JOINT IMPLEMENTATION PROJECT

# Reduction of Methane Emissions at Flanged, Threaded Joints and Shut-down Devices of OJSC "Odesagas" Equipment

The developer of documentation
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Odessa, Ukraine
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**JOINT IMPLEMENTATION PROJECT DESIGN DOCUMENT FORM**
**Version 01 – in effect as of: June 15, 2006**

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## LIST OF ABBREVIATIONS USED IN PROJECT DESIGN DOCUMENTATION

JSC – Joint Stock Company
JIM – Joint Implementation Mechanism
CDM – Clean Development Mechanism
UGSSR – Ukrainian Gas Supply System Safety Rules
PDD – Project Design Documentation
JI – Joint Implementation
PETM – Purposeful Examination and Technical Maintenance

## SECTION A. General description of the project

### A.1. Title of the project:

**Reduction of methane leakage at flange, threaded joints and switch mechanisms of the equipment of JSC Odesagas**

**Area 10. Volatile emissions from fuels (solid, liquid fuels and gases).**

**Version of Project Design Documentation: 07.**

**Date: April 30, 2010.**

### A.2. Description of the project:

**The purpose of the project is reduction of natural gas leakage at gas transport and gas distribution infrastructure of JSC Odesagas. The main sources of leakage are switch mechanisms (bolts, cocks, valves), flange and threaded joints of gas pipelines of JSC Odesagas in the amount of 11 174 pieces. The main reason for natural gas leakage is quick failure of sealant elements. Methane, the main component of natural gas (92-95 vol.%) is a greenhouse gas. Elimination of methane leakage will result in reduction of greenhouse gas emission. Hereinafter an expression "methane leaks" is used to determine natural gas leakage, as instrumental measurements concern methane in particular.**

**The situation before the start of the project.**
**JSC Odesagas is the company uniting gas supply facilities of 26 districts in Odessa region and gas supply facility in Odessa, and providing natural gas transportation and supply to industrial and domestic consumers. The total length of high pressure (12 MPa – 0.6 MPa), middle pressure (0.3 MPa) and low pressure (0.005 MPa) distribution gas pipelines makes 4579 km, 2625 km of which are the property of JSC Odesagas, and average annual volume of transported gas reaches 2861718 thousand $m^3$. The structure of current gas transport rates regulated by the government does not include depreciation and investment needs of gas distribution enterprises, which does not ensure receipt of funds for performance of necessary repair works and modernization of gas networks, purchase of appropriate engineering equipment and components, and also results in increase of natural gas leakage at the objects of JSC Odesagas.**
**Application of JI project mechanisms provided for by Kyoto Protocol was planned before the beginning of implementation of this project.**
**For the purpose of initiation of this project the management of JSC Odesagas issued Order N 219 as of 31/12/2004 On Formation of Working Team for realization of this project.**

**Basic option.**
**Before the start of the project (2005) JSC Odesagas only detected leakages with the help of detectors according to the Ukrainian Gas Supply System Safety Rules in order to avoid emergency and explosive situations. Measurement of the leakage volume, its registration and accounting were not performed, and appropriate measuring devices were missing. Theoretical calculations of the leak volumes on the ground of performed measurements of natural gas leakage in the result of faulty sealing of switch mechanisms (bolts, cocks, valves), flange and threaded joints of distribution gas pipelines of JSC Odesagas can make 38 million $m^3$ per year. Absence of financing sources does not allow elimination of these leaks.**

**Project option.**

**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 JSC Odesagas in the amount of 11174 pieces. Within the scope of the project for repair of equipment, for the purpose of methane leakage elimination, modern compacting materials will be used, replacing service and repair practice based on rubberized asbestos fabric and rubber gaskets, and compacting padding made of cotton fibre with fat soakage and asbestos graphite filler. This practice does not give long-term effect, which leads to additional methane leakage. In addition to reduction of methane leakage, the project activity will lead to reduction of technical leaks of natural gas (and thus, to reduction of financial costs), and will contribute to improvement of environmental situation, to reduction of the risk of accidents, especially for in-house gas pressure regulators and overland gas pipelines.**

**The project activity includes:**

- **Implementation of purposeful examination and technical maintenance (PETM) of all switch mechanisms (bolts, cocks, valves), flange and threaded joints – modern and the most economically effective practice, which allows not only detection of leaking areas, but also determination of leakage volume (i.e., potential volume of gas leakage reduction). This key information is required for substantiation of efficiency of repair works and priority choice of its objects, which is important under short financing for elimination of all leakages. This activity will include purchase and calibration of modern measuring equipment, appropriate training of employees, development of monitoring map for each switch mechanism, flange and threaded joint of gas distribution network, with the list of all equipment components to be regularly examined, creation of leakage data collection and storage system, and implementation of internal audit and quality system for elimination and accounting of methane leakage.**
- **Detection and measurement of leakage: Monitoring system of leaks at all switch mechanisms (bolts, cocks, valves), flange and threaded joints, including eliminated leaks (repaired components of equipment). Monitoring will be done on a regular basis (once in four days or once per week – depending on the type of equipment) by specially trained staff. Each component will be checked according to the monitoring map, and detected leakage will be duly marked with individual number; gas leakage volumes will be measured and registered in the database.**
- **Elimination of all detected leakages: repairs of leaking equipment under this project will vary from replacement of gaskets and wedge valves, use of new compactors or sealing materials, to capital repairs and replacement of safety valves of pressure regulators and piston rods. Repaired equipment components will be regularly checked as a part of a standard monitoring program (see above) to make sure they have not become the source of leakage again.**

The project was initiated in 2005.

January 12, 2005 – Formation of a Working Team, the main task of which is project fulfilment assurance.

February 03, 2005 – A contract was signed between JSC Odesagas and Engineering and technological institute "Biotekhnika" UAAN for carrying out examination of gas-distribution posts of JSC Odesagas, included to the project, development of monitoring program for emissions and development of project design documents (PDD). In 2005 Engineering and Technological Institute "Biotekhnika" of UAAN developed temporary recommendations, and in 2009 the final revision of the document

"Recommendations for monitoring of methane leakage at flange, threaded joints and switch mechanisms of equipment of JSC Odesagas" was developed.

2005 – First reconstruction works have been performed under this project.

**Duration of the project is not limited, as PETM, monitoring and leakage elimination programs are aimed to become a part of work of JSC Odesagas. Reduction of emissions equivalent to CO2 is stated for the period of 22 years according to modality and Joint Implementation Procedures.**

**A.3. Project participants:**

| Invited Party | **Business Name of Project participant** | Please state whether Invited Party is willing to be considered **Project Participant (YES/NO)** |
|---|---|---|
| Ukraine **(HOST PARTY)** | JSC Odesagas | **NO** |
| **SWITZERLAND** | S.A. Vema | **NO** |

## A.4. Technical description of the project:

### A.4.1. Location of the project:

The project is located in Odessa region, in the southern part of Ukraine (**Picture 1**).


*Pic. 1. Map of Ukraine with regions and neighbouring countries.*

#### A.4.1.1. Host Party(-ies):

The project is located on the territory of Ukraine.

Ukraine is a country in the East Europe, which has ratified Kyoto Protocol to UN Framework Convention as of February 04, 2004, enters the list of countries given in the Annex 1, and meets the requirements for participation in Joint Implementation projects.

#### A.4.1.2. Region/State/Province etc.:

The project is located in Odessa region.

#### A.4.1.3. City/Town/Community etc.:

**City of Odesa and cities of Odesa region.** Register of switch mechanisms, flange and threaded joints of distribution gas pipelines of JSC Odesagas is given in the accompanying document 1[1]**.**

[1] Register of switch mechanisms, flange and threaded joints of distribution gas pipelines of JSC Odesagas is made in the electronic format and is submitted to the National Agency for Environmental Investments of Ukraine and to the project verifier of Bureau Veritas Certification Holding SAS.

**A.4.1.4. Detail of physical location, including information allowing the unique identification of the project (maximum one page):**

Odessa and Odessa region are located in the southern part of Ukraine on the Black Sea shore. Odessa region is the largest (33,31 thousand km$^2$) by area region in Ukraine. It includes 26 districts with the population 2,402 million people living in 14 cities, 23 urban settlements, 201 villages, some large industrial enterprises and public utility objects. List and addresses of the objects included to the project is given in the Register of switch mechanisms, flange and threaded joints of distribution gas pipelines of JSC Odesagas, see Accompanying document 1.

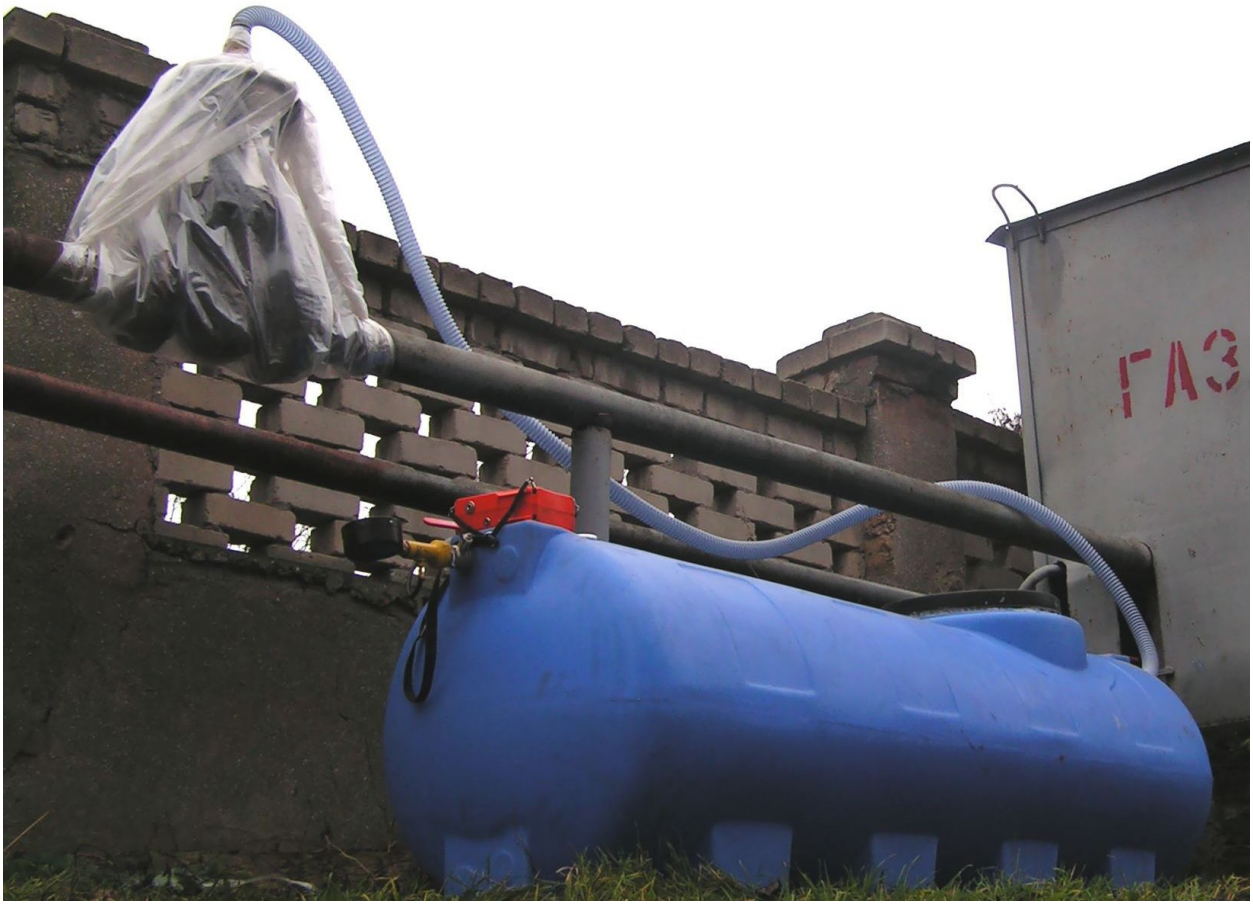

*Pic. 2. Main cities of Odessa region where the project will be implemented*

**A.4.2. Technology(-ies) to be employed, or measures, operations or actions to be implemented by the project:**

**1. Development and implementation of natural gas leakage measurement method**

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 of main gas lines**". 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 $m^3$), package, plastic hose and pressure gauge (see Annex 3, Picture 3). All junctions are sealed.




