



Remediation of silty-clay hydrocarbon contaminated site using Ivey-sol Selective Phase Transfer Technology

Earlier this year, Ivey International Inc. secured its first remediation project in Alberta using its Ivey-sol Selective Phase Transfer Technology (SPTT). This patented technology is being used to treat extensive soil and groundwater contamination at an active service station in Red Deer, Alberta.

With a residential area nearby, the environmental sensitivity is relatively high. Unfortunately, past excavation efforts following the original spill failed to clean-up the soil and groundwater contamination which is still present on-site more than three years later.

Ivey International Inc. founder and CEO, George Ivey, estimates that Ivey-sol SPTT will clean the site within 12 months, an astounding improvement above the industry average of five to seven years.

Key Safety Services Inc.'s Environmental Division incorporates Ivey-sol SPTT in their remediation process and is working in conjunction with Ivey International at the subject site.

"The project we are now working on is in tight clay soil, six metres deep, 35 metres by 20 metres in area," says Terry Timothy, Manager of Environmental Services for Key Safety. "The projected clean up will be nine to 12 months. This is very fast compared to any other in-situ process that we are aware of. The only thing faster is digging up the site and hauling away the soil."

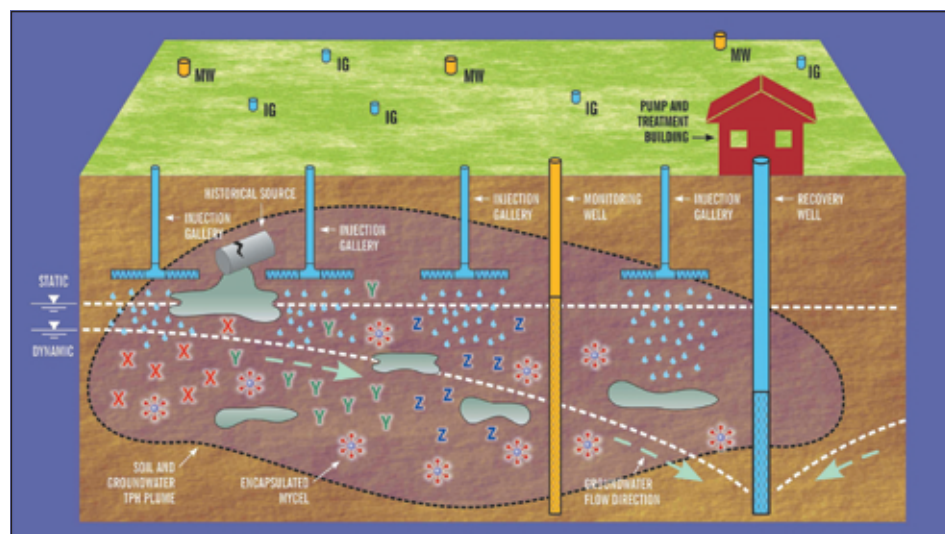
Steve Wasson, P. Eng., Coordinator of Environmental Services for Key Safety says "This process is very cost effective and will save between \$40,000 to \$60,000 compared to the closest available technology that we are aware of. Our division has been working closely with Ivey International for over a year and is convinced this is the future for in-situ remediation."

Ivey-sol works at the molecular level, using designed phase-transfer mixtures that interact with the full range of organic LNAPLs (light non-aqueous phase liquids) and DNAPL (dense non-aqueous phase liquids). Ivey-sol is a patented technology comprising mixtures 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 through on-site recovery wells. 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.

"This versatility is important," says Ivey, whose background in organic chemistry and geological engineering led to his breakthrough discovery between 1993 and 1998. "Ivey-sol can selectively encapsulate different classes of organic compounds within gasoline and oil and get them dissolved in water. Even gasoline has more than 1,000 different components. How can one mixture treat gas, diesel or Bunker-C?"

By applying the various Ivey-sol



Cross-section diagram of the Ivey-sol Selective Phase Transfer Technology.

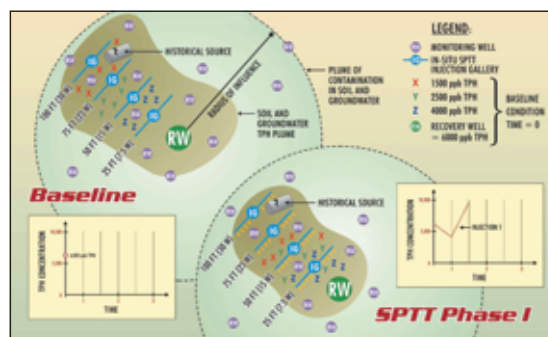


Figure 1 (above) and Figure 2 (right) show the reduction in the size of the contamination over time following a series of injections.

mixtures *in situ* monthly or bi-monthly through injection wells or injection galleries, case studies have shown that 95% of project goals are achieved within 18 months, and typically within 12.

"We get over the solubility barrier," Ivey says. "We get the petrochemical hydrocarbons dissolved, making them more mobile. We then recover and remove them from the soil and groundwater contaminate plume."

The *ex situ* method, in which approximately 35 tons of contaminated soils are placed in metal mesh-lined de-watering units with higher concentrations of SPTT for three to four hours, has proven to be a

portable and economical soil treatment methodology. Soils can even be re-used after treatment. And it's scalable: it can be done with one unit of soil, or 20.

Ivey-sol mixtures have other advantages: they are not significantly affected by the presence of metals, chlorinated

Ivey-sol may also convince industrial and commercial clients to begin remediation they would otherwise deem unfeasible. For instance, at sites where there is a risk of damaging a building's structure to access underground contaminants beneath the foundation, Ivey-sol can be applied right through the basement floor. The injection and clean-up process can proceed without incurring the structural liability faced by other technologies.

Ivey-sol's application is not limited to soil and groundwater remediation. It can also be used for off-shore oil spills, oil and gas wastes, petrochemical wastes, heavy metals and chlorinated solvents among many others.

"The technology and process have the benefit of two- to three-day installation of system, minimal disruption to existing business operations, an average of nine to 15 months remediation time, one day removal of system and working business sites are left in original condition," concludes Timothy. "The future for in-situ remediation is looking very good."

Ivey International Inc.

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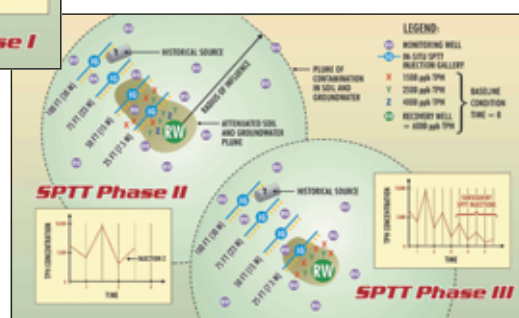


Figure 2.

compounds or salinity, which is especially important in the salty soils of Alberta and coastal B.C. Their effectiveness does not know any geographic boundaries.

With Ivey-sol, clients can usually get an accurate project prognosis after just three or four months based on recovery rates to date.