UK COWCREDIT PROJECT

A UK DAIRY INITIATIVE TO REDUCE METHANE FROM ENTERIC FERMENTATION AND SUPPORT FARMERS

MOOTRAL

Project Title	UK CowCredit project: A UK dairy initiative to reduce methane from enteric fermentation
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1 PROJECT DETAILS

1.1 Summary Description of the Implementation Status of the Project

The UK CowCredit project (Project or Project activity) aims to involve the UK dairy industry with the purpose to reduce greenhouse gas (GHG) emissions from the livestock sector. The project activity introduces Mootral® natural feed supplement into dairy cattle diet aiming to reduce methane (CH_4) emissions from enteric fermentation by direct inhibition of methanogens in the rumen. The initial project activity instance is a dairy farm of around 400 dairy cows which has implemented the Mootral® natural feed supplement into the cattle diet starting on the 7th of May 2019. The dairy farm is located in Lancashire county in North West England, United Kingdom (UK). This monitoring report covers the first monitoring period including initial project activity instance, from 07-May-2019 until 29-February 2020. The dairy farm continued to operate as planned through the monitoring period end date of this Monitoring Report

The total GHG emissions reductions generated during in this monitoring period are 309 tCO2e.

1.2 Sectoral Scope and Project Type

The Project falls under the VCS Sectoral Scope: Livestock and manure management. The Project is a grouped project.

1.3 Project Proponent

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1.4 Other Entities Involved in the Project

N/A

1.5 Project Start Date

The project start date is the 7th of May 2019. The initial instance of the project activity is a dairy farm with 400 dairy cows which has implemented the Mootral® natural feed supplement into the cattle diet starting on the 7th of May 2019.

1.6 Project Crediting Period

The project crediting period is 10 years from 07/05/2019 to 07/05/2029 (1st crediting period), twice renewable for a total of 30 years.[1] 1st Monitoring period 7 May 2019 to 29 February 2020.

1.7 Project Location

This project activity is implemented within the geographical area of the United Kingdom. The first instance included in the grouped project is located 54.0982° N, 2.6551° W. As per the Section 3.10.1 (3) of the VCS Standard v4.0 requirements, a KML file is also provided for the project activity instance.

Adress of the farm: Brades Farm, Farleton, Lancaster LA2 9LF, United Kingdom 38XW+65 Farleton, Lancaster, United Kingdom

1.8 Title and Reference of Methodology

The Project will use the VCS methodology: "VM0041 Methodology for the Reduction of Enteric Methane Emission from Ruminants through the Use of 100% Natural Feed Supplement".

1.9 Participation under other GHG Programs

The project activity has neither been registered nor is seeking registration under any other GHG programs.

1.10 Other Forms of Credit

The project activity neither has nor intends to generate any other form of GHG-related environmental credit for GHG emission reductions claimed under the VCS Program. Until today, there are no other programs in the UK under which the project is eligible to participate

1.11 Sustainable Development

The project activity is promoting sustainable development and is an action to combat climate change and its impacts, seeking to raise awareness and increase capacity on climate change mitigation and adaptation in the livestock sector. This activity is decarbonizing dairy operations and supply chains by reducing the carbon footprint of their products, services and processes.

[1] Because the project is using a new methodology it may apply the VCS version 3 crediting period option of 10 years twice renewable.

This intervention has the greatest potential to improve the environmental and social impact of the system as a whole. Methane emission from the enteric fermentation of ruminant livestock is a main source of greenhouse gas (GHG) emission within the value chain.

Furthermore, is supporting and encouraging the continued viability of small-scale cattle farming, sustaining grower communities by developing partnerships with cooperatives and producer organizations supporting small farmers. The aim is to ensure sustainable food production systems and implement resilient agricultural practices that secures productivity and production, helps maintain ecosystems and strengthens capacity for adaptation to climate change.

2 SAFEGUARDS

2.1 No Net Harm

This project does not produce any net harm.

2.2 Local Stakeholder Consultation

As the 1st monitoring period consists of a single privately-owned dairy farm and in order to assess the adequacy of the local stakeholder consultation the Project Proponent informed all the local stakeholders relevant for the project activity. Project proponent has conducted many meetings to communicate project details to the stakeholders involved. The stakeholders are:

1. People working at the farm
2. Nutritionist of the farm
3. Feedmill
4. Milk distributor
5. UK Government

The stakeholder consultation for the project activity, took place before and during the project implementation. The meetings were organised by the project proponents by email invitation and held at the farm or at the stakeholder's premises. In March 2018 the project proponent with the milk distributor, performed a market research in some local cafes exploring the acceptance of the Mootral project where no negative comments were received. An opening event of the project was made on February 2019. For this purpose, the project proponent invited the relevant stakeholders for a meeting at the feedmill and at the farm. Additionally, national authorities are informed through email exchange (May 2019).

Additionally, the project proponent and farm personnel have attended several conferences in the UK, e.g., LONDON COFFEE FESTIVAL 2019, World Agri-Tech Innovation Summit 2019, where they presented the project and people were informed about the project. We gathered useful feedback

from several stakeholder groups and there were no extra comment or concerns. Comments received verbally or by email.

