

**Monitoring report of JI project  
“Reduction of Methane Emissions at Flanged, Threaded Joints and Shut-  
down Devices of OJSC “Kyivgaz”<sup>1</sup> Equipment»**

**Monitoring period: 01.10.2010 – 30.04.2011**

**Version: 02 as of 07.05.2011**

**Contents:**

- A.** General project activity and monitoring information
- B.** Key monitoring activities
- C.** Quality assurance and quality control measures
- D.** Calculation of GHG emission reductions

**Appendix A.**<sup>2</sup> The summary calculations of GHG emission reduction at flanged, threaded joints and shut-down devices of PJSC “Kyivgaz” equipment for 7 months (October 2010 – April 2011).

---

<sup>1</sup> For current Monitoring period Open Joint Stock Company (OJSC) “Kyivgaz” was renamed to Public Joint Stock Company (PJSC) “Kyivgaz”.

<sup>2</sup> Appendix A is given in electronic form.

## Section A. General project activity and monitoring information

### A.1. Title of the project

**“Reduction of Methane Emissions at Flanged, Threaded Joints and Shut-down Devices of OJSC “Kyivgaz” Equipment»**

### A.2. Status of JI project

JI project “Reduction of Methane Emissions at Flanged, Threaded Joints and Shut-down Devices of OJSC “Kyivgaz” Equipment» was determined by the Bureau Veritas Certification, determination report No. UKRAINE/0125/2010 as of 08.07.2010. The project was approved by the National Environmental Investment Agency of Ukraine (Letter of Approval No. 1121/23/7 as of 28.07.2010) and Federal Office for the Environment of Switzerland (Letter of Approval No. J294-0463 as of 23.07.2010).

### A.3. Short description of the project activity

The following methane emission reductions were achieved as a result of rehabilitation of the flanged, threaded joints and shut-down devices conducted by PJSC “Kyivgaz” in accordance with this project:

Period	01/10/2010 – 31/12/2010	01/01/2011 – 30/04/2011	Total for 7 months (01/10/2010 – 30/04/2011)
Reduction of methane emission during, m <sup>3</sup>	18 811 548	24 536 801	<b>43 348 349</b>
Reduction of GHG leakage, tCO <sub>2</sub> eq.	283 166	369 348	<b>652 514</b>

### A.4. Monitoring period

Commencement: 01.10.2010

Termination: 30.04.2011

### A.5. Methodology applied for project activity

#### A.5.1. Baseline methodology

The methodology approved by the Clean Development Mechanism Executive Committee AM0023 version 3 dated 30.10.2009 «**Reduction of natural gas leaks at compressor or gas distribution stations of main gas lines**» (<http://cdm.unfccc.int/UserManagement/FileStorage/JY2L0XEKMB3HD18T7RPO6ZSFCQINGA>) with the more precise definition of the method for measurement of leakage volume and as stated in clause B.1 PDD version 03.

### **A.5.2. Monitoring methodology**

For quantitative estimation and preparation for reporting on emission reduction on the ground of baseline and project's activity the approved methodology of monitoring conducting AM0023 was applied as stated above, with the more precise definition of the method for measurement of leakage volume and as stated in clause B.1 PDD version 03.

Indefiniteness of measurement method was taken into account in the course of making calculations as to GHG emission reductions (see section D of PDD version 03).

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

Project activities include reduction of methane leakage which is the result of faulty sealing of ground and underground fittings implemented at the switch mechanisms (bolts, cocks, valves), flange and threaded joints of gas pipelines of PJSC "Kyivgaz" in the amount of 60 613 pieces. Types and quantity of fittings are given in the PDD version 3.

During 2005 – 2010 years each of 60 613 switch mechanisms (bolts, cocks, valves), flange and threaded joints of gas pipelines of PJSC "Kyivgaz" were reconstructed or repaired.

The tasks of current monitoring period (October 2010 – April 2011) is further accomplishment of purposeful examination and technical maintenance (PETM) of all switch mechanisms (bolts, cocks, valves), flange and threaded joints. Repaired since 2005 to 2009 years equipment components during current monitoring period regularly checked as a part of a standard monitoring program to make sure they have not become the source of leakage again.

According to Monitoring Plan in PDD version 3 the regular repairs of the components are done once per year, technical maintenance – once per half year.

Methane leakage volumes received in the result of measurements on the repairing equipment of the gas pipeline of PJSC "Kyivgaz" are not exceeding the methane leakage volumes, which was measured after the first repair of equipment.

### **A.7. Possible deviations or revisions of PDD registered version**

There are no significant deviations from PDD registered version. Deviation of emission reductions is -0,3% with respect to emission reduction units given in the registered version of PDD.

