

Developing a Nitrous Oxide Reduction Protocol: Science at Work

October 27-29, 2008

Agenda – October 28, 2008 9:00 – 4:30 pm

9:00 **Welcome and Introductions** – Review and Confirm agenda

Karen Haugen-Kozyra, Climate Change Central

9:15 **Setting the Scene** – Carbon Offsets and the Policy Drivers

Bob Savage, Alberta Environment

-See PowerPoint Presentation

9:45 **How in the World are we Doing This?** - ISO 14064-2 Framework; Protocol Development Approaches

Karen Haugen-Kozyra, Climate Change Central

-See PowerPoint Presentation

10:15 **How do we Stack up vis a vis the rest of the world?** – IPCC Methodology and International Guidance on Nitrous Oxide Reduction; Canada's Quantification Approach

Reynald Lemke/Philippe Rochette, AAFC

-See PowerPoint Presentations

11:15 **We're not Starting From Scratch – Part 1 – Framework for a Nitrous Oxide Reduction Protocol**

Rob Janzen, ClimateCHECK//Karen Haugen-Kozyra

--See PowerPoint Presentation

1:00 **You Can't Manage What you Can't Measure Part II** – Nutrient Stewardship Management

Plans and BMPs to achieve them *Clyde Graham, Canadian Fertilizer Institute/Cliff Snyder and Tom Jensen, IPNI*

-See PowerPoint Presentation

2:00 **Who's on First I?** – State of the Science Findings: A Walk-Through of the Discussion Paper; High Level Discussions *Dr. Rob Janzen, Climate-CHECK*

-See PowerPoint Presentation

3:00 **Who's on First II?** – Framing the Basic Elements of a Nitrous Oxide Emission Reduction Protocol: Setting the Stage for Day Two *Fiona Law, Process Facilitator*

- General Vote – All attendees with voting opportunity – 38 Total Voters (**numbers inside boxes represent actual number of votes per option**)

DP 4.1

The NERP should be designed to comply with the criteria of the Alberta Offset System and Canada's Offset System.

1. Disagree – comply with Alberta Offset System only = 4
2. Agree – comply with Alberta and Canadian systems = 34

89% CONSENSUS – **Accept today to comply with Alberta and Canadian systems**

DP 4.2.4

Categories of emissions within the scope of the NERP should include fertilizer, manure, residues and irrigation:

1. Strongly Disagree = 3
2. Disagree = 1
3. Agree = 16
4. Strongly Agree = 18

89% CONSENSUS – AGREEMENT **accepted as part of the standardized protocol for GHG emissions reduction**

DP 4.2.4 (b)

Categories of emissions within the scope of the NERP should exclude tillage modifications and summerfallow:

1. Strongly Disagree = 2
2. Disagree = 4
3. Agree = 15
4. Strongly Agree = 17

84% CONSENSUS - AGREEMENT **Exclude tillage and summerfallow as part of the standardized protocol for GHG emissions reduction**

DP xx

The 4R approach – Right Rate @ Right Time, Right Form and Right Placement – is appropriate:

1. Strongly Disagree = 1
2. Disagree = 0
3. Agree = 18
4. Strongly Agree = 19

97% CONSENSUS - AGREEMENT **Accept today as part of the standardized protocol for GHG emissions reduction**

Instead of DP 4.4.2

A 4R Nutrient Stewardship Plan is the Gateway for the Protocol:

1. Strongly Disagree = 0
2. Disagree = 2
3. Agree = 20
4. Strongly Agree = 16

95% CONSENSUS - AGREEMENT **Accept today as part of the standardized protocol for GHG emissions reduction**

DP xx

Different Performance Levels of Stewardship are an element of the Protocol to provide flexibility to producers:

1. Strongly Disagree = 1
2. Disagree = 2
3. Agree = 20
4. Strongly Agree = 15

92% CONSENSUS - AGREEMENT **Accept today as part of the standardized protocol for GHG emissions reduction**

4:30 Summary and Close of Day One

Agenda – October 29, 2008 8:30am – 3:00 pm

Focus for the Day

Confidently advance GHG protocol recommendations that address the desired components of a N₂O Reduction Protocol. Day two will engage participants working groups in developing, evaluating and recommending protocol elements for management and reduction of nitrous oxide from Canadian soils.

