MPI Policy and Trade
Agricultural Inventory Advisory Panel Meeting
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Use of revised activity data on dairy effluent management

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Main Purpose: ☑ Decide ☐ Discuss ☐ Note

Purpose of this paper

1. This paper seeks recommendation from the Agricultural Inventory Advisory Panel (the Panel) to use revised activity data in the Agricultural Inventory Model (AIM). The revised data will change the proportion of dairy excreta (dung and urine from dairy cows) entering a manure management system (MMS).

2. This paper also asks that the Panel note that AIM currently assumes that all MMSs are anaerobic lagoons and applies the emissions factor for anaerobic lagoons to all manure entering a generic MMS.

3. Other documents attached to this paper:

   a. A report that outlines the data, methodology and the Excel spreadsheet tool Ledgard, S., Longhurst, B., & Rollo, M. (2017). *Trends in dairy effluent management*

   b. The review of Ledgard, Longhurst & Rollo (2017) by Tony van der Weerden.

Background

4. Under the United Nations Framework Convention on Climate Change (UNFCCC), New Zealand has an obligation to report greenhouse gas emissions and removals every year. New Zealand also has an obligation for the continual improvement of the national inventory to accurate represent New Zealand's greenhouse gas emissions.

5. In the early 2000s most excreta from dairy cows in New Zealand dairy grazing systems was returned directly to the paddock. A proportion was also transferred to the shed and surrounding yards during milking. In AIM it is assumed that any excreta transferred to the shed and surrounding yards enters a generic MMS, and

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that this is an anaerobic lagoon. This assumption is based on research by Ledgard and Brier (2004).

6. In recent years, there has been increased use of off-paddock structures due to the intensification of dairy systems, as well as increases in the variety of MMSs. In response to these changes the Ministry for Primary Industries (MPI) has funded a project to update earlier AIM activity data and methodology, accounting for the uptake of multiple types of off-paddock structures, and different MMSs.

7. The project reviewed several datasets to gather information on the use of manure management and other off-paddock structures, and developed an accounting tool to estimate the percentage of dairy excreta entering a MMS. Future data is expected to be available to MPI because in 2017 Stats NZ added a question to the APC to seek information about different MMSs.

Current activity data used in the Inventory

8. Ledgard and Brier (2004), estimated on average six per cent of annual lactating dairy cow excreta entered the farm dairy effluent system via the milking shed and yards. This was adjusted to five per cent to reflect all cattle and is applied to all years in the AIM.

9. This reflects traditional New Zealand dairy grazing systems, and does not take into account the intensification of dairy since the early-2000s, or the adoption of a variety of off-paddock structures on New Zealand dairy farms. Updating activity data to reflect these changes in management on dairy farms since the early-2000s will improve the accuracy of the AIM.

New method for estimating nitrogen transferred to MMSs

10. A Microsoft Excel® workbook tool (Excel tool) has been developed. This Excel tool will allow users to estimate the proportion of nitrogen transferred to MMSs and off-paddock structures from other activity data inputs.

11. The Excel tool uses the methodology from Ledgard and Brier (2004) to estimate the annual proportion of dairy excreta transferred to a MMS. The annual excreta transferred to MMSs in 2015 was re-estimated using data that reflected the use of off-paddock structures in the 2015/16 season (Botha and O'Connor, 2015). The MMS use values for the years 2005 to 2014 (inclusive) have been linearly extrapolated from the two data points.

12. The user must input annual data on the estimated total nitrogen excreted, off-paddock structures used, and time spent on these different structures. The Excel tool uses the methodology from Ledgard and Brier (2004) to estimate the annual excreta transferred to a MMS from the input data. The Excel tool linearly extrapolates between years where activity data exists.

13. The Excel tool does not apply emission factors to the different off-paddock structures, however it allows for this in future. MPI is not recommending changes to emission factors as there is not currently sufficient research to do so.

14. In 2017, Stats NZ included a new question in the APC that seeks information about different MMSs. In previous years the survey did not include any questions on MMSs. These MMSs have been included in the Excel tool and can be used to estimate the used of MMSs in future. Table 3, appendix 1 contains the new APC question and lists the types of MMSs that were included in the question.