Regarding the mechanism for on-going communication with stakeholders involved with projects and interested stakeholders, they have access to timely and adequate information and open communication channels with project proponents. Besides all the media coverage, Mootral SA has in place a website (https://www.mootral.com/participate/) that invites stakeholders to send their comments and suggestions through the web. An ongoing communication with the farmer and the farm's collaborators secures the operation of the project activity

The verification and validation process as required by the VCS Program verification including validation body's site visit was held on the 3rd - 4th of March.

2.3 AFOLU-Specific Safeguards

This is not an AFOLU project.

3 IMPLEMENTATION STATUS

3.1 Implementation Status of the Project Activity

The project introduced the feed supplement in the 7th of May 2019. However, the accounting for GHG reduction started the 21st of May, considering 14 days of time required for diet adaptation. Most research indicates that ruminant total-tract digestibility ordinarily adjusts to diet within 10 to 14 days[2]. There were no changes to the project proponents or other entities during this monitoring period.

3.2 Deviations

2.3.1 Methodology Deviations

There are no methodology deviations for this project

2.3.2 Project Description Deviations

This project does not use any project description deviations.

3.3 Grouped Projects

This *new project activity instances* meets all the *the eligibility criteria as the project activity instance:*

[2] Time required for adaptation of behavior, feed intake, and dietary digestibility in cattle. Richard J. Grant*, Heather M. Dann, and Melissa E. Woolpert, William H. Miner Agricultural Research Institute, Chazy, NY.

1) It meets all applicability conditions set out in the methodology VM0041.
2) Introduces and applies Mootral® natural feed supplement into dairy cattle diet since the 7th of May 2019.
3) Is in the United Kingdom 38XW+65 Farleton, Lancaster, United Kingdom
4) Uses a baseline scenario as determined in the section 3.4 of the project design document.
5) Is additional as described in section 3.5 of the project design document.

4 DATA AND PARAMETERS

4.1 Data and Parameters Available at Validation

Data / Parameter	GE_j
Data unit	MJ $head^{-1}$ day^{-1} of dry matter
Description	Average monthly gross energy intake for a specific animal group
Source of data	Records and data from livestock operator and nutritionist from Jan 2017 until the continuation of the project activity and its 1st instance.
Value applied	See Table 2
Justification of choice of data or description of measurement methods and procedures applied	Gross energy intake is being calculated by dividing dry matter intake by the energy density of the feedstuff (using equation 4 from the applied methodology) The gross energy (GE) content of the diets is calculated based on the fat level of the diets, therefore the livestock operator or associated partners is demonstrating the fat content of the diet. Parameter to be updated with any change in the animal's feeding regime. Monthly records are being monitored and provided o the project proponent.
Purpose of Data	Calculation of baseline emissions
Comments	Calculated based on measured Daily Dry Matter Intake (DMI)

Data / Parameter	DMI_j

Data unit	Kg head^{-1} day^{-1}
Description	Average dry mass of feed consumed by an animal in a given day
Source of data	Records and data from livestock operator and nutritionist from Jan 2017 until the initiation of the project activity from the 1st instance.
Value applied	See Table 2
Justification of choice of data or description of measurement methods and procedures applied	Data are being provided by the livestock operator and associated partners for each animal group. The farm records must document the average daily dry matter intake by animal grouping in the project. Parameter to be updated with any changes in the animal's feeding regime.
Purpose of Data	Calculation of baseline emissions
Comments	Required to calculate gross energy intake for equation 3

Data / Parameter	Ym_j
Data unit	Dimensionless
Description	Percentage of feed energy converted to methane for each animal group
Source of data	UK NIR 2017 (Issue 2), Table A 3.3.4 "Dairy Cows Tier 2 Methane Emission Factors". The 1st instance of the project activity is using 6.5% as the diet is with an average of 30% NDF. Default values provided in table 8 (Appendix III) of the methodology applied. Therefore, the source of the data for the 1st instance is the NDF records provided by the farm nutritionist.
Value applied	6.5%
Justification of choice of data or description of measurement methods and procedures applied	National environmental agencies are accurate sources and comply with the VCS standards. Table 8 in Appendix III from the methodology provides Ym values derived from cattle with diets containing various levels of neutral detergent fibers (NDF). The NDF values of the feed used in the project must be available in order to use Table 8. Parameters to be updated each crediting period where new data exists.

Purpose of Data	Calculation of baseline emissions
Comments	N/A

Data / Parameter	NDF_j
Data unit	Dimensionless
Description	Forage quality indices (% Neutral detergent fibers)
Source of data	Records and data from livestock operator and nutritionist from Jan 2017 until the continuation of the project activity and its 1st instance.
Value applied	30% (average)
Justification of choice of data or description of measurement methods and procedures applied	Data must be provided by the livestock operator or associated partners for each animal group. The assessment of the quality of forages is typically provided by the farmer's nutritionist formulating the rations for the animals. NDF values are used to determine the Ym. Detailed information can be found in appendix III of the VCS Methodology used for this project activity.
Purpose of Data	Calculation of baseline emissions
Comments	N/A

Data / Parameter	ED
Data unit	MJ per kg of dry matter
Description	Energy content of dry matter
Source of data	Default value
Value applied	19.10 for 1st instance of project activity as the diet includes edible oils with fat contents below 4% (Average 3.7%)
Justification of choice of data or description of measurement methods and procedures applied	Farm specific values are used, when available, otherwise use the typical values provided below: The typical energy density of feedstuff is:

