COMPOSTING PROJECT IN SANTA CATARINA

Document Prepared By Sustainable Carbon – Projetos Ambientais Ltda

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1 PROJECT DETAILS

1.1 Summary Description of the Implementation Status of the Project

The *Composting Project in Santa Catarina* was developed by Sustainable Carbon – Projetos Ambientais Ltda along with 13 swine confinement farms in Brazil, aiming to improve animal manure management systems, reduce greenhouse gases (GHG) emissions and improve the living conditions of the population on the project sites.

The project replaces the baseline Animal Waste Management Systems (AWMS) by a lower GHG emitting AWMS. All farms are located in the State of Santa Catarina, in the south region of Brazil.

The farms involved in the present project are divided into two groups:

- Brownfield farms: in these farms, swine waste was previously treated in anaerobic lagoons, which result in high GHG emissions. As part of the project activity, farmers shifted their AWMS to mechanized composting units, thus avoiding methane (CH_4) emissions.
- Greenfield farms: as part of the project activity, these farmers installed the composting unit since the beginning of their swine confinement operations. This means the composting unit was chosen instead of building anaerobic lagoons, which would be the most likely scenario in the absence of the present Project Activity.

Each farm started the full operation of the automated composting unit in a specific date, i.e., when the composting unit was installed and farm owners received training for its operation; or when the first batch of animals was received following installation. However, the project start date was defined as the date when the first farm included in this project began reducing GHG emissions by applying the composting unit, which was Fazenda Altenor on 21-May-2010.

By replacing the baseline system, the present project activity reduces methane emissions from anaerobic decay through composting, which is a controlled aerobic treatment. Therefore, the *Composting Project in Santa Catarina* resulted in a GHG emission reduction of **28,564 tonnes of CO_2e** during the current monitoring period from 01-January-2013 to 30-June-2015. In addition, this new AWMS technology treats the manure under a more controlled and economically sustainable manner.

As part of this project, animal waste is treated in a mechanized composting unit, where the liquid wastes are incorporated with dry solid substrate to be submitted to the mechanical stirring process. This process mixes the liquid and solid parts, maintaining appropriate levels of oxygen, moisture content, and temperature to ensure that organic matter degradation occurs under aerobic conditions. The final compost obtained is used to fertilize cultivated soil within each farm, or sold to local consumers.

Besides reducing GHG emissions, the project activity promotes other benefits, such as: improvement of health and working conditions; enhancement of the organic matter stabilization for later soil application; reduction of surface runoff risks from animal manure, which also reduces soil leaching and river pollution; odor reduction, thus combating vector proliferation; income distribution; access to innovative technology; capacity building of the people involved in the project; encouragement of regional integration and development of similar projects with a view to sustainable development.

The project has been fully operational on all farms since the start date described above, except for Fazenda Sítio Pickler and Fazenda Pissaia. These farms were not included in the current monitoring report following a personal decision from farm owners. The current operational status of the project in these farms is unknown.

1.2 Sectoral Scope and Project Type

The project is associated to the following scope, as per UNFCCC definitions:

13 - Waste handling and disposal

This is not an AFOLU project. This is not a grouped project. This is a bundled project involving 13 swine farms located in the State of Santa Catarina, in the south region of Brazil.

1.3 Project Proponent

Organization name	Sustainable Carbon - Projetos Ambientais LTDA.
Contact person	Thiago de Ávila Othero Marcelo Hector Sabbagh Haddad Mariana Broso Fieri Dênis Gonçalves dos Santos
Title	Thiago de Ávila Othero: Technical coordinator Marcelo Hector Sabbagh Haddad: Technical coordinator Mariana Fieri: Technical coordinator Dênis Gonçalves dos Santos: Technical analyst
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Organization name	Fazenda Sítio Pickler [1]
Contact person	Mr. Adelmo Pickler
Title	Farm owner
Address	Linha São Roque, S/N Zona Rural Arroio Trinta/SC - Brazil
Telephone	+55 49 3535-1138
Email	Not available

[1] Fazenda Sítio Pickler was not included in the current monitoring report, following a personal decision from Mr. Pickler, the farm owner.

Organization name	Fazenda Altenor
Contact person	Mr. Altenor José Basso
Title	Farm owner
Address	Linha Pinheirinho, S/N Zona Rural Nova Erechim/SC - Brazil
Telephone	+55 49 3333-0122
Email	Not available

Organization name	Fazenda Ramela
Contact person	Mr. Antônio Carlos Ramela
Title	Farm owner
Address	Linha Barreiros, S/N Zona Rural Herval d'Oeste/SC - Brazil
Telephone	+55 49 3554-0692
Email	Not available

Organization name	Sítio Santa Lúcia
Contact person	Mr. Belmirro Secco
Title	Farm owner
Address	Linha Banhado Grande, S/N Zona Rural Jaborá/SC - Brazil
Telephone	+55 49 3525-1196
Email	secco_@brturbo.com.br

Organization name	Fazenda Helena
Contact person	Mr. Diacir Coradi
Title	Manager
Address	Linha Santo Antônio, S/N Zona Rural Vargeão/SC - Brazil

Telephone	+55 49 3434-0447
Email	Not available

Organization name	Fazenda Gilmar
Contact person	Mr. Gilmar José Sinigaglia
Title	Farm owner
Address	Linha Pedreira, S/N Zona Rural Rio das Antas, SC - Brazil
Telephone	+55 49 99134-1119
Email	gilmar@contavi.com.br

Organization name	Fazenda Suruvy
Contact person	Mr. Airton Piovezan
Title	Farm owner
Address	Linha Rui Barbosa, S/N Zona Rural Concórdia /SC - Brazil
Telephone	+55 49 3425-8001
Email	Not available

Organization name	Fazenda Granja Silva
Contact person	Mr. Jair da Silva
Title	Farm owner
Address	Linha Gomercindo, S/N Zona Rural Concórdia/SC - Brazil
Telephone	+55 49 3442-8484
Email	Not available

Organization name	Fazenda Colônia Suspiro
Contact person	Mr. Nóbile Tomazi
Title	Farm owner

Address	Linha Pinheirinho, S/N Zona Rural Nova Erechim/SC - Brazil
Telephone	+55 49 98860-0650
Email	Not available

Organization name	Fazenda Colônia Zuffo
Contact person	Mr. Dario Marcos Zuffo
Title	Farm owner
Address	Linha Vista Alegre, S/N Zona Rural Rio das Antas/SC - Brazil
Telephone	+55 49 3564-2044
Email	Not available

Organization name	Fazenda Pissaia[2]
Contact person	Mr. Neimar Pissaia
Title	Farm owner
Address	Linha Chapada, S/N Zona Rural Arvoredo/SC - Brazil
Telephone	+55 49 3356-3560
Email	Not available

Organization name	Fazenda Baccin
Contact person	Mr. Renato Baccin
Title	Farm owner
Address	Linha 24 de Fevereiro, S/N Zona Rural Concórdia/SC - Brazil
Telephone	+55 49 99109-0087

[2] Fazenda Pissaia was not included in the current monitoring report. The farm was sold to a relative of Mr. Pissaia, and the current status of the project is unknown.

Email	baccin.baccin@yahoo.com.br

Organization name	Fazenda Andretta
Contact person	Mr. Selvino Andretta
Title	Farm owner
Address	Linha Amizade, S/N Zona Rural Nova Itaberaba/SC - Brazil
Telephone	+55 49 3327-0076
Email	fabianeandretta@hotmail.com

1.4 Other Entities Involved in the Project

Organization name	LPC Tecnologia Ambiental
Role in the project	Developer and provider of the Mechanized and Automated Composting Unit (UMAC[3]), which is used in the farms included in this project activity. Moreover, LPC provides assistance to the operation and maintenance of the composting unit on each farm, and support to the monitoring of the carbon project.
Contact person	Mr. Renato Baccin
Title	Director
Address	Rua Padres Franciscanos, s/n, Bairro Nra Salete, Concórdia / SC - Brazil Postal Code: 89.700-000
Telephone	+55 49 3442-2208
Email	baccin@umac.com.br

1.5 Project Start Date

The full operation[4] of the automated composting unit was defined to be the starting date at each farm, i.e., when the farm began reducing GHG emissions. Furthermore, one of the two criteria below was considered to determine the starting date at each farm:

(a) When the composting unit was installed and farm owners received training for its operation; or

(b) When the first batch of animals following event (a) was received.

[3] UMAC – Unidade Mecanizada e Automatizada de Compostagem. For more information please check the website <www.umac.com.br>.

[4] Prior to this date, only tests and field settings were performed, but the composting unit was not available to properly treat animal manure.

Table below provides the starting date and the criteria used for each farm.

Farm Name	Starting Date	Criteria used to defined the project start date (as described above)
Brownfield farms[5]		
Fazenda Altenor	21/05/2010	(b)
Fazenda Pissaia[6]	20/12/2010	(b)
Fazenda Sitio Pickler[7]	27/01/2011	(b)
Fazenda Granja Silva	14/04/2011	**(a)**
Fazenda Helena	18/10/2011	(b)
Fazenda Andretta	26/10/2011	**(a)**
Fazenda Suruvy	28/11/2011	**(a)**
Fazenda Gilmar	11/01/2012	(b)
Greenfield farms		
Fazenda Ramela	21/10/2010	(b)
Sítio Santa Lucia	29/11/2010	(b)
Fazenda Colônia Zuffo	29/11/2010	**(a)**
Fazenda Colônia Suspiro	27/07/2011	(b)
Fazenda Baccin	20/09/2012	(b)

Table 1. Starting date for each farm included in this project activity

However, the project start date was defined as the date when the first farm included in this project began reducing GHG emissions by applying the composting unit under full operation, which was Fazenda Altenor on 21-May-2010.

1.6 Project Crediting Period

The project has a crediting period of 10 years, from 01-January-2011 until 31-December-2020. According to VCS rules, the project crediting period may be renewable at most twice.

The crediting period start date was chosen to simplify the emission reductions calculation and to allow for retroactive credits generated since 2011, in accordance with VCS procedures.

[5] A definition of brownfield and greenfield farms is available on Section 1.1.
[6] Fazenda Pissaia was not included in the current monitoring period.
[7] Fazenda Sítio Pickler was not included in the current monitoring report, following a personal decision from Mr. Pickler.

1.7 Project Location

The project activity was implemented in the municipalities of Arroio Trinta, Nova Erechim, Herval d'Oeste, Jaborá, Vargeão, Rio das Antas, Concórdia, Arvoredo and Nova Itaberaba, as presented in Figure 1 and Table 2 below.

During the current monitoring period, farmers have operated the animal manure management system in accordance to the monitoring plan specified in the VCS PD. However, as described above, the farms Sítio Pickler and Pissaia, located in Arroio Trinta and Arvoredo respectively, were not included in the current monitoring report.

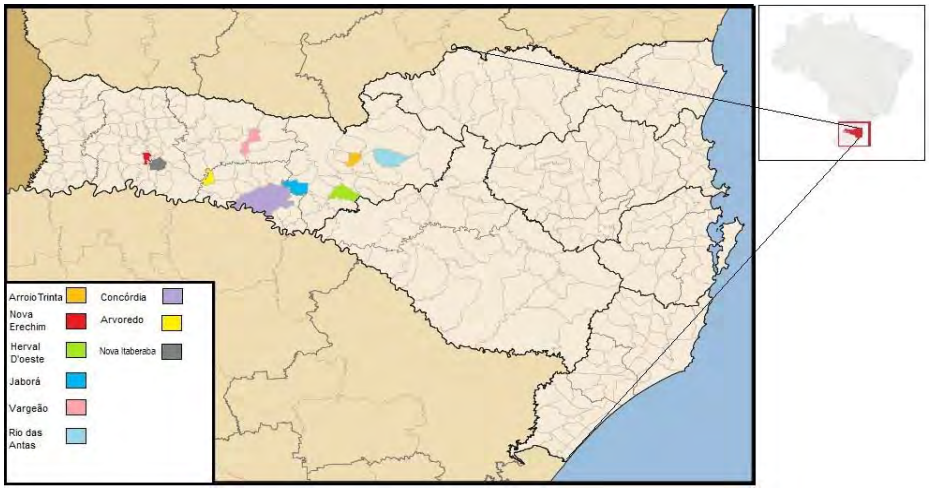

Figure 1. Location of the farms participating in the project activity

State	City	Participating Farm
Santa Catarina	Arroio Trinta	Fazenda Sitio Pickler[8]
	Arvoredo	Fazenda Pissaia[9]
	Concórdia	Fazenda Granja Silva
		Fazenda Baccin
		Fazenda Suruvy
	Herval d'Oeste	Fazenda Ramela
	Jaborá	Sítio Santa Lucia
	Nova Erechim	Fazenda Altenor
		Fazenda Colônia Suspiro
	Nova Itaberaba	Fazenda Andretta
	Rio das Antas	Fazenda Colônia Zuffo
		Fazenda Gilmar
	Vargeão	Fazenda Helena

Table 2. Location of the farms participating in the project activity

[8] Fazenda Sítio Pickler was not included in the current monitoring report, following a personal decision from Mr. Pickler.
[9] Fazenda Pissaia was not included in the current monitoring period.

