RECOMMENDATIONS FOR THE SUSTAINABLE MANAGEMENT OF WATER IN SHALE GAS OPERATIONS IN EUROPE

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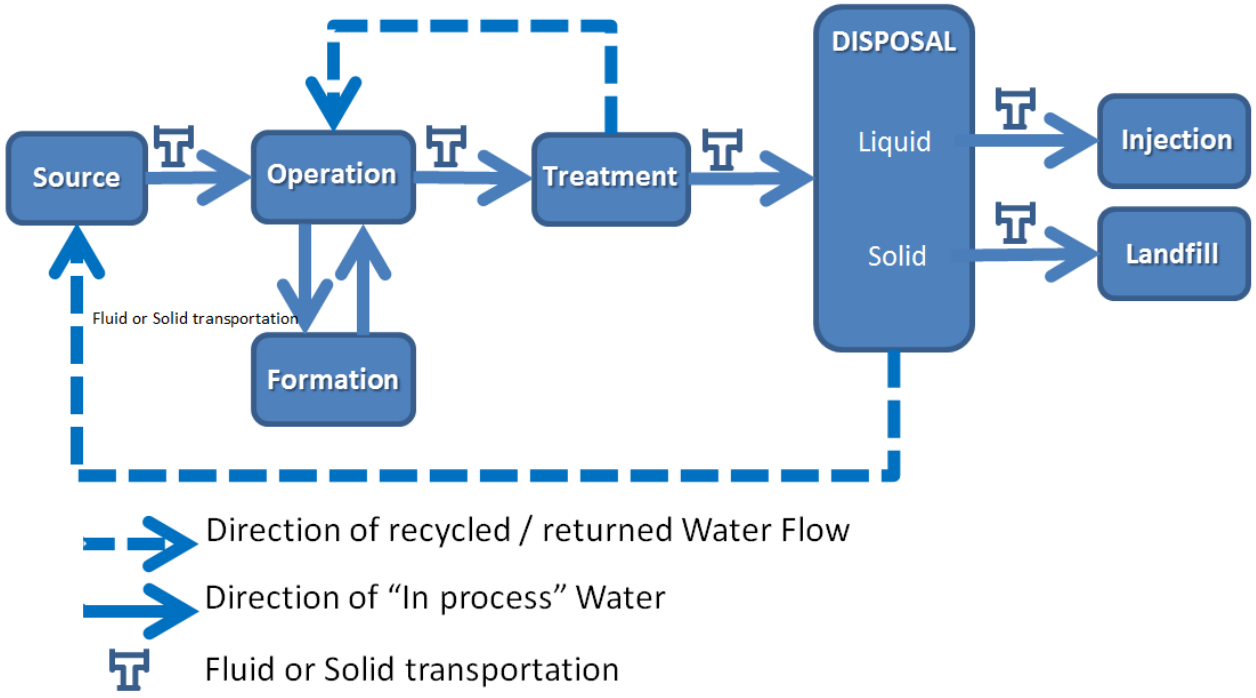

Figure from Vadillo-Fernández et al., 2015 (M4ShaleGas report D9.1) and redrawn and modified from Gay et al., 2012, Water management in shale gas plays (IHS Water White Paper).

Background

Shale gas development can potentially impact both quantity and quality of the water resources. Water issues are one of the environmental hazards mostly discussed in the literature (changes in the quantity and quality of drinking water sources, competition with other uses of the water and reduction of the ecological and quantitative status of water bodies. In addition, the management and disposal of chemicals, fracturing fluids and liquid waste (flowback and produced water) are fundamental issues inasmuch as spills and leaks can occur. Therefore, all the water cycle must be controlled and whatever risk assessment analysis must consider it in a comprehensive manner. Previous deliverables have highlighted the risks scenarios regarding water and liquid waste management. All measures and recommendation are aimed at minimized this risks.

