Monitoring report of JI project «Reduction of methane emissions on the gas equipment of gas-distributing points and on the gas armature of gas-distributing networks of PJSC «Mariupolgaz »»

Monitoring period: 01/01/2008-31/08/2011

Version: 02 as of 12/09/2011

Contents:

Annex A.[1] Calculation of greenhouse gases emission reductions at gas equipment of gas-distributing points (cabinet-type gas-distributing points), gas armature, flanged, screw-thread joints of gas-distributing networks of PJSC «Mariupolgaz » for the period from January 01, 2008 to August 31, 2011.

[1] Annex A is given in electronic form

Section A. General project activity and monitoring information

A.1. Title of the project

Reduction of methane emissions on the gas equipment of gas-distributing points and on the gas armature of gas-distributing networks of PJSC «Mariupolgaz ».

A.2. Status of JI project

JI project "Reduction of methane emissions on the gas equipment of gas-distributing points and on the gas armature of gas-distributing networks of PJSC «Mariupolgaz »" was determined by Bureau Veritas Certification, Determination report No. Ukraine-det/0311/2011 as of 25/07/2011. The project was approved by State Environmental Investment Agency of Ukraine (Letter of Approval No. 2402/23/7 as of 05/09/2011) and Federal Office for Environment (FOEN) of Switzerland (Letter of Approval No. J294-0485 as of 25/07/2011).

A.3. Short description of the project activity

As a result of unscheduled rehabilitation of gas-distributing points (GDP), cabinet-type gas-distributing points (CGDP) and gas armature of gas-distributing networks carried out by PJSC «Mariupolgaz » the following greenhouse gases (GHG) emission reductions were achieved in accordance with this project for the monitoring period from January 01, 2008 to August 31, 2011[1]:

	2008	2009	2010	January – August 2011
Methane emissions reduction for the period, m^3	24 011 647	24 080 235	24 280 879	16 320 798
GHG emissions reduction for the period, tCO_2e.	361 443	362 475	365 495	245 674
Total methane emissions reduction for the period of monitoring, m^3	88 693 559			
Total GHG emissions reduction for the period of monitoring, tCO_2e.	1 335 087			

A.4. Monitoring period

Starting date: 01/01/2008
Closing date: 31/08/2011

[1] The presented values of GHG emission reductions are approximated to integers.

A.5. Methodology applied to the project activity

A.5.1. Baseline determination methodology

The Specific Approach has been applied that based on the Methodology AM0023 version 3.0 of 30/10/2009 «Leak reduction from natural gas pipeline compressor or gate stations»[2] approved by Clean Development Mechanism Executive Board with clarification related to the method of leakage volume measurement and stated in section B.1 of PDD version 05.

A.5.2. Monitoring methodology

For quantitative estimation and preparation of the report on emission reduction on the ground of baseline and project activity the approved monitoring methodology AM0023, version 3.0, specifying the methods of leakage measurement (section B.1 of PDD version 05) was used.
The uncertainty of the method of measurement was taken into account in the course of GHG emission reduction calculation (see section D of PDD, version 05).

A.6. Status of implementation including time table for major project parts

In accordance with PDD, version 05, the project boundaries include the places of methane leakages due to nonhermeticity of gas equipment GDP (CGDP), gas armature, flanged and threaded joints of gas-distributing networks of PJSC «Mariupolgaz ». In total the project's boundaries include equipment of 244 GDP (CGDP) and 6481 units of gas armature.

During the period from starting date of project implementation (2005) to December 31, 2007 233 GDP (CGDP) and 6 297 units of gas armature were repaired (replaced) within the project boundaries. During the reporting monitoring period 11 GDP (CGDP) and 184 units of gas armature were repaired (replaced).