The precise location of farms is identified by means of global positioning system (GPS) as displayed on Table 3 below:

ID	Farm Name	Farm owner	Address	Town	Contact	Global Positioning System[10]	
						S	W
1	Fazenda Sitio Pickler[11]	Adelmo Pickler	Linha São Roque, S/N	Arroio Trinta	Adelmo Pickler	-26.905787°	-51.302095°
2	Fazenda Altenor	Altenor José Basso	Linha Pinheirinho, S/N	Nova Erechim	Altenor José Basso	-26.913729°	-52.932355°
3	Fazenda Ramela	Antônio Carlos Ramela	Linha Barreiros, S/N	Herval d'Oeste	Antônio Carlos Ramela	-27.187098°	-51.395069°
4	Sítio Santa Lucia	Belmiro Secco	Linha Banhado Grande, S/N	Jaborá	Clodoaldo Secco	-27.128526°	-51.688554°
5	Fazenda Helena	Diacir Coradi	Linha Santo Antônio, S/N	Vargeão	Diacir Coradi	-26.905891°	-52.145477°
6	Fazenda Gilmar	Gilmar José Sinigaglia	Linha Pedreira, S/N	Rio das Antas	Gilmar José Sinigaglia	-26.916379°	-51.083891°
7	Fazenda Suruvy	Airton Piovezan	Linha Rui Barbosa, S/N	Concórdia	Gilmar Piovezan	-27.308228°	-52.068764°
8	Fazenda Granja Silva	Jair da Silva	Linha Gomercindo, S/N	Concórdia	Jair da Silva	-27.293422°	-51.900758°
9	Fazenda Colônia Suspiro	Nóbile Tomazi	Linha Pinheirinho, S/N	Nova Erechim	Lenize Tomazi	-26.903279°	-52.931321°
10	Fazenda Colônia Zuffo	Dario Marcos Zuffo	Linha Vista Alegre, S/N	Rio das Antas	Dario Marcos Zuffo	-26.974623°	-51.068915°
11	Fazenda Pissaia[12]	Neimar Pissaia	Linha Chapada, S/N	Arvoredo	Neimar Pissaia	-27.108491°	-52.411704°
12	Fazenda Baccin	Renato Baccin	Linha 24 de Fevereiro, S/N	Concórdia	Renato Baccin	-27.169646°	-52.103517°
13	Fazenda Andretta	Silvino Andretta	Linha Amizade, S/N	Nova Itaberaba	Fabiana Andretta	-26.934749°	-52.833069°

Table 3. Farms location and contact information

[10] All GPS coordinates were taken near the location where the composting machines are installed.
[11] Fazenda Sítio Pickler was not included in the current monitoring report, following a personal decision from Mr. Pickler.
[12] Fazenda Pissaia was not included in the current monitoring report.

1.8 Title and Reference of Methodology

The present project activity applies small scale methodologies approved under the Clean Development Mechanism, as follows:

- Category AMS-III.F. - "Avoidance of methane emissions through composting", version 10, valid from 04-March-2011 to 24-May-2012[13].

Calculations of baseline emissions were determined using relevant sections of:

- Category AMS-III.D. – "Methane recovery in animal manure management systems", version 18, valid from 13-October-2011 to 06-December-2012[14].

Furthermore, procedures for the calculation of project emission from electricity consumption were determined according to:

- "Tool to calculate baseline, project and/or leakage emissions from electricity consumption", version 01, valid from 16-May-2008 onwards[15].

In addition, the SOCIALCARBON Methodology[16] is being applied as a sustainability tool in association with the present VCS project.

1.9 Other Programs

- Emission Trading Programs and Other Binding Limits: The project activity is not included in an emission trading program or any other mechanism that includes GHG allowance trading.
- Other Forms of Environmental Credit: The project activity is not creating any other form of environmental credit under any specific program.
- Participation under Other GHG Programs: The project activity is not registered under any other GHG program.

2 IMPLEMENTATION STATUS

2.1 Implementation Status of the Project Activity

The VCS PD was validated by the Designated Operational Entity TÜV Rheinland (China) Ltd and this present monitoring report is being verified by RINA Services S.p.A.

[13] This version of the methodology is available at: <https://cdm.unfccc.int/filestorage/D/Y/A/DYABR6QZTOW9SH2FM1J3GP5XVKL48N/EB59_repan05_AMS_III.F_ver10.pdf?t=dmF8bnRmbTcwfDCiAXYhcj-F23lSBZzpnh3j>. Last visited on August 06th, 2015.

[14] This version of the methodology is available at: <https://cdm.unfccc.int/filestorage/9/K/Y/9KYSPHV51TNF6MO8LRICJAB0GX3Z27/EB63_repan22_Draft%20revision_AMS_III.D_ver18.pdf?t=STR8bnRmbThtfDCyEKi0h1iLTPcuxYGiID1l>. Last visited on August 06th, 2015.

[15] Tool available at: <https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-05-v1.pdf>. Last visited on August 06th, 2015.

[16] SOCIALCARBON Methodology was developed by Ecológica Institute (www.ecologica.org.br). It was founded on the principle that transparent assessment and monitoring of the social and environmental performance of projects improves their long-term effectiveness. The methodology uses a set of analytical tools that assess the social, environmental and economic conditions of communities affected by the project, and demonstrates through continuous monitoring the project's contribution to sustainable development.

The project activity reduces methane emissions and treats manure produced by small and medium swine farms in a correct manner. Mechanized composting units (UMAC system) were installed instead of using anaerobic lagoons on swine farms. Composting is an aerobic process producing little or no GHG. Emission reductions occurs because of the low methane emissions resulting from composting compared to the large amount of this GHG that would be released to the atmosphere if anaerobic lagoons were used to treat animal manure.

As described in the VCS PD, the project faces difficulties concerning both the current lack of more rigorous legislation and the common practices in the region. Therefore, without the incentive of the carbon credits, the farms involved in the project would install or maintain anaerobic lagoons to treat manure, instead of installing a mechanized composting system. This scenario would ensure compliance with local regulations, but would result in higher GHG emissions.

Besides being more economically attractive than the AWMS proposed by the project activity, anaerobic lagoons were already built in brownfield farms in accordance with Santa Catarina State environmental legislation. Even where there is the need for further investments, anaerobic lagoons would be more economically attractive because the costs would be lower than implementing a new AWMS.

Before implementing the project activity, manure was disposed in anaerobic lagoons over 1 meter deep, causing methane emissions to the atmosphere due to the anaerobic decaying of the organic matter. This occurred in all Brownfield farms and was considered the baseline scenario for all Greenfield farms, as explained in the VCS PD, version 06.1. Besides, wastes generated by anaerobic lagoons were used in liquid form for soil application onsite.

Eight swine farms involved in the current project activity operated anaerobic lagoons prior to the project initiation, since they are less expensive systems and easier to maintain and operate than composting units. The other five farms are considered Greenfield Projects, which means that they started the project activity already using the mechanized composting unit.

As part of this project activity, animal waste is treated in a mechanized composting unit, where liquid wastes are incorporated with dry solid substrate to be submitted to the mechanical stirring process. This process mixes the liquid and solid parts, maintaining appropriate levels of oxygen, moisture content, and temperature to ensure that organic matter degradation occurs under aerobic conditions. The final compost obtained is used to fertilize cultivated soil within each farm, or sold to local consumers nearby.

The project has been fully operational on all farms since the start date described above, except for Fazenda Sítio Pickler and Fazenda Pissaia. These farms were not included in the current monitoring report following a personal decision from farm owners. The current operational status of the project in these farms is unknown.

In addition, three farms operated anaerobic lagoons during this monitoring period:

- Fazenda Colônia Suspiro: as from 01/May/2015, the composting unit was partially deactivated due to maintenance, and only 25% of the manure was treated by composting during this maintenance period, while the rest was treated using anaerobic lagoon.
- Fazenda Gilmar: this farm has never deactivated the anaerobic lagoon, which treats around 40% of the total manure generated in the farm.
- Fazenda Helena: as from 01/June/2015, the composting unit was deactivated due to maintenance and all the manure was treated using anaerobic lagoon during this period.

The operation of anaerobic lagoons in these farms was measured by the parameter Fraction of manure handled in baseline animal manure management system *j* ($MS\%_{BL,j}$), which calculates baseline emissions

by providing the fraction of manure that would be handled in the baseline treatment system (anaerobic lagoon).

Moreover, the project also adopts the SOCIALCARBON® Methodology, an innovative concept developed by the Ecológica Institute to measure the contribution of carbon projects to sustainability. The Methodology is based in six main pointers: Technology; Natural; Financial; Human; Social and Carbon Resources[17].

2.2 Deviations

2.2.1 Methodology Deviations

As described in the VCS PD version 06.1, Project Proponents have applied a minor deviation to the equation used for determining the annual average number of animals of type *LT* in year *y* (parameter $N_{LT,y}$)[18]. This adaptation increases the accuracy of emission reduction quantification, since it allows PPs to use reliable third party information to monitor key parameters related to animal production. Third party information shall be sourced from entities that are the direct responsible for measuring monitored data, such as integrators (food companies that manage the complete meat production cycle) and State Agencies.

As farms usually operate in batches lasting from 3 to 4 months, all data on animal production is documented by integrators after each batch is delivered. Batches and related documents do not follow a yearly calendar.

This deviation will not negatively impact the conservativeness of the quantification of GHG emission reductions or removals; instead, it increases the accuracy of monitoring and emission reduction calculations, as described above. Moreover, this deviation only relates to the criteria and procedures for monitoring or measurement, and does not relate to any other part of the applied methodology.

Project Proponents have also used a deviation in the monitoring of the quantity of electricity consumed by the project, which is related to emissions from electricity consumption. AMS-III.F version 10 determines it shall be assumed that all relevant electrical equipment operate at a full rate capacity, plus 10% to account for distribution losses, for 8,760 hours per year in case electricity consumption is not directly monitored.

However, given the farms management processes and their low energy consumption, a conservative value was applied. Such value is based on monitored data collected in part of this monitoring period and on LPC judgment about the expected time of operation of the manure pump and the UMAC equipment[19], which are the two only equipment demanding electricity consumption in the AWMS. Values applied on the emission reduction calculation were conservatively defined as the highest value from either:

- LPC judgement corrected with the use of a conservative factor of 125%, meaning an operation time 25% higher than expected by LPC; or
- The average operation time of each AWMS equipment, which was monitored by each farmer during part of the monitored period.

This estimate is also considered conservative given that electricity is a significant cost for the operation of the composting unit and farmers would have no interest in using the equipments longer than necessary.

[17] More information on SOCIALCARBON is available at: <http://www.socialcarbon.org>. Last visit on 10/08/2015.
[18] Please check equation 4 on Section 3.1 of the VCS PD.
[19] Estimates from LPC took into consideration the design of each individual farm. Estimates were based on the size of each composting site and the typical operating conditions of the UMAC system.

This deviation will not negatively impact the conservativeness of the quantification of GHG emission reductions or removals, since conservative estimated values were applied in case monitoring data was incomplete[20]. Moreover, this deviation only relates to the criteria and procedures for monitoring or measurement, and does not relate to any other part of the applied methodology.

Project Proponents have also used a deviation regarding the monitoring of the quantity of manure treated in the year *y* (parameter Q_y) and the quantity of compost produced in year *y* (parameter $Q_{y,treatment}$). The applied version of the methodology establishes these parameters should be monitored by on-site data measurement using weigh bridges. However, the project does not involve the transportation of waste by vehicles[21] and the compost is mostly used as fertilizer within the farm or on nearby farms, where weigh bridges are not available.

Project Proponents have proposed to determine the amount of waste composted by monitoring the number of operating hours of the pump that sends manure to the composting unit and/or applying default values. However, as data were incomplete, a conservative value was applied based on monitored data collected in part of this monitoring period and on a scientific study about the quantity of swine manure produced per animal type per day. Values applied on the emission reduction calculation were conservatively defined as the highest value of:

- Embrapa study[22]; or
- The average quantity of manure treated per day monitored by each farmer during part of the monitored period.

Since this parameter is only used to calculate project emissions, using default values is conservative as long as values are higher than monitored data. Also, the CDM Methodological Tool "Project and leakage emissions from composting" (EB 65 Annex 09) allows for a different procedure in case there are no weighing device. The tool recommends estimating the amount of waste based on the number of trucks and their capacity. Under this option, no direct measurement or calibrated equipments are used for the monitoring of the amount waste composted.

Also, since no project emissions from the produced compost are expected (as explained on Section 4.2 below), this deviation will not negatively impact the conservativeness of the quantification of GHG emission reductions or removals, as a conservative approach was chosen to monitor Q_y and $Q_{y,treatment}$. The approach is considered conservative since it is based either on on-site data or on reliable EMBRAPA default values that are applicable to local conditions. Moreover, this deviation is only related to criteria and procedures for monitoring or measurement, and does not relate to any other part of the methodology.

2.2.2 Project Description Deviations

According to methodology AMS.III.D, v.18, the Global Warming Potential (GWP) of methane was 21. However, according to UNFCCC EB 69 Annex 3, "All emission reductions and removals achieved by CDM project activities and PoAs in the second commitment period of the Kyoto Protocol shall be calculated using the global warming potentials (GWPs) adopted by the Conference of the Parties serving as the meeting of the Parties at its seventh session, in accordance with decision 4/CMP.7. This requirement shall apply from 1 January 2013, notwithstanding any GWPs stated to be applicable in the

[20] Evidence on the expected time of operation of electric equipments of each farm was provided to the Validation and Verification Body responsible for project verification.
[21] Waste is carried to composting units by gravity and electrical pumps. Compost is usually removed with wheelbarrow or small vehicles (tractors). This is applicable to all farms included in the project.
[22] OLIVEIRA, Paulo Armando V. de. **Produção e manejo de dejetos de suínos**. Concórdia: Embrapa, 2003. 83 p. Information taken from Table 1. Value adopted to the current monitoring for the amount of solid waste (in kilogram): average daily production of swine manure, including manure and urine, according to animals weight.

relevant procedures, standards, guidance, approved baseline and monitoring methodologies, methodological tools and other rules being used in relation to that project activity or PoA."[23]

In addition, the Decision 4/CMP.7., paragraph 5, states that the GWP "(...) shall be those listed in the column entitled "Global Warming Potential for Given Time Horizon" in table 2.14 of the errata to the contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change, based on the effects of greenhouse gases over a 100-year time horizon (...)".[24]

Therefore, according to Intergovernmental Panel on Climate Change - IPCC (2014), the new GWP of methane based on a 100-year time horizon is 25. This value was used to convert methane emissions to tCO_2e for calculations of baseline and project emissions.

Furthermore, according to VCS PD version 06.1, Helena Farm used to send part of the generated manure to anaerobic lagoon. Thus, carbon credits would not be claimed for the entire animal population, since waste from one barn that holds 600 animals was not sent to the composting unit, being treated in an anaerobic lagoon. However, since the end of 2012, all the swine manure generated in the farm has been treated using the composting unit. Therefore, carbon credits are claimed for the entire animal population, since all farm waste is sent to the composting unit.

2.3 Grouped Project

Not applicable. This is not a grouped project.