*Pic. 3. Photo of a plant for quantitative measurement of methane leakage.*

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

*Pic. 4. Photo of gas analyzer EX-TEC® SR5.*

Gas analyzer has the following characteristics:
- explosion insulation (CENELEC),
- methane 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 meets the standard EN 50054/57[2]
After detection and measurement of leakage respective repair works will be done on the leaking joints of the elements and switch mechanisms (bolts, cocks, valves), flange and threaded joints of gas pipelines of JSC Odesagas, which will include use of modern sealing materials according to GOST 7338-90 [3]and GOST 5152-84[4].

Detailed information on the measuring methods used in leakage monitoring is given in the Annex 3.

**2. Implementation of modern sealants for leakage elimination.**

Sealants (GOST 7338-90) made of oil and petrol resistant rubber are provided for production of mechanical rubber goods used for sealing of immovable joints, prevention of friction between metal surfaces, for perception of single shock loads, and as gaskets, floors and other sealing items.

**Packing (GOST 5152-84). Asbestos braided packings are used for sealing packing chambers of the fittings, eccentric and piston pumps, and different plants at the working temperatures from -70 to +300˚C.**
**Braided packings are the most popular sealing material used for filling packing chambers of the fittings, eccentric and piston pumps and different plants. Over 80% of fittings are completed with this sealant. They differ in material they are made of and in the production method (structure). Both factors considerably effect operating characteristics of packings.** Different types of soakage and fillers are an important component of packings which give them the necessary characteristic.

[2] "Electric apparatus for the detection and measurement of combustible gases. General requirements and test methods".

[3] "Rubber and rubber-fabric sheets"

[4] "Packings"

**3. Replacement of shut-off and regulating valves.**

**Shut-off and regulating valves.** The scope of the project also implies and has partially performed replacement of obsolete shut-off and regulating valves produced in the USSR, with the valves produced by the European company Pietro Fiorentini (*www.**fiorentini**.com/), DKG-EAST RT (*www.DKGEast.hu*).*

***4. Installation of centralized natural gas leakage accounting system.***

During implementation of the project manufacturers of equipment used in detection and elimination of leaks can be replaced depending on the appearance of modern and better technologies and equipment.

Selection of devices and materials will depend on the size, source of leak and operating mode of system component where this leak has been detected using modern PETM system of shut-off stations and gas-distribution networks, including:

- Investigation of basic conditions – upon using measuring devices described above;
- Registration of results and determination of priority in elimination of leaks, which ensures the highest efficiency of this work upon scarcity of repair means.
- Data analysis and evaluation of reduction of natural gas leaks and volumes of emission reduction.
- Development of the plan of future examinations and further monitoring of joints in switch mechanisms (bolts, cocks, valves), flange and threaded joints of gas pipelines of JSC Odesagas inclined to leakage, and monitoring of eliminated leaks.

**Implementation Schedule**

1. Organization of Working Team Execution of the Register of Equipment Development of Monitoring Plan and Program. Development and implementation of natural gas leakage measurement method. Staff training. Purchase of gas analyzers ***EX-***TEC® SR5. Performance of primary monitoring measurements. (January – March 2005)

2. Sealing (reconstruction) of 5832 objects of equipment (March – May 2005)

3. Sealing (reconstruction) of 3,312 objects of equipment (March – May 2006)

4. Sealing (reconstruction) of 529 objects of equipment (March – May 2007)

5. Sealing (reconstruction) of 753 objects of equipment (March – May 2008)

6. Sealing (reconstruction) of 566 objects of equipment (March – May 2009)

7. Sealing (reconstruction) of 182 objects of equipment (March – May 2010)

**A.4.3. Brief explanation of how the anthropogenic emissions of greenhouse gases by sources are to be reduced by the proposed JI project, including why the emission reductions would not occur in the absence of the proposed project, taking into account national and/or field policies and circumstances:**

**The project activity includes: sealing of switch mechanisms (bolts, cocks, valves), flange and threaded joints of gas pipelines of JSC Odesagas using modern sealing materials; leakage monitoring aimed to detect natural gas leaks through leakage points; following restoration of tightness of switch mechanisms, flange and threaded joints. Reduction of natural gas leaks will result in reduction of $CH_4$ emissions.**

**Subject to the absence of the proposed project all equipment, including old equipment with less leak proofness than that of proposed equipment, but yet operable one, will be operated for a long time in the usual mode, and reduction of emissions will not take place.**

**A.4.3.1. Estimated amount of emission reductions over the crediting period:**

During implementation of the project the following emission reductions will be reached at each of project stages:

| **Duration of crediting period** | **Years** |
|---|---|
| 2005-2007 | 3 |
| **Years** | **Expected annual emission reductions in tons of $CO_2$ equivalent** |
| 2005 | 265750 |
| 2006 | 498295 |
| 2007 | 664390 |
| **2005-2007 in total** | **1428435** |
| **Average annual expected emission reductions for the period before crediting (in tons of $CO_2$ equivalent)** | **476145** |

| **Duration of crediting period** | **Years** |
|---|---|
| 2008-2012 | 5 |
| **Years** | **Expected annual emission reductions in tons of $CO_2$ equivalent** |
| 2008 | 664390 |
| 2009 | 664390 |
| 2010 | 664390 |
| 2011 | 664390 |
| 2012 | 664390 |
| **2008-2012 in total** | **3321950** |
| **Average annual expected emission reductions for the crediting period (in tons of $CO_2$ equivalent)** | **664390** |

| **Duration of crediting period under post-Kyoto Mechanism** | **Years** |
|---|---|

| 2013-2023 | 14 |
|---|---|
| **Years** | **Expected annual emission reductions in tons of $CO_2$ equivalent** |
| 2013 | 664390 |
| 2014 | 664390 |
| 2015 | 664390 |
| 2016 | 664390 |
| 2017 | 664390 |
| 2018 | 664390 |
| 2019 | 664390 |
| 2020 | 664390 |
| 2021 | 664390 |
| 2022 | 664390 |
| **2023** | 664390 |
| **2024** | 664390 |
| **2025** | 664390 |
| **2026** | 664390 |
| **2013-2022 in total** | **9301460** |
| **Average annual expected reduction of leakage for the crediting period after crediting of the JIM expiry (in tins $CO_2$ equivalent)** | **664390** |

*Table 3. Estimated amount of $CO_2$ emission reduction*

Description of formula used for calculation of emission reduction is given in the paragraph D.1.4.

**Operation of the system of leakage detection and elimination, and further maintenance of tightness of equipment created under the Project does not have any time limitation. Therefore, the Project will give reduction of methane emission after expiration of the crediting period as well.**

## A.5. Project approval by the Parties involved:

The project has been already supported by the Government of Ukraine, namely by the National Environmental Investment Agency of Ukraine, which has issued a Letter of Endorsement for the JI Project (N 187/23/7 as of 05/03/2010). Therefore organizational risks for the project has been minimized.

After receiving Determination Report from the Certified Independent Body the project documentation will be submitted to the National Environmental Investment Agency of Ukraine for receiving a Letter of Endorsement. Another Letter of Endorsement will be received from the other party of the project participant.

## SECTION B. Baseline

### B0.1. Description and justification of the baseline chosen:

**1. Baseline determination approach.**

Baseline determination (measurement and calculation of natural gas leaks) has been done using the approved guidelines of Clean Development Mechanism AM0023 version 03 **«Reduction of natural gas leaks at compressor or gas distribution stations of main gas lines»**[5] with the modification concerning application of more accurate methane leakage measurement method.

Method AM0023 Revision 03 states that it can be applied for the projects for natural gas leak reduction at compressor, gas-distribution stations in the system of main gas lines, as well as for equipment of gas-distribution systems, including gas-pressure adjusting stations.

Lawfulness of using this methodology in this project arises from the following analysis.

According to Method AM0023/Revision 03 the following three conditions shall be fulfilled:

1. Companies – operators of gas-distribution networks do not use the system allowing systematic detection and elimination of methane leaks by the moment of project implementation;
2. Natural gas leaks can be detected and measured precisely;
3. Monitoring system can be implemented to make sure eliminated methane leaks will not occur again.

The Project fully complies with the second and the third conditions, and with the first condition subject to some notes given below.

Under the *first condition,* before the beginning of the project JSC Odesagas only detects leakages with the help of detectors according to the Ukrainian Gas Supply System Safety Rules in order to avoid emergency and explosive situations. Measurement of the leakage volume, its registration and accounting are not performed, and appropriate measuring devices are missing. Theoretical calculation of leak volumes on the ground of performed measurements make 38 million $m^3$ per annum (see Annex B).

But the above-specified measures are not able to eliminate leaks during the period between the dates of regular checkups, and does not give an idea about real volumes of leaks mainly through using of old compacting materials. The project does not provide for more frequent checkups, but provides for using up-to-date compacting material.

By the results of international experience and data from the regions where this material has been already used, up-to-date compacting materials shall significantly reduce leak volumes at shutters with stuffing-box seals.

Moreover, through the lack of modern equipment for detection and measurement of leak volumes it is expected that effective program for detection and elimination of leaks could not be applied without project activities. The Companies which were mainly motivated by the safety condition could only detect the fact of leak, but could not measure its volume.

In other words, we want to emphasize that the system for detection and elimination of leaks of JSC Odesagas was not able to eliminate leaks included to this Project.

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[5] Leak reduction from natural gas pipeline compressor or gate stations (http://cdm.unfccc.int/UserManagement/FileStorage/JY2L0XEKMB3HD18T7RPO6ZSFCQINGA)

Under the *second condition,* purchase of up-to-date equipment for detection and measurement of leak volume and actual measurement of leak volume at the shutters have shown that leaks can be detected and measured precisely subject to application of modern practices and equipment.