Quantity of repaired (replaced) equipment of GDP (CGDP) and gas-distributing networks of PJSC «Mariupolgaz » by periods is given in Table 1:

[2] http://cdm.unfccc.int/UserManagement/FileStorage/JY2L0XEKMB3HD18T7RPO6ZSFCQINGA

Table 1. Quantity of project repaired GDP (CGDP) and repaired (replaced) gas armature or gas pipelines by periods

Period	Quantity of GDP (CGDP), wherein the gas equipment was replaced (repaired)	Quantity of repaired gas armature of gas-distributing networks
2005	49	1 300
2006	97	2 590
2007	87	2 407
2008	-	28
2009	-	28
2010	5	68
January – August 2011	6	60
Total	**244**	**6 481**

The list of GDP (CGDP) and gas armature, which were repaired (replaced) out of schedule, as well as list of gas armature, repaired (replaced) during reporting period is given in Annex A[3] to the Monitoring report.

Project measures for current monitoring period also involved subsequent Purposeful Examination and Technical Maintenance (PETM) of the whole gas equipment of GDP (CGDP) and gas armature, which were repaired (replaced) out of schedule for the whole period of JI project.

The gas equipment of GDP (CGDP) and gas armature of gas pipelines repaired (replaced) during previous periods of project activity is inspected regularly, as component part of standard monitoring activity, to ascertain, that they do not become the source of emissions again.

Current repair of gas equipment according to the Monitoring Plan, given in PDD, version 05, is carried out once per year, and maintenance is performed once per half-year.

Measurements of volume of methane leakages of repaired (replaced) gas equipment of GDP (CGDP) and gas armature of gas pipelines of PJSC «Mariupolgaz » don't exceed the volume of leakages measured after the first repair of equipment.

[3] Annex A «Calculation of GHG emission reductions at gas equipment of gas-distributing points (cabinet-type gas-distributing points), gas armature, flanged, screw-thread connections of gas-distributing networks of PJSC «Mariupolgaz » for the period from 01/01/2008 to 31/08/2011» is given in electronic form.

A.7. Possible deviations and revisions to the registered PDD

There are no significant deviations to the registered version of PDD.

A.8. Possible deviations or revisions to the registered monitoring plan

There are no deviations to the registered monitoring plan.

A.9. Persons responsible for preparation and submission of monitoring report

Leader of Working Group, chief engineer of PJSC «Mariupolgaz » Grudolov M.A., is responsible for monitoring report on behalf of PJSC «Mariupolgaz » and Director Fabian Knodel is responsible for report on behalf of VEMA S.A.

Section B. Key monitoring activities

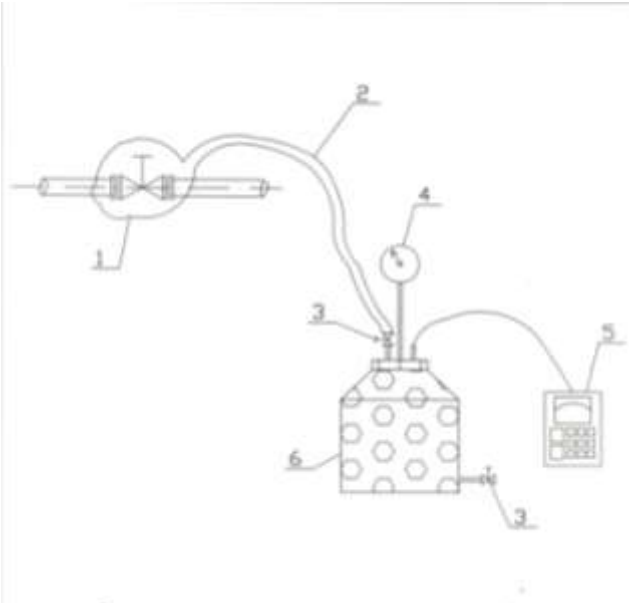
B.1.1. Applied equipment

Control and monitoring system is divided into three parts:
1) measurement of the amount of methane leakages before repair (replacement) of gas equipment;
2) measurement of the amount of methane leakages after the repair (replacement) of gas equipment;
3) archiving and processing of obtained results.