#### **A.8. Possible deviations or revisions of registered monitoring plan**

There are no deviations from registered monitoring plan.

#### **A.9. Persons responsible for preparation and producing of monitoring report**

The following employees of PJSC “Kyivgaz” are responsible for monitoring report: head of working team, the chief engineer – Bernatskiy B.E., and Director of VEMA S.A. - Fabian Knodel.

## Section B. Key monitoring activities

### B.1.1. Applied equipment

Control and monitoring system consists of three parts:

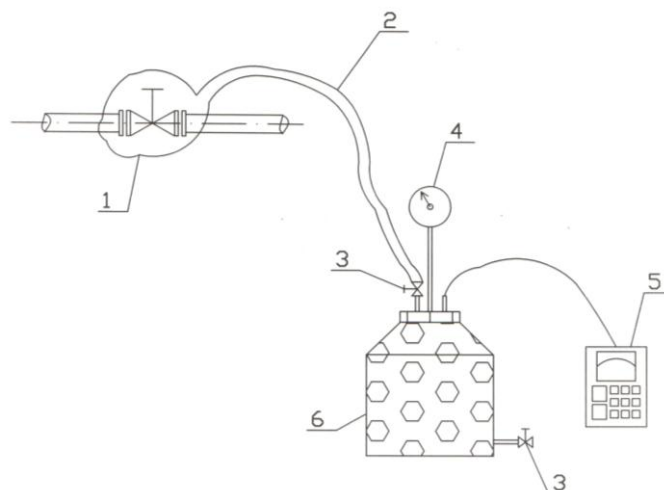
- 1) Measurements of methane leakage value before the rehabilitation (hermetization) of the object;
- 2) Measurements of methane leakage value after the rehabilitation (hermetization) of the object;
- 3) Archiving and processing of obtained results.

To measure leakage volume of natural gas it was decided to use the method based on the Calibrated Bag Technology described in the Approved baseline strategy AM0023 “**Reduction of natural gas leakage at compressor and gas distribution stations**”. One of the problems incurred by using this method is difficult accounting of the volume of the valves measurements are done on, and of the initial air volume upon determination of gas volume received in the bag. A special plant was made to solve these problems. It is made on the basis of a plastic capacity of a certain volume (0,87 m<sup>3</sup>), package, plastic hose and pressure gauge (see Picture 1). All junctions are sealed.



*Pic. 1. Monitoring measurement of methane leakage (April 2011) by means the special plant for quantitative measurement of methane leakage.*

Scheme of plant is represented on Picture 2.



*Pic. 2. Scheme of the plant for quantitative measurement of methane leakage.*

Signs:

1. Hermetic bag.
2. Hose.
3. Crane.
4. Pressure gauge.
5. Gas analyzer EX-TEC® SR5.
6. Hermetic tank.

**Gas analyzer EX-TEC® SR5.** To determine methane concentration in the sample a high-precision gas analyzer EX-TEC® SR5 is used.



- explosion-proof (CENELEC),
- gas detection upon control of pipeline networks (ppm range),
- gas detection at the internal installations (ppm range),
- alarm upon approaching the lower level of explosion (% UEG or Vol. %-range),

- measurement of concentration upon gas contamination and purging of lines (Vol. % range),
  - measurement of concentration in probe aperture (Vol.%-range).
- Relative error makes 10%, which conforms to EN 50054/57 Standard.

After detection and measurement of leaks appropriate repair of leaking areas will be done in flanged, threaded joints and shut-down devices, which will include both use of modern compacting materials and full replacement of worn equipment with new one.

### **B.1.2. Calibration procedure**

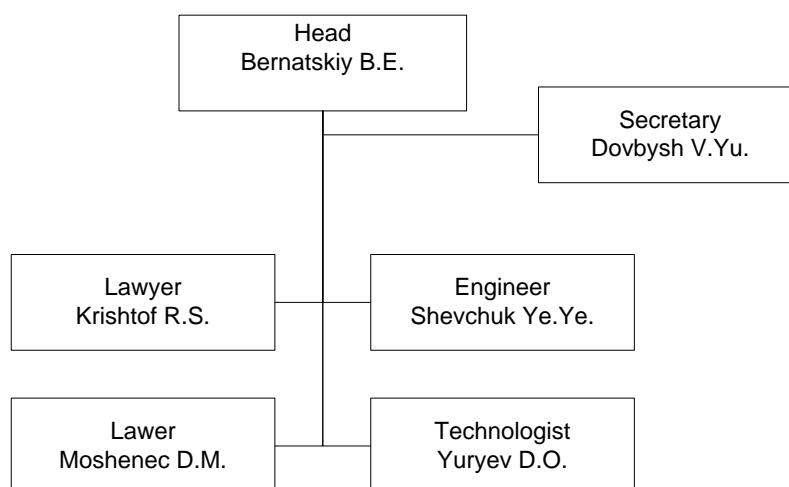
The only device used in the process of methane leakage monitoring is gas analyzer EX-TEC®. Calibration interval is 1 year.

