



**Monitoring report form for CDM programme of activities
(version 01.0)**

MONITORING REPORT

Title of the programme of activities (PoA)	Landfills' gas capture, flaring and use program in Morocco	
UNFCCC reference number of the PoA	6568	
Version number(s) of the PoA-DD(s) applicable to this monitoring report	2	
Coordinating/managing entity (CME)	Fonds d'Equipeement Communal (FEC)	
Version number of this monitoring report	04	
Completion date of this monitoring report	23/02/2017	
Monitoring period number and dates covered by this monitoring report	First monitoring period 28/02/2014-31/07/2016	
Monitoring report number for this monitoring period	N/A	
Host Party(ies)	Host Party(ies) of the PoA	Is this a host Party to a specific-case CPA covered in this monitoring report? (yes/no)
	Morocco	Yes
Sectoral scope(s)	13 : Waste handling and disposal	
Selected methodology(ies)	ACM0001 version 12.0: Flaring or use of landfill gas	
Selected standardized baseline(s)	N/A	
Total amount of GHG emission reductions or net GHG removals by sinks for all specific-case CPAs in the PoA covered in this monitoring report	GHG emission reductions or net GHG removals by sinks reported up to 31 December 2012	GHG emission reductions or net GHG removals by sinks reported from 1 January 2013 onwards
	-	11,169 tCO ₂ e

PART I - Programme of activities

SECTION A. Description of PoA

A.1. Brief description of the PoA

The main objective of the PoA is to avoid methane emissions from municipal waste landfills in Morocco by promoting landfill gas (LFG) capture and flaring or utilization projects.

A.1.1. Generic CPA(s)

Title, identification/reference number and/or version number of the generic CPA(s) of the PoA	Sectoral scope(s)	Applied methodology(ies) or combination of methodologies and/or standardized baseline(s)
Landfills' gas capture, flaring [and/or] use program at the [landfill name] landfill	13 : Waste handling and disposal	ACM0001 version 12.0: Flaring or use of landfill gas

A.1.2. Specific-case CPA(s) covered in this monitoring report

Reference number of the specific-case CPA included in the PoA as of the end of this monitoring period	Title, identification/reference number and version number of the generic CPA to which the specific-case CPA applies	Crediting period dates of the specific-case CPA	Is this specific-case CPA covered in this monitoring report? (yes/no)
CPA1: Landfills' gas capture, flaring and use program at the Oum Azza landfill	Landfills' gas capture, flaring [and/or] use program at the [landfill name] landfill	28/02/2014-27/02/2021	Yes

A.2. Contact information of the coordinating/managing entity (CME) and/or responsible persons(s)/entity(ies)

The entity responsible for completing the CDM-PoA-MR-FORM is the CME, see contact information in Appendix 1.

SECTION B. Implementation of PoA

B.1. Implementation of the management system of the PoA

The management system of the PoA has been implemented by the CME as described in the PoA-DD. The FEC:

- screened and validated the projects for inclusion in the PoA
- arranged training and capacity development for the CPA Implementer
- ensured that the CPA Implementer was aware and agreed to participate in the PoA
- maintained a record keeping system of the CPA
- benefited from grant to improve the PoA management system.

B.2. Implementation of single sampling plan(s)

Not applicable

SECTION C. Post-registration changes to the PoA (including the generic CPA(s))**C.1. Corrections**

Not applicable

C.2. Inclusion of a monitoring plan to the registered PoA-DD (including its generic CPA-DD(s)), if a monitoring plan was not included at the time of registration

Not applicable

C.3. Permanent changes to the monitoring plan as described in the registered PoA-DD, applied methodology, or applied standardized baseline

Not applicable

C.4. Changes to the programme design of the registered PoA-DD (including corresponding changes to project design of the generic CPA-DD(s)) and updates to the eligibility criteria for inclusion of specific-case CPAs in the PoA

Not applicable

C.5. Types of changes specific to afforestation and reforestation activities

Not applicable.

PART II - Specific-case component project activity(ies)**SECTION D. Description of specific-case CPA(s)****D.1. Brief description of implemented specific-case CPA(s)**

The specific-case CPA described in this Monitoring Report consists in the implementation of a landfill gas capture and destruction on the landfill of Oum Azza, near Rabat. The purpose is to avoid GHG emission of methane from the decomposition of waste in the landfill.

The technology employed consists in:

- Vertical gas wells, including perforated HDPE pipes and well heads,
- and an enclosed flaring unit of 1500 Nm³/h capacity manufactured by BFM HAASE (high combustion temperature flare, 300-1500 Nm³/h, 20-100% CH₄, ≥0.3 s retention time).

