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# Monitoring of $CO_2$/H2S gas mixture injection in basaltic rocks at Hellisheiði Geothermal Power Plant, Iceland

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Hellisheiði geothermal power plant emits about 41,000 tonnes of $CO_2$ and 10,000 tonnes of H2S per year as a by-product of geothermal energy production. Icelandic regulations, stricter than WHO guidelines, have been in effect in order to reduce H2S emissions of the geothermal industry, while carbon capture and storage (CCS) is one method recommended to minimise the amount of $CO_2$ released into the atmosphere.

The overall cost of CCS is dominated by that of capture and gas separation. This capture cost could be lowered by injecting gas mixtures into rocks as is now being tested at Hellisheiði geothermal power plant in SW-Iceland. There, a gas mixture of 60% $CO_2$ and 40% H2S is dissolved in water from the plant and injected into the basaltic rocks. The CarbFix and SulFix pilot projects demonstrated solubility storage of the pure separate gases in a few minutes [1,2] and that more than 80% of the injected $CO_2$ into basaltic rocks was mineralised within a year from its injection at 20-50°C [3].

The first phase of the gas mixture injection began on 3 June 2014, while tracer tests started three weeks later. By the end of the year 2015, approximately 6280 tonnes of $CO_2$ and 3520 tonnes of H2S had been injected. The gases are dissolved in condensation water, mixed with waste water and injected to 750 m depth into a high temperature reservoir of 200-270°C.

Water and gas samples were collected from four monitoring wells. There is a minor increase in $CO_2$ (total dissolved carbon) and H2S (total dissolved sulphite), while the majority of major and minor elements are relatively stable. The data from monitoring wells therefore suggests that some of the injected gas mixture is already stored as minerals in the basaltic reservoir.

[1] Sigfusson et al. (2015) Int. J. of Greenh. Gas Control 37, 213–219. [2] Gunnarsson et al. (2013) GRC Transactions 37, 785–789. [3] Matter et al. (2014) Energy Procedia 63, 4180–4185.