CARBON CAPITAL MARKETS®

UNFCCC Joint Implementation Monitoring Report (001) for the Project Activity:

Methane Capture and Destruction at the Solid Waste Landfill in the City of Lviv, Ukraine

JI Project Reference Number: 0172

Monitoring period: 2009-04-01 – 2011-02-28

Version 2

Date: 2012-04-26

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1. GENERAL PROJECT INFORMATION

1.1. Project Background

The project "Methane Capture and Destruction at the Solid Waste Landfill in the City of Lviv, Ukraine" (hereinafter referred to as "the Project") was commissioned, operated and monitored in accordance with the Project Design Document ("PDD"). The Project has been implemented and is operated in order to avoid LFG, and particularly landfill methane, emissions being released into the atmosphere. LFG production results from waste decay in anaerobic conditions created in the landfill body with approximately 50% methane ("CH4") in its content. Consequently LFG is a powerful greenhouse gas ("GhG") contributing to global warming. Additionally, LFG is a fire hazard and a cause of bad odours in the vicinity of landfills. By capturing the LFG, GhG emissions are reduced, local environmental impacts are mitigated and the operational safety of the site is increased.The Project incorporates LFG collection system; integrated booster and LFG flaring plant (high-temperature and high-efficiency flare) **HOF***GAS ®- Ready 2000 C* by Hofstetter AG; LFG generation unit, which consists of one operational and one stand-by generator; and Monitoring and Control system that is integrated with the LFG flaring plant and provides continuous (every operational minute) simultaneous monitoring of the main operational parameters including LFG content, flow, and flaring temperature.

The Project is located in the Lviv Region in Ukraine, at the municipal landfill of the City of Lviv – the landfill is also known as "Zbyranka". The landfill is situated near the Grybovychy village of Zhovkivsky District, about 5 km north of the City of Lviv. The City of Lviv is one of the biggest regional centers in Ukraine with population of approximately 800 thsd inhabitants. Further information on the Project can be obtained from the PDD available on the UNFCCC - JI website:
http://ji.unfccc.int/JI_Projects/DB/ZHLGHC3DBAOZITQKG6OFAYF9JPO28J/Determination/tuevnord1313701109.91/viewDeterminationReport.html

The Project has been implemented and monitored in accordance with its Monitoring Plan. No deviation from the Monitoring Plan has occurred. The starting date of the Project's first (1st) Monitoring / Verification Period, in consistency with the PDD, is April 1, 2009. The first (1st) Monitoring / Verification Period has been defined as a period from 2009-04-01 to 2011-02-28. The "Default Flare Efficiency Approach" specified in the Annex 13 EB 28 Methodological "Tool to determine project emissions from flaring gases containing methane" (hereinafter referred to as "Tool") has been applied in the ERU Calculation Procedure. The calculated Project Emission Reductions amount to 108,528 tCO2eq during the first (1st) Monitoring / Verification Period from 2009-04-01 to 2011-02-28.

A summary of calculation of the emission reductions is included as Annex 1 to this report. It should be noted that due to an upgrade of the system[1] the Project has not consumed any fossil fuel for its operational activities since February 2010. Consequently, emissions from diesel consumption were = 0 from February 2010 and now on (See Table A.1.2).

A summary of monitoring parameters, as in accordance with the Monitoring Plan (Section D of the registered PDD) is included as Annex 2 to this report.

[1] As confirmed by Weekly monitoring reports, the system upgrade has been finalized by 24/01/2010. The Project fossil fuel (diesel) consumption has been zero (0) since that date. Exact weekly/monthly/yearly quantities of the fossil fuel used are provided in the [*YYYYMMDD*]-LVIV-1PV ERUs FINAL SUMMARY excel spreadsheet (See Results Representation Section 4.3. of this report).

1.2. Methodology Applied to the Project Activity

The project applies the methodology ACM0001 ver. 11 (consolidated baseline and monitoring methodology for landfill gas projects activities) for baseline calculation and monitoring activities.

2. PARTIES INVOLVED

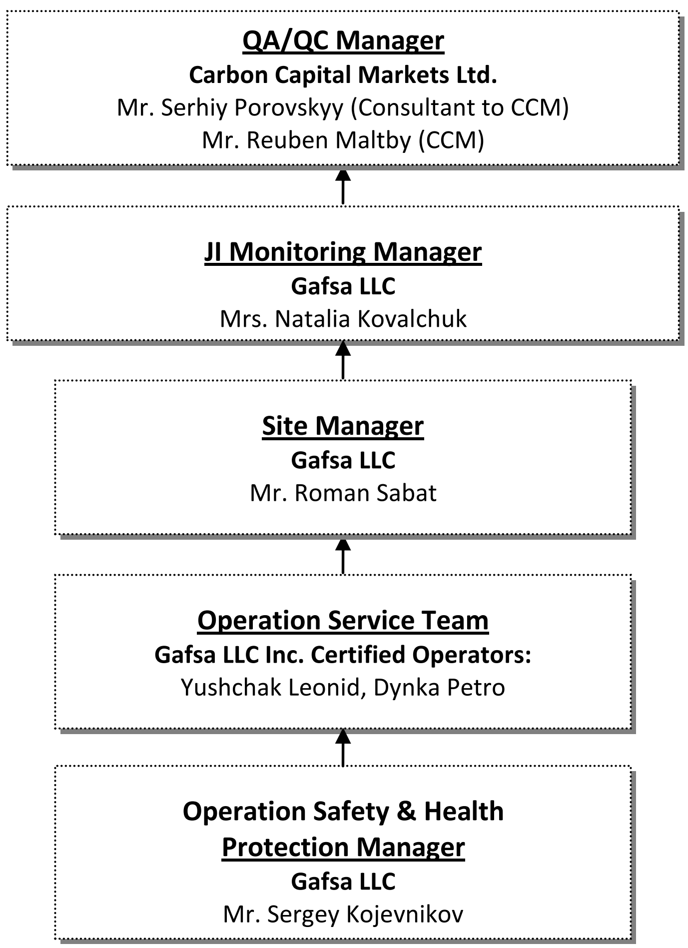
2.1. The Parties Involved in the JI Project Activity

Host country	Ukraine
Host country Project Participant	Gafsa LLC (thereafter referred to as "Gafsa")
Other parties	United Kingdom
Annex-1 Project Participant	Carbon Capital Markets Ltd (thereafter referred to as "CCM")

2.2. Party Responsible for Preparation and Submission of the Monitoring Report

This monitoring report was developed / revised by:	
Mr. Serhiy Porovskyy / Mr. Reuben Maltby	**Carbon Capital Markets Ltd ("CCM")**