Study

Review of data and existing about environmental issues regarding water and wastewater management in U.S. and Canada experiences and identification of practices that can be considered as good or best practices in water and liquid waste management. Identification and description of environmental issues and risk scenarios in the European context. Identification of measures that can be implemented to measure, monitor, mitigate and manage environmental impacts related to water and liquid waste management and assessment of their applicability to the European reality.

Results

Review of available scientific literature, including North American sources, assessed the experience of best techniques and behaviors related to the water and liquid waste management related to hydraulic fracturing activities. We gathered information related to the effects of hydraulic fracturing of shales on water resources, the possible impacts generated by an inadequate water and waste water management, and the adequate techniques to mitigate the effects. Due to the gap of experiences of European shale development, some specific measures regarding the technical aspects of the water and liquid waste management more broadly defined in the U.S. have been replaced by general considerations wherever possible. Some non-technical considerations have been estimated as being useful taking into account the current status in the EU.

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Science-based Recommendations

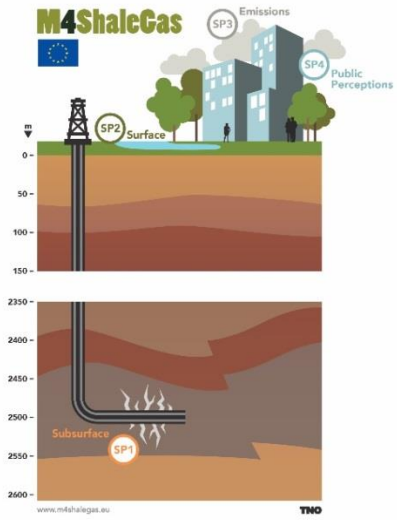
It is recommended that decision-makers when dealing with hydraulic fracturing activities should be focused on:

- Accomplishment by the operators of a Water Management Plan (based on a complete hydrogeological assessment) for each specific play to control effectively the entire water cycle. Aspects as the availability of freshwater and information about the total volume and composition of the water and liquid waste in every part of the water cycle, must be included. In addition, the determination of tracers to perform the monitoring must be assessed in this Plan.
- Follow the hierarchy principle of the Waste Framework Directive and the guidelines of the Water Framework Directive regarding water acquisition: minimising the total volume of water is a best practice. In parallel with this, reusing flowback for subsequent fracturing operations and using alternative sources (treated wastewater from municipal treatment plants and brackish water are conductive for this purpose) would be also best practices. Sharing sources of water with other operators could help to save water resources.
- Reduce of the use of chemicals from the operators and use of non-hazardous chemicals wherever possible.
- Public disclosure of full details of the chemicals used in hydraulic fracturing and information about the composition of hydraulic fracturing fluid and liquid waste (in order to perform a specific risk assessment in a case-by-case basis and guarantee transparency towards the public opinion).
- Careful design of the storage facilities (dimensioning, drainage systems, etc.), development of meticulous equipment maintenance systems and the employee comprehensive training could avoid a large number of spills.
- Protect storage sites with impermeable liners or even to construct a watertight compartment, with enough volume to retain whatever accidental spill.
- Store wastewater in tanks (provided with closed-loop systems).
- Store chemicals, fracturing fluids and liquid waste away from surface waters, aquifers and other sensitive areas, determining buffer zones after a case-by-case examination.
- Design plans for the detection of spills, including periodical inspections and the definition of the measures applicable when a spill is detected.

Furthermore, administrative entities should consider the application of the Directive 2001/42/EC on the assessment of the effects of certain plans and programs on the environment ("SEA Directive") to shale gas operations, since it is the most effective approach to address cumulative impacts at national and European level. A strategic environmental assessment is the framework wherein integral protection of water resources can be establish, for example, making possible to assess the cumulative impact on drinking water, freshwater and groundwater resources, of simultaneous shale gas projects in the same region. In addition, the establishment of prohibited/restricted areas or buffer zones may be implemented at the SEA level (not project specific).

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:
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Coordination:

TNO

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