## Table A-16.A. Enhanced anaerobic biodegradation

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| Technology | Enhanced biodegradation | Within and downgradient of an LNAPL-impacted zone, biodegradation is generally limited by the availability of electron acceptors (i.e., oxygen, nitrate, sulfate, etc.) When the electron acceptor limitation is overcome, nutrients (i.e., trace elements) can become rate limiting. In the case of methanogenesis, the reaction rate can be limited by temperature. Modifying these conditions may result in enhanced biodegradation rates. | |
| Remediation process | Physical mass recovery | No | N/A |
| | Phase change | Yes | Biodegradation processes break down hydrocarbons and produce carbon dioxide. Volatilization of LNAPL fractions occurs. |
| | In situ destruction | Yes | In situ biodegradation processes destroy LNAPL and transform complex substances into simpler daughter products. |
| | Stabilization/ binding | No | N/A |
| Objective applicability | LNAPL saturation | No | N/A |
| | | Example performance metrics | N/A |
| | LNAPL composition | Yes | Reduce accumulation of unacceptable constituent concentrations in soil vapor and/or groundwater from an LNAPL source. |
| | | Example performance metrics | Stable or reducing groundwater plume; LNAPL composition change; soil and/or groundwater VOC concentrations to below regulatory standard; soil vapor plume concentrations to below regulatory standard. |
| Applicable LNAPL type | Enhanced biodegradation applies to all LNAPL types | | |
| Geologic factors | Unsaturated zone | Permeability | Low permeability soils will limit effectiveness of introduced electron acceptors and nutrients reaching indigenous microorganisms. However, fine-grained soils hold moisture longer and biodegradation does not occur well in dry conditions, and temperature changes in the vadose zone are more variable than in groundwater. |
| | | Grain size | More applicable to sands and gravels but can also be applied in finer grained materials. |
| | | Heterogeneity | Heterogeneity challenges delivery of enhancements. Variability in soil moisture and temperature will also impact biodegradation effectiveness. |
| | | Consolidation | Not typically a factor |
| | Saturated zone | Permeability | Because enhancements to the subsurface must typically be injected, more effective in medium to high permeability zones. |
| | | Grain size | More applicable to sands and gravels but can also be applied in finer grained materials. |
| | | Heterogeneity | Heterogeneity challenges delivery of electron acceptors and nutrients and will reduce effectiveness. |

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| | | Consolidation | Not typically a factor |