



## Full scale bioaugmentation for cost-efficient remediation of a large groundwater contamination with CAH

<http://www.bioaugmentatie.be>

### Contents in this issue:

- Results Small scale field tests
- Installation of Full Scale
- Transferring bacteria

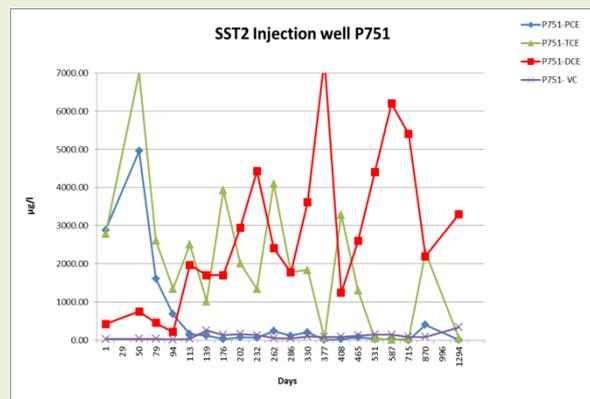
### Conclusion Small scale field tests

After the successful push and pull tests (see newsletter 2) two small scale field tests were conducted. One test was conducted with groundwater from a site with proven natural breakdown of CAH (SST1), the other by adding inoculum 1 (from the successful push and pull test 2). This was named small scale test 2 (SST2).

The conclusion of these small scale tests was that inoculum 1 is also on a larger scale capable of breaking down CAH to an innocent end product. In small scale test 1 there is breakdown of PCE and TCE but the formation of VC and/or ethane is not observed.

For the upscaling to the Full Scale, groundwater from the four injection wells in SST2 will be transferred. When/if the formation of VC and/or ethane is observed in SST1, the need or possibility of using this culture for upscaling to Full +Scale will be assessed. If possible, the injection wells of SST1 will be incorporated in the transferring scheme.

The figure on the right top shows the analysis results of CAH for injection well P751 from SST1.



### Full Scale setup

In November 2013 a first set of 40 injection filters and associated piping is installed. In January 2015 5 more injection filters were installed and finally in June 2015 another 15 injection wells were added. The injection system consists of two tanks where the mixing of groundwater with glycerine and bicarbonate takes place. After mixing, the mixture is pumped into cubitainers. By gravity the mixture then flows in the injection filters which each have their own tap.



# EU-LIFE+ Demonstration Project BacAd

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## Full Scale demonstration

Based on experience gained in the push and pull tests and small scale tests each injection well is monthly fed with 20 kg glycerine and 25 kg bicarbonate. The injections of the first 40 wells started in December 2013, next 5 in February 2015 and the last 15 in August 2015.

In comparison with the earlier tests, it takes longer to reach the desired (geo)chemical conditions. This is probably due to the higher surface that must be covered (distance between injection wells in full Scale is 10 m versus 5 m in small scale tests).

The first transfer is conducted in April 2014, followed by transfers in May 2014 (2), December 2014 (2), July 2015 (2), October 2015 (5) and February 2016 (10). This gives a total of 22 transfers or 22 injection wells that are inoculated with the desired bacteria.

In a first stage CAH-concentrations were followed in the injection wells. This gave a very disturbed image because the injection wells are injected with 'clean' groundwater where the glycerine and bicarbonate is mixed in. To cope with this problem a set of 10 monitoring wells is installed where CAH-concentrations are followed. In monitoring well P358 (see figure on the right) PCE, TCE and DCE are decreasing, but the formation of VC and/or ethene is not observed. Further monitoring is necessary.

Before the start of the injections and 8 months after the first injections molecular analyses have been done for 5 injection wells. The results show that microbial DNA of Dehalococcoides primers has increased in time for 2 out of 5 injection wells. More important, the DNA of the vinyl chloride reductase gene (vcrA) has increased in 4 out of 5 inoculated wells. This indicates that the dehalogenation bacteria have multiplied.

## Planning

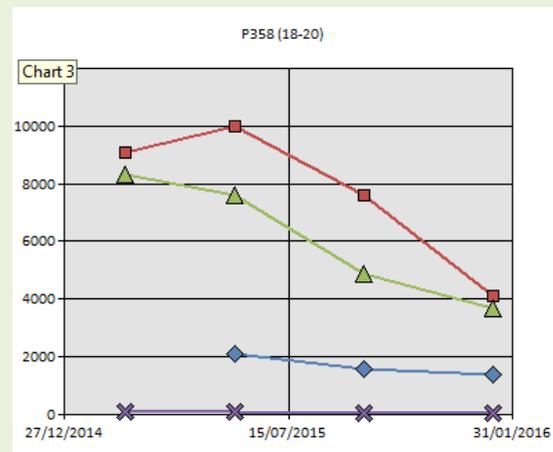
Injection wells will be fed monthly with glycerine and bicarbonate.

Every two months the field parameters (pH, ORP and oxygen content) of the injection wells are followed. Based on these measurements injection wells will be selected to be transferred.

Normally in April 2016 5 injection wells will be transferred. In June 2016 approximately 25 injection wells will be transferred so the whole full scale is covered then.

May 2016 molecular analyses are planned.

30/06/2016 is the end of the LIFE-project.



## More information?

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