2.3. Parties Involved in the Project Monitoring and Compliance Activities



3. KEY MONITORING ACTIVITIES

3.1. Monitoring Background and Measured Parameters

Calculations of Emission Reductions for the 1st Monitoring/Verification period have been performed using:

- Raw data obtained from the on-site Memograph (PLC), which automatically and simultaneously records operational and monitoring parameters for every operational minute. The main continuously monitored parameters used in calculations are outlined in the Table 3.1.1. Other flare parameters, which were considered to define a default value of the flare efficiency, are outlined in the Table 3.1.2.
- Fossil fuel (diesel) consumption by start-up generator. This data was reported on a weekly basis by the Operation Service Team (responsible operator) in the Weekly Monitoring Report. The data has been checked and confirmed by the JI Monitoring Manager. The data indicates that there was no consumption of fossil fuel (diesel) since February 2010. The formal calculation was undertaken in accordance with the EB 39 Annex 7 Tool. The summary Table A.1.2 of the Project Emissions from fossil fuel (diesel) consumption (**$PE_{EC,y}$ = PE_y**), in tCO_2 is provided in the Annex 1.
- Relevant constants as per the Tool summarized in the Table 3.3.1 (See Section 3.3)

The Tables 3.1.1 and 3.1.2 reference only the parameters used in the ERU Calculation Procedure (See Section 3.3). A complete summary of the Monitoring Parameters, as in accordance with the Monitoring Plan of the registered PDD, is included as Annex 2 to this report.

Table 3.1.1: Main Continuously Measured Parameters (Default Approach)

Parameter	Data variable	Data Unit	Equipment	Reference ID	Serial #	Note
W_{CH4}	%CH4 in LFG	%	Gas Analyzer	H- 10376, A141	F09-123070-001	Measurement of CH4, O2, and CO2 in LFG on dry basis. Gas sampling is done near the turbine flow meter.
W_{O2}	%O2 in LFG	%				
W_{CO2}	%CO2 in LFG	%				
FV_{RG}	Volumetric flow rate of the residual gas	m^3/h	Gas Flow Meter (Turbine type)[2]	H- 10376, FIRT61.1	10510214	Measurement of the total LFG flow in dry basis recorded at NTP. Flow meter is located before the flow separation to supply gas generator and the flare.
T_{flare}[3]	Temperature in the exhaust gas of the flare	°C	Thermo-couple	H- 10376, TISAH 81.25	5885-00	Measurement of the exhaust gas temperature. Thermocouple was placed at the top temperature measuring slot of the enclosed flare.

[2] The LFG Turbine Flow Counter records the total flow to the system. The system also has installed 2 T-Mass LFG Flow meters that record separately LFG to the flare and to the LFG generators. In accordance with the assumptions of the applied procedure these T-mass Flow meters are used for quality assurance and control but their record are not used in ERU calculation (See Section 3.3).

[3] Measurement of this parameter is required by the Tool and has been used together with the additional monitored parameters (Table 3.2) in order to determine and assign a default value of the flaring efficiency $\eta_{flare,h}$ in an hour *h*.

Table 3.1.2: Other Flare Parameters (Default Approach)

Parameter	Meaning	Possible Value	Note
Other Flare Parameter	Automatic continuous monitoring of the operational status of the flare	ON/OFF	Confirms physical status of the Flare's operation. Only data records (minutes) for which the flare was "ON" were pre-qualified to be considered in calculation of ERUs.
Other Flare Parameter	Automatic continuous monitoring of the operational conditions of the flare	o.k./Alarm	If any operational condition of the Flare does not meet necessary operational requirements for optimal flaring performance (set by the manufacturer), the flare automatically turns "Alarm" and then turns-off (if it was "on") or prevents the Flare from been turned-on (if it was "off"). Only data records (minutes) for which the flare was "o.k." were pre-qualified to be considered in calculation of ERUs.
Other Flare Parameter	Automatic continuous monitoring of the operational conditions of the flare plant system	o.k./Alarm	If any operational condition of the System does not meet necessary operational requirements for optimal LFG and suction, supply, and flaring, as well as if LFG parameters do not correspond to the ranges set for the system operation, the System's Collective Alarm automatically turns "Alarm". Only data records (minutes) for which the System's Collective Alarm was "o.k." were pre-qualified to be considered in calculation of ERUs
Other Flare Parameter	Automatic continuous monitoring of the operational status of the flare plant system	OK	This parameter identifies the system is on (powered), as well as the parameters recording/monitoring is "OK". Thus, only data records (minutes) for which the flare plant system had "OK" status were pre-qualified to be considered in calculation of ERUs

3.2. Data Collection and Processing

All measured monitored parameters are automatically recorded by Memograph (PLC). The data, which is protected from alteration, is stored and processed in the following way:

1) Stored on-site in SD memory card, placed in the PLC memory-slot; the SD card used has capacity to store data for the entire lifetime of the Project[4].
2) Stored by the Site Manager/Responsible (trained) Operator directly from the PLC into the JI Monitoring Manager's password protected computer[5] or transferred to it via a password protected flash-drive. The data is stored in RSD format, which protects data from any alteration and can be opened only with special software supplied by the Equipment manufacturer and only at the 'Project registered' computer (computer that is registered with the particular Project code used by the software).
3) The Site Manager/Responsible (trained) Operator also prepares a Weekly Monitoring Report and submits it to the JI Monitoring Manager.
4) The JI Monitoring Manager collects a) Raw Gas data, b) Plant Events Log (both obtained from RSD file and converted into Excel spreadsheet) together with c) an on-site Registry log and d) a Weekly Monitoring Report. The JI Monitoring Manager performs a cross-check and review.
5) JI Monitoring Manager stores both RSD cumulative file and all Excel raw data spreadsheets, checks the data and prepares a Weekly data set – a RAR archive which contains raw data spreadsheets, registry log, and a Weekly Monitoring Report.
6) Weekly data sets are submitted to QA/QC Manager (via email), stored by the QA/QC Manager (Consultant to CCM; CC: to CCM designated e-mail), and backed-up onto the CCM's protected server. The weekly data sets are processed by the QA/QC Manager (Consultant to CCM) in accordance with the ERU calculation procedure.

3.3. ERU Calculation Procedure

<u>Emissions Reduction Formula</u>

The monitored data is used to calculate the JI project's ERUs. The general formula from the methodology ACM0001 "Consolidated monitoring methodology for landfill gas project activities" for emission reductions of landfill gas projects is listed as below (See also Section D.1.2.2 in the PDD, formulas 1 and 2 combined):

$$\mathbf{ER_y = (MD_{project,y} - MD_{BL,y}) * GWP_{CH4} + EL_{LFG,y} * CEF_{electricity,BL,y} - ET_{LFG,y} * CEF_{thermal,BL,y} - PE_y} \qquad (1)$$

Since the project activity has not produced electricity from LFG to the grid (and didn't have any other alternatives of LFG-to-energy implemented), the net quantity of electricity produced using LFG ($\mathbf{EL_{LFG,y}}$) is zero (0) and the part of the equation *(1)* $\mathbf{EL_{LFG,y} * CEF_{electricity,BL,y} = 0}$.

