

Is Carbon Capture and Storage Ruined by Old Wellbores Leakage

Richard Baker

BRE Subsurface

Summary

Many of the best aquifers for storage of carbon dioxide in Carbon Capture and Storage (CCS/CCUS) are in petroleum basins because of their flat topography, limited faulting, and superior well control to ensure containment. Unfortunately, those the same basins have large numbers of legacy wellbores. Wellbore leakage out of old wellbores is a major risk consideration in any risk evaluation of CCS whether it's for aquifer or Depleted Gas Reservoirs (DGR). This paper reviews data from 200 old water injection logs and finds the amount of upper vertical communication within twenty meters of the injection zone is very small in the range of two percent. These results of lack of leakage in old wellbores are consistent with other researcher's findings. (Carey 2007, Celia 2010)

Injection wells at high pressure and with larger erratic changes in temperature, would be among the highest risk wells for upward wellbore channeling. In addition, legacy shut-in wells have been shown to communicate laterally in the In Salah reservoir in Algeria.

To understand the risk factor, we examined 200 vintage water injection wells with temperature and radioactive logging signatures to see any evidence of upward channelling. The results strongly support that upward communication in 98% of the injectors are either very low or non-existent. Temperature and radioactive surveys production logging are useful because the can detect behind pipe channeling through cement or casing

Even with wells that have upwards channeling (2%) most of the leakage is less than 40 m from the perforations (target zones). The bottomhole pressures and temperature change would be high when these logging jobs were executed therefore the sensitivity to upwards detection flow would high. The findings are critically important to the analysis of risk and to the debate between saline aquifer and depleted gas reservoirs.

Method

By examining old temperature logs we can see if the phenomena of leakage above the cap rock is common. During injection the temperature of the log is controlled by colder water in the tubing but during shut-in we can we which zones have taken large volumes during injection. As shown in figure 1 below for a non-channeled well (no upward flow). F

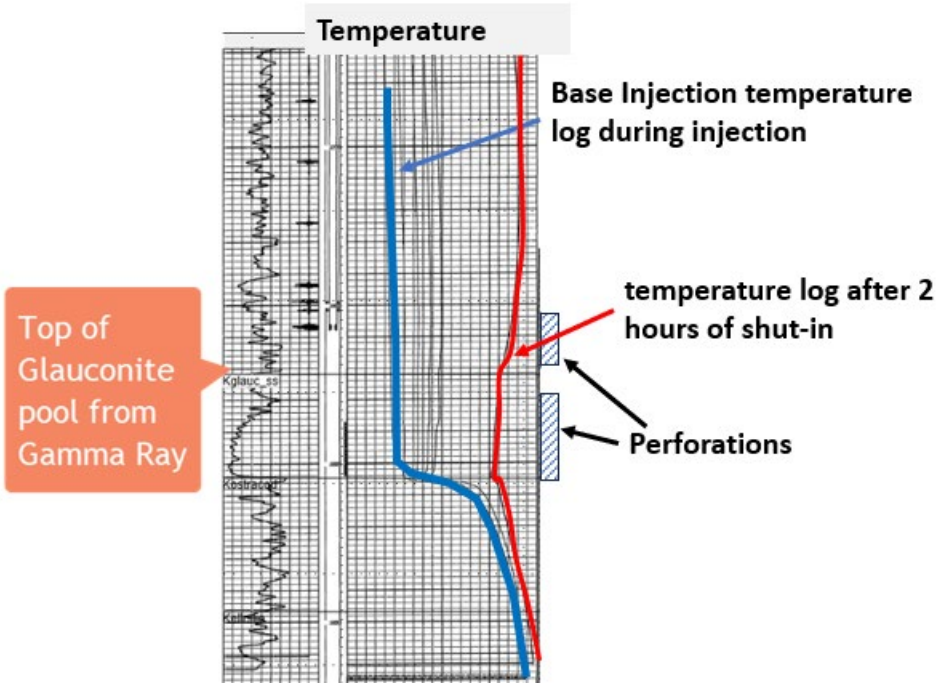


Figure 1 temperature Log on well that shows no upward flow of cold injected water

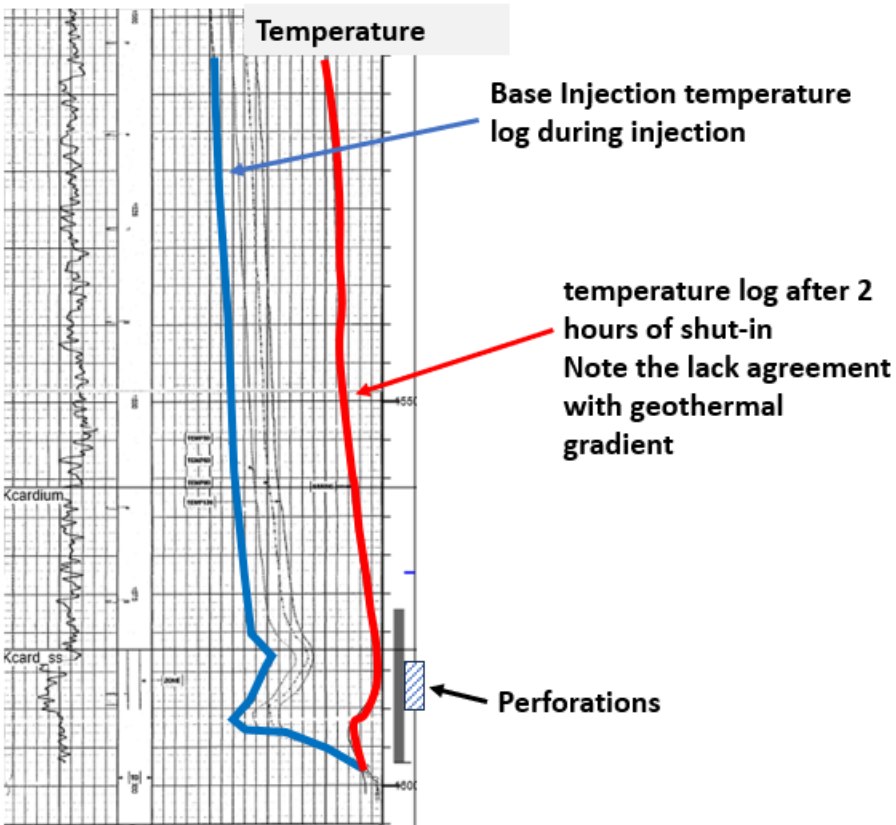


Figure 2 temperature Log on well that shows upward flow of cold injected water

Results, Observations, Conclusions

The results strongly support that upward communication in either the casing or external to the casing in 98% of the injectors is not likely to occur. Two percent of the wells show upward cooling trends but the vertical distance upward is small and amount of flow up is low.

Novel/Additive Information

The results of this study on large numbers of wells have not ever been published before anywhere in the world. These results have large implications for risk of CCS projects

References

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