



POULTRY METHANE AND NITROUS OXIDE EMISSIONS

Authors: Simon Wear

Main Purpose: Decide Discuss Note

Purpose of Report

1. Seek approval from the Agricultural Inventory Advisory Panel to change the emission factors used to estimate methane and nitrous oxide emissions from poultry, and to note the proposed changes to the method to calculate population data for meat poultry.
2. Attached to this paper are the reports:
 - a. *“Poultry management in New Zealand: production, manure management, and emission estimations for the commercial chicken, turkey, duck and layer industries within New Zealand - review by Grant Richards”*.
 - b. *“Poultry management in New Zealand: production, manure management, and emission estimations for the commercial chicken, turkey, duck and layer industries within New Zealand - final report PIANZ 2011”*.

Summary

Background

3. New Zealand has an obligation under United Nations Framework Convention on Climate Change Convention (UNFCCC) to report the anthropogenic greenhouse gas emissions and removals every year. Emissions are reported in the annual submission of the National Inventory Report submitted to the UNFCCC. New Zealand also has a responsibility under the Kyoto Protocol to reduce emissions growth and if not successful will incur a financial cost.
4. The National Inventory Report (NIR) forms the basis of any financial cost that the country may have under the Kyoto Protocol. 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.
5. Changes beyond the default methodology and emission factors to take account of country specific factors are encouraged and need to be well documented and transparent.

6. The IPCC default emission factors for methane and nitrogen excretion rates apply to a typical international poultry flock, composition and management regime, and do not account for New Zealand specific management practices.
7. Poultry makes up a small percentage of New Zealand's total agricultural emissions (0.4% in 2009) so is not a key category when assessed on an annual basis.

Current Inventory

8. Poultry is a source of methane and nitrous oxide emissions from manure management and nitrous oxide emissions from agricultural soils.
9. New Zealand does not presently report or account for enteric fermentation emissions from poultry. There is no IPCC1996 methodology, however, several European countries do voluntarily report and account for enteric fermentation emissions from poultry with an emission factor ranging from 0.008 to 0.02 kgCH₄/bird/year.
10. The inventory applies the same Tier 1 methodology, using IPCC default values for poultry regardless of the subclass of poultry. Emissions from ducks and turkeys will need to be accounted for separately when the IPCC 2006 guidelines are adopted under the UNFCCC.

Report

11. The report was commissioned to document and recommend country specific values for methane and nitrous oxide emissions from poultry for New Zealand.
12. The report was a comprehensive review of the literature by Surinder Saggat (Landcare Research) and a survey of 80 percent of New Zealand broiler and layer farmers by the Poultry Industry Association of New Zealand (PIANZ), and the Egg Producers Federation of New Zealand (EPFNZ).
13. PIANZ and EPFNZ and the New Zealand Agricultural Engineering Institute have measured volatilised solids (VS) and nitrogen excretion rates (N_{ex}) for New Zealand poultry and this has been the basis of country specific estimates of VS and N_{ex} values that the report recommends for New Zealand.

Reviewer's comments

14. The review of the report was carried out by Grant Richards, an animal nutrition expert with over 20 years experience with the poultry industry in Australia and New Zealand.
15. The reviewer notes "considerably high performance standards/efficiency of the NZ industry when compared internationally, indicate that NZ poultry specific numbers are likely to be better/lower than international "averages" within data sets". He contends "that NZ "emissions calculations" will be overestimated in NZ by use of current poultry specific or international/IPCC default values for broiler and layer industries at least."

Methane emissions from manure management

16. The current emissions factor for methane from poultry manure management for all birds is 0.117kg CH₄/bird/year. Values reported by other Annex 1 Parties range from 0.010 kg CH₄/bird/year for Spain to 0.882 kg CH₄/bird/year for Bulgaria. There are 32 out of 44 Annex 1 parties that report values lower than 0.100 kg CH₄/bird/year.
17. Methane emissions from manure management are determined by the daily quantity of animal waste or Volatile Solids (VS), the daily methane potential of the waste (Bo) and a Methane Conversion Factor (MCF). The current default for these variables and applied to all birds are 0.100kg/Vs/bird/day for VS, 0.32 m³ CH₄/kg VS for Bo and 1.5% for MCF.

