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Website: Ends Report
Date: Wednesday, 29th June 2011
Page: N/A
Circulation: N/A

New groundwater remediation technology successfully trialled

Print Version
ENDS Report 437, June 2011, p. 32
29 June 2011

A new, UK-developed technology that is more efficient and cost effective than traditional methods of groundwater remediation has performed well in a trial.


A successful trial of a contaminated groundwater treatment technology has been announced by remediation company, Geo2 Remediation.

The firm, based in Ferrybridge, West Yorkshire trialled the new Nyex material at a Lancashire petrol station forecourt last winter, with partners Arvia Technology. Groundwater at the Barnoldswick site (pictured) was contaminated with hydrocarbons and these were successfully removed.

Nyex is a reusable, granular graphite-based adsorbent that destroys contaminants through an electrochemical process. It was developed by Nigel Brown at the University of Manchester's school of chemical engineering and analytical sciences. Its practical applications were recognised in 2006, by a Royal Society of Chemistry innovation award.

Spun out through the university's intellectual property unit, Arvia then developed its commercial potential. It can be used to treat pollutants usually tackled with ex-situ pump-and-treat methods and could replace established techniques based on costly granular activated carbon (GAC) which must be regenerated off site.

Mark Swindells, Geo2's director said: "This is a potentially more efficient and cost-effective alternative to traditional technologies."

Nyex is used in a three-stage process. First, adsorption is achieved through mixing it with the effluent in an on-site reactor unit. Next, sedimentation occurs when the Nyex particles settle in the base of the unit.

Finally, an electrochemical treatment is carried out by passing a current through the sediment. Pollutants are oxidised and destroyed, yielding water, carbon dioxide and a small amount of hydrogen.

This step also regenerates the Nyex, which becomes ready for immediate reuse. "Regenerating the medium in this way is novel," says Mr Swindells. Nyex has a lower capacity to adsorb contaminants than GAC, but it can be rapidly regenerated allowing multiple cycles of adsorption and destruction to take place. He told ENDS the single-unit continued-adsorption process was "a world first".

The technique's potential was tested during the December 2009 to February 2010 trial. "The aim was to prove the technique's efficiency in treating hydrocarbons and to see whether it could be applied in other areas, such as other organic solvents," says Mr Swindells. "And it worked, achieving 100% destruction... at low cost."

Just 0.5 kilowatt hours of electricity were used per cubic metre of water treated, all contamination was removed and the process costs were just 5p per cubic metre of treated water. GAC-based methods typically use 3.3-6.7kWh/m^3 of water treated, with running costs of 33-67p/m^3.

Also, while the treatment is most effective at warmer temperatures, success was achieved during the unusually cold winter.

Nyex offers other benefits: It needs no added chemicals, yields no solid waste and is a more sustainable method for treating contaminated groundwater than established techniques, says Geo2. There may also be potential cost savings because it is carried out in a single integrated unit, easily moved on and off site.

Developing better remediation techniques has the backing of contaminated land organisation, CLAIRE. Its February 2011 report concluded the sector needed a greater focus on sustainability considerations (ENDS Report 433, pp 30-31). CLAIRE also facilitated the April 2010 publication of Sustainable Remediation Forum UK's sustainable remediation framework (ENDS Report 423, p 23).

CLAIRE has 26 technology demonstration projects. Geo2 and Arvia's will become one if the peer review process is completed.

Developing commercial potential

Following the successful trial, the next stage for Geo2 is to develop the technology's commercial potential. It should prove to be of interest to all those involved in groundwater remediation and related consultancy, the firm says.

As well as petrol station forecourts, it is appropriate for tackling industrial sites affected by contamination from hydrocarbons, chlorinated solvents and other organic substances.

It can also be used to isolate radioactive material from contaminated oily wastes at nuclear sites and has market potential in the pulp and paper, raw water treatment, water reuse, agrochemicals and industrial wastewater treatment sectors.