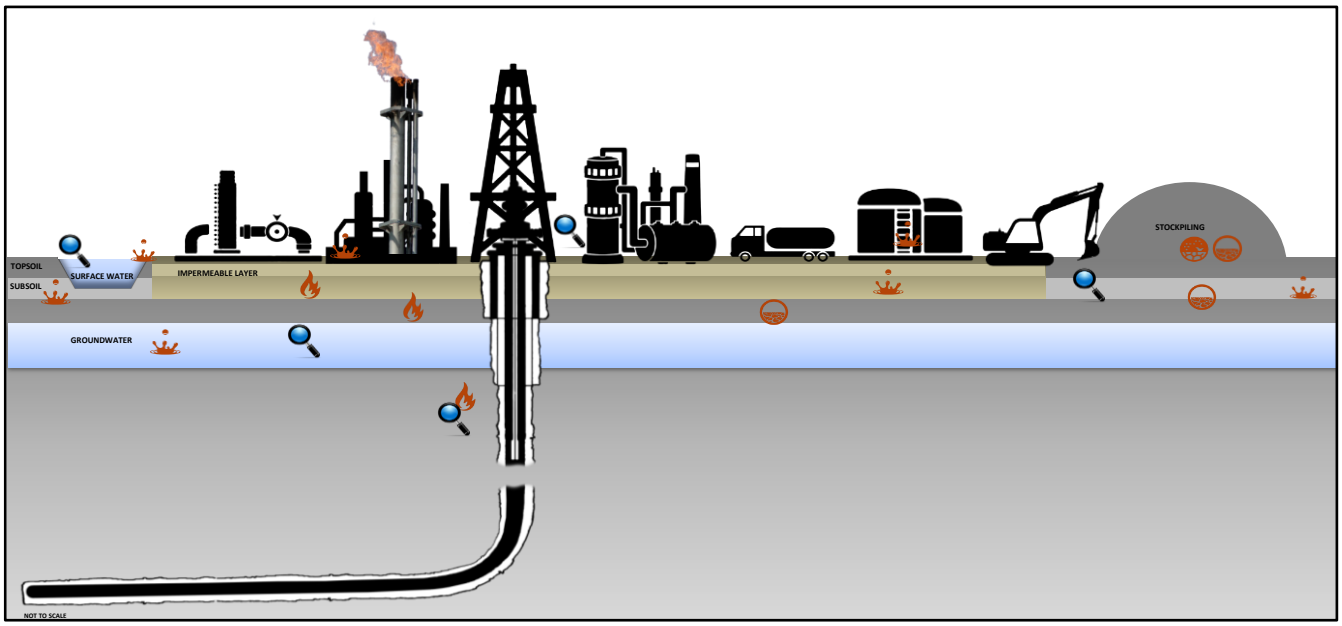
RECOMMENDATIONS ON ENVIRONMENTAL MONITORING

M. KONIECZYŃSKA, O. LIPIŃSKA



Background

Unconventional hydrocarbons exploration and production can theoretically endanger the quality of soils and water resources in the area of activities on land surface. Only obeying strict health safety and environmental standards and procedures on each well site which minimize possibility of spills and leakages and introduce quick remedy actions in case of any accident may significantly diminish probability of unnoticed events which might cause adverse effect in environmental quality. But even with highest technology standards, there is a need for additional control tools which could track and detect any unwanted changes in soils and natural water and groundwater bodies. Such a tool is even more necessary to detect any signs of adverse impact of possible shale gas development legacy – stray gases and fluids migration towards fresh water zone and land surface along wellbore casings or other potential natural or induced migration pathways. A properly designed dedicated environmental monitoring system in relation to defined baselines is believed to be able to play a role of such an early warning control tool.

Study

At European level, basic principles for environmental monitoring are established by European Directives such as the Water Framework Directive or the Groundwater Directive. Moreover, there is a strong aspiration for standardization and unification of results, which is - in case of water monitoring - provided by a codified reporting system. However, goals, measures and results are diverse among countries.

There is a huge number of institutions in EU member states responsible and engaged in both environmental status assessment and environmental monitoring with regard to surface water, groundwater and soils. They have been surveyed for their knowledge on shale gas challenges and views on planning of environmental monitoring as a tool for environmental safeguard in shale gas development.

