

Reconstructing histories of environmental contamination in lakes near *in-situ* operations at Cold Lake using sediment cores

Photo: C. Cooke



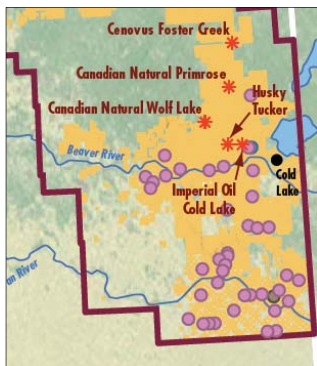
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The Cold Lake Oil Sands



• No refineries or upgraders nearby



Initial Studies - 2013

• Designed to investigate whether *in-situ* operations contribute to atmospheric contaminants

• No evidence of metal contamination

• Some evidence of PAH contamination at certain sites, but does not appear to be consistent with an atmospheric source

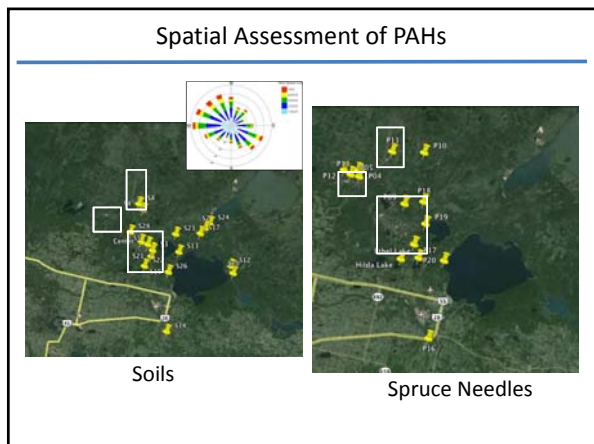
Environmental Pollution
Volume 152, November 2013, Pages 307-316

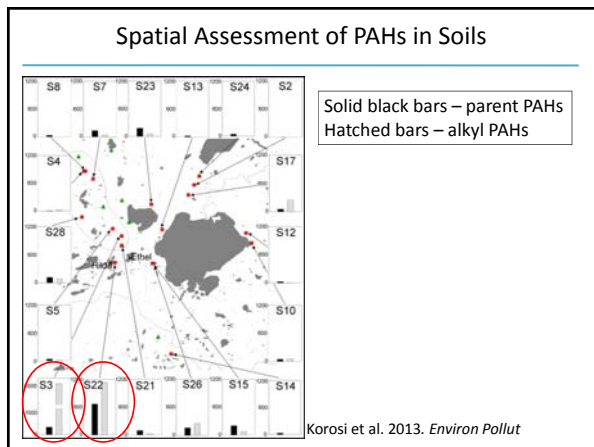
Localized enrichment of polycyclic aromatic hydrocarbons in soil, spruce needles, and lake sediments linked to *in-situ* bitumen extraction near Cold Lake, Alberta

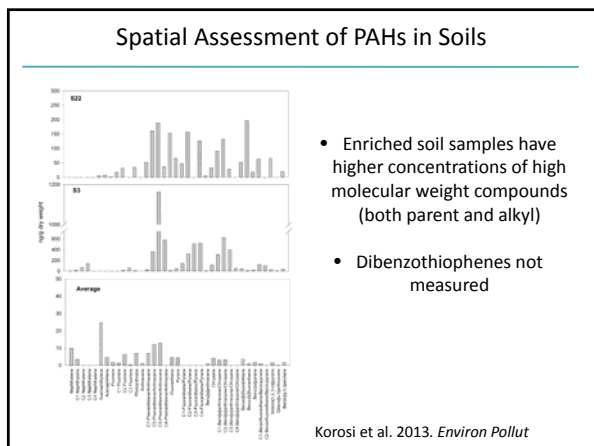
J.S. Kinniburgh, G. Ineson, E.K. Skierszkan, J.B. Dwyer, L.E. Kinniburgh, J. Jamieson, J.M. Sharp

Highlights

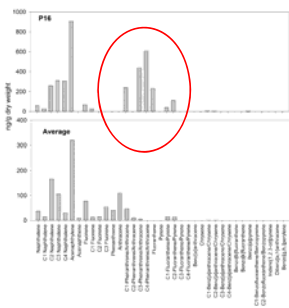
- *In-situ* bitumen extraction linked to rise in alkyl PAHs in one of two study lakes.
- Alkyl PAHs elevated in both soil samples.
- PAH contamination likely related to effluent sources, not atmospheric deposition.







Spatial Assessment of PAHs in Spruce Needles



• Acenaphthylene is the most abundant PAH in spruce needles

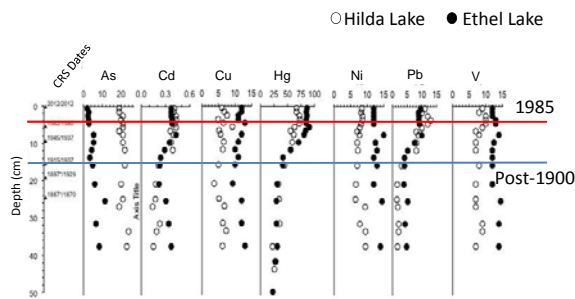
• P16 also has higher concentrations of phenanthrenes and fluoranthenes

