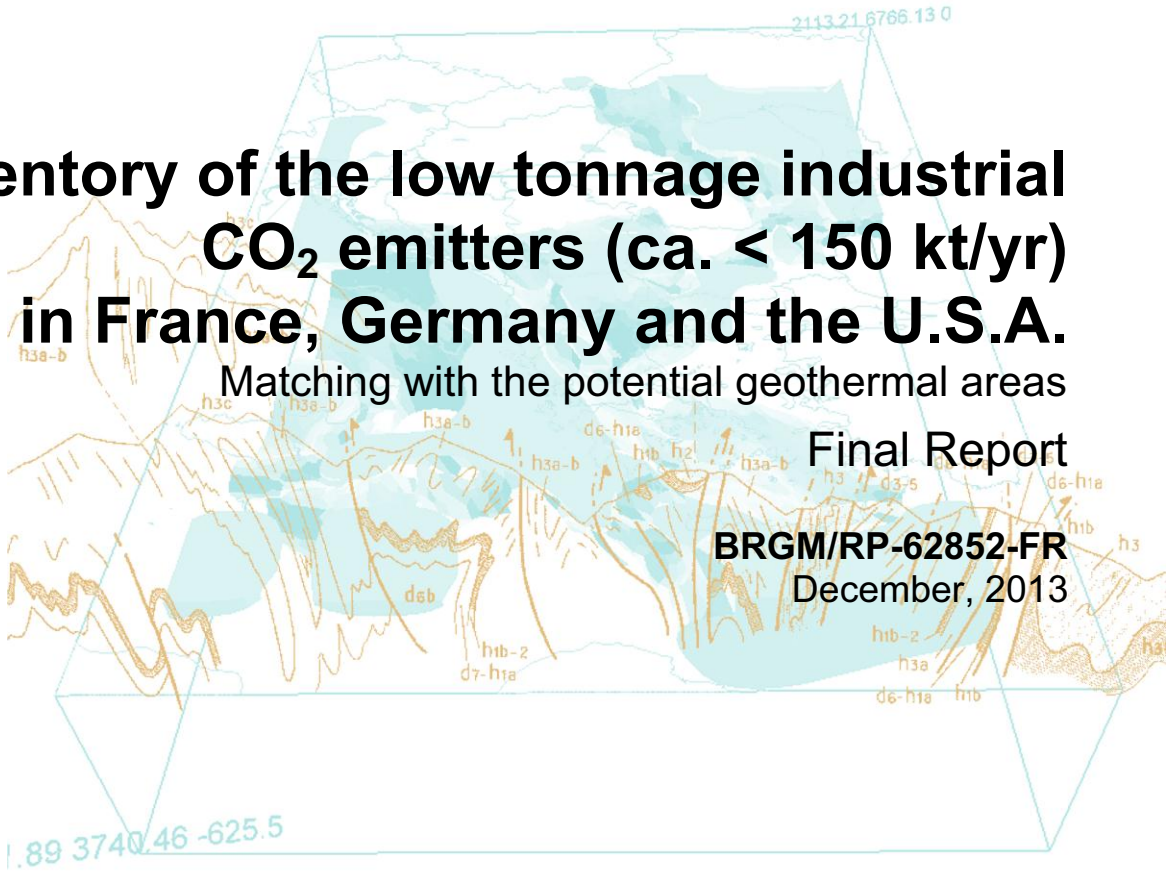
Confidential document

Inventory of the low tonnage industrial CO_2 emitters (ca. < 150 kt/yr) in France, Germany and the U.S.A.

Matching with the potential geothermal areas

Final Report

BRGM/RP-62852-FR
December, 2013



brgm
Geoscience for a sustainable Earth

Confidential document

Inventory of the low tonnage industrial CO_2 emitters (ca. < 150 kt/yr) in France, Germany and the U.S.A.

