**CLEAN DEVELOPMENT MECHANISM**
**PROJECT DESIGN DOCUMENT FORM (CDM-PDD)**
**Version 03 - in effect as of: 28 July 2006**

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## SECTION A. General description of project activity

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

Reducing gas leakages within 'Tiraspoltransgaz-Pridnestrivie' LLC gas distribution network, Transnistria/Republic of Moldova
Version 1.3
07/02/2012

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

**Purpose**

The proposed CDM project aims to reduce gas leakages from "above ground" components in 'Tiraspoltransgaz-Pridnestrivie' LLC gas distribution network, Transnistria/ Republic of Moldova. Gate and pressure regulation stations within the distribution network reduce and maintain the gas pressure for delivery to consumers. At these facilities, a small percentage of the natural gas throughput typically leaks from equipment and is released into the atmosphere contributing to the global warming. Thus, the project will lead to reductions of greenhouse gas (GHG) emissions, namely methane emissions, minimising its contribution to climate change.

The project will be implemented across the distribution network served by 7 branches 'Tiraspoltransgaz-Pridnestrivie' LLC.

Leaks in the distribution system are caused by normal equipment wear, thermal and vibrational stresses and seasonal expansion/contraction cycling from ambient air temperature changes. Methane emissions occur through various sources including, ball/gate/plug valves, flanges, and threaded fittings. Many of these components are not routinely checked under existing safety practices of 'Tiraspoltransgaz-Pridnestrivie' LLC. The company operators lack the advanced leak detectors and trained workers to identify chronically leaking components, accurately measure the leak rates and make reliable repairs of the leaks.

The project will lead to reduction of methane emissions at the valves with stem packing. Mo other GHG emission reductions are included in the project boundaries.

**Scenario existing prior to the start of the implementation of the project activity**
According to current practice, capital repairs and maintenance activities in the gas distribution network are carried out to ensure reliable and safe transmission of gas to consumers. In other words, the inspection and maintenance of the distribution network is not performed because of either economic losses or environmental impacts caused by actual gas leakage. 'Tiraspoltransgaz-Pridnestrivie' LLC does not have economic or administrative incentives to detect and reduce chronic leaks using up-to-date technologies and sealing materials.

**Project scenario**

The project activity will reduce natural gas leakage in the distribution network of Transnistria through the implementation of advanced leak detection and repairs procedures. The project activities will include inspection and leak measurements, as well as repair works at "above-ground" facilities in the distribution system. Specifically leaks will be repaired with the use of the modern Gore-Tex sealing materials (see more details in the section A 4.3). In addition, selected staff of 'Tiraspoltransgaz-Pridnestrivie' LLC will be trained in advanced leak detection, measurement, and repair techniques. Project boundaries are described in details in the Section B.3.

Baseline scenario is the same with the scenario existing prior to the start of the project activity.

**Contribution to Sustainable Development**

Natural gas leaks result in emissions of methane ($CH_4$) into the atmosphere. The implementation of the project is expected to reduce these emissions by 1,639,300 $tCO_2e$ over a ten-year crediting. In addition to reducing greenhouse gas emissions, this project will also contribute to Transnistria/Republic of Moldova sustainable development goals by:

- Improving environmental quality and minimising risks for employees and local communities due to the reduction of harmful pollutants (methane);
- Preserving a finite resource (natural gas). The reduction in gas losses will mean that the same amount of service can be provided to customers of 'Tiraspoltransgaz-Pridnestrivie' LLC but with a lesser amount of gas required. Using a finite resource more efficiently, and thus preventing waste of that resource, is an important example of sustainable development;
- Capacity building of the local staff in advanced leak detection, measurements and repair techniques;
- Strengthening human capital in the country through retention and employment of locals to support the project implementation (leak measurement program, repair works, and monitoring).

Reducing waste such as leaking natural gas from the distribution system is an important step in improving resource efficiency and reducing dependence on expensive and volatile foreign sources of energy.