	- 18.45 MJ kg'$^{-1}$ may be used as a default for diets including edible oils with fat contents in the range of 4 to 6% - 19.10 MJ kg'$^{-1}$ may be used as a default for diets including edible oils with fat contents below 4% Parameters to be updated each crediting period where new data exists.
Purpose of Data	Calculation of baseline emissions
Comments	N/A

Data / Parameter	EC
Data unit	MJ per kg of methane
Description	Energy content of methane
Source of data	Default value taken from IPCC 2006 guidance (Section 10.3.2)
Value applied	55.65
Justification of choice of data or description of measurement methods and procedures applied	This is a standard property of methane. In addition, the *IPCC Guidelines for National Greenhouse Gas Inventories* is internationally recognized, and the data provided in the guidelines is peer reviewed. Parameters to be updated each crediting period where new data exists.
Purpose of Data	Calculation of baseline emissions
Comments	N/A

Data / Parameter	$EF_{Enteric_{i,j}}$
Data unit	kg CH_4 per animal group
Description	Enteric methane emission factor for each animal group
Source of data	Calculated using results from 5.1
Value applied	For 1st instance of project activity:

	Total per group HF per year: 35,202 Total per group Jersey per year: 13,239 Total per group per year: 48,441
Justification of choice of data or description of measurement methods and procedures applied	To allow for flexibility for potential projects, this methodology provides different options to calculate baseline emissions. For the 1st instance option 2 has been applied using farm specific data. Parameters to be updated each crediting period where new data exists.
Purpose of Data	Calculation of baseline emissions
Comment	N/A

Data / Parameter	GWP of CH_4
Data unit	tCO_2/tCH_4
Description	Global warming potential of methane
Source of data	IPCC defaults
Value applied	25
Justification of choice of data or description of measurement methods and procedures applied	The IPCC Guidelines for National Greenhouse Gas Inventories is internationally recognized, and the data provided in the guidelines is peer reviewed. To be updated each crediting period where new data exist or accepted by Verra.
Purpose of Data	Calculation of baseline emissions
Comments	N/A

Data / Parameter:	$ERF_{Enteric\ j}$
Data unit:	Percentage (dimensionless)
Description:	Enteric emission reduction factor

Source of data:	Provided by the feed manufacturer for each animal group or calculated using equation 7 of the applied methodology. Data records and study report of farm operations. Study: Vrancken, H.,Suenkel, M.,Hargreaves, P.R.,Chew, L.and Towers,E.(2019) Reduction of Enteric Methane Emission in a Commercial Dairy Farm by a Novel Feed Supplement. Open Journal of Animal Sciences, 9, 286-296.
Value applied	20.7% and 38.3 % factors applied for the 1st instance of the project activity
Justification of choice of data or description of measurement methods and procedures applied	Fir the 1st instance the project proponent provided evidence to demonstrate the percentage enteric CH_4 reduction for each animal group. Parameters from the feed manufacturer must apply the most conservative value of the uncertainty component.
Purpose of Data	Determination and calculation of project emissions
Comments	N/A

4.2 Data and Parameters Monitored

Data / Parameter:	N_{ij}
Data unit:	Number of animals (head)
Description:	Average number of head in each animal grouping *j* in the farm *i* consuming a supplement during the monitoring period.
Source of data:	Data records of livestock operations using the feed supplement. Livestock inventory records
Description of measurement methods and procedures to be applied:	Count by farm personnel recorded into farm's records system. The farm is using a farm management software, Uniform, where all data are recorded. Each animal has a unique identification and each time a cow is visiting the milk parlour individual data are being recorded. Average monthly values are provided to the project proponent.
Frequency of monitoring/recording:	Single value depending on the number of heads in each animal grouping using the natural feed supplement. Measured by daily or weekly average records.

Value applied	Average monthly number of cows per group used for the 1st instance. See Table 2
Monitoring equipment	Farm's software management system
QA/QC procedures to be applied:	Each farm record must list the number of animals in each group. Management and monitoring system to be established by the project proponent at the start of project. It could include data recording and verification procedures. Records are available to cross check against Farm's livestock inventory records, feed records, etc.
Purpose of data:	• Calculation of baseline emissions • Calculation of project emissions • Calculation of emission reduction
Calculation method:	No calculations are needed.
Comments:	Monitoring is established at the feed purchaser level. An appropriate and unique identification system for the purchasers, e.g. Project participant name, tax identification number, number of animals in each group, unique invoice number and date, would avoid double counting of emissions reduction claimed. At the time of reporting, baseline and project emissions shall be calculated based on livestock population, climatic conditions and other factors specific to the project and time period.

Data / Parameter:	Days
Data unit:	Days
Description:	Number of days project activity implemented in the specific animal grouping.
Source of data:	Data records of livestock operations using project feed supplement
Description of measurement methods and procedures to be applied:	Monthly records are available for the 1st instance
Frequency of monitoring/recording:	Once for start date of supplement feeding and once for end date of supplement feeding, for each animal grouping.