Korosi et al. 2013. *Environ Pollut*

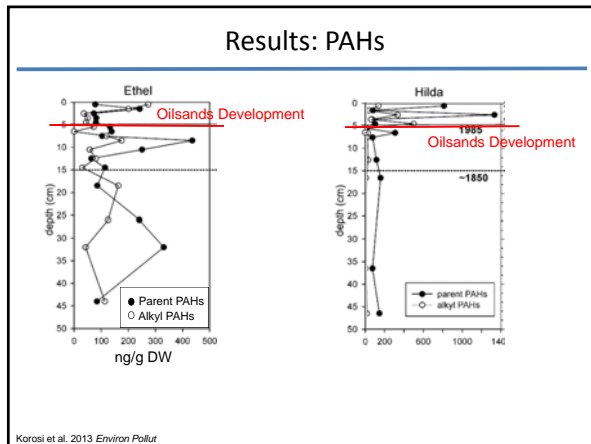
Temporal Assessment: Lake Sediment Cores

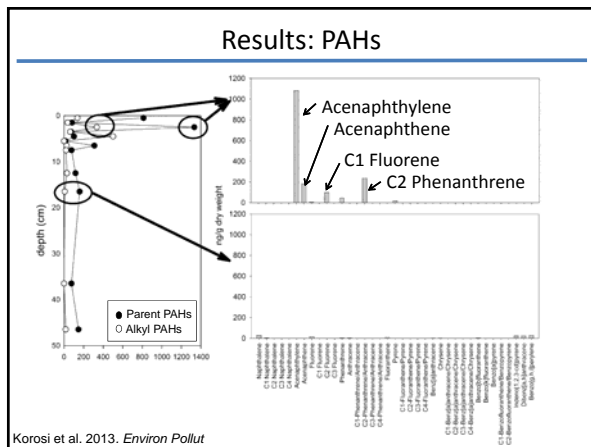


Results: Metals



Skierszkan et al. 2013 *Sci. Tot. Environ.*



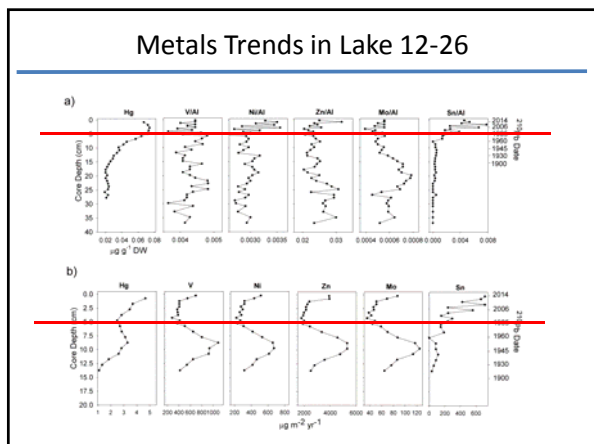


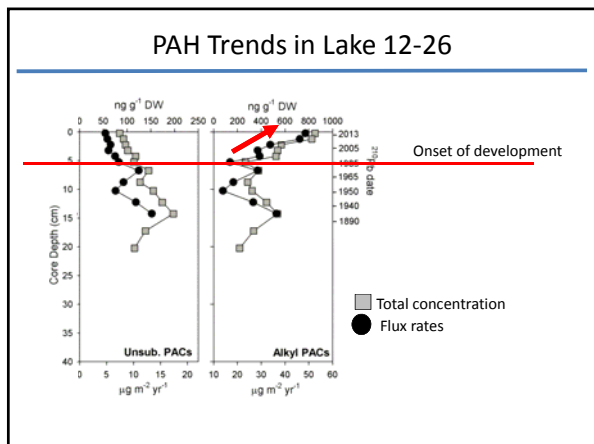
Oilsands leak on northern Alberta weapons range
(June, 2013)

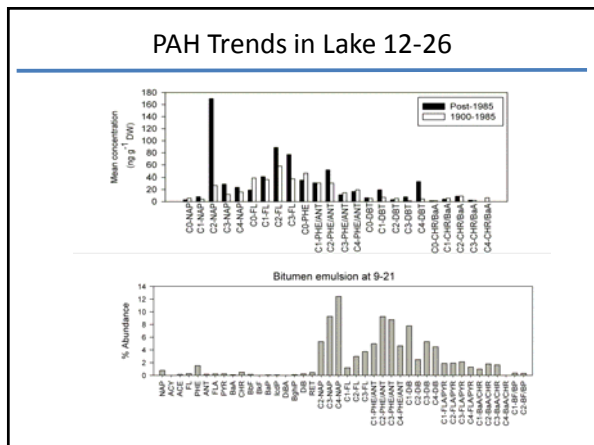
Photos: C. Cooke

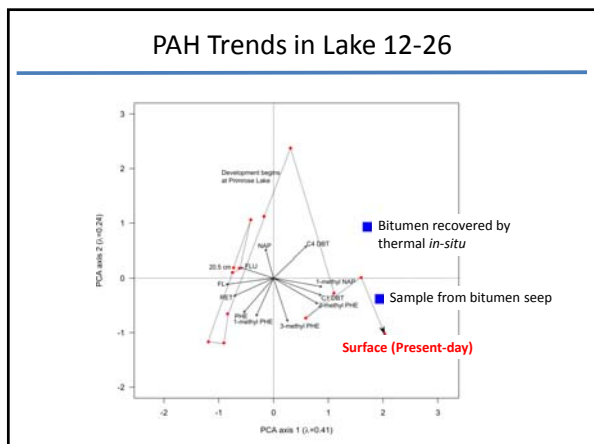












Summary

- Evidence of increases in PAHs in lakes near *in-situ* facilities, but the trends and composition of PAHs differs between them
- No evidence of an increase in vanadium. Recent, post-development increases in other metals (e.g. zinc, nickel), but unclear at present if this is linked to oil sands operations
- Sources and potential mechanisms for PAH enrichment are unknown; an important area for future study