Under the *third condition,* implementation of stepped procedures, creation of comprehensive database and use of additional equipment will enable reliable monitoring of repaired shutters and detection of newly appeared leaks (See Annex 3 to Monitoring Plan). On-site training of personnel and quality control at all stages will allow accurate realization of Monitoring Plan.

**2. Application of selected approach in baseline determination.**

**Initial conditions**

Only two variants of initial conditions can be considered as possible and valid alternatives for the Project:

1. keeping the current system for detection and elimination of leaks;
2. implementation of this Project not as JI project.

The facts submitted in this PDD (see section B.2.) prove that maintenance of the existing leakage detection and elimination system is the most probable development scenario subject to the absence of the Project.

Thus, this scenario can be accepted as Initial Conditions.

**Emission Reduction**

The method for detection of leakage volumes according to the Method AM0023/Revision 03 lies in the preliminary evaluation of emissions with further determination of actual volume.

According to the Method AM0023/Revision 03, the level of emission reduction is determined in the following order:

1. Current practice pf natural gas leakage detection and elimination is evaluated and described. Clear and transparent criteria for determination of whether methane emission detection and elimination are done under the absence of this actual Project are established.
2. The terms for equipment replacement under the absence of this Project are determined.
3. Leakage data are collected in the course of Project fulfilment.
4. Repair efficiency is checked during the monitoring.
5. Actual volume of methane emission reduction is calculated on the basis of the data collected at the previous steps.

Application of these steps for this Project is described below.

**Step 1. Evaluation and description of current practice of emission detection and elimination.**

The Method AM0023/Revision 03 stipulates that “the calculation of emission reduction volumes shall take into account only those types of emissions which are not detected and not eliminated according to the current practice”. As mentioned before, this project method does not fully comply with the original version of the Method AM0023, but ut has been developed on the basis of the Method AM0023. The difference of suggested methodology from original methodology AM0023 lies in the methodology of methane leakage volumes. The method for measurement of methane leakage volume used in this Project is described in the Step 3 below and in Annex 3 of this PDD.

Due to the accepted method all flange and threaded joints and switch mechanisms were included to the project, i.e. were examined and repaired, despite of the fact that they were regularly examined and repaired under the existing maintenance system. From the other side, according to the project all flange and threaded joints and switch mechanisms will be repaired using modern sealing materials, not taking into account whether the leak has been detected or not, in order to prevent leaks in future. At the moment traditional material used for the equipment of OJSC Odesagas presented in this project in performance of repair works ensures only temporary elimination of natural gas leaks, while the approach stipulated by the Project ensures safe elimination of natural gas leaks for a long period of time.

Detailed explanations are given in the section 2.4 and in Annex 2 of this project documentation.

**Step 2. Term of equipment replacement**

Starting from 2005 upon detection of natural gas (methane) leakage repair of flange and threaded joints and switch mechanisms is done according to the activities stipulated in this project. Inclusion of any similar cases of potential replacement of components into calculations of emission reduction is not reasonable as they will not produce any considerable effect on the Project result, i.e. on the level of methane emission reduction. It should be also mentioned that under this Project the sealing material will be replaced at all flange and threaded joints and switch mechanisms, even if leaks are detected only on some of them.

**Step 3. Data collection during the project realization.**

Collection of data on methane emissions arranged together with repair works on all switch mechanisms (bolts, cocks, valves) and flange and threaded joints of gas pipelines covered by this Project. Detection of natural gas leakage was done with the help of detectors acting on the basis of catalytic oxidation/heat conduction. Repair works on the switch mechanisms and flange and threaded joints were done after measurement of methane leakage volumes. Leakage volume of methane (in the natural gas) was measured using the method developed by ETI "Biotekhnika" of UAAN by the request of JSC Odesagas in 2005. The method is based on using a device as a part of insulated vessel of a certain volume, and a gas analyzer EX-TEC® SR5 (see Annex 3).

By its principle this method is the closest to the method of Calibrated Bag used in revision 03 of the method AM0023. After issuance of the method AM0023 revision 03 it was decided to keep to the previously used method for the following reasons:

- The procedure described in the Method AM0023 does not take into account the volume of equipment, which is the object of measurement;
- Use of insulated bag does not allow making precise measurement because of very difficult determination of initial volume of the let-out bag;
- Use of the bag in the manner described in the Method AM0023 does not allow permanent control of methane concentration in it, which can result in creation of combustible mix of methane and air, working with which is hazardous even when using antistatic bag.

After performance of repair works new measurement is done to make sure methane leakage has been eliminated No leakage was detected.

The data collected will be included to the reports on monitoring plan fulfilment. All the data are kept in the database. Each report on monitoring plan fulfilment will include complete information from such database (Annex 3 of this project documentation).

**Step 4. Requirements to monitoring procedures.**

Step 4 of the Project includes monitoring of the objects of the Project for checking for repeated methane leakages. Monitoring plan for this Project covers all repaired bolts, cocks, valves, flange and threaded joints of gas pipelines. Frequency of emission detection and measurement in the places where the emissions have been eliminated is indicated in the Monitoring Plan. Methane emissions from the components on which repeated natural gas leakage is not detected will be taken equal to zero for the whole period after the last check-up/monitoring. Methane emission volume for the components where repeated methane emission is detected shall be measured using the measuring instruments with the accuracy equal to the accuracy corresponding to (or being not worse than) the accuracy of the instruments used in the primary inspection. It will be considered that such emission volume remained on the same level, starting from the day after the last repair of bolts, cocks, valves, flange or threaded joints done according to the Project, or from the last check-up of eliminated emissions, depending on which event occurred later, which corresponds to the requirements established in the Method AM0023/Revision 03. Such methane emissions will be eliminated repeatedly, after which new measurement of methane emissions will be done.
The data collected will be included to the regular reports on monitoring plan fulfilment. All the data are kept in the database. Each report on monitoring plan fulfilment will include complete information from such database (Annex 3 of this project documentation).

**Step 5. Calculation of methane emission reduction.**

Methane emission reduction reached in the result of the Project is determined as the difference between emissions measured before the repair (Step 3) and after repair (Step 4). In (hypothetic) case if the emissions after repair are more than those measured before the repair, negative methane emission reduction will be marked for respective component. In other words, the Method used provides for the case in which methane emissions in the course of the Project exceed the emissions determined in the initial conditions.

Description of Baseline and substantiation of its choice are given in the item B.2. below.

Key information for determination of baseline is given in the tables below.

| **Data/Parameter** | i |
|---|---|
| Measurement unit | Non-dimensional |
| Description | Serial number of bolt, cock, valve, flange or threaded joint where gas leakage was detected |
| Periodicity of measurement/monitoring | Once, in the beginning of the project |
| The source of data applied/to be applied | Leakage measurement activity |
| Data values (for ex-ante calculations/measurements) | - |
| Confirmation of data selection, or description of the measurement method and procedures applied/to be applied | Method AM0023 |
| Measurement quality management/quality assurance procedures applied/to be applied | *The staff will have appropriate qualification for results fixation* |
| Comments | List of switch mechanisms (bolts, cocks, valves), flange and threaded joints is given in the accompanying document 1[6] |

[6] Register of switch mechanisms, flange and threaded joints of distribution gas pipelines of JSC Odesagas.

| **Data/Parameter** | $T_{i,}$ |
|---|---|
| Measurement unit | hour |
| Description | Number of running hours of the equipment at which leakage was detected during the year |
| Periodicity of measurement/monitoring | Permanent |
| The source of data applied/to be applied | Records of check-up results |
| Data values (for ex-ante calculations/measurements) | - |
| Confirmation of data selection, or description of the measurement method and procedures applied/to be applied | Method AM0023 |
| Measurement quality management/quality assurance procedures applied/to be applied | *The staff will have appropriate qualification for results fixation* |
| Comments | Number of running hours of the equipment during the year after its repair (replacement) |

| **Data/Parameter** | $GWP_{CH4,}$ |
|---|---|
| Measurement unit | Tons of $CO_2$ equivalent |
| Description | Global warming potential |
| Periodicity of measurement/monitoring | Permanent |
| The source of data applied/to be applied | IPCC |
| Data values (for ex-ante calculations/measurements) | 21 |
| Confirmation of data selection, or description of the measurement method and procedures applied/to be applied | - |
| Measurement quality management/quality assurance procedures applied/to be applied | *The person responsible for monitoring verifies the data on an annual basis* |
| Comments | Project designer will perform monitoring of any changes in the global warming potential for methane, published by IPCC and approved by COP |

| **Data/Parameter** | $F_{CH4,i}$ |
|---|---|
| Measurement unit | $m_3$ $CH_4$/hr |
| Description | Methane leakage speed for each detected leakage |
| Periodicity of measurement/monitoring | On an annual basis |
| The source of data applied/to be applied | Calculation |
| Data values (for ex-ante calculations/measurements) | - |

| | |
|---|---|
| Confirmation of data selection, or description of the measurement method and procedures applied/to be applied | Calculation according to the Method AM0023 |
| Measurement quality management/quality assurance procedures applied/to be applied | *Equipment has been calibrated and verified according to the quality management procedures. Regular maintenance is done according to the technical specifications.* |
| Comments | - |

| **Data/Parameter** | $t_i$ |
|---|---|
| Measurement unit | $^0C$ |
| Description | Gas temperature |
| Periodicity of measurement/monitoring | Permanent / Periodical |
| The source of data applied/to be applied | Mercury glass thermometer TL-4, according to GOST 8.279[7] |
| Data values (for ex-ante calculations/measurements) | - |
| Confirmation of data selection, or description of the measurement method and procedures applied/to be applied | Method AM0023 |
| Measurement quality management/quality assurance procedures applied/to be applied | *Equipment has been calibrated and verified according to the quality management procedures. Regular maintenance is done according to the technical specifications.* |
| Comments | Measured for determination of CH4 density. Note: Notwithstanding measurements, many variants are not expected as temperature at different stations is taken constant. |

| **Data/Parameter** | $P_i$ |
|---|---|
| Measurement unit | kPa |
| Description | Gas pressure |
| Periodicity of measurement/monitoring | Permanent / Periodical |
| The source of data applied/to be applied | Pressure gauge «D-59N-100-1.0 6 kPa» according to the requirements of GOST 12997[8] |
| Data values (for ex-ante calculations/measurements) | - |
| Confirmation of data selection, or description of the measurement method and procedures applied/to be applied | Method AM0023 |
| Measurement quality management/quality assurance procedures applied/to be applied | *Equipment has been calibrated and verified according to the quality management procedures. Regular maintenance is done according to the technical specifications.* |
| Comments | Measured for determination of CH4 density. Note: |

[7] "Working liquid-in-glass thermometers. Calibration methods".

