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Brine Management in the CSG industry- An untold story
By Aharon Arakel

Public concern in Australia with the potential for groundwater contamination and land degradation associated with CSG drilling and gas field development in fertile farming areas has blurred a much larger and more serious issue - what to do with saline and alkaline effluent ('brine' byproduct) from large desalination facilities planned for CSG production fields in Queensland and NSW?

It is estimated by the Queensland government (**Queensland Government CSG Water Discussion Paper, 2009**) that if only the CSG projects in the Surat Basin progress to their full commercial stage, some 25 gigalitres per year of produced water would be generated over the life of projects (i.e., next 25 years) Based on the salinity level of the produced water (about 2 g/L) the Surat Basin operations alone are expected to bring to the surface approximately 50,000 tonnes of salt per year that needs safe disposal. What these estimates do not say is that this salt will be highly alkaline made up of sodium carbonate and bicarbonate mixed with sodium chloride salt. The environmental impacts of these mixed salts are substantially more complex than that of ordinary salt.

So although currently there is a significant enthusiasm within the CSG industry with the potential for community-wide supply of freshwater from their proposed or planned desalination plants, the issues surrounding sustainable management of desalination brine remains unresolved and largely unknown. Further, a poor understanding of brine management options and passive reference to the scale of this subject matter at recent professional forums has not been conducive to productive outcomes.

The problem with management of brine from desalination of CSG water has several components:

- The generated brine will be highly saline and alkaline so it can not be discharged to landscape because of potential sodicity and salinity impacts;

- When stored in ponds (whether called storage or evaporation ponds) the alkaline brine will be subject to evaporation and release of CO2 gas to the atmosphere thus exacerbating the environmental impacts of brine storage practices. Most importantly, through time the ponds will progressively lose their evaporative capacity (because of increasing salinity), thus reducing their usefulness as storage basins;

- Land needed for setting up the ponds and costs involved in construction and operation of such ponds will be very significant, if not prohibitive;

- Unless the brine is subjected to thermal volume reduction processes there is little chance that salt can be precipitated in the storage ponds in a form that can be extracted economically for sale or disposal. Conventional salt harvesting is probably feasible but this will require substantially larger land area to set up purpose-built evaporation and crystalliser ponds; this is not a preferred option on both economic and environmental grounds and therefore not further considered.

A compounding issue is that the CSG developers are yet to adopt a clear cut brine management strategy that conforms with the Government's hierarchy of preferred brine management options (**Queensland Government CSG Water Management Policy, 2010**). Failure to actively seek sustainable solutions has the potential to turn brine management into a major bottleneck for the CSG-LNG industry to achieve its full commercial potential. There are

several examples from Southwest U.S.A., where the implementation of inland municipal desalination projects have been delayed or even curtailed because of challenges with brine management (**Mickley, 2011**)

In my opinion, there is also an overwhelming need for the CSG-LNG industry to consider the options for minimisation of the cumulative effects of brine management issues at catchment level (ie, beyond the boundaries of the individual upstream CSG operations) if the industry is to avoid further community backlash and potential long delays in the implementation of CSG-LNG projects.

A potentially feasible option to address this particular issue is aggregation of brines in large man-made ponds (or existing salt basins) in low-lying, low-value terrains according to best practices and operated in the same manner as the ponds associated with Murray River Salt Interception Schemes, located in NSW and Victoria. The construction of centralised brine aggregation ponds would be a major yet worthy undertaking, requiring substantial investment in the construction of the ponds and associated brine collection pipes and pumping networks. The upside of this option is that centralised operations will provide significant increases in efficiencies in terms of economies of scale, as well as reducing the liabilities associated with brine management to a single point and/or individual entity. There is a wealth of knowledge on salt interception schemes within Australia that should be applied to brine management within the CSG-LNG industry without the need to reinvent the wheel.

Through my experience with salt interception schemes in Australia and overseas, brine aggregation based on well designed and operated basins can provide a reprieve. This will be a temporary measure but will allow time for the industry and governments to identify and implement appropriate technologies for salt extraction from such basins. It is essential to control the salt balance of the basins through salt extraction in order to maintain the evaporative capacity and hence the long-term sustainability of the Australian CSG-LNG industry.

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