Day 2 voting occurred by technical/scientific experts – 21 Total (**numbers inside boxes represent actual number of votes per option**)

8:30 **Welcome** – Review agenda for Day Two Karen Haugen-Kozyra, Climate Change Central

8:45 **Where do we go from here: Focus Areas from the Science Discussion Document**

Rob Janzen, ClimateCHECK

- Review Questions/Comments on Day 1

9:15 **Where do we go from here I?** – Break-Out groups – Facilitated by Discussion Guides *Fiona Law, Process Facilitator*

1:00 **Break Out Group Presentation of Options**

Fiona Law, Process Facilitator

Groups Presented Discussion in order of: Group 3, Group 2, Group 1

GROUP 1 - Measurement and Emission Factors Group

1. Estimated Emissions – IPCC Tier I and Tier II Calculations

Desired Outcome:

- Validate fundamentals of the Protocol — scope, baseline, incrementality, other interactions.
- Participants understand the Intergovernmental Panel on Climate Change's (IPCC) Tier 1 guidance, and Canada's specific methodology, derived from the IPCC to develop N₂O Emission Factors for the National Emissions Inventory.
- Ensure compatibility with, and linkage to, other protocols
- Gaps in our Understanding

4.2.3a Group Recommendation for Acceptance:

Recommend including GHG reductions from not manufacturing N fertilizer (needs more work, clarification of who owns credits, conservative effects, etc).

DP 4.2.3a

Recommend including GHG reductions from not manufacturing N fertilizer (needs more work, clarification):

1. Accept = 4
2. Accept with more work = 11
3. Hold for now = 4

79% CONSENSUS – NOT ACCEPTED - This option received 79% who agreed or strongly agreed; the Committee will determine whether or not to move forward; definitely needs more work following the workshop: 19 of 21 voters

4.3.1 Group Recommendation for Acceptance

Use historic benchmark (farm-specific), with regional emission factors and formulae derived for the National Emissions Inventory.

DP 4.3.1.

Baseline Scenario - Use Historic Benchmark (farm-specific):

1. Accept = 15
2. Accept with more work = 6
3. Hold for now = 0

100% CONSENSUS - ACCEPT This option is accepted today as part of the standardized protocol for GHG emissions reduction

4.3.2 Group Recommendation for Acceptance

Use farm data from 3 years prior to establish the baseline

- If new crop, need 3 years of data

DP 4.3.2.

Baseline Years – Use farm data from 3 years prior to entry into project:

1. Accept = 14
2. Accept with more work = 6
3. Hold for now = 1

95% CONSENSUS - ACCEPT This option is accepted today as part of the standardized protocol for GHG emissions reduction.

4.4.1 Group Recommendation for Acceptance

Emissions per hectare for each crop in the project as the standard metric

DP 4.4.1.

Functional Equivalence – Emissions per hectare for each crop of the project:

1. Accept = 17
2. Accept with more work = 3
3. Hold for now = 1

95% CONSENSUS - ACCEPT This option is accepted today as part of the standardized protocol for GHG emissions reduction.

Summary of Gaps in Research or Knowledge:

- Ownership of off-farm GHG emissions
- Verification of farm-specific baseline activity data
- Link between regional inventory methodology and farm-specific activities
- Verify/quantify amount of reduction at end of season? Soil test?
- Improving confidence in emission factors with improved measurement and modelling methodologies.
- How to handle a shift in crop mix (e. g. pulse crops)?