[4] The Site Manger and JI Monitoring Manager have confirmed that the placed SD card store data continuously and contain all data since the Project has been functional. The capacity of the SD card can store about 5,000 operational days, which is enough for the expected lifetime of the Project.

[5] The number of computers that can be connected directly to the system's PLC is limited. Only the JI Monitoring Manager can access the Memograph's log directly and (only) download data to her computer. Usually the data is transferred via a password protected flash-drive and, nevertheless, it can be read only at the 'registered' computer, which is the JI Monitoring Manager's computer.

Also, since no thermal energy has been displaced, the quantity of thermal energy produced from LFG (**$ET_{LFG,y}$**) is zero (0) and the part of the equation *(1)* **$ET_{LFG,y}*CEF_{thermal,BL,y}=0$**.

Therefore, the formula (*1*) is amended to be:

$$ER_y = (MD_{project,y} - MD_{BL,y})*GWP_{CH4} - PE_y \qquad (2)$$

Where :

ER_y - emission reductions by the project in the year "y", in tCO_2e/year

$MD_{project,y}$ - amount of methane destroyed/combusted in the year "y", in tCH_4

$MD_{BL,y}$ - amount of methane that would have been destroyed/combusted in the year "y" in absence of the project activity, in tCH_4. According to the description of the baseline for the Project and relevant explanation in the Section B.1 of the PDD (also see PDD, D.1.2.2, p.27), **$MD_{BL,y}$** =0 for this project activity.

GWP_{CH4} - approved Global Warming Potential value for methane, equals to 21 tCO_2e/tCH_4

PE_y - project emissions in the year "y", in tCO_2e/year

Consequently, the final form of the emissions reduction formula that was used to calculate emission reductions from the project activity is:

$$ER_y = MD_{project,y} *GWP_{CH4} - PE_y \qquad (3)$$

<u>Calculation of Amount of Methane Destroyed/Combusted by the Project Activity (**$MD_{project,y}$**)</u>

In accordance with the Monitoring Plan of the registered PDD, the formula used to determine **$MD_{project,y}$** considers two main components: **$MD_{flared,y}$** and **$MD_{electricity,y}$** (assuming that **$MD_{thermal,y}$** and **$MD_{PL,y}$** are "0" (zero)).

<u>The ERU Calculation Procedure incorporates **$MD_{electricity,y}$** into **$MD_{flared,y}$** with a conservative assumption to treat the portion of 'LFG to gas generators' as it would be flared. This assumption is deemed conservative since the applied default efficiency of the flare (≤ 90%) is less than the destruction efficiency of a power generation unit (~100%). Additionally, the ERU Calculation Procedure relies on the measurement of the total gas flow, with the following reasons:</u>

1. Recommendation by the manufacturer to rely on the total LFG flow measurements. The total LFG flow is measured by the LFG Turbine Flow Counter, which provides high-quality measurements at NTP in dry basis (flow records are automatically compensated with the simultaneously measured LFG temperature and pressure). The flow-meters that measure separately LFG to the flare and LFG to the gas generators are T-mass type, which produce the records only adjusted with the measurement of the LFG temperature and would require additional adjustment with "P" records. Consequently, it is more conservative to rely on automatic high-quality measurements at NTP/dry basis by the LFG Turbine Flow Counter than process separately records of the flow to the flare and to the gas generators.
2. The Procedure qualifies the raw gas data based on the assumption of properly operated system and the flare (See the listed 'Other Flare Parameters' in the Table 3.1.2), which implies that the records when LFG power generation unit was ON but the Flare was OFF were disqualified (quality factor = 0) and affected the assigned value of the flare efficiency (**$\eta_{flare,h}$**).

Therefore, a general formula that links LFG flow for the year "y":

$$\mathbf{LFG_{total,y} = LFG_{flare,y} + LFG_{electricity,y}} \quad (4)$$

was simplified to:

$$\mathbf{LFG_{total,y} = LFG_{flare,y}} \quad (5)$$

where $\mathbf{LFG_{flare,y}}$ to correspond to the total LFG flow measurements by the LFG Turbine Flow Counter ($\mathbf{FV_{RG}}$) for a relevant time period. As the LFG total flow measured is done automatically in dry basis and at normal conditions for every minute “m” $\mathbf{LFG_{total,m} = LFG_{flare,m} = FV_{RG,m}}$, where $\mathbf{FV_{RG,m}}$ – volumetric flow rate of the residual gas in dry basis at normal conditions in the minute “m”, in m^3/h.

This approach applied in the ERU Calculation Procedure is very conservative because in addition to reducing destruction efficiency of a power generation unit (from ~100% to = $\eta_{flare,h} \leq 90\%$) it cuts any possible emission reductions that could have been obtained by considering the operation of the LFG power generation unit when the Flare was ‘OFF”.

Despite the separate records of LFG to the flare and LFG to the gas generators (recorded by T-mass flow-meters) were not used in the ERU Calculation procedure, they have been recorded and monitored by the Service Team as a part of QA/QC procedures.

To calculate $\mathbf{MD_{flared,y}}$ in the year “y”, the project emissions from flaring of the residual gas stream in the year “y” ($\mathbf{PE_{flare,y}}$) has to be calculated. For this purpose, the methodological Tool (Annex 13 EB28) has been used.

Generally, the Tool involves the following steps in order to calculate $\mathbf{PE_{flare,y}}$:

STEP 1: Determination of the mass flow rate of the residual gas that is flared
STEP 2: Determination of the mass fraction of carbon (C), hydrogen (H), oxygen (O) and nitrogen (N) in the residual gas
STEP 3: Determination of the volumetric flow rate of the exhaust gas on a dry basis
STEP 4: Determination of methane mass flow rate of the exhaust gas on a dry basis
STEP 5: Determination of methane mass flow rate of the residual gas on a dry basis
STEP 6: Determination of the hourly flare efficiency
STEP 7: Calculation of annual project emissions from flaring based on measured hourly values or based on default flare efficiencies.

The Tool offers two options for determining the flare efficiency for the enclosed flare.
Option 1 (“Default Flare Efficiency Approach”) is to apply the default efficiency values (90%, 50%, or 0%) depending on the measured temperature of the exhaust gas ($\mathbf{T_{flare}}$) and operational parameters.
Option 2 (“Continuous Monitoring Approach”) is to continuously monitor all the required parameters of the residual and exhaust gas in order to calculate the flare efficiency.

