

## **Clinker Challenges: Crude Oil Remediation in a Scoria Butte**

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### **Abstract**

Crude oil spills in North Dakota have always been challenging to remediate. Various topographical and ecological environments exist in North Dakota's oil fields making one-size-fits-all remediation strategies impractical. One of the most challenging environments to remediate is in the Badlands of southwestern North Dakota. Clay, shale, sandstone, and lignite coal are common, and when impacted by crude oil or brine water spills can be difficult to fully remediate without entirely excavating the impacted area. In addition, sections of lignite coal are occasionally ignited by prairie fires caused by lightning strikes, forming brick-like clinker (locally called scoria). These clinker beds are a mixture of the nearby clay, shale, and sandstone in various degrees of thermal alteration. This varied composition along with the related ground subsidence gives clinker beds extremely unpredictable structures, with extensive fractures and voids abruptly transitioning to more contiguous fused layers. The hydrologic profile is subsequently altered, allowing groundwater and contaminant flow through normally impermeable layers along with pooling in normally permeable layers. In 2016, these issues became apparent when a crude oil spill occurred within oilfield infrastructure built into an existing clinker bed hilltop. This presentation presents a case study of the crude oil spill based on investigations by the North Dakota Department of Environmental Quality. The case study details the site stratigraphy, oilfield infrastructure, and both the successes and challenges of the ongoing remediation.