[8] "SSI products. General specifications".

| | |
|---|---|
| | Notwithstanding measurements, many variants are not expected as pressure at different stations is taken constant. |

| **Data/Parameter** | *Vbag* |
|---|---|
| Measurement unit | $m^3$ |
| Description | Reservoir capacity |
| Periodicity of measurement/monitoring | Once, in the beginning of the project |
| The source of data applied/to be applied | Flow meter |
| Data values (for ex-ante calculations/measurements) | 0.87 $m^3$ |
| Confirmation of data selection, or description of the measurement method and procedures applied/to be applied | Method AM0023 |
| Measurement quality management/quality assurance procedures applied/to be applied | *Equipment has been calibrated and verified according to the quality management procedures. Regular maintenance is done according to the technical specifications.* |
| Comments | 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 $m^3$. |

| **Data/Parameter** | $w_{sampleCH4,i}$ |
|---|---|
| Measurement unit | % |
| Description | Methane concentration in sample |
| Periodicity of measurement/monitoring | Periodical |
| The source of data applied/to be applied | Gas analyzer EX-TEC® SR5. |
| Data values (for ex-ante calculations/measurements) | - |
| Confirmation of data selection, or description of the measurement method and procedures applied/to be applied | Method AM0023 |
| Measurement quality management/quality assurance procedures applied/to be applied | *Equipment has been calibrated and verified according to the quality management procedures. Regular maintenance is done according to the technical specifications.* |
| Comments | Methane concentration in the reservoir of leak *i is the difference between methane concentration in the reservoir in the beginning and in the end of measurement* Concentration is measured with gas analyzer EX-TEC® SR5. |

| **Data/Parameter** | $\tau_i$ |
|---|---|
| Measurement unit | second |
| Description | The time during which methane concentration reaches certain |

| | |
|---|---|
| | level |
| Periodicity of measurement/monitoring | Periodical |
| The source of data applied/to be applied | Stopwatch «SOS pr-2b-2», according to GOST 5072-72[9] |
| Data values (for ex-ante calculations/measurements) | - |
| Confirmation of data selection, or description of the measurement method and procedures applied/to be applied | Method AM0023 |
| Measurement quality management/quality assurance procedures applied/to be applied | *Equipment has been calibrated and verified according to the quality management procedures. Regular maintenance is done according to the technical specifications.* |
| Comments | - |

| **Data/Parameter** | URi |
|---|---|
| Measurement unit | % |
| Description | Uncertainty factor of the equipment where leakage is measured |
| Periodicity of measurement/monitoring | On an annual basis |
| The source of data applied/to be applied | IPCC |
| Data values (for ex-ante calculations/measurements) | 95 |
| Confirmation of data selection, or description of the measurement method and procedures applied/to be applied | Method AM0023 |
| Measurement quality management/quality assurance procedures applied/to be applied | *The person responsible for monitoring verifies the data on an annual basis* |
| Comments | Where possible, 95% confidence interval is evaluated; advice of Good Practice Guide given in section 6 2000 IPCC of GPG. If manufacturer of equipment where leaks are measured specifies uncertainty range without specification of confidence internal, it can be taken 95% |

**B.2. Description of how anthropogenic emissions of greenhouse gases from the sources will reduce to the level of those emissions which would exist in case of the JI project absence:**

**1. Approach to demonstration of the fact that the project generates reduction of emissions from the sources being additional to those which would exist in case of its absence**

**The Method AM0023 Revision0 03, and the last revision of "Methodological way of demonstration and evaluation of additionality" Revision 05.2, approved by the Executive Committee of Clean Development Mechanism, have been used for substantiation of the project additionality.**

[9] "Mechanical stopwatch"

**This approach can be used for this project of methane emission reduction because it has been developed particularly for the projects of this type. Taking into account local conditions and laws will allow impartial evaluation of its additionality. .**

**2. Application of selected approach. Proofs of the project additionality.**

***Step 1 – Detection of alternatives of Project realization, which comply with the effective Ukrainian laws and regulations.***

***Step 1a – Determination of alternatives of Project realization.***

**Only two variants of initial conditions can be considered as acceptable for the Project:**

**Variant 1: Retention of current situation;**
**Variant 2: The activities provided for by the Project will be performed without using the mechanism established by article 6 of Kyoto Protocol of UN Framework Convention On Climate Change.**

**Variant 1: Retention of the current practice of detection and elimination of natural gas leaks, and therefore – methane leaks, is the most real and valid alternative of the Project realization, as this variant implies minimal expenses for JSC Odesagas.**

JSC Odesagas **does not receive any financial profit from methane emission reduction. The existing Ukrainian system of rates formation for natural gas provides for reduction of rates for natural gas upon reduction of leakage. The current fee for methane emission within the established limits is hard or impossible to be charged because of the absence of the measurement procedure and because of big amount of small emissions spread over the large area.**

**Variant 2: According to the Method AM0023/Revision 03, to determine the probably variant of initial conditions it is necessary to determine "whether such activities for reduction of methane emissions from such important components as bolt units, blowdown valves, sealing of rods and pressure release valves, using the technologies for detection and measurement of methane emissions similar to those described in this Method".** Until recently JSC Odesagas did not perform the activities for direct inspection and technical maintenance which would exceed the safety requirements established by the regulations. **Types and volumes of engineering leaks in the Ukrainian gas distribution networks were generally unknown until the first direct inspections and preventive examinations have been done for evaluation of possibilities of projects realization under the mechanisms established by article 6 of Kyoto Protocol to UN Framework Convention On Climate Change. Evaluations of net volume of gas consumption and leakage were approximate because most end users do not have gas meters, and invoicing is done on the basis of standard norms.**

**In addition, JSC Odesagas has neither incentives nor means for realization of the activities provided for by the Project in the absence of its support by the mechanisms established by article 6 of Kyoto Protocol to UN Framework Convention On Climate Change (step 1.2, step 2 and step 3 further on). The Project provides for additional expenses on measuring instruments, modern compacting materials and staff training. In order to cover such expenses on realization of this Project or similar activities represented in this project JSC Odesagas does not financial incentives, except for possible receipts received under the mechanism established by article 6 of Kyoto Protocol to UN Framework Convention On Climate Change.**

**Evaluation: JSC Odesagas will not agree to the expenses upon implementation of Variant 2. Therefore, the most real and valid variant of the Project realization is Variant 1.**

***Step 1b – Conformance to the effective Ukrainian laws and norms.***

***Variant 1: Current practice of detection and elimination of natural gas leaks and therefore, methane emissions, conforms to all effective laws and norms of Ukraine. The law allows natural gas leaks, and therefore, methane leaks during natural gas transportation. The norms only determine the periodicity of inspection of equipment to be done by gas distribution organization for detection of natural gas leaks. The practice of natural gas leakage detection by JSC Odesagas conforms to the specified norms. Control of conformance to the norms is done by means of annual revisions performed by the authorized bodies.***

***The project also conforms to the existing legislative requirements in Ukraine concerning detection of natural gas leakage and methane emission at gas distribution objects, and to any other currently applicable legislative norms.***

***The program of JSC Odesagas for regular detection of natural gas leakage will be realized parallel to application of more up-to-date methods of detection and measurement of natural gas leakage, and therefore, methane emissions, and the activities for long-term elimination of natural gas leakage, and therefore, methane emissions, provided for by this Project.***

***Conclusion: selected realistic conservative variant deserving trust (variant 1) fully conforms to compulsory requirements and norms of the Ukrainian laws.***

***Step 2 – Investment Analysis***

***Step 2a – Determination of applicable analysis method.***

As realization of the Project does not bring any other financial or economic advantage except for the profit from realization of the Project, which can be received under the mechanism established by article 6 of Kyoto Protocol to UN Framework Convention On Climate Change, a simple cost analysis is used according to the additionality tools in case of the absence of such profit to determine that the suggested realization of the Project is less reasonably from the economic point of view.

***Currently available Procedure for Rates Formation approved by the National Commission For Energy Market Adjustment does not allow receiving benefits in case of reduction of natural gas leaks. The whole economic burden connected with natural gas leakage is carried onto the end consumer of natural gas.***

The following steps have been done according to the additionality tools of the CDM Executive Committee “Methodological way of demonstration and evaluation of additionality” (revision 05.2).

***Step 2b – Variant 1. Use of simple cost analysis.***

Realization of the Project will require the costs in addition to the existing expenses, for performance of the activities for detection and elimination of natural gas leakage, and therefore – methane emissions. Additional expenses on realization of the Project will include the costs of: purchase of modern equipment for detection and measurement of methane emissions, sealing materials, replacement of obsolete shut-off and regulating valves, staff training, preventive check-ups, systematic data collection etc.

*< paragraph was moved to section «Step 3. Financial barrier» >*

Materials used in this Project are the best ones from the point of view of leak tightness, performance quality and used technical solutions, out of all materials represented at the Ukrainian market. Important characteristics considered in choice of equipment were availability of spare parts in Ukraine.

***Up-to-date sealing material will be used in the course of project realization.*** According to the previous monitoring results sealing material according to GOST 7338-90 and GOST 5152-84 is much more effective, but also more expensive than the sealing materials used in the current practice. In the result of real practice all natural gas leaks are imposed on the end consumers, and JSC Odesagas has no reasons to purchase and to use the foregoing sealing material.

By the moment of project beginning obsolete shut-off and regulating valves produced in the USSR are used in the gas distribution units of JSC Odesagas, which have worse insulation characteristics than new samples produced by the European manufactures, but which are much cheaper. Therefore installation of new equipment produced by Pietro Fiorentini was a single case, and could not be of mass character because of the lack of funds.

In addition, because of high cost of gas metering devices and gas correctors, accounting of natural gas was not done at all gas distribution units of JSC Odesagas at the moment of project beginning. Installation and implementation of centralized natural gas accounting system will allow operative tracking of gas flow inside the network, and increase of gas distribution system efficiency.

Application of Kyoto mechanisms to this project makes these activities economically efficient and is the only way to their implementation.

JSC Odesagas will not receive any direct economic advantage from reduction of methane emission, which is reached by the Project realization, not taking into account receipts from sale of reduction units, as under the existing tariff system all network leaks are carried onto the end consumers of natural gas.

It should be also taken into account that in Ukraine methane is not included to the list of ecologically harmful gases and is not punished by environmental fines. Therefore, JSC Odesagas does not face any financial difficulties in connection with payments for environmental pollution, and therefore will not receive any financial advantage from reduction of emission volume from the point of view of reduction of payments for pollution.

***As emission reduction does not bring any economic advantage to JSC Odesagas, and realization of this project does not bring any economic advantage to the other project participants, including the project applicant, except for the advantage to be formed under JP Project, we can make a conclusion that realization of the Project without receiving profits under JIP will produce barriers for investments.***

***Conclusion: It goes from the everything stated above that this project is economically unattractive without registration of the project as JIP, which will indicate additionality of this project.***

***Step 3 – Barrier analysis.***

The Project is the first project of this type, and therefore there are some types of barriers. JSC Odesagas faces serious financial barriers, and lack of potential and experience in using new approaches and measuring tools for detection and elimination of gas leaks at its objects, including:

- Organizational barrier.

Lack of labour and technical resources at JSC Odesagas for implementation and performance of purposeful examination, technical maintenance and reconstruction of all switch mechanisms (bolts, cocks, valves), and flange and threaded joints of gas pipelines. It is connected with the absence of qualified staff: during the last years the company faced considerable outflow of qualified workers, and newly employed workers do not have enough experience and knowledge yet.