No gas engine has been installed yet as the level of LFG is not sufficient.

The law authorizing independent power producers to deliver medium voltage electricity to the grid is still pending to be ratified. Thus, grid connection is currently not permitted.

In parallel, actions are taken to improve the LFG production such as a plan to connect inclined and horizontal wells on another cell of the landfill, leachate pumping, balancing of the wells and improvement of the network, etc.

Relevant dates:

- Installation of the gas collection network (45 vertical wells): February-March 2015
- Commissioning of the flare system: 30-31 July 2015
- During the month of August 2015, the flare was in testing phase and was shut down most of the time (availability 16%).
- Additional installation of 2 horizontal wells: May 2016 (installed, not yet connected to the network).
- Frequent flare stops occurred during the monitoring period due to a low pressure of gas flow.

The total GHG emission reductions achieved during the monitoring period are 11,169 tCO₂.

This landfill is not CDM registered in another PoA neither as an individual project activity, therefore there is no double counting of GHG emission reductions.

D.2. Geographical references or other means of identification of the location of the specific-case CPA(s)

Host Party: Morocco

The landfill of Oum Azza is located near the city of Rabat in the commune of Oum Azza.

Geocoordinates: +33.8727, -6.8089

SECTION E. Post-registration changes to specific-case CPA(s)

E.1. Temporary deviations from registered monitoring plan, applied methodology or applied standardized baseline

None.

E.2. Corrections

None.

E.3. Changes to the start date of the crediting period of the specific-case CPA(s)

The start date of the crediting period has been changed from 01/01/2013 to 28/02/2014.

E.4. Inclusion of a monitoring plan into the specific-case CPA(s) that was not included at registration

None.

E.5. Permanent changes to the monitoring plan as described in the registered specific-case CPA-DD(s), applied methodology or standardized baseline

None.

E.6. Changes to project design of the specific-case CPA(s)

None.

E.7. Types of changes specific to afforestation and reforestation specific-case CPA(s)

Not applicable.

SECTION F. Description of the monitoring system of specific-case CPA(s)

The data acquisition system is AEMS, managed by Geotech.

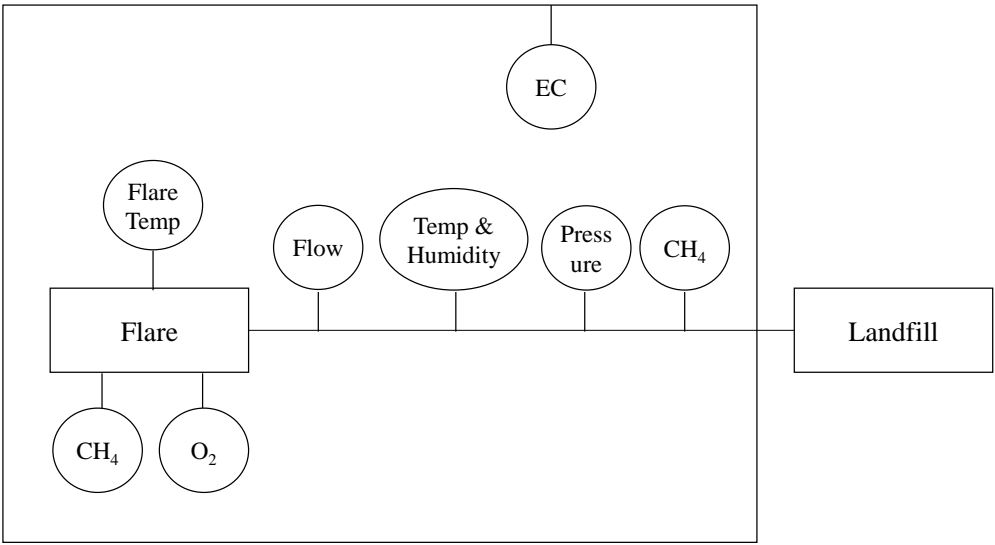
All the parameters described in section G.2. are automatically recorded in the data logger every 5 minutes.

Data is kept on the remote server for 3 months and a copy of monitored data is kept on site.

