Quantification Protocol for Nitrous Oxide Emission Reductions

Alberta Offset System Protocol Review

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Presented by:

Rob Janzen (Climate Check)
Jamie Calendar (Blue Source)

Blue Source Canada

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Presentation Outline

- Project Description
- Process Overview
- Applicability Criteria
- Project and Baseline Conditions
  - Process Flow Diagrams
- Consistency With Alberta Offset System Criteria
- Flexibility Mechanisms
- Quantification Approach & Sample Calculation
- Questions

Description of the Project

- Protocol quantifies N_2O emission reductions achieved from the implementation of a Nitrogen fertilizer Stewardship Plan, where best practices 'modify' or reduce the emissions relative to the baseline management.

- The foundation of good fertilizer stewardship rests on the 4R principles of using the **right source** at the **right rate**, the **right time**, and with the **right placement**.

- Quantification of reductions achieved using Canada-specific methodology (adjusted for Ecodistrict conditions), plus a reduction modifier derived from expert judgment.

- Practices for 3 years prior to implementation of 4R plan are considered to be the baseline scenario.

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Process Overview

Protocol Development:

- Uses ISO 14064-2 guidelines for project level for quantification, monitoring and reporting of greenhouse gas emission reductions or removal enhancements

Seed Documents:

- Greenhouse Gas Emissions from Cropping Systems and the Influence of Fertilizer Management (IPNI)
- Technical Background Document for Nitrogen Fertilizer Use Efficiency Protocol

Technical Review

- Technical review of background papers by consensus of experts through in-person and web-based consultations.
- Technical review of draft protocol

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Process Overview

- Initial Consultation Workshop for NERP held in Calgary, 28 & 29 October 2008.
- Only participants with a research-based graduate degree in a relevant science (agronomy, plant science, soil science, etc.) voted to determine consensus.
- 22 qualified participants from Canada and USA provided >80% consensus.
- Experts approved the general design of the NERP according to the 4R stewardship model, implementing the country-specific quantification method of Canada's National Inventory Report, and using reduction modifiers for the Basic, Intermediate, and Advanced performance levels.

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Process Overview

- Gaps identified in the Consultation Workshop were addressed in a Decision Paper, which was submitted to the science experts in an on-line webinar format to further the consensus-building process.

- 16 qualified experts from Canada and USA participated in achieving >80% consensus.