The measurement of natural gas leakages volumes are made on the basis of technology of the "calibrated bag" that is described in the approved CDM methodology AM0023, version 3.0 «Leak reduction from natural gas pipeline compressor or gate stations». One of the problems of the use of this methodology is difficulty of armature volume calculation used for measuring, and also the initial volume of air, at determination of gas volume that entered the "bag".
To solve these problems a special setting was made on the base of plastic tank of the known volume (0,11 m^3), a package, plastic hose and manometer (see Pic.1). All connections are executed hermetically.

Pic. 1. Photo of quantitative measuring of methane emissions device.

Scheme of device is given on Picture 2.



Pic. 2.Scheme of device for quantitative measuring of methane leakages

Legend:
1. Hermetic bag.
2. Hose.
3. Tap.
4. Manometer.
5. Gas analyzer EX-TEC® HS 680.
6. Hermetic tank.

Gas analyzer EX - TEC® HS 680. For determination of methane concentration in this case a high-fidelity gas analyzer of EX - TEC® HS 680 is used.

Pic. 3. Photo to the gas analyzer EX-TEC® HS 680.

The Gas analyzer has protection from an explosion (CENELEC).
Application to the gas analyzers and ranges of measuring are given in Table 2.

Table 2. Application and ranges of measuring of gas analyzer EX - TEC® HS 680

Application	Range of measuring
Above-ground check-up	From 0 ppm to 10 volume percent (%) CH_4
Measuring in deepening of trenches of underground pipelines	from 0,0 to 100 volume percent (%) of CH_4 from 0 to 30 volume percent (%) of CO_2
Verification is in the closed spaces	From 0 ppm to 10 volume percent (%) of CH_4
Verification in apartments	From 0 ppm to 10 volume percent (%) of CH_4
Notification about the presence of explosive gases	From 0 ppm to 10 volume percent (%) of CH_4
Measuring of amount of mixtures in gases	From 0,0 to 100 volume percent (%) of CH_4
Analysis of ethane	CH, CH_4, C_2H_6, C_3H_8 (additionally)

A relative error amounts in 10% that corresponds to the standard EN 50054/57[4]

After an exposure and emission measuring repair or replacement of gas equipment GDP (CGDP) and gas armature of gas pipelines is executed with the use of modern materials of sealers (GOST 7338-90[5], GOST 5152-84[6] or GOST 10330-76[7]) and complete replacement of worn out equipment by new and modern one of European manufacturers or their analogues of domestic production.

B.1.2. Calibration procedure

The only device that requires calibration procedures and is used in the monitoring of methane leakages is gas analyzer EX-TEC ® HS 680. Inter-calibration interval is 1 year.
As a result of verification (calibration) the certificate confirming the technical serviceability of device is issued.

[4] Electrical apparatus for the detection and measurement of combustible gases) General requirements and test methods.
[5] «Rubber and rubber-fabric plates»
[6] «Stuffing»
[7] «Scutched flax fibre. Technical conditions»

