

# Duane R. Smith

## Thesis

Greenhouse Gas Emissions from Manure Management: A review with case studies

## Abstract

Canada is a major producer of livestock and animal products. Typically, a livestock operation consists of a large number of animals managed in a confined area and the resulting manure is stored in large piles or disposed of in lagoons. Recent expansion and intensification in the livestock industry has resulted in growing health and environmental concerns, especially in areas where intensification has resulted in larger numbers of animals in relatively smaller areas.

The agricultural sector is also an important source of greenhouse gas (GHG) emissions. The complex biological nature of processes involved in producing GHGs in the agricultural sector make emissions highly variable and sporadic. Trade-offs between the two dominant agricultural GHGs, nitrous oxide (N<sub>2</sub>O) and methane (CH<sub>4</sub>), depending on which waste and manure management strategies are selected.

The purpose of this project is to better understand current agricultural manure management practices and their effects on greenhouse gas emissions (GHG). This report reviews the current International Panel of Climate Change (IPCC) methodology for establishing national inventories for estimating GHG emissions from manure management. A selection of manure management practices, broadly defined as liquid systems, solid storage, composting and anaerobic digestion were also reviewed with the aim of understanding GHG formation within each system.

Three case studies are presented as a "first cut" estimate to demonstrate how GHG reductions can be achieved and to point out current limitations in the application of GHG methodologies to these systems. The results of the case studies suggest that anaerobic digestion is an effective GHG reduction strategy where solid storage is the current manure management system. The design and configuration of the digester system had less of an impact on GHG emissions when compared to the GHG reductions that could be achieved through the displacement of fossil fuel combustion. The results were inconclusive when switching from a liquid manure system to a compost system. A significant difference between the use of emission factors and actual field measurements was found for one case study, reflecting the need to continually compare estimated emissions and actual measurements.

## Degree

M.Eng.

## Completion

2005

## Supervisor

Karman

