Nitrous Oxide Emission Reduction Protocol (NERP)

Introduction

Alberta has introduced first-of-its-kind legislation in North America that gives agricultural producers new ways to benefit from helping to reduce greenhouse gas emissions. The result is the Alberta Offset System, which includes a number of protocols producers can follow in order to earn carbon offsets from documented improvements to practice changes. These may be sold in the carbon offset market.

Alberta Agriculture and Rural Development (ARD) has developed a series of Protocol Summary documents to provide producers with a brief introduction to each of the protocols related to agriculture, including the one you are reading here on the protocol related to nitrous oxide emission reduction. Producers interested in pursuing projects that meet the requirements of these protocols can get more information through the website links and contact information provided at the end of this document.

The Opportunity for Producers

The opportunity for generating carbon offsets with the NERP protocol arises from the direct and indirect reductions of nitrous oxide (N_20) emissions achieved through the implementation of a 4-R (Right Source@ Right Rate, Right Tịme and Right Place™) Nitrogen (N) Stewardship Plan for agricultural lands. This protocol is designed for incremental improvements in nitrogen management.

Benefits of Improved Nitrogen Stewardship

There are many other benefits from using improved nitrogen stewardship in addition to those acknowledged in the protocols.

Improves nitrogen use efficiency. Reducing nitrogen fertilizer application to achieve current crop yields or increases crop yields with current nitrogen fertilizer rates, saving money on fertilizer purchases.

Reduces nitrogen losses (leaching and/or denitification). Prevents over application of nitrogen fertilizer by monitoring soil test nitrogen levels.

Precision farming. Variable rate nitrogen fertilizer application targets field areas that will best balance crop nitrogen demands and fertilizer application.

Farm data systems. Sets up producers for other emerging environmental market opportunities that require documentation

Key Details

The key details of this protocol fall into several categories.

Main requirements

For most protocols, earning carbon offsets is based on showing "before" and "after" practice change that results in lowering of GHG emissions. This protocol provides you with options for implementation of best management practices (BMPs) in the context of a comprehensive 4-R (Right Source@, Right Rate, Right Time and Right Place™) Nitrogen Stewardship Plan. The implementation of a comprehensive 4-R Nitrogen Stewardship Plan reduces the amount of nitrous oxide emitted, through the improved utilization of the 4-Rs.

The protocol recognizes two categories: Basic and Intermediate. As you move from Basic to Intermediate there is a greater reduction occurring.

The scope of this protocol is limited to on-farm reductions of nitrogen sources such as fertilizer, manure and crop residues from crop events. However, the reduction coefficients used in this protocol assume that when comparing the project and baseline scenarios for all other aspects of crop production management, the GHG impacts are negligible.

To use this protocol, producers must provide evidence that a 4-R Nitrogen Stewardship Plan has been implemented. Three years of historical operations data prior to implementation of the 4-R Nitrogen Stewardship Plan, for each crop event (i.e. area under a particular crop for a given year) are also required for each participating farm. The crop event is the operational unit for which N_2O emissions intensity (N_2O per kg crop) is calculated for Baseline and Project. The crop event has three elements: crop type, crop year, and management zone. The crop type is the annual or perennial crop. For annuals, the crop year is accounted from harvest of previous crop to harvest of current crop. For perennials (baled or grazed forages and silages), the crop year is accounted from last harvest of previous year to last harvest of current year. The management zone varies with the selected performance level for which the 4-R Plan is designed, and thus will vary between baseline and project. Farming operations that include pulse crops are eligible to use this protocol. Farms that utilize manure are also included in this protocol.

This protocol does not address changes in manure management practices, but manure nitrogen sources must be accounted for in the plan. Other soil management protocols (i.e. Conservation Cropping) can be used in conjunction with this protocol.

To be eligible, producers need to produce annual crops and have dated farm records that show where nitrogen fertilizer management has occurred during the protocol application period (e.g. field records, field investigations, farm implement measures, machinery receipts). Farmers also need records that show ownership and any contracts related to the land being claimed for carbon offsets. A data management system, to support the date that the records were created, improves ease of use for 3rd party verifiers. The farmer must also affirm with a signature that the records provided are accurate and true.

Protocol Approach

Producers must implement a specific set of best management practices (BMPs), as per the general guidance included in the protocol. In order to determine the emissions reduction modifier associated with their project condition, the required BMPs described in table 1 of the protocol must be implemented. This 4-R Nitrogen Stewardship Plan must then be signed-off by an Approved Professional Advisor (APA) to ensure its eligibility for the use of this protocol. The Approved Professional Advisor is an individual who has proof of professional accreditation (such as a qualified P.Ag.) and proof of successful completion of the Canadian Fertilizer Institute's 4-R training Course. The signed-off 4-R Stewardship Plan is not the Offset Project Plan, but it must be in place before the project can be implemented, and the Offset Project Plan must refer to it.