Proposals for methane emissions from manure management in the report

18. New Zealand specific values for VS of:
 - 0.019 kg/Vs/bird/day (EF = 0.022 kg CH₄/bird/year) for broilers;
 - 0.014 kg/Vs/bird/day (EF = 0.016 kg CH₄/bird/year) for layers;
 - 0.023 kg/Vs/bird/day (EF = 0.027 kg CH₄/bird/year) for ducks; and,
 - 0.110 kg/Vs/bird/day (EF = 0.129 kg CH₄/bird/year) for turkeys.
19. The report made no specific recommendations that for values that should be used for the methane potential (Bo) of volatile solids (VS). The report tables values for Bo along with a median value and ranges. The reviewer makes a strong case for the use of the lower values of Bo reported in the range presented in the report based on New Zealand specific circumstances, and New Zealand's highly efficient feed regimes and animal digestibility.

Recommended methodology for methane emissions from manure management

20. We recommend using the reports values for VS by bird and to retain the current default settings for Bo (0.32 m³ CH₄/kgVS) until a consensus can be obtained.

Nitrous oxide emissions from poultry

21. The IPCC1996 default value is for nitrogen excreta per bird is 0.60 kg N/bird/year. Values reported by other Annex 1 Parties range from 0.21 kg N/bird/year for Norway to 0.78 kg N/bird/year for Germany. Japan appears to be an outlier at 1.02 kg N/bird/year.
22. Direct and indirect nitrous oxide emissions from nitrogen applied to soil via poultry excreta are treated in the same way as nitrogen excreta from other livestock. Nitrous oxide emission factors are the same for poultry except for poultry specific nitrous oxide emissions from poultry waste management systems. New Zealand currently uses the non-poultry specific emissions factor (EF₃) of 0.005 kg N₂O-N/kg.
23. The proportion of manure deposited on agricultural soils via free range farming (3%) and through poultry waste management systems (97%) is based on IPCC defaults.

Proposals for nitrous oxide emissions in the report

24. Country specific values for nitrogen excretion rates (N_{ex}) of 0.39 kg N/bird/year for broilers, 0.42 kg N/bird/year for layers. The report recommends keeping the current IPCC defaults for ducks and turkeys (N_{ex} 0.60 kg N/animal/year) because there is not sufficient information to make a change.
25. The report recommends continuation of country specific emission factors of 0.07 for nitrogen leaching ($Frac_{leach}$), 0.1 for volatilisation ($Frac_{gas}$) and 0.01 EF_3 (pasture range and paddock). These country specific emission factors are the same and apply to all nitrogen on agriculture soil from excreta regardless of livestock type.
26. The current non-poultry specific emission factor EF_3 (0.005 kg N_2O -N/kg) for litter category birds is reduced to poultry-specific EF_3 (Other-AWMS-poultry) 0.001 kg N_2O -N/kg N emission factor nitrogen in excreta applied to soil from animal waste management systems.
27. The report recommends changing the percentage of poultry on free range from 3% to 5.8% for layers, and 4.9% for broilers for 2010. The survey covered 80% of poultry farmers for the most recent year's activity. There were no survey results for previous years back to 1990. PIANZ are trying to elicit information, expert opinion if necessary, on the proportions of birds that were free range in 1990.
28. The reviewer agrees with the findings and supports the changes to the nitrogen excretion rates.

Recommended methodology for nitrous oxide emissions

29. We recommend using the reports recommendations for nitrogen excretion rates, for EF_3 and if data on the share of poultry in free range can be obtained from 1990 to 2010 to use this data to apportion excreta to different animal waste systems.

Poultry population

30. Broiler and layer population data are sourced from the Agricultural Production Survey (APS) provided by Statistics NZ. The APS sourced broiler numbers do not account for stand-down time between production runs in the sheds, and therefore do not match the IPCC methodology used to estimate emissions from poultry.
31. The report concludes that the average flock size of meat poultry can be more accurately determined using Equation 10.1 from the 2006 IPCC Guidelines. The reviewer agreed with the report and commented that the current method to estimate broiler flock size will overestimate numbers because it does not allow for considerable downtime while sheds are rested.
32. Statistics NZ has agreed to work with MAF to update the current poultry modelling methodology to account for the downtime in broiler sheds and to revise broiler numbers reported from the APS.

