

# Virtual Curtain

A versatile technology for the rapid treatment of complex, multi-contaminant oil, gas and mining industry wastewaters

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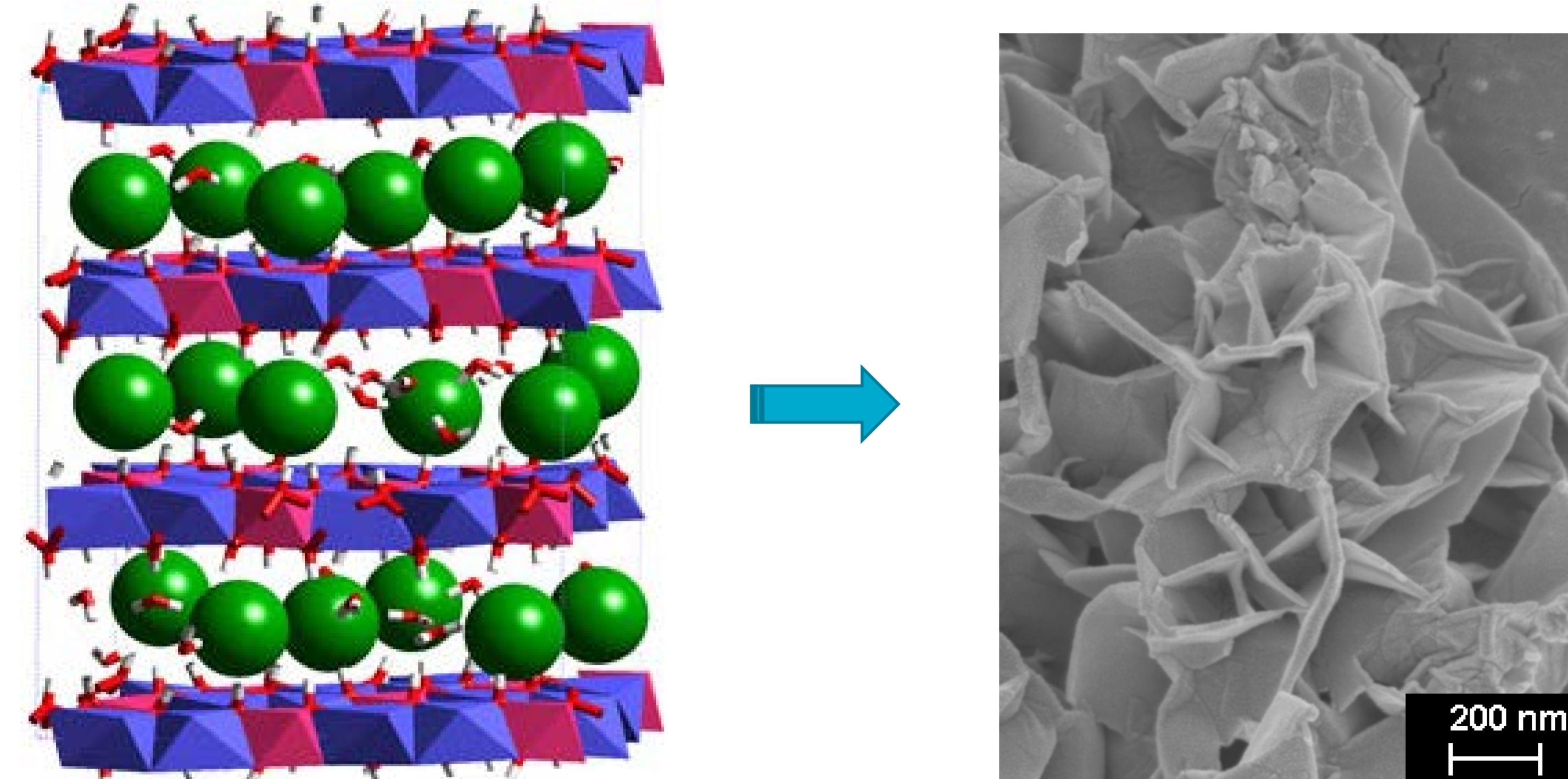


## The Challenge

Produced wastes and wastewaters generated from the extraction of oil and gas may contain a complex suite of organic and inorganic contaminants and radionuclides and may span a range of pH, redox and salinities. With increasingly stringent environmental regulation, innovative technologies such as Virtual Curtain offer improved contaminant removal and environmental outcomes.

## The Solution

The Virtual Curtain technology, based on the in-situ formation of a layered hydroxyl-based mineral (Fig. 1), can be implemented over a range of physico-chemical conditions to simultaneously remove a diversity of cationic and anionic contaminants. The Virtual Curtain technology facilitates greatly improved efficiencies in allied technologies such as RO, thereby further reducing treatment costs.



Crucially, once the appropriate conditions are produced, hydroxyl-based mineral formation is instantaneous, and thus minimal time is required using either pump-and-treat or batch processes. Furthermore, the process is inherently simple and stable, low-volume residues are produced that may be readily dewatered for disposal. Post-treatment waters are often similar in composition to the influent, particularly for saline waters, thus removing this potential impediment to reuse or disposal.

