RECOMMENDATIONS FOR LIQUID WASTE MANAGEMENT IN SHALE GAS OPERATIONS

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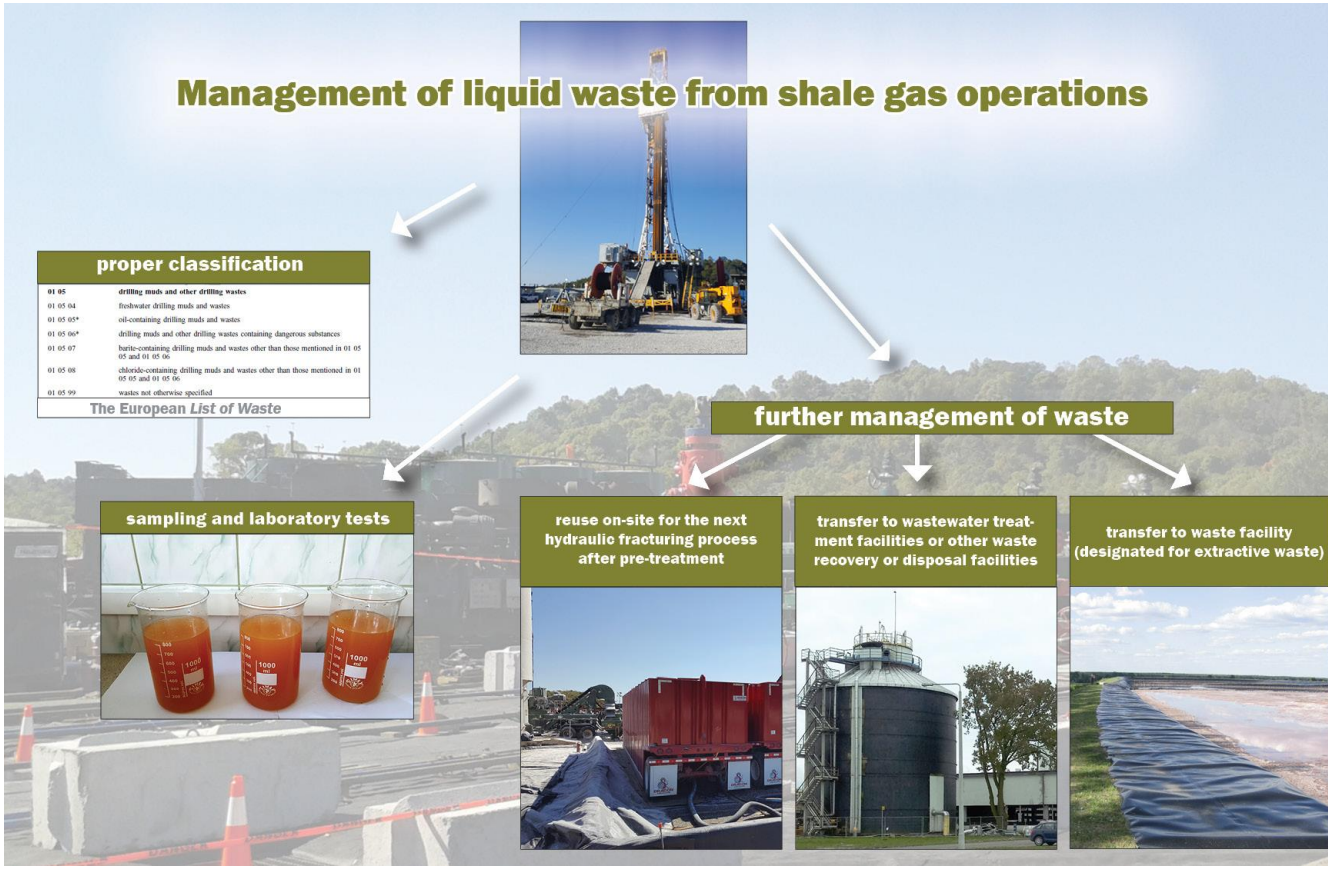

Background

Proper management of waste generated during shale gas operations is a crucial issue while considering safety of natural environment, mainly due to the fact that these are new, hardly recognized wastes in Europe. In Europe there are currently no legal regulations particularly dedicated to the management of flow-back and produced water from the exploration and exploitation of unconventional hydrocarbons. The aim of this study was the review of applicable legal regulations and best practices for managing drilling materials and generated waste from shale gas operations, presentation of the results of a literature and laboratory study of the composition of waste generated during shale gas operations, as well as the development of guidelines for the proper management of this type of waste. The results obtained within the project should contribute to the minimization of environmental impact and avoidance of potential hazards associated with mining waste generated during shale gas operations as well as their improper management.

