Atmospheric Black Carbon (BC)

- Causal relationship with numerous adverse health effects
- Strong climate forcing and short atmospheric lifetime
  - Absorbs ~75% of incident light in the mid-visible spectrum
  - Lifetime on the order of weeks rather than 100’s of years (CO₂)
- Significant mitigation potential often coupled with economic benefits

Sky-LOSA

- Patent-pending Canadian technology
  - Developed through collaboration of Carleton University’s Energy and Emissions Research Laboratory and the National Research Council of Canada
- Line-of-Sight Attenuation using skylight, enabling time-resolved BC emission rate measurements

Field Measurements

- 17 measurements of BC emission rate have been performed to date from 12 flares in Uzbekistan (2008), Mexico (2011 & 2012), Ecuador (2014 & 2015), and Alberta (2017)

Historical BC emission rate measurements using sky-LOSA

- First-ever direct measurements of BC yield (BC emissions per volume of flare gas) from in-field flares
  - Allows derivation of a simple heating value-based BC emission factor

The Future of the Diagnostic

- Extension of upper detection limit via a multiple-scattering correction
  - A multiple-scattering correction to the sky-LOSA algorithm can be derived using a backward Monte Carlo ray-trace analysis on realistic simulations of flare plumes
- Standardization as an Other Test Method with the U.S. EPA
  - Creation of a measurement protocol via a general uncertainty analysis, culminating in a Windows-based application to guide an end-user in the acquisition of sky-LOSA data
- Continued field-measurement work
  - Expand existing emission inventories and improve emission factor model
  - Perform BC yield measurements during hydraulic fracturing flowback

Selected Publications: