Outreach Module for Ruminant Emission Measurements: REMS Mobile

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Overview

At the UIUC Beef Farm, a Ruminant Emission Measurement System (REMS) was designed, constructed, and validated to quantify methane emissions from cattle, partially supported by a grant from the Dudley Smith Foundation. REMS collects gas samples, measures environmental conditions, and calculates gas emissions. REMS is comprised of polycarbonate chambers that enclose the animal’s heads and secures around their necks, thermal environmental control and fresh air supply to maintain animal comfort, and a gas sampling and analysis system to measure gases of interest.

The REMS laboratory system has been adapted for outreach use twice in the past year (Figures 1-3), with very positive feedback. The system lends itself well to engaging a crowd and generating an interest in methodology as well as interpretation of emissions results. These two outreach experiences could be improved to better convey the message based on the audience. Our team has identified the potential for this approach to become a more widely used tool for public engagement on the issue of gaseous emissions from livestock.

Figure 1: A research team student engages high school students, teachers, and parents while a classmate's emissions are assessed in the chamber. Photo taken at ExplorACES 2013.
An excellent opportunity exists to educate and stimulate curiosity in science, technology, engineering, mathematics, and agriculture. We propose to use the REMS laboratory system and approach as a basis for an extension and outreach module. The original REMS was optimized for research with cattle, resulting in a robust and very heavy unit with very precise, expensive, and delicate equipment. It is not practical for moving to extension and outreach events. Additionally, these units are dedicated investment for research. Time for outreach would compete for their utilization and increase the risk for damage to the system. A smaller, simpler, less expensive and more mobile REMS is needed for outreach activities.

The portable version of REMS, which we will call REMS-Mobile, would monitor carbon dioxide production and calculate emission rates from a person in the chamber. This approach is analogous to monitoring methane eructated by cattle, as carbon dioxide production is a function of human metabolic activity. The goals of the outreach module include: utilize and present a basic method of emission measurement, demonstrate the value of emission studies and the importance of accurate and validated systems, instill a basic understanding of reasonable interpretation of gaseous emissions information, and generate conversation for a scientific
approach to address a contemporary issue in food production. This is an opportunity to create outreach with a hands-on approach for science in both agriculture and engineering.

Outreach Demonstration and Educational Modules

The development of this outreach program requires physical components for the portable demonstration unit and the development of educational modules for delivery of the information. Educational materials would target three primary audiences: farmers, school age children, and general public.

PHYSICAL COMPONENTS

Mobile Chamber: The original REMS system installed at the UIUC beef farm was designed to be very robust to withstand cattle, making it very heavy. The chamber proposed for the outreach module would visibly look similar to the original but would be optimized for outreach with humans, such as being less expensive or using lighter weight materials.

Instrumentation: Instrumentation required includes the CO$_2$ sensor. Gas measurement for the research environment can be very expensive and requires delicate equipment. For outreach, the precision for research in a controlled experiment is not needed, and a less expensive sensor may be implemented. The proposed sensor for this project also integrates well with the proposed data logging and a visual output equipment.

Visual Display: The visual display will show a figure comparing the current CO$_2$ emissions from the person in the chamber, a cow, a car, and an average human. The display must be: (i) easy to transport, (ii) viewable to a crowd, and (iii) inexpensive. A netbook computer connected to a larger monitor was selected to meet all three of these requirements.

EDUCATIONAL MODULE

The education module will consist of: (i) training materials and fact sheets for each module, as well as suggested talking points for the REMS Mobile system, appropriate for the age and audience, (ii) a poster display appropriate for each module to be set up at each event, (iii) a one-page handout with information from the poster and about the system, also age and audience appropriate. All materials will acknowledge the faculty leads as well as the financial support to create REMS Mobile, and any other funding received to offset the utilization of the unit.
*Educational Module: School Age Children and Young Adults.* The module for the school age audience will be adaptable for grades 3-12 and will excite and educate the kids about a topic with importance in science and engineering. The materials developed for the young people will discuss CO₂ production and why measuring gas emissions is important. Likely venues include student recruitment events, youth science programs, open houses, and national events (such as the National FFA convention). Leave-behind materials will link the science to potential career paths in agriculture, and we will work with the college recruiting office for developing these materials.

**Timeline**

Preparation of the outreach module will begin as soon as funding is in place, with a target deadline for completion before ExplorACES 2014 in mid-March. The exhibit has already been registered and advertised with ExplorACES 2014.