Study

A review of materials and chemicals used in shale gas operations and their impact on natural environment was carried out. Regulatory frameworks applicable in Europe and worldwide which apply to the management of waste produced during shale gas operations were also reviewed as well as the literature data regarding the scope of physicochemical parameters which are determined in this type of waste. Also, laboratory tests of physicochemical parameters and hydrocarbons content, alcohols, metals, inorganic anions, sulphur compounds and other components of fracturing fluids and flowback water real-life samples, derived from one of the drilling sites in Poland, were conducted. Moreover, assessment of potential environmental impact of these fluids based on results of laboratory tests and in relation to existing legislation in the field of water quality requirements and waste characteristics was carried out.

Results

The analyses carried out as part of the project showed that waste from shale gas operations is usually not inert. Flowback water is characterized by a slightly acidic pH index, varying amounts of suspended solids and organic compounds, significant amounts of salt and other components associated with the geological structure of the rock. The correct classification of waste is very important for proper waste management. Recommended basic scope of the determinations for testing liquid waste for potential environmental impact should include: general parameters, alkali or alkaline-earth metals and heavy metals, inorganic anions, aliphatic and aromatic hydrocarbons, and other organic and inorganic parameters. In addition, when analysing samples of flowback water, it is also important to use an analytical method, which should have a properly defined limit of quantification and uncertainty. Reuse of flowback water on site in the next hydraulic fracturing process is a preferable way of further management and reduction of generated volume of this type of waste.

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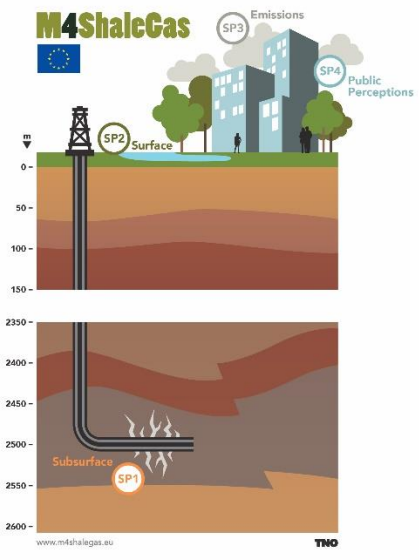
Science-based Recommendations

- Supplement the existing legislation with requirements on how to handle waste such as flowback and produced water, including uniform requirements for testing/ characterization of this waste.
- Supplement the List of Waste with a new type of waste (i. e. flowback and produced water) with codes suitable for both hazardous and non-hazardous waste.
- It is important not to classify flowback water as a wastewater, since as such, it cannot be reused for hydraulic fracturing or injected underground as disposal option in accordance with current legislation.
- Disclosure for public, more broadly than before, data on the composition (quantitative and qualitative) of the technological fluids used during shale gas operations and information on the composition and properties of the waste generated, as well as information on how to further manage the waste. Data on the final management of waste would be valuable information for local communities and would also facilitate control in the correct application of procedures for the further management of waste authorised for this control body.
- Collecting and keeping data on the composition (quantitative and qualitative) of technological fluids and waste. Storage of this type of information will allow us to make a clear statement whether possible environmental pollution, occurring even after time, is related to shale gas operations.
- Recommended basic scope of determinations for testing physicochemical characteristics of flowback and produced water for potential environmental impact should include: pH, specific conductance, total dissolved solids (TDS), dry residue, total organic carbon (TOC), chemical oxygen demand (COD), metals (including heavy metals), inorganic anions, hydrocarbons (including mono- and polycyclic aromatic hydrocarbons), phenol index, ammonia nitrogen or total nitrogen, anionic surfactants, substances extractable with petroleum ether or chloroform and alcohols. Knowledge of the flowback and produced water composition will enable selection of the appropriate waste treatment method and/or informative decision on further disposal or storage of the waste.
- Develop a flowback water sampling procedure for laboratory testing and guidance on analytical methods dedicated to the determination of individual substances and components in these fluids with very complex matrix. Testing of such samples should not involve methods routinely used for testing water quality.
- The analytical methods used in laboratory tests of flowback and produced water should have an appropriately defined limit of quantification and uncertainty, allowing for a correct comparison of the obtained test results, e. g. with the criteria set out in the legal regulations and the results obtained by different laboratories. A correctly defined limit of quantification is particularly important when determining the traces of the substances present in the liquid waste samples.
- Tests of shale gas operations wastes should be carried out by laboratories experienced in carrying out analyses of this type of waste and accredited in this field. These laboratories should also be a third party, i. e. they should not be associated with the shale gas operator.
- Waste connected with shale gas operations should not enter the environment in an untreated form, even unintentionally, e. g. as a result of failure.
- Flowback water should be used on-site for further treatments. The transport of such waste to other locations for reuse or to mining waste disposal facilities should be in accordance with waste transport procedures. It is also possible to dispose flowback water via underground injection.

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

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TNO

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