MPI POLICY
Agricultural Inventory Advisory Panel Meeting
13 November 2012

NITROUS OXIDE FROM LEACHING AND RUNOFF

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Main Purpose: ☑ Decide ☑ Discuss ☐ Note

Purpose of Report

1. Seek approval from the Agricultural Inventory Advisory Panel on the recommendations to change the emission factor (EF_5) for nitrous oxide emissions from nitrogen leaching and runoff.

2. Attached to this paper is the report:

   "*Nitrous oxide emissions from waterways"* including the review of the report by Steve Thomas and responses by the authors.

Summary

Background

3. New Zealand has an obligation under United Nations Framework Convention on Climate Change (UNFCCC) to report 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 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 in the Revised 1996 IPCC Guidelines and the 2000 IPCC Good Practice Guidance to take account of national circumstances are encouraged and need to be well documented and transparent.

6. As a matter of course the 2006 IPCC guidelines are not currently used in the estimation of emissions from the national greenhouse gas inventory (including agriculture). Until these guidelines are fully

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adopted countries must continue to use the Revised 1996 IPCC Guidelines and the 2000 IPCC Good Practice Guidance unless a country can fully justify why they have changed. If a methodology, emission factor or parameter is not available from the current guidelines but is from the 2006 IPCC guidelines, a country is able to use the information contained in the 2006 IPCC guidelines. Also, if a country has investigated an area and found the values in the 2006 IPCC guidelines are more appropriate to national circumstances then this too is a justification for changing.

7. Rivers in New Zealand are short and fast flowing compared with rivers in other parts of the world such as Australia, America and Europe. The Waikato River as New Zealand's longest river is an exception, starting at Lake Taupõ and finishing at Port Waikato; a distance of 330 km. Water in the Waikato River takes between 373 and 961 hours to travel the length of the river; depending upon the season. The river is situated in the Waikato region in New Zealand's North Island.

Current Inventory

8. The current national inventory uses a default emission factor (EF_5) for nitrous oxide emissions from nitrogen leaching and runoff from the revised 1996 IPCC Guidelines.

9. The EF_5 comprises three components for nitrous oxide (N_2O) emissions from groundwater and surface drainage ($EF_{5\text{-}g}$), estuaries ($EF_{5\text{-}e}$) and rivers ($EF_{5\text{-}r}$).

10. The Revised 1996 IPCC Guidelines default emission factors for groundwater and surface drainage, estuaries, and rivers are: 0.015, 0.0025, and 0.0075 kg N_2O-N/kg $N_{LEACHED}$, respectively. Therefore the combined EF_5 in the Revised 1996 IPCC guidelines is 0.025 kg N_2O-N/kg $N_{LEACHED}$.

11. In 2010 indirect N_2O emissions from leaching and runoff were estimated at 5.172Gg N_2O; equivalent to 1.6Mt of carbon dioxide (4.8 percent of New Zealand's total agricultural emissions in 2010).

Report

12. The report for the Waikato River found that measured N_2O-N fluxes were less than 120 μg m^2/hour.When used in conjunction with the Waikato River's 10 year median values for nitrate concentrations and flow rates, a calculated $EF_{5\text{-}r}$ value for the true river (Karapiro to Waikato heads) equated to 0.0005 kg N_2O-N per kg $N_{LEACHED}$.

13. The report cites further work by Dong *et al*., (2004); and Clough *et al*., (2006 o*p cit*) where ranges of estimates for $EF_{5\text{-}r}$ for rivers have been estimated between 0.0003 and 0.0005 kg N_2O-N/kg $N_{LEACHED}$. The estimates by Dong *et al.*, 2004 and Clough *et al.*, 2006 are based on rivers in Wales and England, and lowland streams and braided rivers in South Island of New Zealand respectively.

Recommendations from the report

14. The report recommends taking a conservative approach and changing the emissions factor for $EF_{5\text{-}r}$ from 0.0075 to 0.0025 kg N_2O-N/kg $N_{LEACHED}$. No estimates for New Zealand, including for field trials on the Waikato River have exceeded 0.0005 kg N_2O-N/kg $N_{LEACHED}$.

15. The report notes the default emission factor ($EF_{5\text{-}g}$) from the revised IPCC 1996 guidelines was considered too high and was reduced to 0.0025 kg N_2O–N/kg $N_{LEACHED}$ in the 2006 IPCC guidelines.

16. The report recommends a combined emission factor (EF5) of 0.0075 kg N_2O–N/kg $N_{LEACHED}$ for New Zealand.

Effect of changes

17. In comparison to the inventory submitted in 2012, the proposed changes will reduce indirect nitrous oxide emissions from leaching and waterways by 3.62 GgN_2O; equivalent to 1.1 million tonnes of carbon dioxide for 2010.

Response to reviewer comments

18. The reviewer Steve Thomas (Plant and Food Research) found the report's interpretation of results well justified. The report's authors have adopted some of Steve Thomas's editorial suggestions to improve the transparency of the report.

Strategic Risks

19. The changes may not be accepted by an expert review team of the *United Nations Framework Convention on Climate Change* (UNFCCC) reviewers. 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 original IPCC defaults before any penalty would be applied.

Strategic Opportunities

20. New Zealand will be meeting the UNFCCC obligations of continual improvement of the national inventory

21. The new values will make a noticeable difference to the total emissions estimate for New Zealand, and will now be well documented, therefore meeting the UNFCCC requirement for transparency.

22. The change also prepares New Zealand to meet updated reporting requirements agreed in Durban during the Seventeenth Conference of the Parties (COP17) under the UNFCCC. Decision 15/CP.17 *Revision of the UNFCCC reporting guidelines on annual inventories for Parties included in Annex I to the Convention* decides that from 2015 Parties to the UNFCCC will report using the 2006 IPCC Guidelines and Global Warming Potentials from the Fourth Assessment Report of the Intergovernmental Panel on Climate Change.

Recommendations

It is recommended that the Agricultural Inventory Advisory Panel:

23. *Agree that the value used for nitrous oxide emissions from nitrogen leaching into rivers (EF_{5-r}) be changed from 0.0075 kg N_2O-N/kg $N_{LEACHED}$ (Revised 1996 IPCC default) to 0.0025 kg N_2O-N/kg $N_{LEACHED}$ (country specific)*

Agree / not agreed

24. *Agree that the value used for nitrous oxide emissions from nitrogen leaching into groundwater and surface draining (EF_{5-g}) be changed from 0.015 kg N_2O-N/kg $N_{LEACHED}$ (Revised 1996 IPCC default) to 0.0025 kg N_2O-N/kg $N_{LEACHED}$ (country specific)*

Agree / not agreed

25. *Agree that if the values used for nitrous oxide emissions in recommendations 23 and 24 above are agreed the combined (EF_5) for leaching and runoff be changed from the IPCC default of 0.025 kg N_2O-N/kg $N_{LEACHED}$ to a country specific value of 0.0075 kg N_2O-N/kg $N_{LEACHED}$.*

Agree / not agreed

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Approved/ Not Approved/ Approved as Amended

Chris Jones
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Chair Agricultural Inventory Panel

Date