As described in the registered PDD, Option 2 (“Continuous Monitoring Approach”) would be used where possible; otherwise, Option 1 (“Default Flare Efficiency Approach”) will be used. For the reported Monitoring period “Default Flare Efficiency Approach” has been applied.

The decision that the “Default Flare Efficiency Approach” shall be applied for the 1st Monitoring / Verification period, rather than “Continuous Monitoring Approach”, was related to the operational requirement of installation of the second thermocouple not linked to the plant automatic self-adjustment system.

Due to the use of the “Default Flare Efficiency Approach”, the Steps 3 and 4 are not applicable. Consequently, only STEPs 1, 2, 5, 6, and 7 were considered in the procedure for calculation of the project emissions from flaring. The Table 3.3.1 provides a list of the constants used in the relevant equations from the Tool.

Table 3.3.1: Constants Used for Calculation of Emission Reductions

Parameter	ID	Value	SI Unit
Global Warming Potential of methane	GWP_{CH4}	21	tCO_2e/tCH_4
Universal ideal gas constant	R_u	8,314.472	$Pa.m^3/kmol.K$
Molecular mass of methane	MM_{CH4}	16.04	kg/kmol
Molecular mass of oxygen	MM_{O2}	32.00	kg/kmol
Molecular mass of carbon dioxide	MM_{CO2}	44.01	kg/kmol
Molecular mass of nitrogen	MM_{N2}	28.02	kg/kmol
Atomic mass of carbon	AM_C	12.00	kg/kmol
Atomic mass of oxygen	AM_O	16.00	kg/kmol
Atomic mass of hydrogen	AM_H	1.01	kg/kmol
Atomic mass of nitrogen	AM_N	14.01	kg/kmol
Density of methane gas at normal conditions	$\rho_{CH4,n}$	0.716	kg/m^3
Atmospheric pressure at normal conditions	P_n	101,325	Pa
Temperature at normal conditions	T_n	273.15	K

It is important to clarify that the measured values of $\mathbf{W_{CH4}}$, $\mathbf{W_{O2}}$, and $\mathbf{W_{CO2}}$ (in %) were converted into fraction in order to be used in calculation. Thus, the volumetric fractions of CH4, O2, and CO2 in the residual gas in the minute "m" were received as:

$$fv_{CH4,m} = W_{CH4,m}/100\%, \quad fv_{O2,m} = W_{O2,m}/100\%, \quad fv_{CO2,m} = W_{CO2,m}/100\% \qquad (6)$$

It is also important to further explain the mechanism and assumptions used in the ERU Calculation Procedure for determination and assignment of the default flare efficiency values.

The Tool (Annex 13 EB 28) specifies the following rule to assign a default value of the flare efficiency:

- $\eta_{flare,h}$ is 0% if the temperature in the exhaust gas of the flare (T_{flare}) is below 500 °C for more than 20 minutes during the hour "*h*".
- $\eta_{flare,h}$ is 50%, if the temperature in the exhaust gas of the flare (T_{flare}) is above 500 °C for more than 40 minutes during the hour "*h*", but the manufacturer's specifications on proper operation of the flare are not met at any point in time during the hour "*h*".
- $\eta_{flare,h}$ is 90%, if the temperature in the exhaust gas of the flare (T_{flare}) is above 500 °C for more than 40 minutes during the hour "*h*" and the manufacturer's specifications on proper operation of the flare are met continuously during the hour "*h*".

However, as is in accordance with the manufacturer's recommendations for the high-temperature / high-efficiency enclosed flares, the flare's efficiency is above 99% when the exhaust temperature is equal or above 700 °C. <u>To be conservative</u>, this temperature (700 °C) instead of the lower temperature (500 °C), specified in the Tool, was used to check whether $\mathbf{T_{flare}}$ value meets the necessary requirement.

The assumption that incorporates measurement of $\mathbf{T_{flare}}$, and the additional continuously measured parameters (See Table 3.1.2) in order to select and assign the default flare efficiency value is:

> If in any minute (data point) of an hour h $\mathbf{T_{flare}}$ is > 700 C, AND the Flare status is "on", AND the Flare is "o.k.", AND the Collective Alarm Status is "o.k.", AND the Plant's System Status is "OK" this minute meets ALL operational requirements and is assigned with a Quality factor "1"; otherwise, Quality factor is "0"; - When there are less than 60 data points for an hour h, the missing data points are assumed to have "0" Quality factor

- $\mathbf{\eta_{flare,h}}$ is 90%, if the sum of Quality factors for each calendar hour *h* is 60;
- $\mathbf{\eta_{flare,h}}$ is 50%, if the sum of Quality factors for each calendar hour *h* is less than 60 but more or equals 40;
- $\mathbf{\eta_{flare,h}}$ is 0% if the sum of Quality factors for each calendar hour *h* is less than 40.

The second part of the equation (3), the Project emissions in the year "y", was calculated in accordance with the "Tool to calculate baseline, project and/or leakage emissions from electricity consumption" (Version 01) EB 39, Annex 7 (also See Monitoring Plan, Section D of the registered PDD).

Considering that the project activity didn't have any consumption of heat ($\mathbf{PE_{FC,j,y} = 0}$), the general formula (8) in the PDD is simplified:

$$\mathbf{PE_y = PE_{EC,y}} \quad (7)$$

Also, as the was only one type of fossil fuel – diesel – used by the start up generator; and any and all of the generated electricity was consumed by the system (at start-up) it is appropriate to assume:

$$\mathbf{EC_{PJ,y} = EG_{start\text{-}up,y}} \quad (8)$$

where:

$\mathbf{EC_{PJ,y}}$	quantity of electricity consumed by the project (at start-up) in year "y", (MWh)
$\mathbf{EG_{start\text{-}up,y}}$	quantity of electricity generated by the start-up generator in year "y", (MWh)

Consequently, the formulas 9 and 10 in the PDD will be simplified to:

$$\mathbf{PE_{EC,y} = FC_y * NCV_y * EF_{CO2,y}} \quad (9)$$

where:

$\mathbf{FC_y}$	quantity of fossil fuel (diesel) used by the start-up generator in year "y", in Litres
$\mathbf{NCV_y}$	average net calorific value for diesel in year "y", equals 43.33 $TJ/10^3 t$[6]
$\mathbf{EF_{CO2,y}}$	average CO_2 emission factor for diesel in year "y", default value is 74.1 tCO_2/TJ[7]

[6] Source: Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories; Workbook; Chapter 1, Table 1.3. Despite the PDD envisages use of the values provided by the fossil fuel supplier (in invoices) such information has been assessed as less appropriate (due to scattered-data) than an assumption of a conservative value from a reliable source.

