Critical Pressure Calculations

To delineate the pressure front, the minimum or critical pressure (ΔP_{crit}) must be calculated. ΔP_{crit} is the pressure necessary to reverse the flow direction between the lowermost USDW and the injection zone and thus cause fluid flow from the injection zone into the USDW formation matrix. BP calculated ΔP_{crit} (Nicot 2009[1]), where the pressure front is given by:

[redacted]

Where,

ΔP	Critical pressure (MPa)
g	Gravitational acceleration (m/s^2)
Z_v	base USDW (m)
Z_i	top injection zone depth (m)
λ	Density gradient λ at constant TDS (kg/L-m)
ξ	Initial density gradient ξ in borehole (kg/L-m)
$P_{i,\lambda}$	Final density difference at base of USDW (kg/L)

This method estimates a pressure differential that would displace fluid initially present in a hypothetical borehole into the lowermost USDW and is based on two assumptions:
(1) hydrostatic conditions; and (2) initially linearly varying densities in the borehole and constant density once the injection zone fluid is lifted to the top of the borehole.

The data and assumptions used in the pressure front delineation calculations are:

- [redacted]

1 Jean-Philippe Nicot, Curtis M. Oldenburg, Steven L. Bryant, and Susan D. Hovorka, 2009. Pressure perturbations from geologic carbon sequestration: Area-of-review boundaries and borehole leakage driving forces

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