CENTRE DE VALORISATION DE CRABTREE
C.P. 31, Crabtree (Québec) J0K 1B0

National Ecocredit

Avoidance of methane production from decay of biomass through controlled mechanical treatment

Greenhouse Gas Project Report
Period January 1st, 2012 to Decembre 31st, 2013

Project proponent: *Centre de Valorisation de Crabtree*
143, 21e Rue
Crabtree (Québec)
J0K 1B0

Prepared by: *National Ecocredit*
1100, Boulevard René-Levesque Ouest, Suite 1310
Montréal (Québec)
H3B 4N4

September 12th , 2014

SOMMAIRE EXÉCUTIF

(*Please note that the remainder of the document is in English*)

Alors que le recyclage du papier, du plastique et du métal est maintenant un acquis dans nos villes, il en est tout autrement pour la valorisation des boues. Or, ces résidus contiennent principalement de la matière organique et des nutriments : des ressources clés pour le secteur agricole. En 2012, le centre de valorisation de Crabtree a été inauguré pour traiter les boues de fosses septiques. Ce projet de 2,5 millions $ permet de valoriser cette ressource en l'épandant sur des terres agricoles.

Le projet et les réductions d'émissions de GES seront enregistrés au Registre des GES ÉcoProjets®. Ces réductions sont quantifiées conformément aux principes et lignes directrices de la norme ISO 14064 tel que stipulé par le Registre des GES ÉcoProjets®. La méthodologie *AMS-III.E. Avoidance of methane production from decay of biomass through controlled combustion, gasification or mechanical/ thermal treatment*[1] du CDM a été sélectionnée afin de choisir les sources, puits et réservoirs de GES à inclure dans la quantification ainsi que comme guide pour les calculs de réductions.

Les réductions d'émission pour 2012-2013 sont au nombre de :

Année	Réductions d'émission (t CO_2e)
2012	990
2013	2 924

[1] http://cdm.unfccc.int/methodologies/DB/GPWCV89KQ7IFPEDCXA92BL6XK7JR3Y

TABLE OF CONTENT

LIST OF TABLES

ABBREVIATIONS

BS	Baseline Scenario (GHG Emission Source)
CDM	Clean Development Mechanism
CH_4	Methane
CO_2	Carbon dioxide
CO_2e	Carbon dioxide equivalent (usually expressed in metric tons)
CSA	Canadian Standards Association
EF	Emission Factor
GHG	Greenhouse gases
ISO	International Organization for Standardization
IPCC	Intergovernmental Panel on Climate Change
kWh	Kilowatt hour
N_2O	Nitrous oxide
PS	Project Scenario (GHG emission source)
SSR	Source, Sink and Reservoir
SWDS	Solid Waste Disposal Site
t	Ton (metric)
VERR	Verified Emission Reductions-Removals

1. INTRODUCTION

While the recycling of paper, plastic and metal is now a given in our cities, it is not the case for sludge from wastewater treatment units. Yet, these residues contain mainly organic matter and nutrients: key inputs for the agricultural sector. In 2012, the *Centre de valorisation de Crabtree* has been inaugurated to treat sludge from septic tanks. The $2,5 million project allows to valorize this resource by drying the material that is then spread on local agricultural land. ABC Environment is responsible for collecting the sludge, and Centre de valorisation de Crabtree is responsible for processing the sludge.

In Québec, common practice for the handling of sludge is disposal in a solid waste disposal site (SWDS). This results in large amounts of methane, a powerful greenhouse gas, being produced from the degradation of the waste under anaerobic conditions. Conversely, very small amounts of GHG are produced during the processing and short term storage of the sludge in the Crabtree recycling center. The treated sludge is spread on land where it aerobically degrades in the soil for the most part[2]. The aerobic decomposition of waste results in smaller emissions of GHG than the anaerobic option. Consequently, the Crabtree recycling center contributes to reducing the GHG emissions from the management of septic tank sludge when compared to the common practice scenario. This report quantifies the emissions reductions resulting from the treatment of sludge at the recycling center instead of the landfill option.

The treated sludge, used as a substitute for manufactured fertilizers or virgin materials, delivers additional environmental benefits from the avoidance of the production and transport of conventional fertilizers. In addition, ABC Environnement recently acquired 2 specialized collection trucks equipped with a solid-liquid separation technology which increases the total number of stops by up to 300% in one trip. These trucks will result in lowering the number of travels for unloading and hence reducing emissions associated to transport.

The CDM methodology, "*AMS-III.E. Avoidance of methane production from decay of biomass through controlled combustion, gasification or mechanical/ thermal treatment*[3]" is selected to identify the sources, sinks and reservoirs (SSRs) to be included in the quantification and for the calculation of emission reductions. This methodology is deemed to be the most appropriate one given that the applicability conditions it stipulates apply to the project. In section 3, the selection of the baseline scenario and the assessment of additionality were performed according to best practices and the expertise of the quantification team. A barrier analysis is performed and used to confirm the most plausible scenario and to provide a solid argument on which to base the additionality assessment.