Value applied	See Table 2
Monitoring equipment	Feed records from Farm's software management system
QA/QC procedures to be applied:	Management and quality control system to be established by the project proponent at the start of project. It could include data recording and verification procedures. The number of days could be less than 365. For example, in the case of young cattle the number of days represents the length of stay in a specific animal group.
Purpose of data:	• Calculation of baseline emissions • Calculation of emission reduction
Calculation method:	No calculations are needed
Comments:	N/A

Data / Parameter:	j
Data unit:	Animal grouping
Description:	Animals at each farm *i* should be grouped based on a homogenous ruminant population characterization
Source of data:	Data records of livestock operations using project feed supplement.
Description of measurement methods and procedures to be applied:	Ruminant Population Characterization: Methane emissions from ruminants vary by animal type, weight, production phase (e.g., pregnant or lactating cow), feed type and seasonal conditions. Accounting for these variations in a ruminant population throughout the year is important to accurately characterize annual emissions. Project proponents must provide evidence at each validation and verification that emissions estimates are based on a homogenous population and the herd size and individual animal characteristics remain constant for a given period. Table 10.1 Representative Livestock Categories, in the IPCC 2006 report is an example of detailed characterization required for each livestock species.
Frequency of monitoring/recording:	Once for validation and at least once per monitoring period
Value applied	2 groups. See also Table 2

Monitoring equipment	Farm's software management system
QA/QC procedures to be applied:	Management and quality control system to be established by the project proponent at the start of project. It could include data recording and verification procedures.
Purpose of data:	• Calculation of baseline emissions • Calculation of emission reduction
Calculation method:	No calculations are needed
Comments:	N/A

Data / Parameter:	FM
Data unit:	Kg per month
Description:	Amount of feed supplement purchased by the farm *i* during the monitoring period
Source of data:	Data records of livestock operations purchasing project feed supplement
Description of measurement methods and procedures to be applied:	Monitoring is established at the feed purchaser level. An appropriate and unique identification system for the purchasers, e.g. Client name, unique invoice number and date, feed purchase receipts, weights, etc. and/or; feed delivery records. Delivery notes and invoices need to be reconciled between buyer and seller to verify records integrity. Sales records should be cross-checked with both buyer and seller of the feed supplemental to make sure records are consistent.
Frequency of monitoring/recording:	Monthly
Value applied	See Table 5
Monitoring equipment	Farm records showing monthly-purchased complete feed and manufactured complete feed delivered to the farm
QA/QC procedures to be applied:	Management and quality control system to be established by the project proponent at the start of project. It could include data recording and verification procedures.

	Farm records or third-party managed data showing both monthly-purchased complete feed and manufactured complete feed delivered to each grouping
Purpose of data:	Calculation of project emissions
Calculation method:	No calculations are needed
Comments:	Necessary to measure in order to determine monthly volumes of the feed supplement purchased.

Data / Parameter:	EF_P
Data unit:	kg CO_2e kg^{-1}
Description:	Emission factor for production of feed supplement. GHG emitted per kg of feed. All activities involved at the manufacturer's production facility of the feed supplement.
Source of data:	Records and documentation provided by the feed manufacturer.
Frequency of monitoring/recording:	Monthly
Value applied	For the 1st instance per kg produced: 19 kg CO2e + 325 kg CO2e + 529 kg CO2e
Monitoring equipment	Records provided by the production site
QA/QC procedures to be applied:	These values must be based on well-documented, reliable sources (e.g., national energy balances, government publications, industry associations, WRI/WBCSD GHG Protocol)
Purpose of Data	Determination and calculation of project emissions
Calculation method:	No calculations are needed
Comments	N/A

Data / Parameter:	$EF_{T,I}$
Data unit:	tCO2e

Description:	Emission factor for transportation of feed supplement to the feed mill or directly to the farm *I* during the monitoring period. GHG emitted per kg of feed.
Source of data:	Records and documentation provided by the feed manufacturer.
Frequency of monitoring/recording:	Monthly
Value applied	1.9 tCO2e
Monitoring equipment	N/A
QA/QC procedures to be applied:	The project proponent must provide evidence to demonstrate the level of emission the monitoring period. These values must be based on well-documented, reliable sources (e.g., national energy balances, government publications, industry associations, WRI/WBCSD GHG Protocol)
Purpose of Data	Determination and calculation of project emissions
Calculation method:	No calculations are needed
Comments	N/A

Data / Parameter:	Qelec
Data unit:	MWh kg^{-1}
Description:	Quantity of electricity used by production facility supplied by the grid per kg of feed supplement produced
Source of data:	Documentation and date provided by the feed manufacturer
Description of measurement methods and procedures to be applied:	Electric utility bills provided by the manufacturer. For the production of the feed supplement, the monitoring would be for the manufacturer to provide the electricity consumption at the specific production line used for the manufacturing of the monthly quantity. Alternatively, where product line level data is not available the manufacturer can use a ratio based on the percentage the feed supplement represents in the total volume produced by the facility.