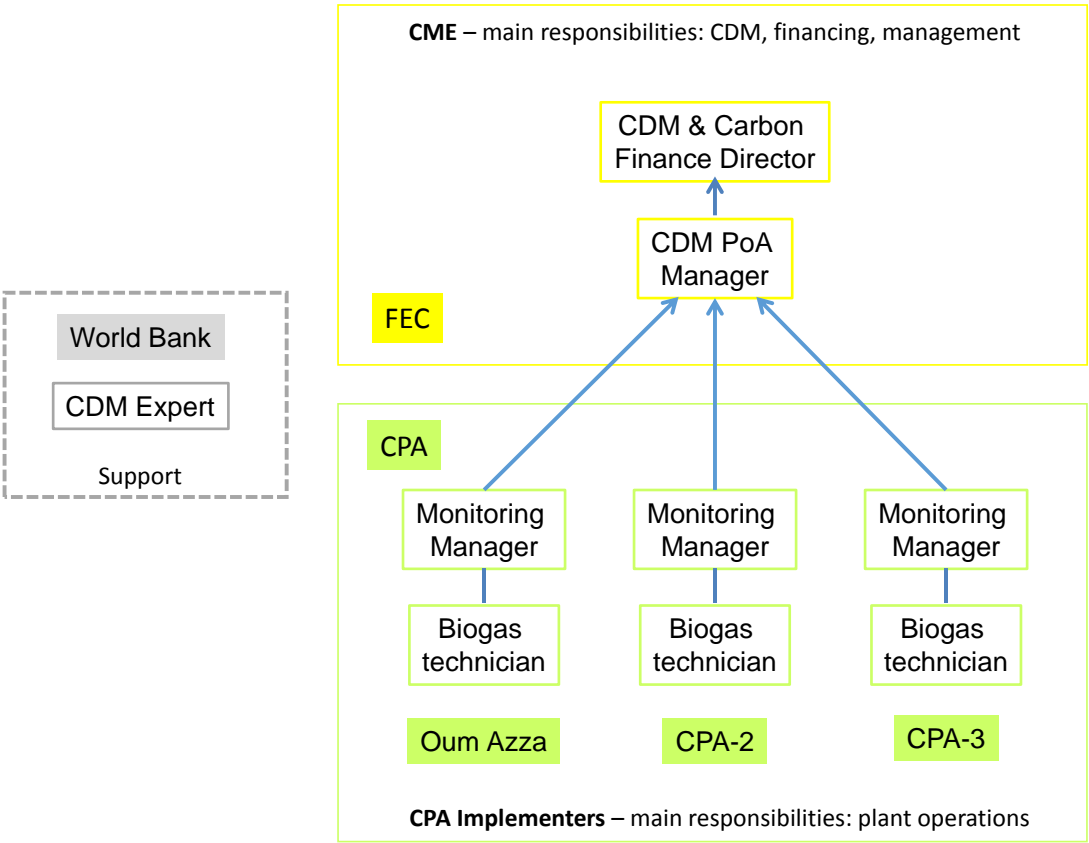
Raw data is extracted from the remote server every week and every month and sent by email to the CME and the World Bank, together with weekly / monthly operations reports.

Project data and documentation is uploaded on Dropbox and information is shared between the CPA Implementer, the CME and the World Bank.

The monitoring system is illustrated in the figure below:



Organizational structure, roles and responsibilities of personnel for the monitoring system:



The CME is responsible for managing the PoA, and thus the CDM. Though the FEC is the intermediary between the World Bank funds and the project development, it is not responsible for financing of the projects.

The CPA Implementers are responsible for the construction and operations of the LFG plants, including maintenance and monitoring. The Monitoring Manager is responsible for the monitoring plan and reporting to the CME.

The Biogas Technician is responsible for the daily operations of the project, including balancing of the gas network, maintenance of the LFG plant, data extraction, etc.

The World Bank will give support on CDM expertise, such as training, technical review of documents, validation and verification with the objective of building capacity so that in the future all activities can be undertaken by the CME.

QA/QC procedures:

- Internal audits carried out by the CME and the World Bank
- Trainings
- Regular maintenance
- Calibration planning
- Restricted access to raw data
- Shared access to project documentation between the three parties

Emergency procedures:

- Technical failure of a device: rapid identification of the damage, availability of spare parts, pool of suppliers identified for rapid replacement, regular maintenance to prevent technical failure
- Loss of data: back up of the data, manual records
- Calibration delays: use of a calibration planning, identification of a pool of laboratories or accredited agent for rapid calibration

SECTION G. Data and parameters
G.1. Data and parameters fixed ex ante, at registration, inclusion or renewal of crediting period

Data/parameter:	GWP_{CH4}
Unit	tCO ₂ e/tCH ₄
Description	Global warming potential for CH ₄
Source of data	IPCC
Value(s) applied)	25
Choice of data or measurement methods and procedures	As per COP decision
Purpose of data	Calculation of baseline emissions
Additional comments	None