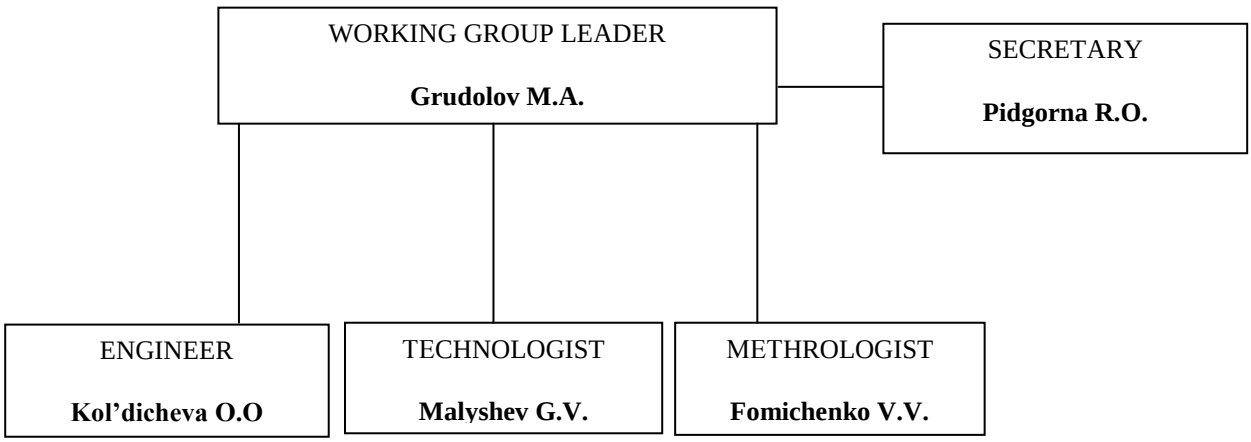
B.1.3. Involvement of Third Parties

SE «Kharkivstandardmetrology».
State Enterprise «Kharkivstandardmetrology» is the enterprise which has low powers to spend checking and calibration of gas analyzers.
«Kharkivstandardmetrology» performance of such kinds works for enterpise "Analitgaz-Service" which has operating contract with PJSC "Mariupolgaz" for repair and technical service of all gas analyzers of PJSC "Mariupolgaz".
This contract also provides that "Analitgazs-Service" on the instructions of "Mariupolgaz" carries out services in checking and calibration of gas analyzers in State Standard organisations.

B.2. Data collection (accumulated data for the whole monitoring period).

B.2.1. The operational and management structure in order to enable the project operator implement the monitoring plan.

Co-ordination of work of all departments and services of PJSC "Mariupolgaz" is carried out in relation to introduction of JI project by the Working group created by Order of Chairman of Board of PJSC "Mariupolgaz" № 243 of 30/12/2004. The update structure of the Working group was approved by Order of General director of PJSC "Mariupolgaz" №132a of 26/05/2011 and is presented on Pic. 5.



Pic.5. Structure of the Working group.

Responsible for collection of all information foreseen by the monitoring plan, and also implementation of all necessary calculations is Kol'dicheva O.O. Responsible for storage and archiving of all obtained information as a result of the conducted measuring and calculations is Pidgorna R.O. On the basis of the received information the leader of the working group Grudolov M.A. determines the plan of measures on Project and the volume of necessary resources. Malyshev

G.V. is responsible for organization of monitoring measurement of leakages and their removal. Fomichenko V.V. provides availability of trusted measuring equipment and maintenance.

B.2.2. List of parameters used in the course of calculation

The parameters given in Table 3 are used in the course of calculation.

Table. 3. Parameters used in the course of GHG emissions calculation

Identification number	Data variable	Source of data	Data unit measurement	Form of representation of obtained data	Comments
1. i	The sequence number GDP (CGDP), bolt, tap, valve, flanged and threaded joint, where methane emissions are found , removed and then checked	Leakage measurement activities	Dimensionless	Electronic	Corresponding number is appropriated to leakage found at device. List of gas equipment GDP (CGDP), shut-off devices (bolts, taps, valves), flanged and threaded joints is given in Annex A. Inspection is carried out after repair.
2. Ti	Time	Records of investigation results	The amount of hours of exploitation of equipment on which leakages were found during a year	Electronic	Quantity of hours of exploitation during a year from the moment of its repair (replacement)
3. Data	Date	Data on repair (replacement) and monitoring (register)	Date of repair (replacement) and monitoring	Electronic	Date of rehabilitation used together with the quantity of hours of equipment exploitation to determine the total number of hours of operation. In the case of repeated leakages the date is the date of last inspection, which showed no leakages
4. GWP_{CH4}	Global warming potential	IPCC	tCO_2e/ tCH_4	Electronic	Project developer will conduct monitoring of any changes in global warming potential for methane published by IPCC and approved by COP
5. $F_{CH4,i}$	Leakage speed for each found leakage	Leakage measurement activity	m^3CH_4/h	Electronic	It is calculated by using the largest deviation of device error (10% for gas analyzer)