- Absence of special technical knowledge.

By the moment of project beginning available qualified staff did not have experience in using the tools and methods for measurement of gas leakage volume: tool (gas analyzer) used by JSC Odesagas only ensures detection of leaks, but does not measure and register volume of leaks. Therefore, project implementation requires time to gain practical experience in measurement of natural gas leakage volumes.

- ***Financial barrier.***

***Additional expenses on the project realization include the costs of:***

- Purchase and use of modern equipment for detection and measurement of methane emissions (gas analyzer EX-TEC® SR5);
- ***Purchase and application of sealing materials of different type and diameter;***
- Replacement of obsolete shut-off and regulating valves with new valves of European manufacturers (Pietro Fiorentini, DKG-EAST RT);
- Staff training for performance of actual preventive examination and technical maintenance, and for using and maintenance of sealing materials, shut-off and regulating valves produced by Pietro Fiorentini, DKG-EAST RT I;
- Systematic data collection and management;
- Systematic and long-term control of efficiency of elimination of detected natural gas leakage.

Financial barriers are connected with the structure of existing tariffs for gas transport and distribution, which are regulated by the government and do not take into account depreciation and investments needs of gas distribution enterprises. Such state of business result in permanent lack of funds and impossibility of timely performance of capital repair, assurance of equipment operation, investment into modernization and development of gas distribution infrastructure.

***Step 4 – Analysis of generally used practice.***
***Step 4a – Analysis of other activity similar to that suggested in the Project.***

Absence of financial incentives described for Step 2 and barriers described in Step 3 is typical not only for JSC Odesagas, but also for other companies operating low-pressure gas distribution networks in Ukraine. Therefore the existing practice of detection and elimination of methane leakage described in the variant of initial conditions selected for real Project is common for Ukraine in general.

In general, the whole Ukraine uses the same devices for detection of natural gas leakage as those used in Odessa region. Sealing materials used for leakage reduction also differ a little by regions. Gas companies of Ukraine do not have the equipment for measurement of natural gas leakage volumes. The programs for detection and elimination of natural gas leakage used in Ukraine are focused at fulfilment of safety requirements and at prevention of accidents.

***Step 4b – Discussion of similar approved decisions.***

***Beside this Project and other projects realized under the mechanism established by article 6 of Kyoto Protocol to UN Framework Convention On Climate Change, Ukraine does not realize the other programs for actual detection and elimination of natural gas leakage from gas distribution networks. The Project provides for use of modern technologies and equipment for detection and measurement of natural gas leakage. Such equipment and its application are rather new.***

***Perspectives for Project financing under the mechanism established by article 6 of Kyoto Protocol to UN Framework Convention On Climate Change allowed its developer to prepare this Project. Thus, we can believe that any actions, similar to those provided for by the present Project, are developed and realized in Ukraine in expectation of profit according to the mechanisms established by article 6 of Kyoto Protocol to UN Framework Convention On Climate Change.***

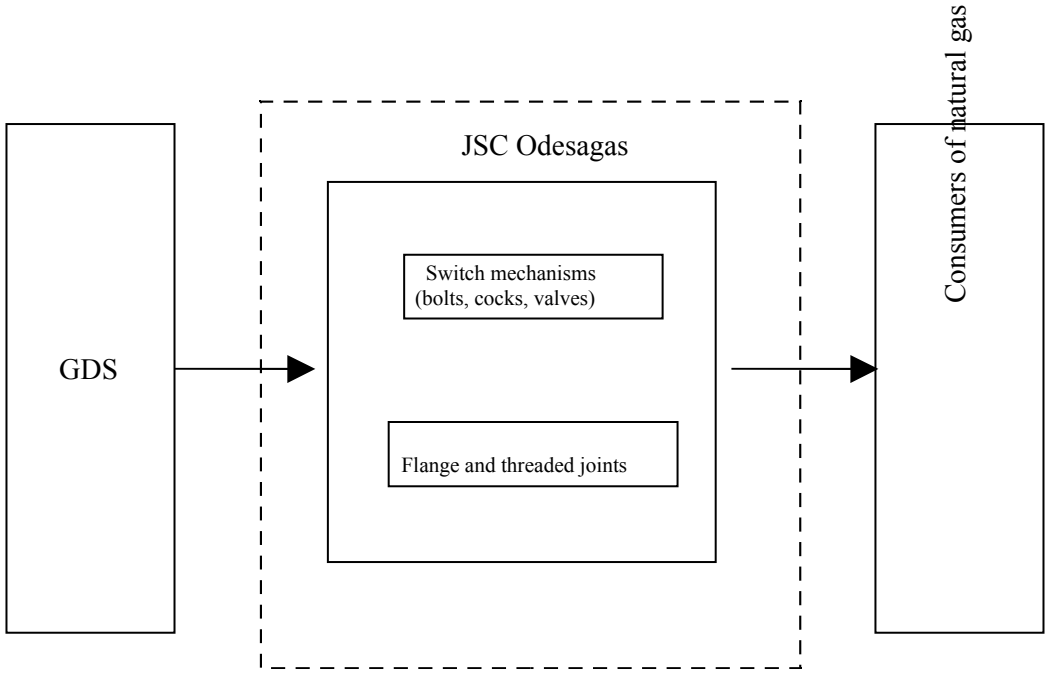
***Conclusion: The activities similar to those provided for by this Project can be done at the present time only subject to receipt of expected profit from realization of the mechanism established by article 6 of Kyoto Protocol to UN Framework Convention On Climate Change. Thus, the real Project is considered to be the project which satisfies the additionality criterion.***

***<step 5 is deleted>***

**B.3. Description of how the definition of the project boundary is applied to the project:**

Sources of greenhouse gases and project boundary:

Project boundary for a basic scenario are marked with dashed line at the scheme (**Fig. 5)**




*Pic. 5 Project boundary scheme:*

***The project covers only methane leakage through leakage in switch mechanisms (bolts, cocks, valves) and flange and threaded joints of the equipment of JSC Odesagas, located on the territory of Odesa and Odesa region.***

**B.4. Further information about baseline, including the date of baseline determination and the name(s) of the person(s)/company(-ies) determining the baseline:**

Baseline formation date: 20/09/2005
Baseline has been determined by Engineering Technological Institute "Biotekhnika" of UAAN.

Engineering Technological Institute "Biotekhnika" of UAAN
19, Bolshaya Arnautska Str.
Odesa
Odessa region
65125
Ukraine
(048) 725-12-11
(048) 725-53-89

## SECTION C. Duration of the project / Crediting period

### C.1. Starting date of the project:

**The project activity begins on 12/01/2005. Date of formation of the Working Team for realization of activities of methane leakage elimination.**

### C0.2. Expected operational lifetime of the project:

**Operation of the system of leakage detection and elimination, and further maintenance of tightness of equipment created under the Project does not have any time limitation, as periodical replacement of sealing materials on gas valves will be carried out on a permanent basis. Following the principle of conservatism, we will take the life cycle and respective crediting period for further calculations equal to 22 years/264 months (2005-2026).**

### C0.3. Length of the crediting period:

The JI project relates to the first period of obligations and makes 5 years/60 months (January 01, 2008 – December 31, 2012).

Starting date of the crediting period was the date of the first actions on project implementation, - January 12, 2005. The end date of the crediting period is December 31, 2012. Therefore, length of the crediting period will make 8 years/96 months.

If after the first period of obligations under Kyoto Protocol its validity is not prolonged, crediting period under the project can be shortened to December 31, 2026. Taking into account the period preceding the crediting period, the crediting period and the period after its expiration, the total crediting period will make 22 years/264 months.

## SECTION D. Monitoring plan

### D.1. Description of monitoring plan chosen:

**For the purpose of quantitative evaluation and preparation of reports on emission reduction on the ground of baseline and project activity, the Method AM0023 "Reduction of natural gas leakage at compressor and gas distribution stations of main lines" will be used with modification concerning improvement of accuracy of measurement of leakage volume as per section B.1. above will be applied.**

**After detection and measurement of leakage a detailed monitoring program will be developed for each switch mechanism, flange and threaded joint. Realization of such program will become a part of the JI project activity. Monitoring will cover leakage from the sources of leakages which are repeatedly detected, and control of already repaired equipment where gas leaks have been detected before.**

Under the JI project Working Team of JSC Odesagas executed a Register of switch mechanisms, flange and threaded joints of distribution gas pipelines of JSC Odesagas (see Accompanying document 1), which includes full information about all switch mechanisms, flange and threaded joints of the Project, and which is regularly updated during the reconstruction.

**All relevant data connected with calculation of emission reduction will be saved in the electronic database. Each monitoring report will contain full information from this database.**

**The whole information on the project in the electronic and hard form according to the Order N 219 as of 31/12/2004 issued by the management of JSC Odesagas will be saved till 31/12/2028.**

### D.1.1. Subsection 1 – Emission monitoring in project option, and basic option:

By the moment of project beginning there was no uniform method for methane leakage measurement and monitoring in Ukraine. Therefore, JSC Odesagas entered into agreement with Engineering Technological Institute "Biotekhnika" of UAAN for development of measurement method and program for methane leakage monitoring.
Monitoring plan was developed on the basis of monitoring plan given in the Method AM0023 "**Reduction of natural gas leakage at compressor and gas distribution stations of main gas lines**" (Revision 03) with some assumptions concerning measurement method of methane leakage volume described in the item B.1. above; detailed description of monitoring method is given in Annex 3.