This graded approach, which moves to more comprehensive and efficient levels of nitrogen management, results in greater N_2O emissions reductions. The protocol does this by requiring more comprehensive data for N recommendations, more extensive monitoring procedures in the 4-R N Stewardship Plan, and more sophisticated BMPs. The baseline management for the producer is determined by the APA, in cases where the management is already at the basic level of 4-R N Stewardship Plan this will be the new baseline to compare against- resulting in only a 10% modification or reduction as the producer moves to intermediate or advanced performance levels.

Emission reductions are quantified based on the difference between baseline and project for each crop event (i.e. area under a particular crop in the baseline, and area under a particular crop in the project- under the 4-R N Stewardship Plan) and quantified by comparing the N_2O emissions between the baseline and project and applying the emission reduction modifier in order to determine the amount of reductions resulting from the farm's implementation of the 4-R N Stewardship Plan.

Baseline emissions are determined based on three years of data, for the crop event prior to the implementation of the 4-R N Stewardship Plan. In cases where three years of historical data on crop events are not available, a flexibility mechanism allows Producers to utilize a standardized baseline.

The quantification of direct and indirect N_2O emissions from more sophisticated use of fertilizer in this protocol is based on published emission factors from Canada's National Inventory Report and is calculated as a proportion of the amount of fertilizer nitrogen applied. This quantification is performed on an eco-district basis, which accounts for variables associated with soil type, texture, topography, and climate.

In order to ensure functional equivalence when comparing the baseline and project calculations, the emission reductions are expressed on a per unit mass of crop produced per unit area basis.

As research advances and more BMPs are developed, these will be added to NERP to achieve greater N_2O emission reductions.

Additional important considerations
Aggregators can help. Farmers will not usually earn enough carbon offsets to enter the marketplace individually, as buyers are typically seeking offsets that represent carbon dioxide emission equivalents in the thousands of tonnes. That's where "aggregators" come in.

These service providers seek to pull together offsets from many different farmers, to produce a much larger project/ package of offsets that is easier to manage (reduced verification costs and reporting requirements) and easier to sell. They also typically handle for farmers many of the requirements of dealing in the Alberta Offset System, such as identifying and registering the specific acres for which emission reductions will be calculated.

There are a growing number of aggregators in Alberta and a list of these is available on the Farmers Advocate website, at http://www1.agric.gov.ab.ca/$department/deptdocs.nsf/all/ofa13569

Link to the full Nitrous Oxide Emissions Reduction Protocol with more details:
http://environment.gov.ab.ca/info/library/8294.pdf

For an online course on NERP see the Canadian Fertilizer Institute website:
http://www.cfi.ca/nitrousoxideemissionreductionprotocol

Link to the main Alberta Agriculture Carbon Market page with information sheets on all the agricultural protocols:
http://www.agriculture.alberta.ca/agcarbonoffsets

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For more information contact the Ag-Info Centre at 310-FARM (3276) or Paul Jungnitsch at 780-427-3801

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TABLE 1. Overview of the 4-R N Stewardship Plans and BMP Performance Levels for the Drier Soils in Canada*

Performance Level	Right Source	Right Rate	Right Time	Right Place	Reduction Modifier
Basic	Ammonium-based formulation	Apply nitrogen according to recommendation of 4-R N stewardship plan**, using annual soil testing and/or N balance to determine application rate.	Apply fertilizer in spring; or Split apply; or Apply after soil cools in fall	Apply in bands/ Injection	0.85
Intermediate	Ammonium-based formulation; and 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/ Injection	0.75
Advanced	Formula must be ammonium based; and Use slow/controlled release fertilizers; or Inhibitors; or Stabilized nitrogen	Apply nitrogen according to qualified field variability (e.g. digitized soil maps, grid sampling, satellite imagery, real time crop sensors) and complimented by in season crop monitoring	Apply fertilizer in the spring; or Split apply: or Apply after soil cools in the fall if using slow/controlled release fertilizer or inhibitors/stabilized nitrogen.	Apply in bands/injection	0.75***

* Most of Alberta Drier soils defined as those Ecodistricts with a Precipitation/Potential Evapotranspiration ratio (P/ PE) < 1.0
**4-R N Stewardship Plan must account for all sources of N, including previous crop residues, fertilizer, manure or biosolids applications. Plan also prescribes assessment of N in crop, so this serves to supplement or replace information from soil testing.
***Consensus was not achieved at the science workshop to determine Advanced level modifier; review scientists were not confident that actual measurable differences between Intermediate and Advanced can be proven at this time.