



## Monitoring report form (Version 03.1)

### Monitoring report

<b>Title of the project activity</b>	Jaroensompong Corporation Rachathewa Landfill Gas to Energy Project
<b>Reference number of the project activity</b>	1413
<b>Version number of the monitoring report</b>	1.0
<b>Completion date of the monitoring report</b>	12/06/2013
<b>Registration date of the project activity</b>	14/03/2008
<b>Monitoring period number and duration of this monitoring period</b>	Monitoring period No. 2 (01/01/2009 – 31/12/2012)
<b>Project participant(s)</b>	- Jaroensompong Co., Ltd. - Mitsubishi UFJ Morgan Stanley Securities Co., Ltd.
<b>Host Party(ies)</b>	Thailand
<b>Sectoral scope(s) and applied methodology(ies)</b>	13: Waste handling and Disposal  ACM0001 (version 05): Consolidated baseline and monitoring methodology for landfill gas project activities
<b>Estimated amount of GHG emission reductions or net anthropogenic GHG removals by sinks for this monitoring period in the registered PDD</b>	239,704 tCO <sub>2</sub>
<b>Actual GHG emission reductions or net anthropogenic GHG removals by sinks achieved in this monitoring period</b>	120,833 tCO <sub>2</sub>

## SECTION A. Description of project activity

### A.1. Purpose and general description of project activity

Jaroensompong Corporation Rachathewa Landfill Gas to Energy Project (the Project) has received Thai DNA approval on 30/08/2007 and officially registered with CDM Executive Board on 14/03/2008 with registration reference number 1413.

Developer of the Project Jaroensompong Co., Ltd. (JS) has installed a landfill gas (LFG) collection system and a 1.1 MW electricity generator at the Rachathewa landfill site, which is located 30km east of the Bangkok Metropolitan Area (BMA), Thailand. The LFG collection system for the Project is based on horizontal lines and wells, which include a system for drainage and collection of leachate at the outer edges of the landfill. LFG collection system is constructed using PVC and HDPE piping to allow for settlement. Recovered LFG is being utilized as fuel for the electricity generator. The generated electricity is being sold to the Metropolitan Electricity Authority (MEA) under a power purchase agreement. The Project has also installed an open flare system to combust excess LFG not used in power generation to avoid release of collected LFG into atmosphere.

The project is the first in Thailand to utilize LFG for electricity generation on a commercial scale and contributes to sustainable development of the country by mitigating uncontrolled GHG emission from the landfill site in environmentally sound manner such as; preventing on-site fire hazard, controlling the release of volatile organic compounds, reducing undesirable odors, providing greater control of leachate drainage, and physically stabilizing the landfill site.

The Project started on 01/08/2004, which is the date on which JS entered into a contractual agreement with a local Engineering Company for the project construction, and is the earliest date at which real action of the project activity began. The construction of the LFG collection system and installation of biogas electricity generator has completed in June 2005. The commercial operation of the project (i.e. LFG collection and electricity generation) started on 03/03/2006.

The total Emission Reductions claimed for the 2<sup>nd</sup> Monitoring Period from 01/01/2009 to 31/12/2012 is 120,833 tCO<sub>2</sub>e.

### A.2. Location of project activity

Host Party: The Kingdom of Thailand

Region/State/Province: Samuthprakarn

City/Town/Community: Rachathewa, Bangplee

Physical/Geographical location:

The geographical coordinate of the Project is 13°41'17.10"N and 100°43'42.75"E.

The Project is located at the Rachathewa landfill area, about 30 km east of BMA. The area in the vicinity of the landfill is primarily industrial, with numerous heavy industrial compounds and some agricultural and residential establishments. The Rachathewa landfill site occupies some 40 hectares and includes ancillary facilities necessary to support its operations. It also includes a buffer zone around the disposal area. The landfill site has been separated into two sites. Among the two sites of the landfill area, the Project is implemented at Site 1. Details of the two sites are described below:

Site 1:	Operations commenced in December 1999. The site was capped and closed in November 2001. The area contains approximately 2.5 million tons of newly disposed solid waste and 2.2 million tons of old solid waste relocated from the On-Nuch landfill site.
Site 2:	Operation commenced in December 2001 and was closed in December 2006. It is estimated that this disposal site will contain approximately 6 million tons of solid waste by the end of 2006.

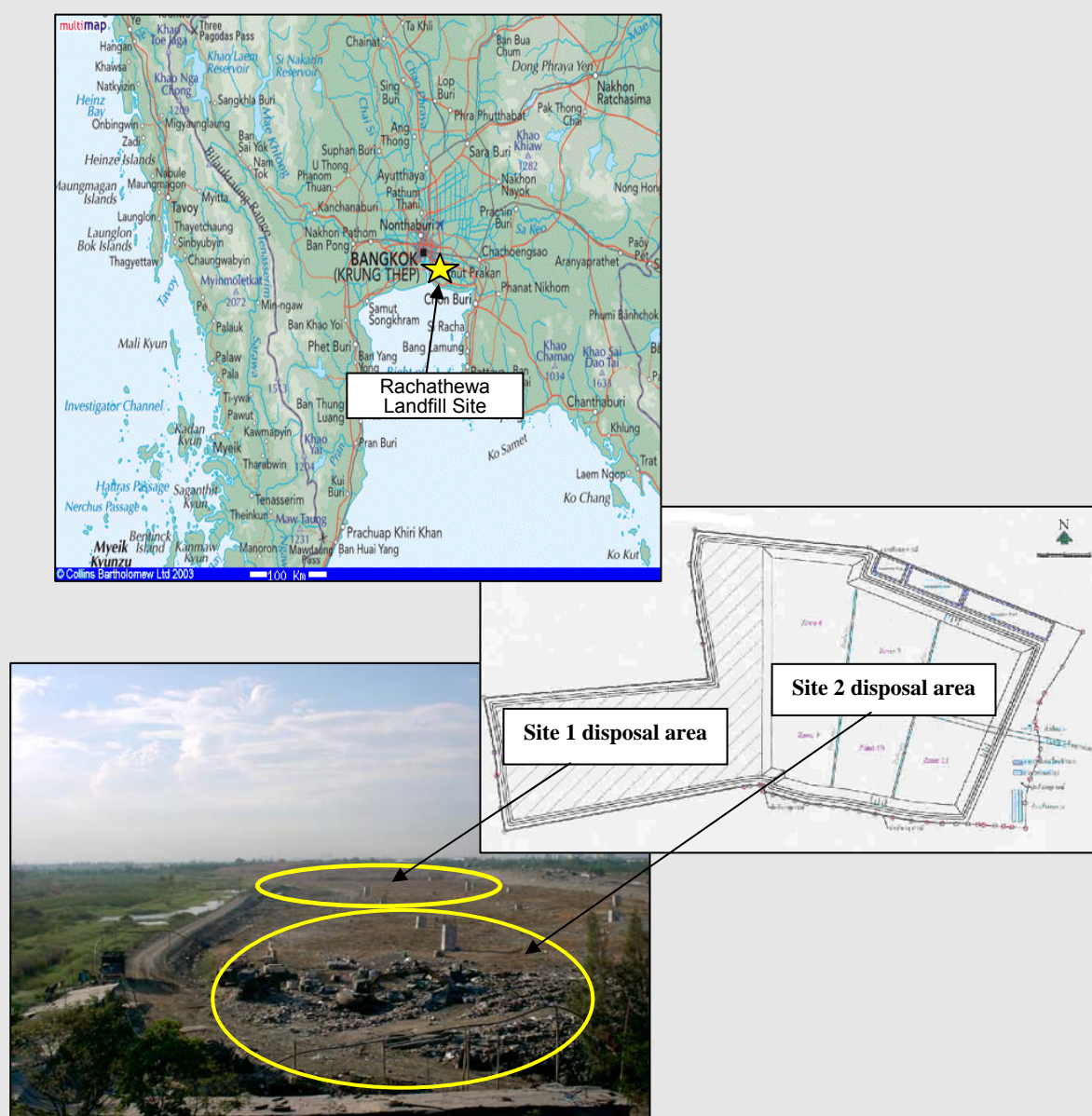


Figure 1. Location and overview of the Rachathewa landfill sites

### A.3. Parties and project participant(s)

Party involved (host) indicates a host Party)	Private and/or public entity(ies) project participants (as applicable)	Indicate if the Party involved wishes to be considered as project participant (Yes/No)
Thailand (host)	Jaroensompong Co., Ltd. (Private entity)	No
Japan	Mitsubishi UFJ Morgan Stanley Securities Co., Ltd. (Private entity)	No

**A.4. Reference of applied methodology**

ACM0001 version 05 “Consolidated baseline and monitoring methodology for landfill gas project activities”  
[http://cdm.unfccc.int/UserManagement/FileStorage/CDMWF\\_AM\\_V66J3B48JSA77ID045VYMSLQX2BGFI](http://cdm.unfccc.int/UserManagement/FileStorage/CDMWF_AM_V66J3B48JSA77ID045VYMSLQX2BGFI)

AMS I.D version 11 “Grid connected renewable electricity generation”  
[http://cdm.unfccc.int/UserManagement/FileStorage/CDMWF\\_AM\\_UYF1PQNDY5FZ4VH4HZ28FYAP13SI9W](http://cdm.unfccc.int/UserManagement/FileStorage/CDMWF_AM_UYF1PQNDY5FZ4VH4HZ28FYAP13SI9W)

“Tool for the demonstration and assessment of additionality (version 03)”  
<http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-01-v3.pdf>

“Methodological Tool to determine project emissions from flaring gases containing methane”  
<http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-06-v1.pdf>

**A.5. Crediting period of project activity**

Type of crediting period: fixed crediting period  
 Starting date of the crediting period: 14/03/2008  
 End date of the crediting period: 13/03/2018  
 Length of the crediting period: Ten (10) years

**SECTION B. Implementation of project activity****B.1. Description of implemented registered project activity**

This 2<sup>nd</sup> monitoring report for the project “Jaroensompong Corporation Rachathewa Landfill Gas to Energy Project” (UNFCCC Ref No.1413) covers the period from 01/01/2009 to 31/12/2012.