- How to handle a baseline year that is highly divergent?
- How to include more efficient use of manure N (rates, handling, injection)? Another Workshop?
- Address adaptation of inventory methodology from regional to farm specific (e.g. irrigation, texture, depressions)

GROUP 2 - Practices and Technologies – BMPs to Reduce N₂O (Simple, Intermediate and Advanced)

Desired Outcome:

- Determine the components of the 4R N stewardship plan for each level of the NERP.
- Define Right Product formulations.
- Define Right Time practices and technologies.
- Define Right Place practices and technologies.
- Gaps in our understanding – needs in the Nutrient Stewardship Plans

4.4.3 Group RECOMMENDATION:

1. Use of ammonium-based formulations, but AN and UAN need to be included in for surface applied application, under irrigation

DP #1

To decrease N₂O emissions, implement use of ammonium-based formulations, but AN and UAN need to be included for surface applied:

4. Accept = 11
5. Accept with more work = 8
6. Hold for now = 2

90% CONSENSUS - ACCEPT This option is accepted today as part of the standardized protocol for GHG emissions reduction with more work after the workshop.

2. Use of controlled release formulations (included as an option already in Group 2)
3. Use of split applications in irrigation and high-moisture eco-zones (included as an option already in Group 2)
4. Banding (up to 10 cm and need input on SBU) –
5. Application rates specific to landscape position
6. Application to cool soils in fall
7. Apply in spring
8. Include use of nitrification inhibitors (urease and N inhibitors)
9. Include use of manure with determination of N content

DP #9

To decrease N₂O emissions, include use of manure with determination of N content:

1. Accept = 10
2. Accept with more work = 11
3. Hold for now = 0

100% CONSENSUS - AGREEMENT This option is accepted today as part of the standardized protocol for GHG emissions reduction with more work after the workshop.

4.4.4a Group RECOMMENDATION:

NERP should be designed with simple, intermediate and advanced levels **with modifiers** for each eco/climatic zone

Note – the eco-climatic zone differentiation will be captured as a result of the Tier 11 calculation formulae and emission factors of the national inventory approach, and the division of the prairie region with the humid regions of Canada will reflect different sets of practices with appropriate modifiers)

DP 4.4.4a

The NERP should be designed to generate GHG reduction credits according to a multi-level system:

2. Accept = 20
3. Accept with more work = 1
4. Hold for now = 0

100% CONSENSUS - AGREEMENT Accept today as part of the standardized protocol for GHG emissions reductions protocol

DP xx

The multi-level system should be made up of three levels: basic, intermediate and advanced levels

1. Accept = 18
2. Accept with more work = 3
3. Hold for now = 0

100% CONSENSUS - AGREEMENT Accept today as part of the standardized protocol for GHG emissions reductions protocol

5.0 Group RECOMMENDATION:

N plans should be developed as follows:

- General guidance provided (Agree)
- Content prescribed (Agreed)
- Advisor or qualified professional sign off (Agreed)

Group Recommendation: Ensure NPKS sufficiency to achieve realistic target yields

DP xx

The 4R N plans should be developed with General Guidance, provided, Content prescribed, and Advisor sign-off:

4. Accept = 18
5. Accept with more work = 3
6. Hold for now = 0

100% CONSENSUS - AGREEMENT This option is accepted today as part of the standardized protocol for GHG emissions reduction with more work after the workshop.

Discussion: guidance for management plans that would be signed off by an Advisor; definition approved advisors

Gaps in our Understanding and Knowledge – needs in the Nutrient Stewardship Plans

- Pulse crops need to be reviewed in terms of economic and market impact
- Some S and P products show promise in slowing nitrification, but more research needed.
- Chart on page 20 of the Science Discussion document needs more work
- Need more work on N balance in pulses
- The term “N efficiency” needs further definition

- We are unsure that the N₂O emissions under long-term No-till are fully understood particularly in Eastern Canada.
- *For the intermediate level, must determine concave and convex field sectors and other spatial characteristics, i.e. salinity*

GROUP 3 - Quantification for NERP Levels

Desired Outcomes:

- Determine which BMPs should be required for each level of the Protocol/N Stewardship Plan.
- Derive a relationship between sophistication of landscape classification (i.e. none vs concave/convex vs GIS-directed) and the degree of emission reduction expected.
- Clarify/support/derive appropriate modifiers.
- Identify gaps

4.4.4.a Group Recommendation

Recommendation for Acceptance: The NERP should be designed to generate GHG reduction credits according to a multi-level system.