This GHG report meets the requirements of the CSA's GHG CleanProjects® Registry and the ISO 14064-2 guidelines and principles:

- Relevance:

[2] http://www.ipcc-nggip.iges.or.jp/public/gp/bgp/5_2_CH4_N2O_Waste_Water.pdf
[3] http://cdm.unfccc.int/methodologies/DB/GPWCV89KQ7IFPEDCXA92BL6XK7JR3Y

All relevant GHG sources are meticulously selected and presented in section 4. A precise methodology is used along with project specific parameter values.

- Completeness:

A complete assessment of GHG sources is made and all GHG types are considered in the applied quantification methodology. Complete information regarding project implementation, activities and GHG quantification is given through this GHG report.

- Consistency:

Chosen quantification methodology is appropriate for project of *Centre de valorisation de Crabtree*. The established baseline scenario, as described in section 3, is consistent with the project level of activity related to energy needs of on-site installations.

- Accuracy:

Calculation uncertainties are kept as small as possible.

- Transparency:

Project related information is transparently communicated throughout this document so that the intended user can identify important data, how they are collected, and how the project actually leads to GHG emissions reduction. Data monitoring and GHG emission reductions calculation are clearly detailed in order to provide the reader sufficient information to allow the user to confidently make decisions.

- Conservativeness:

GHG emission reductions are not overestimated. When accuracy is jeopardized because of assumptions, conservative choices are made to make sure that GHG reductions are not overestimated.

This report will be made available for public consultation. It is intended to serve as a transparent reference document to support the prospection of potential verified emission reductions (VER) buyers.

2. PROJECT DESCRIPTION

2.1. Project Title

Avoidance of methane production from decay of biomass through controlled mechanical treatment

2.2. Objectives

The project aims to avoid the methane production from the decay of septic tank sludge in a waste disposal site by collecting, drying and applying the sludge on agricultural land.

2.3. Project Lifetime

Centre de valorisation Crabtree has begun operating the equipment required to dry the collected sludge in April 2012. The project start date is January 1st 2012. The project will continue until it ceases to respect the principle of additionality (e.g. the valorization of wastewater sludge becomes common practice or required by law) or until the equipment has reached the end of its useful life (i.e. approximately 20 years).

Expected reductions are presented for only ten years in this report since circumstances in terms of regulation or operations at the center could change causing the baseline scenario to change.

2.4. Type of GHG Project

This project is a Type III- other project activities according to the CMD nomenclature. It generates emissions reductions by avoiding methane emissions from the decay of biomass in a landfill.

2.5. Location

Centre de valorisation de Crabtree
143, 21e Rue
Crabtree (Québec)
J0K 1B0
Latitude: 45.97192
Longitude: 73.480593

2.6. Conditions prior to Project Initiation

Prior to the project implementation the sludge from the septic tank now serviced by ABC was transported to the closest option between the Berthierville and the Lachute SWDSs.

2.7. Description of how the Project will achieve GHG Emission Reductions or Removal Enhancements

By collecting the septic tank sludge, drying it and spreading it on agricultural land, the project is avoiding the emissions associated to the anaerobic decay of the sludge in a SWDS.

2.8. Project Technologies, Products, Services and Expected Level of Activity

Centre de valorization de Crabtree has purchased and has been operating since April 2012 a three channels rotary press by Fournier. The model number is 3-900/3000CV. It has a dewatering area of 3,00 m^2 and a motor of 7,5 kW. This equipment was designed for a twenty year life cycle although it has demonstrated it can exceed that time frame often[4]. No chemicals are used in this process. This equipment required an investment of close to 600 000$.

Figure 1 Rotary press

ABC Environnement recently acquired 2 specialized collection trucks equipped with a solid-liquid separation technology (Juggler Technology, see picture below) which increases the total number of stops by up to 300% in one trip. These trucks will result in lowering the number of travels for unloading and hence reducing emissions associated to transport.

Figure 2 The Juggler sludge collection truck

[4] Personal communication with Jim Russel at Fournier, 207-944-3991

2.9. Aggregate GHG Emission Reductions and Removal Enhancements likely to occur from the GHG Project

This is the first GHG report produced for this project. The results of the achieved emissions for 2012-2013 as well as the expected emissions reductions for years 2014-2021 are presented in the table below.

Table 2.1: Expected and Achieved Emission Reductions (t CO2e)

Year	Expected Emission Reductions (t CO2e)	Achieved Emission Reductions (t CO2e)
2012	990	990
2013	2 924	2 924
2014	2 892	
2015	2 892	
2016	2 892	
2017	2 892	
2018	2 892	
2019	2 892	
2020	2 892	
2021	2 892	
TOTAL	27 050	3 914

2.10. Identification of Risks

This emission reductions report was written according to ISO 14064-2 Specifications Requirements for quantification, monitoring and reporting of greenhouse gas emission reductions and removal enhancements assertions. In order to minimize risks, the methodology and GHG emission factors were selected based on their completeness and their international recognition.