15. MPI has not used this tool to estimate the use of MMSs for 2017. The survey question was not well understood by survey participants and it is likely to change in future. MPI will be carrying out further work in 2019 on the accuracy of this data and how it can be best used in the AIM.

Proposed changes to the proportion of dairy excreta entering MMSs

16. Table 1 summarises the proposed changes to average annual proportion of excreta transferred to MMSs by dairy cows. The majority of excreta entering MMSs is from lactating dairy cows and is corrected to a value for all dairy cows.

Table 1: Comparison of current AIM value and proposed AIM value for excreta transferred to a MMS

Year	Current value (lactating dairy cows)	Proposed value (lactating dairy cows)	Current value (all dairy cows)	Proposed value (all dairy cows)[1]
1990 – 2004	***6%***	***5.78%***	***5%***	***4.82%***
2005	6%	5.84%	5%	4.86%
2006	6%	5.91%	5%	4.92%
2007	6%	5.99%	5%	4.99%
2008	6%	6.11%	5%	5.09%
2009	6%	6.26%	5%	5.22%
2010	6%	6.47%	5%	5.39%
2011	6%	6.73%	5%	5.61%
2012	6%	7.05%	5%	5.88%
2013	6%	7.45%	5%	6.21%
2014	6%	7.94%	5%	6.62%
2015	***6%***	***8.52%***	***5%***	***7.10%***
2016	6%	8.52%	5%	7.10%
2017	6%	8.52%	5%	7.10%

17. This paper proposes from 2005 onwards, the AIM use the values estimated by the model. In the years 1990 to 2004 (inclusive) this paper proposes replacing the current value of six per cent (recommended in Ledgard and Brier (2004)) with 5.78 per cent (rounded to two decimal places) for consistency with the new values. These are the best estimates on the use of MMSs before 2004. Other estimates of use of off-paddock structures before 2004 are based on expert opinion.

18. This paper proposes that AIM adopt the same value as the last year estimated from available activity data. For example, in 2016 and 2017 the proposed value is 8.52%,

[1] Note actual values for the proportion of excreta that is transferred to a MMS for all dairy cows is calculated based on activity data in AIM, therefore these numbers may be different in AIM.

estimated from 2015 activity data. This paper proposes that these values are revised when new activity data becomes available.

19. The new APC question will provide activity data on manure management systems in census years, which could be used to calibrate the spreadsheet model, and revise the proportion of dairy excreta transferred to a MMS in years without activity data.

20. The Panel should note that AIM currently assumes that all MMSs are anaerobic lagoons and applies the emissions factor for anaerobic lagoons to all manure entering a generic MMS. Information based on expert opinion collected in Ledgard. Longhurst & Rollo (2017) suggests that this was appropriate in 1990, however that the variation in MMSs has increased since 1990 and anaerobic lagoons now make up only 10% of manure management systems. More work is required to reflect this in AIM at present.

Estimated impact on Inventory

21. Table 2 below shows the difference that the proposed changes make to the emissions estimates in the model, for the dairy sector and in agriculture.

Table 2: Proposed changes impact on Inventory emissions estimates for 1990 and 2016

	1990			2016			Change since 1990	
	Current	Proposed	Change	Current	Proposed	Change	Current	Proposed
Dairy	7910	7911	0.01%	18018	17991	-0.15%	127.78%	127.42%
Total	34582	34583	0.00%	38727	38701	-0.07%	11.99%	11.91%

22. The proposed changes make negligible difference (0.00 per cent) to total agricultural greenhouse gas emissions in 1990. In 2016 the proposed changes decrease total greenhouse gases by 0.07 per cent. The overall impact on the percentage change since 1990 is a decrease of 0.08 per cent from 11.99 per cent to 11.91 per cent.

23. In absolute terms, total emissions in 1990 increase by 1 kilotonne carbon dioxide equivalent (kt CO_2e). In 2016, total emissions decrease by 26 kt CO_2e.

Reviewer comments

24. Tony van der Weerden (AgResearch) reviewed the report. The reviewer noted that the report provided a thorough and transparent explanation of the method used to revise the proportion of dairy cattle excreta entering MMSs.

