



Reconciling Basin-Scale Top-Down and Bottom-Up Methane Emission Measurements for Onshore Oil and Gas Development

**Cooperative Research and
Development Final Report**

CRADA Number: CRD-14-572

NREL Technical Contact: Garvin Heath

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Cooperative Research and Development Final Report

In accordance with Requirements set forth in Article X: REPORTS AND PUBLICATIONS A.(2), of the CRADA agreement, this document is the final CRADA report, including a list of Subject Inventions, to be forwarded to the Office of Science and Technical Information as part of the commitment to the public to demonstrate results of federally funded research.

Parties to the Agreement: Colorado School of Mines

CRADA number: CRD-14-572

CRADA Title: Reconciling Basin-Scale Top-Down and Bottom-Up Methane Emission Measurements for Onshore Oil and Gas Development

Joint Work Statement Funding Table showing DOE commitment:

Estimated Costs	NREL Shared Resources
Year 1	\$ 482,757.00
Year 2	\$ 405,817.00
Mod 1	\$ - 657,144.00
TOTALS	\$ 231,430.00

Abstract of CRADA Work:

The overall objective of the Research Partnership to Secure Energy for America (RPSEA)-funded research project is to develop independent estimates of methane emissions using top-down and bottom-up measurement approaches and then to compare the estimates, including consideration of uncertainty. Such approaches will be applied at two scales: basin and facility. At facility scale, multiple methods will be used to measure methane emissions of the whole facility (controlled dual tracer and single tracer releases, aircraft-based mass balance and Gaussian back-trajectory), which are considered top-down approaches. The bottom-up approach will sum emissions from identified point sources measured using appropriate source-level measurement techniques (e.g., high-flow meters).

At basin scale, the top-down estimate will come from boundary layer airborne measurements upwind and downwind of the basin, using a regional mass balance model plus approaches to separate atmospheric methane emissions attributed to the oil and gas sector. The bottom-up estimate will result from statistical modeling (also known as scaling up) of measurements made at selected facilities, with gaps filled through measurements and other estimates based on other studies. The relative comparison of the bottom-up and top-down estimates made at both scales

will help improve understanding of the accuracy of the tested measurement and modeling approaches.

The subject of this CRADA is NREL's contribution to the overall project. This project resulted from winning a competitive solicitation # RPSEA RFP2012UN001, proposal #12122-95, which is the basis for the overall project. This Joint Work Statement (JWS) details the contributions of NREL and Colorado School of Mines (CSM) in performance of the CRADA effort.

Summary of Research Results:

As a result of mid-course project re-scoping, Task 5 of the contract was terminated as of 5/31/15, with a close-out report due 7/31/15. This summary describes the products of Task 5 in the state of completion achieved by the close out date of 5/31/15.

Task 5 is titled "Development of New Bottom-Up Inventory Approaches for Oil and Gas Operations" with two sub-tasks

1. Activity Factors
2. Emission Factors

Subtask 5.1 was led by ENVIRON International (now Ramball Environ). Subtask 5.2 was led by Colorado State University. NREL led this "inventory team," coordinating and contributing to all work products.

It should be emphasized that National Energy Technology Laboratory (NETL) directed the performing organizations to end work on these deliverables before their completion. Therefore, they are draft, incomplete and should not be considerable useable, final products. They should not be cited, quoted, published or distributed as they would not be useful to an end user and would not reflect well on the organizations that developed them, or the sponsors of this work. The organizations who contributed to these products assert no warranty or liability should these documents be used in their current state. They are provided at the direction of NETL under the above-listed contract per its terms to demonstrate fulfillment of contractual obligations.

Subject Inventions Listing:

None

Report Date:

10 September 2017

Responsible Technical Contact at Alliance/NREL:

Garvin Heath, PhD

Name and Email Address of POC at Company:

Contract title: Reconciling basin-scale top-down and bottom-up methane emission measurements for onshore oil and gas development

Contract #: RPSEA No. 12122-95 / DE-AC26-07NT42677

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