Evaluation of Remediation of an Oil Spill in a Peat Bog: Chemical Analysis and Stable Isotope Ratio Monitoring

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A pipeline spill at a peat bog occurred in Northern Alberta in the early 1970s (Nipisi). Since most oil spill cleanup and remediation efforts have focused on marine environments, this offered an opportunity to monitor the efforts of cleanup and remediation in a freshwater wetland. Several methods were attempted to clean up and remediate the spill, including burning and fertilization. From field evaluations made 25 years later, the samples showed that extensive degradation of oil in the surface samples had occurred while subsurface samples were less degraded indicating that natural recovery rates were slow at lower depths. The extent of contamination and degree of degradation correlated with sample depth throughout the site. In an environmental setting hydrocarbon loss can be attributed to several factors, including biodegradation, evaporation, sorption, etc., and it would be advantageous to determine the amount of contaminant loss due to biological activities. Gas chromatographic techniques have been developed elsewhere to allow discrimination of losses due to biodegradation. The emerging technique of applying gas chromatography isotope ratio mass spectrometry to analyze hydrocarbon loss may also help identify biodegradation as the agent of ongoing remediation. Laboratory results with individual low molecular weight hydrocarbons have shown that an increase of $\delta^{13}C$ in the residuals generally accompanies decreasing concentration during biodegradation studies. There is also a significant increase of $\delta^{13}C$ in the residuals following degradation of light hydrocarbon mixtures. Field studies have confirmed these observations. We are now applying this analysis to the samples from the Nipisi spill to determine how accurately these results compare with those obtained from standard gas chromatography techniques.