In Salah Gas CO_2 Storage JIP: Surface gas and biological monitoring

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Carbon dioxide removed from natural gas by amine stripping is being re-injected into the flanks of the gas field at Krechba, Algeria. There are three CO_2 injection wells placing the gas below the gas-water contact at depths greater than 1850 m.

An initial feasibility study into the use of soil gas techniques for monitoring at surface was carried out in August 2004 just a few days after injection had started in the first well, KB-501. A small number of measurements and gas samples for laboratory analysis were taken at six sites, around the three injection wells, the original discovery well, above the crest of the gas reservoir and at a background site to the west of the field, away from both the producing and CO_2 injection zones.

Ground conditions were found to be difficult for the use of standard soil gas probes and, because the ground was so dry and permeable, dilution of the soil gas by atmospheric air was significant. Measured concentrations of all gases were, therefore, very close to atmospheric values. They provide a very low background against which to monitor possible leakage of gas to surface. Methane concentrations, although very low, were higher than expected and suggest possible low level diffuse leakage from the reservoir or another geological source. Helium anomalies were also observed that suggest the migration of gas from depth. Proposals were made for a monitoring network of shallow boreholes sufficiently deep (5-10 m) to avoid atmospheric dilution effects. However, this proposal has yet to be implemented, because the focus initially has been on deeper monitoring through wells into the regional aquifer (325-350m depth) below the water table at some 105-110m below ground surface.

Further surface gas measurements were made during two visits in 2009 (March and November; Figure 1) after more than 3 million tonnes of CO_2 had been injected. These included atmospheric measurements of CO_2 just above the ground surface with a mobile open path laser, measurements of soil gas concentrations and CO_2 flux and the installation of some continuous gas monitoring equipment. Data were obtained between the KB-502 injector and the KB-5 well, where breakthrough of CO_2 occurred in late 2007, around the other injection wells, KB-501 and KB-503, around KB-4 and in the background area. The data collection was planned to cover areas of uplift identified by Satellite-based interferometry work in the vicinity of the injection wells. Barasol probes for continuous monitoring of the natural tracer gas radon were placed near KB-502 and at a background location to the south of KB-7 (Figure 1). Passive charcoal integrative samplers were deployed near the three injection wells.

An initial assessment of the results confirms the very low levels of CO_2 and other gases at depths of up to 1m (at atmospheric levels at most sites). Some higher values were recorded than in 2004 (up to 0.33% CO_2 in the laboratory determinations), but in areas not sampled in the earlier work.

Fluxes of CO_2 across the ground surface are also very low. There appears to be some variability in atmospheric levels of CO_2 and the extent to which that is real, or due to instrumental effects arising from high dust levels, is under investigation. A more detailed analysis of the results will be presented along with the results of biological studies summarised below.

In November 2009, preliminary biological studies were also carried out, primarily around the three injection wells. These included identification of the flora and an assessment of microbial biomass using Adenosine Triphosphate (ATP) analysis and total microbial numbers by epifluoresence microscopy on samples from shallow depth (typically up to 50 cm). Up to 20 different species of plants were recognised although identification to species (or even family) level was not always possible.

It is planned to retrieve the Barasol probes and passive samplers in early 2010 at which point the data for continuous monitoring and integrated observations can be assessed.

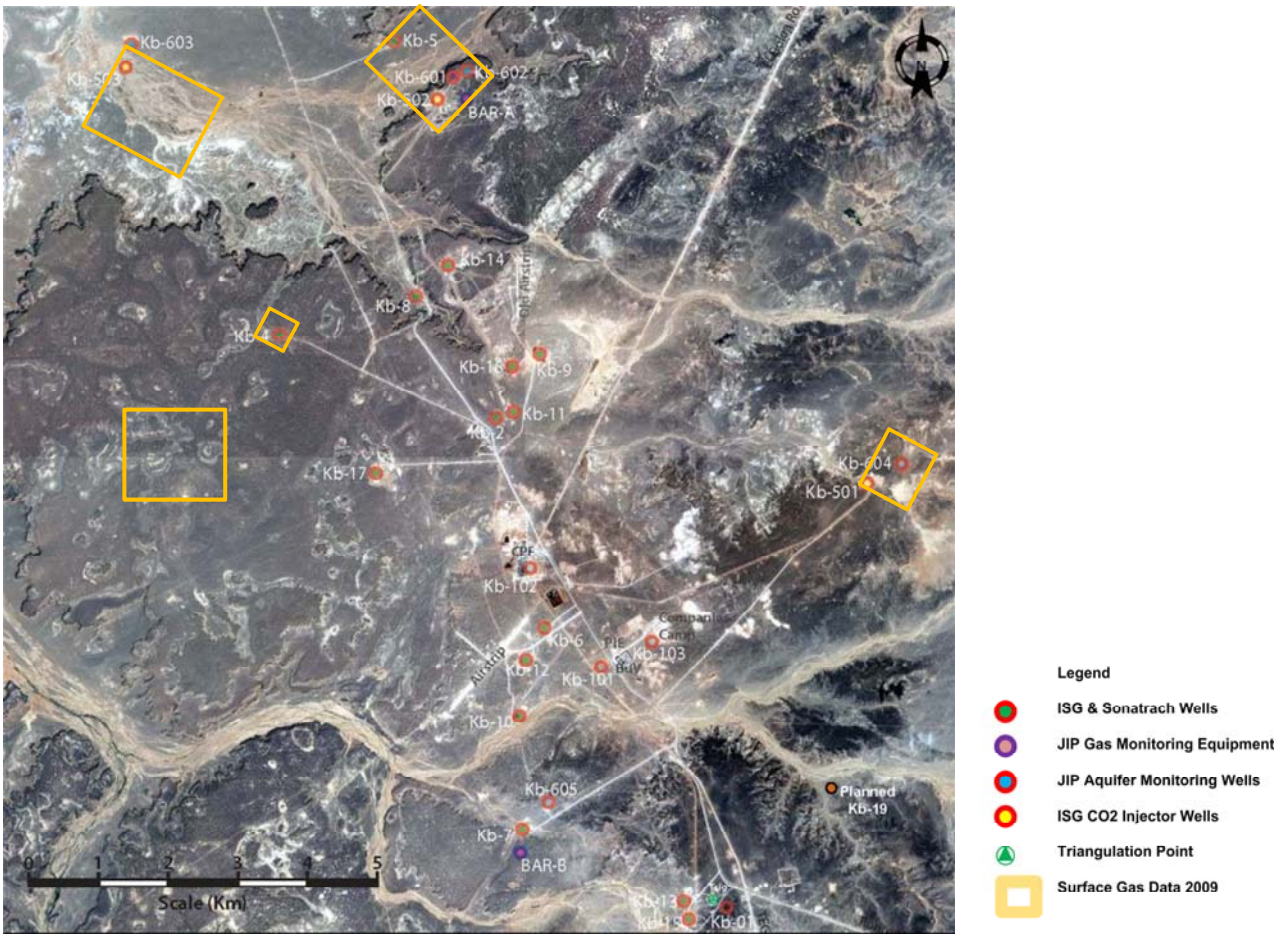

Figure 1. Locations of surface gas monitoring, Krechba, 2009 on Quickbird satellite image (CPF = Central Processing Facility, BdV= Base de Vie, BAR-A and BAR-B = Barasol locations)

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