[7] Source: 2006 IPCC Guidelines for National Greenhouse Gas Inventories; Volume 2, Table 2.2.

To be applied properly in the formula, the reported values of the consumed fossil fuel (diesel) $\mathbf{FC_y}$ were converted from litres to metric tonnes[8]. The results of the calculation for each year are summarized in the Table A.1.2 (Annex 1).

To assure the highest possible accuracy, the ERU Calculation Procedure has been applied to calculate Project Emissions from flaring ($PE_{flare,m}$) and Emission Reductions from flaring (ER_m) for every minute "m". The received values of $PE_{flare,m}$ and ER_m were accumulated to present weekly $PE_{flare,w}$ and ER_w values shown in the ERU Calculation Workbooks (See Section 4.3 for details), as well as monthly ($ER_{flare,mon}$) and annual ($ER_{flare,y}$) values, which are outlined in the Table A.1.1 (Annex 1).

It's important to note that calculated weekly, monthly, and annual values are obtained by summing up relevant minute/weekly/monthly values without any additional mathematic operation (like data averaging or rounding); appropriate rounding has been performed only in order to show the final results, which does not affect the highest accuracy of the results.

[8] Density for diesel is 0.837 kg/L; or $83.7 \cdot 10^{-5}$ t/L. Source: MIT Energy "Units & Conversion Fact Sheet", Massachusetts Institute of Technology: http://web.mit.edu/mit_energy

4. MONITORING RESULTS

4.1. Emission Reductions

The calculated Net Emission Reductions amount to **108,528 tCO2eq for the period from 2009-04-01 to 2011-02-28**. The summary of calculation of the Emission Reductions during the 1st Monitoring Period is included as Annex 1 to this report.

4.2. Monitoring Period

This is the first (1st) Monitoring and Verification period reported for this project. The Monitoring report covers the period from 2009-04-01 to 2011-02-28.

4.3. Presentation of Monitoring Results

In accordance with the "Data collection and processing procedure" (Section 3.2), each week Raw data files together with a Weekly Monitoring Report and a weekly technical Registry file are presented as a Weekly Data Set and submitted to the QA/QC Manager by the JI Monitoring Manager. Each Weekly Data Set has been named as "LVIV YYYYMMDD-YYYYMMDD", where YYYYMMDD-YYYYMMDD indicates a start and an end date of the reported week.

The ERU Calculation results are presented as Excel workbooks with files named "LVIV ERUCalc-DEFAULT-YYYYMMDD-YYYYMMDD", where YYYYMMDD-YYYYMMDD indicates a start and an end date of the reported week. Each weekly ERU Calculation workbook has an explanation of its structure and the assumptions used in the ERU Calculation procedure. This explanation is provided in the "Read Me" spreadsheet. The raw data is transferred from the Raw Data Gas file, which corresponds to the calculated week, into the "Raw Gas Data" worksheet. All required measured parameters from the "Raw Gas Data" worksheet (See Section 3.1 above) are linked to the "A" worksheet. The "A" worksheet is designed to a) perform necessary unit conversion of the measured values to be applied in the ERU Calculation procedure (See Section 3.3); b) determine a default value of the flare efficiency ($\boldsymbol{\eta}_{\mathbf{flare,h}}$)[9] for each operational hour "*h*"[10]. The worksheet "B" contains all constants required for calculation (See Table 3.3.1). A comprehensive calculation is presented in the "Calc Sheet", which links the data from the worksheets "A" and "B" and, following the STEPs 1, 2, 5, 6, and 7 of the Tool, results with the values of Project Emissions from flaring $\mathbf{PE_{flare,m}}$ and Emission Reductions from flaring $\mathbf{ER_m}$ for the minute "*m*". The accumulated weekly values $\mathbf{PE_{flare,w}}$ and $\mathbf{ER_w}$ are also shown in the "Calc Sheet".

Summary of the results were presented in the "YYYYMMDD-LVIV-1PV ERUs FINAL SUMMARY" excel workbook. This file contains:

- All weekly values, monthly and annual values of the Emission Reductions from flaring; weekly/monthly/annual amounts of used fossil fuel (diesel) and resulting annual Project Emissions

[9] To be applied for calculation of the project emissions and emission reductions from flaring, the value of ($\boldsymbol{\eta}_{\mathbf{flare,h}}$) is converted into fraction (0.0 for 0% default flare efficiency; 0.5 for 50%; and 0.9 for 90%).

[10] The default value of the flare efficiency is assigned as a function of quantity of qualified operational minutes when all operational requirements are met (See Table 3.1.2 for the list of additional parameters been continuously monitored) and the temperature of the exhaust gas $\mathbf{T_{flare}} \geq 700$ °C (refer to the Section 3.3 for explanation).

from the fossil fuel consumption; and finally the Net Emission Reductions (**ER_y**) for the year "y": 2009 (Partial year from 01 April to 31 December); 2010 (full year from 01 January to 31 December); and 2011 (Partial year from 01 January till 28 February); and total for the monitoring period (from 2009-04-01 to 2011-02-28).

- Summary Tables A.1.1, A.1.2, and A.1.3 that are provided in the Annex 1 to this Monitoring report.

5. QUALITY ASSURANCE AND CONTROL MEASURES

All the monitoring data has been quality controlled for the following measures:

1) Certification/License provided by the manufacturers of instrumentation to accredited standard
2) Calibration certificates for instrumentation standard
3) JI database archives management regulation

Monitoring equipment calibration and certification has been performed by independent, external accredited laboratories or by the direct manufacturers, if applied.

Maintenance and operational calibration of the equipment has been carried by the Operation Service Team (Gafsa LLC) in accordance with the Calibration and Maintenance Schedule (Table 5.1 and Table 5.2) and detailed in the Weekly Monitoring reports submitted to QA/QC Manager (CCM).

Table 5.1: Calibration and Maintenance Schedule[11]

Equipment (Manufacturer, ID, Serial #)	Frequency	Maintenance	Calibration
LFG Gas Analyzer HOFGAS-Assay (ExTox) PID H-10376: A141, Serial# F09-123070-001	Weekly	Check function control for measuring gas cooler, condensate pump and cabinet fan; exchange filter in measuring gas filter	On-site, using recommended calibration gas mixture with max pressure 300hPa. Before calibration - "zeroing" procedure should be carried out. For zeroing, the analyzer has to be flushed with nitrogen (N2) or opposite calibration gas.
	Yearly	Change calibration gas. Pressure test entire analyzer system; check function control	
LFG Turbine Gas Flow Counter[12]: (Elster-Instromet AG) PID H-10376: FIRT61.1 (inc. PIR61.1 TIR61.1, and FIR61.1), Serial# 10510214	Weekly	Lubrication of system	
	6 month	Spintest. Check mechanical smooth running	
	Every 3yr.		Certified Calibration of the pressure transmitter (PIR61.1), temperature transmitter (TIR61.1), and the flow counter (FIR61.1)
Thermocouple (Jumo) TISAH 81.25, Series 5885-00[13]	6 month >=3 yr.	Recommendation by the manufacturer: Check every/at least 6 month; replace or repair with consequent certified calibration if malfunctioning; replace latest after 3yr. of use Operation and Maintenance by the Service Team (more conservative): thermocouple, even if functioned normally, was revised periodically (monthly) and recalibrated on annual basis. A new or a re-calibrated (by an authorized and certified facility) thermocouple has been put into operation for one year period.	