## A.3. Project participants:

**Table 1 List of the Project Participants**

| Name of Party involved (*) (host) indicates a Host Party) | Private and/or public entity(ies) project participants (*) (as applicable) | Kindly indicate if the Party involved wishes to be considered as project participant (Yes/No) |
|---|---|---|
| Republic of Moldova (Host) | 'Tiraspoltransgaz-Pridnestrivie' LLC | No |
| Denmark | Danish Carbon Assets ApS | No |
| (*) In accordance with the CDM modalities and procedures, at the time of making the CDM-PDD public at the stage of validation, a Party involved may or may not have provided its approval. At the time of requesting registration, the approval by the Party(ies) involved is required. | | |

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

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

The project is hosted by the 'Tiraspoltransgaz-Pridnestrivie' LLC – the company which operates gas distribution network of Transnistria/Republic of Moldova. The company's headquarters is based in Tiraspol with the coordinates of 46.5025°N, 29.3836°E [1].

[1] http://en.wikipedia.org/wiki/Tiraspol

The project will be implemented across the Transnistria network composed of 7 branches of gas distribution company. This network covers all regions of the Transnistria/Republic of Moldova.

This network covers all regions of Transnistria (Figure 2). Such geographical scope of the project has been decided, as 'Tiraspoltransgaz-Pridnestrivie' LLC manages the whole distribution system in Transnistria; consequently, their objective is focused on improving the whole network. Additionally, the feasibility study was conducted on different parts of the system (in all branches), which illustrated that leakage was prevalent across the network.