The CDM project developed by Jaroensompong Co., Ltd. reduces GHG emissions by utilizing LFG which was released into the atmosphere in the absence of the project activity for electricity generation.

The CDM project does not involve phased implementation, consisting only one site.

The project started its commercial operation on 03/03/2006 and it has been in operation since then. By the time of CDM registration on 14/03/2008, monitoring system was installed and the project has been monitored for CDM purpose since then.

During the 2<sup>nd</sup> monitoring period, most landfill gas was sent to the biogas engine and utilized for electricity generation. As the result, the open flare system was rarely in operation.

Request for post-registration changes were submitted during the verification process of the first monitoring period and approved by the CDM-EB on 02/04/2013 (PRC-1413-001). However, there are no post registration changes for this monitoring period as indicated in Section B.2.

**B.2. Post registration changes****B.2.1. Temporary deviations from registered monitoring plan or applied methodology**

No temporary deviations have been applied during this monitoring period.

#### **B.2.2. Corrections**

No corrections to project information or parameters fixed at validation have been applied during this monitoring period.

#### **B.2.3. Permanent changes from registered monitoring plan or applied methodology**

No permanent changes from the registered monitoring plan or applied methodologies have been applied during this monitoring period.

#### **B.2.4. Changes to project design of registered project activity**

No changes to the project design for the project activity have been applied during this monitoring period.

#### **B.2.5. Changes to start date of crediting period**

No changes to the start date of the crediting period have been applied during this monitoring period.

#### **B.2.6. Types of changes specific to afforestation or reforestation project activity**

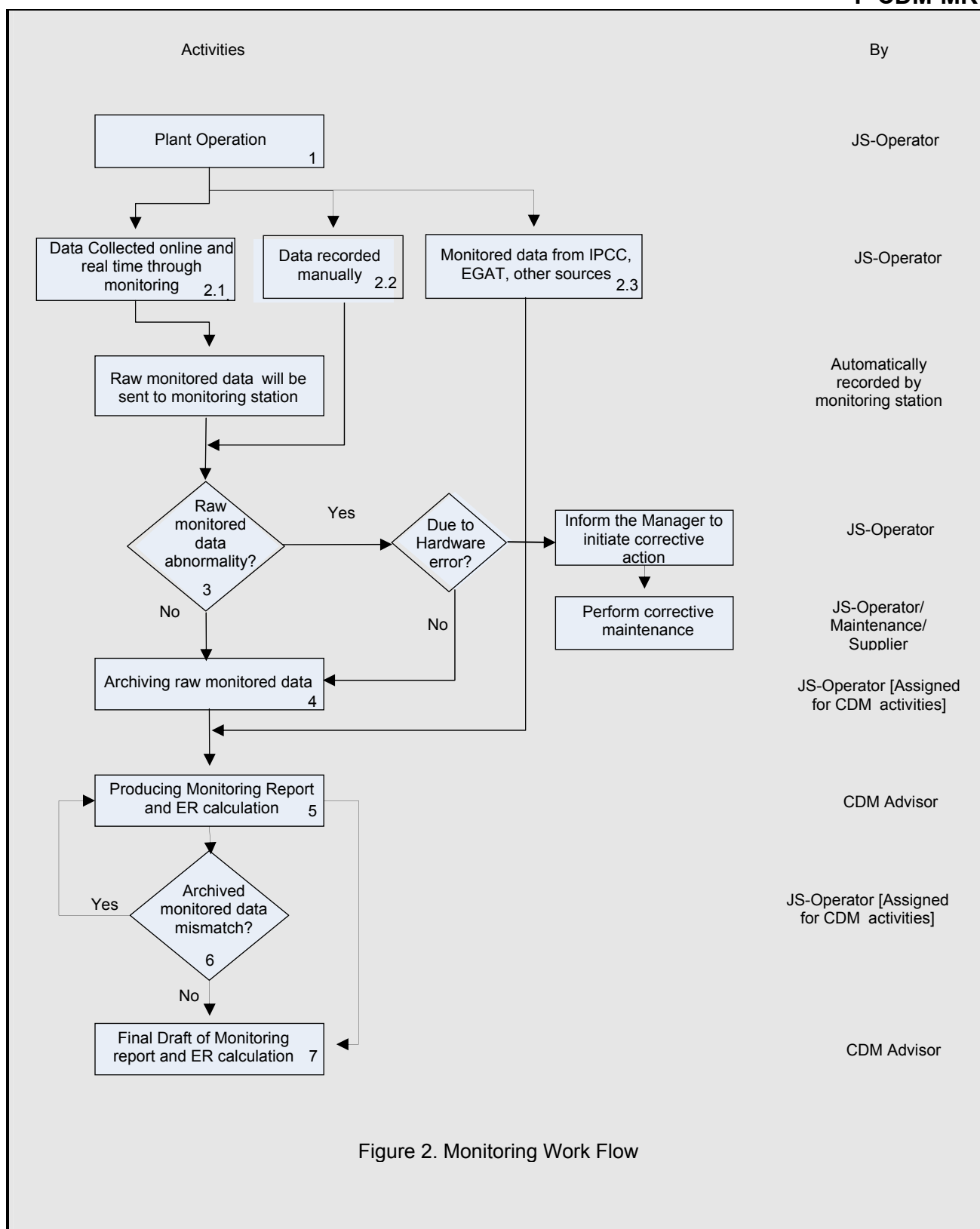
Not applicable to the project activity.

### **SECTION C. Description of monitoring system**

In order to meet the requirement of monitoring plan stated in the revised registered PDD, JS has created the CDM monitoring team.

#### **CDM Monitoring structure**

Members of the monitoring organization consist of JS Operator, Operation Manager, CDM advisor and JS Director. Collected raw data from monitoring devices have been read and recorded periodically by JS Operator. Other operational data ( $EL_{EX,LFG}$ ,  $EL_{IMP}$ ,  $ET_y$ , operation of the energy plant) have been read and recorded on monthly basis by JS Operator apart from data from monitoring station. Operation Manager manages overall operation of the plant and CDM activities. Monitoring data have been forwarded to and reviewed by Operation Manager on a monthly basis in order to ensure that the Project follows the requirements of the monitoring plan. Whereas, CDM Advisor provides advisory services to JS regarding the CDM monitoring activities, its transaction and procedures. JS Director supervises overall operation and maintenance to Operation Manager and CDM Advisor.



## SECTION D. Data and parameters

### D.1. Data and parameters fixed ex ante or at renewal of crediting period

Data / Parameter:	$GWP_{CH_4}$
Unit:	tCO <sub>2</sub> e/tCH <sub>4</sub>
Description:	Global warming potential for CH <sub>4</sub>

Source of data:	IPCC
Value(s) applied):	21
Purpose of data:	Calculation of baseline and project emissions
Additional comment:	21 for the first commitment period. It shall be updated according to any future COP/MOP decisions.

<b>Data / Parameter:</b>	<b>AF</b>
Unit:	%
Description:	Adjustment factor
Source of data:	Registered PDD
Value(s) applied):	0 %
Purpose of data:	Calculation of baseline emissions
Additional comment:	There are no enforced regulatory or contractual requirements for LFG collection/utilization in Thailand at the time of project registration.

<b>Data / Parameter:</b>	<b>EF<sub>grid</sub></b>
Unit:	tCO <sub>2</sub> /MWh
Description:	CO <sub>2</sub> emission factor of the grid
Source of data:	Registered PDD
Value(s) applied):	0.51 tCO <sub>2</sub> /MWh
Purpose of data:	Calculation of baseline and project emissions
Additional comment:	Fixed ex-ante as in the registered PDD. Data choice and calculation method as per AMS I.D. version 11. Calculated based on the data sourced from EGAT and EPPO, for the year 2001, 2002 and 2003 which were the most recent data available at the time of the validation.