To manage the risk of the project ceasing to respect the principle of additionality over its course, and, as a result, to be eligible under the CSA's GHG CleanProjects® Registry, the following aspects will be monitored:

- The spreading on agricultural land of treated sludge should not become common practice nor should it become required by law via new regulation. According to Recyc-Québec 2010-2011 report[5], only 31% of sludge was spread on land for those years. However, the government plans to change the Residual Materials Management Policy to ban the landfilling of putrescible organic materials by 2020.

[5] http://www.recyc-quebec.gouv.qc.ca/Upload/Publications/Bilan_2010_2011_GMR_Final.pdf , p.8

- The rotary press must remain operational throughout the project period. The equipment was purchased in 2012 and has an expected useful life of 20 years.
- *Centre de valorisation de Crabtree* must remain the owner of the equipment and the valorization center over the project period (to maintain its ownership of the carbon credits generated within this project).
- All the treated sludge must be spread on land. At any time over the course of the project, should the demand from farmers not be high enough to consume all treated sludge or should the sludge not meet the quality requirements for spreading on land the sludge would be landfilled and hence would not generate any emissions reductions. To manage this risk, the quantity of sludge treated and sludge spread on land as well as the results of the sludge analysis will be monitored.

Emission reductions are also closely related to the selection of the baseline and the application of the appropriate quantification methodology. The methodology must remain the same over the project period, but the baseline could change if regulation or common practices evolve in such a way to affect the baseline scenario.

2.11. Roles and Responsibilities

2.11.1 Project Proponent and Representative

Project proponent : *Centre de valorization de Crabtree*
Representative : Eugene David
Director, ABC Environnement
143, 21e Rue
Crabtree (Québec)
edavid@abcenvironnement.com

2.11.2 Monitoring and Data Collection

Eugene David is responsible for the project implementation and data monitoring and providing the date.

2.11.3 Quantification and reporting Responsible Entity

National Ecocredit is a firm specialized in non-traditional corporate financing. An expertise has been developed in the quantification of GHG emissions. Services are offered for GHG inventory, GHG emissions reduction project implementation, GHG markets advising, regulatory requirements and much more.

Camille Orthlieb works at National Ecocredit as a carbon credits advisor. She has an environmental engineering master degree from Ecole Polytechnique Fédérale de Lausanne, Switzerland. Before joining National Ecocredit, she worked with an engineering company, specialized on building energy efficiency.

Camille Orthlieb
Carbon credits advisor
National Ecocredit
corthlieb@nationalecocredit.com
514 871 5335 ext. 305

2.11.4 Authorized Project Contact

Karine Desjardins has the signing authority for National Ecocredit. She is authorized by the project proponent to perform requests and administrative tasks regarding the project registration.

Karine Desjardins

VP-Sales, Marketing and Structured Transactions
National Ecocredit
kdesjardins@nationalecocredit.com
514 871 5335

2.12. Project eligibility under the GHG Program

The project is eligible under the GHG CleanProjects® Registry. It is implemented following the ISO 14064-2 guidelines and principles, is not attempted to be registered under another GHG program and does not create any other environmental credit.

There is no specific Federal or Quebec law or regulation that stipulates the obligation to valorize septic tank sludge; Crabtree's center project is voluntary.

2.13. Environmental Impact Assessment

The nature of the project does not require an environmental impact assessment as the impact on the environment is limited to GHG emissions.

2.14. Stakeholder Consultations and Mechanism for on-going Communication

Eugene David, Director at ABC Environnement is responsible for the communications with the quantifier, the verifier and with all relevant stakeholders within and outside the company. Over the course of the project, no stakeholder communication has generated outcomes worthy of mention in this report.

2.15. Detailed Chronological Plan

The project started in January 1st 2012 and will end in December 31st 2021. This first report covers the emissions achieved in 2012 and 2013. Reports will be produced annually to cover the emissions reductions from 2014-2021.

2.16. Ownership

The *Centre de valorisation de Crabtree* is the owner of the emission reductions resulting from this project. The *Centre de valorisation de Crabtree* transforms the sludge initially collected by ACB Environment. The *Centre de valorisation de Crabtree* is the owner of the sludge transformation plant.

The transformed sludge produced by *Centre de valorisation de Crabtree* is then sold by *Centre de valorisation de Crabtree* to farmers in order to be scaterred over the agricultural fields.

3. SELECTION OF THE BASELINE SCENARIO AND ASSESSMENT OF ADDITIONALITY

The baseline scenario is selected among alternative scenarios representing what would have happened in the absence of this project. The alternative scenario that is most likely to occur is selected as the baseline scenario. Only alternatives that could realistically be implemented on-site are listed below: three options are identified as plausible scenarios to the drying and spreading on land of the sludge collected from the septic tanks at ABC'S clients.

