MINIMIZING THE IMPACT OF SHALE GAS DEVELOPMENT ON AIR QUALITY

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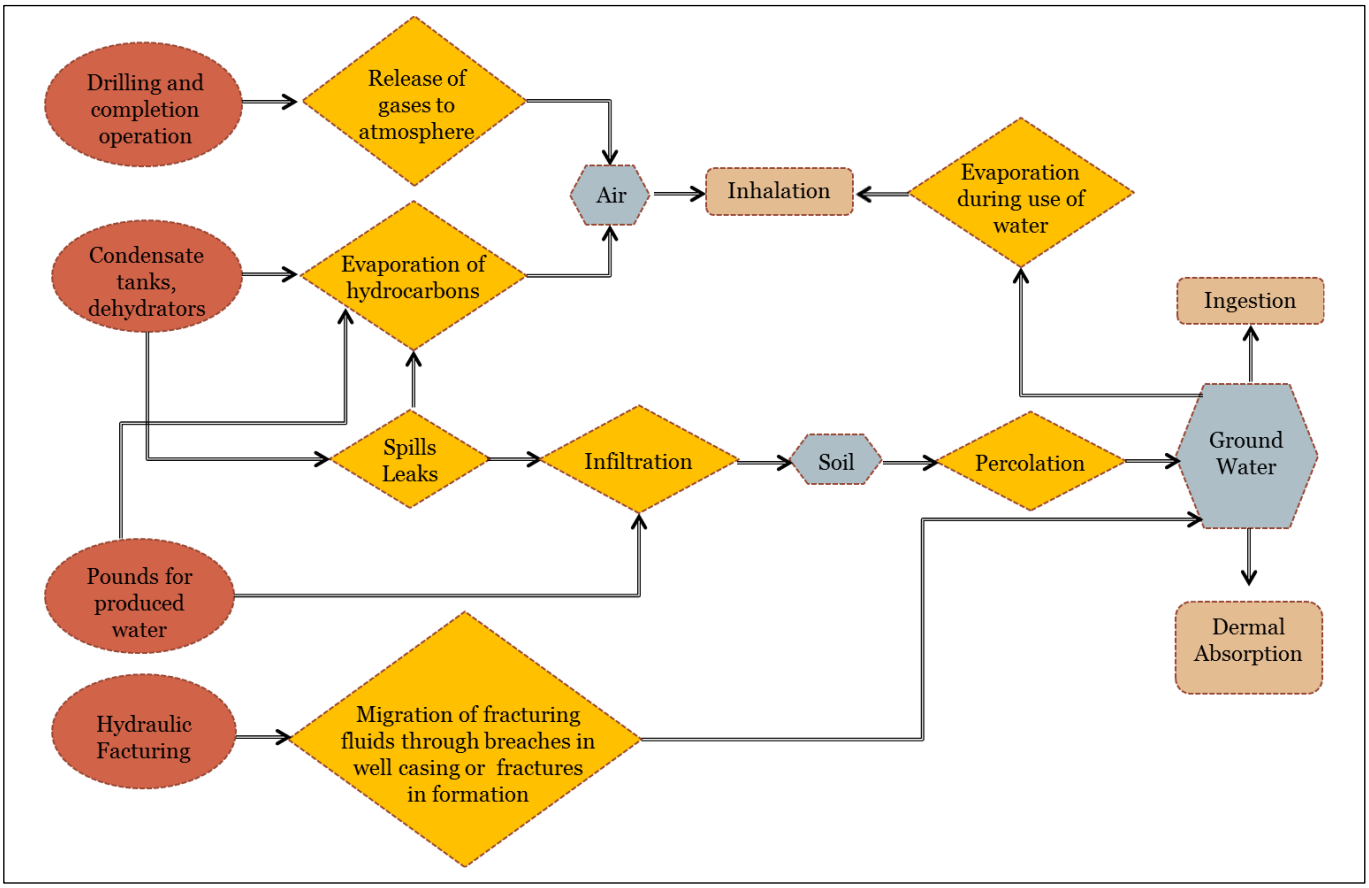

Background

Environmental impact associated with shale gas development is a major concern to the public, policy makers and other stakeholders. The knowledge on the effects and consequences of shale gas development comes mostly from shale gas practices in the U.S. It is important to address differences in geological settings and societal environment between Europe and the U.S., and the impact of these differences for the potential future development of shale gas in Europe. It is also important to evaluate whether or not the existing EU Directives and regulations appropriately address unconventional hydrocarbon extraction. The overall objective of the study is 1) to give an overview on the current scientific knowledge base of the potential contribution of shale gas production to gaseous emissions, 2) to identify knowledge gaps and 3) to prepare recommendations to minimize the potential impact of emissions.

