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The Impact of Thermal Remediation on Soil Rehabilitation

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In an effort to restore the social and economic value of brownfield sites contaminated by hazardous organic liquids, many new remediation techniques involving the use of elevated temperatures to desorb and extract or destroy these contaminants have been developed. These approaches are typically applied to heavily contaminated soils to effect substantial source removal from the subsurface. These processes operate over a range of temperatures from just above ambient to in excess of 1000˚C depending on technology choice and contaminant type. To facilitate the successful rehabilitation of treated soils for agriculture, biomass production, or habitat enrichment the effects of high temperatures on the ability of soil to support biological activity needs to be understood.

Four soils were treated with high temperatures or artificially contaminated and subjected to a smouldering treatment (600-1100°C) in this investigation. Subsequent chemical analysis, plant growth trials and microbial analysis were used to characterise the impacts of these processes on soil geochemistry, plant health, and potential for recovery. Decreases were found in levels of carbon (>250˚C), nitrogen (>500˚C) and phosphorus (1000˚C) with intermediate temperatures having variable affects on bio-available levels. Macro and micro nutrients such as potassium, calcium, zinc and copper also showed changes with general trends towards reduced bioavailability at higher temperatures. Above 500°C, cation exchange capacity and phosphate adsorption were lowered indicating that nutrient retention will be a problem in some treated soils. In addition, these temperatures reduced the content of clay sized particles changing the texture of the soils. These changes had a statistically significant impact on plant growth with moderate growth reductions occurring at 250°C and 500°C. Above 750°C, growth was extremely limited and soils treated at these temperatures would need major restorative efforts. Microbial re-colonisation and activity were inhibited in soils treated above 500°C due to the lack of available carbon sources. Early experiments with organic amendments and green manures show promise in facilitating more rapid recolonisation. These results underscore the importance of considering long-term soil recovery as part of the remediation strategy.