Option 1: incineration

Option 2: landfilling

Option 3: drying and spreading on land

A barrier assessment is used to help identify barriers to any of the identified plausible scenarios and the project scenario. A barrier assessment is a common technique used to help justify the most realistic baseline scenario: the option that does not have any significant barrier to its implementation.

Although Recyc-Québec's 2010-2011 report[6] stating that 23.08% of sludge was landfilled while 46.15% was incinerated for those years would suggest that incineration is the most common practice, the very large distances between the territory covered by ABC and the closest incinerator exclude incineration as a plausible baseline scenario. The landfilling scenario is hence selected as the baseline scenario. The project of *Centre de valorisation de Crabtree* is additional because of significant technological and financial barriers (for the purchase of the rotary press and recycling center) and because it is not required by law.

Table 3.1: Barrier Assessment

Potential Barrier	Baseline Scenario Landfilling	Project Scenario Spreading on land	Other Scenario Incineration
Financial: Capital investment	No barrier	**Barrier** Significant Investment required for equipment and infrastructure	No barrier
Technology	No barrier	**Barrier** Significant Investment required for equipment and infrastructure	The closest incinerator is very far, transportation costs would be high
Common practice	No barrier Most common practice in the region	**Barrier** Not the most common practice	No barrier

[6] http://www.recyc-quebec.gouv.qc.ca/Upload/Publications/Bilan_2010_2011_GMR_Final.pdf Tableau 2.2

4. IDENTIFICATION AND SELECTION OF GHG SOURCES, SINKS AND RESERVOIRS

The SSRs for the baseline and the project scenario are identified in the table below which also indicates whether they are included or excluded from the quantification and whether they are controlled, related, or affected.

The CDM methodology *AMS-III.E. Avoidance of methane production from decay of biomass through controlled combustion, gasification or mechanical/ thermal treatment*[7] was selected as a guide for this project. The closest prescribed application of this methodology to the project of *Centre de valorisation de Crabtree* is one that prevents the decay of wastes that would have been in a waste disposal site through mechanical/thermal treatment to produce stabilized biomass (SB). The project of *Centre de valorisation de Crabtree* deviates from this scenario in that the mechanical treatment (i.e. centrifugation) of the biomass (i.e. sludge) does not produce SB; the resulting dry matter is applied on land and via degradation by the biota present in the soil the nutrients it contains becomes available to plants. This practice is recommended by the government of Québec since 2004, except for crops for human consumption[8]. The project delivers the advantage of reducing the need for chemical fertilisers on agricultural soils. This results into substantial environmental benefits. Fertiliser production is energy intensive and generates considerable greenhouse gas (GHG) emissions; it was estimated that their production consumes 1.2% of the world's energy and is responsible for 1.2% of the total GHG emissions. [9]

Although the methodology only requires that CO_2 and CH_4 to be included, this report also includes N_2O for a more complete assessment of the emissions profile.

According to the methodology, the baseline scenario is the situation where, in the absence of the project activity, organic waste matter is left to decay within the project boundary and methane is emitted to the atmosphere. The yearly baseline emissions are the amount of methane that would have been emitted from the decay of the cumulative quantity of the waste diverted or removed from the disposal site, to date, by the project activity, calculated as the methane generation potential using the "Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site".

[7] http://cdm.unfccc.int/methodologies/DB/GPWCV89KQ7IFPEDCXA92BL6XK7JR3Y
[8] http://www.radio-canada.ca/regions/Montreal/2011/09/05/009-epandage-boues-usees-controverse.shtml
[9] Sam Wood and Annette Cowie (2004). A Review of Greenhouse Gas Emission Factors for Fertiliser Production. Research and Development Division, State Forests of New South Wales. Cooperative Research Centre for Greenhouse Accounting http://www.ieabioenergy-task38.org/publications/GHG_Emission_Fertilizer%20Production_July2004.pdf

Table 4.1: SSR's Baseline Scenario Inventory

SSR - Baseline	Included / Excluded	Controlled/ Related / Affected	GHG	Explanation
B1. Distances between the collection points to Crabtree center	Excluded	related	-	This source is excluded because transportation related to sludge collection is the same before and after the project. It cannot lead to emission reductions
B2. Distance between Crabtree and the landfill (Berthierville or Montreal)	Excluded	related	-	This source is excluded because sludge transportation from. Crabtree center is not considered after the project.
B3. Decay of organic matter	Included	controlled	CO_2, CH_4, N_2O	This is the only source of emissions for the baseline scenario