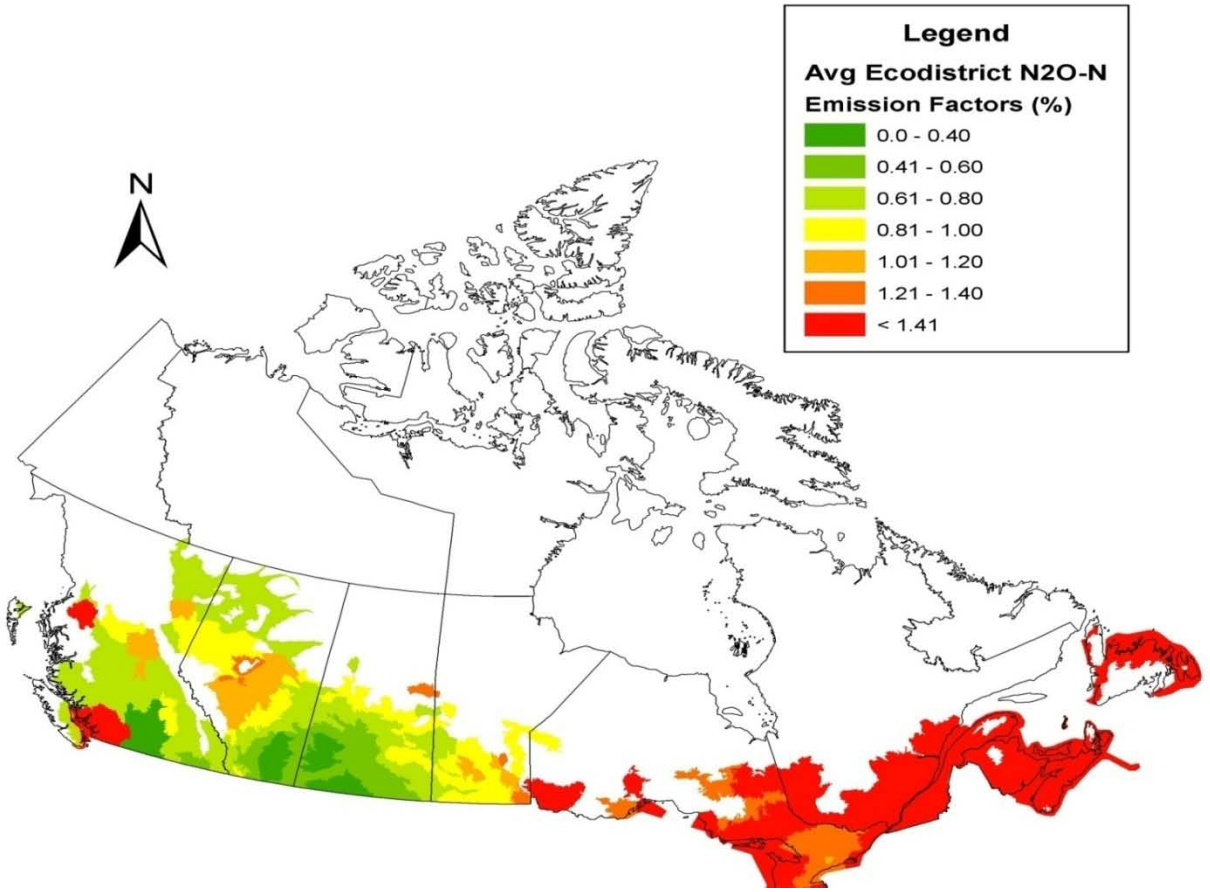
- Participants resolved the development of the NERP to allow standardization and submission to the formal review and approval process of the Alberta Offset System.

Process Overview

- In parallel with Alberta approval process, CFI, IPNI, and TFI are developing training and extension materials and programs to support implementation of the NERP across North America.
- Series of training modules with examinations are in use to train CCA's regarding the 4R system.
- CFI investigating options to support implementation of the NERP.

Process Overview

- Standardized baseline requires more development.



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Applicability Criteria

- The scope of protocol is limited to **on-farm sources, sinks, and reservoirs (SSRs)** thereby excluding upstream SSRs.
- 4-R Nitrogen Stewardship Plan must be approved by an Approved Professional Advisor (APA)
- A “graded approach” where increasingly comprehensive management practices result in greater GHG reductions.
- Potential to use the protocol with other related protocols (tillage management, summerfallow)

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Project Condition

	Right Source	Right Rate	Right Time	Right Place
Basic	• Ammonium-based formulation;	• Apply nitrogen according to recommendation of 4-R N stewardship plan,	• Apply in spring; or • Split apply; or • Apply after soil cools in fall	Apply in bands
Intermediate	• Ammonium-based formulation; and • Use slow / controlled release fertilizers; or • Inhibitors; or • Stabilized nitrogen.	• Apply nitrogen according to qualitative estimates of field variability (landscape position, soil variability)	• Apply fertilizer in spring; or • Split apply; or • Apply after soil cools in fall if using slow / controlled release fertilizer or inhibitors / stabilized nitrogen	Apply in bands
Advanced	• Ammonium-based formulation; and • Use slow / controlled release fertilizers; or • Inhibitors; or • Stabilized nitrogen.	• Apply nitrogen according to quantified field variability complimented by in season crop monitoring	• Apply fertilizer in spring; or • Split apply; or • Apply after soil cools in fall if using slow / controlled release fertilizer or inhibitors / stabilized nitrogen	Apply in bands

