

Effluent treatment using a Multi-stage Pre-treatment Train integrated with Electro-kinetic Remediation (EK3) and Electro-Dialysis (ED) - V. Martez (SAIT), T. Michailuck and B. Swift (Pioneer Professional Services Group)

Salt impacted soil and groundwater generated from produced water spills, persistently plague the oil and gas industry. Traditionally remediation of salt impacted fine-grained soils has been through "digging and dumping" which essentially transfers the problem to another location. Saline impacted groundwater is traditionally remediated by extracting contaminated water through recovery wells, followed by deep well injection disposal. Both of these traditional methods are not sustainable. Treatment of soils by electrokinetics and then subsequent treatment and reuse of the effluent waters is a more sustainable remediation approach for saline impacted sites.

Pioneer Professional Services Group and Shell Canada Energy partnered with Volker Stevin Contracting and SAIT through the NRC's Industry Research Assistance Program to demonstrate an advanced electro-kinetic remediation (EK3) technology (*in-situ*), to remediate soil and groundwater with elevated salinity at a former battery site in Alberta. Desalination by Electrodialysis (ED) was chosen to treat the salt impacted effluent from the EK3 system.

Electrodialysis selectively transports positively and negatively charged dissolved ions respectively through ion selective electro membranes under the influence of an electrical potential gradient. The positively and negatively charged ions separate from the feed water to form a brine stream (waste effluent) and a de-mineralized product water stream (clean effluent).

A multi-stage pretreatment train was required for the pretreatment of EK3 effluent water prior to desalination by the ED system. The pretreatment train was used to reduce or eliminate a wide range of water borne multi-contaminants, including elevated water hardness which could not be addressed with the electrodialysis system. The demonstration of this patent pending multistage pre-treatment train integrated with EK3 and ED technologies provides industry with the knowledge that effluent waters can be treated (*on-site*) for reuse by remediation processes. This hybrid integration of advanced technologies is expected to reduce the requirement for hauling fresh water onsite for EK3 processes and demonstrates remediation processes that are environmental sustainable.

Vita Martez, M.Sc.

Ms. Martez is currently the Director, Applied Research & Technology Development, CTC Calgary, Alberta & Part-time Instructor, Energy Department, Southern Alberta Institute of Technology, Calgary, Alberta. She has a M.Sc. in Environmental Science and Management, (University of Royal Roads, British Columbia) - 2002 B.Sc. Physics and Chemical Technology. She has demonstrated experience in coordinating and conducting collaborative trans-disciplinary geo-environmental research and technology development and holds a few patents. Ms. Martez's experience has focused on soil remediation, remediation technologies, and sustainable remediation development.

Bonnie Swift, MBA, CCEP, P.Eng.

Ms. Swift holds a MBA from Royal Roads University, a civil engineering degree with a double major in environmental engineering and water resources, and has her Chemical Technologies diploma from SAIT. Ms. Swift also acts as the environmental chairperson for the International Right of Way Association (IRWA). Over the past 6 years she has helped build, develop and manage Pioneers' ever expanding, multi-million dollar environmental department growing into Pioneer R&D, and Geosci. Ms. Swift is responsible for keeping these divisions on the cutting edge of any and all environmental technologies, theories and issues.

Tanya Michailuck. M.Eng., P.Eng.

Ms. Michailuck is an environmental engineer who is passionate about the research, development and application of innovative remediation technologies. Ms. Michailuck is currently the Research and Development Manager for Pioneer whose role involves helping sustainable technology inventors demonstrate their technologies. She is one of the founding members of the Sustainable Remediation Technology Initiative. She has managed several contaminated sites assessment and remediation projects using in-situ and ex-situ remediation technologies. Her environmental consulting experience has focused on remediation projects in upstream oil and gas, residential, commercial, and industrial land uses throughout Alberta.

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