SECTION D. Application of a monitoring methodology and plan

D.1. Name and reference of approved monitoring methodology applied to the project activity:

This project activity uses the approved monitoring methodology AM0011 for "Landfill gas recovery with electricity generation and no capture or destruction of methane in the baseline scenario".

D.2. Justification of the choice of the methodology and why it is applicable to the project activity:

The chosen monitoring methodology is designed for the project activities that reduce greenhouse gas emissions through landfill gas capture and flaring.

The conditions for the methodology to be applied are respected:

- This monitoring methodology is based on direct and continuous measurement of the actual amount of landfill gas used and its the methane content by means of a continuous flow meter, a continuous methane analyser, monitoring pressure and temperature and measuring continuously the electricity generated.
- The basis for the monitoring of the emission reduction is the measuring of landfill gas amount and composition recovered.
- The CH_4 content of the emissions from flares is analysed to determine the fraction of CH_4 destroyed.
- The emissions reductions are defined as the difference of emissions in the baseline situation and in the project situation.

D.2. 1. Option 1: Monitoring of the emissions in the project scenario and the baseline scenario

D.2.2.1. Data to be collected in order to monitor emissions from the project activity, and how this data will be archived:

ID number *(Please use numbers to ease cross-referencing to table D.3)*	Data variable	Source of data	Data unit	Measured (m), calculated (c), estimated (e),	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	Comment

This option is not applicable.

D.2.1.2. Description of formulae used to estimate project emissions (for each gas, source, formulae/algorithm, emissions units of CO_2 equ.)

Not applicable.
See section D.2.2.1.

D.2.1.3. Relevant data necessary for determining the baseline of anthropogenic emissions by sources of GHGs within the project boundary and how such data will be collected and archived:

ID number	Data variable	Source of data	Data unit	Measured (m), calculated (c) or estimated (e)	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	Comment

Not applicable.

D.2.1.4. Description of formulae used to estimate baseline emissions (for each gas, source, formulae/algorithm, emissions units of CO_2 equ.)

Not applicable.

D. 2.2. Option 2: Direct monitoring of emission reductions from the project activity (values should be consistent with those in section E).

D.2.1.1. Data to be collected in order to monitor emissions from the project activity, and how this data will be archived:

ID number *(Please use numbers to ease cross-referencing to D.3)*	Data variable	Source of data	Data unit	Measured (m), calculated (c) or estimated (e)	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	For how long is archived data kept	Comment
1.	Amount of landfill gas collected from the project wells	PLC Control unit	Nm^3	M	Continuous	100%	Electronic	2 years after the crediting period	Measured by a flow meter and corrected according to LFG temperature and pressure. Data will be aggregated monthly
2.	Methane fraction in the landfill gas	Analyzer	%	M	Continuous	100%	Electronic	2 years after the crediting period	Measured by continuous gas quality analyser
3.	LFG Temperature and Pressure	Transmitter	°C/m Bar	M	Continuous	100%	Electronic	2 years after the crediting period	Measured by a continuous Temperature and Pressure Transmitter and used to normalized the flow.
4.	Flare efficiency		%	m and c	Monthly until stable values reached, then semi-annual	n/a	Electronic	2 years after the crediting period	Methane content of exhaust gas
5.	Amount of landfill gas flared	Flow meter	Nm^3	M	Continuous	100%	Electronic	2 years after the crediting period	Corrected volume according to landfill gas temperature and pressure. Data will be aggregated monthly

6.	Amount of LFG used for electricity generation	PLC Control unit	Nm^3	M	Continuous	100%	Electronic	2 years after the crediting period	--
7.	Amount of electricity generated	kWh meter	MWh	M	Continuous	100%	Electronic	2 years after the crediting period	Data will be aggregated monthly.
8.	Flare Working Hours	PLC Control unit	h	M	Continuous	100%	Electronic	2 years after the crediting period	--
9.	Flare temperature	Temperature transmitter	°C	M	Continuous	100%	Electronic	2 years after the crediting period	There is a temperature gauge to measure a combustion temperature of the flare. Data will be aggregated hourly.

D.2.2.2. Description of formulae used to calculate project emissions (for each gas, source, formulae/algorithm, emissions units of CO_2 equ.):

Emissions	**Significance**	**Description of formulas**
CH_4 not captured by the plant	Significant	Cannot be measured
CO_2 generated to supply energy to the plant	Insignificant	A biogas-fuelled generator will be used to supply power to the plant, so CO_2 released during the processing will be zero because it was originally fixed via biomass. The public grid will be used just in case of emergency. CO_2 = EF * EA EF = emission factor EA = energy absorbed by the public grid
CO_2 generated by CH_4 flaring	Insignificant	CO_2 released during the combustion process was originally fixed via biomass so that the life cycle of CO_2 emissions is zero.
Emissions of CO_2 from transport of equipment to the project site	Insignificant	Most of the equipment and materials for the construction will be purchased locally. There will be just two transports of special equipment from Italy to Argentina. CO_2 = NT * (CO_{2tr} + CO_{2sh}) = 3.244,9 tCO_2 < 1% NT = Number of Transports = 2 CO_{2tr} = CO_2 generated by truck = EF_{diesel} * KMs = 0,026 tCO_2 EF_{diesel} = diesel emission factor = 0.26 $kgCO_2$/km KMs = distance harbour in Geneva - the place where equipment is assembled= 100 km CO_{2sh} = CO_2 generated by ship = FC_{ship} * EF_{ship} * D = 1.622,4 tCO_2 FC_{ship} = Fuel Consumption = 33,80 t_{fuel}/day EF_{ship} = 3,2 tCO_2/t_{fuel} D = days needed by a ship to travel from Italy to Argentina = 15
Emissions from the venting of biogas (no flaring or incineration)	Non-existing	Emissions from the suction of biogas will not occur thanks to the protection against failures provided by an automatic feedback control system. If there is no flaring or incineration, the suction of biogas from the landfill body will be automatically stopped
Emissions of CO_2 from transport of waste to the landfill site	Non-existing	The landfill Puente Gallego has not been in operation since 2003 and therefore carbon dioxide from transport of waste to the landfill is not relevant.