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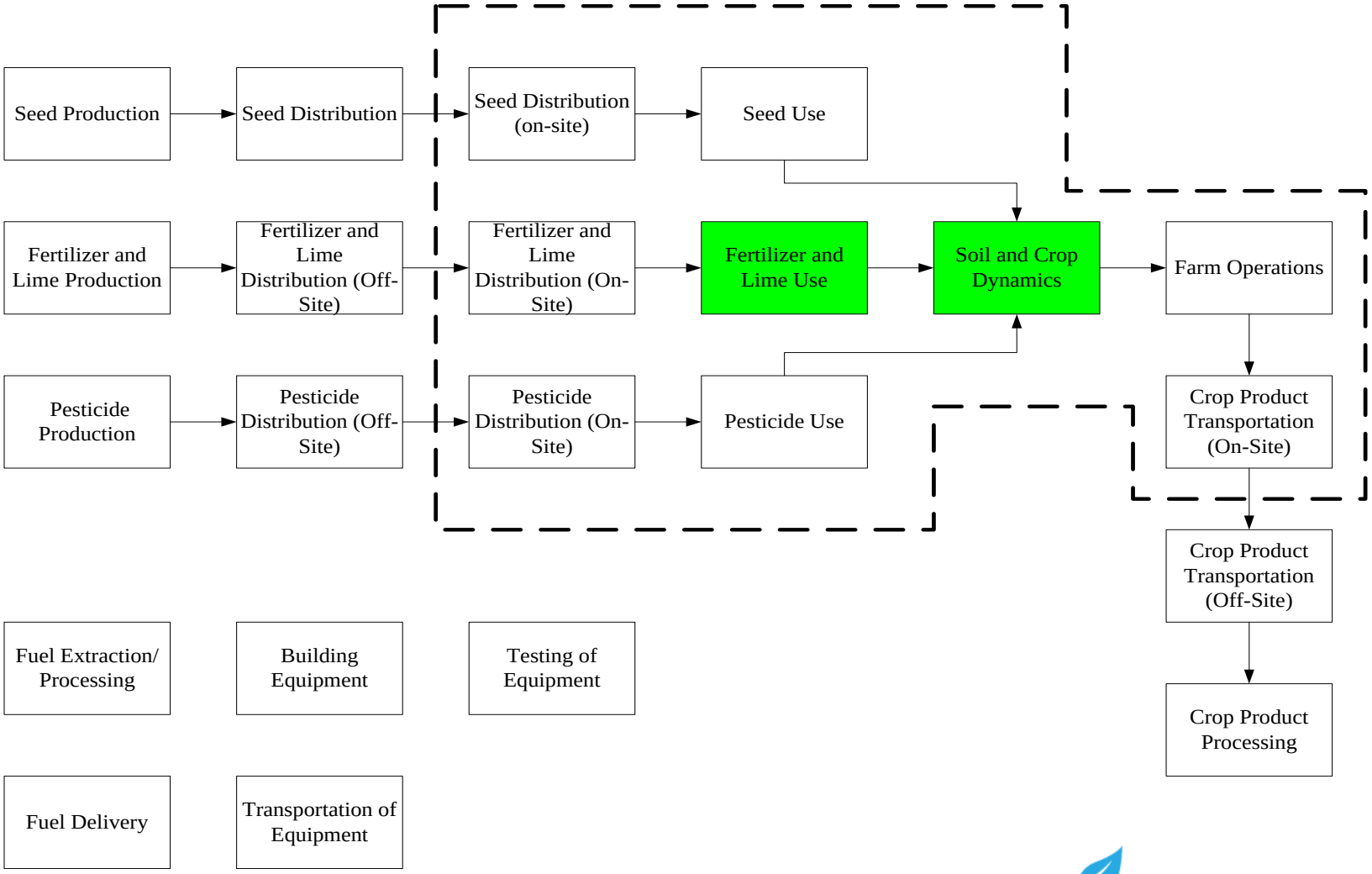
Process Flow Diagram for the Project Condition