<b>Data / Parameter:</b>	<b>EF<sub>OM</sub></b>
Unit:	tCO <sub>2</sub> /MWh
Description:	CO <sub>2</sub> Operating Margin emission factor of the grid
Source of data:	Registered PDD
Value(s) applied):	0.60 tCO <sub>2</sub> /MWh
Purpose of data:	Calculation of baseline and project emissions
Additional comment:	Fixed ex-ante as in the registered PDD. Data choice and calculation method as per AMS I.D. version 11.

<b>Data / Parameter:</b>	<b>EF<sub>BM</sub></b>
Unit:	tCO <sub>2</sub> /MWh
Description:	CO <sub>2</sub> Build Margin emission factor of the grid
Source of data:	Registered PDD
Value(s) applied):	0.42 tCO <sub>2</sub> /MWh
Purpose of data:	Calculation of baseline and project emissions

Additional comment:	Fixed ex-ante as in the registered PDD. Data choice and calculation method as per AMS I.D. version 11.
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## D.2. Data and parameters monitored

Data / Parameter:	LFG <sub>total,y</sub>																																																																															
Unit:	m <sup>3</sup> at STP (0°C, 1 bar)																																																																															
Description:	Total amount of landfill gas captured																																																																															
Measured/ Calculated / Default:	Measured																																																																															
Source of data:	On-site measurements																																																																															
Value(s) of monitored parameter:	<table><tr><th>Year Month</th><th>2009</th><th>2010</th><th>2011</th><th>2012</th></tr><tr><td>January</td><td>397,158</td><td>413,308</td><td>417,691</td><td>396,819</td></tr><tr><td>February</td><td>354,581</td><td>365,486</td><td>359,843</td><td>426,052</td></tr><tr><td>March</td><td>424,805</td><td>401,129</td><td>354,084</td><td>453,254</td></tr><tr><td>April</td><td>336,881</td><td>230,083</td><td>0</td><td>362,698</td></tr><tr><td>May</td><td>389,186</td><td>326,023</td><td>392,673</td><td>430,099</td></tr><tr><td>June</td><td>405,324</td><td>294,203</td><td>352,566</td><td>411,850</td></tr><tr><td>July</td><td>386,871</td><td>366,340</td><td>352,566</td><td>454,841</td></tr><tr><td>August</td><td>254,620</td><td>366,367</td><td>436,876</td><td>405,038</td></tr><tr><td>September</td><td>401,385</td><td>262,186</td><td>446,844</td><td>423,669</td></tr><tr><td>October</td><td>329,312</td><td>354,474</td><td>389,028</td><td>433,270</td></tr><tr><td>November</td><td>298,710</td><td>305,899</td><td>374,196</td><td>323,184</td></tr><tr><td>December</td><td>410,535</td><td>373,969</td><td>433,569</td><td>396,082</td></tr><tr><td>Year Total</td><td>4,389,367</td><td>4,059,466</td><td>4,309,937</td><td>4,916,858</td></tr><tr><td>Total</td><td colspan="4">17,675,628</td></tr></table>					Year Month	2009	2010	2011	2012	January	397,158	413,308	417,691	396,819	February	354,581	365,486	359,843	426,052	March	424,805	401,129	354,084	453,254	April	336,881	230,083	0	362,698	May	389,186	326,023	392,673	430,099	June	405,324	294,203	352,566	411,850	July	386,871	366,340	352,566	454,841	August	254,620	366,367	436,876	405,038	September	401,385	262,186	446,844	423,669	October	329,312	354,474	389,028	433,270	November	298,710	305,899	374,196	323,184	December	410,535	373,969	433,569	396,082	Year Total	4,389,367	4,059,466	4,309,937	4,916,858	Total	17,675,628			
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Monitoring equipment:	<div>Device ID: FL-02 Device Name: Gas Flow Meter Instrument Type: Flow sensor/ Differential pressure transmitter Serial No.: N1U0139599904 Manufacturer: Verabar /SIEMENS Model: Verabar V100/ 7MF4433-1BA22-146-Z Measuring Range: 0 to 1200 m<sup>3</sup>/hr Accuracy Class: 0.075% Calibration frequency: Once a year Date of calibration:</div> <table><tr><td>Year</td><td>Calibration date</td><td>Validity</td></tr><tr><td>2008</td><td>02/08/2008</td><td>01/08/2009</td></tr><tr><td>2009</td><td>28/07/2009</td><td>27/07/2010</td></tr><tr><td>2010</td><td>26/07/2010</td><td>25/07/2011</td></tr><tr><td>2011</td><td>24/07/2011</td><td>23/07/2012</td></tr><tr><td>2012</td><td>22/07/2012</td><td>21/07/2013</td></tr></table>					Year	Calibration date	Validity	2008	02/08/2008	01/08/2009	2009	28/07/2009	27/07/2010	2010	26/07/2010	25/07/2011	2011	24/07/2011	23/07/2012	2012	22/07/2012	21/07/2013																																																									
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Calculation method (if applicable):	N/A																																																																															



QA/QC procedures:	Flow meters will be subject to a regular maintenance and testing regime to ensure accuracy.			
Purpose of data:	Calculation of baseline and project emissions			
Additional comment:	N/A			

<b>Data / Parameter:</b>	<b>LFG<sub>flare,y</sub></b>																																																																															
Unit:	m <sup>3</sup> at STP (0°C, 1 bar)																																																																															
Description:	Amount of landfill gas flared																																																																															
Measured/ Calculated / Default:	Measured																																																																															
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Measuring/ Reading/ Recording frequency:	Measured continuously using a flow meter. Data to be aggregated monthly and yearly.																																																																															

Calculation method (if applicable):	N/A				
QA/QC procedures:	Flow meters will be subject to a regular maintenance and testing regime to ensure accuracy.				
Purpose of data:	Calculation of baseline and project emissions				
Additional comment:	N/A				

Data / Parameter:	LFG <sub>electricity,y</sub>																																																																															
Unit:	m <sup>3</sup> at STP (0°C, 1 bar)																																																																															
Description:	Amount of landfill gas combusted in power plant																																																																															
Measured/ Calculated / Default:	Measured																																																																															
Source of data:	On-site measurements																																																																															
Value(s) of monitored parameter:	<table><tr><th>Year Month</th><th>2009</th><th>2010</th><th>2011</th><th>2012</th></tr><tr><td>January</td><td>384,514</td><td>399,520</td><td>419,176</td><td>352,436</td></tr><tr><td>February</td><td>340,745</td><td>354,148</td><td>359,330</td><td>378,096</td></tr><tr><td>March</td><td>398,887</td><td>394,647</td><td>349,201</td><td>391,105</td></tr><tr><td>April</td><td>330,193</td><td>225,384</td><td>0</td><td>305,110</td></tr><tr><td>May</td><td>389,112</td><td>314,387</td><td>368,166</td><td>360,496</td></tr><tr><td>June</td><td>401,566</td><td>287,709</td><td>330,891</td><td>343,330</td></tr><tr><td>July</td><td>373,821</td><td>365,808</td><td>330,891</td><td>381,324</td></tr><tr><td>August</td><td>247,673</td><td>363,645</td><td>406,290</td><td>332,666</td></tr><tr><td>September</td><td>389,624</td><td>253,560</td><td>416,554</td><td>353,262</td></tr><tr><td>October</td><td>312,274</td><td>352,449</td><td>359,898</td><td>354,950</td></tr><tr><td>November</td><td>258,809</td><td>307,884</td><td>343,703</td><td>259,148</td></tr><tr><td>December</td><td>391,392</td><td>375,830</td><td>397,368</td><td>323,163</td></tr><tr><td>Year Total</td><td>4,218,610</td><td>3,994,971</td><td>4,081,467</td><td>4,135,086</td></tr><tr><td>Total</td><td colspan="4">16,430,135</td></tr></table>					Year Month	2009	2010	2011	2012	January	384,514	399,520	419,176	352,436	February	340,745	354,148	359,330	378,096	March	398,887	394,647	349,201	391,105	April	330,193	225,384	0	305,110	May	389,112	314,387	368,166	360,496	June	401,566	287,709	330,891	343,330	July	373,821	365,808	330,891	381,324	August	247,673	363,645	406,290	332,666	September	389,624	253,560	416,554	353,262	October	312,274	352,449	359,898	354,950	November	258,809	307,884	343,703	259,148	December	391,392	375,830	397,368	323,163	Year Total	4,218,610	3,994,971	4,081,467	4,135,086	Total	16,430,135			
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Total	16,430,135																																																																															
Monitoring equipment:	<p>Device ID: FL-03 Device Name: Gas Flow Meter Instrument Type: Flow sensor/ Differential pressure transmitter Serial No.: N1U0139599905 Manufacturer: Verabar /SIEMENS Model: Verabar V100/ 7MF4433-1BA22-146-Z Measuring Range: 0 to 1200 m<sup>3</sup>/hr Accuracy Class: 0.075% Calibration frequency: Once a year Date of calibration:</p> <table><tr><td>Year</td><td>Calibration date</td><td>Validity</td></tr><tr><td>2008</td><td>18/09/2008</td><td>17/09/2009</td></tr><tr><td>2009</td><td>15/09/2009</td><td>14/09/2010</td></tr><tr><td>2010</td><td>12/09/2010</td><td>11/09/2011</td></tr><tr><td>2011</td><td>09/09/2011</td><td>08/09/2012</td></tr><tr><td>2012</td><td>06/09/2012</td><td>05/09/2013</td></tr></table>					Year	Calibration date	Validity	2008	18/09/2008	17/09/2009	2009	15/09/2009	14/09/2010	2010	12/09/2010	11/09/2011	2011	09/09/2011	08/09/2012	2012	06/09/2012	05/09/2013																																																									
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2012	06/09/2012	05/09/2013																																																																														

