MPI POLICY AND TRADE
Agricultural Inventory Advisory Panel Meeting
20 November 2014

UPDATED EQUATION FOR METHANE EMISSIONS FROM ANAEROBIC EFFLUENT PONDS

Authors: Simon Wear and Nicki Stevens

Main Purpose: Decide   Discuss   ☑ Note

Purpose of Report

1.   To advise the Agricultural Advisory Inventory Panel on a change to the equation used for estimating methane emissions from effluent ponds.

2.   Attached to this briefing paper is the following documentation:

   - Pratt et al. (2014) Flaws in the current method for calculating methane emissions during dairy manure management in New Zealand, NZ Journal of Agricultural Research, 57 (3): 244-249
   - Pratt et al. (2012) Revised methane emission factors and parameters for dairy effluent ponds. Report for the Ministry for Primary Industries, Wellington, New Zealand.
   - Minutes of a workshop held on 5 June 2014 with the proposed solution to adapt the 2006 IPCC methodology

Summary

Background

3.   New Zealand has an obligation under the United Nations Framework Convention on Climate Change (UNFCCC) and the Kyoto Protocol to report anthropogenic greenhouse gas emissions and removals every year. Emissions are estimated and reported in the annual submission of the National Inventory Report submitted to the UNFCCC. This reporting requirement is also legislated by the New Zealand Climate Change Response Act (2002).

4.   Any future commitments taken by New Zealand to reduce greenhouse gas emissions may have a financial cost based on emissions reported in the National Inventory Report. Therefore reported emissions and removals need to be as accurate as possible. New Zealand has a long-standing research program in estimating country-specific emission factors to aid in the improvement of reported emissions and removals from the land-based sectors.

Growing and Protecting New Zealand

5.   Reporting must meet the recommendations in the guidelines provided by the Intergovernmental Panel on Climate Change (IPCC)[i]. Improvements are encouraged to take account of national circumstances beyond the default methodology and emission factors that are recommended in the 2006 IPCC Guidelines, and need to be well-documented and transparent.

Current Equation

6.   Methane emissions from effluent ponds are currently determined using the following methodology as documented in (Pickering & Wear, 2013[1], equation 62). The methodology was originally implemented in 2003 and was first referenced in the national inventory report in 2006 (MfE 2006):

$M = (FDM \times MMS) \times W/1000/d \times Y_m$

Where: M = methane from manure management
MMS = proportion of faecal material deposited on pasture
W = water dilution rate (litres per kg faecal dry matter)
d = average depth of a lagoon (m)
Y_m = methane yield (g CH_4 per m^2 per year).

Proposed Improvement to the Inventory

7.   A number of papers have recently been published in the scientific literature criticising the equation used in the Inventory for calculating methane emissions from effluent ponds (e.g. Pratt et al. 2014, enclosed).

8.   A workshop was held on 5 June 2014 to discuss this issue and to find an agreed solution.

9.   The proposal to adapt the equation published in the 2006 IPCC guidelines was accepted (see attached workshop minutes).

10.   The 2006 IPCC (10.23) equation is expressed as:

$$EF_{(T)} = \left(VS_{(T)} \bullet 365\right) \bullet \left[B_{o(T)} \bullet 0.67\,kg/m^3 \bullet \sum_{S,k} \frac{MCF_{S,k}}{100} \bullet MS_{(T,S,k)} \right]$$

Where:

$VS_{(T)}$ is the volatile solids excreted by dairy cattle (kg) and can be determined from the faecal dry matter (FDM) by adjusting for the ash content of FDM. The ash content of manure is calculated as a fraction of the dry matter feed intake using default values from the 2006 IPCC guidelines of 8 per cent (0.08 expressed as a decimal), i.e. $VS_{(T)}$ = (1-ASH%) x FDM. Australia also uses this approach to estimate volatile solids from FDM.

$B_{o(T)}$ is the maximum CH_4 producing capacity for manure produced by an animal within a defined population (m^3/kg). The 2006 IPCC default value for $B_{o(T)}$ for dairy in the Oceania region is 0.24.

---

[1] Pickering A & S Wear (2013) Detailed methodologies for agricultural greenhouse gas emission calculation version 2, MPI Technical Paper 2013/27, http://www.mpi.govt.nz/news-resources/publications?title=Detailed methodologies for agricultural greenhouse gas emission calculation version

MS is the fraction of the manure from dairy cattle treated in anaerobic lagoons. For the NZ greenhouse gas inventory, the currently-used estimate of MS is 6 per cent (0.06 expressed as a decimal) and is based on the amount of time dairy cows producing milk spend in the milk shed where the effluent can be collected. This translates to approximately 5 per cent of the total dairy herd (i.e. including dairy bulls and cows not in milk). We propose to retain this value until more robust estimates can be obtained and reviewed.

MCF is the Methane Conversion Factor. The 2006 IPCC default value is 71 percent; however Pratt et al. (2012) propose a country-specific value for MCF of 74 per cent (0.74 expressed as a decimal). This MCF value is based on assumptions regarding the average temperature of effluent ponds in New Zealand.

Review comments

11.   We have not requested peer-review of this equation as it is based on the 2006 IPCC methodology.

Recommendations

This paper is for information only. It is recommended that the Agricultural Inventory Advisory Panel:

12.   *Note the change in the equation for calculating methane emissions from effluent storage in anaerobic effluent ponds, which will be included in the Agriculture Inventory from 2015 onwards and applied to estimates of emissions from this source from 1990 to 2013 inclusive.*

Simon Wear and Nicki Stevens
Senior Analyst, Ministry for Primary Industries

Approved/ Not Approved/ Approved as Amended

Peter Ettema
Resource Information and Analysis Manager
Chair Agricultural Inventory Panel

Date

---

[i] 2000 IPCC Good Practice guidelines and 2006 IPCC guidelines