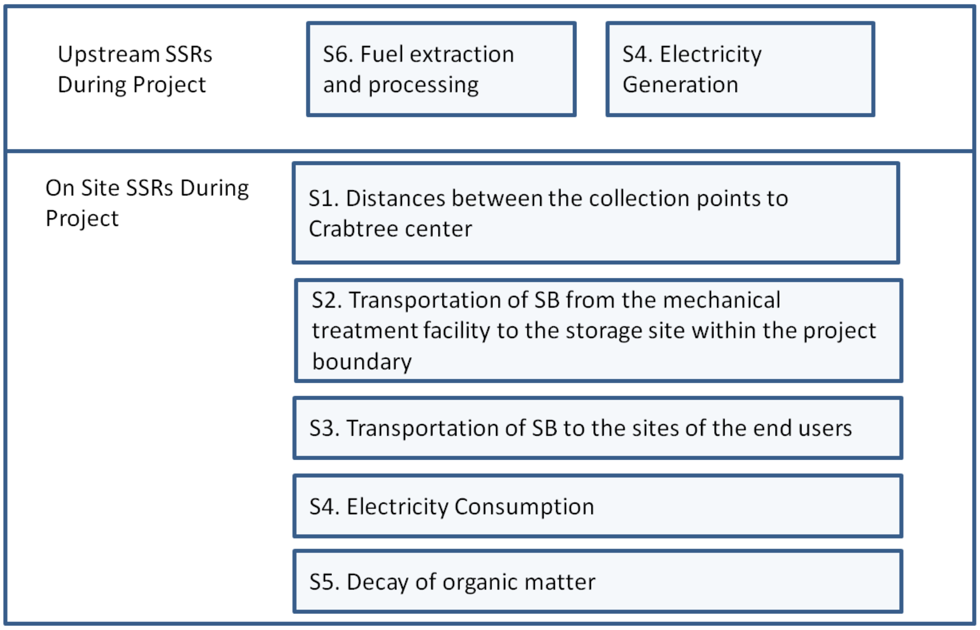
According to the methodology, project emissions consist of:

- CO_2 emissions related to the mechanical treatment facility;
- Incremental CO_2 emissions due to:
    - Incremental distances between the collection points to the project site as compared to the baseline disposal site;
    - Transportation of SB from the mechanical treatment facility to the storage site within the project boundary
    - Transportation of SB to the sites of the end users .
- CO_2 emissions related to the fossil fuel and/or electricity consumed by the project activity facilities, including the equipment for air pollution control required by regulations. In case the project activity consumes grid-based electricity, the grid emission factor (tCO_2e/MWh) should be used, or it should be assumed that diesel generators would have provided a similar amount of electricity

Table 4.2: SSR's Project Inventory

SSR - Project	Included/ Excluded	Controlled/ Related / Affected	GHG	Explanation
P1. Distances between the collection points to Crabtree center	Excluded	related	-	This source is excluded because transportation related to sludge collection is the same before and after the project. It cannot lead to emission reductions.
P2. Transportation of SB from the mechanical treatment facility to the storage site within the project boundary	Excluded	related	-	This source is neglected because the transport between the treatment facility and the temporary storage is very small
P3. Transportation of SB to the sites of the end users	Excluded	related	-	This source is excluded because the farmers using the treated sludge are located within a 5 km radius of the treatment center and in the absence of the project, the delivery of chemical fertilizers would have generated longer transportation.
P4. Electricity generation and consumption	Included	controlled	CO_2, CH_4, N_2O	This source is included and may represent a significant source of emissions (i.e. energy consumption from the gas effluent treatment process)
P5. Decay of organic matter	Excluded	related	-	This source is excluded because of the use of this organic matter on agricultural land reduces the need for chemical fertilizers whose production are CO_2 intensive.
P6. Fuel extraction and processing	Excluded	related	-	This emission source is assumed to be negligible compared to the combustion of the fuel for transport.

Figure 3 SSRs project scenario



5. QUANTIFICATION OF GHG EMISSIONS AND REMOVALS

The quantification consists in mainly subtracting the emissions associated to the project to the baseline emissions. Project emissions are obtained by multiplying the different emission sources, identified in the previous section, by the appropriate emission factor. These are taken from the Canadian National Inventory Report (NIR 1990-2011).

5.1. Baseline and Project GHG Emissions

The baseline emissions are calculated using the CDM methodological tool "Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site[10]" (Version 5). This tool was judged most appropriate for the purpose of this calculation as its scope and applicability cover the ‘‘baseline emissions of methane from waste that would in the absence of the project activity be disposed at solid waste disposal sites (SWDS)’’ which corresponds perfectly to the baseline scenario for this project.