| D.1.1.1 Data to be collected for monitoring of emissions from the project, the manner these data will be received: | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Identification Number** *(please use numbers to facilitate cross reference to D.2.)* | **Variable Data** | **Data Sources** | **Data measurement unit** | **Measured (m), calculated (c) or evaluated (e)** | **Record frequency** | **Data frequency for monitoring** | **The form of data delivery (electronic/paper)** | **Comments** |
| 1. i | Serial number of bolt, cock, valve, flange or threaded joint where gas leakage was detected, eliminated and then checked Number | Leakage measurement activity | Non-dimensional | m | Once | 100% | Electronic | The leakage detected at the device is given a serial number. List of switch mechanisms (bolts, cocks, valves), flange and threaded joints is given in the accompanying document 1. Inspection is done after repair. |
| 2. $T_i$ | Time | Records of check-up results | Number of running hours of the equipment at which leakage was detected during the year | m | Permanent | 100% | Electronic | Number of running hours of the equipment during the year after its replacement (repair) |
| 3. | Date | Repair (reconstructio n) and | Date of repair (reconstructio n) and | m | Permanent | 100% | Electronic | Date of reconstruction, used together with |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | monitoring data (register) | monitoring | | | | | the number of running hours of equipment for determination of the total number of running hours In case of repeated leaks it is taken the same as the date of the last inspection which showed the absence of leakage. |
| 4. $GWP_{CH4}$ | Global warming potential | IPCC | Tons of $CO_2$ equivalent | c | Permanent | 100% | Electronic | Project designer will perform monitoring of any changes in the global warming potential for methane, published by IPCC and approved by COP |
| 5. $F_{CH4,i}$ | Leakage speed for each detected leakage | Leakage measurement activity | $m_3$ $CH_4$/hour | c | On an annual basis | 100% | Electronic | **Calculated using the biggest deviation of device error (for gas analyzer – 10%)** |
| 6. t, P | Gas temperature and pressure | Measurement data from mercury-in- | $^0$C and kPa | m | Permanent / Periodical | 100% | Electronic | Measured for determination of CH4 density. |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | glass thermometer TL-4ta and from pressure gauge D-59N-100-1.0 6 kPa | | | | | | Note: Notwithstanding measurements, many variants are not expected as pressure and temperature at different stations are taken constant |
| 7. URi | Uncertainty factor of the equipment where leakage is measured | Information manufacturer and/or IPCC GPG | % | m or e | On an annual basis | 100% | Electronic | Where possible, 95% confidence interval is evaluated; advice of Good Practice Guide given in section 6 2000 IPCC of GPG If manufacturer of equipment where leaks are measured specifies uncertainty range without specification of confidence internal, it can be taken 95% |
| 8. *Vbag* | Reservoir capacity | Flow meter measurement data | $m^3$ | m | Once | 100% | 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 $m^3$. |
| 9. $w_{sampleCH4,i}$ | Methane concentration in sample | Measurement data from gas analyzer EX-TEC® SR5. | % | m | Every time during the measurement | 100% | 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. $\tau_i$ | The time during which methane concentration reaches certain level | Measurement data from stopwatch SOS pr-2b-2 | seconds | m | Every time during the measurement | 100% | 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. |

According to the effective laws, all metering devices in Ukraine shall satisfy the established norms and standards and shall pass regular inspections (once per year).

**D.1.1.2 Description of the formula used for evaluation of project emissions (for each gas, source, $CO_2$ emission units):**

**Using the method of measuring leak volumes with the help of hermetic capacity, volume of methane leaks from one equipment can be calculated by the formula:**

$$F_{CH4,iP} = Vbag * w_{sampleCH4,i} * 3600 / \tau_i \quad (1)$$

Where:
$F_{CH4,P}$ = Methane leakage through leaking element of the device *i* after reconstruction (m³/hour);
*Vbag* = Capacity of sealed tank for measurement (m³);
$w_{sampleCH4,i}$ = Methane concentration in a sample of leak *i,* which is a difference of concentrations in the beginning and in the end of measurement (%);
*ti* = Average duration of tank filling for leak *i* after reconstruction (seconds)

Annual methane leaks are calculated by the formula:

$$Q_{yP} = ConvFactor * \Sigma[F_{CH4P} * Ti,y * URi] * GWP_{CH4} * 0.9 \quad (2)$$

Where:
*QyP* = Methane emissions for the period y for reconstructed equipment (tCO2eq).
*ConvFactor* = Conversion factor мiCH4 into tCH4, at standard temperature and pressure (0 degree Celsius and 101.3 kPa) it makes 0.0007168 tCH4/мiCH4
*URi* = Factor taking into account uncertainty of measurement method
$T_{i,y}$ = Time (in hours) for i-equipment functioning during the period under consideration (monitoring period) y.
*GWPCH4* = Potential of Global Warming for methane (21 tCO2eq/tCH4)
*0.9*= Factor taking into account equipment error

Reduction of methane volumes to standard conditions:
Methane leakage volumes received in the result of measurements are reduced to standard conditions ($R_н$ = 0,1013 MPa, $T_н$ = 273 K) by the formula:

$$F_{CH_4} = \frac{F \cdot 273 \cdot P}{0,1013 \cdot (273 + t)} \qquad (3)$$

where $F_{CH4}$ – methane leakage volume reduced to standard conditions $m^3$/hour;
$P$ – gas pressure in the tank, MPa;
$t$ – gas temperature in the tank, °C.

**D.1.1.3. The data required for determination of <u>baseline</u> of anthropogenic emissions of greenhouse gases by the sources under the project, and the manner these data will be collected and delivered:**

| **Identification Number** *(please use numbers to facilitate cross reference to D.2.)* | **Variable Data** | **Data Sources** | **Data measurement unit** | **Measured (m), calculated (c) or evaluated (e)** | **Record frequency** | **Data frequency for monitoring** | **The form of data delivery (electronic/paper)** | **Comments** |
|---|---|---|---|---|---|---|---|---|
| 1. i | Serial number of bolt, cock, valve, flange or threaded joint where gas leakage was detected, eliminated and then | Leakage measurement activity | Non-dimensional | m | Once | 100% | Electronic | The leakage detected at the device is given a serial number. List of switch mechanisms (bolts, cocks, valves), flange and threaded joints is given in the accompanying document 1. |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | checked Number | | | | | | | Inspection is done after repair. |
| 2. $T_i$ | Time | Records of check-up results | Number of running hours of the equipment at which leakage was detected during the year | m | Permanent | 100% | Electronic | Number of running hours of the equipment during the year after its replacement (repair) |
| 3. | Date | Repair (reconstruction) and monitoring data (register) | Date of repair (reconstruction) and monitoring | m | Permanent | 100% | Electronic | Date of reconstruction, used together with the number of running hours of equipment for determination of the total number of running hours In case of repeated leaks it is taken the same as the date of the last inspection which showed the absence of leakage. |
| 4. $GWP_{CH4}$ | Global warming potential | IPCC | Tons of $CO_2$ equivalent | c | Permanent | 100% | Electronic | Project designer will perform monitoring of any changes in the global warming potential for |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | | methane, published by IPCC and approved by COP |
| 5. $F_{CH4,i}$ | Leakage speed for each detected leakage | Leakage measurement activity | $m_3$ $CH_4$/hour | c | On an annual basis | 100% | Electronic | **Calculated using the biggest deviation of device error (for gas analyzer – 10%)** |
| 6. t, P | Gas temperature and pressure | Measurement data from mercury-in-glass thermometer TL-4ta and from pressure gauge D-59N-100-1.0 6 kPa | $^0$C and kPa | m | Permanent / Periodical | 100% | Electronic | Measured for determination of CH4 density. Note: Notwithstanding measurements, many variants are not expected as pressure and temperature at different stations are taken constant |
| 7. URi | Uncertainty factor of the equipment where leakage is measured | Information manufacturer and/or IPCC GPG | % | m or e | On an annual basis | 100% | Electronic | Where possible, 95% confidence interval is evaluated; advice of Good Practice Guide given in section 6 2000 IPCC of GPG If manufacturer of equipment where leaks are measured |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | | specifies uncertainty range without specification of confidence internal, it can be taken 95% |
| 8. *Vbag* | Reservoir capacity | Flow meter measurement data | $m^3$ | m | Once | 100% | 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 $m^3$. |
| 9. $w_{sampleCH4,i}$ | Methane concentration in sample | Measurement data from gas analyzer EX-TEC® SR5. | % | m | Every time during the measurement | 100% | 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. $\tau_i$ | The time during | Measurement data from | seconds | m | Every time during the | 100% | Electronic | Time during which methane |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | which methane concentration reaches certain level | stopwatch SOS pr-2b-2 | | | measurement | | | 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. |

**D.1.1.4. Description of the formula used for evaluation of basic emissions (for each gas, source, $CO_2$eq emission units):**

**Using the method of measuring leak volumes with the help of hermetic capacity, volume of methane leaks from one equipment can be calculated by the formula:**

$$F_{CH4,iB} = Vbag * w_{sampleCH4,i} * 3600 / \tau_i \quad (4)_i$$

Where:
$F_{CH4,B}$ = Methane leakage through leaking element of the device *i* before reconstruction (m³/hour);
*Vbag* = Capacity of sealed tank for measurement ($m^3$);
$w_{sampleCH4,i}$ = Methane concentration in a sample of leak *i,* which is a difference of concentrations in the beginning and in the end of measurement (%);
*ti* = Average duration of tank filling for leak *i* before reconstruction (seconds)

Annual methane leaks are calculated by the formula:

$$Q_{yB} = ConvFactor * \Sigma[F_{CH4y} * Ti,y * URi] * GWP_{CH4} * 0.9 \quad (5)$$

Where:
$Q_{yB}$ = Methane emissions for the period y for equipment before reconstruction (tCO2equivalents).
*ConvFactor* = Conversion factor $m^3$CH4 into tCH4, at standard temperature and pressure (0 degree Celsius and 101.3 kPa) it makes 0.0007168 tCH4/мiCH4
*URi* = Factor taking into account uncertainty of measurement method
*Ti,y* = Hour (in hours) for respective component and during which it used to operate during the period under consideration (monitoring period) y, taking into account the methodology given above (for example, for calculation of incoming leaks)
*GWPCH4* = Potential of Methane Global Warming (21 tCO2eq/tCH4)
*0.9*= Factor taking into account equipment error

Reduction of methane volumes to standard conditions is done by the formula (3).

**D.1.2. *Subsection 2* – Direct *monitoring* of emission reduction from the project (quantities shall match the data in section E):**

| D.1.2.1 The data collected to perform monitoring of emission reduction from the project, and the sources of these data: | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Identification Number** *(please use numbers to facilitate cross reference to D.2.)* | **Variable Data** | **Data Sources** | **Data measurement unit** | **Measured (m), calculated (c) or evaluated (e)** | **Record frequency** | **Data frequency for monitoring** | **The form of data delivery (electronic/paper)** | **Comments** |
| | | | | | | | | |
| | | | | | | | | |

**Direct monitoring of emission reduction is not used.**

**D.1.2.2 Description of the formula used for calculation of emission reduction from the project (for each gas, source etc., $CO_2$eq emission units):**

**Direct monitoring of emission reduction is not used.**

**D.1.3. . Determination of leakage in the monitoring plan:**

| **D.1.3.1. If possible, please describe the data and the information to be collected for the purpose of monitoring of project leakage impact:** | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Identification Number** *(please use numbers to facilitate cross reference to D.2.)* | **Variable Data** | **Data Sources** | **Data measurement unit** | **Measured (m), calculated (c) or evaluated (e)** | **Record frequency** | **Data frequency for monitoring** | **The form of data delivery (electronic/paper)** | **Comments** |
| | | | | | | | | |

No leakage found.

**D.1.3.2. Description of the formula used for evaluation of leakage (for each gas, source, formula/algorithm, $CO_2$ emission units):**

No leakage found.

**D.1.4. Description of the formula used for evaluation of emission reduction for the project (for each gas, source, $CO_2$ emission units):**

Number of Emission Reduction Units (ERU), t $CO_2e$:

$$ERU = \sum[ Q_{yB} - Q_{yP}] \quad (6)$$

ERU – emission reduction units, t $CO_2$ ;
$Q_{yP}$ **– project emissions, t $CO_2$;**
$Q_{yB}$ **– basic emissions, t $CO_2$.**

**D.1.5. Relevant information required by the Party on the territory of which the project is implemented concerning collection and access to the information about the environmental impact of the project:**

Implementation of this Project does not provide for any negative environmental impact (See section F below). Therefore data collection on environmental impacts of the Project is not required. There are no laws or regulations in Ukraine requiring collection of such information.