The certificate confirming device's serviceability is issued as a result of calibration.

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

### **B.2.1. The operational and management structure for the operator to implement monitoring plan.**

Coordination of work of all departments and services of PJSC "Kyivgaz" concerning project implementation is done by specially created Working team. Renewed structure of Working team is approved by the order № 179 акція 04.05.2011 of the Chairman of the Board of PJSC "Kyivgaz" Gorovoy S.A. The structure of Working team is shown on the Picture 3.



*Pic. 3. Structure of Working team.*

Head of working team Bernatskiy B.E. is responsible for general management of the project and coordination of all actions of the parties, determines plan of measures under the Project and scope of resources required. Yuryev D.O. coordinates collection of all information provided for by monitoring plan, and makes all necessary calculations. Archiving of all received information in the result of measurements and settlements is done under guidance of Dovbysh V.Yu. Technical maintenance of the Project is carried out by Shevchuk Ye.Ye. Legal support of the Project is carried out by Krishtof P.S. and Moshenec D.M.

### B.2.2. List of parameters applied in the course of calculation

Parameters applied for calculation are given below in the table 1.

<input type="checkbox"/> Identification No.	<input type="checkbox"/> Variable data	<input type="checkbox"/> Source of data	<input type="checkbox"/> Unit of data measurement	Form of data received	Comments
1. i	Serial number of bolt, cock, valve, flanged or threaded joint, where the gas leakage was detected, is eliminated and then checked	Measurement of leakage	Dimensionless	Electronic	Detected leakage is awarded with respective No. List of shut-down devices (valves, cocks, bolts), flanged and threaded joints is given in Appendix A. Check after repair is conducted.
2. T <sub>i</sub>	Time	Results of inspection	Quantity of hour of operation of the equipment, wherein the leakage was detected within the year	Electronic	Quantity of hours pf the equipment operation during the year from the moment of its repair (replacement)



□ Identification No.	□ Variable data	□ Source of data	□ Unit of data measurement	Form of data received	Comments
3.	Date	Repair (rehabilitation) and monitoring (register) data	Date of repair (rehabilitation) and monitoring	Electronic	Date of reconstruction used together with the number of hours of equipment operation to determine general number of hours of operation Should leaks be repeated, it is taken the same as the date of last inspection which showed the absence of leakage
4. $GWP_{CH_4}$	Global warming potential	IPCC	Tones of CO <sub>2</sub> equiv.	Electronic	Project developer will conduct monitoring of any potential changes caused by global warming for methane, published by IPCC and approved by COP
5. $F_{CH_4,i}$	Speed of leakage for each detected leakage	Leakage measurement	m <sup>3</sup> CH <sub>4</sub> /year	Electronic	Calculated by means of the largest deviation from device's error (10% for gas analyzer)
6. t, P	Gas temperature and pressure	Data of measurements of glass mercury thermometer TL-4 and manometer «D-59H-100-1.0 6 kPa».	°C and kPa	Electronic	Measured for determination of CH <sub>4</sub> density Note: Notwithstanding measurements, many variants are not expected as pressure and temperature at different stations are taken constant
7. UR <sub>i</sub>	Equipment uncertainty factor; measurement of leakage	Information provided by manufacturer and/or IPCC GPG	%	Electronic	Where possible, 95% confidence interval is evaluated; advice of management board given in section 6 2000 IPCC of GPG If manufacturer of equipment where leaks are measured specifies uncertainty range without specification of confidence interval, it can be taken 95%
8. $V_{bag}$	Reservoir capacity	Data of flow meter measurement	m <sup>3</sup>	Electronic and paper	Reservoir is filled in with water. Amount of water measured by flow meter will be reservoir capacity Measurement showed that reservoir capacity is 0.87 m <sup>3</sup> .

