

The methodology to deploy in term of geochemistry (with iterative operations) in regard to the shale gas exploitation cycle (baseline – exploitation – after exploitation) for monitoring well leakage.

## Background

Producing hydrocarbons from source rocks requires creating permeability within the rock matrix by at least hydraulically fracturing the source rock. It corresponds to the production of hydrocarbon products that have not been naturally expelled from the pressurized matured source rock and that remain trapped in the porosity or/and kerogen porosity of the impermeable matrix.

In the geological context of a sedimentary basin, aquifers are always present in the vicinity such shale formations: deep aquifers (near the shale formation) up to shallow and potable (surface) aquifers.

## Study

Our purpose will be to track any unsuitable invasion or migration of chemical species into aquifers, originating from the production of matured shale fluids. Our objective is to provide methodologies to detect any chemical compositional anomaly in aquifers from well leakage, in order to assess environmental impacts. The approach consists in deploying a dedicated sampling tool within a well to recover formation fluids and to run a series of appropriate analyses to provide a status on formation fluid characteristics.

The reservoir conditions are preserved and with a specific fluid transfer at surface, the analyses and interpretation/recommendations in real time could be performed.

## Results

The recommendations presented below describe briefly the protocol for monitoring the production of shale hydrocarbon fluids, in considering the source-rock reservoir itself, the aquifers, and also the chemical species present in the fluids that are used for hydraulic fracturing operations.

These recommendations described the different steps to realize baseline measurements and processes survey for long-term monitoring with iteration operations for the geochemistry point of view, and permanent operations for the seismic point of view, both in order to put in evidence any leakages/impacts of shale play exploitation along wells.

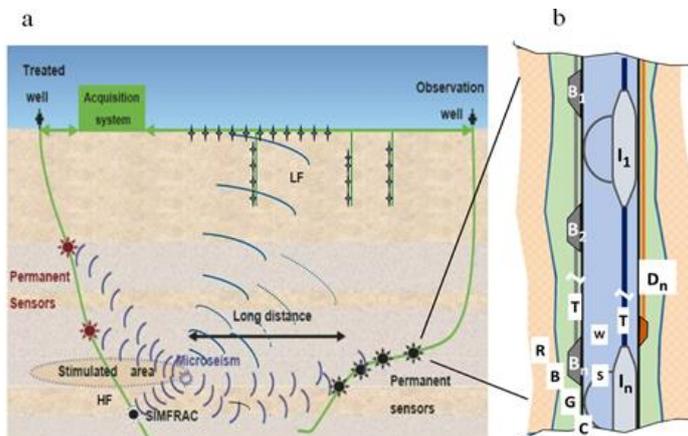
## Science-based Recommendations

### Baseline measurements:

- 1- Realize passive seismic measurements.
- 2- Realize a complete geochemical characterization of the shale play itself, if possible from cores, better than from cuttings.
- 3- Realize some samplings at strategic locations (from monitoring wells and from wells used for fracturing operations) and determine the geochemical composition for specific species. This step is essential to compare data before shale play exploitation and during their exploitation, also after. With these comparisons, some possible well leakages could be put in evidence rapidly.
- 4- In a general point of view, determine the background signal.
- 5- Use the softwares developed for both seismic and geochemistry to anticipate by calculations the evolution of signals in case of an eventual leakage from wells (by comparing the baseline with the results of these calculations).

### Operations Survey and long-term monitoring:

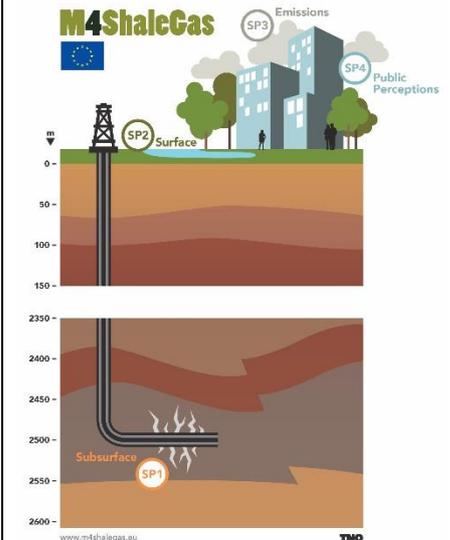
- 1- Realize passive and active seismic measurements, with permanent sensors (figure 2).
- 2- Continue to realize some samplings and iterative operations to evaluate an eventual evolution of geochemical signal.
- 3- Use the softwares to calibrate the data with shale gas production operation and evaluate if yes or no there is an eventual leakage from the process (by comparing here, at this step, the signals obtained during the background determination and signals obtained during operations and after operation).



The methodology to deploy in term of passive and active seismic in regard to the shale gas exploitation to determine an eventual well leakage with permanent sensors.

## The Project

**M4ShaleGas** examines the potential environmental impacts and risks related to **shale gas** exploration and exploitation in Europe with the goal to build a technical and social knowledge base on best practices and innovative approaches for **measuring, monitoring, mitigating, and managing** these impacts.



### 4 sub-programs:

- SP1-subsurface
- SP2-surface
- SP3-air emissions
- SP4-public perceptions

### Funding:

The project that has received funding by the European Union's Horizon 2020 research and innovation programme under grant agreement number 640715.

### Horizon 2020 Topic LCE-16-2014:

Understanding, preventing and mitigating the potential environmental impacts and risks of shale gas exploration and exploitation.

### Project duration:

1 June 2015 – 30 November 2017

### Coordination:

**TNO**



The content of this factsheet reflects only the authors' view. The *Innovation and Networks Executive Agency (INEA)* or *TNO* is not responsible for any use that may be made of the information it contains.