

QUANTIFICATION PROTOCOL FOR EMISSION REDUCTIONS FROM DAIRY CATTLE

ALBERTA FARMERS CAN FOLLOW THIS PROTOCOL TO QUALIFY FOR CARBON OFFSETS UNDER THE ALBERTA OFFSET SYSTEM.

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.

Record keeping is critical. To qualify for offsets, producers need to document practices for the periods both before and after they adopt emissions-reducing practice changes. This is critical not only to earn offsets, but to protect producers from liability if there is any challenge to the carbon offset credits they are claiming.

THE OPPORTUNITY FOR PRODUCERS

A top priority for the development of protocols that relate to agriculture is to focus on opportunities that have value for improving production in their own right, yet also accomplish the goal of reducing greenhouse gas emissions.

This quantification protocol has been developed with the purpose of quantifying greenhouse gas (GHG) emissions and emission reductions from dairy farms in Canada. GHG emissions are to be normalized to unit of “GHG emissions per unit of fat corrected milk (FCM) produced”.

The scope of the protocol encompasses the animals, buildings, and land which constitute the biophysical system of a dairy farm. However, because of the complexity of the system, and because of on-going development of other GHG quantification protocols in Canada, some aspects of the animal/building/land system are simplified or excluded.

This protocol is intended to quantify emissions and emission reductions of carbon dioxide (CO₂), methane (CH₄), and nitrous oxide (N₂O) for dairy farms

in Canada. The main sources of GHG emissions from dairy farms include CH₄ emissions from enteric fermentation and manure, N₂O emissions from manure, and CO₂ and N₂O emissions from feed production. Although the type of GHG emissions reduced under this protocol will be dependent on the specific project(s) undertaken, the majority of projects will result in emission reductions of CO₂, CH₄, and N₂O.

KEY DETAILS

The key details of this protocol fall into several categories.

Main requirements

- All projects sold in the Alberta Offset System are required to take place on dairy farms located in Alberta. For the purpose of this protocol, a “dairy farm” is described as any farm which produces milk for eventual retail sale. For this protocol, a “dairy farm” may conduct other farming practices such as beef or veal farming, while maintaining its status as a “dairy farm” provided that it continues to produce milk for retail sale.

Calculating offsets

- This protocol provides flexibility for the user by introducing Basic and Advanced approaches to GHG emission quantification for specific sources. The Basic approach for quantification will use accepted emission factors or default assessments of feed quality/GHG emissions, while the Advanced approach will require on-site measurement (with proper calibrations and QA/QC procedures). Basic and Advanced approaches are not available in all quantifications; wherever flexibility is an option, the requirements and result of each approach will be stated.



- Protocol participants using the Basic approach will use a discount factor to decrease the number of GHG reductions created. To be eligible for “Advanced approach” benefits, participants in the protocol must follow the Advanced approach for all quantification calculations which offer such flexibility (no Basic approaches may be followed).

Main areas of greenhouse gas reductions are:

- **Increased milk production**
- **Retaining fewer replacement heifers**
- **Increased feed efficiency**
- **Manure management changes**

The reductions will be assessed against a baseline level of GHG emissions (also calculated per kg FCM), which need to be calculated as the average of three years of emissions before the project start. So, each participating farm will use its own data (animal inventory, feed quality, feed quantity, milk production, manure spreading) to calculate baseline emissions per unit of milk on a 3.7 per cent fat corrected basis.

Definitions

- **Acid Detergent Fibre (ADF)** - The fibrous, least-digestible portion of roughage. ADF consists of the highly indigestible parts of the forage, including lignin, cellulose, silica and insoluble forms of nitrogen. Roughages high in ADF are lower in digestible energy than roughages that contain low levels of ADF. As ADF levels increase, digestible energy levels decrease.
- **Concentrates** — A broad classification of feedstuffs which are high in energy and low in crude fibre (<18% Crude Fibre). This can include grains and protein supplements, but excludes feedstuffs like hay or silage or other roughage.
- **Dry Cows** – Cows that are not producing milk (not lactating).
- **Dry Matter** - Total weight of feed minus the weight of water in the feed, expressed as a percentage. May also be referred to as: dry, dry basis, dry result, or moisture-free basis. You can convert from As-fed basis or dry matter basis by using the following formulas: DM basis = As-fed basis x (Dry Matter %/100) or As-fed basis = DM basis x (Dry Matter %/100).†
- **Dry Matter Intake (DMI)** - all the nutrients contained in the dry portion of the feed consumed by animals.
- **Edible Oils** - Oils derived from plants that are composed primarily of triglycerides. Although many different parts of plants may yield oil, in commercial practice oil is extracted primarily from the seeds of oilseed plants. Whole seeds can be applied as a feed ingredient so long as the oil content is calculated on a dry matter basis to achieve the 4 to 6% content in the diet.
- **Enteric Methane Emission** - Methane (CH₄) released by cattle (or other ruminants) as part of the normal digestive process.
- **Fat Corrected Milk (FCM)** – Quantity of milk, normalized to a common energy basis. FCM is used in the scientific literature to mean 4 % percent fat corrected milk. The equation for calculating it is given as:

$$\text{g milk} + \{(15 \times \% \text{ fat}/100)\} \times \text{kg milk}$$

However, for this protocol, the milk quantity is corrected to 3.7 per cent fat. And, the equation is:

$$\text{kg } 3.7\% \text{ FCM} = (\text{kg milk production} * (3.7 / \text{actual fat } \%).$$