Data/parameter:	OX_{top_layer}
Unit	Dimensionless
Description	Fraction of methane that would be oxidized in the top layer of the SWDS in the baseline
Source of data	Tool "Emission from solid waste disposal sites"
Value(s) applied)	0.1

Choice of data or measurement methods and procedures	Default value used
Purpose of data	Calculation of baseline emissions
Additional comments	None

Data/parameter:	EF_{grid,CM,y} or EF_{EL,y}
Unit	tCO ₂ / MWh
Description	Emission factor of the electricity grid in Morocco
Source of data	Fixed ex-ante in the PoA-DD
Value(s) applied)	0.6639
Choice of data or measurement methods and procedures	EF _{grid,CM,y} is calculated as a weighted sum of the OM and BM emission factors
Purpose of data	Calculation of project emissions
Additional comments	None

Data/parameter:	TDL_{i,y}
Unit	-
Description	Average technical transmission of the electricity grid in Morocco
Source of data	Default value as per the <i>Tool to calculate baseline, project and/or leakage emissions from electricity consumption</i> . Fixed ex-ante in the PoA-DD
Value(s) applied)	20%
Choice of data or measurement methods and procedures	Default value
Purpose of data	Calculation of project emissions
Additional comments	None

Parameters η_{PJ} , $\phi_{default}$, F , $DOC_{i,default}$, $MCF_{default}$, DOC_j , k_j , f , W_x , $p_{n,i,x}$ are not presented here as they are not relevant for monitoring.

G.2. Data and parameters monitored

Data / Parameter:	V_{t,wb} (same as FV_{RG,h})
Unit:	Nm ³ /h
Description:	Volumetric flow of the LFG in time interval t on a wet basis
Measured/ Calculated / Default:	Measured
Source of data:	Flow meter
Value(s) of monitored parameter:	Refer to electronic spreadsheets for exhaustive measures during the monitoring period.

Monitoring equipment:	Monitoring equipment	Manufacturer Type Accuracy	Serial number	Calibration frequency	Date of last calibration	Validity of the calibration
	Thermal mass flow meter	Endress+Hauser Proline Prowirl R200 Accuracy $\pm 0.75\%$	K3262219 000	Not necessary ("lifelong calibration")	Initial calibration: 15/04/2015	Lifelong calibration
Measuring/ Reading/ Recording frequency:	Measured continuously; recorded every 5 minutes					
Calculation method (if applicable):	Not calculated					
QA/QC procedures:	According to the manual, the flowmeter "offers lifelong calibration". It does not need to be recalibrated.					
Purpose of data:	Baseline emission calculations					
Additional comment:	<p>Two flow meters are installed in the plant. One is located before the blower "FT1" and the other one is located after the blower in the pipe, close to the flare stack "FT2". Values from FT2 are used for the calculations.</p> <p>The measures of the moisture content analyser show that the flow is in wet conditions. Option C of the <i>Tool to determine the mass flow of a greenhouse gas in a gaseous stream</i> will be applied.</p>					

Data / Parameter:	$v_{CH_4,t,wb}$ (same as $fv_{CH_4,h}$)					
Unit:	$m^3 CH_4 / m^3 LFG$ (wet)					
Description:	Volumetric fraction of CH_4 in time interval t on a wet basis					
Measured/ Calculated / Default:	Measured					
Source of data:	Gas analyser					
Value(s) of monitored parameter:	Refer to electronic spreadsheets for exhaustive measures during the monitoring period.					
Monitoring equipment:	Monitoring equipment	Manufacturer Type Accuracy	Serial number	Calibration frequency	Date of last calibration	Validity of the calibration
	Gas analyser	Geotech FAU 2% 0.2% with autocalibration	GA14466 GA14465	Auto-calibration	Factory calibration 18/04/2015 Start of use 01/08/2015 Calibrated by the manufacturer on 08/04/2016 Start of use 23/04/2016	Valid during the entire monitoring period
Measuring/ Reading/ Recording frequency:	Measured and recorded every 5 minutes					
Calculation method (if applicable):	Not applicable					
QA/QC procedures:	<p>An auto calibration module ensures a high accuracy.</p> <p>The measures of the gas analyser are checked every day ("calcheck"), if a deviation is found, a calibration is automatically triggered. A zero check (verified with air) and a typical value check are performed by comparison with standard certified gas (59.9% CH_4 / 40.1% CO_2, certificate S095880, valid until 06/07/2018)</p>					
Purpose of data:	Baseline emissions calculations					