Study

The sources and types of emissions associated with the various phases of shale gas production were identified and reviewed. The main knowledge gaps were identified to be baseline concentration, methane leakage, well and borehole integrity. The relevance of atmospheric concentration baselines was discussed and the raw shale gas composition was identified, as shale gas components may be used to trace gas leakages. Well integrity is one of the weak spot in the system, being an important concern in environmental protection issues. Lacks in the methods for the evaluation of the degree of well integrity are still an issue. Some potential emission reduction techniques were also discussed. The existing legislation in EU for controlling GHG emissions from shale gas operations was reviewed.

Results

Emitted substances within the various stages of shale gas production were identified. CH_4, VOC, NOx, SOx, PM, benzene, HPA and O_3 are considered the main pollutants. Emissions from shale gas operation are dominant in the extraction stage and can be attributed to three main sources: Fossil fuels combustion to drive engines of the equipment, transport of equipment, resources and waste, fugitive emissions escaping during well construction and production stages and emissions from natural gas collected and combusted onsite or vented directly to the atmosphere. Minimizing the impact of shale gas production on the atmosphere requires 1) monitoring ambient air quality prior to and during operations, 2) prevention and minimization of GHG and toxic chemicals emissions by identifying emission sources, and 3) implementing operational practices to reduce emissions.

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Science-based Recommendations

Process Stage

- Ensuring that personnel and equipment can be sourced locally
- Identifying sources or materials locally (including water and sand used in the hydraulic fracturing process)
- Identifying local facilities to recycle, and dispose of waste products
- Using efficient transport engines
- Using alternative fuels for combustion engines (gas engines or electric engines)
- Recycling of flow back water, using more tanks (rather than ponds) to store waste water and improve pond designs
- Assess the quantity of water that will be needed for fracking and how will it be transported to the well site and from which source
- Use of gas engines or local electric grid in the hydraulic fracturing and re-fractured (if needed) operations
- Placing more wells per pad and drilling longer laterals resulting in less pads and roads
- Assess the realistic ranges of production per well by shale formation in Europe
- Assess the depth and width of specific well in Europe
- Use of reduced emission completions (REC), or green completions to control methane emissions from the flow back / well completion step
- Use of vapour recovery units (VRU's) and flares
- Replacing glycol dehydrators with desiccant dehydrators
- Replacing high-bleed pneumatics devices by low-bleed pneumatics devices
- Implementation of a Leak Detection and Repair (LDAR) programme (identifying component; Leak definition; Monitoring components; Repairing components; Record keeping)
- Well integrity rigorous monitoring in the field is needed and results should be transparently reported
- The abandonment procedures for onshore gas wells should be defined and regulated.

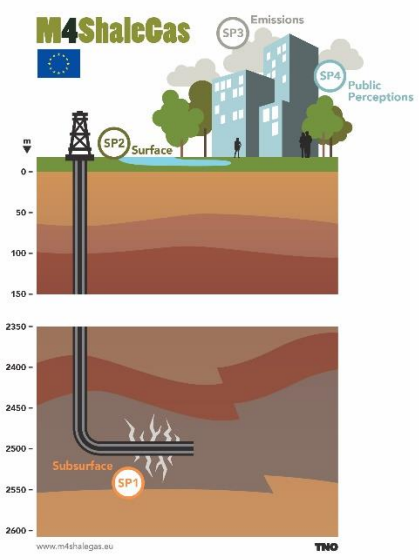
Monitoring Stage

- Implement a monitoring baseline program prior to shale gas development (to promote the set-up of a data base for Europe)
- Monitor gas compositions at different European scenarios
- Assess the potential leakage rates and model methane and ethane concentrations, determining the elevations
- Operators should be made mandatory to monitor potential leakages of methane or other emissions to the atmosphere before, during and after shale gas operations
- Data collected by operators should be submitted to the appropriate regulator
- Assess source distribution including sources other than the oil and gas operations, such as stationary industrial sources and mobile traffic sources
- Use tracers for shale gas methane detection (ethane, possibly in combination with propane)
- Long-term air monitoring, increasing the frequency of sampling
- Conduct short-term (acute) air monitoring by collecting 1-hour air samples

An Environmental Risk Assessment should be mandatory for all shale gas operations, involving the participation of local communities at the earliest possible opportunity and assess risks across the entire lifecycle of shale gas extraction (including the disposal of wastes and well abandonment).

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

Funding:
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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

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