

Superbugs offer solvent solution

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A world-first superbug is to undergo field trials to clean up two of Australia's most polluted industrial sites at Port Botany in NSW and Altona in Melbourne in the coming year.

The microbe, the first in the world found to completely break down chloroform – a common industrial pollutant and [carcinogen](#) – in groundwater, was discovered by a team at the University of NSW in 2011, Associate Professor Mike Manefield will tell the CleanUp 2013 Conference in Melbourne today.

"Organochlorine-contaminated groundwater is a major environmental concern all round the world," Prof. Manefield says. "These substances are used in the manufacture of plastics, as solvents, degreasing and [cleaning agents](#) – and the very qualities that make them useful to industry also make them incredibly hard to break down in the environment.

"Consequently they can hang round in groundwater for decades, maybe even centuries, and pose a risk to the health of anyone who drinks or swims in the water, eats food grown with it, or inhales vapour in areas where the chemicals are concentrated."

Australia, he says, has hundreds and possibly thousands of sites contaminated with chlorinated ethenes, ethanes and methanes – former petrochemical [refineries](#), mechanical workshops and dry cleaners mainly – and around 40 tonnes of these substances are still being released here yearly, despite efforts by regulators to limit their use.

Cleaning up these chlorinated compounds poses particular challenges, as they are not susceptible to oxidation with the usual bioremediation techniques and suites of [beneficial microbes](#).

"They are extremely tough molecules, they resist dissolving, and they sink to the bottom of the aquifer where natural breakdown occurs far more slowly," he explains "Once they start moving offsite in groundwater, you have a real problem in limiting who is exposed to them – so you need to clean them up on the spot if possible."

In 2011 Prof. Manfield and his colleague Dr Matthew Lee were examining sediment from the chemical works at the Botany Industrial Park and came across a species of bacteria which took in chloroform – the main pollutant of concern – and turned it into harmless hydrogen, acetate and carbon dioxide. Since chloroform inhibits bioremediation of other chlorinated solvents at many heavily polluted industrial sites globally, their world-first discovery was hailed internationally.

"It happened quite suddenly. We had been culturing the naturally occurring bugs for a couple of months when suddenly, on day 70, we saw a sudden surge of activity and the chloroform levels in the groundwater began to drop sharply. In a few days it was gone. Subsequent re-feeding of chloroform revealed high tolerance by the bugs and rapid degradation."

What had turned on the chloroform-munching bugs remains a mystery that Prof. Manfield and his team are still striving to decipher – but for the first time, humanity has a feasible way to eliminate a serious and widespread cancer-causing pollutant at a relatively low cost.

The team has since developed three main cultures for addressing different mixtures of chlorinated solvents and plans to trial them at two of Australia's most heavily contaminated industrial sites – the Port

Botany chemical plant and Altona refinery – over the next 12 months.

Australia has lagged behind in the application of bioremediation to organochlorine-contaminated groundwater partly because the relevant diagnostic tools and cultures have not been available – but that is now about to change, Prof. Manefield believes.

"Essentially we believe these bacteria will work in any aquifer round the world where the pollutants and conditions are similar to those in the Botany Aquifer, which is quite acidic," he explains. "So this isn't just a solution for a specific contaminated site: potentially it can deliver global benefits."

Chloroform especially is a byproduct of the plastics industry and is still being produced globally in huge amounts, despite its known links to cancer. Perchloroethene is still used universally in the dry cleaning industry. All these substances pose a risk to human health via the global food chain – as more and more food is now imported from distant countries where pollution controls are poor – and in urban [groundwater](#) used for household purposes.

More information: www.cleanupconference.com/

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