Identification number	Data variable	Source of data	Data unit measurement	Form of representation of obtained data	Comments
6. t	Gas temperature and pressure	Data of measurements of glass mercury thermometer TL-4	^{0}C	Electronic	It is measured for determination of CH_4 density.
7. P	Gas pressure	Data of measurements of barometer	MPa	Electronic	It is measured for determination of CH_4 density.
8. URi	Vagueness factor of emission measuring equipment	Information given by manufacturer and/or IPCC	%	Electronic	If possible, 95% confidence interval is measured, advice of Good Practice Guidelines presented in section 6 2000 IPCC. If the manufacturer of leakage measurement equipment states uncertainty interval without specifying the confidence interval, it can be considered as 95%.
9. *Vbag*	Tank capacity	Data of measurements of flow meter	m^3	Electronic	Tank is filled with water. Quantity of water measured by flow meter shall be a tank capacity. Measurement showed that the volume capacity is 0.11 m^3.
10. $w_{sampleCH4,i}$	Methane concentration in a sample	Data of measurements of gas analyzer EX-TEC® SR5	%	Electronic	The concentration of methane in the sample (in tank) of leakage *i* is the difference between the concentration of methane in the sample at the beginning and end of measurement. Concentration is measured by gas analyzer EX-TEC ® HS 680.
11. τ_i	Time when methane concentration in tank reaches a certain level	Data of measurements of second meter «SOS pr-2b-2»	seconds	Electronic	Time during which the concentration of methane in tank reaches a certain level is determined by the second meter. Measurement begins with the opening tap on the tank lid and ends in 180 seconds.

B.2.3. Data concerning leakages

There are no leakages during the project implementation (JI Specific Approach on the basis of the approved Methodology AM0023, version 3.0 also as well as Metodology AM0023, version 3.0 doesn't provide for leakages).

B.3. Data processing and archiving

All data will be processed and archived in electronic and/or paper form and kept till December 31, 2019.

B.4. Extraordinary situations and disturbances

There were no extraordinary situations for current monitoring period (from 01/01/2008 to 31/08/2011) at gas-distribution networks of PJSC "Mariupolgaz".

B.5. Procedures for detection and elimination of failures at gas-distributing points and gas-distribution networks of PJSC "Mariupolgaz".

Detection, elimination and registration of failures and extraordinary situations at shut-off stations of PJSC "Mariupolgaz" is carried out according to the Gas Supply Safety Rules of Ukraine.

B.6. External data (type, source, access)

Such external data are using for monitoring:

Data/Parameter	GWP_{CH4},
Unit	tCO_2e/tCH_4
Description	Potential of global warming for methane
Periodicity of measuring/ of monitoring	Constantly
Source of data that was (will be) applied	IPCC
The value of data (for ex - ante calculations/ determinations)	21
Confirmation of data choice or description of method and measuring procedures that were (will be) applied	-
Procedures of management of quality / providing of quality of measuring that were (will be) applied	The responsible for monitoring person checks the data annually.
Comments	The project developer monitors any changes in global warming potential for methane published IPCC (IPCC Second Assessment Report: Climate Change 1995 (SAR)) and accepted COP. The value of GWP for

	methane is provided on the UNFCCC web-site: http://unfccc.int/ghg_data/items/3825.php

Data/Parameter	URi
Unit	%
Description	Factor of vagueness of equipment of emissions measuring
Periodicity of measuring/ of monitoring	Annually
Source of data that was (will be) applied	IPCC
The value of data (for ex - ante calculations/ determinations)	95
Confirmation of data choice or description of method and measuring procedures that were (will be) applied	Methodology of AM0023, version 3.0
Procedures of management of quality / providing of quality of measuring that were (will be) applied	The responsible for monitoring person checks the data annually
Comments	Estimated where possible, 95% confidence interval, advice of IPCC presented in division 6 of *IPCC Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories, 2000*[8]. If the producer of equipment of emissions measuring declares the area of vagueness without clarification of confidence interval, it can be accepted 95%

B.7. Level of measuring equipment error

Relative error of gas analyzer EX-TEC® HS 680 is 10%, corresponding to standard EN 50054/57. The device is calibrated annually.