<u>BASELINE EMISSIONS</u>

$TBE_y = BE_{CH4,SWDS,y}$

$BE_{CH4,SWDS,y}$ = Yearly Methane Generation Potential of the wastes diverted to be disposed in the landfill from the beginning of the project (x=1) up to the year y, (tCO2e)

It should be noted that the equation to calculate $BE_{CH4,SWDS,y}$ was slightly modified. The original equation yields emissions associated to the degradation of material landfilled in one year distributed over the years based on a first order decay model (taking into consideration the decay rate of the material). The modified equation ignores the decomposition rate of the material and yields all emissions associated to the degradation of the material landfilled for the year it is landfilled. This modification does not alter the total amount of emissions for a quantity of material landfilled. It simply allows to immediately showcase the environmental benefit of avoiding landfilling instead of the original equation which suggests that benefits are generated before many years down the road.
In term of emissions, not taking into account this decay results in lowering a little bit the emissions.

$$BE_{CH4,SWDS,y} = \varphi \cdot (1-f) \cdot GWP_{CH4} \cdot (1-OX) \cdot \frac{16}{12} \cdot F \cdot DOC_f \cdot MCF \cdot \sum_j W_{j,x} \cdot DOC_j$$

φ	Model correction factor to account for model uncertainties =0,9
f	Fraction of methane captured at the SWDS and flared, combusted or used in another manner
OX	Oxidation factor (reflecting the amount of methane from SWDS that is

[10] http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-04-v5.pdf

	oxidized in the soil or other material covering the waster)
F	Fraction of methane in the SWDS gas (volume fraction) = 0,5
DOC_f	Fraction of degradable organic carbon (DOC) that can decompose
MCF	Methane correction factor
W_x	Amount of organic waste prevented from disposal in the SWDS in the year x (tons)
j	Waste type category (index)
DOC_j	Fraction of degradable organic carbon (by weight) in the waste type j
y	Year for which methane emissions are calculated

PROJECT EMISSIONS

The CDM methodology, "*AMS-III.E. Avoidance of methane production from decay of biomass through controlled combustion, gasification or mechanical/ thermal treatment*" [11] was selected to calculate project emissions.

$$TPE_y = PE_{y,\ power}$$

$PE_{y,\ power}$: emissions through electricity consumption in th year y (tCO_2e)

$$PE_{y,\ power} = Q_{y,\ elec} * (EF_{elec,CO2} + EF_{elec,CH4} * GWP_{CH4} + EF_{elec,N2O} * GWP_{N2O})$$

$Q_{y,\ elec}$	Electricity consumption in year y (kWh)
$EF_{elec,\ CO2}$ $EF_{elec,\ CH4}$ $EF_{elec,\ N2O}$	GHG Emission factor of electricity consumption (g gas /kWh)

1 kg = 1000g
1 ton = 1000km

5.2. Emission Reductions

$$TPER_y = BS_y - PE_y$$

$TPER_y$ = Total Project Emission Reductions in year "y"

Calculation examples are provided in Annex I

[11] http://cdm.unfccc.int/methodologies/DB/GPWCV89KQ7IFPEDCXA92BL6XK7JR3Y

5.3. Emission Factors and other Parameters

Table 5.1: Emission factors summary

Factor	Gas	Value	Unit	Source
EF_{elec}	CO_2	1.64	g gas/kWh	National Inventory Report 1990-2011, Greenhouse Gas Sources and Sinks in Canada, Part 3, Table A13-6, p.74
	CH_4	0.0002		
	N_2O	0.0001		
EF_{diesel}	CO_2	2663	g/L	National Inventory Report 1990-2011, Greenhouse Gas Sources and Sinks in Canada, Part 2, Table A8-11, p.188, Light-duty diesel truck, Moderate control
	CH_4	0.14		
	N_2O	0.082		

Table 5.2: Parameters summary

Para-meter	Description	Value	Source
φ	Model correction factor to account for model uncertainties	0.9	Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site[12]
f	Fraction of methane captured at the SWDS and flared, combusted or used in another manner	0.571	CH_4 collection rate per province, from Craig Palmer, Senior Program Engineer, Environment Canada
OX	Oxidation factor (reflecting the amount of methane from SWDS that is oxidized in the soil)	0.1	Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site [13], default value to be conservative
F	Fraction of methane in the SWDS gas (volume fraction)	0.5	Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site [14], default value.
DOC_f	Fraction of degradable organic carbon (DOC) that can decompose	0.5	IPCC 2006 Guidelines for National Greenhouse Gas Inventories, volume 5, ch.3, p3.13[15]
MCF	Methane correction factor in managed anaerobic SWDS	1	IPCC 2006 Guidelines for National Greenhouse Gas Inventories volume 5, ch.3, p3.14[16]
DOC_j	Degradable Organic Carbon for the untreated sludge generated	0.5	CDM Methodology III.H. Methane recovery in wastewater treatment, p7/32, DOCs for domestic sludge[17]

[12] http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-04-v5.pdf
[13] http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-04-v5.pdf
[14] http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-04-v5.pdf
[15]http://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/5_Volume5/V5_3_Ch3_SWDS.pdf
[16]http://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/5_Volume5/V5_3_Ch3_SWDS.pdf
[17]https://cdm.unfccc.int/filestorage/8/R/I/8RIV5MZ4AG7YE9UQJ6HSL3NTFXD1C0/EB58_repan22_AMS-III.H_ver16.pdf?t=Tll8bmE5MW1mfDCsqIegmtEUkaU5WB9shPtC