DP 4.4.4a

The NERP should be designed to generate GHG reduction credits according to a multi-level system:

5. Accept = 20
6. Accept with more work = 1
7. Hold for now = 0

100% CONSENSUS - AGREEMENT Accept today as part of the standardized protocol for GHG emissions reductions

4.4.4.b Group Recommendation

Recommendation for Acceptance: The multi-level system should be made up of three levels: Basic, Intermediate, Advanced.

Note terminology change: Simple to Basic

DP 4.4.4b

The multi-level system should be made up of three levels: basic, intermediate and advanced levels:

1. Accept = 18
2. Accept with more work = 3
3. Hold for now = 0

100% CONSENSUS - AGREEMENT Accept today as part of the standardized protocol for GHG emissions reductions

Recommended Option to the Workshop: Table 5 Changes detailed below.

NOTE: to proceed, the Plenary decided:

1. This table applies to inorganic fertilizers only
2. This table reflects Western Canadian BMP combinations for each level; a parallel process will be needed to define the Levels in the more humid regions of Canada.

	Right Product	Right Rate	Right Time	Right Place	Proposed Modifier
Simple Basic	Ammonium-based formulation.	Apply N according to recommendation of 4R N stewardship plan, using annual soil testing and/or N balance to determine application rate.	Apply in spring, or split apply, or after soil cools in fall or use controlled release fertilizer formulations	Apply in shallow bands	0.8
Intermediate	Ammonium-based formulation -slow / controlled release fertilizers -Inhibitors / stabilized nitrogen.	Apply N according to qualitative estimates of field variability ((landscape position, soil variability)	Apply in spring, or split apply, or after soil cools in fall if using slow / controlled release fertilizer or inhibitors / stabilized nitrogen	Apply in shallow bands	0.65 0.6
Advanced	Ammonium-based formulation slow / controlled release fertilizers Inhibitors / stabilized nitrogen based on quantified field variability	Apply N according to quantified field variability (precision farming techniques, ex. Digitized soil maps, grip sampling, satellite imagery, real time crop sensors.) complimented by in season crop monitoring	Apply in spring, or split apply, or after soil cools in fall if using controlled release fertilizer or inhibitor / stabilized nitrogen	Apply in shallow bands	0.5

Recommendation for Acceptance:
Acceptance will be proposed in stages.

Group Recommendation: Table 5 – Right Place

Recommendation for Acceptance: Removed the requirement for shallow placement for all levels.

DP xx

Remove the requirement for “shallow” placement for all levels :

1. Accept = 7
2. Accept with more work = 13
3. Hold for now = 1

95% CONSENSUS - ACCEPT This option will be acceptable but needs more work following the workshop; consider changing the wording to ‘concentrated placements’?

Group Recommendation: Table 5

Consideration of slow / control release fertilizers - removed these materials from Basic

-Changed description to:

“Slow / controlled release fertilizers” and “inhibitors / stabilized nitrogen”

-Added these materials to the Right Product for Intermediate and Advanced levels, and conditional to fall application for Intermediate and Advanced

DP xx

Right Product/Right Time changes for Intermediate and Advanced - slow / controlled – inhibitors / stabilized N:

1. Accept = 11
2. Accept with more work = 9
3. Hold for now = 1

95% CONSENSUS - ACCEPT This option will be acceptable but needs more work following the workshop.

More Work:

The Plenary Group decided that in order to manage the risk of N₂O emissions in the Basic (and all other levels) - add the requirement of a 10 degrees Celsius threshold for 'cool soils' to manage risk at the Basic level and all other levels

- The Committee will undertake more work to identify data sources for 5 or 10 year averages of fall soil temperatures across the Prairies and when they hit 10 degrees Celsius or below; and correlate that with significant dates for eco-district or eco-region levels (whichever seem more appropriate) after which the soils are deemed 'cool' enough for fall application.