3 DATA AND PARAMETERS

3.1 Data and Parameters Available at Validation

Data / Parameter:	***Annual average temperature***
Data unit:	ºC
Description:	Annual average temperature at project site
Source of data:	National Institute of Meteorology (Instituto Nacional de Meteorologia – INMET). Available at: <http://www.inmet.gov.br/portal/index.php?r=clima/normaisClimatologicas>. Insert the following information to compose the graphic: Temp. Méd. Compensada (°C) and at Annual basis. Last visit on: 19-August-2015.
Value applied:	18ºC
Justification of choice of data or description of measurement methods and procedures applied:	The annual average temperature at the western region of Santa Catarina State was determined according to the data available at INMET.

[23] More information at: <https://cdm.unfccc.int/faq/Reference/Standards/meth/reg_stan02.pdf>. Last visited on: October 16th, 2015.
[24] More information at: <http://unfccc.int/resource/docs/2011/cmp7/eng/10a01.pdf#page=23>. Last visited on: October 16th, 2015.
Moreover, Table 2.14 of the errata to the contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC) can be found here: <https://www.ipcc.ch/publications_and_data/ar4/wg1/en/ch2s2-10-2.html#table-2-14>. Last visited on: October 16th, 2015.

Purpose of the data:	According to AMS.III.D version 18, this parameter is necessary to comply with the requirement described in the first paragraph of item (c): "*The annual average temperature of baseline site where anaerobic manure treatment facility is located must be higher than 5°C*". The annual average temperature at western region of *Santa Catarina* State is 18ºC according to data available from. This parameter follows the conditions of applicability of AMS.III.D. It is not used in the quantification of GHG emission reductions.
Comments	

Data / Parameter:	GWP_{CH4}
Data unit:	tCO_2e/tCH_4
Description:	Global Warming Potential of CH_4
Source of data:	Table 2.14 of the errata to the contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC) based on the effects of greenhouse gases over a 100-year time horizon.
Value applied:	25
Justification of choice of data or description of measurement methods and procedures applied:	Although the value of 21 was indicated in version 18 of the methodology AMS-III.D, this parameter shall be updated according to decisions of COP/MOP. The Annex 3 from EB 69 established that "All emission reductions and removals achieved by CDM project activities and PoAs in the second commitment period of the Kyoto Protocol shall be calculated using the global warming potentials (GWPs) adopted by the Conference of the Parties serving as the meeting of the Parties at its seventh session, in accordance with decision 4/CMP.7. This requirement shall apply from 1 January 2013, notwithstanding any GWPs stated to be applicable in the relevant procedures, standards, guidance, approved baseline and monitoring methodologies, methodological tools and other rules being used in relation to that project activity or PoA."[25] In addition, the Decision 4/CMP.7., paragraph 5, states that the GWP "(...) shall be those listed in the column entitled "Global Warming Potential for Given Time Horizon" in table 2.14 of the errata to the contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change, based on the effects of greenhouse gases over a 100-year time horizon (...)".[26]

[25] More information at: <https://cdm.unfccc.int/faq/Reference/Standards/meth/reg_stan02.pdf>. Last visited on: October 16th, 2015.
[26] More information at: <http://unfccc.int/resource/docs/2011/cmp7/eng/10a01.pdf#page=23>. Last visited on: October 16th, 2015.

	Therefore, according to Intergovernmental Panel on Climate Change - IPCC (2014), the new GWP of methane based on a 100-year time horizon is 25.
Purpose of the data:	This parameter is used to convert methane emissions to tCO_2e for calculation of baseline and project emissions.
Comments:	

Data / Parameter:	DCH_4
Data unit:	t/m^3
Description:	Density of CH_4
Source of data:	Methodology AMS-III.D., version 18 Information available on Page 3.
Value applied:	0.00067 at room temperature (20ºC) and 1 atm pressure.
Justification of choice of data or description of measurement methods and procedures applied:	Value proposed by the methodology.
Purpose of the data:	This parameter is used to convert methane emissions from cubic meters to tonnes regarding the calculation of baseline emissions.
Comments:	

Data / Parameter:	UF_b
Data unit:	Fraction
Description:	Correction factor to account for model uncertainties.
Source of data:	Methodology AMS-III.D., version 18 Information available on Page 3.
Value applied:	0.94
Justification of choice of data or description of measurement methods and procedures applied:	Value proposed by the methodology.
Purpose of the data:	This parameter is a correction factor to account for model uncertainties on the calculation of baseline emissions.
Comments:	

Moreover, Table 2.14 of the errata to the contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC) can be found here: <https://www.ipcc.ch/publications_and_data/ar4/wg1/en/ch2s2-10-2.html#table-2-14>. Last visited on: October 16th, 2015.

Data / Parameter:	MCF_j
Data unit:	Fraction
Description:	Annual methane conversion factor for the baseline animal manure management system *j*.
Source of data:	2006 IPCC Guidelines for National Greenhouse Gas Inventories, volume 4, chapter 10, table 10.17.
Value applied:	Uncovered anaerobic lagoons: 77%
Justification of choice of data or description of measurement methods and procedures applied:	The methane conversion factor of 77% for anaerobic lagoons was determined according to IPCC (2006), considering 18°C as the annual average temperature at the region where project is located.
Purpose of the data:	This parameter is used to calculate baseline emissions, providing the methane conversion factor from the use of anaerobic lagoons to treat animal manure.
Comments:	

Data / Parameter:	$B_{0,LT}$
Data unit:	m^3 CH_4/kg dm
Description:	Maximum methane producing potential of the volatile solid generated for animal type *LT.*
Source of data:	2006 IPCC Guidelines for National Greenhouse Gas Inventories, volume 4, chapter 10, table 10.A-7 and 10A-8.
Value applied:	The following values are applied:

Animal Type	Value	Reference
Market swine	0.29	Latin America
Breeding swine	0.45	Western Europe

Justification of choice of data or description of measurement methods and procedures applied:	Brazil does not have published data of the maximum methane producing potential from manure. Hence, default values sourced from IPCC (2006) were applied.
Purpose of the data:	This parameter is used to calculate baseline emissions. Provides the maximum methane producing potential of volatile solids present in manure, depending on the animal type.
Comments:	Farrowing farms included in the present project activity are in compliance with all conditions described in paragraph 10 (d) of AMS-III.D version 18. Hence, default values from developed countries can be utilized to define $B_{0,LT}$.

Data / Parameter:	$MS\%_{BL,j}$

<table>
<tr><td>Data unit:</td><td>%</td></tr>
<tr><td>Description:</td><td>Fraction of manure handled in baseline animal manure management system j</td></tr>
<tr><td>Source of data:</td><td>Project proponent</td></tr>
<tr><td>Value applied:</td><td>
<table>
<tr><th rowspan="2">Farm</th><th colspan="3">$MS\%_{BL,j}$
From 01/Jan/2013 to 30/June/2015</th></tr>
<tr><th>2013</th><th>2014</th><th>2015</th></tr>
<tr><td>Fazenda Altenor</td><td>100%</td><td>100%</td><td>100%</td></tr>
<tr><td>Fazenda Andretta</td><td>100%</td><td>100%</td><td>100%</td></tr>
<tr><td>Fazenda Baccin</td><td>100%</td><td>100%</td><td>100%</td></tr>
<tr><td>Fazenda Colônia Suspiro</td><td>100%</td><td>100%</td><td>84%</td></tr>
<tr><td>Fazenda Colônia Zuffo</td><td>100%</td><td>100%</td><td>100%</td></tr>
<tr><td>Fazenda Gilmar</td><td>60%</td><td>60%</td><td>60%</td></tr>
<tr><td>Fazenda Granja Silva</td><td>100%</td><td>100%</td><td>100%</td></tr>
<tr><td>Fazenda Helena</td><td>100%</td><td>100%</td><td>78%</td></tr>
<tr><td>Fazenda Ramella</td><td>100%</td><td>100%</td><td>100%</td></tr>
<tr><td>Fazenda Suruvy</td><td>100%</td><td>100%</td><td>100%</td></tr>
<tr><td>Sitio Santa Lúcia</td><td>100%</td><td>100%</td><td>100%</td></tr>
</table>
</td></tr>
<tr><td>Justification of choice of data or description of measurement methods and procedures applied:</td><td>All waste was sent to the baseline treatment system (anaerobic lagoons) prior to the project initiation in Brownfield farms. This is also considered the baseline scenario for Greenfield farms, since it is the common practice in the region.</td></tr>
<tr><td>Purpose of the data:</td><td>This parameter is used to calculate baseline emissions, providing the fraction of manure that would otherwise be handled on the considered baseline treatment system (anaerobic lagoon).</td></tr>
<tr><td>Comments:</td><td>As described in Section 2.1 above - Implementation Status of the Project Activity, three farms operated anaerobic lagoons during this monitoring period. The operation of anaerobic lagoons in these farms was measured by the parameter Fraction of manure handled in baseline animal manure management system j ($MS\%_{BL,j}$), based on the period within the monitoring period that each farm operated anaerobic lagoons. This approach has been carried out in order to claim emission reductions only for the manure treated by the composting process during the monitoring period, as this parameter directly impacts the GHG emission reductions.</td></tr>
</table>

Data / Parameter:	$W_{default}$
Data unit:	Kg
Description:	Default average animal weight of a defined population

Source of data:	2006 IPCC Guidelines for National Greenhouse Gas Inventories, volume 4, chapter 10, tables 10A-7 and 10A-8.
Value applied:	The following values are applied:

Animal Type	Value	Reference
Market swine	28	Latin America
Breeding swine	198	Western Europe

Justification of choice of data or description of measurement methods and procedures applied:	Default average animal weight value was obtained from IPCC (2006).
Purpose of the data:	This parameter is used to calculate baseline emissions by providing the estimated amount of volatile solid excretion rate for each animal type according to the average animal weight.
Comments:	Farrowing farms included in the present project activity are in compliance with all conditions described in paragraph 10 (d) of AMS-III.D version 18. Hence, default values from developed countries can be utilized to define $W_{default}$.

Data / Parameter:	$VS_{default}$
Data unit:	Kg dm/animal/day
Description:	Default value for the volatile solid excretion rate per day on a dry-matter basis for a defined livestock population
Source of data:	2006 IPCC Guidelines for National Greenhouse Gas Inventories, volume 4, chapter 10, tables 10A-7 and 10A-8.
Value applied:	The following values are applied:

Animal Type	Value	Reference
Market swine	0.3	Latin America
Breeding swine	0.46	Western Europe

Justification of choice of data or description of measurement methods and procedures applied:	Brazil does not have published data of the volatile solid excretion rate by animal type. Hence, default values sourced from 2006 IPCC were applied. Values for Latin America are used for market swine and for Western Europe are used for breeding swine, since farrowing farms comply with all conditions of paragraph 10 (d) of AMS-III.D, version 18. Hence, default values from developed countries can be utilized.
Purpose of the data:	This parameter is used to calculate baseline emissions by providing the estimated amount of volatile solid excretion rate for each animal type according to average animal weight.
Comments:	

Data / Parameter:	$EF_{composting}$
Data unit:	gCH_4 / kg of waste treated on a wet basis
Description:	Emission factor for composting of manure
Source of data:	2006 IPCC Guidelines for National Greenhouse Gas Inventories, table 4.1, chapter 4, Volume 5
Value applied:	4
Justification of choice of data or description of measurement methods and procedures applied:	This emission factor is described in the applied methodology to calculate methane emissions from composting
Purpose of the data:	This parameter is used to calculate project emissions from composting. It is a default value that provides composting emissions from the amount of waste composted per year
Comments:	

Data / Parameter:	$TDL_{j,y}$
Data unit:	Percentage
Description:	Average technical transmission and distribution losses for providing electricity to source *j* in year *y*
Source of data:	Approved methodology AMS-III.F, version 10.
Value applied:	10%
Justification of choice of data or description of measurement methods and procedures applied:	This value is recommended by the applied methodology AMS-III.F, version 10, as described on Table III.F.1.
Purpose of the data:	This parameter is used calculate project emissions from electricity consumption taking into consideration the expected transmission and distribution losses.
Comments:	

Data / Parameter:	***MD***
Data unit:	Kg/m³
Description:	Manure density
Source of data:	OLIVEIRA, Paulo Armando V. de. **Produção e manejo de dejetos de suínos**. Concórdia: Embrapa, 2003. 83 p.
Value applied:	1,016
Justification of choice of data or description of measurement methods	The density of 1,016 kg per m³ was obtained from a publication of an EMBRAPA researcher (Mr. Paulo Armando V. de Oliveira). Such density is applicable for swine manure with 3% of solid matter,

and procedures applied:	which is the expected value for the farms included in the project[27].
Purpose of data	This density is used to convert monitored values of Q_y (Quantity of manure treated in the year *y*) from volume to weight, regarding calculations of project emissions.
Comments:	More information on the calculation of Q_y is available on Sections 3.2 and 4.2 below.

3.2 Data and Parameters Monitored

Data / Parameter:	$VS_{LT,y}$
Data unit:	kg dm/animal/year
Description:	Volatile solids for livestock *LT* entering the animal manure management system in year *y*
Source of data:	- IPCC default value from: 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 4, chapter 10, tables 10 A-7 and 10 A-8; - W_{site}: Farmers, based on documents provided by integrators, State Agencies or other internal documents.
Description of measurement methods and procedures to be applied:	Values from IPCC were applied ($W_{default}$ and $VS_{default}$); however they were adjusted considering the weight of animals in the project sites (W_{site}). The parameter W_{site} was monitored as described in this section below.
Frequency of monitoring/recording:	Annually
Value monitored:	Detailed information on Appendix 1.
Monitoring equipment:	No monitoring equipment is used. Since this is a default value from IPCC, it is not possible to quantify the accuracy. However, the correction of this parameter with W_{site} ensures values are consistent to the project situation.
QA/QC procedures to be applied:	This parameter was calculated with monitored data on *ndy* and W_{site}. More information about QA/QC procedures can be found at the respective description of each parameter.
Purpose of the data:	This parameter is used to calculate baseline methane emissions from animal manure treatment system.
Calculation method:	Calculated through Equation 3 of VCS PD v06.1, considering the average animal weight at the project site (W_{site}), the default average animal weight ($W_{default}$) according to IPCC (2006), the default value of volatile solid excretion rate ($VS_{default}$) also according to IPCC (2006), and the number of days the system is operational during

[27] This value is used by LPC Tecnologia Ambiental on the Technical Project of the composting unit. Hence, it is considered applicable to the farms conditions.

	year *y* (nd_y).
Comments:	Data will be kept for two years after the end of the crediting period or the last issuance of carbon credits for this project activity, whichever occurs later.