## Silica and Total Hardness Reduction

### Coal to chemicals wastewater, Yulin, Shaanxi Province, China

The Virtual Curtain technology was successfully applied to treat 7GL of coal to chemicals wastewater. Reductions of 60% in Total Hardness, 66% in silica and 85% in turbidity resulted in a 50% increase in RO output at a fraction of the CAPEX and OPEX of new infrastructure.

### Fort Irwin Army Base, Mojave Desert, California, USA

Successful pilot trials have also been undertaken to treat post-EDR groundwater used to supply ~22 ML/day of potable water to 10,000 troops stationed at Fort Irwin. Full implementation of the technology is due to occur in early 2018.

## Metal and Metalloid Removal

### Acid mine water, Queensland, Australia

A total of 56ML of acidic contaminant-laden mine pit water was treated using the Virtual Curtain technology in around two weeks. Following RO treatment, over 90% of the treated solute was discharged to a sensitive receiving environment. Concentration factors of ~2000 times resulted in the formation of a precipitate containing 8% Cu and 4% Zn, substantially higher than the ore grade mined at the deposit with potential for reprocessing to offset remediation costs.

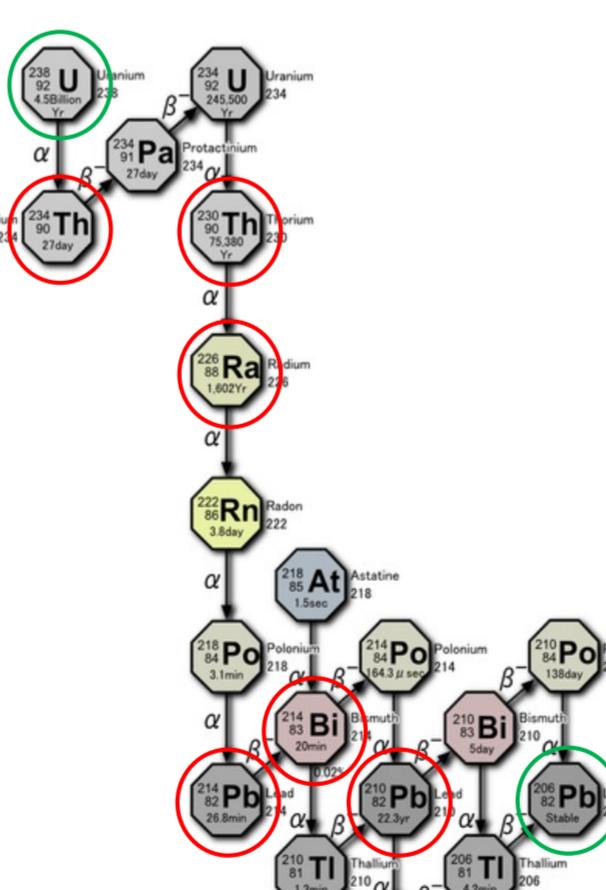


Analyte	pH	As (mg/L)	Cu (mg/L)	Cd (mg/L)	Co (mg/L)	F (mg/L)	Fe (mg/L)	Mn (mg/L)	Pb (mg/L)	Si (mg/L)	Zn (mg/L)
Pre-Treatment	2.9	0.04	40	0.3	0.54	59	59	16	0.13	60	22
Post-HT Treatment	9.2	<0.005	<0.005	0.001	<0.005	34	<0.05	0.04	<0.005	1.3	<0.005
Post-RO Treatment	7.0	<0.003	0.001	<0.0001	<0.001	0.97	<0.005	<0.005	<0.001	0.04	
ANZECC Guidelines	4.0-9.0	0.1-2.0	0.2-5.0	0.01-0.05	1.0-2.0	200-10,000	200-10,000	2.0-5.0	2.0-5.0	2.0-5.0	

## Radionuclide Removal

### In-situ leach U mining barren lixiviant, Beverley, South Australia

In addition to a range of other contaminants, a suite of radionuclides can be removed from wastewaters using the Virtual Curtain technology. In this case, there was simultaneous removal of U-Th decay chain radionuclides with concentration factors in the solid hydroxyl-based mineral of ~200-300 times relative to the solute and removal efficiencies of 92 to 99.9%.



Radionuclide	Barren lix (Bq/L)	Treated lix (Bq/L)	Percent removal	HT ppt (Bq/g)
<sup>238</sup> U	225	2	99.1	67194
<sup>234</sup> Th	557	<1	99.9	120986
<sup>230</sup> Th	8683	66	99.2	1955469
<sup>226</sup> Ra	324	26	92.0	55282
<sup>214</sup> Pb	326	26	92.1	53822
<sup>214</sup> Bi	322	26	92.0	57013
<sup>210</sup> Pb	2193	4	99.8	488302

## The Opportunity

### A range of similar formation and wastewaters are generated in the oil and gas industry

Virtual Curtain ([www.virtualcurtain.com.au](http://www.virtualcurtain.com.au)) may be used as an adjunct to existing technologies to improve process efficiency or as a replacement in both onshore and offshore settings with its inherent advantages of rapid treatment, high concentration factor/low solids volumes and low operational footprint.

#### FOR FURTHER INFORMATION

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