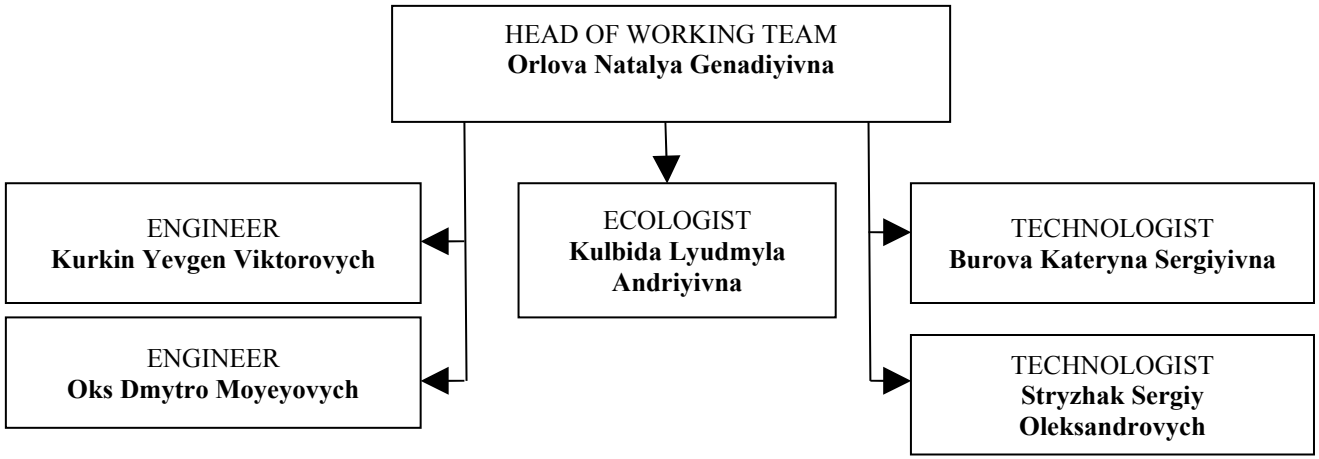
**D.2. Quality Management (QM) and Quality Assurance (QA) procedures applied for data monitoring:**

| **Data** *(Indicate the table and identification number)* | **Data uncertainty level (High/Middle/Low)** | **Please explain whether any QM/QA procedures have been scheduled for these data, or why there is no need to perform such procedure** |
|---|---|---|
| 1. | Low | Each leakage shall be marked by a certain No., and monitoring shall be done after repair for the purpose of detection of additional leakage |
| 2. | Low | Logbook shall be placed where it is possible for frequently switched-off equipment for the purpose of running hours counting. |
| 3. | Low | Working orders, receipts and other records shall be kept in the additional repair logbook. |
| 4. | Low | Project participants shall keep the records of any new greenhouse gases accepted by COP. |
| 5. | Low | The leakage level will be measured and twice checked before the repair – the main discrepancies will be prevented by the third test. In other words, if gas analyzer is used for measurement of leakage level, and if the results of both tests significantly differ from each other, check-up shall continue until the results of two measurements are close to each other (to reduce any discrepancies in the process of testing). If gas analyzer or any other equipment require recalibration to confirm its accuracy, project participants shall take necessary measures for that. |
| 6. | Low | Records of data about calibrated and verified equipment, to be made on a regular basis |
| 7. | Middle/Low | IPCC GPG will be consulted on the expected discrepancies. |
| 8. | Low | The volume of insulated reservoir does not change with time, that is why permanent verification of its capacity is not obligatory. |
| 9. | Low | Gas analyzer EX-TEC® SR5 meets the requirements of the European Standard EN50054/57, and goes through annual calibration/verification. |

| | | |
|---|---|---|
| 10. | Low | Stopwatch is a simple device, and is not included to the list of devices subject to annual verification. Stopwatch «SOS pr-2b-2» will be used, according to GOST 5072-72[10] |

| **D.3. Please describe the structure of administration and management for the project operator to implement monitoring plan** |
|---|

**Coordination of activities of all departments and services of JSC Odesagas concerning the project implementation is done by the Working Team created pursuant to the Order of the management board of JSC Odesagas as of 31/12/2004 N 219. The structure of the Working Team is shown on the Picture 6.**




*Pic. 6 Structure of Working Team*

**Sergiy Oleksandrovych Stryzhak and Lyudmyla Andriyivna Kulbida are responsible for collection of all information provided for by monitoring plan, and for making all necessary settlements. Archiving of all received information in the result of measurements and settlements is done under guidance of Kateryna Sergiyivna Burova. The head of working team (Nataliya Genadiyivna Orlova) on the basis of received information determines plan of measures under the Project and scope of resources required. Technical maintenance of the Project is carried out by Dmytro Moyseyovych Oks and Yevgen Viktorovych Kurkin.**

[10] "Mechanical stopwatch"

| D.4. Name of the person(s) / enterprise(s) determining the monitoring plan: |
|---|

Engineering Technological Institute “Biotekhnika” of UAAN
19, Bolshaya Arnautska Str.
Odesa
Odessa region
65125
Ukraine
(048) 725-12-11
(048) 725-53-89

## SECTION E. Estimation of greenhouse gas emission reductions

### E.1. Evaluated project emissions:

Evaluation of project emissions was done on the basis of the data received by the monitoring plan given in item D.1.1.2 and in Annex 3. The results of measurements and calculations done by the Engineering Technological Institute "Biotekhnika" of UAAN (see Annex B) according to the determined emission monitoring plan are given in the Table 4.

| Year | Estimated project emissions (tons $CO_2$ equivalent) |
|---|---|
| 2005 | 423840 |
| 2006 | 191295 |
| 2007 | 25200 |
| **2005-2007 in total** | **640335** |
| 2008 | 25200 |
| 2009 | 25200 |
| 2010 | 25200 |
| 2011 | 25200 |
| 2012 | 25200 |
| **2008-2012 in total** | **126000** |
| 2013 | 25200 |
| 2014 | 25200 |
| 2015 | 25200 |
| 2016 | 25200 |
| 2017 | 25200 |
| 2018 | 25200 |
| 2019 | 25200 |
| 2020 | 25200 |
| 2021 | 25200 |
| **2022** | 25200 |
| **2023** | 25200 |
| **2024** | 25200 |
| **2025** | 25200 |
| **2026** | 25200 |
| **2013-2022 in total** | **352800** |
| **Total (tons $CO_2$ equivalent)** | **1119135** |

Table 4. Estimated Project Emissions

### E.2. Estimated leakage:

No leakage found.

## E.3. The sum of E.1. and E.2.:

**As there is no leakage, the sum of E.1. and E.2. will be equal to E.1. (see Table 4).**

## E.4. Estimated basic emissions:

Basic emissions given in the Table 5 were evaluated similar to the project emissions, using the formulas given in item D.1.1.4.

| Year | Estimated basic emissions (tons $CO_2$ equivalent) |
|---|---|
| 2005 | 689590 |
| 2006 | 689590 |
| 2007 | 689590 |
| **2005-2007 in total** | **2068770** |
| 2008 | 689590 |
| 2009 | 689590 |
| 2010 | 689590 |
| 2011 | 689590 |
| 2012 | 689590 |
| **2008-2012 in total** | **3447950** |
| 2013 | 689590 |
| 2014 | 689590 |
| 2015 | 689590 |
| 2016 | 689590 |
| 2017 | 689590 |
| 2018 | 689590 |
| 2019 | 689590 |
| 2020 | 689590 |
| 2021 | 689590 |
| **2022** | 689590 |
| **2023** | 689590 |
| **2024** | 689590 |
| **2025** | 689590 |
| **2026** | 689590 |
| **2013-2022 in total** | **9654260** |
| **Total (tons $CO_2$ equivalent)** | **15170980** |

## E.5. The difference between E.4. and E.3., which shows reduction of emissions in the project:

Estimated annual reduction of greenhouse gas emissions in the project is calculated by the formula:

Estimated reduction of emissions in the project = Estimated basic emissions – (Estimated project emissions + Estimated leakage)
(7)

All results of evaluation of emission reduction in the project are given in the Table 6 below.

**E.6. The table explaining the quantities received by the formula given above:**

| Year | Estimated basic emissions (tons $CO_2$ equivalent) | Estimated leakage (tons $CO_2$ equivalent) | Estimated project emissions (tons $CO_2$ equivalent) | Estimated emission reduction (tons $CO_2$ equivalent) |
|---|---|---|---|---|
| 2005 | 689590 | 0 | 423840 | 265750 |
| 2006 | 689590 | 0 | 191295 | 498295 |
| 2007 | 689590 | 0 | 25200 | 664390 |
| **2005-2007 in total** | **2068770** | **0** | **640335** | **1428435** |
| 2008 | 689590 | 0 | 25200 | 664390 |
| 2009 | 689590 | 0 | 25200 | 664390 |
| 2010 | 689590 | 0 | 25200 | 664390 |
| 2011 | 689590 | 0 | 25200 | 664390 |
| 2012 | 689590 | 0 | 25200 | 664390 |
| **2008-2012 in total** | **3447950** | **0** | **126000** | **3321950** |
| 2013 | 689590 | 0 | 25200 | 664390 |
| 2014 | 689590 | 0 | 25200 | 664390 |
| 2015 | 689590 | 0 | 25200 | 664390 |
| 2016 | 689590 | 0 | 25200 | 664390 |
| 2017 | 689590 | 0 | 25200 | 664390 |
| 2018 | 689590 | 0 | 25200 | 664390 |
| 2019 | 689590 | 0 | 25200 | 664390 |
| 2020 | 689590 | 0 | 25200 | 664390 |
| 2021 | 689590 | 0 | 25200 | 664390 |
| **2022** | 689590 | **0** | 25200 | 664390 |
| **2023** | 689590 | **0** | 25200 | 664390 |
| **2024** | 689590 | **0** | 25200 | 664390 |
| **2025** | 689590 | **0** | 25200 | 664390 |
| **2026** | 689590 | **0** | 25200 | 664390 |
| **2013-2022 in total** | **9654260** | **0** | **352800** | **9301460** |
| **Total (tons $CO_2$ equivalent)** | **15170980** | **0** | **1119135** | **14051845** |

*Table 6. Expected emissions $CO_2$*

## SECTION F. Environmental impacts

**F0.1. The documents on analysis of evaluation of environmental impact of the project, including transboundary impact, according to the procedures determined by the Party on the territory of which the project is to be implemented.**

According to ecologic norms of Ukraine natural gas emissions into the air are not considered polluting. Therefore no ecologic permits are required. The only environmental impact is reduction of natural gas emissions into the air.

Implementation of this project will allow increasing safe operation of gas equipment, which in its turn will reduce probability of explosions or fires. Experience of JSC Odesagas employees and observance of PBSGU norms will allow reduction to minimum of the probability of emergencies during the project implementation.