Group Recommendation: Table 5

Recommendation for Acceptance: Basic Level

Right Product: No changes

Right Rate: No changes

Right Time: will sort out the 10 degrees C requirement

DP xx

Basic level – Right Time, remove or use controlled release fertilizer formulation:

4. Accept = 16
5. Accept with more work = 5
6. Hold for now = 0

100% CONSENSUS - ACCEPT This option is accepted today as part of the standardized protocol for GHG emissions reduction for Prairie conditions.

Group Recommendation: Table 5

Recommendation for Acceptance: Intermediate Level

Right Product: Added "slow / controlled release, inhibitors / stabilized nitrogen"

Right Rate: Remove concave/convex terminology

Change to "...according to **qualitative** estimates of field variability (landscape position, soil variability)"

Right Time: The fall application was qualified with "if using slow / controlled release fertilizer or inhibitors / stabilized nitrogen"

DP xx

Intermediate level – Right Product/Rate/Time as per edited table:

7. Accept = 10
8. Accept with more work = 11
9. Hold for now = 0

100% CONSENSUS - ACCEPT This option is accepted today as part of the standardized protocol for GHG emissions reduction with more work after the workshop.

Discussion – concern over inclusion of controlled release fertilizers in Right Product; Noted that it is an option in the Right Product, and to include in the fall for Intermediate and Advanced is a risk mitigation technique.

Group Recommendation: Table 5

Recommendation for Acceptance: Advanced Level

Right Product: Added “slow / controlled release, inhibitors / stabilized nitrogen based on quantified field variability”

Right Rate: Remove concave/convex terminology

Change to - “...**quantified** field variability (precision farming techniques, ex. Digitized soil maps, grip sampling, satellite imagery, real time crop sensors.) complimented by in season crop monitoring”

Right Time: The fall application was qualified with “if using slow / controlled release fertilizer or inhibitors / stabilized nitrogen”

DP xx

Advanced level – Right Product/Rate/Time as per edited table:

1. Accept = 12
2. Accept with more work = 9
3. Hold for now = 0

100% CONSENSUS - ACCEPT This option is accepted today as part of the standardized protocol for GHG emissions reduction with more work after the workshop.

Discussion – Question raised as to whether there is enough distinction between levels; it was noted that the Right Rate column is basically the crux of the progressive nature of the protocol – the rest complement.

Group Recommendation: Table 5

Recommendation for Acceptance: Proposed Modifiers (arbitrary numbers/level of decreasing modifier under discussion)

Basic: No changes (0.8)

Intermediate: Changed from 0.65 to 0.6

Advanced: No changes (0.5)

DP xx

Proposed Modifiers – To have modifiers with incremental values as one moves from Basic up to Intermediate to Advanced :

1. Accept = 8
2. Accept with more work = 13
3. Hold for now = 0

100% CONSENSUS - ACCEPT This concept of modifiers is acceptable but this option needs more work following the workshop. No vote occurred on the numbers as the technical/scientific experts were not comfortable with the modifiers proposed.

Discussion – the modifiers seem too aggressive. Focus should be on mitigating risk for the modifiers with more substantiation associated with them to justify the numbers. At each level, there are clearly practices for the Prairies that we can hang some demonstrated reductions from, if not the entire combination of BMPs in each level.

More Work:

The Committee will draft a Decision paper to circulate to the technical/scientific experts for their judgement. The Decision Paper will recommend modifiers for each level, with substantiation based on prairie research that demonstrates N₂O emission reductions for a certain practice in each level. It is conservative to ignore any additional reductions arising from the companion BMPs.

Summary of Knowledge and Research Gaps

- Potential sub-levels based on soil zones, climate, etc.
- N₂O emissions from nitrification of ammonium vs. losses from de-nitrification of nitrate
- Quantify benefits (or lack thereof) of split application
- Additional guidance on "Right Place" (surface vs subsurface)
- Modifiers have very low certainty.
- Benefits of site specific / precision management
- Differences between irrigated and dry-land systems
- N₂O loss from ammonium sulfate