Measuring/ Reading/ Recording frequency:	Measured continuously using a flow meter. Data to be aggregated monthly and yearly.
Calculation method (if applicable):	N/A
QA/QC procedures:	Flow meters will be subject to a regular maintenance and testing regime to ensure accuracy.
Purpose of data:	Calculation of baseline and project emissions
Additional comment:	N/A

<b>Data / Parameter:</b>	<b>PE<sub>flare,y</sub></b>												
Unit:	tCO <sub>2</sub> e												
Description:	Project emissions from flaring of the residual gas stream in year y												
Measured/ Calculated / Default:	Calculated												
Source of data:	Calculated as per the “tool to determine project emissions from flaring gases containing methane”, based on LFG <sub>flare</sub> , fv <sub>CH<sub>4</sub>,h</sub> , and the density of methane												
Value(s) of monitored parameter:	<table> <tr> <th>Year</th><th>Annual Total</th></tr> <tr> <td>2009</td><td>0.123</td></tr> <tr> <td>2010</td><td>0.118</td></tr> <tr> <td>2011</td><td>0.023</td></tr> <tr> <td>2012</td><td>0.001</td></tr> <tr> <td>Total</td><td>0.265</td></tr> </table>	Year	Annual Total	2009	0.123	2010	0.118	2011	0.023	2012	0.001	Total	0.265
Year	Annual Total												
2009	0.123												
2010	0.118												
2011	0.023												
2012	0.001												
Total	0.265												
Monitoring equipment:	N/A												
Measuring/ Reading/ Recording frequency:	N/A												
Calculation method (if applicable):	Calculation is in accordance with the Methodological “Tool to determine project emissions from flaring gases containing methane”.												
QA/QC procedures:	N/A												
Purpose of data:	Calculation of project emissions												
Additional comment:	The parameters used for determining the project emissions from flaring of the residual gas stream in year y (PE <sub>flare,y</sub> ) will be monitored as per the “Tool to determine project emissions from flaring gases containing Methane”												

<b>Data / Parameter:</b>	<b>fv<sub>CH<sub>4</sub>,h</sub></b>
Unit:	-
Description:	Volumetric fraction of CH <sub>4</sub> in the residual gas in the hour h

Measured/ Calculated / Default:	Measured																			
Source of data:	On-site measurements																			
Value(s) of monitored parameter:	<table border="1"> <tr> <th>Year</th> <th>Annual average</th> </tr> <tr> <td>2009</td> <td>0.491</td> </tr> <tr> <td>2010</td> <td>0.439</td> </tr> <tr> <td>2011</td> <td>0.368</td> </tr> <tr> <td>2012</td> <td>0.482</td> </tr> </table>		Year	Annual average	2009	0.491	2010	0.439	2011	0.368	2012	0.482								
Year	Annual average																			
2009	0.491																			
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2011	0.368																			
2012	0.482																			
Monitoring equipment:	<p>           Device ID: GA-02            Device Name: Fixed Type Gas Analyzer            Instrument Type: Gas Analyser            Serial No.: I-02253            Manufacturer: HITECH INSTRUMENTS            Model: HITOX IR-600            Measuring Range: 0-100%            Accuracy Class: <math>\pm 2\%</math>            Calibration frequency: Once a year            Date of calibration:         </p> <table border="1"> <tr> <th>Year</th> <th>Calibration date</th> <th>Validity</th> </tr> <tr> <td>2008</td> <td>04/12/2008</td> <td>03/12/2009</td> </tr> <tr> <td>2009</td> <td>02/12/2009</td> <td>01/12/2010</td> </tr> <tr> <td>2010</td> <td>30/11/2010</td> <td>29/11/2011</td> </tr> <tr> <td>2011</td> <td>28/11/2011</td> <td>27/11/2012</td> </tr> <tr> <td>2012</td> <td>26/11/2012</td> <td>25/11/2013</td> </tr> </table>		Year	Calibration date	Validity	2008	04/12/2008	03/12/2009	2009	02/12/2009	01/12/2010	2010	30/11/2010	29/11/2011	2011	28/11/2011	27/11/2012	2012	26/11/2012	25/11/2013
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2011	28/11/2011	27/11/2012																		
2012	26/11/2012	25/11/2013																		
Measuring/ Reading/ Recording frequency:	Measured continuously using a continuous gas analyser. Values to be averaged hourly.																			
Calculation method (if applicable):	N/A																			
QA/QC procedures:	Analysers will be periodically calibrated according to the manufacturer's recommendation. A zero check and a typical value check will be performed by comparison with a standard certified gas.																			
Purpose of data:	Calculation of project emissions																			
Additional comment:	N/A																			
<b>Data / Parameter:</b>	<b>FV<sub>RG,h</sub></b>																			
Unit:	m <sup>3</sup> /h																			
Description:	Volumetric flow rate of the residual gas in dry basis at normal condition in the hour h																			
Measured/ Calculated / Default:	Measured																			
Source of data:	On-site measurement																			

Value(s) of monitored parameter:	<table border="1"> <thead> <tr> <th>Year</th> <th>Annual average</th> </tr> </thead> <tbody> <tr> <td>2009</td> <td>2.09</td> </tr> <tr> <td>2010</td> <td>2.20</td> </tr> <tr> <td>2011</td> <td>0.56</td> </tr> <tr> <td>2012</td> <td>0.01</td> </tr> </tbody> </table>	Year	Annual average	2009	2.09	2010	2.20	2011	0.56	2012	0.01								
Year	Annual average																		
2009	2.09																		
2010	2.20																		
2011	0.56																		
2012	0.01																		
Monitoring equipment:	<p>Device ID: FL-01  Device Name: Gas Flow Meter  Instrument Type: Flow sensor/ Differential pressure transmitter  Serial No.: N1T1109491336  Manufacturer: Verabar /SIEMENS  Model: Verabar V100/ 7MF4433-1BA22-146-Z  Measuring Range: 0 to 1200 m<sup>3</sup>/hr  Accuracy Class: 0.075%  Calibration frequency: Once a year  Date of calibration:</p> <table border="1"> <thead> <tr> <th>Year</th> <th>Calibration date</th> <th>Validity</th> </tr> </thead> <tbody> <tr> <td>2008</td> <td>18/09/2008</td> <td>17/09/2009</td> </tr> <tr> <td>2009</td> <td>15/09/2009</td> <td>14/09/2010</td> </tr> <tr> <td>2010</td> <td>12/09/2010</td> <td>11/09/2011</td> </tr> <tr> <td>2011</td> <td>09/09/2011</td> <td>08/09/2012</td> </tr> <tr> <td>2012</td> <td>06/09/2012</td> <td>05/09/2013</td> </tr> </tbody> </table>	Year	Calibration date	Validity	2008	18/09/2008	17/09/2009	2009	15/09/2009	14/09/2010	2010	12/09/2010	11/09/2011	2011	09/09/2011	08/09/2012	2012	06/09/2012	05/09/2013
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2010	12/09/2010	11/09/2011																	
2011	09/09/2011	08/09/2012																	
2012	06/09/2012	05/09/2013																	
Measuring/ Reading/ Recording frequency:	Measured continuously using a flow meter. Values to be averaged hourly. The same bases (dry or wet) is considered for this measurement and the measurement of volumetric fraction of all components in the residual gas ( $fv_{i,h}$ ) when the residual gas temperature exceed 60 °C.																		
Calculation method (if applicable):	N/A																		
QA/QC procedures:	Flow meters will be periodically calibrated according to the manufacturer's recommendation.																		
Purpose of data:	calculation of project emissions																		
Additional comment:	N/A																		

<b>Data / Parameter:</b>	<b>Flare operation parameter</b>
Unit:	min/h
Description:	Minutes that flare is detected during the hour h
Measured/ Calculated / Default:	Measured
Source of data:	On-site measurement
Value(s) of monitored parameter:	N/A

Monitoring equipment:	Device Name: Flame Detector Instrument Type: Flame Detector Serial No.: 945011V Manufacturer: USHIO INC. Model: SF-102B Measuring Range: Detect ON/OFF signal Accuracy Class: n/a
Measuring/ Reading/ Recording frequency:	Flame detector continuously detects the flame at the flaring system and sends the signal to the monitoring station.
Calculation method (if applicable):	N/A
QA/QC procedures:	N/A
Purpose of data:	Calculation of project emissions
Additional comment:	Operation/Reading Procedure: The detector will detect the flame and then the controller will send the digital signal to data logger automatically.