25. The reviewer noted that the data on MMSs in New Zealand was limited, however the data that the authors had managed to source provided valuable information. The reviewer also noted that the APC survey question only covers manure management systems, not all off-paddock structures, and therefore the Excel spread sheet tool would also not be able to analyse the effect of other off-paddock structures on manure management emissions in New Zealand.

Risks of Implementation

26. The data used to revise the proportion of dairy excreta entering MMSs is from different sources. The methodology used to collect this data is not the same, therefore there is a risk it will come under scrutiny from the public and UNFCCC expert review teams. This risk is mitigated by the fact that the proposed data is the most accurate information on MMSs in New Zealand.

27. AIM currently assumes that all MMSs are anaerobic lagoons and applies the emissions factor for anaerobic lagoons to all manure entering a generic MMS. However, information based on expert opinion collected in Ledgard. Longhurst & Rollo (2017) suggests that the variation in MMSs has increased since 1990 and anaerobic lagoons now make up only 10% of manure management systems in use. MPI consider that this risk is mitigated by the fact that the proposed data is the most accurate information on MMSs in New Zealand at present and the overall impact of the change on total emissions estimated by AIM is negligible. The APC question will provide more activity data and enable MPI to mitigate this risk in future.

Opportunities

28. Under the UNFCCC, countries should consider ways to improve their inventory. By continuing to develop new methodologies that more accurately represent its circumstances, New Zealand is showing that it is meeting its UNFCCC obligations.

29. There is scarce historical data on the use of MMSs, however the introduction of a MMS question in the APC will address this issue in future. Updating AIM with activity data generated by the Excel tool makes use of the best data available and will allow MPI to use future data to improve accuracy and reflect possible emissions mitigation options.

Recommendations

It is recommended that the Agricultural Inventory Advisory Panel:

30. ***Recommend*** the use of the Excel spreadsheet tool to estimate the proportion of average annual excreta transferred to a MMS, this results in the following activity data being used in AIM for the years 1990 to 2017.

Year	Proportion transferred to MMS (lactating dairy cows)	Proportion transferred to MMS (all dairy cows)
1990 – 2004	***5.78%***	***4.82%***
2005	5.84%	4.86%
2006	5.91%	4.92%
2007	5.99%	4.99%
2008	6.11%	5.09%
2009	6.26%	5.22%
2010	6.47%	5.39%
2011	6.73%	5.61%
2012	7.05%	5.88%
2013	7.45%	6.21%
2014	7.94%	6.62%
2015	***8.52%***	***7.10%***
2016	8.52%	7.10%
2017	8.52%	7.10%

Agree / not agreed

31. ***Note*** that AIM currently assumes that all MMSs are anaerobic lagoons and applies the emissions factor for anaerobic lagoons to all manure entering a generic MMS. However the variation in MMSs is likely to have increased since 1990 and further research is required to reflect this in AIM.

Noted

32. ***Note*** the inclusion of new questions in the APC and the development of an Excel spreadsheet tool that will allow the use of revised activity data in the AIM, and could allow the use of different emission factors for different off paddock structures in future.

Noted

Jamie Ash
Policy Analyst, Domestic Climate Change

Approved/ Not Approved/ Approved as Amended

Gerald Rys
Principal Science Advisor, Science and Skills Policy

Chair Agricultural Inventory Panel

Date

Appendix 1

Table 3: The new (2017) APC question and MMSs included

Q86: During the year ended 30 June 2017, did the farm use any effluent management system? Yes → go to Q87 No → skip Q87		
Q87: During the year ended 30 June 2017, what was the **main type** of effluent management system that was used on the farm? Please mark one only.		
APC line code (LC)	MMS	Additional text in APC question
5900	Multiple pond system	with anaerobic and aerobic ponds that discharge
5901	Multiple pond system	with anaerobic and aerobic ponds that occasionally discharge and use land application the rest of the time
5902	Single storage ponds/tanks	with sufficient storage to irrigate when suitable – no solid separation system
5903	Single storage ponds/tanks	which include a solid separation and storage system
5904	Sump storage	storage for at least 1-2 days prior to irrigation
5905	Other	please specify