[11] The table lists the maintenance and calibration requirements only for the equipment measurements from which were used for ERU Calculation during the reported Monitoring period. Maintenance procedures for all necessary components of the flaring plant have been provided in the Operational Manual by the manufacturer “Hofstetter Umwelttechnik AG”

[12] Turbine Gas Flow Counter incorporates LFG Gas flow meter (FIR61.1), pressure (PIR61.1) and temperature (TIR61.1) transmitters in order to provide a record of the LFG flow rate at NTP conditions.

[13] The thermocouples supplied with the flaring plant by manufacturer (Hofstetter) were tested for the entire series of Type S Thermocouples (original manufacturer Jumo).

Table 5.2: Last Calibration Performed

Description	ID	Calibration			
		Frequency	Date of preceding calibration	Date of the last calibration for the 1st Monitoring Period	Scheduled Date for next calibration
LFG Gas Analyzer	A141	Weekly[14]	23.02.2011	28.02.2011	08.03.2011
Thermo-couple	TISAH 81.25	6 month >=3 yr.[15]	10.02.2010	03.02.2011	Before 03.02.2014*
LFG Turbine Gas Flow Counter[16]	PIR 61.1	Every 3 Years	16.01.2009	16.01.2009	Before 16.01.2012**
	TIR 61.1	Every 3 Years	16.01.2009	16.01.2009	Before 16.01.2012**
	FIR(T) 61.1	Every 3 Years	16.01.2009	16.01.2009	Before 16.01.2012**

[14] The weekly calibration, as per Gas Analyzer Calibration procedure, was undertaken every week starting the formal commissioning of the Flaring Plant on 18/05/2009.

[15] As stated in the Table 5.1 a more conservative Calibration and Maintenance procedure by the Project Operation and Service team (Gafsa LLC) has prevailed. Under that procedure, thermocouples have been replaced or recalibrated (with certification) after <= 1 year of operation. From the date (18/05/2009) of the flaring plant commissioning by the manufacturer in situ (at the Lviv Landfill) the thermocouples were exchanged on 10/02/2010 and 03/02/2011 within the reported Monitoring Period. The expected thermocouples change to be performed in February 2012*.

[16] As per the manufacturer recommendations, the equipment to be re-calibrated on 3 yr basis, which was conservatively assumed as 3 yr since the previous certified calibration (16/01/2009), so to be conducted on/before 16/01/2012. Despite the scheduled date is beyond the reported Monitoring period, the Operation and Service Team (Gafsa LLC) has provided all necessary certificates of re-calibration of the LFG Turbine Gas Flow Counter (its all three main components) made on 28/11/2011** (which was before the scheduled deadline 16/01/2012).

ANNEX 1: SUMMARY OF CALCULATION OF THE EMISSION REDUCTIONS

MONITORING PERIOD: 2009 April 1 to 2011 February 28

As explained in the Section 3.3, the final formula that was used to calculate emission reductions from the project activity is:

$$ER_y = MD_{flared,y} * GWP_{CH4} – PE_y \quad (3)$$

Emission Reductions from flaring (**MD_{flared}*GWP_{CH4}**):

The first part of the equation (3), the Emission Reductions from flaring (**ER_{flare}=MD_{flared}*GWP_{CH4}**), was calculated in accordance with the ERU Calculation Procedure for every minute and then accumulated to present weekly/monthly/annual values. The Table A.1.1 shows the monthly **$ER_{flare,mon}$**, annual **$ER_{flare,y}$**, and the total values of the Emission Reductions from flaring, in tCO_2e.

Table A.1.1: Emission Reductions from Flaring

MONTH	YEAR		
	2009	2010	2011
	$ER_{flare,mon}$, tCO_2e	$ER_{flare,mon}$, tCO_2e	$ER_{flare,mon}$, tCO_2e
JANUARY	N/A	5,020	4,870
FEBRUARY	N/A	4,095	5,475
MARCH	N/A	4,299	N/A
APRIL	0	3,901	N/A
MAY	2,269	4,757	N/A
JUNE	6,427	2,300	N/A
JULY	6,998	6,298	N/A
AUGUST	5,012	5,592	N/A
SEPTEMBER	5,276	5,835	N/A
OCTOBER	5,105	5,634	N/A
NOVEMBER	4,741	6,261	N/A
DECEMBER	4,552	3,812	N/A
Project Activity $ER_{flare,y}$, tCO_2e	40,380	57,804	10,345
Monitoring Period Total ER_{flare}, tCO_2e	**108,529**		

Project Emissions from fossil fuel combustion (**PE_y**)

The second part of the equation (3), the Project emissions in the year "y", was calculated in accordance with the "Tool to calculate baseline, project and/or leakage emissions from electricity consumption" (Version 01) EB 39, Annex 7 (also See Monitoring Plan, Section D of the registered PDD).

As explained in the Section 3.3, the final formula that was used to calculate project emissions from fossil fuel combustion by the start-up generator is:

$$PE_y = PE_{EC,y} = FC_y * NCV_y * EF_{CO2,y} \quad (9)$$

Table A.1.2: Project Emissions from Fossil Fuel (Diesel) Combustion

PERIOD	Project Emissions from fossil fuel combustion PE_y, tCO2e
2009 (Partial Year: APR-DEC)	1
2010 (Full Year: JAN-DEC)	0
2011 (Partial Year: JAN-FEB)	0
Total* for the Monitoring Period, tCO_2	**1**

Net Emission Reductions (**ER**)

The Table A.1.3 provides the summary of the calculation of the Project Emission Reductions in accordance with the formula (3), in tCO_2e.

The total value of the Project Emission Reductions for the 1st Monitoring period from 2009-04-01 to 2011-02-28 is 108,528 tCO_2e.