<b>Data / Parameter:</b>	<b>w<sub>CH<sub>4</sub>,y</sub></b>											
Unit:	m <sup>3</sup> CH <sub>4</sub> /m <sup>3</sup> LFG											
Description:	Methane fraction in the landfill gas											
Measured/ Calculated / Default:	Measured											
Source of data:	On-site measurement											
Value(s) of monitored parameter:	<table><tr><td>Year</td><td>Annual average</td></tr><tr><td>2009</td><td>0.491</td></tr><tr><td>2010</td><td>0.439</td></tr><tr><td>2011</td><td>0.368</td></tr><tr><td>2012</td><td>0.482</td></tr></table>		Year	Annual average	2009	0.491	2010	0.439	2011	0.368	2012	0.482
Year	Annual average											
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2011	0.368											
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Monitoring equipment:	Device ID: GA-02 Device Name: Fixed Type Gas Analyzer Instrument Type: Gas Analyzer Serial No.: I-02253 Manufacturer: HITECH INSTRUMENTS Model: HITOX IR-600 Measuring Range: 0-100% Accuracy Class: $\pm 2\%$ Calibration frequency: Once a year Date of calibration: <table border="1"> <thead> <tr> <th>Year</th> <th>Calibration date</th> <th>Validity</th> </tr> </thead> <tbody> <tr> <td>2008</td> <td>04/12/2008</td> <td>03/12/2009</td> </tr> <tr> <td>2009</td> <td>02/12/2009</td> <td>01/12/2010</td> </tr> <tr> <td>2010</td> <td>30/11/2010</td> <td>29/11/2011</td> </tr> <tr> <td>2011</td> <td>28/11/2011</td> <td>27/11/2012</td> </tr> <tr> <td>2012</td> <td>26/11/2012</td> <td>25/11/2013</td> </tr> </tbody> </table>		Year	Calibration date	Validity	2008	04/12/2008	03/12/2009	2009	02/12/2009	01/12/2010	2010	30/11/2010	29/11/2011	2011	28/11/2011	27/11/2012	2012	26/11/2012	25/11/2013
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Measuring/ Reading/ Recording frequency:	Measured continuously using a continuous gas analyser.																			
Calculation method (if applicable):	N/A																			
QA/QC procedures:	Analysers will be periodically calibrated according to the manufacturer's recommendation. A zero check and a typical value check will be performed by comparison with a standard certified gas.																			
Purpose of data:	Calculation of baseline and project emissions																			
Additional comment:	N/A																			

<b>Data / Parameter:</b>	<b>T</b>											
Unit:	°C											
Description:	Temperature of the landfill gas											
Measured/ Calculated / Default:	Measured											
Source of data:	On-site measurements											
Value(s) of monitored parameter:	<table border="1"> <thead> <tr> <th>Year</th> <th>Annual average</th> </tr> </thead> <tbody> <tr> <td>2009</td> <td>58.55</td> </tr> <tr> <td>2010</td> <td>58.29</td> </tr> <tr> <td>2011</td> <td>49.80</td> </tr> <tr> <td>2012</td> <td>70.76</td> </tr> </tbody> </table>		Year	Annual average	2009	58.55	2010	58.29	2011	49.80	2012	70.76
Year	Annual average											
2009	58.55											
2010	58.29											
2011	49.80											
2012	70.76											

Monitoring equipment:	<p>Device ID: TE-01          Device Name: Temperature Controller with PT100          Instrument Type: Thermocouple and RTD with temperature Controller          Serial No.: T07216/PT07081          Manufacturer: SHIMAX with FW System          Model: Pt100N MAC3D-MCF-NN-NTN with FWP-7A-4.8x30 (S4)          Measuring Range:          Accuracy Class: <math>\pm 0.3\%</math>          Calibration frequency: Once a year          Date of calibration:</p> <table border="1" data-bbox="496 544 1005 734"> <thead> <tr> <th>Year</th><th>Calibration date</th><th>Validity</th></tr> </thead> <tbody> <tr><td>2008</td><td>22/07/2008</td><td>21/07/2009</td></tr> <tr><td>2009</td><td>20/07/2009</td><td>19/07/2010</td></tr> <tr><td>2010</td><td>18/07/2010</td><td>17/07/2011</td></tr> <tr><td>2011</td><td>16/07/2011</td><td>15/07/2012</td></tr> <tr><td>2012</td><td>14/07/2012</td><td>13/07/2013</td></tr> </tbody> </table> <p>Device ID: TE-03          Device Name: Temperature Controller with PT100          Instrument Type: Thermocouple and RTD with temperature Controller          Serial No.: T08151/PT08133          Manufacturer: SHIMAX with FW System          Model: Pt100N MAC3D-MCF-NN-NTN with FWP-7A-4.8x30 (S4)          Measuring Range: -50 to 400 °C          Accuracy Class: <math>\pm 0.3\%</math>          Calibration frequency: Once a year          Date of calibration:</p> <table border="1" data-bbox="496 1171 1005 1361"> <thead> <tr> <th>Year</th><th>Calibration date</th><th>Validity</th></tr> </thead> <tbody> <tr><td>2008</td><td>22/07/2008</td><td>21/07/2009</td></tr> <tr><td>2009</td><td>20/07/2009</td><td>19/07/2010</td></tr> <tr><td>2010</td><td>18/07/2010</td><td>17/07/2011</td></tr> <tr><td>2011</td><td>16/07/2011</td><td>15/07/2012</td></tr> <tr><td>2012</td><td>14/07/2012</td><td>13/07/2013</td></tr> </tbody> </table>	Year	Calibration date	Validity	2008	22/07/2008	21/07/2009	2009	20/07/2009	19/07/2010	2010	18/07/2010	17/07/2011	2011	16/07/2011	15/07/2012	2012	14/07/2012	13/07/2013	Year	Calibration date	Validity	2008	22/07/2008	21/07/2009	2009	20/07/2009	19/07/2010	2010	18/07/2010	17/07/2011	2011	16/07/2011	15/07/2012	2012	14/07/2012	13/07/2013
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Measuring/ Reading/ Recording frequency:	Measured periodically to determine the density of methane (DC <sub>H4</sub> ) using a thermocouple																																				
Calculation method (if applicable):	N/A																																				
QA/QC procedures:	Maintenance Free. Only replacement																																				
Purpose of data:	Calculation of baseline and project emissions																																				
Additional comment:	N/A																																				
<b>Data / Parameter:</b>	<b>p</b>																																				
Unit:	Pressure of the landfill gas																																				
Description:	Pa																																				



