On-Site Treatment of a Dissolved Chromium Plume: From Bench Trial to Remediation to Results

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A dissolved chromium plume was identified at an industrial property in Edmonton, Alberta. The origin of the plume was due to site operations involving chrome plating and the associated underground tank system used to store bulk quantities of chromic acid. Soil impacts were minimal and isolated to two small source areas, whereas the dissolved-phase impacts were significantly more widespread (~2,000 m^2). Dissolved hexavalent chromium concentrations were reported as high as 300 mg/L and total chromium concentrations were reported as high as 308 mg/L at the source areas, with target numerical guidelines being 0.001 mg/L and 0.0089 mg/L, respectively.

Design of the remediation plan needed to take into consideration that the facility was still operational, which limited ex-situ options. Furthermore, the relatively shallow depth and higher hydraulic conductivity of the groundwater on site was conducive to a pump and treatment system and/or in situ injection program. A bench study was initially completed to evaluate the effectiveness of two potential reducing agents (sodium meta-bisulphate and ferrous sulphate), that could be utilized for the onsite treatment of the contaminant plume. Results from the bench study indicated that the ferrous sulphate was effective at reducing the dissolved hexavalent and total chromium by 99.99%, whereas the sodium meta-bisulphate reduced dissolved hexavalent and total chromium by approximately 50%. As such, an on-site pump and treat system and targeted in situ injection programs were initiated on the Property, utilizing ferrous sulphate as the reducing agent.

To be effective, the treatment system required a large volume of groundwater to be recovered at the two source areas. Large diameter bored wells equipped with submersible pumps recovered and transferred groundwater to an on-site treatment reactor. Rather than recovering and disposing of contaminated groundwater as hazardous waste, the treated water was discharged via the sanitary sewer system following the appropriate testing and approval. Targeted injection programs were also utilized to treat areas of the contaminant plume outside the recovery area radius of influence.

Following several field seasons, the contaminant plume across the Property has been significantly reduced in size and the remaining concentrations have been considerably reduced by upwards of 99% in the source areas. Operations on site were uninterrupted during the remediation program and cost incurred by the landowner were significant reduced through the elimination, transport and disposal of hazardous wastes. Onsite treatment of the impacted groundwater was proven to be a sustainable approach that met the remedial goals desired in a timely, cost effective, and environmentally responsible manner.

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Barry Rakewich is the Environmental General Manger for Nichols Environmental (Canada) Ltd. In Edmonton, Canada. Mr. Rakewich is a Professional Agrologist with a B.Sc. in Environmental and Conservation Sciences from the University of Alberta with over 16 years of consulting and industry experience. His areas of expertise include soil and groundwater assessments and investigations; site remediation evaluation, design and implementation; in-situ remediation via chemical oxidation and reduction; spill response and clean up. Mr. Rakewich has completed assessment and remediaton projects across Canada and into the southern USA. Mr. Rakewich has also completed spill response and clean-up for clients throughout the Western Canada provinces of British Columbia, Alberta, Saskatchewan and Manitoba. Corporately, Nichols Environmental has been in business since 1997 and currently employs more than 35 professionals and technologists with education and experience in engineering, geology, biological and earth sciences, with offices in Edmonton, Calgary and Whitecourt. Nichols Environmental has completed over 2,500 environmental site assessments and remediation projects throughout Western Canada.

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