Additional comment:	GA14466 was replaced by GA14465 on 23/04/2016, which was duly calibrated by the manufacturer before installation in the plant. The measures of the moisture content analyser show that the volumetric fraction of methane is in wet conditions. Option C of the <i>Tool to determine the mass flow of a greenhouse gas in a gaseous stream</i> will be applied.
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Data / Parameter:	P_t					
Unit:	mbar					
Description:	Pressure of the LFG in time interval <i>t</i>					
Measured/ Calculated / Default:	Measured					
Source of data:	Pressure sensor					
Value(s) of monitored parameter:	Refer to electronic spreadsheets for exhaustive measurements during the monitoring period.					
Monitoring equipment:	Monitoring equipment	Manufacturer Type Accuracy	Serial number	Calibration frequency	Date of last calibration	Validity of the calibration
	Pressure sensor	Endress +Hauser Cerabar M PMP51 0.15%	K5060D 01129	Every year	Factory calibration 20/05/2015 Start of use 01/08/2015 Recalibrated 13/06/2016	01/08/2015 to 31/07/2016 and from 13/06/2016 to 12/06/2017
Measuring/ Reading/ Recording frequency:	Measured continuously; recorded every 5 minutes					
Calculation method (if applicable):	Not applicable					
QA/QC procedures:	Calibrated according to the manufacturer's specifications					
Purpose of data:	Baseline emissions calculations					
Additional comment:	Measured to determine the density of methane ρ_{CH_4}					

Data / Parameter:	T_t					
Unit:	°C					
Description:	Temperature of the LFG in time interval <i>t</i>					
Measured/ Calculated / Default:	Measured					
Source of data:	Temperature and humidity sensor					
Value(s) of monitored parameter:	Refer to electronic spreadsheets for exhaustive measures during the monitoring period.					
Monitoring equipment:	Monitoring equipment	Manufacturer Type Accuracy	Serial number	Calibration frequency	Date of last calibration	Validity of the calibration
	Temperature sensor	Avenisense Wateract-air Typical 0.2°C Max 0.5°C	10036	Every year	Factory calibration 15/06/2015 Start of use 01/08/2015	01/08/2015 to 31/07/2016
Measuring/ Reading/ Recording frequency:	Measured continuously; recorded every 5 minutes					
Calculation method (if applicable):	Not applicable					
QA/QC procedures:	Calibrated according to the manufacturer's specifications					

Purpose of data:	Baseline emissions calculations
Additional comment:	T_i is measured to determine the density of methane ρ_{CH_4} The temperature and humidity sensor is used to determine whether the measurements of LFG are in dry or wet conditions. Though the average temperature is below 60°C, the measurements of the moisture content analyser show that the measurements of the flow and the volumetric fraction of methane are taken in wet basis.

Data / Parameter:	T_{flare}					
Unit:	°C					
Description:	Temperature in the exhaust gas of the flare					
Measured/ Calculated / Default:	Measured					
Source of data:	Thermocouple					
Value(s) of monitored parameter:	Refer to electronic spreadsheets for exhaustive measures during the monitoring period.					
Monitoring equipment:	Monitoring equipment	Manufacturer Type Accuracy	Batch number	Calibration / replacement frequency	Date of last calibration / replacement	Validity
	Thermo-couple	Günther Type S $\pm 1.0^\circ\text{C}$	05-2038721 0-0500	Every year	Factory calibration 27/07/2015 Start of use 01/08/2015	01/08/2015 to 31/07/2016
Measuring/ Reading/ Recording frequency:	Measured continuously; recorded every 5 minutes					
Calculation method (if applicable):	Not applicable					
QA/QC procedures:	Calibration or replacement every year					
Purpose of data:	Baseline emissions calculations					
Additional comment:	-					

Data / Parameter:	$fv_{CH_4,FG,h}$					
Unit:	mg/m^3					
Description:	Concentration of CH_4 in the exhaust gas of the flare in dry basis at normal conditions in the hour h					
Measured/ Calculated / Default:	Measured					
Source of data:	Gas analyser					
Value(s) of monitored parameter:	Refer to electronic spreadsheets for exhaustive measures during the monitoring period.					
Monitoring equipment:	Monitoring equipment	Manufacturer Type Accuracy	Serial number	Calibration frequency	Date of last calibration	Validity of the calibration
	Gas analyser	Servomex Servopro 4900 1% of reading or 0.5 ppm	653383	Auto calibration	Factory calibration 15/06/2015 Start of use 01/08/2015 Recalibrated by a third party on 13/06/2016	Valid during the entire monitoring period
Measuring/ Reading/ Recording frequency:	Measured continuously; recorded every 5 minutes					