Measured/ Calculated / Default:	Measured periodically to determine the density of methane (DC <sub>H4</sub> ) using a pressure transmitter.											
Source of data:	On-site measurements											
Value(s) of monitored parameter:	<table><tr><th>Year</th><th>Annual average</th></tr><tr><td>2009</td><td>40,987.95</td></tr><tr><td>2010</td><td>51,130.90</td></tr><tr><td>2011</td><td>32,456.17</td></tr><tr><td>2012</td><td>15,400.07</td></tr></table>		Year	Annual average	2009	40,987.95	2010	51,130.90	2011	32,456.17	2012	15,400.07
Year	Annual average											
2009	40,987.95											
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Monitoring equipment:	<div>Device ID: PR-01</div> <div>Device Name: Pressure Transmitter</div> <div>Instrument Type: Pressure Transmitter</div> <div>Serial No.: 1107030328</div> <div>Manufacturer: NAGANO</div> <div>Model: ADZ-SML-10.0</div> <div>Measuring Range: -1 to 1 bar</div> <div>Accuracy Class: ±0.5%</div> <div>Calibration frequency: Once a year</div> <div>Date of calibration:</div> <table><tr><th>Year</th><th>Calibration date</th><th>Validity</th></tr><tr><td>2008</td><td>30/12/2008</td><td>29/12/2009</td></tr><tr><td>2009</td><td>28/12/2009</td><td>27/12/2010</td></tr><tr><td>2010</td><td>26/12/2010</td><td>25/12/2011</td></tr><tr><td>2011</td><td>24/12/2011</td><td>23/12/2012</td></tr><tr><td>2012</td><td>22/12/2012</td><td>21/12/2013</td></tr></table>	Year	Calibration date	Validity	2008	30/12/2008	29/12/2009	2009	28/12/2009	27/12/2010	2010	26/12/2010	25/12/2011	2011	24/12/2011	23/12/2012	2012	22/12/2012	21/12/2013
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2011	24/12/2011	23/12/2012																	
2012	22/12/2012	21/12/2013																	
	<div>Device ID: PR-02</div> <div>Device Name: Pressure Transmitter</div> <div>Instrument Type: Pressure Transmitter</div> <div>Serial No.: 1107030324</div> <div>Manufacturer: NAGANO</div> <div>Model: ADZ-SML-10.0</div> <div>Measuring Range: -1 to 1 bar</div> <div>Accuracy Class: ±0.5%</div> <div>Calibration frequency: Once a year</div> <div>Date of calibration:</div> <table><tr><th>Year</th><th>Calibration date</th><th>Validity</th></tr><tr><td>2008</td><td>02/01/2008</td><td>01/01/2009</td></tr><tr><td>2009</td><td>29/12/2008</td><td>28/12/2009</td></tr><tr><td>2010</td><td>27/12/2009</td><td>26/12/2010</td></tr><tr><td>2011</td><td>25/12/2010</td><td>24/12/2011</td></tr><tr><td>2012</td><td>23/12/2011</td><td>22/12/2012</td></tr></table>	Year	Calibration date	Validity	2008	02/01/2008	01/01/2009	2009	29/12/2008	28/12/2009	2010	27/12/2009	26/12/2010	2011	25/12/2010	24/12/2011	2012	23/12/2011	22/12/2012
Year	Calibration date	Validity																	
2008	02/01/2008	01/01/2009																	
2009	29/12/2008	28/12/2009																	
2010	27/12/2009	26/12/2010																	
2011	25/12/2010	24/12/2011																	
2012	23/12/2011	22/12/2012																	
	<div>Device ID: PR-03</div> <div>Device Name: Pressure Transmitter</div> <div>Instrument Type: Pressure Transmitter</div> <div>Serial No.: 0702080001</div> <div>Manufacturer: NAGANO</div> <div>Model: ADZ-SML-10.0</div> <div>Measuring Range: -1 to 1 bar</div> <div>Accuracy Class: ±0.5%</div> <div>Calibration frequency: Once a year</div> <div>Date of calibration:</div> <table><tr><th>Year</th><th>Calibration date</th><th>Validity</th></tr><tr><td>2008</td><td>02/08/2008</td><td>01/08/2009</td></tr><tr><td>2009</td><td>31/07/2009</td><td>30/07/2010</td></tr><tr><td>2010</td><td>29/07/2010</td><td>28/07/2011</td></tr><tr><td>2011</td><td>27/07/2011</td><td>26/07/2012</td></tr><tr><td>2012</td><td>25/07/2012</td><td>24/07/2013</td></tr></table>	Year	Calibration date	Validity	2008	02/08/2008	01/08/2009	2009	31/07/2009	30/07/2010	2010	29/07/2010	28/07/2011	2011	27/07/2011	26/07/2012	2012	25/07/2012	24/07/2013
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2009	31/07/2009	30/07/2010																	
2010	29/07/2010	28/07/2011																	
2011	27/07/2011	26/07/2012																	
2012	25/07/2012	24/07/2013																	
Measuring/ Reading/ Recording frequency:	N/A																		

Calculation method (if applicable):	N/A			
QA/QC procedures:	Maintenance Free. Only replacement.			
Purpose of data:	Calculation of baseline and project emissions			
Additional comment:	N/A			

<b>Data / Parameter:</b>	<b>EL<sub>EX,LFG</sub></b>																																																																														
Unit:	MWh																																																																														
Description:	Total amount of electricity exported out of the project boundary																																																																														
Measured/ Calculated / Default:	Measured																																																																														
Source of data:	On-site measurements																																																																														
Value(s) of monitored parameter:	<table border="1"> <tr> <th>Year Month</th> <th>2009</th> <th>2010</th> <th>2011</th> <th>2012</th> </tr> <tr><td>January</td><td>534</td><td>569</td><td>436</td><td>486</td></tr> <tr><td>February</td><td>564</td><td>502</td><td>445</td><td>277</td></tr> <tr><td>March</td><td>688</td><td>594</td><td>331</td><td>350</td></tr> <tr><td>April</td><td>685</td><td>440</td><td>0</td><td>320</td></tr> <tr><td>May</td><td>703</td><td>484</td><td>523</td><td>321</td></tr> <tr><td>June</td><td>680</td><td>272</td><td>354</td><td>323</td></tr> <tr><td>July</td><td>666</td><td>489</td><td>478</td><td>349</td></tr> <tr><td>August</td><td>398</td><td>320</td><td>416</td><td>249</td></tr> <tr><td>September</td><td>656</td><td>239</td><td>350</td><td>302</td></tr> <tr><td>October</td><td>533</td><td>336</td><td>400</td><td>290</td></tr> <tr><td>November</td><td>558</td><td>470</td><td>363</td><td>220</td></tr> <tr><td>December</td><td>578</td><td>460</td><td>283</td><td>223</td></tr> <tr><td>Year Total</td><td>7,243</td><td>5,281</td><td>4,379</td><td>3,755</td></tr> <tr><td>Total</td><td colspan="4">20,507</td></tr> </table>				Year Month	2009	2010	2011	2012	January	534	569	436	486	February	564	502	445	277	March	688	594	331	350	April	685	440	0	320	May	703	484	523	321	June	680	272	354	323	July	666	489	478	349	August	398	320	416	249	September	656	239	350	302	October	533	336	400	290	November	558	470	363	220	December	578	460	283	223	Year Total	7,243	5,281	4,379	3,755	Total	20,507			
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Monitoring equipment:	<p>Device ID: Electricity Meter  Instrument Type: Electricity Meter  Serial No.: PK-201103 ( Refer to MEA's meter number)  Manufacturer: ELSTER  Model: A1RL+  Specification: TOU METER with internal Modem 3P/3Wire 5A, 120V, 3Phase, 3 Wire  Accuracy Class: Refer to MEA's meter number  Calibration frequency: Periodically  Date of calibration:</p> <table border="1"> <tr> <th>Year</th> <th>Calibration date</th> <th>Validity</th> </tr> <tr> <td>2008</td> <td>12/06/2008</td> <td>11/06/2009</td> </tr> <tr> <td>2009</td> <td>10/06/2009</td> <td>09/06/2010</td> </tr> <tr> <td>2010</td> <td>08/06/2010</td> <td>07/06/2011</td> </tr> <tr> <td>2011</td> <td>06/06/2011</td> <td>05/06/2012</td> </tr> <tr> <td>2012</td> <td>04/06/2012</td> <td>03/06/2013</td> </tr> </table>				Year	Calibration date	Validity	2008	12/06/2008	11/06/2009	2009	10/06/2009	09/06/2010	2010	08/06/2010	07/06/2011	2011	06/06/2011	05/06/2012	2012	04/06/2012	03/06/2013																																																									
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2012	04/06/2012	03/06/2013																																																																													

Measuring/ Reading/ Recording frequency:	Measured continuously using an electricity meter. Aggregated and recorded monthly.																																																																														
Calculation method (if applicable):	N/A																																																																														
QA/QC procedures:	The electricity meter will be subject to a regular maintenance and testing regime to ensure accuracy. Amount of electricity exported will be double checked with receipt of sale. The data was cross-checked against the MEA statement monthly.																																																																														
Purpose of data:	Calculation of baseline emissions																																																																														
Additional comment:	N/A																																																																														
<b>Data / Parameter:</b>	<b>EL<sub>IMP</sub></b>																																																																														
Unit:	MWh																																																																														
Description:	Total amount of electricity imported to meet project requirement																																																																														
Measured/ Calculated / Default:	Measured																																																																														
Source of data:	On-site measurements																																																																														
Value(s) of monitored parameter:	<table border="1"> <tr> <th>Year Month</th><th>2009</th><th>2010</th><th>2011</th><th>2012</th></tr> <tr><td>January</td><td>0</td><td>0</td><td>0</td><td>0</td></tr> <tr><td>February</td><td>0</td><td>0</td><td>0</td><td>0</td></tr> <tr><td>March</td><td>0</td><td>0</td><td>0</td><td>0</td></tr> <tr><td>April</td><td>0</td><td>0</td><td>0</td><td>0</td></tr> <tr><td>May</td><td>0</td><td>0</td><td>0</td><td>0</td></tr> <tr><td>June</td><td>0</td><td>0</td><td>0</td><td>0</td></tr> <tr><td>July</td><td>0</td><td>0</td><td>0</td><td>0</td></tr> <tr><td>August</td><td>0</td><td>0</td><td>0</td><td>0</td></tr> <tr><td>September</td><td>0</td><td>0</td><td>0</td><td>0</td></tr> <tr><td>October</td><td>0</td><td>0</td><td>0</td><td>0</td></tr> <tr><td>November</td><td>0</td><td>0</td><td>0</td><td>0</td></tr> <tr><td>December</td><td>0</td><td>0</td><td>0</td><td>0</td></tr> <tr><td>Year Total</td><td>0</td><td>0</td><td>0</td><td>0</td></tr> <tr><td>Total</td><td colspan="4">0</td></tr> </table>				Year Month	2009	2010	2011	2012	January	0	0	0	0	February	0	0	0	0	March	0	0	0	0	April	0	0	0	0	May	0	0	0	0	June	0	0	0	0	July	0	0	0	0	August	0	0	0	0	September	0	0	0	0	October	0	0	0	0	November	0	0	0	0	December	0	0	0	0	Year Total	0	0	0	0	Total	0			
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Year	Calibration date	Validity																		
2008	12/06/2008	11/06/2009																		
2009	10/06/2009	09/06/2010																		
2010	08/06/2010	07/06/2011																		
2011	06/06/2011	05/06/2012																		
2012	04/06/2012	03/06/2013																		
Measuring/ Reading/ Recording frequency:	Measured continuously using an electricity meter. Aggregated and recorded monthly.																			
Calculation method (if applicable):	N/A																			
QA/QC procedures:	Amount of electricity imported will be double checked with receipt of sale. Record at the project site was cross-checked against the MEA's invoice.																			
Purpose of data:	Calculation of project emissions																			
Additional comment:	N/A																			