**Figure 1 Map of Transnistria (location and regions)**

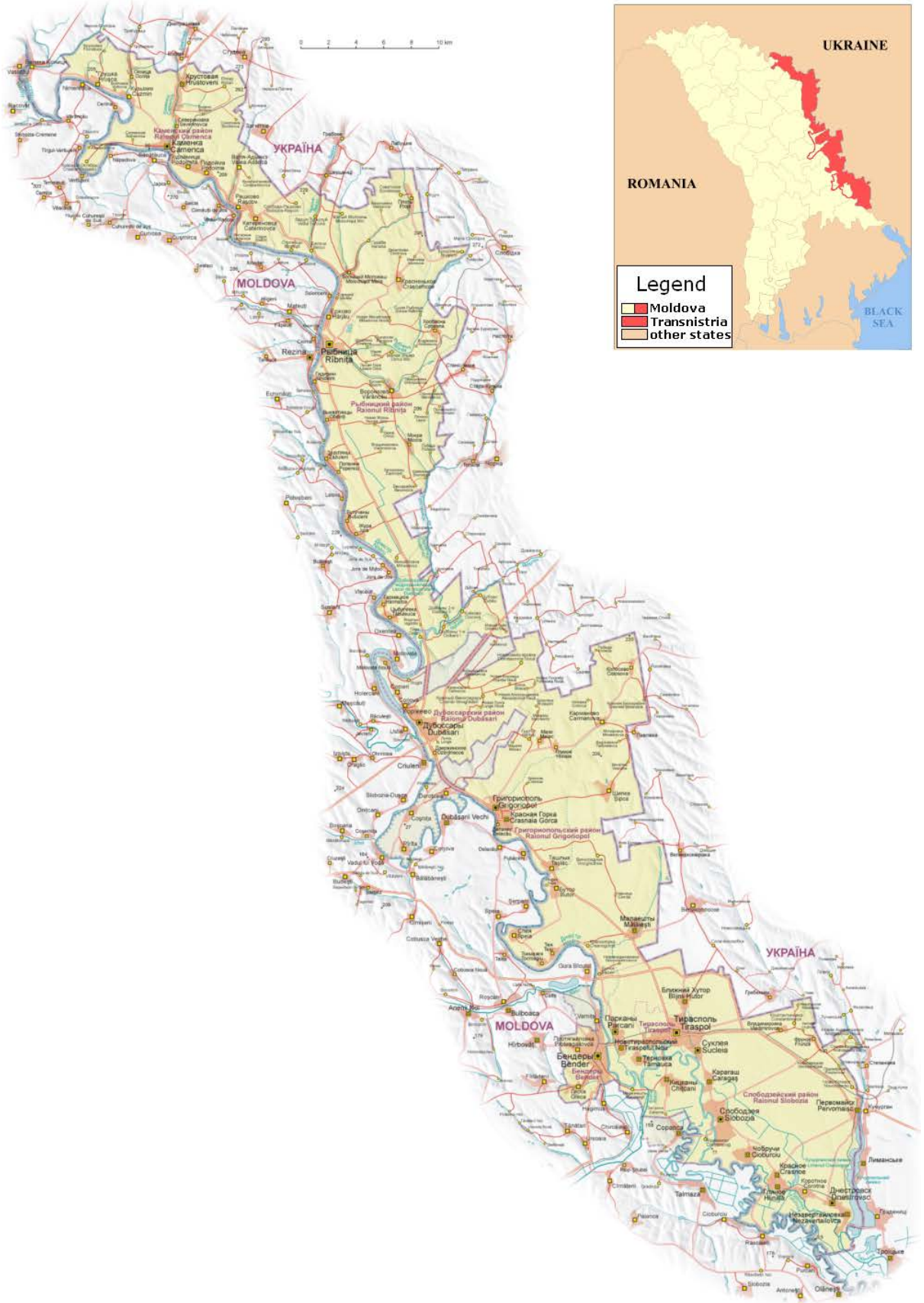
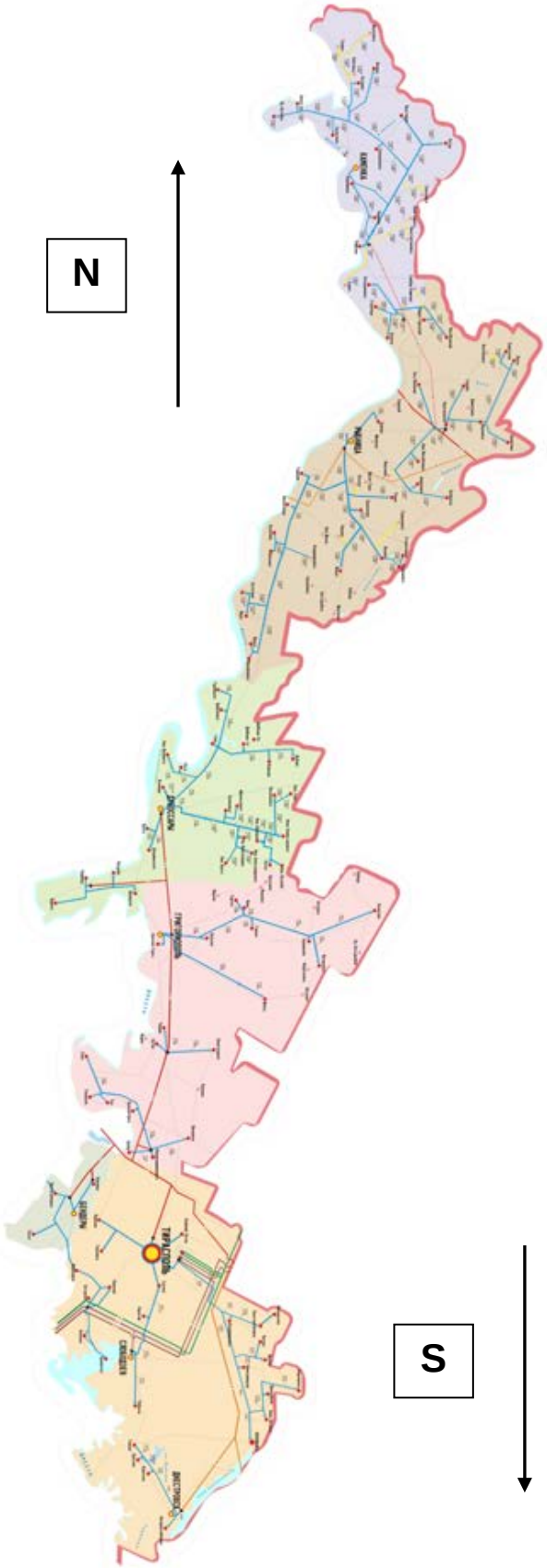


**Figure 2 Map of Gas Network System in Transnistria**



**A.4.1.1. Host Party(ies):**

Transnistria/Republic of Moldova

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

All the regions of Transnistria/Republic of Moldova.

The following is a list of 'Tiraspoltransgaz-Pridnestrivie' LLC branches are included in the project boundaries.