[8] IPCC Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories, 2000: http://www.ipcc-nggip.iges.or.jp/public/gp/english/6_Uncertainty.pdf

Section C. Quality assurance and quality control measures

C.1. Documented procedures and management plan

C.1.1. Roles and responsibilities

Chief engineer of PJSC "Mariupolgaz", Grudolov M.A., manages the project. He manages and coordinates the activity of all departments. Specially organized Working Group is responsible for collection and processing of parameters.
Structure of data collection and Project management is given in Section B.2 of this Monitoring Report.

C.1.2. Trainings

Special training for work with new equipment is not needed. All trainings concerning the project were held by the equipment suppliers and their cost is included into the cost of equipment.

C.2. Internal audits and control measures

Under the guidance of a specially established working group PJSC "Mariupolgaz" formed a group for measurement of all necessary parameters provided for by the methane leakage monitoring plan.
Monitoring measurements are performed by specifically trained personnel according to the Methods of measurements. Data on Monitoring measurements are recorded in paper form directly in the course of measurements. Then, on the basis of paper data the single electronic database of leakage monitoring measurements is formed.

Current repair of gas equipment GDP (CGDP) and gas armature of gas-distribution networks is carried out once per year, and maintenance is performed once per half-year.

Repaired gas equipment is inspected regularly as component part of standard monitoring activity, to ascertain, that it doesn’t become the source of emissions again.

C.3. Information on factors of social influence of the project and its effect upon environment

As a result of project implementation the quality of gas supply of the region population will be improved.
Also there will be will reduction of natural gas losses, reduction of GHG emissions which cause greenhouse effect and climate change. The level of safety of gas pipelines’ operation will be increased.

Section D. Calculation of greenhouse gases emission reductions

D.1. Project emissions

Using the method of measuring of emissions volume by means of leakage-proof tank, the volume of methane emissions from one gas equipment (armature) after repair (replacements) is possible to calculate according to the formula:

$F^{+}_{CH4,i} = Vbag * w_{sampleCH4,i} * 3600 / \tau_i$, where (1)

$F^{+}_{CH4,i}$ - speed of methane emissions (emission volume) through leaking equipment and after the repair (substitution) (m³/hour.);
Vbag - leakage-proof tank volume for measuring (m³);
$w_{sampleCH4,i}$ - methane concentration in the emission sample, which is the difference of concentrations at the beginning and the end of measuring (%);
τ_i - average duration of filling the tank for emission and up to the determined concentration (seconds).

Adjustment of speed (volume) of methane emissions till normal conditions:

Received as the result of measuring the speed (volume) of methane emissions is agjusted to the normal conditions ($P_н$ = 0,1013 MPa, $T_н$ = 273 K) as per the formula:

$$F_{CH_{4,i,P}} = \frac{F^{+}_{CH_{4,i}} \cdot 273 \cdot P}{0{,}1013 \cdot (273+t)}$$, where (2)

$F_{CH_{4,i,P}}$ – speed (volume) of project (after repair, substitution) of methane emission for i- equipment, adjusted to the normal conditions (m^3/hours.);
P – gas pressure in the tank, MPa;
t – temperature of gas in the tank, °C.

Annual project methane emissions (emissions after repair, equipment substitution) are calculated as per the formula:

$Q_{yP} = ConvFactor * \Sigma[F_{CH_{4,i,P}} * Ti,y * URi] * GWP_{CH4} * 0,9$, where (3)

Q_{yP} - methane emissions during the period y, for equipment, which was repaired (substituted) (tCO2e);
ConvFactor - coefficient of transformation m^3CH_4 in tCH_4. Under normal conditions (0 °C and 0.1013 MPa) it equals 0.0007168 tCH_4/m^3CH_4;
URi - coefficient which takes into account the vagueness of measuring method (equals to 95%);

Ti,y - time (in hours) for i-equipment, which functioned during period **y** (period of monitoring) being repaired (substituted);
GWP_{CH4} - Global Warming Potential for methane (equals to 21 tCO_2e/tCH_4);
0,9 - coefficient which takes into account the error of measuring devices.

Emissions formed after taking project measures are given in Table 4[9].

