Role of Baseline Measurements in Assessing Air Quality Impact of Shale Gas Operations

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Abstract : Environmental impact associated with large scale shale gas development is of major concern to the public, policy makers and other stakeholders. To assess this impact on the atmosphere, it is important to monitoring ambient air quality prior to and during all shale gas operation stages. Baseline observations can provide a standard of the pre-shale gas development state of the environment. The lack of baseline concentrations was identified as an important knowledge gap to assess the impact of emissions to the air due to shale gas operations. In fact baseline monitoring of air quality are missing in several regions, where there is a strong possibility of future shale gas exploration. This makes it difficult to properly identify, quantify and characterize environmental impacts that may be associated with shale gas development. The implementation of a baseline air monitoring program is imperative to be able to assess the total emissions related with shale gas operations. In fact, any monitoring programme should be designed to provide indicative information on background levels. A baseline air monitoring program should identify and characterize targeted air pollutants, most frequently described from monitoring and emission measurements, as well as those expected from hydraulic fracturing activities, and establish ambient air conditions prior to start-up of potential emission sources from shale gas operations. This program has to be planned for at least one year accounting for ambient variations. In the literature, in addition to GHG emissions of CH4, CO2 and nitrogen oxides (NOx), fugitive emissions from shale gas production can release volatile organic compounds (VOCs), aldehydes (formaldehyde, acetaldehyde) and hazardous air pollutants (HAPs). The VOCs include a.o., benzene, toluene, ethyl benzene, xylenes, hexanes, 2,2,4-trimethylpentane, styrene. The concentrations of six air pollutants (ozone, particulate matter (PM), carbon monoxide (CO), nitrogen oxides (NOx), sulphur oxides (SOx), and lead) whose regional ambient air levels are regulated by the Environmental Protection Agency (EPA), are often discussed. However, the main concern in the emissions to air associated to shale gas operations, seems to be the leakage of methane. Methane is identified as a compound of major concern due to its strong global warming potential. The identification of methane leakage from shale gas activities is complex due to the existence of several other CH4 sources (e.g. landfill, agricultural activity or gas pipeline/compressor station). An integrated monitoring study of methane emissions may be a suitable mean of distinguishing the contribution of different sources of methane to ambient levels. All data analysis needs to be carefully interpreted taking, also, into account the meteorological conditions of the site. This may require the implementation of a more intensive monitoring programme. So, it is essential the development of a low-cost sampling strategy, suitable for establishing pre-operations baseline data as well as an integrated monitoring program to assess the emissions from shale gas operation sites. This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 640715.

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