Calculation method (if applicable):	Not applicable
QA/QC procedures:	An auto calibration module ensures a high accuracy. A zero check (verified with N ₂ , certificate S107685, valid until 14/01/2019) and a typical value check are performed by comparison with standard certified gas (0.69% CH ₄ / 10% O ₂ , certificate S107684, valid until 14/01/2019).
Purpose of data:	Baseline emissions calculations
Additional comment:	The point of measurement is located in the upper section of the flare stack.

Data / Parameter:	t_{O₂,h}					
Unit:	-					
Description:	Volumetric fraction of O ₂ in the exhaust gas of the flare in the hour <i>h</i>					
Measured/ Calculated / Default:	Measured					
Source of data:	Gas analyser					
Value(s) of monitored parameter:	Refer to electronic spreadsheets for exhaustive measures during the monitoring period.					
Monitoring equipment:	Monitoring equipment	Manufacturer Type Accuracy	Serial number	Calibration frequency	Date of last calibration	Validity of the calibration
	Gas analyser	Servomex Servopro 4900 0.05%	653383	Auto calibration	Factory calibration 15/06/2015 Start of use 01/08/2015 Recalibrated by a third party on 13/06/2016	Valid during the entire monitoring period
Measuring/ Reading/ Recording frequency:	Measured continuously; recorded every 5 minutes					
Calculation method (if applicable):	Not applicable					
QA/QC procedures:	An auto calibration module ensures a high accuracy. A zero check (verified with N ₂ , certificate S107685, valid until 14/01/2019) and a typical value check are performed by comparison with standard certified gas (0.69% CH ₄ / 10% O ₂ , certificate S107684, valid until 14/01/2019).					
Purpose of data:	Baseline emissions calculations					
Additional comment:	The point of measurement is located in the upper section of the flare stack.					

Data / Parameter:	EC_{P,J,y}
Unit:	MWh
Description:	Quantity of electricity consumed by the CPA in the year <i>y</i>
Measured/ Calculated / Default:	Measured
Source of data:	Electricity meter
Value(s) of monitored parameter:	37.6 MWh for the flaring system and 59.3 MWh for the leachate pumping system during the monitoring period
Monitoring equipment:	Manufacturer / type / model: Siemens Sentron PAC3200 Serial number: LQN1315 Accuracy: 0.5% Calibration: calibrated by the manufacturer. Recalibration not required
Measuring/ Reading/ Recording frequency:	Measured continuously; recorded every 5 minutes.

Calculation method (if applicable):	Aggregated according to the monitoring period
QA/QC procedures:	According to the manual, the electricity meter has been calibrated by the manufacturer and recalibration is not required.
Purpose of data:	Project emissions calculations
Additional comment:	<p>All electricity consumptions have been accounted, including consumptions during the installation and testing phase prior to the flare commissioning.</p> <p>In addition to the flare, two compressors are used to extract leachate from the landfill. The electricity consumed by the compressors are not monitored by the Siemens electricity meter but should be accounted for.</p> <p>Both compressors were installed after the commissioning of the flare. The first compressor was installed 18/09/2015 and the second compressor was installed 01/12/2015. Each compressor has a nominal capacity of 4 kW.</p> <p>To be conservative, we will assume that the compressors have been functioning at full capacity every hours of the monitoring period + 10%, since the date of installation of the pumps. The amount of electricity consumed due to leachate pumping during the monitoring period is estimated as: 59.347 MWh.</p> <p>This amount corresponds to $(59.347 \text{ MWh} \times 0.6639 \text{ tCO}_2/\text{MWh} \times (1 + 20\%)) = 47.3 \text{ tCO}_2\text{e}$ project emissions, with have been accounted for in the ER calculations.</p>

Data / Parameter:	Other flare operation parameter
Unit:	-
Description:	Data and parameters required to monitor whether the flare operates within the range of operating conditions according to the manufacturer specifications
Measured/ Calculated / Default:	Measured
Source of data:	Flow meter and gas analyser
Value(s) of monitored parameter:	Refer to electronic spreadsheets for exhaustive measures during the monitoring period.
Monitoring equipment:	Flow meter and gas analyser
Measuring/ Reading/ Recording frequency:	Measured continuously; recorded every 5 minutes
Calculation method (if applicable):	Not calculated
QA/QC procedures:	Refer to parameters $V_{t,wb}$ and $v_{CH4,t,wb}$
Purpose of data:	Baseline emission calculations
Additional comment:	The range of operating conditions of the flare are: minimum flow of 300 Nm ³ /h and a minimum methane concentration of 20%.