6. DATA MONITORING AND CONTROL

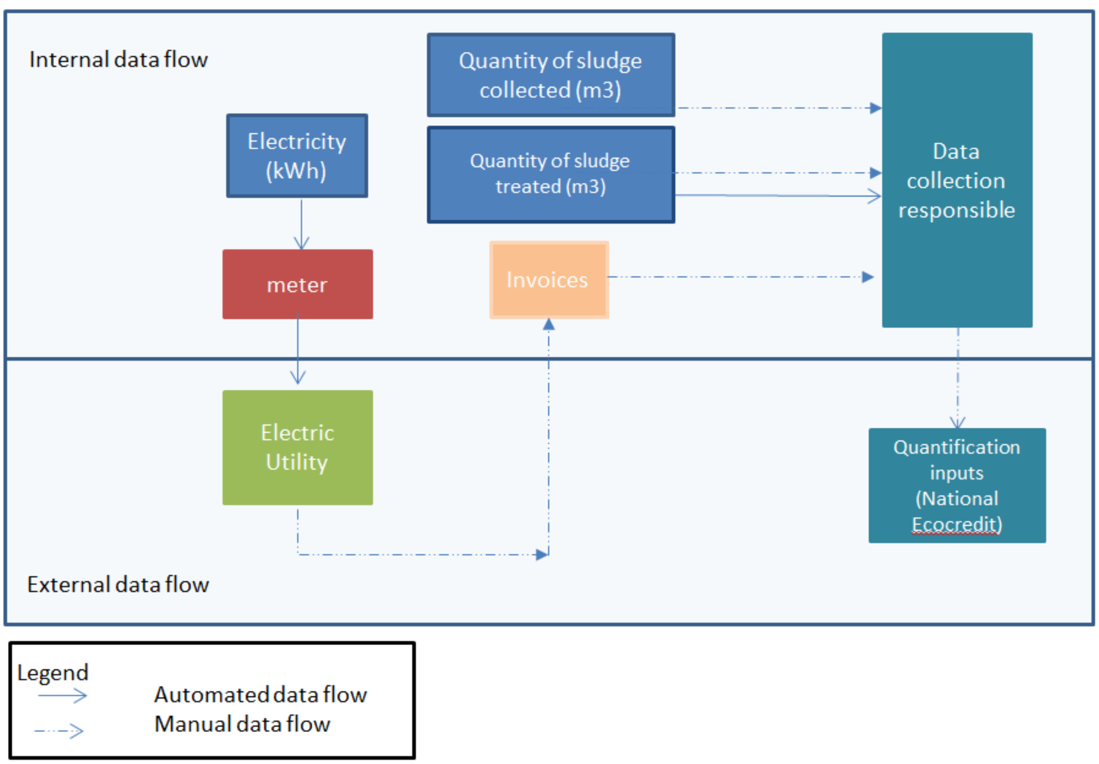
6.1. Data Management and Backups

All data is provided by Eugene David who prepares yearly energy consumption summaries from energy suppliers' invoices and sludge collection/treatment summaries from the internal data management system of *Centre de valorisation de Crabtree*. Monitored data are safely handled to prevent losses and hence compromising data integrity and the accuracy of GHG reductions calculation.

Concerning energy data, control system and procedures are very limited since they mostly come from the energy suppliers' data acquisition and storage system. These external systems are deemed sufficiently safe and reliable and allow for transparent communication of the relevant data. These are easily verifiable. Therefore, no limited access data storage system or control procedure are implemented.

Concerning the data for sludge collection and treatment, each truck is issued a coupon after unloading at the site. The coupons are compared with the treatment system's measures of the daily volume of sludge received. Following the treatment, each load for delivery is issued a coupon for valorization. These coupons are the data source for the total amount of sludge treated.

Figure 4 Data flowchart



6.2. Data Control and Procedures

Table 6.1: Data monitoring summary

Data/ Para-meter	Unit	Description	Source of data to be used	QA/QC procedure
W_x= $Q_{y,SB}$	Tons	Amount of organic waste prevented from disposal in the SWDS in the year x = Quantity of SB (treated sludge) produced in the year y	Each load for delivery is issued a coupon for valorization. These coupons are the data source.	Each truck is issued a coupon upon unloading at the site. The coupons are compared with the treatment system's measures of the daily volume of sludge received.
Q_y	Tons	Quantity of sludge collected in the year y	The treatment system's measures of the daily volume of sludge received is recorded.	This data is recorded and stored at the treatment plant.
$Q_{y, elec}$	kWh	Electricity consumption in year y	Hydro-Québec energy bills	Electricity meter monitors the power usage. The meter is read on a monthly basis and invoices reflect the usage of that period. Data are collected directly from energy bills. Paper copies of the invoices are stored and kept for future verification.