Table. 4. Project GHG emissions

	2008	2009	2010	January – August 2011
Volumes of project GHG emissions for the period, tCO_2e.	44 434	44 547	45 064	30 416
Total volumes of project GHG emissions for the monitoring period, tCO_2e.	164 461			

D.2. Baseline emissions

Using the method of measuring of volume of emissions by means of impermeable capacity, the volume of baseline methane emissions from one equipment is calculated by the formula:

$$\bar{F}_{CH_{4,i}} = Vbag * w_{sampleCH4,i} * 3600 / \tau_i \quad \text{, where} \qquad (4)$$

$\bar{F}_{CH_{4,i}}$ - speed (volume) of methane emissions through leaking equipment and before repair (m^3/hours);
Vbag -volume of impermeable tank for measuring (m^3);;
$w_{sampleCH4,i}$ -concentration of methane in the sample of emission *i* that is the difference of concentrations at the beginning and at the end of measuring;
τ_i -average duration of filling to the tank for emissions i before its repair (replacement) (seconds).

The speed (volume) of methane emissions obtained as the result of measuring is corrected to the normal conditions (P_H = 0,1013 MPa, T_H = 273 K) as per the formula:

[9] The presented values of project GHG emission are approximated to integers.

$$F_{CH_{4,i,B}} = \frac{\bar{F}_{CH_{4,i}} \cdot 273 \cdot P}{0{,}1013 \cdot (273+t)}$$, where (5)

$F_{CH_{4,i,B}}$ – speed (volume) of base methane emission for i -element, corrected to the normal conditions (before repair, replacement) (m^3/hours);
P – pressure of gas in a tank, MPa;
t – gas temperature in a tank, °C.

The annual baseline methane emissions are calculated as per the formula:

$Q_{yB} = ConvFactor * \Sigma[F_{CH_{4,i,B}} * Ti,y * URi] * GWP_{CH4} * 0,9$, where (6)

QyB – baseline emissions of methane on gas equipment for the period y (before its repair, replacement) (tCO_2e);
ConvFactor Conversion Factor m^3CH_4 in tCH_4. At normal conditions (0 degrees Celsius and 101.3 kPa) it equals 0,0007168 tCH_4/m^3CH_4;
URi – coefficient that takes into account the vagueness of method of measuring;
Ti,y – time (in hours) for the equipment of i, that functioned during the considered period y (monitoring period) before its repair (replacements);
GWP_{CH4} – Global Warming Potential for methane (equal to 21 tCO_2e/ tCH_4);
0,9 – coefficient that takes into account the error of measuring devices.

Emissions that will take place in case of absence of rehabilitation measures are given in Table 5[10].

Table. 5. Baseline GHG emissions.

	2008	2009	2010	January – August 2011
Volumes of baseline GHG emissions for the period, tCO_2e.	405 877	407 022	410 559	276 090
Total volumes of baseline GHG emissions for the monitoring period, tCO_2e.	1 499 548			

[10] The presented values of baseline GHG emission are approximated to integers.

D.3. Leakages

There are no leakages during the project implementation (Methodology AM0023 doesn't provide for leakages).

D.4 Emissions reduction as a result of project implementation.

Emissions reduction as a result of project implementation is calculated as difference between baseline and project emissions.

Quantity of Emission Reduction Units (ERUs) in t CO_2e is calculated under the formula:

$ERU = \sum[Q_{yB} - Q_{yP}]$, where (7)

ERU– Emission Reduction Units, tCO_2e.;
Q_{yP} – project emissions, tCO_2e.;
Q_{yB} – baseline emissions, tCO_2e.

Table demonstrates emission reduction for the monitoring period from 01/01/2008 to 31/08/2011 as a result of project implementation[11].

Table. 6. GHG emission reductions

	2008	2009	2010	January – August 2011
Quantity of GHG emission reduction for the period, tCO_2e.	361 443	362 475	365 495	245 674
Total quantity of GHG emission reduction for the monitoring period, tCO_2e.	1 335 087			

[11] The presented values of GHG emission reductions are approximated to integers.