- **Forage** – High fibre feed, produced from grasses and legumes. Examples of forages include hay, pasture or silage. Forage is often referred to as roughage.
- **Gestation** - The carrying of an embryo or fetus.
- **Gross Energy** – The total energy contained in feed; measured by calorimetry.
- **Hay** – Dried forage used for feed.
- **Heifer** – A young, female cow that has not given birth to a calf.
- **Ionophores** – Antimicrobial compounds fed to animals to improve feed efficiency.
- **Lactation/Lactating** – Process of producing and/or secreting milk.
- **Liquid Manure** – Manure with water added to it during the collection, storage, or treatment process.
- **Methane (CH₄)** – A greenhouse gas with a global warming potential (GWP) of 21.
- **Neutral Detergent Fibre (NDF)** - commonly called “cell walls.” NDF give a close estimate of fibre constituents of feedstuffs as they measure cellulose, hemicellulose, lignin, silica, tannins and cutins. Neutral detergent fibre has been shown to be negatively correlated with dry matter intake. As the NDF in forages increases, animals will be able to consume less forage. NDF is used in formulas to predict the dry matter intake of cattle.
- **Nitrous Oxide (N₂O)** - A greenhouse gas with a GWP of 310.
- **Pasture** - Land with vegetation used for grazing of cows and other livestock.
- **Protein** - Complex compounds containing carbon, hydrogen, oxygen, nitrogen and usually sulphur - composed of one or more chains of amino acids. Proteins are essential in the diet of animals for growth, lactation and reproduction. In ruminants (for example, cattle), the rumen microbes break down about 80 per cent of the protein in the feed to ammonia, carbon dioxide, volatile fatty acids and other carbon compounds. The microbes then use the ammonia to synthesize their own body protein. As feed is passed through the rumen into the rest of the digestive tract, the micro-organisms containing about 65 per cent of the high quality protein are washed along too. The ruminant obtains most of its required protein by digesting these micro-organisms.
- **Quota** – The quantity of milk a dairy farmer is permitted to sell.
- **Replacement Cattle** – Young cattle (calves, heifers, bulls) raised on a farm to replace milk cows removed from the herd.
- **Silage** – High-moisture fodder that is compressed and fermented (used as feed).
- **Solid Manure** – Manure that has not undergone any treatment process involving the addition of water.
- **Total Mixed Ration (TMR)** - Consists of all the feed ingredients — concentrates, forage, minerals and vitamins — mixed together to form the ration allowance for the animal.

Source: Dairy Reference Manual (3rd Edition). Penn State University.

Additional important considerations

- Importance of farm data. Detailed data and documentation are necessary to meet the requirements of the protocol, and to support the verification to prove these requirements have been met. Farm production and management records, and wherever possible documentation from professional advisors (such as nutritionists and veterinarians), are necessary to generate offsets.
- Aggregators can help. The majority of farmers will not 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 Carbon Offset Solutions website, at www.carbonoffsetsolutions.ca/eot/resources/marketservice.html.

Capturing Credits Back to 2002. Producers may claim carbon offsets based on eligible practices adopted at any time between 2002 and the current year, as long as requirements such as having necessary records are met. However, this option will not be available after January 1, 2012 due to increased verification requirements.

LEARN MORE

Producers who are interested in pursuing projects that meet the requirements of the dairy production protocol can access more information through the following website links:

Alberta Agriculture and Rural Development – Climate Change:
[www1.agric.gov.ab.ca/\\$department/deptdocs.nsf/all/cl11618](http://www1.agric.gov.ab.ca/$department/deptdocs.nsf/all/cl11618)

Alberta Environment – Climate Change:
www.environment.alberta.ca/0923.html

Climate Change Central – Carbon Offset Solutions:
www.carbonoffsetsolutions.ca

These resources include background information, available Interpretive Guides on the protocol, as well as access to the complete Protocol Documents. Producers can also contact ARD directly at (780) 310-FARM (3276) or Toll Free at 1 (866) 882-7677.

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Disclaimer: The information provided in this document is intended as general guidance only, as a first step for agricultural producers considering projects for the Alberta Offset System protocols. Please consult the full Government of Alberta approved protocols and available Interpretive Guides for more complete information before making a decision to pursue practice change aimed at earning carbon offsets.

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