Frequency of monitoring/recording:	Monthly
Value applied	For one year: Total Electricity Consumption, kWh per total Production Quantity, KG Unit E: 75 Unit G: 1,271
Monitoring equipment	Records provided by the production site
QA/QC procedures to be applied:	To confirm the production of feed supplement monthly production output data, need to be available by the manufacturer.
Purpose of data:	Calculation of project emissions
Calculation method:	No calculations are needed
Comments:	N/A

Data / Parameter:	EF_{elec}
Data unit:	kg CO2e KWh^{-1}
Description:	Emission factor for electricity
Source of data:	UK Government Conversion Factors for greenhouse gas (GHG) reporting, https://www.gov.uk/government/publications/environmental-reporting-guidelines-including-mandatory-greenhouse-gas-emissions-reporting-guidance
Description of measurement methods and procedures to be applied:	Default values must be sourced from recognized, credible sources and be geographically and temporally relevant to project specifics. Estimation, reference values must be obtained from the relevant national GHG inventory. The value used should be consistent with the source of generation. In the absence of local or regional data, reference values may be obtained from the most recent version of the IPCC guidelines for National Greenhouse Gas Inventories.

Frequency of monitoring/recording:	Annual
Value applied	0.2556 kg CO2e KWh^{-1}
Monitoring equipment	N/A
QA/QC procedures to be applied:	N/A
Purpose of data:	Calculation of project emissions
Calculation method:	No calculations are needed
Comments	The latest approved versions of CDM tools "Tool to calculate the emission factor for an electricity system" may be used to determine Efelec where country or state/province data are not available. https://cdm.unfccc.int/methodologies/Pamethodologies/tools/am-tool-07-v7.0.pdf

Data / Parameter:	TEF
Data unit:	Tonnes per km or miles per kg of feed (tCO2 $kg^{-1}km^{-1}$)
Description:	Emission factor values for each mode of transport m
Source of data:	UK Government Conversion Factors for greenhouse gas (GHG) reporting, https://www.gov.uk/government/publications/environmental-reporting-guidelines-including-mandatory-greenhouse-gas-emissions-reporting-guidance
Description of measurement methods and procedures to be applied:	Default values must be sourced from recognized, credible sources and be geographically and temporally relevant to project specifics. These values must be based on well-documented, reliable sources. The range of appropriate data must be documented and the chosen data must be justified, using criteria that include data source (recognized and authoritative sources); geographic, temporal and technology specificity; conservativeness (i.e., does not overestimate emission reduction); and where the data is peer reviewed (preferred)
Frequency of monitoring/recording:	Monthly
Value applied	- HGV (all diesel), Rigid (>7.5-17 tonnes), 50% Laden, kg CO2e/tonne/km (freighting goods): 0.27393

	- HGV (all diesel), Rigid (>17 tonnes), 100% Laden, kg CO2e/tonne/km (freighting goods): 0.12125
Monitoring equipment	N/A
QA/QC procedures to be applied:	Where more than one recognized source is available, the most appropriate source must be selected, based on data quality indicators including technological appropriateness, regional specificity, and vintage of the data.
Purpose of data:	Calculation of project emissions
Calculation method:	No calculations are needed
Comments:	N/A

Data / Parameter:	D*i*
Data unit:	Distance unit (e.g. kilometers, miles)
Description:	Total distance travelled by the production site to the feedmill and then to the farm
Source of data:	Data provided by the project proponent or manufacturer
Description of measurement methods and procedures to be applied:	Distance travelled by transport mode m delivering feed supplement consumed during the monitoring period to the project location, farm. Where the feed supplement goes through a feedmill then the distance to the feedmill should be measured and not to the farm.
Frequency of monitoring/recording:	Monthly
Value applied	246 km to feedmill and 152 km to the farm
Monitoring equipment	N/A
QA/QC procedures to be applied:	N/A
Purpose of data:	Calculation of project emissions
Calculation method:	No calculations are needed
Comments:	N/A

4.3 Monitoring Plan

The monitoring plan involves the monitoring, collection, and reporting of all data described in Section 4.2 above. The responsibility for monitoring lies with the project proponent, Mootral SA and the dairy farm.

The project proponent has established a monitoring plan and GHG information system. The system includes an online spreadsheet for obtaining, recording, compiling and analyzing data, parameters and other information important for quantifying and reporting GHG emissions.. Furthermore, people involved in the project received relevant training, to ensure that monitoring duties will be performed by trained staff.

A summary of roles and responsibilities is as follows:

Table 1 Project activity roles and responsibilities

Organisation	Roles	Activities
Mootral SA	Environmental Solution Provider	• Owner of the proprietary natural feed supplement, Mootral • Supplier of natural feed supplement for enteric methane emission reduction. • Carbon projet proponent.
Brades Farm	Farmers	• Dairy farm feeding ruminants with the feed supplement • Providing data