Table A.1.3: Emission Reductions

PERIOD	Emission Reductions from flaring ($MD_{flared,y}$*GWP_{CH4}), tCO_2e	Project Emissions from fossil fuel combustion PE_y, tCO2e	Emission Reductions ER_y, tCO_2e
2009 (Partial Year: APR-DEC)	40,380	1	40,379
2010 (Full Year: JAN-DEC)	57,804	0	57,804
2011 (Partial Year: JAN-FEB)	10,345	0	10,345
Project Total for the Monitoring Period, tCO_2	**108,529**	**1**	**108,528**

ANNEX 2: SUMMARY OF MONITORING PARAMETERS

The following Tables A.2.1 through A.2.3 provide a summary of monitoring measured (Table A.2.1) and calculated (Table A.2.2) parameters with their link to the PDD Monitoring Plan (Section D) and the Tool (Annex 13 EB 28); as well as the Equipment Legend (Table A.2.3) for the Project Activity.
Some of the Monitoring parameters are not applicable for the selected Default flare efficiency approach. Applied Monitoring parameters are detailed in the Section 3 of this Monitoring Report.

Table A.2.1: Measured Monitoring Parameters

Equipment	Ref. ID	Parameter(s)	Description	Notes	Frequency/ uncertainty	Link to PDD / Tool
LFG Turbine Gas Flow Counter[17]: (Elster-Instromet AG)	FIRT 61.1	$FV_{RG,m}$ = $LFG_{total,m}$ = $LFG_{flare,m}$	Volumetric flow rate of residual gas in dry basis at normal conditions in the minute "m", in m^3/h.	Measurement of the total LFG flow in dry basis recorded at NTP. Flow meter is located before the flow separation to supply gas generator and the flare. Explanation on the link to PDD parameters is provided in the Section 3.3, equations 4, 5, pp.8-9 of this Monitoring Report.	Continuous electronic recording (100% of data); Uncertainty level is Low	**PDD:** $LFG_{total,y}$, $LFG_{flare,y}$, $LFG_{electricity,y}$, FV_{RG} **Tool** $FV_{RG,h}$
LFG Gas Analyzer HOFGAS-Assay (ExTox)	A141	$W_{CH4,m}$ $W_{O2,m}$ $W_{CO2,m}$	Volumetric fraction of CH4, O2, and CO2 in the residual gas in the minute "m", in % Vol.	Measurement of CH4, O2, and CO2 in LFG on dry basis. Gas sampling is done near the turbine flow meter. These parameters are converted into $fv_{CH4,m}$, $fv_{CO2,m}$, and $fv_{O2,m}$ (See explanation in the Section 3.3, equation 5, p.9)	Continuous electronic recording (100% of data); Uncertainty level is Low	**PDD:** W_{CH4} , W_i: W_{O2}, W_{CO2} **Tool** $fv_{CH4,h}$, $fv_{O2,h}$, $fv_{CO2,h}$

[17] LFG Turbine Gas Flow Counter (FIRT 61.1) incorporates Gas flow meter (FIR61.1), pressure (PIR61.1) and temperature (TIR61.1) transmitters in order to provide a record of the LFG flow rate at NTP conditions.

Equipment	Ref. ID	Parameter(s)	Description	Notes	Frequency/ uncertainty	Link to PDD / Tool
Fluegas Analyzer HOFGAS-Assay FlueGas (ExTox)	RG81.30	$W_{CH4ex,m}$ $W_{O2ex,m}$	Volumetric fraction of CH4 and O2 in the exhaust gas in the minute "m" on dry basis at NTP, in % Vol.	This is measured on dry basis at normal conditions in accordance with Annex 13 EB 28 (only applicable in the case of continuous monitoring of the flare efficiency). Point of measurement is in the top (~80% of flare height) section of the flare and probes are adequate to high temperatures.	Continuous electronic recording (100% of data); Uncertainty level is Low	**PDD:** W_{CH4ex} W_{O2ex} **Tool** $t_{O2,h}$, $fv_{CH4,FG,h}$ (conversion from % Vol into mg/m3 will be performed as per Tool p.13)
Temperature Transmitter (FlowComp Inc. in FIRT61.1)	TIR61.1	**T**	Temperature of the landfill gas (main), in ^{o}C	Measurement of the LFG temperature at the point of flow/ pressure measurement. Since the LFG flow is recorded at NTP, the temperature is not used in calculations, but is recorded to be complete	Continuous electronic recording (100% of data); Uncertainty level is Low	**PDD:** **T**
Pressure Transmitters (Rosemount Inc. in FIRT61.1)	PIR61.1	**P**	Pressure of the landfill gas (main), in mbar	Measurement of the LFG pressure at the point of flow/temperature measurement. Since the LFG flow is recorded at NTP, the pressure is not used in calculations, but is recorded to be complete	Continuous electronic recording (100% of data); Uncertainty level is Low	**PDD:** **P**
Thermo-couple (Jumo)	TISAH 81.25	T_{flare}	Temperature of the exhaust gas of the enclosed flare, in ^{o}C	Measurement of the exhaust gas temperature. Thermocouple is placed at the top temperature measuring slot of the flare. Thermocouple used is of Type S, which is of a higher measuring standard then Type N.	Continuous electronic recording (100% of data); Uncertainty level is Low	**PDD:** T_{flare} **Tool** T_{flare}
LFG piston generator counter (control panel)	UMG-60	**h**	Operation of the LFGTE generating unit, hours	This is monitored to ensure that CH4 destruction is only claimed for CH4 used in the biogas generator when it is operational.	Continuous but documented weekly; Uncertainty level is Low	**PDD:** **h**

Equipment	Ref. ID	Parameter(s)	Description	Notes	Frequency/ uncertainty	Link to PDD / Tool
Meter (scale)	N/A	**FC_y**	Quantity of fossil fuel (diesel) used by the start-up generator in year *y*, in Litres	All electricity generated on site using fossil fuel (diesel) is covered by this parameter. The values of this parameter are accumulated monthly and annually and used in calculation of Project Emissions from electricity consumption produced by start-up fossil fuel generator in the year "y" (**$PE_{EC,y}$**). (See explanation in the Section 3.3, pp.11-12)	Weekly; Uncertainty level is Low/Medium	**PDD:** **FC_y**
Plant Control, Memograph	A101	Other Flare parameters	Automatic continuous monitoring of the operational status of the flare	Confirms physical status of the Flare's operation. Only data records (minutes) for which the flare was "ON" were pre-qualified to be considered in calculation of ERUs.	Continuous electronic recording (100% of data); Uncertainty level is Low	**PDD/Tool** Other Flare operation parameters according to the Annex 13 EB28 (Tool)
Plant Control, Memograph	A101	Other Flare parameters	Automatic continuous monitoring of the operational conditions of the flare	If any operational condition of the Flare does not meet necessary operational requirements for optimal flaring performance (set by the manufacturer), the flare automatically turns "Alarm" and then turns-off (if it was "on") or prevents the Flare from been turned-on (if it was "off"). Only data records (minutes) for which the flare was "o.k." were pre-qualified to be considered in calculation of ERUs.	Continuous electronic recording (100% of data); Uncertainty level is Low	**PDD/Tool** Other Flare operation parameters according to the Annex 13 EB28 (Tool)
Plant Control, Memograph	A101	Other Flare parameters	Automatic continuous monitoring of the operational conditions of the flare plant system	If any operational condition of the System does not meet necessary operational requirements for optimal LFG and suction, supply, and flaring, as well as if LFG parameters do not correspond to the ranges set for the system operation, the System's Collective Alarm automatically turns "Alarm". Only data records (minutes) for	Continuous electronic recording (100% of data); Uncertainty level is Low	**PDD/Tool** Other Flare operation parameters according to the Annex 13 EB28 (Tool)