Matching with the potential geothermal areas

Final Report

BRGM/RP-62852-FR
December, 2013

Study carried out as part of the CO2-DISSOLVED project,
funded by the ANR (agreement ANR-12-SEED-0009-01)

C. Castillo, S. Knopf and C. Kervévan
With the collaboration of
K. O'Neil

Checked by:	Approved by:
Name: M. GASTINE	Name: N. DÖRFLIGER
Date: 11.12.13	Date: 20,12,2013
Signature:	Signature:

The quality management system of BRGM is certified according to ISO 9001 and ISO 14001.

Geoscience for a sustainable Earth
brgm

Warning

This report is the result (deliverable D1.1) of part of the research work carried out in the framework of the CO_2-DISSOLVED project, funded by the ANR (agreement ANR-12-SEED-0009-01).

*This report remains **confidential** and its distribution is restricted to the project partners and to the ANR **until the end of the project (01/14/2016)**.*

***By the end of the project (from 01/15/2016)**, the status of this **report will become public**.*

Keywords: CO_2-DISSOLVED project, Carbon capture and storage (CCS) technology, Geothermal heat recovery, Small to medium CO_2 emitters (ca. 10-150 kt/yr), France, Germany, United States.

In bibliography, this report should be cited as follows:

Castillo C., Knopf S. and Kervévan C. with the collaboration of **O'Neil K.** (2013) - Inventory of the low tonnage industrial CO_2 emitters (ca. < 150 kt/yr) in France, Germany and the U.S.A. - Matching with the potential geothermal areas. BRGM/RP-62852-FR. 50 p., 25 fig., 7 tab., 1 ann.

Synopsis

This report is the deliverable D1.1 of the CO_2-DISSOLVED project. This project is funded by the ANR (French National Research Agency) in the framework of the 2012 call for proposals of the SEED program (acronym – in French – for Energy Efficient and Decarbonized Systems). The CO_2-DISSOLVED project proposes to assess the feasibility of a novel CO_2 injection strategy in deep saline aquifers, combining injection of dissolved CO_2 (instead of supercritical CO_2) and recovery of the geothermal heat from the extracted brine. This combined CO_2 injection and heat extraction approach basically relies on a "classical" geothermal doublet system. In order to account for the physical limitations of the amount of CO_2 potentially injectable as a dissolved species in brine, it is proposed to apply this concept to low tonnage industrial emitters (ca. 10-150 kt/yr) which would be compatible with a single doublet installation. Another key aspect of the project is that this storage/heat recovery system be implemented at the immediate vicinity of the industrial emitter, so that both the surface footprint and the transport costs are minimized. As a consequence, this approach requires that a favorable underground hydrogeological environment is available close to the considered CO_2 emitting industry.

The results of this study show that potential compatible candidates exist in each of the geographical areas investigated. In France and Germany, this novel CCS concept could potentially be applied in all the major sedimentary basins. In particular, the Paris Basin and the North German Basin would be among the most favorable sectors considering that their industry produces more than 25% of the total of the small to medium (ca. ≤ 150 kt/yr) CO_2 emissions (*i.e.* a total of 5 to 10 Mt of CO_2/yr each). The data collected for the U.S.A suggest that the most favorable areas are located in the western part of the country, including Alaska and Hawaii, where the geothermal resources are particularly concentrated. However, it has to be noticed that we did not find any data about the depth of these geothermal resources. It has thus to be considered that some of these resources might not be accessible at sufficiently affordable prices to ensure the economic viability of the project. Consequently, further investigations on specific case studies would have to be carried out to draw more definitive conclusions on the actual potential in the U.S.A; however, this was beyond the scope of this global inventory work.

The CO_2-DISSOLVED concept also relies on a new low-cost patented CO_2 capture and dissolution technology whose efficiency is related to the nature of the co-emitted gases. We initially intended to also inventory the smokes compositions, at least the typical average rates classified by industry typology. However, no such specific information is available on public documents. As a consequence, this inventory does not consider this parameter to classify the potential compatible candidates. However, availability of the smokes composition data will be one of the key points considered for selecting the application test-cases (one in France, one in Germany) that will be studied in the final tasks of this project. Thus, this selection will be made after contacting some emitters identified as compatible ones in this report.