Reconciling region-, facility-, & component-level emissions data

David Lyon
Daniel Zavala-Araiza
Ramon Alvarez
Steven Hamburg

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Barnett Shale
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Figure 1. Multi-scale measurements used to characterize methane emissions from oil and gas sources in the Barnett Shale.
Different measurement scales

• Region-level
  – aircraft mass balance, tower & satellite inversion modeling

• Facility-level
  – tracer flux, near-field dispersion modeling & mass balance

• Component-level
  – direct flow measurements, bagging, metering
Regional mass balance

76 ± 13 total and 60 ± 11 fossil metric tons CH$_4$ hr$^{-1}$

$\approx 1.3 – 1.9\%$ loss rate (Karion et al., Smith et al.)
Facility-level emissions inventory

72 (+10/-9) total & 46(+8/-6) O&G metric tons CH$_4$ hr$^{-1}$

$\approx$ 1.0 – 1.4% loss rate (Lyon et al.)
Barnett O&G CH$_4$ Emission Estimates

Karion et al. estimate is average of flight envelopes. Other estimates are for 25 county region.

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Barnett production segment component-level inventory

• Regional activity factors
  – Drillinginfo
  – TX Railroad Commission
  – GHGRP

• Regional & national emission factors
  – GHG Inventory
  – UT production studies
  – Environ/CenSARA O&G inventory
  – HARC/TCEQ tank reports
  – AP-42 engine exhaust
component-level central estimate ≈ 20% lower than facility-level
Insights from multi-scale comparison

• Region- and facility-level based estimates of Barnett O&G methane emissions are similar.

• Regional variation in activity factors result in different component-level estimates than prorated national GHGI.

• Some source estimates improved with updated EFs.

• Current best estimates component-level emissions are lower than facility-level estimate but with overlapping uncertainty.

• “Super-emitter” sources may explain the difference.
  – e.g., stuck dump valves, blowdowns, tank control malfunctions