Equipment	Ref. ID	Parameter(s)	Description	Notes	Frequency/ uncertainty	Link to PDD / Tool
				which the System's Collective Alarm was "o.k." were pre-qualified to be considered in calculation of ERUs		
Plant Control, Memograph	A101	Other Flare parameters	Automatic continuous monitoring of the operational status of the flare plant system	This parameter identifies the system is on (powered), as well as the parameters recording/monitoring is "OK". Thus, only data records (minutes) for which the flare plant system had "OK" status were pre-qualified to be considered in calculation of ERUs	Continuous electronic recording (100% of data); Uncertainty level is Low	**PDD/Tool** Other Flare operation parameters according to the Annex 13 EB28 (Tool)

Table A.2.2: Calculated Monitoring Parameters

Parameter(s)	Description	Notes	Link to PDD / Tool
$fv_{CH4,m}$, $fv_{CO2,m}$, $fv_{O2,m}$, and $fv_{N2,m}$	Volumetric fraction of CH4, O2, CO2, and N2 in the residual gas in the minute “m”.	The volumetric fractions of three gases (CH4, CO2, and O2), represented by parameters $fv_{CH4,m}$, $fv_{CO2,m}$, and $fv_{O2,m}$, are converted into fraction from continuously monitored measured parameters W_{CH4}, W_{O2}, and W_{CO2} (in Vol. %). The volumetric fraction of N2 ($fv_{N2,m}$) is calculated in accordance with the Tool, as: $fv_{N2,m}=1-(fv_{CH4,m}+fv_{CO2,m}+fv_{O2,m})$	**Tool** $fv_{i,h}$
$PE_{flare,m}$, $PE_{flare,w}$, $PE_{flare,mon}$, $PE_{flare,y}$	Project Emissions from flaring the residual gas stream in the minute “m”, week “w”, month “mon” and year “y”, in tCO_2e	Calculated using the methodological Tool (Annex 13 EB28), Steps 1 – 7 (Steps 3 and 4 are applicable only in a case of “Continuous flare efficiency monitoring). Calculation was performed as per ERU Calculation Procedure (Section 3.3) to calculate Project Emissions from flaring and Emission Reductions from flaring for every minute “m”. The received values were accumulated into weekly/monthly/annual values.	**PDD/Tool** $PE_{flare,y}$
$PE_{EC,y}$	Project emissions from electricity consumption produced by start-up diesel generator in the year “y”, in tCO_2e	Calculated from the weekly measured quantities of fossil fuel (diesel) used by the start-up generator (in Litres), accumulated into monthly/annual values (in Litres) - FC_y; then converted into tCO_2e using: a) density for diesel, b) average Net Calorific Value for diesel (NCV), and c) average CO2 Emission Factor for diesel (EF_{CO2})	**PDD/Tool** $PE_{EC,y}$
NCV_y[18]	Average Net Calorific Value of the fossil fuel used by the start-up generator in the year “y”, $TJ/10^3t$	Selected for the used fossil fuel –diesel – from the Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories: Workbook; Chapter 1, p.1.6, Table 1.3.	**PDD/Tool** NCV_y, $NCV_{i,t}$

[18] Estimated parameter based on the type of fossil fuel used.

Table A.2.3: Monitoring Equipment Legend for the Project Activity

Equipment ID	Drawing ID; Serial #	Parameters monitored	Equipment Description	Notes
LFG Gas Analyzer (A 141)	H- 10376; Serial# F09-123070-001	Measured in %.Vol.: $W_{CH4,m}$ $W_{O2,m}$ $W_{CO2,m}$	HOFGAS-Assay (ExTox) Measuring range Vol%: CH4: 0..100 %; O2: 0..25%;CO2: 0..100% Uncertainty level: U_{95}<±1.0%	For proper operation the equipment has to be calibrated as per calibration procedure
Fluegas Analyzer (RG81.30)	H- 10376; Serial# F09-123508-001	Measured in %.Vol.: $W_{CH4ex,m}$ $W_{O2ex,m}$	HOFGAS- Assay FlueGas (ExTox) Measuring range: CH4: 0.5% Vol.; O2: 0..25% Vol. Uncertainty level: U_{95}<±1.0%	For proper operation the equipment has to be calibrated as per calibration procedure
LFG Turbine Gas Flow Counter (FIRT61.1)	H- 10376; Serial# 10510214	$FV_{RG,m}$ = $LFG_{total,m}$ = $LFG_{flare,m}$	LFG Flow meter (Elster-Instromet AG) Measuring range: 130-2500 m^3/h Uncertainty level: U_{95}=±0.3%	The Equipment is compensated with Pressure and Temperature transmitters. Original Certification is a part of Calibration Certificate for the Turbine Gas Flow Counter.
Pressure Transmitter (PIR61.1)	H- 10376; Serial# 8427446 10/07	**P**	Pressure Transmitter (Rosemount) Measuring range: 0.0..2.5 bar; max 10bar Uncertainty level: U_{95}=±0.05%	Original Certification is a part of Calibration Certificate for the Turbine Gas Flow Counter. Recalibration Certificate by a Certified Lab is provided as per calibration procedure
Temperature Transmitter (TIR61.1)	H- 10376; Serial# 6700201 4070	**T**	Temperature Transmitter (FlowComp) Measuring range: -50..+100 ^oC; max +120 ^oC Uncertainty level: class A U_{95}=±1.0 ^oC	Original Certification is a part of Calibration Certificate for the Turbine Gas Flow Counter. Recalibration Certificate by a Certified Lab is provided as per calibration procedure
Thermocouple (TISAH81.25)	H- 10376; Series 5885-00	T_{flare}	Thermocouple Type S (Jumo) Measuring range: 0..+1600 ^oC Uncertainty level: U_{95}=±1.5 ^oC	Original manufacturer Calibration Certificate was provided for the Series of Thermocouples. For proper operation the equipment has to be calibrated as per calibration procedure