



## Ivey-sol technology has potential to increase oil recovery of oil-sands waste by 15-25 percent

Alberta's oil sands are comprised of one of the world's largest sources of bitumen, containing an estimated 1.6 trillion barrels. About two tonnes of oil sands must be dug up and processed to produce one barrel of oil. Oil sands recovery processes include extraction and separation systems to remove bitumen from sand and water. Separating the oil from the sand is difficult and costly, and getting the most petroleum at the least cost is a key challenge.

Once the petroleum is recovered from the oil sands, a sand waste by-product is generated. This sand waste still contains high concentrations of oil that was not removed during the initial oil extraction process. Ivey International recently conducted a treatment test to measure the effectiveness of their patented Ivey-sol technology to treat this sand waste.

"Ivey-sol has proven to be very effective at liberating and dissolving petroleum hydrocarbons, chlorinated solvents, and heavy metals from soils and/or groundwater, regardless of the type of contamination," says George Ivey, Ivey International Inc. founder and CEO. "It has worked so well that it has generated a strong market demand for both in-situ and ex-situ remediation applications."

Ivey-sol - Selective Phase Transfer Technology (SPTT) is comprised of environmentally safe constituents that encapsulate and separate hydrocarbons from contaminated soil, bedrock, groundwater and solid wastes. In doing so, this allows for the rapid recovery of the "dissolved" contaminants via on-site recovery wells (in-situ) or other process method (ex-situ) applications. The "selective" aspect of Ivey-sol means there are four different mixture options and two processes, enabling it to accurately target everything from light hydrocarbons such as gasoline to heavy Bunker-C oil among others.

Vertex Environmental Solutions Inc., an environmental contracting company that specializes in the remediation of contaminated soils and groundwater, is working with Ivey International to implement the SPT technology at various sites across Canada. During the summer of 2004, the Ontario Ministry of the Environment provided Vertex with a mobile Certificate of Approval, which allows Vertex to inject SPTT anywhere in Ontario.

"SPTT has been proven highly effective at remediating both oil-based contamination and chlorinated solvents in a variety of different soil types, ranging from sands to clays," says Bruce Tunnicliffe, President, Vertex Environmental. "Given the current need for innovative and cost-effective clean-up technologies, usage of SPTT will significantly increase in the upcoming years."

### Treatment tests

A total of three purposes served as the basis for the Ivey-sol Oil-Sands Treatment Test. The first was to evaluate the effectiveness of Ivey-sol technology and mixtures for the removal of petroleum hydrocarbons from oil-sands wastes. The second was to determine if the technology could treat the subject soils to within compliance with the Tier I course-soils criteria for commercial and/or industrial sites as set out in the Canadian Council of the Ministers of Environment (CCME) guidelines. The third was to evaluate the Ivey-sol technology as a



Pre and post treated oil-sands by-product wastes treated with Ivey-sol.

CCME Fraction	Base Line Concentration	Ivey-sol Treatment Sample #1	Ivey-sol Treatment Sample #2	Ivey-sol Treatment Sample #3	Comment
F1 - C <sub>6-10</sub>	15 ppm	N.D.	N.D.	N.D.	Pass
F2 - C <sub>10-16</sub>	1100 ppm	230 ppm	99 ppm	N.D.	Pass
F3 - C <sub>16-34</sub>	40,000 ppm	15,000 ppm	8,200 ppm	1,400 ppm	Pass
F4 - C <sub>34-50+</sub>	13,000 ppm	5,300 ppm	2,600 ppm	500 ppm	Pass
		60 - 100% Reductions	80 - 100% Reductions	96.2 - 100% Reductions	Compliance with Commercial/Industrial

Table 1-1: Ivey-sol oil-sand by-product waste treatment test results summary.

potential method for the recovery of oil from the oil-sand by-product waste streams.

The oil-sands by-product wastes that were treated were sources from a site in Northern Alberta. The oil-sands were taken from the post oil extraction by-product sand wastes stored at an operating facility. Baseline analysis of the subject oil-sand waste soil showed hydrocarbon concentrations in excess of 54,000 ppm total petroleum hydrocarbons (TPH).

Testing of the Ivey-sol oil-sands treatment involved a series of three brief treatments with sample collection and analysis being undertaken after each to confirm and evaluate findings. Each treatment involved a three to

five minute wash of the oil-sand by-product waste with a low-concentration of the Ivey-sol mixture. Post treatment soil samples were collected after each treatment and analyzed in accordance with the CCME guidelines for soils testing. These are presented in Table 1-1.

### Results

Following the first treatment between 60% and 100% of the fractions analyzed were removed. Fractions F1 and F2 were in compliance with the CCME guidelines while F3 and F4 were reduced by 63% and 60% respectively. The second treatment proved very effective with F1, F2 and F4 fractions all falling within the CCME compliance

guidelines, while F3 showed a significant 80% reduction. The third and final treatment successfully achieved compliance for all fractions with 96.2% to 100% hydrocarbon removal for all fractions tested. The soil after the final treatment was in compliance with the CCME guidelines for both commercial and industrial land use applications.

"The potential market for Ivey-sol is huge. Recent research completed with Canadian and U.S. firms led to some breakthrough applications for Ivey-sol treating everything from heavy metals to radio-active NORMS, engine and heavy-equipment cleaning, mine-sulphur leach control and hydrocarbon vapour suppression. We are very excited about the future of Ivey-sol," says Ivey.

Ivey-sol has proven to be very effective in the removal of residual oils from oil-sand by-product waste. Used in conjunction with current oil-sands production methods, Ivey-sol can increase the net oil recovered per cubic metre of soil by as much as 15 to 25%. With this consideration, Ivey-sol has the potential for becoming an economical primary or secondary method to extract oil from natural oil-sands deposits.

### Ivey International Inc.

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