7. REPORTING AND VERIFICATION DETAILS

The project plan and report is prepared in accordance with ISO 14064-2 standard and the GHG CleanProjects® Registry requirements. The methodology that is used, the choice of region specific emission factors and a rigorous monitoring plan allow for a reasonably low level of uncertainty. National Ecocredit is confident that the emission reductions are not overestimated and that the numbers of emission reductions that are reported here are real and reflect the actual impacts of the project.

The GHG report is prepared in accordance with ISO 14064-2 and GHG CleanProjects® Registry requirements. Emission reductions will be verified by an independent third party to a reasonable level of assurance. Expected emission reductions are reported here for years 2014 to 2022. These estimations are based on actual data from 2012-2013.

Due to SPEDE program[18], National Ecocredit cannot guarranty the carbon credits after 2015.

Table 7.1: Baseline Scenario GHG Emissions for 2012 to 2021 (t CO2e)

	Total Baseline emissions = CH4 emissions from disposal (t CO_2e)				
Year	CO2	CH4	N2O	TOTAL	
2012	0	993	0	993	Actual
2013	0	2927	0	2927	Actual
2014	0	2895	0	2895	Expected
2015	0	2895	0	2895	Expected
2016	0	2895	0	2895	Expected
2017	0	2895	0	2895	Expected
2018	0	2895	0	2895	Expected
2019	0	2895	0	2895	Expected
2020	0	2895	0	2895	Expected
2021	0	2895	0	2895	Expected
TOTAL	**0**	**27080**	**0**	**27080**	

[18] For more information about SPEDE (Système de Plafonnement et d’Echange de Droits d’Emission de gaz à effet de serre du Québec) click on http://www.mddelcc.gouv.qc.ca/changements/carbone/Systeme-plafonnement-droits-GES.htm

Table 7.2: Project Scenario GHG Emissions for 2012 to 2021 – (t CO_2e)

	Total Project Emissions = emissions due to electricity consumption (t CO_2e)				
Year	CO_2	CH_4	N_2O	Total	
2012	1	1	1	3	Actual
2013	1	1	1	3	Actual
2014	1	1	1	3	Expected
2015	1	1	1	3	Expected
2016	1	1	1	3	Expected
2017	1	1	1	3	Expected
2018	1	1	1	3	Expected
2019	1	1	1	3	Expected
2020	1	1	1	3	Expected
2021	1	1	1	3	Expected
TOTAL	10	10	10	30	

Table 7.3: Expected and achieved GHG Emission Reductions for 2012 to 2021 (t CO_2e)

Year	TER - TOTAL CO2 t CO2e	CH4 t CO2e	N2O t CO2e	TOTAL t CO2e	
2012	-1	992	-1	990	Actual
2013	-1	2 926	-1	2 924	Actual
2014	-1	2 894	-1	2 892	Expected
2015	-1	2 894	-1	2 892	Expected
2016	-1	2 894	-1	2 892	Expected
2017	-1	2 894	-1	2 892	Expected
2018	-1	2 894	-1	2 892	Expected
2019	-1	2 894	-1	2 892	Expected
2020	-1	2 894	-1	2 892	Expected
2021	-1	2 894	-1	2 892	Expected
TOTAL	-10	27 070	-10	27 050	

APPENDIX I

Calculation example for year, y= 2012

BASELINE EMISSIONS:

Emissions due to degradation of material landfilled t CO2 eq

$BE_{CH4,SWDS,2012}$	=	ϕ	*	(1-	f	)*	GWP_{CH4}	*	(1-	OX	)*	"16/12"	*	F	*	DOC_f	*	MCF	*	W_x	*	DOC_j
993.65	=	0,9	*	(1-	0,571	)*	21	*	(1-	0.1	)*	1,33	*	0,5	*	0,5	*	1	*	817	*	0,05

$BE_{CH4,SWDS,2012}$ = 993 t CO_2e, rounded down

PROJECT EMISSIONS:

Emissions due to electricity consumption

$PE_{elec\ CO2}$	=	$(EF_{ele,CO2}$	*	$Q_{y,ele}$ /1000/1000
0.18	=	1,64	*	0,1120
	=	1		Rounded up

$PE_{elec\ CH4}$	=	$EF_{ele,CH4}$	*	GWP_{CH4}		$Q_{y,ele}$ /1000/1000
0.00047	=	0,0002	*	21	+	0,1120
	=	1		Rounded up		

$PE_{elec\ N2O}$	=	$EF_{ele,N2O}$	*	GWP_{N2O}		$Q_{y,ele}$ /1000/1000
0.003	=	0,0001	*	310		0,1120
	=	1		Rounded up		

$PE_{elec} = PE_{elec\ CO2} + PE_{elec\ CH4} + PE_{elec\ N2O}$ = 3t CO_2e, rounded up

EMISSIONS REDUCTIONS:

$TER_{2012} = BE_{CH4,SWDS,2012} - PE_{elec}$ = 993 – 3 = 990 t CO2eq