Data / Parameter:	$\boldsymbol{nd_y}$
Data unit:	Days
Description:	Number of days in year *y* in which the animal manure management system is operational.
Source of data:	Project proponents
Description of measurement methods and procedures to be applied:	The number of days the manure management system is operational were obtained either from monitoring spreadsheets where farmers record operating time of the composting unit or from third party information (such as documents from integrators or State Agricultural agencies). The treatment plant is considered to be operational whenever manure is applied and/or the composting windrows are mixed with substrate to produce compost. In case third party information was used, nd_y was considered as the number of days animals are alive in the farm per year, since farmers need to operate the composting unit on a daily basis when animals are confined in the farms.
Frequency of monitoring/recording:	Annually based on daily records (monitoring spreadsheets) or monthly records (third party information).
Value monitored:	Detailed information on Appendix 1.
Monitoring equipment:	No equipment is used to monitor this parameter. Farmers filled in paper spreadsheets or stored third party information regarding animal confinement to monitor this parameter.
QA/QC procedures to be applied:	Farmers were trained for the monitoring of this parameter. Monitoring spreadsheets were cross-checked with third party information to avoid possible errors.
Purpose of the data:	This parameter is used to calculate baseline methane emissions from animal manure treatment system. It is also used to calculate project emissions resulting from electricity consumption and from composting process.
Calculation method:	*ndy* was obtained by counting the days in the years in which monitoring data indicates that the animal manure management system was operational on each farm.
Comments:	Data will be kept for two years after the end of the crediting period or the last issuance of carbon credits for this project activity, whichever occurs later.

Data / Parameter:	W_{site}
Data unit:	Kg
Description:	Average animal weight of a defined livestock population at the project site
Source of data:	Project proponents
Description of measurement methods and procedures to be applied:	The average animal weight by animal type was obtained from the following sources: 1. Third party information (such as documents from integrators or State Agricultural agencies) 2. Onsite measurements 3. Other farms included in the Project that have similar production conditions 4. Conservative default values given the project conditions
Frequency of monitoring/recording:	Periodic records provided by integrators for each batch. Integrators provide documents for each batch. Thus, animal weight controls do not follow an annual schedule; instead they are based on each batch period.
Value monitored:	Detailed information on Appendix 1. W_{site} for Finishing Unit farms were mostly obtained from Third party information, as integrators are responsible to measure animal weight. W_{site} for breeding swine found in Farrowing Unit farms were based on IPCC (2006) default values, as these are considered conservative given the project conditions. This approach is considered conservative, since breeding swine in the project region usually weight from 220kg to 250kg[28].
Monitoring equipment:	No monitoring equipment is used. Animal weight is usually measured by integrators for commercial purposes, in order to determine due financial compensations for farmers.
QA/QC procedures to be applied:	Control forms and registration documents provided by third parties (integrators, State Agencies, etc) are considered reliable sources, once data are used for financial purposes. Sustainable Carbon - Projetos Ambientais Ltda. kept a database with the information provided for each farm.
Purpose of the data:	This parameter is used to calculate baseline methane emissions from animal manure treatment system, specifically for calculating

[28] According to TALAMINI, T J D; MARTINS, F M; ARBOIT, C; WOLOZSYN, N. Custos agregados da produção integrada de suínos nas fases de leitões e de terminação. **Custos e @gronegocio online**. v. 02, October/2006. Information available at Page 75. This study was performed with farms located within the project region and the report states sows usually weight 220Kg and boars weight 250kg. Document available at: <http://www.custoseagronegocioonline.com.br/especialv2/custos%20agregados%20de%20producao.pdf>. Last visited on 19/08/2015.

	the volatile solids for livestock entering the animal manure management system ($VS_{LT,y}$).
Calculation method:	Calculated based on a weighted average of the initial medium weight and the final medium weight of animal batches at each farm per year.
Comments:	Data will be kept for two years after the end of the crediting period or the last issuance of carbon credits for this project activity, whichever occurs later.

Data / Parameter:	$N_{da,y}$
Data unit:	Days
Description:	Number of days animal is alive in the farm in the year *y*
Source of data:	Project proponents
Description of measurement methods and procedures to be applied:	Market swine: this parameter was monitored using registries from third parties (integrators, State Agencies, etc) regarding input and output data of animals in each farm. Breeding swine: this parameter was also monitored using registries from third parties (integrators, State Agencies, etc) regarding input and output data of animals in each farm. However, some breeding swine (i.e. boars and sows) usually stay in the farm during the whole year, therefore the value considered to this parameter was 365 days per year.
Frequency of monitoring/recording:	Periodic records provided by integrators for each batch. Integrators provide document control and financial arrangements for each batch, which do not follow an annual schedule; instead the frequency of monitoring is based on each batch period.
Value monitored:	Detailed information on Appendix 1.
Monitoring equipment:	No monitoring equipment is used. This parameter is usually based on third party information, such as documents from integrators and State Agencies. Therefore, although it is not feasible to quantify accuracy, a high level of accuracy is expected.
QA/QC procedures to be applied:	Control forms and registration documents provided by third parties (integrators, State Agencies, etc) are considered reliable sources, once data are used for financial purposes. Sustainable Carbon - Projetos Ambientais Ltda. kept a database with the information provided for each farm.
Purpose of the data:	This parameter is used to calculate baseline methane emissions from animal manure treatment system, specifically for calculating the annual average number of animals ($N_{LT,y}$).
Calculation method:	Calculated based on a weighted average of the period that animal batches stay in each farm per year.

Comments:	The current monitoring period starts in 01/January/2013, thus the number of days animals are alive in the farm (*Nda,y*) starts only after this date, regardless if the batch entry date was before January 2013. This approach has been carried out in order to claim emission reductions only during the current monitoring period. In addition, the Number of days animal is alive in the farm was also limited to the final date of the current monitoring period. Data will be kept for two years after the end of the crediting period or the last issuance of carbon credits for this project activity, whichever occurs later.

Data / Parameter:	$N_{p,y}$
Data unit:	Number of animals
Description:	Number of animals produced annually of type *LT* for the year *y*
Source of data:	Project proponents
Description of measurement methods and procedures to be applied:	Market swine: this parameter was monitored using registries from third parties (integrators, State Agencies, etc) regarding input and output data of animals in each farm. Breeding swine: this parameter was also monitored using registries from third parties (integrators, State Agencies, etc) regarding input and output data of animals in each farm. However, some breeding swine (i.e. boars and sows) usually stay in the farm during the whole year, and thus are not included in registries from third parties. Therefore, this parameter was monitored using internal registries from farmers. The number of animals produced was considered the annual average.
Frequency of monitoring/recording:	Periodic records provided by integrators for each batch. Integrators provide document control and financial arrangements for each batch, which do not follow an annual schedule; instead the frequency of monitoring is based on each batch period.
Value monitored:	Detailed information on Appendix 1.
Monitoring equipment:	No monitoring equipment is used. This parameter is usually based on third party information, such as documents from integrators and State Agencies. Therefore, although it is not feasible to quantify accuracy, a high level of accuracy is expected.
QA/QC procedures to be applied:	Control forms and registration documents provided by third parties (integrators, State Agencies, etc) are considered reliable sources, once data are used to financial purposes. Sustainable Carbon - Projetos Ambientais Ltda. kept a database with the information provided for each farm.
Purpose of the data:	This parameter is used to calculate baseline methane emissions from animal manure treatment system, specifically for calculating

	the annual average number of animals ($N_{LT,y}$).
Calculation method:	Total of animals *LT* produced at each farm per year (or in a specific period of time according to the current monitoring period).
Comments:	Data will be kept for two years after the end of the crediting period or the last issuance of carbon credits for this project activity, whichever occurs later.

Data / Parameter:	$N_{LT,y}$
Data unit:	Number of animals
Description:	Annual average number of animals of type *LT* in year *y*
Source of data:	Project proponents
Description of measurement methods and procedures to be applied:	This parameter was monitored based on parameters $N_{da,y}$ and $N_{p,y}$ previously described. Project Proponents have applied a minor deviation to the equation used for determining the annual average number of animals of type *LT* in year *y* ($N_{LT,y}$), as defined on the VCS PD version 06.1. This adaptation increases the accuracy of emission reduction calculations, since it allows PPs to use reliable third party information to monitor key parameters related to animal production. Third party information were sourced from entities that are the direct responsible for measuring monitored data, such as integrators (food companies that manage the complete meat production cycle) and State Agencies. As farms operate in batches lasting from 3 to 4 months, all data on animal production is documented by integrators after each batch is delivered. Batches and related documents do not follow a yearly calendar.
Frequency of monitoring/recording:	Annually, based on periodic records.
Value monitored:	Detailed information on Appendix 1.
Monitoring equipment:	No monitoring equipment is used. This parameter is calculated based on third party information, such as documents from integrators and State Agencies. Therefore, although it is not feasible to quantify accuracy, a high level of accuracy is expected.
QA/QC procedures to be applied:	Farmers are responsible for storing data regarding animal production, such as control forms and registration documents provided by integrators. Sustainable Carbon - Projetos Ambientais Ltda. kept a database with the information provided for each farm.
Purpose of the data:	This parameter is used to calculate baseline methane emissions from animal manure treatment system.
Calculation method:	The annual average number of animals of type *LT* was calculated

	using the Equation 4 described in VCS PD version 06.1, considering the number of days animals are alive in the farm ($N_{da,y}$) and the total number of animals produced ($N_{p,y}$) in year *y*. The annual average number of animals ($N_{LT,y}$) was calculated by Sustainable Carbon technical team. However, as described above, a minor deviation is used to calculate this parameter in this project. Given that documents regarding the production of animals are not generated annually, but based on batches, a period of time different than 365 is usually considered. Hence, $N_{LT,y}$ is obtained by dividing the number of animals produced by the number of days in the period of time considered[29].
Comments:	Data will be kept for two years after the end of the crediting period or the last issuance of carbon credits for this project activity, whichever occurs later.

Data / Parameter:	$Q_{y,treatment}$
Data unit:	Tonnes
Description:	Quantity of compost produced in year *y*
Source of data:	Project proponents
Description of measurement methods and procedures to be applied:	Farmers monitored the amount of compost produced per year using spreadsheets. Compost was measured using standard storage units with known volume or weight. In addition, farmers measured the amount of storage units every time compost is used or sold.
Frequency of monitoring/recording:	Annually, based on monthly records.
Value monitored:	Values monitored are available at Appendix 1. For detailed information, please check VCS MR Calculation spreadsheet. Spreadsheet template can be found in Appendix 2, which was used for monitoring the quantity of compost produced per year, sale price, and final destination.
Monitoring equipment:	Storage bags with predefined weight or volume. The indirect measurement procedure chosen to monitor this parameter is expected to result in low levels of accuracy. However, procedures with higher precision are not feasible given the farmers reality. Also, no project emissions from the produced compost are expected. Hence, the low accuracy of this parameter is not expected to affect the calculation of GHG emission reductions during the current monitoring period.

[29] The period of time considered in a specific year is the period between the entry date of the first batch managed in the year and the end date of the last batch managed in the year.
End dates are limited to the monitoring period end date. This ensures emission reductions are not claimed for a period beyond the monitoring period.

QA/QC procedures to be applied:	Farmers were trained on the project monitoring in order to achieve a higher accuracy in the determination of this parameter.
Purpose of the data:	This parameter is monitored as requested by the applied methodology. However, since compost is not subject to anaerobic treatment or disposal, no emissions are associated to the amount of compost produced. Therefore, it is not used in the quantification of GHG emission reductions.
Calculation method:	The total quantity of compost produced per year was monitored through farmers' records, which also detailed the final destination of compost (i.e. usage, sale, etc).
Comments:	As previously described in section 2.2.1 (Methodology Deviations), project proponents applied a deviation regarding the monitoring of the quantity of compost produced in year *y* (parameter $Q_{y,treatment}$). The applied version of the methodology establishes this parameter should be monitored by on-site data measurement using weigh bridges. However, compost is mostly used as fertilizer within the farm or on nearby farms, where weigh bridges are not available. Data will be kept for two years after the end of the crediting period or the last issuance of carbon credits for this project activity, whichever occurs later.

Data / Parameter:	$EC_{PJ,j,y}$
Data unit:	MWh
Description:	Quantity of electricity consumed by the project electricity consumption source *j* in year *y*
Source of data:	Project proponents
Description of measurement methods and procedures to be applied:	As predicted in the VCS PD v.06.1, farmers would record the frequency of operation of the manure pumps and of the mixing equipment (Mechanized and Automated Composting Unit - UMAC) in spreadsheets on a daily basis. These are the only two equipment demanding electricity consumption in the AWMS. Since monitoring data is incomplete for the current monitoring period, this parameter was conservatively defined as the highest value of: • LPC judgment corrected with the use of a conservative factor of 125%, meaning an operation time 25% higher than expected by LPC was considered. • The average operation time of each equipment as monitored by each farmer during part of the monitored period. The approach used and the value applied for each farm is available in Section 3.3 – Monitoring Plan, below.