<input type="checkbox"/> Identification No.	<input type="checkbox"/> Variable data	<input type="checkbox"/> Source of data	<input type="checkbox"/> Unit of data measurement	Form of data received	Comments
9. $W_{sampleCH4,i}$	Methane concentration in sample	Data of gas analyzer EX-TEC® SR5 measurements	%	Electronic	Methane concentration in sample (in reservoir) of leak $i$ is the difference between methane concentration in the beginning and in the end of measurement. Concentration is measured with gas analyzer EX-TEC® SR5.
10. $\tau_i$	Time during which methane concentration in reservoir reaches certain level	Data of measurements made by seconds counter «SOS pr-2b-2»	seconds	Electronic	Time during which methane concentration in reservoir reaches certain level is determined with stop-watch. Measurement starts from the moment the tap is opened on the tank cap and ends when methane concentration inside the reservoir reaches certain level.

*Table 1. Parameters used in calculation of GHG emissions*

### **B.2.3. Data as to leakages**

There are no leakages in the course of project implementation (Methodology AM0023 doesn't provide for any leakages).

### **B.3. Data processing and archiving**

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

### **B.4. Emergencies and technological breaches**

There were no emergencies at gas distribution stations of PJSC “Kyivgaz” during 7 months (October 2010 – April 2011) of current monitoring period.

### **B.5. Procedures for detection and liquidation of malfunctions at flanged, threaded joints and shut-down devices of PJSC “Kyivgaz” equipment”**

Detection, liquidation and registration of failures and emergencies at flanged, threaded joints and shut-down devices of PJSC “Kyivgaz” equipment is carried out according to Safety rules of gas-supply systems of Ukraine.

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

External data are not used in the course of monitoring of methane emissions at flanged, threaded joints and shut-down devices of gas distribution pipeline of PJSC “Kyivgaz”.

**B.7. Error level of metering equipment**

Relative error of gas analyzer EX-TEC® SR5 is 10%, meeting the standard EN 50054/57. The device is calibrated annually.

## **Section C. Quality assurance and quality control measures**

### **C.1. Documented procedures and management plan**

#### **C.1.1. Roles and responsibilities**

Management of the project is implemented by the Chief Engineer of PJSC “Kyivgaz” Bernatskiy B.E. He manages and coordinates the activities of all departments. Specially formed working team is responsible for collection and processing of the parameters.

Structure of data collection and project management is given in the Section B.2 of this Monitoring Report.

#### **C.1.2. Trainings**

There is no need to conduct trainings for operation with new equipment. All trainings related to the project were conducted by the equipment suppliers and their cost is included into the equipment cost.

### **C.2. Internal audits and control measures**

According to distribution of duties between the parties of the project the organization of monitoring measurements of leaks of methane on flanged, threaded joints and shut-down devices of the PJSC "Kiyvgaz" equipment is incurred by company VEMA S.A. With that end in view company VEMA S.A. concludes corresponding contracts with other companies on carrying out of such monitoring measurements. Thus, direct monitoring measurements are spent by the personnel of these companies, but at presence and at control of representatives of PJSC "Kiyvgaz" and company VEMA S.A. At carrying out of monitoring measurements the parties of the project co-ordinate the activity through working group specially created in at PJSC "Kiyvgaz". Data of monitoring measurements of leaks is fixed and in the electronic form transfer to participants of the project for their further processing, carrying out of calculations and storage.

Specially formed working team of PJSC “Kyivgaz” ensures control of measurement of all necessary parameters provided according to monitoring plan. Operating repair (once a year) and maintenance service (once a half year) flanged, threaded joints and shut-down devices, according to distribution of duties between the project parties, carries out by PJSC "Kiyvgaz".

### **C.3. Information about the indicators of project’s social and environmental effect**

The quality of gas supply of the region’s population will be improved as a result of project implementation.

Also there will be decrease in natural gas losses and GHG emission reduction causing greenhouse effect and climate fluctuation.

## Section D. Calculation of GHG emission reductions

### D.1. Project emissions

Using the method for leakage volume measurement with the help of leak-proof tank, volume of methane leakage of one equipment unit can be calculated by the formula:

$$F_{CH_4,iP} = V_{bag} * w_{sampleCH_4,i} * 3600 / \tau_i, \quad \text{where} \quad (1)$$

$F_{CH_4,P}$  - Methane leakage through leak point  $i$  through leakage element after reconstruction (m<sup>3</sup>/h);

$V_{bag}$  - Volume of leak-proof tank for measurement (m<sup>3</sup>);

$w_{sampleCH_4,i}$  - Concentration of methane in the leak sample  $i$  which is the difference of concentrations at the beginning and at the end of measurement (%);

$\tau_i$  - Average time of filling in the tank for leakage  $i$  after reconstruction (seconds)

Annual methane leakage is calculated by the formula:

$$Q_{yP} = ConvFactor * \Sigma [F_{CH_4P} * T_{i,y} * UR_i] * GWP_{CH_4} * 0.9, \quad \text{where} \quad (2)$$

$Q_{yP}$  = Methane emissions for the period  $y$ , for rehabilitated equipment (tCO<sub>2</sub>eq).