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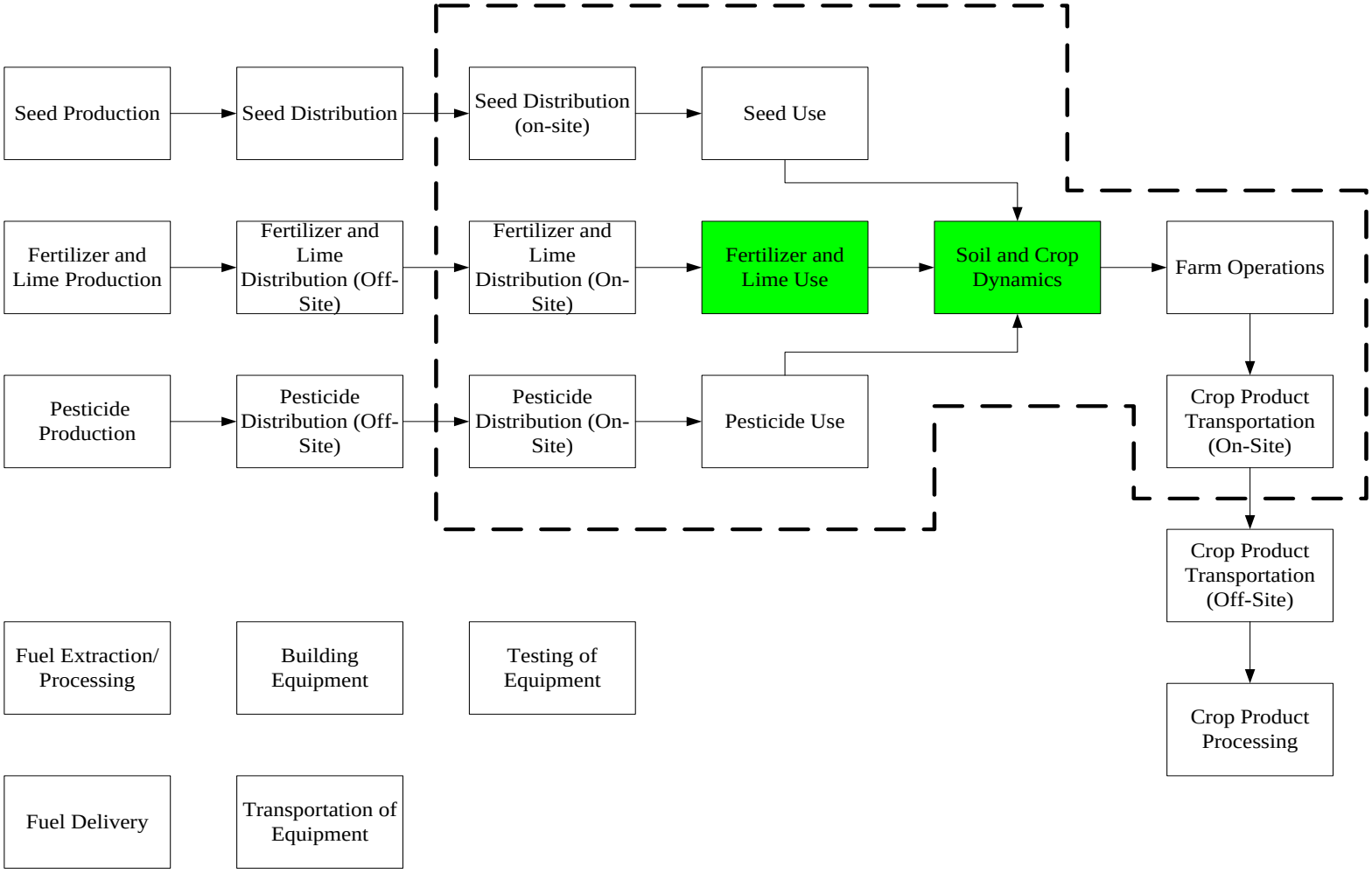
Baseline Condition