Frequency of monitoring/recording:	Daily
Value monitored:	Detailed information on Appendix 1.
Monitoring equipment:	No equipment is used to monitor this parameter. Monitoring is based on default value applied to all farms. The indirect measurement procedure chosen to monitor this parameter is expected to result in low levels of accuracy. However, procedures with higher precision are not feasible to apply given the farmers reality. Project emissions from electricity are expected to be quite low compared to emission reductions (around 1%). Hence, the low accuracy is not expected to significantly affect the calculation of emission reductions during the crediting period.
QA/QC procedures to be applied:	Farmers were trained on the project monitoring in order to achieve a higher accuracy in the determination of this parameter. In addition, Sustainable Carbon shall manage the project database and check possible errors. Estimated values were only applied when it was possible to ensure that their use resulted in a conservative calculation of emission reduction. In addition, estimated values were compared either to existing data of the same farm (for different periods of time) or to data from other farms with similar operating conditions. Such comparison confirmed that estimated values were in most cases conservative.
Purpose of the data:	This parameter is used to calculate project emissions from electricity consumption.
Calculation method:	Farmers recorded the exact time period per day they operated the mixing equipment (UMAC) and the manure pump only during part of the monitored period. Thus, estimated value was also applied. Estimated values were defined by LPC and are described on Annex 2 of the VCS PD v06.1. However, when those default values could not be considered conservative, project proponents utilized the existing data (average operation time of each equipment), which was then extrapolated for the whole monitoring period.
Comments:	Currently, electricity consumption is measured for the whole farm, which includes several components that are not within the project boundary. Project Proponents have used a deviation in the monitoring of the quantity of electricity consumed by the project. This monitoring approach has been chosen since it is not feasible to measure the electricity consumption separately for the operation of each AWMS. This would require installing equipments and making changes to electricity systems within the farm, which are costly. Given the farms management processes and their low energy consumption, a conservative value was applied. Such value is

	based on monitored data collected in part of this monitoring period and on LPC judgment about the expected time of operation of the manure pump and the UMAC equipment. More information is available on Section 2.2.1 – Methodology Deviation. Data will be kept for two years after the end of the crediting period or the last issuance of carbon credits for this project activity, whichever occurs later.

Data / Parameter:	$EF_{EL,j,y}$
Data unit:	tCO_2/MWh
Description:	Emission factor for electricity generation for source *j* in year *y* (tCO_2/MWh)
Source of data:	Brazilian Designated National Authority (DNA)[30]
Description of measurement methods and procedures to be applied:	Sustainable Carbon – Projetos Ambientais Ltda. was responsible to organize the emission factor of the grid available in the Brazilian DNA website.
Frequency of monitoring/recording:	Annually
Value monitored:	The annual emission factor for electricity consumption is described below: Year | $EF_{EL,j,y}$ (tCO_2/MWh) 2013 | 0.4322 2014 | 0.4400 2015 | 0.4400
Monitoring equipment:	No monitoring equipment is used. As this parameter is calculated by the Brazilian Designated National Authority following CDM methodologies, a high accuracy level is expected.
QA/QC procedures to be applied:	The grid emission factor will be obtained directly from the Brazilian DNA website. No QA/QC procedures are applied to this parameter.
Purpose of the data:	This parameter is used to calculate project emissions from electricity consumption.
Calculation method:	Emission factor is calculated by the Brazilian DNA according to current CDM tools and guidelines. The calculation of the combined margin (CM) emission factor ($EF_{grid,CM,y}$) is based on a weighted average of the Build Margin and the Operating Margin, using a 0.5 weight for each parameter, as detailed below:

[30] Interministerial Committee of Global Climate Change (Comissão Interministerial de Mudança Global do Clima – CIMGG), Brazilian DNA. Available at: <http://www.mct.gov.br/index.php/content/view/74689.html>. Last visited on: 20/08/2015.

	Emission factors – annual average (tCO_2/MWh) | Year 2013 | Year 2014 | Year 2015 Build Margin | 0.2713 | 0.2963 | - Operating Margin | 0.5932 | 0.5837 | - Combined margin emission factor ($EF_{grid,CM,y}$) | 0.4322 | 0.4400 | 0.4400 The emission factor of the grid - Year 2015 is not available yet. Therefore, the same value of the year before (2014) was used. More information on the calculation method of the grid emission factor is available at: <http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-07-v3.0.0.pdf>. Last visited on 20/08/2015.
Comments:	All farms included in the project exclusively use electricity from the Brazilian Interconnected System. Data will be kept for two years after the end of the crediting period or the last issuance of carbon credits for this project activity, whichever occurs later.

Data / Parameter:	Q_y
Data unit:	Tonnes (wet basis)
Description:	Quantity of manure treated in the year *y*
Source of data:	Project Proponents
Description of measurement methods and procedures to be applied:	The amount of waste produced per year was monitored by registering the operating hours of the pump that destine the manure from the storage tank to the composting unit. Spreadsheets were used to record the operation time per day of manure pumps. Nevertheless, during the current monitoring period, default values of animal waste production had to be used to obtain the quantity of manure treated (Q_y), since monitoring data was incomplete. Given the farms management processes, a conservative value was applied. Such value is based on monitored data collected in part of this monitoring period and on a scientific study about the quantity of manure produced per animal type per day. Values applied on the emission reduction calculation were conservatively defined as the highest value of: • Embrapa scientific study[31]. • The average quantity of manure treated per day monitored by each farmer during part of the monitored period.

[31] OLIVEIRA, Paulo Armando V. de. **Produção e manejo de dejetos de suínos**. Concórdia: Embrapa, 2003. 83 p. Information taken from Table 1. Value adopted to the current monitoring for the amount of solid waste (in kilogram): average daily production of swine manure, including manure and urine, according to animals weight.

	The most conservative value was then multiplied by the number of days where animal manure management system is operational (nd_y), achieving the quantity of manure treated per year (Q_y). The approach used and the value applied for each farm is available in Section 3.3 – Monitoring Plan, below.
Frequency of monitoring/recording:	Annually, based on monthly records
Value monitored:	Detailed information on Appendix 1.
Monitoring equipment:	The indirect measurement procedure chosen to monitor this parameter is expected to result in low levels of accuracy. However, procedures with higher precision are not feasible to apply given the farmers reality. The installation of hour meters or data loggers to record information automatically will increase accuracy, but this will only be possible in a near future. Please see calculation method below for more information.
QA/QC procedures to be applied:	Values were cross-checked with estimated data from Embrapa. These values are based in Santa Catarina State Environmental Agency (FATMA) normative and specific literature, and were also used by LPC in the design of the composting units.
Purpose of the data:	This parameter is used to calculate project emissions resulting from the composting process.
Calculation method:	The amount of waste (in wet basis) was calculated by multiplying the most conservative value found of average daily production of swine manure by the number of days in a year in which the treatment plant is operational (nd_y). If data monitored by each farmer during part of the monitored period is more conservative, the amount of waste (in wet basis) is calculated by the nominal flow rate of the pump multiplied by the time of operation, as monitored by the farmers with manual spreadsheets. Thus, the value is estimated in liters and then, converted to weight, using a default value for the density of the waste. This parameter was also corrected to discount water that is flushed to the composting site. However, if Embrapa default values are more conservative, a scientific study[32] developed by this Institution was utilized to obtain default values on the average production of swine manure, which are established according to the swine weight, as described in table below.

Animal	Average daily production of swine manure (manure and urine, in kg)

[32] OLIVEIRA, Paulo Armando V. de. **Produção e manejo de dejetos de suínos**. Concórdia: Embrapa, 2003. 83 p. Information taken from Table 1. Value adopted to the current monitoring for the amount of solid waste (in kilogram): average daily production of swine manure, including manure and urine, according to animals weight.

	<table><tr><td>Swine weight from 25 to 100 kg</td><td>4.90</td></tr><tr><td>Sows in gestation</td><td>11.00</td></tr><tr><td>Sows</td><td>18.00</td></tr><tr><td>Boars</td><td>6.00</td></tr><tr><td>Nursery</td><td>0.95</td></tr><tr><td>Average</td><td>5.80</td></tr></table> In case these values were used, they were multiplied by the annual average number of animals of each type and by the number of days in year *y* where the animal manure management system was operational, thus obtaining the quantity of manure treated in the year *y*. Embrapa publication indicates that wastes from swine confinements are composed of dung, urine and flushed water. Swine manure (both dung and urine) consist of nearly 70% of total wastes (i.e., 4.9kg out of 7 liters, or 7.112 kg considering a density of 1.016 kg per liter). Such density is expected for swine manure with 3% of solid matter, which is the expected value for the farms included in the project[33]. The predicted value of manure and urine to be processed by the LPC equipment is 7 liters of liquid waste, following Embrapa's reference values. More information about the Q_y calculation method applied at each farm is described on Section 3.3 – Monitoring Plan, below.
Comments:	As previously described in Section 2.2.1 – Methodology Deviations, Project Proponents applied a deviation regarding the monitoring of the quantity of manure treated in the year *y*. The applied version of the methodology establishes this parameter should be monitored by on-site data measurement using weigh bridges. However, the project does not involve the transportation of waste by vehicles[34]. Project Proponents have proposed to calculate the amount of waste composted by monitoring the number of hours that the pump that sends manure to the composting unit operates and/or applying default values. The amount of wash water was not considered as it does not present organic matter and does not result in methane emissions. This approach is considered appropriate, given that the UNFCCC Methodological Tool "Project and leakage emissions from composting" v.01.0.0[35] provides the following information: (i) Composting converts biodegradable organic carbon to mostly

[33] This value is used by LPC Tecnologia Ambiental on the Technical Project of the composting unit. Hence, it is considered applicable to farms conditions.
[34] Waste is carried to the composting units by gravity and electrical pumps. Compost is usually removed with wheelbarrow or small vehicles (tractors). This is applicable to all farms included in the project.
[35] Available at: <http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-13-v1.pdf>. Last visited on 20/08/2015.

	carbon dioxide (CO_2) and a residue (compost) that can be used as a fertilizer. Other outputs from composting can include, inter alia, methane (CH_4), nitrous oxide (N_2O), and run-off wastewater (in case of co-composting). Therefore, emissions from composting are only expected for the degradation of biodegradable organic carbon. (ii) Even in cases of co-composting (a type of composting where solid wastes and wastewater are composted together), wastewater should not be accounted for the estimation of *Qy*. The current project does not involve co-composting. Instead, the project involves the composting of animal manure diluted with wash water from the barns. Such water does not contain organic carbon and, therefore, should not result in project emissions from composting. Data will be kept for two years after the end of the crediting period or the last issuance of carbon credits for this project activity, whichever occurs later.

Data / Parameter:	***Conditions of the composting process***
Data unit:	ºC for temperature; moisture level (qualitative analysis), ranging from very humid to very dry; Frequency of time for operation of the mixing equipment.
Description:	Conditions of the composting process include monitoring the following parameters: temperature and moisture of the composting mass and frequency of operation of the mixing equipment (UMAC).
Source of data:	Project proponents
Description of measurement methods and procedures to be applied:	Farmers followed technical recommendations from LPC to ensure that the composting unit was operating according to a quality control program. Farmers periodically monitored the temperature and moisture of the composting mass in composting windrows. In addition, they also recorded the operation frequency of the UMAC equipment, which mixes the composting mass. Farmers took notes of the measurements on manual spreadsheets (paper copies).
Frequency of monitoring/recording:	The average monitoring/recording frequency of the temperature and moisture in the composting mass was of around 15 days. Frequency of operation of the composting equipment was monitored on a daily basis.
Value monitored:	Not applied for calculations. All spreadsheet templates can be found in Appendix 3, which were used for monitoring the temperature and moisture of the composting mass in the composting windrows, and frequency of operation of the UMAC equipment.
Monitoring equipment:	Thermometers and moisture meters. Measurement accuracy is expected to be high (above 90%), given the technical specification

	of the equipment and the fact that farmers were trained for the measurement of these parameters.
QA/QC procedures to be applied:	Farmers performed the measurement of the temperature and moisture of the composting mass using thermometers and moisture meters. Sustainable Carbon controlled the database of the project (spreadsheet, measurements, etc.) LPC gave support on how to control the moisture of the composting process. The moisture of the composting mass was monitored by each farmer using visual inspections to check whether the composting mass is too dry (crumbling in the hand), or too wet (dripping liquid). In addition, a moisture meter was used to indicate the level of moisture in the composting mass. Farmers were trained to ensure that these parameters were correctly measured. Farmers were instructed to contact LPC for assistance in case the temperature or moisture of the composting mass is outside desired ranges.
Purpose of the data:	This parameter is monitored as requested by the applied methodology. However, it is not used for the calculation of GHG emission reductions.
Calculation method:	Thermometers and moisture meters provide direct measurement of these parameters.
Comments:	Data will be kept for two years after the end of the crediting period or the last issuance of carbon credits for this project activity, whichever occurs later.

Data / Parameter:	***Soil application of the compost for agricultural purposes***
Data unit:	Numerical frequency
Description:	Number of times that the compost is removed from the treatment system, providing a description of the soil application.
Source of data:	Project proponents
Description of measurement methods and procedures to be applied:	Swine farmers controlled the final destination of the compost (control of sales, consumer records, distance, etc) using a spreadsheet developed by Sustainable Carbon.
Frequency of monitoring/recording:	Annually, based on monthly records
Value monitored:	Not applied for calculations. The compost was applied in a manner to avoid methane emissions. Part of the compost was sold to rural properties located nearby the farms.
Monitoring equipment:	No monitoring equipment is used. The indirect monitoring procedure chosen for this parameter is expected to result in medium to low levels of accuracy. However, procedures with a

	higher precision are not feasible to apply given the farmers reality. Also, no project emissions from the produced compost are expected. Hence, the low accuracy is not expected to affect the calculation of emission reductions during the current monitoring period.
QA/QC procedures to be applied:	An annual verification was carried out by a technician in a sample of users, who analyzed the compost application in the farms.
Purpose of the data:	This parameter is monitored as requested by the applied methodology. It is used to confirm that the compost is not subject to anaerobic treatment or disposal and thus, verifying if project emissions could be expected from this source.
Calculation method:	The soil application of the compost was monitored through a sheet fed by the farmers, who are responsible for controlling the final destination of the compost in each farm.
Comments:	Data will be kept for two years after the end of the crediting period or the last issuance of carbon credits for this project activity, whichever occurs later.

3.3 Monitoring Plan

Sustainable Carbon – Projetos Ambientais Ltda. was responsible for managing the monitoring plan during the current monitoring period and also executed on-site inspections on each individual farm to confirm that the monitoring plan is being executed properly. Sustainable Carbon also provided training on data collection and storage, as well as emergency reporting procedures.