$ConvFactor$  = m<sup>3</sup>CH<sub>4</sub> - tCH<sub>4</sub> conversion ratio at the standard temperatures and pressure (0 °C and 101.3 kPa), it makes 0.0007168 tCH<sub>4</sub>/m<sup>3</sup>CH<sub>4</sub>

$Uri$  = Factor taking into account uncertainty of measurement method (0,95%);

$T_{i,y}$  = Time (in hours) for corresponding component  $i$ , during which it worked within the period of consideration (monitoring period)  $y$ ;

$GWP_{CH_4}$  = Methane Global Warming Potential (21 tCO<sub>2</sub>eq/tCH<sub>4</sub>)

0.9= Equipment Error Factor.

Emissions generated after implementation of project arrangements are given in the Table 3.

Period	01/10/2010 – 31/12/2010	01/01/2011 – 30/04/2011	Total for 7 months (01/10/2010 – 30/04/2011)
Project emissions tCO <sub>2</sub> eq	17 816	23 239	<b>41 055</b>

Table 3. Project emissions tCO<sub>2</sub>eq.

## D.2. Baseline emissions

Using the method for leakage volume measurement with the help of leak-proof tank, volume of methane leakage of one equipment unit can be calculated by the formula:

$$F_{CH_4,iB} = V_{bag} * w_{sampleCH_4,i} * 3600 / \tau_i \quad , \quad \text{where} \quad (3)$$

$F_{CH_4,B}$  - Methane leakage through component  $i$  due to leakage element before reconstruction (m<sup>3</sup>/h);

$V_{bag}$  - Volume of leak-proof tank for measurement (m<sup>3</sup>);

$w_{sampleCH_4,i}$  - Concentration of methane in the leak sample  $i$  which is the difference of concentrations at the beginning and at the end of measurement (%);

$\tau_i$  - Average time of filling in the tank for leakage  $i$  after reconstruction (seconds)

Annual methane leakage is calculated by the formula:

$$Q_{yB} = ConvFactor * \Sigma [F_{CH_4,y} * T_{i,y} * UR_i] * GWP_{CH_4} * 0.9 \quad , \quad \text{where} \quad (4)$$

$Q_{yB}$  - Methane emissions for the period  $y$ , for equipment before the rehabilitation (tCO<sub>2</sub>eq)

$ConvFactor$  - M<sup>3</sup>CH<sub>4</sub> - tCH<sub>4</sub> conversion ratio at the standard temperatures and pressure (0 °C and 101.3 kPa), it makes 0.0007168 tCH<sub>4</sub>/M<sup>3</sup>CH<sub>4</sub>

$UR_i$  - Factor taking into account uncertainty of measurement method

$T_{i,y}$  - Time (in hours) for corresponding component  $i$ , during which it worked within the period of consideration (monitoring period)  $y$

$GWP_{CH_4}$  = Methane Global Warming Potential (21 tCO<sub>2</sub>eq/tCH<sub>4</sub>)

0.9= Equipment Error Factor.

Emissions which will be generated subject to absence of the rehabilitation arrangements are given in the Table 4.

Period	01/10/2010 – 31/12/2010	01/01/2011 – 30/04/2011	Total for 7 months (01/10/2010 – 30/04/2011)
Baseline emissions tCO <sub>2</sub> eq	300 982	392 586	<b>693 569</b>

Table 4. Baseline emissions tCO<sub>2</sub>eq.

## D.3. Leakage

There is no leakage in the course of project implementation (Methodology AM0023 doesn't provide for leakage).

#### D.4. Emission reduction as a result of implementation for 7 months (October 2010 – April 2011).

Emission reduction as a result of project implementation shall be calculated as a difference in baseline and project emissions.

Quantity of emission reduction units (ERU), tCO<sub>2</sub>eq:

$$ERU = \sum [ Q_{yB} - Q_{yP} ] \quad (5)$$

ERU– emission reduction units, t CO<sub>2</sub>eq;

$Q_{yP}$  – project emissions, t CO<sub>2</sub>eq;

$Q_{yB}$  – baseline emissions, t CO<sub>2</sub>.eq

Table 5 contains the emission reductions as a result of project implementation.

Period	01/10/2010 – 31/12/2010	01/01/2011 – 30/04/2011	Total for 7 months (01/10/2010 – 30/04/2011)
Emission reductions, tCO <sub>2</sub> eq	283 166	369 348	<b>652 514</b>

*Table 5. Emission reductions tCO<sub>2</sub>eq.*