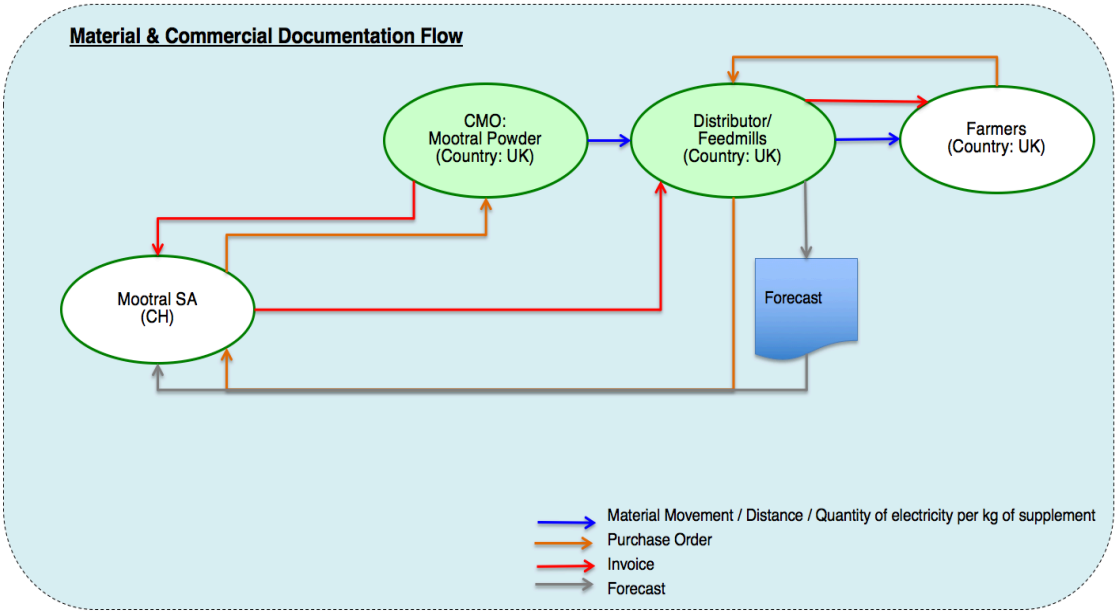
Data required for the calculation of net emissions reductions are registered in either electronic form through the farm's software or on paper worksheets on the premises by the farmer or a farmer's collaborator, e.g., veterinarian or nutritionist. The farm's nutritionist is responsible for uploading online all the necessary data. The farmer has in place a management system allowing the farmer, among others, to control the feed quantity, animal number and lifecycle stage, milk yield. The source of the data is the farm software (Uniform), the sample milk analysis (NML) reports and veterinarian's reports. Any change in the process frequency or any change made in the used technology must be reported and recorded online. Online access allows periodic controls of the monitoring records by the project proponent. Data records can be cross-checked to ensure the results are consistent with the raw farm data.

The project proponent must be able to demonstrate the ruminants for which it is claiming emission reductions have been fed with the appropriate quantity of feed supplement. In order to do so, project proponent has provided detailed feeding records as per manufacturer instructions (applicability condition 3c) for each farm as well as proof of purchase of an appropriate quantity of the feed supplement. Proof of purchase may be provided through delivery receipts and invoices, which must contain batch information, or other identification information, that can trace the feed supplement back to the manufacturer.

Supply of Mootral product to the herd on a regular and consistent basis is validated by the auditor through a documentary audit of the supply chain / purchase process and a physical inventory of the product stocks at the farm

The monitoring process is further summarized below as a line diagram, 1. Also, a spreadsheet is available for the verification.

Figure 1 Monitoring process



Quality control and quality assurance procedures will guarantee the quality of monitored data. All data will be archived electronically and backed up regularly. All necessary documents are collected and centrally stored by the project proponent and be available for verification at any time. The data subject to monitoring and required for the determination and further verification are archived and stored in electronic format by the project proponent for at least two years for at least two years after the first crediting period.

5 QUANTIFICATION OF GHG EMISSION REDUCTIONS AND REMOVALS

5.1 Baseline Emissions

The baseline emissions are calculated in accordance with the methodology VM0041. The baseline emissions are calculated using equation 3 in the methodology. Equation 3 becomes:

$$EF_{Enteric_{i,j}} = \left[GE_j \bullet Y_{m,j} \bullet N_{i,j} \bullet Days_{i,j}\right] \bullet EC^{-1}$$

Where:

$EF_{Enteric_{i,j}}$	Enteric CH4 emissions factor for each animal group j during the monitoring period (kg CH4 group^{-1})
GE_j	Average gross energy intake per animal group 1 and 2 in the farm *i* (MJ head^{-1} day^{-1})
Ym_j	6.5%
Days	298
$N_{i,j}$	Average number of head in each animal grouping *j* in the farm *i* in the monitoring period (dimensionless)
EC	Energy content of methane (=55.65 MJ kg^{-1} of CH_4)
i	Identification of livestock farm (1)
j	Animal grouping (1,2)

Gross energy intake GE is calculated by multiplying dry matter intake by the energy density of the feedstuff:

$$GE_j = \left[DMI_j \bullet ED\right]$$

Where

DMI_j	Average dry mass of feed consumed by animal group 1 and 2 in a given day (Kg head^{-1} day^{-1})
ED	Energy Density. Average energy content of dry matter =19.10 MJ kg^{-1}

Table 2 Animal grouping parameters and data

Animal Grouping										
Month	**May 2019**	**June 2019**	**Jul 2019**	**Aug 2019**	**Sept 2019**	**Oct 2019**	**Nov 2019**	**Dec 2019**	**Jan 2020**	**Feb 2020**
Days	11	30	31	31	30	31	30	30	31	29
Average monthly number of heads in each animal grouping										
Number of lactating HF(N)	190	251	242	243	235	227	226	227	241	242
Number of lactating Jersey	103	128	148	134	134	138	139	144	142	136
Month	**May 2019**	**June 2019**	**Jul 2019**	**Aug 2019**	**Sept 2019**	**Oct 2019**	**Nov 2019**	**Dec 2019**	**Jan 2020**	**Feb 2020**
DMI of each animal grouping (kg/lactating cow/day):										
DMI of lactating HF	21	22	22	24	26	25	24	24	22	22
DMI of lactating Jersey	15	15	16	18	15	15	15	14	14	14
GEI of each animal grouping										
Lactating HF	403	428	426	456	495	478	458	458	414	428
Lactating Jersey	284	288	304	338	288	280	290	271	273	271

Results:

Dairy livestock group – 1st project instance	$EF_{Enteric,j}$ during this monitoring period	$BE_{Enteric,j}$ during this monitoring period
Group 1 (Dairy cows, Holstein-Friesian)	35,202	880
Group 2 (Dairy cows, Jersey)	13,239	331
Total	**47'988**	**1'211**

Attached are electronic spreadsheets as a separate file to facilitate the verification of the results.