<b>Data / Parameter:</b>	<b>ET<sub>y</sub></b>
Unit:	TJ
Description:	Thermal energy used in landfill during project
Measured/ Calculated / Default:	Measured
Source of data:	On-site measurements
Value(s) of monitored parameter:	0 (No thermal use in the plant)
Monitoring equipment:	N/A
Measuring/ Reading/ Recording frequency:	If fossil fuel is used, the quantity of fossil fuel used will be measured using weight or volume meters.
Calculation method (if applicable):	N/A
QA/QC procedures:	N/A
Purpose of data:	Calculation of project emissions

Additional comment:	It is not expected any thermal energy will be used for the Project Activity. However, this variable will be monitored.
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<b>Data / Parameter:</b>	<b>CEF<sub>thermal,y</sub></b>
Unit:	tCO <sub>2</sub> /TJ
Description:	CO <sub>2</sub> emission intensity of the thermal energy
Measured/ Calculated / Default:	Calculated
Source of data:	Local data and/or IPCC default values
Value(s) of monitored parameter:	N/A
Monitoring equipment:	N/A
Measuring/ Reading/ Recording frequency:	N/A
Calculation method (if applicable):	N/A
QA/QC procedures:	N/A
Purpose of data:	Calculation of project emissions
Additional comment:	If fossil fuel is used, CO <sub>2</sub> emission intensity of the thermal energy will be calculated with local data of NCV and/or IPCC default values.  No fossil fuel was used during this monitoring period.

<b>Data / Parameter:</b>	<b>Regulatory requirements</b>
Unit:	-
Description:	Regulatory requirements relating to landfill gas projects
Measured/ Calculated / Default:	NA
Source of data:	Local/national data
Value(s) of monitored parameter:	There are no regulatory or contractual requirements for LFG collection/combustion in Thailand at the time of project registration.  No change during this monitoring period
Monitoring equipment:	N/A
Measuring/ Reading/ Recording frequency:	At the renewal of crediting period (as per ACM0001ver05)

Calculation method (if applicable):	N/A
QA/QC procedures:	N/A
Purpose of data:	Calculation of baseline emissions
Additional comment:	N/A

<b>Data / Parameter:</b>	-										
Unit:	Hours										
Description:	Operation of the energy plant										
Measured/ Calculated / Default:	Measured										
Source of data:	On-site measurements										
Value(s) of monitored parameter:	<table border="1"> <thead> <tr> <th>Year</th><th>Operation Hour</th></tr> </thead> <tbody> <tr> <td>2009</td><td>7,954</td></tr> <tr> <td>2010</td><td>8,148</td></tr> <tr> <td>2011</td><td>7,594</td></tr> <tr> <td>2012</td><td>8,671</td></tr> </tbody> </table>	Year	Operation Hour	2009	7,954	2010	8,148	2011	7,594	2012	8,671
Year	Operation Hour										
2009	7,954										
2010	8,148										
2011	7,594										
2012	8,671										
Monitoring equipment:	Count by analogue gauge										
Measuring/ Reading/ Recording frequency:	Recorded annually										
Calculation method (if applicable):	N/A										
QA/QC procedures:	N/A										
Purpose of data:	Calculation of baseline and project emissions										
Additional comment:	This is monitored to ensure methane destruction is claimed for methane used in electricity plant when it is operational.										

### D.3. Implementation of sampling plan

Not applicable.

## SECTION E. Calculation of emission reductions or GHG removals by sinks

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

In accordance with ACM0001 version 5 that was applied for the Project, the emission reductions achieved by the project activity during a year  $y$  is determined as follows:

$$ER_y = (MD_{project,y} - MD_{reg,y}) \times GWP_{CH_4} + EL_y \times CEF_{electricity,y} - ET_y \times CEF_{thermal,y}$$

where:

$ER_y$	Emission reductions in tonnes of CO <sub>2</sub> equivalents (tCO <sub>2</sub> e)
$MD_{project,y}$	Amount of methane that would have been destroyed/combusted during the year in tonnes of methane (tCH <sub>4</sub> )
$MD_{reg,y}$	Amount of methane that would have been destroyed/combusted during the year in the absence of the project in tonnes of methane (tCH <sub>4</sub> )
$GWP_{CH_4}$	Global Warming Potential value for methane for the first commitment period is 21 tCO <sub>2</sub> e/tCH <sub>4</sub>
$EL_y$	Net quantity of electricity exported during year $y$ in megawatt hours (MWh)
$CEF_{electricity,y}$	CO <sub>2</sub> emissions intensity of the electricity displaced in tCO <sub>2</sub> e/MWh
$ET_y$	Incremental quantity of fossil fuel defined as difference of fossil fuel used in the baseline and fossil fuel used during the project for energy requirement on site under project activity during the year in TJ
$CEF_{thermal,y}$	CO <sub>2</sub> emissions intensity of the fuel used to generate thermal/mechanical energy in tCO <sub>2</sub> e/TJ

Net quantity of electricity exported during year  $y$  in megawatt hours ( $EL_y$ ) is estimated as follows:

$$EL_y = EL_{EX,LFG} - EL_{IMP}$$

where:

$EL_{EX,LFG}$	Net quantity of electricity exported during year $y$ produced using landfill gas in megawatt hours (MWh)
$EL_{IMP}$	Net incremental electricity imported, defined as difference of project imports less any imports of electricity in the baseline, to meet the project requirements in megawatt hours (MWh)

In cases where the  $MD_{reg,y}$  is given/defined as a quantity, that quantity will be used.

In cases where regulatory or contractual requirements do not specify  $MD_{reg,y}$  and “Adjustment factor” (AF) shall be used and justified, taking into account the project context.

$$MD_{reg,y} = MD_{project,y} \times AF$$

Amount of methane that would have been destroyed/combusted during the year ( $MD_{project,y}$ ) can be arrived at by applying the following equation:

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

where:



$MD_{\text{flared},y}$	Quantity of methane destroyed by flaring during year y (tCH <sub>4</sub> /year)
$MD_{\text{electricity},y}$	Quantity of methane destroyed by generation of electricity during year y (tCH <sub>4</sub> /year)
$MD_{\text{thermal},y}$	Quantity of methane destroyed by generation of thermal energy during year y (tCH <sub>4</sub> /year)

$$MD_{\text{electricity},y} = LFG_{\text{electricity},y} \times w_{\text{CH}_4,y} \times D_{\text{CH}_4}$$

where:

$LFG_{\text{electricity},y}$	Quantity of landfill gas into electricity generator during the year y (m <sup>3</sup> /year)
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$$MD_{\text{thermal},y} = LFG_{\text{thermal},y} \times w_{\text{CH}_4,y} \times D_{\text{CH}_4}$$

where:

$LFG_{\text{thermal},y}$	Quantity of landfill gas fed into boiler during the year y (m <sup>3</sup> /year)
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$$MD_{\text{flared},y} = (LFG_{\text{flare},y} \times w_{\text{CH}_4,y} \times D_{\text{CH}_4}) - (PE_{\text{flare},y} \div GWP_{\text{CH}_4})$$

where:

$LFG_{\text{flare},y}$	Quantity of landfill gas fed to the flare during the year measured in cubic meters (m <sup>3</sup> /year)
$w_{\text{CH}_4,y}$	Average methane fraction of the landfill gas as measured during the year and expressed as a fraction (m <sup>3</sup> CH <sub>4</sub> /m <sup>3</sup> LFG)
$D_{\text{CH}_4}$	Methane density expressed in tonnes of methane per cubic meter of methane (tCH <sub>4</sub> /m <sup>3</sup> CH <sub>4</sub> )
$PE_{\text{flare},y}$	Project emissions from flaring of the residual gas stream in year y (tCO <sub>2</sub> /year), calculated as per the "Tool to determine project emissions from flaring gases containing methane"

$$PE_{\text{flare},y} = \sum_{h=1}^{8760} TM_{\text{RG},h} \times (1 - \eta_{\text{flare},h}) \times \frac{GWP_{\text{CH}_4}}{1000}$$

where:

$TM_{\text{RG},h}$	Mass flow rate of methane in the residual gas in the hour h (kg/h)
$\eta_{\text{flare},h}$	Flare efficiency in hour h

$$TM_{\text{RG},h} = FV_{\text{RG},h} \times fv_{\text{CH}_4,\text{RG},h} \times \rho_{\text{CH}_4,n}$$

where:

$FV_{\text{RG},h}$	Volumetric flow rate of the residual gas in dry basis at normal conditions in hour h (m <sup>3</sup> /h)
$fv_{\text{CH}_4,\text{RG},h}$	Volumetric fraction of methane in the residual gas on dry basis in hour h
$\rho_{\text{CH}_4,n}$	Density of methane at normal conditions (0.716 kg/m <sup>3</sup> )

## CER calculation from year 2009 to year 2012

## ERC-Emission Reduction Calculation

	ER =	(MD <sub>project</sub> - MD <sub>reg</sub> )	GWP <sub>CH4</sub> +	EL x	CEF <sub>electricity</sub> -	ET x	CEF <sub>thermal,m</sub>
Year 2009	34,952	1,489	0	21	7,243	0.51	0
Year 2010	29,144	1,262	0	21	5,175	0.51	0
Year 2011	24,860	1,077	0	21	4,379	0.51	0
Year 2012	31,877	1,428	0	21	3,710	0.51	0
2009-2012	120,833						
	unit : tCO <sub>2</sub> e	tCH <sub>4</sub>	tCH <sub>4</sub>	tCO <sub>2</sub> e/tCH <sub>4</sub>	MWh	tCO <sub>2</sub> e/MWh	TJ
							tCO <sub>2</sub> e/TJ

	MD <sub>reg</sub> =	MD <sub>project</sub> x	AF
Year 2009	0	1,489	0
Year 2010	0	1,262	0
Year 2011	0	1,077	0
Year 2012	0	1,428	0
	unit : tCH <sub>4</sub>	tCH <sub>4</sub>	

	MD <sub>project,y</sub> =	MD <sub>flare</sub> +	MD <sub>electricity</sub> +	MD <sub>thermal</sub>
Year 2009	1,489	5	1,483	0
Year 2010	1,262	5	1,257	0
Year 2011	1,077	1	1,076	0
Year 2012	1,428	0	1,428	0
	unit : tCH <sub>4</sub>	tCH <sub>4</sub>	tCH <sub>4</sub>	tCH <sub>4</sub>

	EL <sub>y</sub> =	EL <sub>EX,LGFG</sub> -	EL <sub>IMP</sub>
Year 2009	7,243	7,243	0.000
Year 2010	5,175	5,175	0.000
Year 2011	4,379	4,379	0.000
Year 2012	3,710	3,710	0.000
	unit : MWh	MWh	MWh

	MD <sub>flare</sub> =	LFG <sub>flare</sub> x	W <sub>CH4,y</sub> x	D <sub>CH4</sub> -	( PE <sub>flare</sub> /	GWP <sub>CH4</sub> )
Year 2009	5.23	16,625.76	0.439	0.0007168	0.12	21
Year 2010	4.72	17,911.42	0.368	0.0007168	0.12	21
Year 2011	1.46	4,231.38	0.482	0.0007168	0.02	21
Year 2012	0.04	114.41	0.491	0.0007168	0.001	21
	unit : tCH <sub>4</sub>	m <sup>3</sup>	m <sup>3</sup> CH <sub>4</sub> /m <sup>3</sup> LFG	tCH <sub>4</sub> /m <sup>3</sup> CH <sub>4</sub>	tCO <sub>2</sub> e	tCO <sub>2</sub> e/tCH <sub>4</sub>

	MD <sub>electricity</sub> =	FG <sub>electricity</sub> x	W <sub>CH4,y</sub> x	D <sub>CH4</sub>
Year 2009	1,483.3	4,218,610	0.491	0.0007168
Year 2010	1,257.4	3,994,971	0.439	0.0007168
Year 2011	1,076.0	4,081,467	0.368	0.0007168
Year 2012	1,427.8	4,135,086	0.482	0.0007168
	unit : tCH <sub>4</sub>	m <sup>3</sup>	m <sup>3</sup> CH <sub>4</sub> /m <sup>3</sup> LFG	tCH <sub>4</sub> /m <sup>3</sup> CH <sub>4</sub>

	MD <sub>thermal</sub>	LFG <sub>thermal</sub>	x W <sub>CH4</sub>	x	D <sub>CH4</sub>
Year 2009	0	0	0.491	0.0007168	
Year 2010	0	0	0.439	0.0007168	
Year 2011	0	0	0.368	0.0007168	
Year 2012	0	0	0.482	0.0007168	

unit : tCH<sub>4</sub>      m<sup>3</sup>      m<sup>3</sup> CH<sub>4</sub>/m<sup>3</sup> LFG      tCH<sub>4</sub>/m<sup>3</sup> CH<sub>4</sub>

	PE <sub>flare</sub> =	8760 Σ TM <sub>RG,h</sub> × (1-η <sub>flare,h</sub> ) × h=1	GWP <sub>CH4</sub> /	1000
Year 2009	0.123	5.85	1	0.021
Year 2010	0.118	5.64	1	0.021
Year 2011	0.023	1.12	1	0.021
Year 2012	0.001	0.04	1	0.021

unit : tCO<sub>2</sub>      kg      tCO<sub>2</sub> e/kgCH<sub>4</sub>

	TM <sub>RG,h</sub> =	FV <sub>RG,h</sub>	x fv <sub>CH4,RG,h</sub>	x	ρ <sub>CH4,n</sub>
Year 2009	0.0007349	2.09	0.491	0.0007168	
Year 2010	0.0006919	2.20	0.439	0.0007168	
Year 2011	0.0001469	0.56	0.368	0.0007168	
Year 2012	0.0000046	0.01	0.482	0.0007168	

unit : kg/h      m<sup>3</sup>/h      m<sup>3</sup> CH<sub>4</sub>/m<sup>3</sup> LFG      kg/m<sup>3</sup>

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

As per the applied methodology ACM0001 version 05, separate procedures for calculation of project emissions are not provided in the methodology. Rather, project emissions during this monitoring period are already accounted in the baseline emissions calculation described in Section E.1. It is also noted that, during this monitoring period, no fossil fuels are consumed for the Project.

## E.3. Calculation of leakage

No leakage effects need to be accounted under the applied methodology, ACM0001 version 5.

## E.4. Summary of calculation of emission reductions or net anthropogenic GHG removals by sinks

Item	Baseline emissions or baseline net GHG removals by sinks (t CO <sub>2</sub> e)	Project emissions or actual net GHG removals by sinks (t CO <sub>2</sub> e)	Leakage (t CO <sub>2</sub> e)	Emission reductions or net anthropogenic GHG removals by sinks (t CO <sub>2</sub> e)
Year 2009	34,952	0	0	34,952
Year 2010	29,144	0	0	29,144
Year 2011	24,860	0	0	24,860
Year 2012	31,877	0	0	31,877
Total	120,833	0	0	120,833

**E.5. Comparison of actual emission reductions or net anthropogenic GHG removals by sinks with estimates in registered PDD**

Item	Values estimated in ex-ante calculation of registered PDD	Actual values achieved during this monitoring period
Emission reductions or GHG removals by sinks (t CO <sub>2</sub> e)	239,704	120,833

**E.6. Remarks on difference from estimated value in registered PDD**

The actual GHG emission reductions achieved during the 2<sup>nd</sup> monitoring period of 01/01/2009-31/12/2012 (4 years) is less than the GHG emission reductions estimated ex-ante in the registered PDD. No further explanation is provided as per the guideline for completing the monitoring report form.

**E.7. Actual emission reductions or net anthropogenic GHG removals by sinks during the first commitment period and the period from 1 January 2013 onwards**

Item	Actual values achieved up to 31 December 2012	Actual values achieved from 1 January 2013 onwards
Emission reductions or GHG removals by sinks (t CO <sub>2</sub> e)	120,833	-

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### Document information

<i>Version</i>	<i>Date</i>	<i>Description</i>
03.1	2 January 2013	Editorial revision to correct table in section E.5.
03.0	3 December 2012	Revision required to introduce a provision on reporting actual emission reductions or net anthropogenic GHG removals by sinks for the period up to 31 December 2012 and the period from 1 January 2013 onwards (EB70, Annex 11).
02.0	13 March 2012	Revision required to ensure consistency with the "Guidelines for completing the monitoring report form" (EB 66, Annex 20).
01	28 May 2010	EB 54, Annex 34. Initial adoption.
Decision Class: Regulatory Document Type: Form Business Function: issuance Keywords: monitoring report, performance monitoring		