

## The ENACT project:

### ENACT: Extending the Monitored Natural Attenuation Toolbox for Chlorinated Solvents

#### Aims and objectives

The presence of harmful chlorinated substances in the subsurface is a large threat to our groundwater reserves. Fortunately, nature has found several ways to destroy these compounds. In the subsurface, both biological and chemical processes may occur that cause degradation to non-toxic end products. This is called natural attenuation or NA. Some of these NA processes are well-known and can be demonstrated rather easily. For other processes that can potentially play an important role, it is more difficult to find evidence. Traditional methods are not suited for demonstrating these processes and their significance in the subsurface is still unknown.

In this project, we investigate the use of a new analytical technique called "compound specific stable isotope analysis (CSIA)" to study the relevance of the abovementioned NA processes. With CSIA, we can study the properties of single atoms in the contaminant molecules. Chlorinated solvents consist of carbon and chlorine. By looking into both types of atoms, it is possible to identify and quantify different NA processes. CSIA for carbon is already applicable for field application, but CSIA for chlorine has been developed very recently and requires optimization.

The objective of the project is to optimize the use of CSIA for chlorine and to demonstrate the use of combined carbon and chlorine isotope analysis as a tool for demonstrating natural attenuation of chlorinated solvents.

#### Research activities

At the institute WAR of the Technical University of Darmstadt in Germany, the method for stable chlorine isotope analysis will be optimized to make it suitable for application on samples from contaminated groundwater. At the same time, a laboratory study will be performed at VITO in Belgium, in which the relation between the targeted degradation processes and the isotope analysis results will be established.

Since the results of the isotope analyses from field sites are difficult to interpret and to explain, an existing computer model suitable for interpreting carbon isotope data will be extended to make it applicable to chlorine isotopes.

In the next phase, the method will be applied at three field sites contaminated with chlorinated solvents. At the same time, ... (continued on page 2)



#### About ENACT



Dear readers,

ENACT is a follow-up to a Dutch-Belgian-Swiss SKB project in which tools for demonstrating novel MNA processes for chlorinated solvents were developed. Stable carbon isotope analysis proved to be a valuable tool, but could not be used to discriminate between different mechanisms. At the 2006 Dechema Conference in Frankfurt, contact was made with Darmstadt University of Technology where, in a KORA project, a practical method for stable chlorine isotope analysis was developed. In this ENACT project, we combine carbon and chlorine isotope analysis. Theoretical insights in isotope fractionation mechanisms from the Institute of groundwater Ecology - Helmholtz Center Munich - is expected to provide valuable support.

Yours sincerely,

Frank Volkering, project coordinator

#### ENACT contact

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## ENACT facts

ENACT is a research project trans-nationally funded under the SNOWMAN umbrella by:

Flanders (Belgium), Germany, and the Netherlands.

The project partners are:

- Tauw bv, Deventer/Netherlands, contact: Frank Volkering
- Institut WAR der Technischen Universität Darmstadt, Darmstadt/Germany, contact: Kaori Sakaguchi-Söder
- VITO, Mol/Belgium, contact: Johan Gemoets
- Vrije Universiteit Amsterdam, Amsterdam/Netherlands, contact: Boris M. van Breukelen
- TNO Built environment and Geosciences, Utrecht/Netherlands, contact: Harry Veld
- Helmholtz Center Munich: German Research Center for Environmental Health, Neuherburg/Germany, contact: Martin Elsner

Project duration: 12 months

Project start: 27.11.2007

## SNOWMAN facts

SNOWMAN is a network of national funding organisations and administrations providing the research funding platform for soil and groundwater bridging the gap between knowledge demand and supply.

The consortium is funded by the European Commission's 6<sup>th</sup> Framework Programme for Research and Technological Development (RTD) and includes 7 partners from seven different EU countries representing national activities in the field of SNOWMAN.

Project duration:

January 2004 - June 2009

**Coordinator:**

Dr. Stefan Vetter, BMLFUW/Austria

## Research activities (continuation from page 1)

... more conventional methods will be applied to obtain a complete picture on the natural processes. The site data will be interpreted using the developed computer model.

The results from this project will help us to understand the complex natural processes that determine the fate of this class of harmful groundwater contaminants.

## Dissemination activities

For this project to be meaningful, it is essential that the knowledge and the tools developed become known to the consultants, authorities and scientists who work on the protection of our groundwater.

This will be achieved by publication in scientific and technical journals, by organizing a symposium and by incorporating the methods in guidelines.

A first platform presentation on the ENACT project will be given at ConSoil 2008 in Milano (<http://www.consoil.de>).

## Perspectives

Stable carbon isotope analysis is rapidly becoming an accepted tool for studying contaminant processes in the subsurface. We expect that this ENACT project will be a strong stimulus for application of chlorine isotope analysis and will lead to a better understanding on NA processes for chlorinated solvents.