



Field Measurements of Black Carbon Emissions from Gas Flaring using Sky-LOSA



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Abstract

Recently, the quantification and mitigation of short lived climate pollutants (SLCPs) has garnered international attention, with all G8 countries being signatories to the United Nation's Climate and Clean Air Coalition (CCAC). One specific SLCP of interest is black carbon (BC), a particulate emission that is a product of incomplete combustion. Within the upstream oil and gas (UOG) industry, a significant anthropogenic source of BC is the process of flaring undesired gases associated with production. Despite the global scale of gas flaring however, models relating BC emissions to flare volumes (i.e. emission factors) are badly flawed. This is largely due to the relative lack of quantitative field measurement data, and is further hampered by the well-known sensitivity of flare BC emissions to flare gas composition, flow rates, design, and ambient conditions.

An emergent optical diagnostic, sky-LOSA (line-of-sight attenuation using skylight), has finally enabled the remote quantification of BC emissions from in-situ flares. To date, with support from the World Bank Global Gas Flaring Reduction partnership and CCAC among others, sky-LOSA has been deployed in seventeen field measurements in Uzbekistan, Mexico, Ecuador, and just this last year, Alberta. These field measurement data have indicated a more than four order of magnitude variation in absolute emission rate and have allowed for the derivation of a simple BC emission factor relation. Critical to the Canadian context, these data have also indicated a clear over-estimation in BC emissions from gas flaring using the single-valued emission factor of the Canadian Association of Petroleum Producers (CAPP). These data highlight the crucial need for further field measurements at Canadian facilities, with the goal of improving emissions inventories, deriving a more sophisticated BC emission factor relation, and enhancing the understanding of flare BC emissions in Canada's UOG industry.