5.2 Project Emissions

Project emissions are calculated according to Equation 6, as follows:

$$PE_{Enteric\ i} = \sum_{j=1}^{N}[EF_{Enteric_{ij}}] \bullet [1 - ERF_{Enteric_j}] \bullet \frac{GWP}{1000} + EFME_i$$

Where:

1)

Dairy livestock group	$ERF_{Enteric}$	$EF_{Enteric_{i,j}} \bullet (1- ERF_{Enteric}) \bullet \frac{GWP}{1000}$
Group 1 (Dairy cows, Holstein-Friesian)	20.7%	698
Group 2 (Dairy cows, Jersey)	38.3 %	204
Total	-	**902**

Where:

Table 3 Animal grouping parameters and data

Parameters $PE_{Enteric}$										
Month	**May 2019**	**June 2019**	**Jul 2019**	**Aug 2019**	**Sept 2019**	**Oct 2019**	**Nov 2019**	**Dec 2019**	**Jan 2020**	**Feb 2020**
Lactating HF	26	74	74	80	81	78	72	72	72	69
Lactating Jersey	8	20	25	25	21	22	22	21	22	19

2) **According to the VCS methodology we need to calculate the following**

$$\mathrm{EFME}_{\mathrm{i}} = \frac{\mathrm{FM}_{\mathrm{i}} \bullet \mathrm{EFP}}{1000} + \mathrm{EFT}_{\mathrm{i}}$$

Where:

$EFME_i$ Total emissions associated with manufacturing and transport of the feed supplement in the farm i during the monitoring period (tCO_2e)

FM_i Amount of feed supplement purchased by the farm i during the monitoring period (kg)

EFP Emission factor for production of feed supplement (kg CO_2e kg^{-1})

EFT Emissions for transport of feed supplement consumed during monitoring period to the farm i (tCO_2e)

Input Data

a) **Manufacturer facility power consumption**

All Mootral related activities at the manufacturer are in Unit G and E[3]. The consumption Unit G has been estimated at 4,238kWh per month. We conclude that Mootral represents a 3% of the total power utilisation of Unit G, for the following reason:

Batch size per campaign run= 1,000 kg

Lead time per campaign run =1.88

To produce 1'560 kg, we need 1.88 weeks= 1.56/52 = 3.0% (52 weeks per year)

UK factor[4]: 1kwh= 0.2556 kg CO2e

Total months for Brades farm 1st verification May until February = 10 months

Therefore, **Manufacturer Facility Unit G Mootral power consumption = 325 kgCO2e**

The consumption at Unit E has been estimated at 152.4 kWh kWh per month. We conclude that Mootral represents a 5.9% of the total power utilisation of Unit E. The average storage quantity per month in Unit E, is 31,864.5 Kg. Mootral production quantity for the 1st verification period is 1,560kg

Total months for Brades farm 1st verification May until February = 10 months

Manufacturer Facility Unit E Mootral power consumption = 19 kg CO2e

b) **Energy consumption from pelleting process at Feedmill facility.**

The process requires no steam and no conditioning from the BOA(heating), and requires 41.5 kWhr per tonne produced. The electricity type used is national grid electricy.

We know that from April 2019 until Feb 2020 Feedmill delivered 49,825kg of Mootral pellets at Brades farm.

Therefore, 49.825 tonnes of Mootral require 2,068 kWH

[3] We have excluded from the calculations 1) equipment energy consumption as it is part of Unit G power consumption, and 2) Unit H (offices & R&D) at the manufactury

[4] UK Government Conversion Factors for greenhouse gas (GHG) reporting, https://www.gov.uk/government/publications/environmental-reporting-guidelines-including-mandatory-greenhouse-gas-emissions-reporting-guidance

UK factor[5]: 1kwh= 0.2556 kg CO2e

Therefore, **total energy used for pelleting process = 528.514 kg CO2e**

c) **Mootral powder is being transported from Manufacturer facilty to Feedmill facility.**

Each time we transport at **300-315 kg for 2019**, the distance between the manufactury and the feedmill from google map is 246 km. From 2019 and until Feb 2020 (monitoring period), we delivered a total of 1 delivery of 300 kg and 4 deliveries of 315 kg (1st delivery April 2019 last delivery Jan 2020).