Effect of changes

33. In comparison to the inventory submitted in 2011, the proposed changes have the following effect on the 2009 emissions estimates from poultry. These are not cumulative effects but are the effect of each individual change.
- The effect of implementing the change to the estimate of VS will be to reduce emissions of CH₄ from poultry by approximately 37 GgCO₂-e.
 - Reductions in the estimate of N_{ex} will reduce emissions of N₂O by 27 GgCO₂-e.
 - Changes to emission factor EF₃ will reduce N₂O emissions by 21 GgCO₂-e.
 - Changes to the proportion of free range poultry will reduce emissions by 0.3 Gg CO₂-e.
34. Implementing all these changes reduces estimated poultry emissions by 54 Gg CO₂-e in 2009 from 133 Gg CO₂-e (0.4% of agriculture emissions) to 79 Gg CO₂-e (0.2% of agriculture emissions).
35. Based on 2009 estimates provided in the 2011 poultry report, the estimate of broiler numbers will decrease from 14.6 million birds to approximately 8.0 million birds. This equates (using current emission factors) to reduced emissions of approximately 62 Gg CO₂-e.

Other recommended changes to inventory

36. The report recommended the introduction of a conservative value from a range of values for the loss of nitrogen from volatilisation in poultry waste management systems. The conservative value is specific to an IPCC2006 methodology.
37. The report discussed calculating emissions from different poultry housing and management systems but did not make any conclusions to use New Zealand specific emissions factors for different types of animal waste management systems in poultry.

Strategic Risks

38. The changes may not be accepted by an expert review team organised by the *United Nations Framework Convention on Climate Change* (UNFCCC). However, if this is the case there is an extensive process which is followed in which New Zealand can state its case or change back to the IPCC default before any penalty would be applied.

Strategic Opportunities

39. New Zealand will be meeting the UNFCCC obligations of continual improvement of the national inventory, and in addition the new values be well documented, therefore meeting the UNFCCC requirement for transparency.
40. Reporting emissions by each subclass of poultry will improve the accuracy of emissions from poultry, and prepare New Zealand to report emissions for different classes of poultry when the 2006 guidelines are eventually implemented.

Recommendations

It is recommended that the Agricultural Inventory Advisory Panel:

41. *Agree that the specific values for VS used of 0.019 kg/Vs/bird/day for broilers, 0.014 kg/Vs/bird/day for layers, 0.023 kg/Vs/bird/day for ducks, and 0.110 kg/Vs/bird/day for turkeys instead of the IPCC default for all poultry of 0.100 kg/Vs/bird/day.*

Agree / not agreed

42. *Agree that the current IPCC1996 default value for Bo of 0.32 m³ CH₄/kgVS until consensus can be obtained between the report's authors and the reviewer.*

Agree / not agreed

43. *Agree that the values of nitrogen excretion rates (N_{ex}) be changed from 0.60 kg N/bird/year for all poultry to 0.39 kg N/bird/year for broilers, 0.42 kg N/bird/year for layers. No change for ducks and turkeys.*

Agree / not agreed

44. *Agree that the current non-poultry specific EF₃ 0.005 kg N₂O-N/kg for litter category birds is changed to poultry-specific EF₃ 0.001 kg N₂O-N/kg N from animal waste management systems.*

Agree / not agreed

45. *Agree to 2010 estimate of free range excreta vs other animal waste management systems, and that MAF will derive a time series back to 1990 using expert opinion.*

Agree / not agreed

46. *Note that Statistics and MAF are working together to update the methodology used to estimate the average annual flock size for broilers, ducks and turkeys.*

Noted

Simon Wear
Senior Policy Analyst

Approved/ Not Approved/ Approved as Amended/Noted

Alice Marfell-Jones
Manager Information and Analysis
Chair Agricultural Inventory Panel

Date