Parameters $V_{t,db}$, $v_{CH4,t,db}$, $M_{t,wb}$, $M_{t,db}$, $p_{H2O,t,sat}$, $F_{CH4,EL}$, $EC_{BL,k,y}$, and Operation hours of the energy plant are not presented here as they are not relevant for this monitoring period.

Parameters $F_{CH4-sent-flare,y}$, PE_{flare} and $PE_{EC,y}$ are not presented here as they are not monitored but calculated. Values of these parameters for the monitoring period can be verified in the ER calculations spreadsheets and related formulas are presented in section H.

G.3. Implementation of specific-case CPA level sampling plan

Not applicable

SECTION H. Calculation of GHG emission reductions

H.1. Calculation of baseline emissions or baseline net GHG removals by sinks

The baseline emission are calculated as follows:

$$BE_y = BE_{CH4,y} + BE_{EC,y} \quad (1)$$

Where:

BE_y Baseline emissions in year y (tCO_2e)

$BE_{CH_4,y}$ Baseline emissions of methane from the SWDS in year y ($t CO_2e/yr$)

$BE_{EC,y}$ Baseline emissions associated with electricity generation in year y ($t CO_2/yr$), equal to zero as electricity generation is not implemented during this monitoring period

$$BE = BE_{CH_4,y} = (1 - OX_{top_layer}) * F_{CH_4,PJ} * GWP_{CH_4} \quad (2)$$

Where:

$$F_{CH_4,PJ} = F_{CH_4,flared} + F_{CH_4,EL} \quad (3)$$

$F_{CH_4,PJ,y}$ Amount of methane in the LFG which is flared and/or used in the project activity in year y ($t CH_4/yr$)

$F_{CH_4,flared,y}$ Amount of methane in the LFG which is destroyed by flaring in year y ($t CH_4/yr$)

$F_{CH_4,EL,y}$ Amount of methane in the LFG which is used for electricity generation in year y ($t CH_4/yr$), equal to zero as electricity generation is not implemented during this monitoring period

And where $F_{CH_4,flared}$ is calculated as follows:

$$F_{CH_4,flared} = F_{CH_4,sent-flare} - PE_{flare} / GWP_{CH_4} \quad (4)$$

Where:

$F_{CH_4,sent-flare}$ is the mass flow of methane in the LFG sent to the flare and is calculated based on the following parameters:

$$F_{CH_4,sent_flare} = V_{t,wb} * v_{CH_4,t,wb} * \rho_{CH_4} \quad (5)$$

Where:

$V_{t,wb}$ Volumetric flow of the LFG in time interval t on a wet basis

$v_{CH_4,t,wb}$ Volumetric fraction of CH_4 in time interval t on a wet basis

ρ_{CH_4} Density of methane ($kg CH_4/m^3 CH_4$)

A humidity sensor has been installed to determine whether the measurements of LFG are in dry or wet conditions and the records show that the measurements of the volumetric flow and fraction of methane are taken in wet basis.

Option C of the "Tool to determine the mass flow of a greenhouse gas in a gaseous stream" is applied to calculate the density of methane, and the resulting mass flow of methane:

The density of methane is calculated according to the following equation:

$$\rho_{CH_4} = P_n * MM_{CH_4} / R_u * T_n \quad (6)$$

Where:

P_n Absolute pressure at normal conditions (Pa)

MM_{CH_4} Molecular mass CH_4 ($kg/kmol$)

R_u Universal ideal gas constant ($Pa.m^3 / kmol.K$)

T_n Temperature at normal conditions (K)

PE_{flare} is calculated as per the "Tool to determine project emissions from flaring gases containing methane" as described in the PoA-DD.

$$PE_{flare} = \sum TM_{RG,h} * (1 - \eta_{flare,h}) * GWP_{CH_4} / 1000 \quad (7)$$

Where:

$TM_{RG,h}$ Mass flow of methane in the residual gas stream, which is the same as $F_{CH_4,sent_flare}$

$\eta_{\text{flare,h}}$ Flare efficiency (fraction) when LFG is flared
 GWP_{CH_4} Global Warming Potential of methane (t CH₄/t CO₂)

And:

$$\eta_{\text{flare,h}} = 1 - (\text{TM}_{\text{FG,h}} / \text{TM}_{\text{RG,h}}) \quad (8)$$

Where:

$\text{TM}_{\text{FG,h}}$ is the mass flow of methane in the exhaust gas of the flare (kg/h)

Baseline emissions calculated during the monitoring period: 11,247 tCO₂e

Full detailed calculations of baseline emissions are provided in electronic spreadsheets attached to the monitoring report.