Available information on technology and substances currently used for drilling and hydraulic fracturing processes has been studied together with facts-based analyses of spills and leakages risk from surface and underground operations. Compilation of such knowledge has allowed for future effective impact monitoring systems principles formulation.

Results

The level of knowledge on shale gas related issues varies between Member States institutions responsible for environmental monitoring and control and some of them have not found it relevant to their work so far.

Environmental monitoring as a safety control measure in shale gas development may help to find tools to minimize surface impact of shale gas activities. Surveillance monitoring with locally adjusted solutions is the most suitable option. The main foundations for effective monitoring are:

- properly defined purpose,
- identification of scope and frequency of observations in each phase of development, including economic reasonableness,
- adequate methodologies (e.g. selected sampling points justification, adequate limits of determination and detection, sensitivity, uncertainty and precision of used methods).

Baseline environmental status must be recognized before starting any shale gas activity and the results stored in publicly available databases. Similarly all details of used technology and chemicals should be kept for future references. Monitoring must be conducted up to certain time after decommission of wells.

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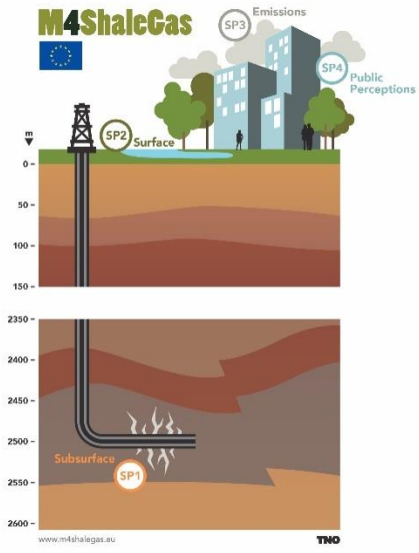
Science-based Recommendations

- Dedicated environmental monitoring for shale gas development is a need. In an early exploration and production stage in Europe it should be prepared and conducted for particular well-pads chosen as representative for a location. In next phase, when more well pads operate, the monitoring program should cover a group of well pads located within the same location (where as location an area characterized by similar geological and hydrogeological conditions and land-use patterns is considered).
- Monitoring scope and network must be planned with regard to local current and historical land use, geological and hydrogeological conditions, ecosystems needs as well as to specific features of used well drilling and completion technology. Future observations must be compared with baseline assessment results obtained prior to any shale gas activities.
- Monitoring needs to cover the entire life-time of shale gas operations, with baseline state measurements, observations of boreholes drilling & completion activities and their direct impact on surroundings (noise levels, emissions and air quality, spills and accidents and effects on soil and water quality), long term survey during production period and post closure observations. The monitoring scope, frequencies and focus in each phase can be different.
- Monitoring system has to enable detection of changes in quality of soils and fresh water (both surface and groundwater), identification of such changes causes and mechanisms and launch of quick and proper remedy actions.
- Monitoring of deeper saline aquifers should aim in early warning of induced fugitive migration of fluids and/or gases from deep geological strata towards the fresh water zone and land surface.
- A soil gas observation network in direct vicinity of working or decommissioned boreholes as well as other well defined potential migration pathways (such as known fault zones, old deep mine shafts) should be established for detection of gas migration towards land surface along casing or other artificial or natural paths. Isotopic ratio analyses of soil gas constituents (e.g. hydrogen and carbon isotopes in methane) need to be implemented for a better interpretation of observations results (especially gas source identification).
- All baseline results, technological details with regard to types and quantities of substances used in shale gas operations as well as subsequent monitoring observations results should be stored in a well-organized and easily accessible database operated by a relevant, legally entrusted institution.
- Environmental monitoring ought to be conducted by independent institutions but financed by shale gas operators indirectly via dedicated fund.
- On site closure, despite the phase of activity, soil productivity parameters must be assessed versus baseline results to enable a proper site reclamation.
- Additional environmental monitoring might be necessary around waste facilities and treatment installations to observe potential impact of waste generated by shale gas activities, especially if legal requirements and control measures cannot ensure tracing proper handling of flowback fluid.

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 **m**easuring, **m**onitoring, **m**itigating, and **m**anaging these impacts.



4 sub-programs:

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

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TNO

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