-phase partitioning calculations
2. Calculated from measured groundwater concentrations
3. From site specific sub-foundation soil gas measurements

This document also characterizes the risk posed by the migration-to-indoor air route for several commonly used Alaskan fuels. These conservative risk characterization results suggest that BTEX, GRO aromatics and aliphatics and DRO aromatics and aliphatics have the potential to cause vapor intrusion risks exceeding allowable risk criteria.

This document recommends that the vapor intrusion route be included in the assessment of risk posed by fuel hydrocarbon spill sites in Alaska, and that a research program be initiated to assess the impact of arctic and subarctic building and soil conditions on the risk calculations for the vapor intrusion route.