H.2. Calculation of project emissions or actual net GHG removals by sinks

Project emission due to electricity consumption $\text{PE}_{\text{EC},y}$:

$$\text{PE}_{\text{EC},y} = \text{EC}_{\text{PJ},i,y} \times \text{EF}_{\text{EL},y} \times (1 + \text{TDL}_{i,y}) \quad (9)$$

Where

$\text{EC}_{\text{PJ},i,y}$ Net quantity of electricity consumed from the grid (MWh)
 $\text{EF}_{\text{EL},y}$ Emission Factor of the grid used for CPA's electric consumption (tCO₂/MWh)
 $\text{TDL}_{i,y}$ Average technical transmission and distribution losses in the grid in the year y

Monitored values of Project Emissions from electricity consumed by the CPA during the monitoring period are: 78 tCO₂e.

There were no project emissions due to electricity consumption prior to 31/07/2015, since the project operations had not started.

Full detailed calculations of project emissions are provided in electronic spreadsheets attached to the monitoring report.

Project emission from flaring $\text{PE}_{\text{flare},y}$:

PE_{flare} is calculated as 137 tCO₂e for the monitoring period.

Formulae are presented in section H.1 above because PE_{flare} is part of the calculation of baseline emissions.

H.3. Calculation of leakage

No leakage is considered for the PoA.

H.4. Summary of calculation of GHG emission reductions or net GHG removals by sinks

Specific-case CPA reference number	Baseline emissions or baseline net GHG removals by sinks (tCO ₂ e)	Project emissions or actual net GHG removals by sinks (tCO ₂ e)	Leakage (tCO ₂ e)	GHG emission reductions or net GHG removals by sinks (tCO ₂ e) achieved in the monitoring period		
				Up to 31/12/2012	From 01/01/2013	Total amount
CPA-1	11,247	78	0	-	11,169	11,169
Total	11,247	78	0	-	11,169	11,169

H.5. Comparison of GHG emission reductions or net GHG removals by sinks with estimates in the included CPA-DD(s)

Specific-case CPA reference number	Value estimated in ex ante calculation in the included CPA-DD(s)	Actual values achieved by the specific-case CPA(s) during this monitoring period
CPA-1	134,336	11,169
Total	134,336	11,169

The value estimated in ex ante calculation in the included CPA-DD is calculated as follows:
 $134,336 \text{ tCO}_2\text{e} = 5/12^{(1)} \text{ months in 2015} * 128,649 \text{ tCO}_2\text{e} + 7/12 \text{ months in 2016} * 138,399 \text{ tCO}_2\text{e}.$

⁽¹⁾ The project started operating on 01/08/2015, so we compare the CPA-DD value at this date. Otherwise, the CPA-DD estimation from 01/03/2013 to 31/07/2016 is: 397,820 tCO₂e

H.6. Remarks on difference from the estimated value in the included CPA-DD(s)

The difference between the values estimated in ex-ante calculation and the values actually achieved is due to a lower amount of landfill gas generated in the landfill due to the presence of leachate.

Appendix 1. Contact information of coordinating/managing entity and/or responsible persons/entities

Coordinating/managing entity and/or responsible person/entity	<input checked="" type="checkbox"/> Project participant <input checked="" type="checkbox"/> Person/entity responsible for completing the CDM-PoA-MR-FORM
Organization name	Fond d'Equipement Communal (FEC)
Street/P.O. Box	Espace Oudayas, Angle Avenue Annakhil et Avenue Ben Barka, BP 2175 – Has Ryad
Building	-
City	Rabat
State/Region	-
Postcode	-
Country	Morocco
Telephone	+(212)5 37 56 90 34
Fax	+(212)5 37 56 90 12
E-mail	ammor@fec.ma
Website	-
Contact person	Mr. Idris AMMOR
Title	Secretary General
Salutation	Mr.
Last name	AMMOR
Middle name	-
First name	Idris
Department	-
Mobile	-
Direct fax	+(212)5 37 56 90 12
Direct tel.	+(212)5 37 56 90 34
Personal e-mail	ammor@fec.ma