

## Self-sealing evaporation ponds for small inland desalination facilities and containment equivalence concepts in Texas

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### ABSTRACT

Evaporation ponds are a low-maintenance option for disposing of desalination concentrate. Substantial savings can be achieved in Texas if exemptions are granted in the construction of pond liners. Currently approved liners include a ~0.9-m-thick layer of in situ or compacted clay (with hydraulic conductivity  $<10^{-7}$  cm/s) or a geomembrane liner  $>30$  mil (0.075 cm). An alternative liner may also be used if it can be demonstrated to achieve and maintain equivalent containment capabilities with the preapproved liners. We examine (1) the possibility of incorporating a lowpermeability layer into the pond-liner system as a liner component or possibly as the liner itself as the pond water starts precipitating minerals, sealing any liner defect, and (2) the ability of the newlyformed minerals to, at minimum, plug liner defects. Assessment of previous laboratory experiments suggests that precipitation of a specific claylike mineral (sepiolite) could have many advantages. From geochemical calculations for assumed evaporation pond parameters, after 5 years of operation, an average precipitate thickness (mostly calcite and gypsum) is approximately 0.38 cm, containing about 7% sepiolite. Our analysis suggests that the precipitant, even with a conductivity  $>1 \times 10^{-7}$  cm/s, could efficiently plug defects of the geomembrane, allowing a thinner geomembrane to be used. On the other hand, the modest thickness of precipitant suggests that, to achieve equivalent containment, the precipitated material needs to have a conductivity  $\ll 1 \times 10^{-7}$  cm/s to impart the required properties to a scaled-down liner and to be successfully substituted in part or all of the clay liner. However, even if legal requirements are not fully met, self-sealing deposition could be advantageous in settings where an additional defense-in-depth layer is needed, such as areas with an underlying unconfined aquifer sensitive to contamination. In both cases (plugging defects or developing a blanket-like liner), cost remains an issue.

**Keywords:** Evaporation ponds; Sepiolite; Self-sealing mechanisms; Containment equivalence; Brackish water; Waivers

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