Baseline Condition:

Historic Benchmark Approach

- baseline GHG emissions are quantified for each crop event based on the historic nitrogen application rates
- Baseline emissions are farm specific and averaged over 3 years to establish the baseline
- Functional equivalence is maintained by calculating emissions per kg of crop produced on a dry matter basis

Process Flow Diagram for the Baseline Condition



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Flexibility Mechanisms

- A project proponent may choose to select non-consecutive years to set the baseline to match with data availability and to account for any extra-ordinary growing seasons;
- Protocol can be combined with other protocols where multiple projects are undertaken to lower overall greenhouse gas emission reductions;
- Standardized baseline approach maybe used in the absence of data availability.

AB Offset System Eligibility Criteria

Real:

- Baseline emissions represent practices in place prior to the implementation of a 4R stewardship plan
- The estimated GHG reductions associated with BMPs can be related directly to indices of nitrogen use efficiency calculated on a per unit crop yield (mass/unit area)

Quantifiable:

- Quantification based on the tonnes of CO_2 emissions 'modified' or reduced relative to the baseline management practices through the implementation of the 4Rs

Not Required By Law / Counted Once:

- Facilities that are required to reduce emissions under the SGER can not receive offsets

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Project Implementation: Barriers & Co-benefits

Barriers:

- Lack of science concerning GHG emission associated ‘stacked’ BMPs
- Lack of capability of farmers and their professional advisors to design and implement 4R N stewardship plans (programs for grower extension, professional training, and aggregator support are being developed)

Co-benefits:

- Decreased loss of N into the environment (improved air and water quality). For this reason, NERP is currently indicated for co-implementation by potential participants in the Wetlands Protocol).
- Increased yield of crops.
- Transforming tool for nutrient management.

Review of Existing Projects

- Management practices are specific to individual farming operations, thus the exact methods applied at Alberta farming facilities will vary.
- 30% of Alberta farms do not perform annual soil nutrient testing at all, with 44% of farms performing the test on a periodic basis (every 2 to 5+ years) (StatsCan).
- Only 11% of Alberta's farms had developed and implemented nutrient management plans (StatsCan).
- Projects will require implementation of the 4R plan, so

Quantification Approach

- Canada-specific quantification method accounts for N_2O emissions based on amount of N added to the system;

- The reduction modifier gives credit for decreased N_2O losses (and increased N efficiency) associated with innovative N management at increasing degree of landscape-directed approach.
  - Basic Level: $F_{BASIC} = 0.85$
  - Intermediate Level: $F_{INT} = 0.75$
  - Advanced Level: $F_{ADV} = 0.75$

Quantification Approach

$$\text{Emission Reduction}_{\text{crop i}} = \sum[(\text{Emissions}_{\text{Baseline, crop i}} - \text{Emissions}_{\text{Project, crop i}} * \text{RM}_{\text{crop i}}) * \text{Area}_{\text{crop i, field y}} * \textbf{Crop}\ \text{Production}_{\text{crop i, field y}}] - \text{Emissions}_{\text{Project, Fertilizer Dist}}$$

$$\text{Emissions}_{\text{Project, crop i}} = N_2O_{\text{Project, crop i}}$$

$$\text{Emissions}_{\text{Baseline, crop i}} = N_2O_{\text{Baseline, crop i}}$$

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Sample Calculation

See Word document

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Questions?

Rob Janzen
Climate Check
RJ@Climate-CHECK.com
www.climate-check.com

Jamie Callendar
Blue Source Canada
jamiec@bluesourcecan.com
www.bluesource.com