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Toward developing a streamlined workflow for methane emission monitoring, reporting, and verification in the oil and gas industry

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Establishing a streamlined workflow within the Monitoring, Measuring, Reporting, and Verifying (MMRV) framework is crucial for effective methane emission management and accurate methane emission reconciliation in the oil and gas (O&G) industry. Despite existing MMRV standards such as the Oil & Gas Methane Partnership 2.0 (OGMP 2.0), Veritas 2.0, and MIQ providing valuable guidance, the O&G industry still faces obstacles in compliance with these standards. These obstacles include (1) The Bottom-Up (BU) inventory, constructed with generic activity and emission factors, underestimates emissions and poses gaps in closing uncertainties during the reconciliation process, (2) The decision to deploy one or multiple methane sensing technologies, relying on emission profiles derived from limited sample measurements, can not accurately represent all emissions due to their inherent limitations and the stochasticity and intermittency of emissions, (3) No standard has been employed to assimilate observations from sensing technologies with varying measurement scales and data from operational events, and (4) Addressing various uncertainties, including those arising from direct measurements, atmospheric inversion modeling, and population inference from sample emission events, proves challenging in the final stages of the reconciliation process.

In this study, we present a streamlined MMRV-focused workflow integrating established and novel methodologies for reconciling emissions. The workflow consists of five key steps: Firstly, using the Oil and Gas Production Greenhouse Gas Emissions Estimator (OPGEE) to construct more accurate BU inventories and emission profiles for each type of equipment; secondly, determining the technology deployment plan and work practice based on constructed emission profiles using the Leak Detection and Repair Simulator (LDAR-Sim); thirdly, assimilating real measurements from deployed technologies through an ISO/OGC standard-based integrated sensor web architecture; fourthly, leveraging assimilated measurements and operational data to resolve emission events and reconcile the emissions; and finally estimating uncertainties from emission quantifications, inaccuracies in establishing emission event duration, and missed emission events. We demonstrate this workflow using data from the upstream O&G sites provided by an anonymous company. At the end of the demonstration we reconcile and report emissions by following the OGMP 2.0 guidelines.