Transboundary effects from project activity according to their definition in the text of the Convention on Transboundary Pollution At Big Distances ratified by Ukraine will not take place.

The project implementation does not provide for any harmful environmental impacts.

**F0.2. If the environmental impact is considered to be big by the project participants or by the Party on the territory of which the project is implemented, please give the conclusions and all references for support of the documents on evaluation of environmental impact done in accordance with the procedure to be done as required by the Party:**

**The project implementation does not provide for any harmful environmental impacts.**

## SECTION G. Stakeholders' comments

### G0.1. Information about Stakeholders' comments:

**Consulting was done with the specialists of the Institute for Market Problems and Economic and Environmental Surveys of the NAS of Ukraine. No Stakeholders' comments were received. The project activity does not imply any negative environmental impact and negative social effect.**

Annex 1

**Contact information on project participants**

**Supplier:**

| | |
|---|---|
| Company: | JSC Odesagas |
| Street, p.o. box | Odariya Street |
| Building: | 1 |
| City: | Odesa |
| State/region | Odessa region |
| Zip-code | 65003 |
| Country | Ukraine |
| Telephone | +(380) 48 734 07 38 |
| Fax | |
| Website | odgaz.odessa.ua |
| Represented by | |
| Position | Executive Director |
| Reference | |
| Last Name | Gerasimenko |
| Patronymic | Oleksandrovych |
| First Name | Vitaliy |
| Department: | |
| Direct fax | |
| Direct telephone | |
| Cellphone | +38(050)316 53 17 |
| Personal e-mail | |

**Partner - Buyer**

| | |
|---|---|
| Company: | VEMA S.A. (Registered in Switzerland, 26th of September 1994) |
| Street, p.o. box | Route de Thonon |
| Building: | 45 |
| City: | Geneva |
| State/region | |
| Zip-code | Case postale 170 CH-1222 Vésenaz |
| Country | Switzerland |
| Telephone | +41 (22) 855 09 69 |
| Fax | +41 (22) 855 09 79 |
| E-mail | vema@bluewin.ch |
| Website | |
| Represented by | |
| Position | Director |
| Reference | MR. |
| Last Name | KNODEL |
| Patronymic | |
| First Name | FABIAN |
| Department: | |
| Direct fax | |
| Direct telephone | +41 (22) 855 09 79 |
| Cellphone | +41 (22) 855 09 69 |
| Personal e-mail | VEMA@BLUEWIN.CH |

## Annex 2

## Baseline Information

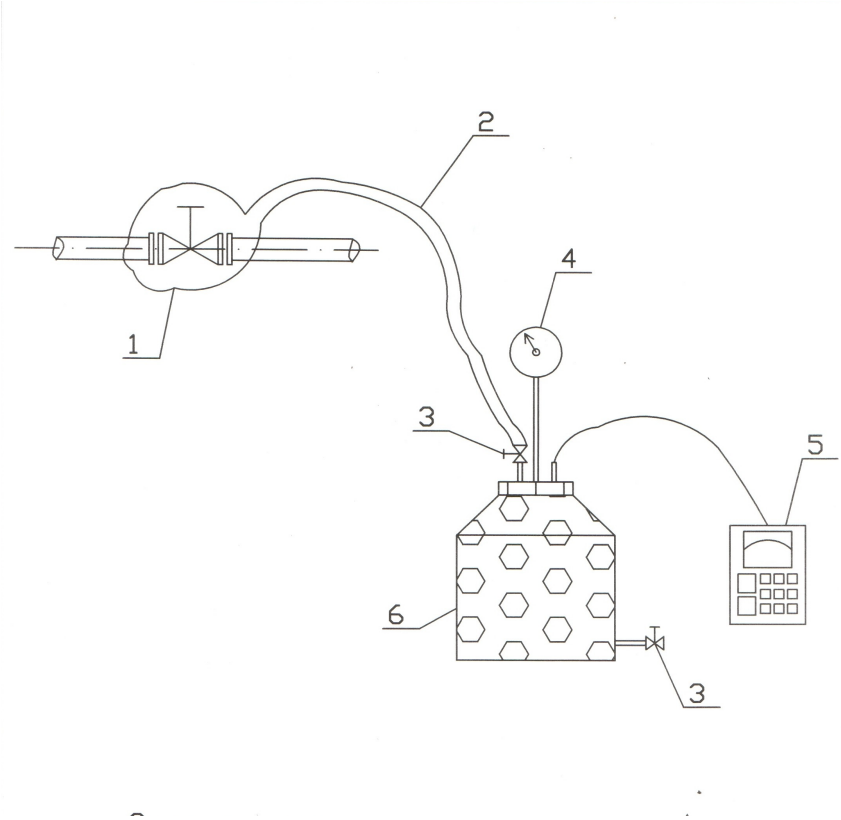
Key information for determination of baseline is given in the tables of section B.1.

Annex 3

**Monitoring plan**

Because of the absence of method and equipment for determination of methane leaks through the leakage in the equipment in Ukraine at the moment of project beginning, ETI "Biotekhnika" of UAAN developed a plant on the basis of an insulated tank and gas analyzer EX-TEC® SR5.

The diagram of a plant is shown on the Picture 7.




***Pic. 7 Diagram of Methane Leakage Measurement Plant***

References:
1. Insulated bag
2. Hose
3. Cock
4. Pressure gauge
5. Gas analyzer EX-TEC® SR5.
6. Insulated reservoir

**Methane leakage measurement procedure**

The team:
Master of the maintenance service of street gas pipelines and house inlets (MSSG HI);
Locksmith for operation and repair of gas equipment at GDU – 2 persons;
MSSG HI locksmith – 1 person.

Required materials and equipment:

1) Wrenches, tools;
2) High-sensitive gas analyzer EX-TEC® SR5 – 1 piece;
3) Insulated tank, insulated bag, hose, sealant, adhesive tape (Skotch tape);
4) Pressure gauge
5) Thermometer
6) Stopwatch
7) Fire extinguisher

Procedure for natural gas leakage measurement at the equipment of gas regulating unit (GRU):

1. To mount the tank (6). To put plastic bag (1) on the measured element (bolt, filter, pressure controller etc.)
2. To connect the bag and the tank with hose (2). To seal joints with adhesive tape for tightness. To measure methane concentration in the tank.
3. To open cock (3).
4. To determine the time of tank filling with methane using the stopwatch.
5. Measurement should be stopped when concentration in the tank reaches 1% of CH4. In case of small leaks in order to save time measurements are stopped after certain time from the beginning (at least in 2 min), and fixation of methane concentration by the end of measurement is done.
6. Gas concentration in the tank is determined using high-sensitive gas analyzer EX-TEC SR-5 (2).
7. Gas pressure is controlled by means of pressure gauge D-59N-100-1.0 6 kPa.
8. After measurement the cock (3) should be shut down. To disconnect the tank from the hose. To open cocks (3) and (7) for ventilation. To repeat measurement for at least three times.
9. After completion of measurements, to eliminate detected gas leaks and to repeat measurement.

**PROGRAM**
**of initial monitoring measurement for switch mechanisms (cocks, valves, bolts), flange and threaded joints of gas distribution networks of JSC Odesagas**

**Content:**
The purpose of initial measurement is:

1. Obtainment of more reliable evaluation of methane leakage volume from the system (EXCEPT FOR leakage connected with operation, technical maintenance or accidents), and in the result of that – determination of potential profit from the JI Project, and the volume of repair works/replacement of equipment which can be required subject to advantageous payback term of investments made to the project.
2. determination of priorities for works to be done at the objects, and for their distribution among these objects;
3. Piling up of some initial experience in using measurement equipment, determination of issues to be solved or improved (such as additional measurement equipment, accuracy level, necessary training of responsible workers) before the beginning of the project to ensure its proper operation.

JIP depends on the determination, measurement, elimination and monitoring of leakage. In case when measurements are required, the most important question at the initial stage is receipt of demonstrative example of leaks at shut-off station and gas distribution networks. If full examination of all elements at each station is unreasonable, it is necessary to select the most demonstrative and typical elements. For example, station workers shall have a grounded opinion as to the equipment being the best solution for particular objects and under which conditions, - these two questions are subject to verification. Some questions shall be systematically determined during the initial measurements:

- Where are leaks, their size (instructions for specialized use of metering devices shall be attached in the maximal possible amount);
- in which places the leakage is not big;
- Where the possibilities for repair and/or replacement (of such equipment as gaskets and flanges) require insufficient costs;
- Where are the biggest leaks elimination of which will not require big costs.

Qualitative information (e.g., difficulties in taking measurements at particular valves because of limited access to them) shall be also recorded where possible in order to facilitate project planning and fulfilment. Flow meters shall provide a possibility of data saving and loading; if there is such an option, it shall be used in addition to manual registration of meter readings. Nomination/numeration system shall be agreed BEFORE THE BEGINNING of measurements.

The tables given below shall be of explanatory and actual character, and not of ordering and regulatory character.

**Measurement devices the leaks have been measured by:**

1. Calibrated insulated bag of known capacity: bag capacity ____ $m^3$ at the pressure of ___ kPa.
2. Gas analyzer EX-TEC® SR5.
3. Pressure gauge
4. Thermometer
5. Stopwatch

**Monitoring Group:**

1. _____
2. _____

3. _____
4. _____

**Management Board** _____

**Table 1Information about the object ____**

A logbook of technical check-up of equipment (logbook for maintenance done by the trackmen) is maintained - once in four days, by the appropriate responsible worker. Leaks are indicated in the logbook of reports. Gas contamination is determined by using gas detector for the purpose of conformance to the requirements of UGSSR for prevention of accidents.

Regular repair is done once per year, technical maintenance – once per six months.

| Object (object code according to the register) | Gas pressure at the inlet/outlet (MPa) | Gas temperature at the inlet/outlet, °C | % $CH_4$ (methane) in gas |
|---|---|---|---|

**Table 2 Report on leaks at _____**

| Serial No. | Position | Measurement of air flow sample | | Time of calibrated bag filling, sec | Methane leaks per hour, $m^3/h$ | Annual, tCO2/hour |
|---|---|---|---|---|---|---|
| | | Initial concentration, % | Sample concentration, % | | | |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| | | | | | | |

Explanations to Table 2

(1) Serial number of equipment according to the register
(2) Address of equipment
(3) Initial concentration – methane concentration in the insulated reservoir before the beginning of measurement (vol. %)
(4) Sample concentration – methane concentration in the insulated reservoir after the completion of measurement (vol. %)
(5) Time of filling (seconds)
(6) Methane leaks are calculated by the formula (1)
(7) Annual methane leaks are calculated by the formula (2)

**Reduction of methane volumes to standard conditions**

Methane leakage volumes received in the result of measurements are reduced to standard conditions ($R_н$ = 0,1013 MPa, $T_н$ = 273 K) by the formula:

$$F_{CH_4} = \frac{F \cdot 273 \cdot P}{0{,}1013 \cdot (273 + t)}$$

where $F$ – methane leakage volume, $m^3$/hour;
$P$ – gas pressure in the tank, MPa;

$t$ – gas temperature in the tank, °C.