IN-SITU LEACH URANIUM MINING

Nuclear-Free Campaign – Friends of the Earth Australia
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In 2001, an in-situ leach (ISL) mine, the Beverley uranium mine, began operating in the northern Flinders Ranges in South Australia. The mine is owned by General Atomics, a US-based company, and managed by its subsidiary, Heathgate Resources. In 2014, Beverley was put into care-and-maintenance, while the nearby Beverley Four Mile began producing.

ISL involves pumping acid into an aquifer. This dissolves the uranium ore and other heavy metals and the solution is then pumped back to the surface. The small amount of uranium is separated at the surface. The liquid radioactive waste – containing radioactive particles, heavy metals and acid – is simply dumped in groundwater. From being inert and immobile in the ore body, the radionuclides and heavy metals are now bioavailable and mobile in the aquifer.

There has never been a commercial acid leach mine in the USA given environmental approval. Experiences with its use in the Eastern Bloc and elsewhere have left aquifers heavily polluted.

Heathgate has no plans to clean up the aquifer as it says the pollution will ‘attenuate' – that the aquifer will return to its pre-mining state over time. This claim has been queried by the scientific community as being highly speculative with little or no firm science behind it.

According to Assoc. Prof. Gavin Mudd, a hydrogeologist and engineering lecturer at RMIT: "The critical data which could answer scientific questions concerning contaminant mobility in groundwater has never been released by General Atomics. This is especially important since GA no longer maintain the mine is 'isolated' from surrounding groundwater, with desires to expand the mine raising legitimate concerns over the groundwater contamination legacy left at Beverley."

Jillian Marsh, Adnyamathanha Traditional Owner, noted in her submission to 2002-03 Senate References and Legislation Committee that: "The government chose not to demand that the groundwater be rehabilitated, an unacceptable situation for the Australian public at large given our increasing reliance on groundwater and the increasing salinity of land surfaces and water systems."

The 2003 report of the Senate Committee noted "a pattern of under-performance and non-compliance" in Australia's uranium mining industry, it identified "many gaps in knowledge and found an absence of reliable data on which to measure the extent of contamination or its impact on the environment", and it concluded that changes were necessary "in order to protect the environment and its inhabitants from serious or irreversible damage".

On ISL mining, the 2003 Senate report stated:

"The Committee is concerned that the ISL process, which is still in its experimental state and introduced in the face of considerable public opposition, was permitted prior to conclusive evidence being available on its safety and environmental impacts.

"The Committee recommends that, owing to the experimental nature and the level of public opposition, the ISL mining technique should not be permitted until more conclusive evidence can be presented on its safety and environmental impacts.

"Failing that, the Committee recommends that at the very least, mines utilising the ISL technique should be subject to strict regulation, including prohibition of discharge of radioactive liquid mine waste to groundwater, and ongoing, regular independent monitoring to ensure environmental impacts are minimised."

A sham inquiry was subsequently convened by the SA government to justify ISL mining and to justify the government's indefensible decision not to require rehabilitation of groundwater. The inquiry had all the hallmarks of a whitewash yet still acknowledged that attenuation is "not proven" and could only cite a period of "several years to decades" for it to occur.

The 2003 Senate report also noted: "Another serious claim made by the ACF concerns the status and release of Heathgate Resources' reports on the Beverley FLTs [Field Leach Trials], including the Groundwater Monitoring Summary. The ACF states that release of these reports under the Freedom of Information Act was delayed by company claims of commercial-in-confidence for more than two years. A successful ACF appeal to the South Australian Ombudsman finally secured the release of some of these reports, the Ombudsman finding that in no case was a commercial-in-confidence claim justified."

Another feature of ISL mining is surface contamination from spills and leaks of radioactive solutions. At least 59 spills have been documented at Beverley, such as the spill of 62,000 litres of contaminated water in January 2002 after a pipe burst, and the spill of 15,000 litres of contaminated water in May 2002.

More information on ISL mining (and the notorious General Atomics / Heathgate): www.nuclear.foe.org.au/in-situ-leach-uranium-mining/

ISL URANIUM MINING FAR FROM 'BENIGN'

By Assoc. Prof. Gavin Mudd
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The mining technique of in situ leaching (ISL), often referred to as solution mining, is becoming an increasingly favoured method for the extraction of uranium across the world. This is primarily due to its low capital and operating costs compared to conventional mining. Little is known about the environmental impact of this method, and mining companies have been able to exploit this to promote the method as "environmentally benign".

The ISL process involves drilling ground water bores or wells into a uranium deposit, injecting corrosive chemicals to dissolve the uranium within the ore zone, then pumping back the uranium-laden solution.

The method can be applied only to uranium deposits located within a ground water system or confined aquifer, commonly in palaeochannel deposits (old buried river beds).

Although ISL is presented in simplified diagrams by the nuclear industry, the reality is that geological systems are inherently complex and not predictable.

There are a range of options for the chemistry of the mining solutions. Either acidic or alkaline chemical agents can be used in conjunction with an oxidising agent to dissolve the uranium.

Typical oxidising agents include oxygen or hydrogen peroxide, while alkaline agents include ammonia or sodium-bicarbonate or carbon dioxide. The most common acidic chemical used is sulphuric acid, although nitric acid has been tried at select sites and in laboratory tests.

The chemicals can have potentially serious environmental impacts and cause long-term changes to ground water quality.

The use of acidic solutions mobilises high levels of heavy metals, such as cadmium, strontium, lead and chromium. Alkaline solutions tend to mobilise only a few heavy metals such as selenium and molybdenum. The ability to restore the ground water to its pre-mining quality is, arguably, easier at sites that have used alkaline solution chemistry.

A review of the available literature on ISL mines across the world can easily counter the myths promulgated about ISL uranium mining. Whether one examines the USA, Germany, Russia and associated states, Bulgaria, the Czech Republic, Australia or new ISL projects across Asia, the truth remains the same – the ISL technique merely treats ground water as a sacrifice zone and the problem remains "out of sight, out of mind".

ISL uranium mining is not controllable, is inherently unsafe and is unlikely to meet "strict environmental controls". It is not an environmentally benign method of uranium mining.

The use of sulphuric acid solutions at ISL mines across Eastern Europe, as well as a callous disregard for sensible environmental management, has led to many seriously contaminated sites.

Perhaps the most severe example is Straz pod Ralskem in the Czech Republic, where up to 200 billion litres of ground water is contaminated. Restoration of the site is expected to take several decades or even centuries.

Solution escapes and difficult restorations have been documented at ISL sites in Texas and Wyoming.

Australia has encountered the same difficulties, especially at the controversial Honeymoon deposit in South Australia during pilot studies in the early 1980s and at Manyingee in Western Australia until 1985.

The Honeymoon pilot project used sulphuric acid in conjunction with ferric sulphate as the oxidising agent. The wells and aquifer experienced significant blockages due to the minerals jarosite and gypsum precipitating, lowering the efficiency of the leaching process and leading to increased excursions. The aquifers in the vicinity of Honeymoon are known to be connected to aquifers used by local pastoralists to water stock.

Journal articles, conferences papers etc. by Assoc. Prof. Mudd: http://users.monash.edu.au/~gmudd