In case of emergencies, farmers contacted LPC Tecnologia Ambiental immediately, usually requiring maintenance or repairs on the composting unit. Farmers also contacted Sustainable Carbon to inform on the type of emergency, its cause, its consequences and any information needed to allow Sustainable Carbon determining the impact of such emergency on the project emission reductions for the corresponding monitoring period.

In general terms, farmers applied the monitoring plan on a regular basis and were responsible to store data regarding animal production and to record and store monitoring data on the operation of the composting unit. This includes filling monitoring spreadsheets prepared by Sustainable Carbon, taking notes on animal production and storing documents provided by the integrators.

Part of the monitoring data on $EC_{PJ,j,y}$ and Qy was incomplete. In general, alternative procedures described on the VCS PD version 06.1 allowed for conservative estimates of emission reductions generation. These procedures involved applying estimated values based on LPC judgment and/or scientific studies to determine the quantity of electricity consumed and the quantity of manure treated by the Project. Tables below provide more information on which procedure method was chosen for each farm.

Farm	(A) Average Manure pump daily operating time (hours)[36]	(B) LPC estimated data	Conservative estimate: manure pump operating time (hours)	Approach used
Fazenda Altenor	1.20	0.67	1.20	(A)
Fazenda Andretta	0.49	0.94	0.94	(B)
Fazenda Baccin	1.03	0.96	1.03	(A)
Fazenda Colônia Suspiro	0.51	1.46	1.46	(B)
Fazenda Colônia Zuffo	0.22	0.52	0.52	(B)
Fazenda Gilmar	1.47	0.96	1.47	(A)
Fazenda Granja Silva	0.41	0.73	0.73	(B)
Fazenda Helena	0.86	1.25	1.25	(B)
Fazenda Ramella	0.43	0.73	0.73	(B)
Fazenda Suruvy	0.33	0.52	0.52	(B)
Sitio Santa Lúcia	1.33	0.96	1.33	(A)

Table 4. Assessment of monitoring data on the manure pump daily operating time (hours)

[36] Based on monitored data collected in part of the current monitoring period.

Farm	(A) Average UMAC equipment daily operating time (hours)[37]	(B) LPC estimated data	Conservative estimate: UMAC equipment daily operating time (hours)	Approach used
Fazenda Altenor	2.57	4.38	4.38	(B)
Fazenda Andretta	1.58	4.06	4.06	(B)
Fazenda Baccin	4.13	6.35	6.35	(B)
Fazenda Colônia Suspiro	0.54	6.58	6.58	(B)
Fazenda Colônia Zuffo	2.00	2.71	2.71	(B)
Fazenda Gilmar	1.67	3.96	3.96	(B)
Fazenda Granja Silva	2.54	3.29	3.29	(B)
Fazenda Helena	2.19	5.42	5.42	(B)
Fazenda Ramella	1.64	3.33	3.33	(B)
Fazenda Suruvy	0.33	2.71	2.71	(B)
Sitio Santa Lúcia	3.12	3.96	3.96	(B)

Table 5. Assessment of monitoring data on the daily operating time of the UMAC equipment (hours)

Farm	(A) Average Q_y (tonnes/day)[38]	(B) Embrapa estimated data	Conservative estimate: Q_y (tonnes/day)	Approach used
Fazenda Altenor	17.04	9.37	17.04	(A)
Fazenda Andretta	6.91	9.70	9.70	(B)
Fazenda Baccin	14.59	21.76	21.76	(B)
Fazenda Colônia Suspiro	16.34	16.31	16.34	(A)
Fazenda Colônia Zuffo	2.30	5.77	5.77	(B)
Fazenda Gilmar	15.73	7.25	15.73	(A)
Fazenda Granja Silva	3.47	4.83	4.83	(B)
Fazenda Helena	21.51	11.11	21.51	(A)
Fazenda Ramella	3.64	5.61	5.61	(B)
Fazenda Suruvy	2.84	4.04	4.04	(B)
Sitio Santa Lúcia	12.33	8.38	12.33	(A)

Table 6. Assessment of monitoring data on the quantity of manure treated (tonnes per day).

[37] Based on monitored data collected in part of the current monitoring period.
[38] Based on monitored data collected in part of the current monitoring period.

According to Section 4.2 of the VCS PD v.06.1, third parties (i.e. integrators and State agencies) were the direct responsible for measurement and recording of some monitoring parameters (such as *ndy*, W_{site}, $N_{da,y}$ and $N_{p,y}$). Such information is used to determine farms' productivity and to calculate financial compensations. For these reasons, third parties information is considered the most reliable data source.

In general terms, farmers do not control animal production on a consistent and regular basis, as this is the responsibility of integrators, according to predefined agreements and procedures. Fazenda Andretta is an exception to this statement as the animal production is monitored through software. In such case, data from this software was utilized instead of third parties information.

Integrators are agribusiness companies responsible for the productive cycle of animals and food products. They establish partnerships with farmers to outsource stages of the production cycle (such as animal fattening). Furthermore, these enterprises are responsible for providing feed, medicines and technical assistance to producers in order to ensure swine quality and production. They have control of the number and weight of animals, which generates documents with information related to each batch of animals. In finishing unit farms, the animals usually remain for a period of approximately 04 months, whereas in farrow to nursery farms, this period varies from 30 to 60 days for piglets/ nursery and 02 years for others animals (gilts, sows in gestation, sows and boars).

Monitored variables are described in Section 3.2 above. In addition, each farm has an authority for organizing the monitoring data, as described in table below:

Farm Name	Town	Monitoring authority
Fazenda Altenor	Nova Erechim	Mr. Altenor José Basso
Fazenda Ramela	Herval d'Oeste	Mr. Antônio Carlos Ramela
Sítio Santa Lucia	Jaborá	Mr. Belmiro Secco
Fazenda Helena	Vargeão	Mr. Diacir Coradi
Fazenda Gilmar	Rio das Antas	Mr. Gilmar José Sinigaglia
Fazenda Suruvy	Concórdia	Mr. Airton Piovezan
Fazenda Granja Silva	Concórdia	Mr. Jair da Silva
Fazenda Colônia Suspiro	Nova Erechim	Ms. Lenize Tomazi
Fazenda Colônia Zuffo	Rio das Antas	Mr. Dario Marcos Zuffo
Fazenda Baccin	Concórdia	Mr. Renato Baccin
Fazenda Andretta	Nova Itaberaba	Ms. Fabiana Andretta

Table 7. Monitoring authority on each farm.

The organizational structure of the project regarding the monitoring plan is illustrated in figure below.

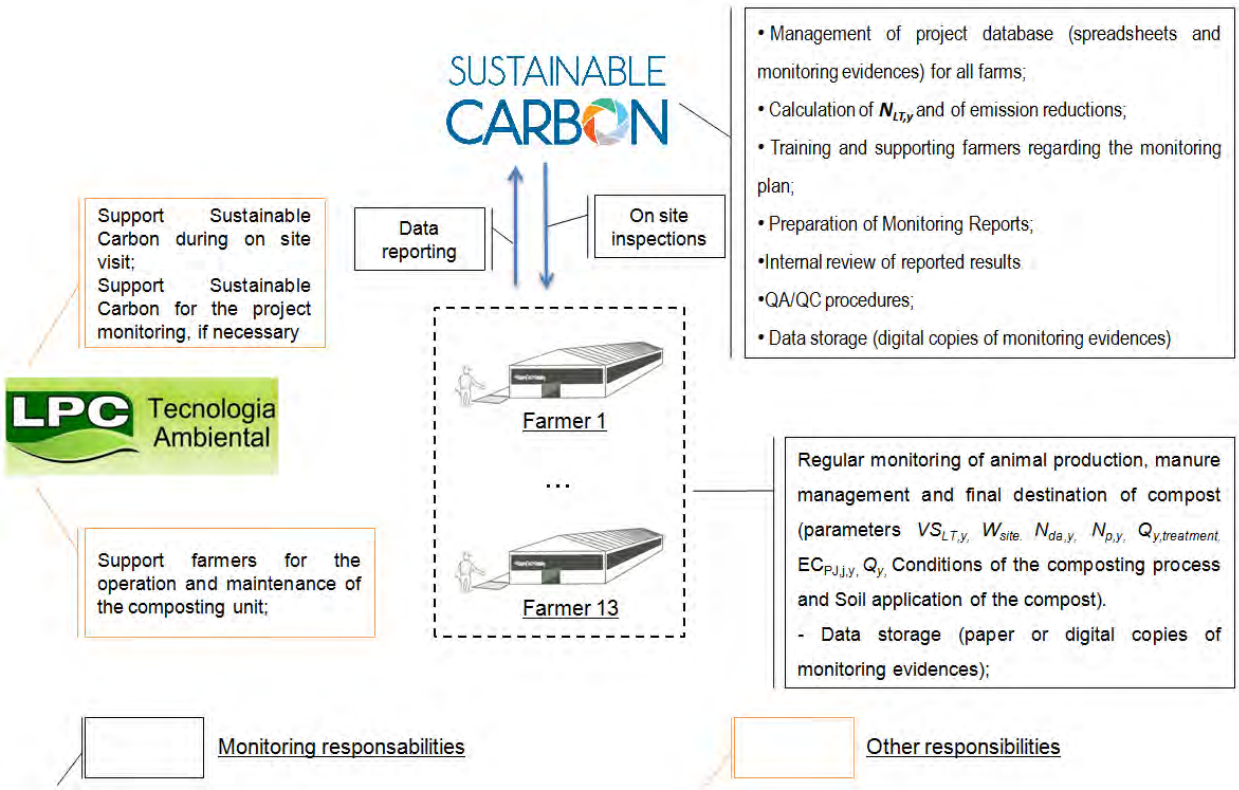

Figure 2. Organizational structure for the project monitoring

During the preparation of the current monitoring report, Sustainable Carbon carried out internal reviews of collected data. The calculation of emission reductions was made based on existing documentation, taking into account the most conservative assumption in case of incompleteness of the monitoring data.

Sustainable Carbon also assisted farmers to double check monitored parameters. Sustainable Carbon performed double check of several monitoring parameters, especially those related to animal production and compost management (such as $N_{p,y}$, $N_{da,y}$, $Q_{y,treatment}$, among others). Double check was performed by comparing different sources of information (when available). Sustainable Carbon also double checked the monitoring information of each farm against monitoring checklists to ensure monitoring data was complete.

Non-conformities identified during double check procedures were clarified between Sustainable Carbon technical team, LPC, and the monitoring responsible on the farms.

4 QUANTIFICATION OF GHG EMISSION REDUCTIONS AND REMOVALS

4.1 Baseline Emissions

Baseline emissions are calculated according to AMS-III.F. Version 10, paragraph 14. According to such paragraph of the methodology, baseline emissions are calculated as:

$$BE_y = BE_{CH4,SWDS,y} + BE_{ww,y} + BE_{CH4,manure,y} - MD_{y,reg} * GWP\_CH_4$$

Equation 1

Where,

$BE_{CH4,SWDS,y}$	Yearly methane generation potential of the solid waste composted by the project activity during the years *x* from the beginning of the project activity (*x*=1) up to the year *y* estimated as per the latest version of the "Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site" (tCO_2e). The tool may be used with the factor "f=0.0" assuming that no biogas is captured and flared. With the definition of year *x* as 'the year since the project activity started diverting wastes from landfill disposal, *x* runs from the first year of crediting period (*x*=1) to the year for which emissions are calculated (*x*=*y*)'
$MD_{y,reg}$	Amount of methane that would have to be captured and combusted in the year *y* to comply with the prevailing regulations (tonne)
$BE_{CH4,manure,y}$	Baseline emissions from manure composted by the project activities, as per the procedures of AMS-III.D
$BE_{ww,y}$	Where applicable, baseline emissions from the wastewater co-composted, calculated as per the procedures in AMS-III.H
GWP_CH_4	GWP for CH4 (value of 25 is used)

Only baseline emissions from animal manure composted by the project activities are considered. Hence, baseline emissions are calculated in accordance to procedures from approved methodology AMS-III.D, version 18. Procedures from paragraph 9(a) are used, since data needed to apply option 9(b) is not available.

The baseline emissions are calculated by Equation 2 below:

$$BE_y = GWP_{CH4} * D_{CH4} * UF_b * \sum_{j,LT} MCF_j * B_{0.LT} * N_{LT,y} * VS_{LT,y} * MS\%_{Bl,j}$$

Equation 2

Where:

BE_y	Baseline emissions in year y (tCO_2e)
GWP_{CH4}	Global Warming Potential (GWP) of CH_4 (25)
D_{CH4}	CH_4 density (0.00067 t/m³ at room temperature (20 ºC) and 1 atm pressure)
LT	Index for all types of livestock
j	Index for animal manure management system
MCF_j	Annual methane conversion factor (MCF) for the baseline animal manure management system *j*
$B_{0,LT}$	Maximum methane producing potential of the volatile solid generated for animal type *LT* (m^3CH4 / kg dm)
$N_{LT,y}$	Annual average number of animals of type *LT* in year *y* (numbers)
$VS_{LT,y}$	Volatile solids for livestock *LT* entering the animal manure management system in year *y* (on a dry matter weight basis, kg dm/animal/year)
$MS\%_{Bl,j}$	Fraction of manure handled in baseline animal manure management system *j*
UF_b	Model correction factor to account for model uncertainties (0.94)

The value of $VS_{LT,y}$ is adjusted according to the average animal weight of project activity, by means of Equation 3 below, considering the default value of IPCC ($VS_{default}$):

$$VS_{LT,y} = \left(\frac{W_{site}}{W_{default}} \right) * VS_{default} * nd_y$$

Equation 3

Where:

W_{site}	Average animal weight of a defined livestock population at the project site (kg)
$W_{default}$	Default average animal weight of a defined population, this data is sourced from 2006 IPCC (kg)
$VS_{default}$	Default value for the volatile solid excretion rate per day on a dry-matter basis for a defined livestock population (kg dm/animal/day)
nd_y	Number of days in year *y* where the animal manure management system is operational.