D.2.3. Treatment of leakage in the monitoring plan

D.2.3.1. If applicable, please describe the data and information that will be collected in order to monitor leakage effects of the project activity

ID number *(Please use numbers to ease cross-referencing to table D.3)*	Data variable	Source of data	Data unit	Measured (m), calculated (c) or estimated (e)	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	Comment

No leakages are associated with landfill gas extraction.

D.2.3.2. Description of formulae used to estimate leakage (for each gas, source, formulae/algorithm, emissions units of CO_2 equ.)

No leakages under AM0011

D.2.4. Description of formulae used to estimate emission reductions for the project activity (for each gas, source, formulae/algorithm, emissions units of CO_2 equ.)

$ER_y = (MD_{project,y} – MD_{reg,y}) * GWP_{CH4}$

Wherein:
ER are the emission reductions during the year;
$MD_{reg,y}$ is the amount of CH_4 destroyed/burnt during the year in the absence of the project;
$MD_{project,y}$ is the amount of CH_4 actually destroyed/burnt during the year;
GWP_{CH4} is the approved global warming potential value for methane;

$MD_{reg,y} = MD_{project,y} * AF$

AF is 0% because Argentinan laws don't regulate biogas recovery.

$MD_{project,y} = CH_{4\ flared,y} + CH_{4\ electricity,y} + CH_{4\ thermal,y}$

$CH_{4\ flared,y} = LFG_{flare,y} * w_{CH4,y} * D_{CH4} * FE$

$CH_{4\ electricity,y} = LFG_{electricity,y} * w_{CH4,y} * D_{CH4}$

$CH_{4\ thermal,y} = 0$

In this case, $CH_{4\ flared,y}$ is the amount of CH_4 destroyed by flaring during the year (tCH_4), $LFG_{flare,y}$ is the amount of landfill gas flared in a 1-year period measured in normal cubic meters (Nm^3), $LFG_{electricity,y}$ is the amount of landfill gas used to generate electricity in a 1-year period measured in normal cubic meters (Nm^3), $w_{CH4,y}$ is the average CH_4 fraction of the landfill gas as measured in a 1-year period and expressed as a fraction of CH_4 volume / biogas volume and D_{CH4} is the CH_4 density expressed in tonnes of methane / cubic meter of CH_4 (tCH_4/m^3CH_4), measured at STP.
This value is in fact 0.0007168 tCH_4/Nm^3CH_4.
FE is the flare efficiency. It is 100% because high temperature torches are used.

D.3. Quality control (QC) and quality assurance (QA) procedures are being undertaken for data monitored		
Data ***(Indicate table and ID number e.g. 3.-1.; 3.2.)***	**Uncertainty level of data (High/Medium/Low)**	**Explain QA/QC procedures planned for these data, or why such procedures are not necessary.**
1.	Low	Flow meter is subject to a regular maintenance and testing regime to ensure accuracy.
2.	Low	The gas analyzer is subject to a regular maintenance and testing regime to ensure accuracy.
4.	Low	Regular maintenance ensure optimal operation of the flare. Flare efficiency is checked semi-annually, with monthly checks if the efficiency shows significant deviations from previous values.
5.	Low	Flow meter is subject to a regular maintenance and testing regime to ensure accuracy.
6.	Low	Flow meter is subject to a regular maintenance and testing regime to ensure accuracy.

D.4 Please describe the operational and management structure that the project operator will implement in order to monitor emission reductions and any leakage effects, generated by the project activity

To assure a correct monitoring, the training of the Argentinean staff will be organised.
Minimum 2 people will be trained:
- general knowledge about the equipment used in the landfill
- reading and recording data
- calibration methodology
- emergency situation.

Chosen trainees will have a good understanding of the processes and installation technology of the landfill gas extraction.
Verification and training start parallel with preliminary works for the installation.
A guidebook about landfill gas extraction and use in Italian and Spanish will also be available. The guidebook will include:
- operation manual
- drawings
- maintenance instructions
- description of parts of the equipment
- parameters for landfill gas composition, temperature and pressure.

Additionally the telephone helpdesk will be available with direct connection to Italy, where experts of Asja Ambiente Italia S.p.A. can give technical advice.

D.5 Name of person/entity determining the monitoring methodology:

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