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Environmental Actions

Abstract Title	**When Inaction or Limited Action Is the Best Action for Hazwaste Site Cleanups—MONA**
Abstract	When all conditions are met, monitored natural attenuation (MONA) is a potentially easy and effective method of hydrocarbon (HC) release cleanup. Because these conditions frequently need some enhancement, adding to nature's supply of necessary ingredients (terminal electron acceptors [TEA], nutrients, microbial colony forming units, and food) can optimize MONA. Since the mid-1990s, environmental regulators have recognized how natural attenuation (NA) can mitigate oil spills. NA mechanisms include evaporation or volatilization, dissolution and dilution, adsorption or sticking to soil or aquifer surfaces, intrinsic biodegradation or consumption by micro-organisms, and product aging or transformation. MONA is the presumptive cleanup remedy for petroleum releases in which the various parameters are verified and documented. AFCEE, USGS, and USEPA prepared guidance documents and case studies. Visualizing the subsurface as a giant biofilter treatment system, MONA is demonstrated through contaminant mass reduction (difficult to show), and more easily, presence of micro-organisms, reduction in contaminant concentrations, HC conversion to byproducts, and environmental attenuation markers. Where microbes, food source (hydrocarbon or HC), macronutrients and terminal electron acceptors are plentiful, microbial degradation proceeds unimpeded. For aerobic (O_2) HC degradation, dissolved oxygen (DO) must be at 1 to 2 mg/L. At many sites, DO is consumed rapidly in the core of the plume shortly after the HC release, followed by consumption of other terminal electron acceptors (TEA) in the order of decreasing metabolic rates: NO_3, Fe(II)/Mn, SO_4, and CO_2. If these TEAs were abundant in nature, long HC plumes would not develop. The energy level for aerobic microbes is much higher than the others; they are more efficient eaters of HC. Once O_2 and NO_3 are consumed, meaningful HC degradation stops. Conditions may be enhanced by passively adding DO or macronutrients. MONA cleanups are so well defined that they are often contracted under pay-for-performance agreements. MONA examples are presented from case studies.
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