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Effects of aggressive remediation on soil properties and function

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Aggressive remediation processes such as thermal desorption, smouldering, and chemical oxidiation remediation processes have significant promise to deliver substantial contaminant reduction in short periods of time, effecting as much as 95-99+% mass removal from non-aqueous phase liquid (NAPL) source zones. In situ thermal remediation exposes soils to temperatures of 100+°C for periods of weeks or months. In situ smouldering exposes soils to 600-1000+°C for hours to days. Chemical oxidation exposes soils to harsh oxidizing chemicals for weeks or months effecting reactive degradation of chemical contaminants but also surrounding soils. These processes have the potential to result in significant changes to the soil properties, particularly at the particle surface and grain interfaces.

The dynamic effects of these changes have important implications in soil management practice. The mobilisation of soil nutrients may challenge rehabilitation or biological “polishing” after aggressive remediation. Plant germination and growth are inhibited and water dynamics are affected as well. Although permeability remains unaffected, infiltration is more rapid and capillary rise is reduced after smouldering remediation. Mobilisation of fines does not explain the change in infiltration and capillary rise; these effects persist after removal of the smaller half of the particle size distribution. Some separation of the soil column is observed in water infiltration after both thermal and smouldering remediation, indicating that erosion and subsidence are potential problems. These effects may be manifestations of subcritical water repellency. Based on the retention of capillary rise and lack of effects on other soil properties, the soil should be amenable to improvement measures. This presentation will place the effects of aggressive remediation into context within real soils and model materials.