The average number of animals ($N_{LT,y}$) is calculated by Equation 4:

$$N_{LT,y} = N_{da,y} * \left(\frac{N_{p,y}}{365} \right)$$

Equation 4

N_{day}	Number of days animal is alive in the farm in the year *y* (numbers)
$N_{p,y}$	Number of animals produced annually of type *LT* for the year *y* (numbers)

A minor adaptation to equation 4 is used in this project. Since documents regarding the production of animals is not generated monthly, but based on batches, a period of time different than 365 is usually considered. Hence, $N_{LT,y}$ is obtained by dividing the number of animals produced by the number of days in the period of time considered.

This causes no significant alteration to $N_{LT,y}$, but allows for a correct calculation given the type of documentation available on animal production. Farmers are granted documents and financial compensation from integrators for each batch. Thus, animal production controls do not follow an annual schedule; instead it is based on each batch period. Project Proponents consider documents provided by integrators to be the most reliable and conservative source of monitoring data. Hence, monitoring will be done based on documents for each batch.

The parameters GWP_{CH4}, D_{CH4}, UF_b, MCF_j, $B_{0,LT}$, $MS\%_{Bl,j}$, $W_{default}$, and $VS_{default}$ are used to calculate baseline emissions, which values are described above in Section 3.1 – Data and Parameters Available at Validation. The number of days animals is alive in the farm ($N_{da,y}$), the number of days in year *y* in which the animal manure management system is operational (nd_y), the number of animals produced in year *y* ($N_{p,y}$), and the annual average number of animals per type ($N_{LT,y}$) are also used to calculate baseline emissions, and their values are shown in Appendix 1.

Baseline emissions during the monitored period are summarized in the following table. More detailed information can be seen in tables on Appendix 1.

Year	BE_y (tCO_2e)
2013 (01/Jan/2013 to 31/Dec/2013)	12,954
2014 (01/Jan/2014 to 31/Dec/2014)	15,492
2015 (01/Jan/2015 to 30/June/2015)	11,274
Total in the Monitoring Period	39,720

Table 8. Total baseline emissions for the *Composting Project in Santa Catarina* during the current monitoring period

4.2 Project Emissions

According to the methodology AMS-III.F., version 10, project activity emissions consist of:

(i). CO_2 emissions due to the incremental transportation distances;

(ii). CO_2 emissions from electricity and/or fossil fuel consumption by the project activity facilities;

(iii). Methane emissions during composting process;

(iv). Methane emissions from runoff water; and

(v). Methane emissions due to compost storage.

The equation for project emission calculation is:

$$PE_y = PE_{y,transp} + PE_{y,power} + PE_{y,comp} + PE_{y,runoff} + PE_{y,res\ waste}$$

Equation 5

Where:

PE_y	Project activity emissions in the year *y* (tCO_2e)
$PE_{y,transp}$	Emissions from incremental transportation in the year *y* (tCO_2e)
$PE_{y,power}$	Emissions from electricity or fossil fuel consumption in the year *y* (tCO_2e)
$PE_{y,comp}$	Methane emissions during composting process in the year *y* (tCO_2e)
$PE_{y,runoff}$	Methane emissions from runoff water in the year *y* (tCO2e)
$PE_{y,res\ waste}$	In case produced compost is subjected to anaerobic storage or disposed in a landfill: methane emissions from the anaerobic decay of the residual organic content (tCO_2e)

Among the project emissions listed by the methodology AMS-III.F., version 10, the proposed project activity will not produce emissions referring to the consumption of fossil fuels, emissions due to incremental transportation distances, emissions due to runoff water, and emissions related to compost storage. This is justified by the following:

- ✓ There is no fossil fuel consumption by the equipments installed as part of the project; the project will not result in additional transportation of waste or compost;
- ✓ The project results in a significant reduction in the volume of treated manure, since the composting process evaporates most of the water content on the treated manure. This reduction in volume also reduces associated consumption of fossil fuels for its transportation until final destination;
- ✓ The mechanized composting units are automated and designed to not apply excessive wastes on the substrate. In addition, sheds are covered, avoiding rainwater percolation onto the substrate. Any runoff water is recirculated into the composting mass;
- ✓ Finally, the compost is not stored in anaerobic conditions nor sent to landfills. Thus, the equation to be applied to determine project activity emissions takes the following structure:

$$PE_y = PE_{y,power} + PE_{y,comp}$$

Equation 6

a) Emissions from electricity or fossil fuel consumption in the year *y* ($PE_{y,power}$)

Emissions from grid electricity consumed by the project are determined according to the "Tool to calculate baseline, project and/or leakage emissions from electricity consumption", version 01[39]. Emissions from electricity are calculated as the product of the energy consumed by the CO_2 emission factor of the grid, according to the equation below:

$$PE_{y,power} = \sum_j EC_{PJ,j,y} \times EF_{EL,j,y} \times (1 + TDL_{j,y})$$

Equation 7

Where:

$EC_{PJ,j,y}$	Quantity of electricity consumed by the project electricity consumption source *j* in year *y* (MWh/yr)
$EF_{EL,j,y}$	Emission factor for electricity generation for source *j* in year *y* (tCO_2/MWh)
$TDL_{j,y}$	Average technical transmission and distribution losses for providing electricity to source *j* in year *y*

Therefore, $PE_{y,power}$ (as defined on Equation 6, above) is equal to $PE_{EC,y}$ as provided by the referred tool. Please note that in Equation 7 the term $PE_{EC,y}$ was replaced by $PE_{y,power}$ to ensure consistency with the applied methodology. The quantity of electricity consumed by the project activity on each farm ($EC_{PJ,j,y}$) is determined considering the combined power capacity of the all equipments in the mechanized composting unit and a conservative estimate on the time of operation of each equipment.

All farms included in the present project consume electricity exclusively from the grid. Grid emission factors shall be calculated through the Brazilian combined margin (CM) emission factor ($EF_{grid,CM,y}$), which is based on a weighted average of the Build Margin and the Operating Margin, using a 0.5 weight for each parameter, in accordance with procedures described in version 18 of AMS-III.D. Both parameters are calculated by the Brazilian DNA (Interministerial Commission on Global Climate Change - Comissão

[39] Tool available at: <https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-05-v1.pdf>. Last visited on August 06th, 2015

Interministerial de Mudança Global do Clima - CIMGC). Thus, the Brazilian combined margin emission factor ($EF_{grid,CM,y}$) is calculated through the equation below[40]:

$$EF_{grid,CM,y} = EF_{grid,OM,y} * W_{OM} + EF_{grid,BM,y} * W_{BM}$$

Equation 8

Where,

$EF_{grid,CM,y}$	Combined margin CO_2 emission factor in year *y* (tCO_2/MWh)
$EF_{grid,OM,y}$	Operating margin CO_2 emission factor in year *y* (tCO_2/MWh)
W_{OM}	Weighting of operating margin emissions factor (%)
$EF_{grid,BM,y}$	Build margin CO_2 emission factor in year *y* (tCO_2/MWh)
W_{BM}	Weighting of build margin emissions factor (%)

Furthermore, according to Table III.F.1, paragraph 27 of methodology AMS-III.F., version 10, $TDL_{j,y}$ is defined as 10%.

b) Methane emissions during composting process in the year *y* ($PE_{y,comp}$)

Methane emissions generated during the composting process ($PE_{y,comp}$) are determined according to Equation 9 below:

$$PE_{y,comp} = Q_y * EF_{composting} * GWP\_CH_4$$

Equation 9

Where:

Q_y	Quantity of raw waste/manure treated in the year *y* (tonnes)
$EF_{composting}$	Emission factor for composting of manure (tCH_4/ton waste treated). Emission factors can be based on site measurements, country specific values or IPCC default values (table 4.1, chapter 4, Volume 5, 2006 IPCC Guidelines for National Greenhouse Gas Inventories). IPCC default values are 10 gCH_4/kg waste treated on a dry basis and 4 gCH_4/kg waste treated on a wet basis. $EF_{composting}$ can be set zero in case the monitored oxygen content during of the composting process within the windrow is above 8%.

During the current monitoring period, $EF_{composting}$ was considered as 4 gCH_4/kg of waste treated on a wet basis, sourced from 2006 IPCC as referred in the methodology. This approach was taken since the level of oxygen in the composting windrows had not been monitored.

The quantity of raw manure treated per year (Q_y) was monitored by registering the operating hours of the pump that destine the manure from the storage tank to the composting unit. Nevertheless, during the current monitoring period, default values of animal waste production had also to be used to obtain the quantity of manure treated, since monitoring data was incomplete. The most conservative value was

[40] UNFCCC. Methodological tool: Tool to calculate the emission factor for an electricity system. Version 03.0.0. Equation 14. Document available at: <http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-07-v3.0.0.pdf>. Last visit: 20/08/2015.

applied for calculating GHG emission reductions, as described above in Section 3.2 – Data and Parameters Monitored.

$$Q_y = P_{NF} * P_{TO,y} * MD * 0.7$$

Equation 10

Where:

P_{NF}	Pump nominal flow (m³/hour)
$P_{TO,y}$	Pump time of operation in year y (hours)
MD	Manure density (tonnes/m³)
0.7	Fraction of waste from confinement that is manure

Project emissions during the monitored period are summarized in the following table. More detailed information is also available on Appendix 1.

Year	PE_y (tCO_2e)
2013 (01/Jan/2013 to 31/Dec/2013)	3,811
2014 (01/Jan/2014 to 31/Dec/2014)	4,080
2015 (01/Jan/2015 to 30/June/2015)	3,265
Total in the Monitoring Period	11,156

Table 9. Total project emissions for the *Composting Project in Santa Catarina* during the current monitoring period

4.3 Leakage

As the project does not involve equipment transference from another activity, there is no leakage to be considered, according to methodology AMS-III.F., version 10.

4.4 Net GHG Emission Reductions and Removals

According methodology AMS-III.F., version 10, GHG emission reductions achieved by the project activity are calculated as the difference between the baseline emissions and the project emissions, as described below:

$$ER_y = BE_y - PE_y$$

Equation 11

Where,

ER_y	Emission reduction in year *y* (tCO_2e)

The specific annual summary of GHG reductions and removals at each farm composing the *Composting Project in Santa Catarina* are included in Tables 10, 11 and 12 below. Latter tables include baseline emissions (BE_y), project emissions (PE_y), leakage emissions, and the resulting GHG emissions reduction (ER_y) per farm.

Emission Reductions - Year 2013 (01/Jan/2013 to 31/Dec/2013)				
Farm	BE_y tCO_2e	PE_y tCO_2e	*Leakage* tCO_2e	ER_y tCO_2e
Fazenda Altenor	1,308	438	0	870
Fazenda Andretta	954	362	0	592
Fazenda Baccin	3,684	670	0	3,014
Fazenda Colônia Suspiro	1,390	311	0	1,079
Fazenda Colônia Zuffo	773	139	0	634
Fazenda Gilmar	599	420	0	179
Fazenda Granja Silva	380	183	0	197
Fazenda Helena	1,628	749	0	879
Fazenda Ramella	506	163	0	343
Fazenda Suruvy	650	102	0	548
Sitio Santa Lúcia	1,082	274	0	808
TOTAL	12,954	3,811	0	9,143

Table 10. Emission Reductions for *Composting Project in Santa Catarina* – Year 2013[41]

Emission Reductions - Year 2014 (01/Jan/2014 to 31/Dec/2014)				
Farm	BE_y tCO_2e	PE_y tCO_2e	*Leakage* tCO_2e	ER_y tCO_2e
Fazenda Altenor	1,422	454	0	968
Fazenda Andretta	978	362	0	616
Fazenda Baccin	3,489	496	0	2,993
Fazenda Colônia Suspiro	3,198	576	0	2,622
Fazenda Colônia Zuffo	1,287	207	0	1,080
Fazenda Gilmar	588	371	0	217
Fazenda Granja Silva	384	183	0	201
Fazenda Helena	1,242	675	0	567
Fazenda Ramella	710	200	0	510
Fazenda Suruvy	761	137	0	624
Sitio Santa Lúcia	1,433	419	0	1,014
TOTAL	15,492	4,080	0	11,412

Table 11. Emission Reductions for *Composting Project in Santa Catarina* – Year 2014[42]

[41] Fazenda Sítio Pickler and Pissaia were not included in the current monitoring report, following a personal decision from farm owners.

Emission Reductions - Year 2015 (01/Jan/2015 to 30/June/2015)				
Farm	BE_y tCO_2e	PE_y tCO_2e	*Leakage* tCO_2e	ER_y tCO_2e
Fazenda Altenor	1,365	474	0	891
Fazenda Andretta	456	179	0	277
Fazenda Baccin	2,677	613	0	2,064
Fazenda Colônia Suspiro	2,370	519	0	1,851
Fazenda Colônia Zuffo	744	125	0	619
Fazenda Gilmar	711	374	0	337
Fazenda Granja Silva	190	91	0	99
Fazenda Helena	749	406	0	343
Fazenda Ramella	613	133	0	480
Fazenda Suruvy	493	87	0	406
Sitio Santa Lúcia	906	264	0	642
TOTAL	11,274	3,265	0	8,009

Table 12. Emission Reductions for *Composting Project in Santa Catarina* – Year 2015[43]

The net GHG Emission Reductions in the Composting Project in Santa Catarina during the monitored period are summarized in the following table. More detailed information can be seen in tables on Appendix 1.

Year	Baseline emissions or removals (tCO_2e)	Project emissions or removals (tCO_2e)	Leakage emissions (tCO_2e)	Net GHG emission reductions or removals (tCO_2e)
2013 (01/Jan/2013 to 31/Dec/2013)	12,954	3,811	0	9,143
2014 (01/Jan/2014 to 31/Dec/2014)	15,492	4,080	0	11,412
2015 (01/Jan/2015 to 30/June/2015)	11,274	3,265	0	8,009
Total	**39,720**	**11,156**	**0**	**28,564**

Table 13. GHG Emission Reductions generated by the *Composting Project in Santa Catarina* during the current monitoring period

[42] Fazenda Sítio Pickler and Pissaia were not included in the current monitoring report, following a personal decision from farm owners.
[43] Fazenda Sítio Pickler and Pissaia were not included in the current monitoring report, following a personal decision from farm owners.

APPENDIX 1: DETAILS OF DATA AND PARAMETERS MONITORED

Data and parameters monitored of the *Composting Project in Santa Catarina* can be verified in following tables. These parameters are described on Section 3.2 of the current monitoring report.