Therefore, the emissions generated from the transportation of Mootral to the feedmill (for all deliveries) were: **Emissions from transportation to feedmill** = 105 $kgCO_2e$

Table 4 Emissions from Transport to the feed mill

Transport from the manufactury to the feedmill					
Distance, km	246				
Total deliveries (01 Apr 2019 - 29 Feb 2020)	5				
Total distance, km	1,230				
Total quantity per delivery, tonne	0.3	0.315	0.315	0.315	0.315
HGV (all diesel), Rigid (>7.5-17 tonnes), 50% Laden, kg CO2e/tonne/km (freighting goods)	0.27393				
Total emission per tonne delivered, kg CO2e/tonne/km	20.22	21.23	21.23	21.23	21.23
Total emission from transportation during monitoring period, kg CO2e	105				

[5] UK Government Conversion Factors for greenhouse gas (GHG) reporting, https://www.gov.uk/government/publications/environmental-reporting-guidelines-including-mandatory-greenhouse-gas-emissions-reporting-guidance

d) The feed supplement is being incorporated in a pellet at the **feedmill and then transported to Brades farm.**

For pelleting, the production happened at the feedmill site, then the pellets were transported to a temporary site for storage. Therefore, we have taken the distance from the feedmill to to the storage to Brades Farm, 152 km.

Vehicles type for transporation to the farm was provided by Dugdale and they mentioned they will do endeavour to run their vehicles full at all times, hence we assumed 100% laden. HGV (all diesel), Rigid (>17 tonnes), 100% Laden.

Therefore, emissions from transportation to the farm= 918.27 kgCO2

Table 5 Emissions from Transport to the farm

Transport from feemil to the Farm											
Distance, km	152										
Total deliveries (01 Apr 2019 - 29 Feb 2020)	11										
Total distance, km	1'672										
Total quantity per delivery, tonne	4.00	4.85	1.00	4.88	5.00	5.00	4.98	5.00	5.13	5.00	5.00
HGV (all diesel), Rigid (>17 tonnes), 100% Laden, kg CO2e/tonne/km (freighting goods)	0.1212										
Total emission per tonne delivered, kg CO2e/tonne/km	73.72	89.39	18.43	89.85	92.15	92.15	91.69	92.15	94.45	92.15	92.15
Total emission from transportation during monitoring period, kg CO2e	**918.27**										

According to the VCS methodology we need to calculate the following

$$EFME_i = \frac{FM_i \bullet EFP}{1000} + EFT_i$$

Where:

$EFME_i$ Total emissions associated with manufacturing and transport of the feed supplement in the farm i during the monitoring period (tCO_2e)

FM_i Amount of feed supplement purchased by the farm i during the monitoring period (kg)

EFP Emission factor for production of feed supplement (kg CO_2e kg^{-1})

EFT Emissions for transport of feed supplement consumed during monitoring period to the farm i (tCO_2e)

From a) - d) we have:

FM_i For 2019 we delivered 1,560kg of Mootral to the feedmill and 49,825 to the farm

EFP 19 kg CO2e + 325 kg CO2e + 529 kg CO2e

EFT 105 kg CO2e + 918.27 kg CO2e

Therefore,

Total emissions:

$$EFME_i = \frac{FM_i \bullet EFP}{1000} + EFT_i$$

$$\mathbf{EFME_i = 1.896\ tCO2e}$$

The Tool for testing significance of GHG emissions in A/R CDM project activities describes that the GHG emissions by sources, possible decreases in carbon pools and leakage emissions not marked are considered insignificant if their sum is lower than 5% of net anthropogenic removals by sinks.

We have estimated that the first instance of the project activity has achieved a net reduction of 309tCO2e. The GHG emissions generated by feed production are considered insignificant as their sum is lower than 5% of net anthropogenic removals by sinks.

Therefore, **significance of GHG emissions from feed production = 1.896 tCO2e / 309tCO2e = 0.6%**

Total emissions:

$$\mathbf{EFME_i = 1.896\ tCO2e}$$

Attached are electronic spreadsheets and detailed documents as separate files to facilitate the verification of the results.

5.3 Leakage

In the context of the methodology applied for this project activity, leakage could potentially consist of a change in the number of animals in the livestock operation due to livestock performance impacts of introducing the supplement, thereby necessitating changes in livestock populations

in non-project operations to fulfill market demand. However, supplements are expected to have an insignificant impact on livestock performance. Additionally, due to the economics of livestock production, it is unlikely that the costs and risks associated with increasing or decreasing the number of animals in the operation is justified from the minimal expected changes in animal performance alone. From the initial project activity instance, no significant change has been observed regarding the number of animals in the operation. Therefore, leakage is considered to be zero.

5.4 Net GHG Emission Reductions and Removals

Emissions reductions are quantified for each year according to Equation 11.

$$ER_{Enteric\ i} = \sum_{i=1}^{N} [BE_{Enteric\ i} - PE_{Enteric\ i}]$$

Where:

$ER_{Enteric\ i}$ = 1,211 – 902 = 309 tCO2e

The *Table 6* below indicates *the reductions for the 1st instance in this monitoring period. The deviation from the PDD is because the verified monitoring period is less than a year. Therefore the reductions are 309* tCO2e *instead of 372* tCO2e.

Table 6 Calculation of the first instance of project's activity emissions

Year	Estimated baseline emissions (tCO_2e)	Estimated project emissions (tCO_2e)	Estimated leakage emissions (tCO_2e)	Estimated net GHG emission reductions (tCO_2e)
Year 2019 – Year 2020	1,211	902	0	309
Total	1'211	902	**0**	**309**