Data and parameters monitored - Year 2013											
Farm Name	**Farm owner**	**Animal Type**	**$N_{da,y}$**	**$N_{p,y}$**	**$N_{LT,y}$**	**W_{site}**	**$VS_{LT,y}$**	**nd_y**	**$Q_{y,treatment}$**	**$EC_{P,j,y}$**	**Q_y**
			(number)	**(number)**	**(number)**	**(Kg)**	**(Kg dm/animal/year)**	**(number)**	**(tonnes)**	**(MWh)**	**(tonnes)**
Fazenda Altenor	Altenor José Basso	Finishers	126	4,142	1,898	72	196	253	94	13	4,311
Fazenda Andretta	Silvino Andreta	Gilts	364	24	24	198	167	364	38	17	3,530
		Sows in gestation	364	393	393	198	167				
		Sows	364	133	133	198	167				
		Boars	364	4	4	198	167				
		Piglets	26	13,130	948	4	15				
		Nursery	57	12,133	1,910	15	59				
Fazenda Baccin	Renato Baccin	Nursery	44	4,281	4,281	18	57	303	39	22	6,593
		Finishers	130	8,508	3,140	79	256				
Fazenda Colônia Suspiro	Nóbile Tomazi	Finishers	93	8,331	2,202	90	180	186	14	14	3,040
Fazenda Colônia Zuffo	Dario Marcos Zuffo	Finishers	117	2,334	1,079	81	204	234	-	7	1,350
Fazenda Gilmar	Gilmar José Sinigaglia	Finishers	88	5,291	1,194	84	238	263	-	13	4,137
Fazenda Granja Silva	Jair da Silva	Gilts	364	30	30	198	167	364	50	14	1,758
		Sows in gestation	364	300	300	198	167				
		Sows	364	50	50	198	167				
		Boars	364	5	5	198	167				
		Piglets	25	6,245	439	5	19				
Fazenda Helena	Diacir Coradi	Finishers	108	5,910	1,710	74	271	343	260	22	7,379
Fazenda Ramela	Antônio Carlos Ramela	Gilts	71	1,662	357	65	42	280	23	11	1,570
		Finishers	91	2,081	540	74	223				
Fazenda Suruvy	Airton Piovezan	Finishers	121	1,828	790	90	234	243	40	8	981
Sítio Santa Lucia	Belmiro Secco	Finishers	109	3,763	1,615	82	191	218	-	11	2,687

Table 14. Parameters monitored for the *Composting Project in Santa Catarina* – Year 2013

Data and parameters monitored - Year 2014											
Farm Name	**Farm owner**	**Animal Type**	**$N_{da,y}$**	**$N_{p,y}$**	**$N_{LT,y}$**	**W_{site}**	**$VS_{LT,y}$**	**nd_y**	**$Q_{y,treatment}$**	**$EC_{P,j,y}$**	**Q_y**
			(number)	**(number)**	**(number)**	**(Kg)**	**(Kg dm/animal/year)**	**(number)**	**(tonnes)**	**(MWh)**	**(tonnes)**
Fazenda Altenor	Altenor José Basso	Finishers	131	4,104	1,941	74	208	262	66	14	4,464
Fazenda Andretta	Silvino Andreta	Gilts	364	30	30	198	167	364	75	17	3,530
		Sows in gestation	364	375	375	198	167				
		Sows	364	170	170	198	167				
		Boars	364	2	2	198	167				
		Piglets	28	14,266	1,094	4	15				
		Nursery	53	12,697	1,860	16	60				
Fazenda Baccin	Renato Baccin	Nursery	50	7,660	7,660	19	45	224	-	16	4,874
		Finishers	174	4,210	4,210	64	155				
Fazenda Colônia Suspiro	Nóbile Tomazi	Finishers	172	8,272	3,920	63	232	344	8	26	5,622
Fazenda Colônia Zuffo	Dario Marcos Zuffo	Finishers	116	3,957	1,167	84	314	348	286	11	2,008
Fazenda Gilmar	Gilmar José Sinigaglia	Finishers	116	3,513	1,532	73	182	232	60	12	3,650
Fazenda Granja Silva	Jair da Silva	Gilts	364	30	30	198	167	364	-	14	1,758
		Sows in gestation	364	300	300	198	167				
		Sows	364	50	50	198	167				
		Boars	364	5	5	198	167				
		Piglets	26	6,829	489	5	19				
Fazenda Helena	Diacir Coradi	Gilts	80	2,511	1,017	61	44	309	263	20	6,648
		Finishers	103	5,318	1,271	68	223				
Fazenda Ramela	Antônio Carlos Ramela	Gilts	80	1,512	374	57	46	345	-	13	1,935
		Finishers	115	1,660	734	65	239				
Fazenda Suruvy	Airton Piovezan	Finishers	109	2,740	809	77	268	326	40	10	1,316
Sítio Santa Lucia	Belmiro Secco	Finishers	111	5,733	1,607	71	254	333	172	16	4,105

Table 15. Parameters monitored for the *Composting Project in Santa Catarina* – Year 2014

Data and parameters monitored - Year 2015											
Farm Name	**Farm owner**	**Animal Type**	**$N_{da,y}$**	**$N_{p,y}$**	**$N_{LT,y}$**	**W_{site}**	**$VS_{LT,y}$**	**nd_y**	**$Q_{y,treatment}$**	**$EC_{P,j,y}$**	**Q_y**
			(number)	**(number)**	**(number)**	**(Kg)**	**(Kg dm/animal/year)**	**(number)**	**(tonnes)**	**(MWh)**	**(tonnes)**
Fazenda Altenor	Altenor José Basso	Finishers	137	4,059	1,897	70	205	274	-	14	4,668
Fazenda Andretta	Silvino Andreta	Gilts	180	68	68	198	83	180	-	9	1,746
		Sows in gestation	180	407	407	198	83				
		Sows	180	113	113	198	83				
		Boars	180	4	4	198	83				
		Piglets	29	6,652	1,083	4	7				
		Nursery	43	6,558	1,549	15	30				
Fazenda Baccin	Renato Baccin	Finishers	139	8,495	3,657	70	208	277	135	20	6,028
Fazenda Colônia Suspiro	Nóbile Tomazi	Finishers	156	8,164	3,866	63	208	310	171	24	5,066
Fazenda Colônia Zuffo	Dario Marcos Zuffo	Finishers	105	2,794	1,287	73	165	211	-	7	1,218
Fazenda Gilmar	Gilmar José Sinigaglia	Finishers	117	3,497	1,712	79	197	234	43	12	3,681
Fazenda Granja Silva	Jair da Silva	Gilts	180	30	30	198	83	180	270	7	869
		Sows in gestation	180	300	300	198	83				
		Sows	180	50	50	198	83				
		Boars	180	5	5	198	83				
		Piglets	26	3,715	498	5	9				
Fazenda Helena	Diacir Coradi	Gilts	86	1,685	746	60	26	186	120	12	4,001
		Finishers	90	4,444	2,060	59	117				
Fazenda Ramela	Antônio Carlos Ramela	Gilts	89	1,134	482	59	31	228	-	9	1,279
		Finishers	113	1,907	946	65	160				
Fazenda Suruvy	Airton Piovezan	Finishers	103	1,810	871	73	161	206	20	6	831
Sítio Santa Lucia	Belmiro Secco	Finishers	105	3,794	1,697	68	152	210	29	10	2,589

Table 16. Parameters monitored for the *Composting Project in Santa Catarina* – Year 2015

APPENDIX 2: PARAMETER MONITORED - $Q_{Y,TREATMENT}$ (QUANTITY OF COMPOST PRODUCED)

Farmers monitored the amount of compost produced per year using manual spreadsheets (the templates in Portuguese and English are shown below). Compost was measured using standard storage units with known volume or weight. Farmers measured the amount of storage units every time compost was used or sold. The spreadsheet template can be verified below.

1. Portuguese template

PROJETO DE COMPOSTAGEM EM SANTA CATARINA

PLANILHA DE MONITORAMENTO 4 - Controle do destino do composto

Produtor:	

Data	Comprador/ Destinatário	Quantidade	Unidade (m³, Kg sacas)	Preço da venda (R$)	Placa do veículo	Destino do composto			Assinatura do destinatário
						Cidade	Distância (Km)	Uso	

2. English template

COMPOSTING PROJECT IN SANTA CATARINA

MONITORING SPREADSHEET 4 - Control on the destination of compost

Farmer name:	

Date	Buyer/ Receiver	Quantity	Measurement unit (m³, Kg sacas)	Sales price (BRL)	Vehicle Identification	Final destination of the compost			Signature of recipient
						City	Distance (Km)	Use	

APPENDIX 3: PARAMETER MONITORED - CONDITIONS OF THE COMPOSTING PROCESS

Farmers periodically monitored the temperature and moisture of the composting mass in composting windrows, as well as recorded the frequency of operation of the UMAC equipment, which mixes the composting mass. Farmers took notes of the measurements on manual spreadsheets (paper copies). Spreadsheets templates are shown below, in Portuguese and English.

1. Portuguese template - Monitoring of temperature and moisture of the composting mass in composting windrows

PROJETO DE COMPOSTAGEM EM SANTA CATARINA

PLANILHA DE MONITORAMENTO 2 - Controle da temperatura e umidade da massa de compostagem

Produtor:

		Data:		Data		Data:		Data		Data:		Data		Data:	
		Leira revolvida:		Leira revolvida		Leira revolvida:		Leira revolvida		Leira revolvida:		Leira revolvida		Leira revolvida:	
		Temperatura (°C)	Umidade (%)	Temperatura (°C)	Umidade (%)	Temperatura (°C)	Umidade (%)	Temperatura (°C)	Umidade (%)	Temperatura (°C)	Umidade (%)	Temperatura (°C)	Umidade (%)	Temperatura (°C)	Umidade (%)
Leira 1	Ponto 1														
	Ponto 2														
Leira 2	Ponto 3														
	Ponto 4														
Leira 3	Ponto 5														
	Ponto 6														
Leira 4	Ponto 7														
	Ponto 8														
Leira 5	Ponto 9														
	Ponto 10														
Leira 6	Ponto 11														
	Ponto 12														
Leira 7	Ponto 13														
	Ponto 14														
Leira 8	Ponto 15														
	Ponto 16														

2. English template - Monitoring of temperature and moisture of the composting mass in composting windrows

COMPOSTING PROJECT IN SANTA CATARINA

MONITORING SPREADSHEET 2 - Monitoring of temperature and moisture of the composting mass in the composting windrows

Farmer name:

		Date		Date		Date		Date		Date		Date		Date	
		Windrow Upturned		Windrow Upturned		Windrow Upturned		Windrow Upturned		Windrow Upturned		Windrow Upturned		Windrow Upturned	
		Temperature (°C)	Moisture (%)	Temperature (°C)	Moisture (%)	Temperature (°C)	Moisture (%)	Temperature (°C)	Moisture (%)	Temperature (°C)	Moisture (%)	Temperature (°C)	Moisture (%)	Temperature (°C)	Moisture (%)
Windrow 01	Point 1														
	Point 2														
Windrow 02	Point 1														
	Point 2														
Windrow 03	Point 1														
	Point 2														
Windrow 04	Point 1														
	Point 2														
Windrow 05	Point 1														
	Point 2														
Windrow 06	Point 1														
	Point 2														
Windrow 07	Point 1														
	Point 2														
Windrow 08	Point 1														
	Point 2														

3. Portuguese template - Control of frequency of operation of the UMAC equipment

PROJETO DE COMPOSTAGEM EM SANTA CATARINA

PLANILHA DE MONITORAMENTO 1 - Controle do acionamento da bomba de dejetos e da UMAC

Produtor:

DATA	Bomba de dejetos		UMAC		Leira revolvida no dia	OBSERVAÇÃO
	Hora acionada	Hora parada	Hora acionada	Hora parada		
01/12/2012 Sábado						
02/12/2012 Domingo						
03/12/2012 **Segunda-feira**						
04/12/2012 Terça-feira						
05/12/2012 Quarta-feira						
06/12/2012 Quinta-feira						
07/12/2012 Sexta-feira						
08/12/2012 Sábado						
09/12/2012 Domingo						
10/12/2012 **Segunda-feira**						
11/12/2012 Terça-feira						
12/12/2012 Quarta-feira						
13/12/2012 Quinta-feira						
14/12/2012 Sexta-feira						
15/12/2012 Sábado						
16/12/2012 Domingo						
17/12/2012 **Segunda-feira**						
18/12/2012 Terça-feira						
19/12/2012 Quarta-feira						
20/12/2012 Quinta-feira						
21/12/2012 Sexta-feira						
22/12/2012 Sábado						
23/12/2012 Domingo						
24/12/2012 **Segunda-feira**						
25/12/2012 Terça-feira						
26/12/2012 Quarta-feira						
27/12/2012 Quinta-feira						
28/12/2012 Sexta-feira						
29/12/2012 Sábado						
30/12/2012 Domingo						
31/12/2012 **Segunda-feira**						

4. English template - Control of frequency of operation of the UMAC equipment

COMPOSTING PROJECT IN SANTA CATARINA							
MONITORING SPREADSHEET 1 - Control of frequency of operation of the UMAC equipment							
Farmer name:							
		Pump		**UMAC Equipment**		**Windrow Upturned**	NOTE
DATE		**Start time**	**Finish time**	**Start time**	**Finish time**		
DD/MM/YYYY	Saturday						
DD/MM/YYYY	Sunday						
DD/MM/YYYY	Monday						
DD/MM/YYYY	Tuesday						
DD/MM/YYYY	Wednesday						
DD/MM/YYYY	Thursday						
DD/MM/YYYY	Friday						
DD/MM/YYYY	Saturday						
DD/MM/YYYY	Sunday						
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DD/MM/YYYY	Sunday						
DD/MM/YYYY	Monday						
DD/MM/YYYY	Tuesday						
DD/MM/YYYY	Wednesday						
DD/MM/YYYY	Thursday						
DD/MM/YYYY	Friday						
DD/MM/YYYY	Saturday						
DD/MM/YYYY	Sunday						
DD/MM/YYYY	Monday						
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