**Table 2 List of the Branches/Regions Included in the Project Boundaries**

| No | Branches of the company / Regions |
|---|---|
| 1 | 'Tiraspoltransgaz-Pridnestrivie' LLC, Tiraspol |
| 2 | 'Tiraspoltransgaz-Pridnestrivie' LLC, Bendery |
| 3 | 'Tiraspoltransgaz-Pridnestrivie' LLC, Slobodzeya |
| 4 | 'Tiraspoltransgaz-Pridnestrivie' LLC, Grigoriopol |
| 5 | 'Tiraspoltransgaz-Pridnestrivie' LLC, Dubossary |
| 6 | 'Tiraspoltransgaz-Pridnestrivie' LLC, Rybnitsa |
| 7 | 'Tiraspoltransgaz-Pridnestrivie' LLC, Kamenka |

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

All cities, towns, communities within the indicated regions are included in the project boundaries.

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

The physical location for this project activity includes all valves with stem packing installed at the surface equipment of the gas distribution system of 'Tiraspoltransgaz-Pridnestrivie' LLC, such as:

- High pressure gas regulation points (GRPs) - 133 units;
- Cabinet type gas regulation points (CTRPs) - 2,549 units; and
- Stand-alone valves with stem packing - 1,447 units.

Geographical coordinates of Northern, Southern, Western, and Eastern furthest points of Transnistria/Republic of Moldova are as follows[2]:

1. North: 48°10′N; 28°34′E
2. South: 46°33′N; 29°54′E
3. West: 48°09′N 28°30′E
4. East: 46°49′N; 29°58′E

[2] Coordinates are determined with the use of Google Earth program - http://www.google.com/earth/index.html

The exact locations of all the identified and repaired leaks will be recorded in the monitoring system database.

The project participants have undertaken the baseline leak survey in all branches of 'Tiraspoltransgaz-Pridnestrivie' LLC for preparation of this PDD.

The Figures (3-5) present illustrative examples of components/units measured during the survey, and which will form the project activity.


**Figure 3 High Pressure Gas Regulation Point**


**Figure 4 Cabinet Type Gas Regulation Point**


**Figure 5 A Stand-Alone Valve with Stem Packing**

## A.4.2. Category(ies) of project activity:

**Project Type:** "Leak reduction from natural gas pipeline compressor or gate stations" (AM0023 version 03)

**Project Category:** Sectoral Scope 10 – Fugitive emissions from fuels (solid, oil and gas)

## A.4.3. Technology to be employed by the project activity:

The project activity proposes to establish a systematic advanced leak detection and measurement plan and procedure using best available techniques. The following table provides a summary of the

technologies that are currently used by 'Tiraspoltransgaz-Pridnestrivie' LLC and those to be utilised under the project:

**Table 3 Comparing of Technologies Before and After Project Implementation**

| Maintenance practice | Technology used before project implementation | Equipment / technology to be implemented |
|---|---|---|
| Leak detection and measurement | Leak detector devices: mine interferometers ShI-11, electronic detecting devices - STX 17-6; STX 17-80; SGG -20; IT-M; FP-12.<br>Soap solution, sniff test.<br>Leak measurement devices: None. | ▪ GMI Gassurveyor™ (500 Series)<br>▪ Hi-Flow™ Sampler |
| Leak repair | Repairs are performed due to emergency/safety requirements, with the use of outdated sealing materials, namely sealant ТУ 2573-265-00149363-2005 which is linen twisted cord filled with oil. | ▪ GORE® sealing materials |

**Baseline leak survey (feasibility study):**
The feasibility study was conducted on August 08-18, 2011. The measurements using methane detectors Gassurveyor™ 3500, were taken in all seven 'Tiraspoltransgaz-Pridnestrivie' LLC branches: Tiraspol, Bendery, Slobodzeya, Grigoriopol, Dubossary, Rybnitsa, Kamenka. Details on the equipment used are provided below, under the Project Technology heading. All leaks identified on the valves (those that screened above 0.5% methane in air) were tagged and numbered. Once leaks were identified, leak rate measurements were made using the Hi-Flow™ sampler. Digital photos of Hi Flow Sampler screen reading were taken for every measured leak. Based on this approach, 160 leaking valves were identified; further details are provided in the Annex 3.

**Baseline Technology:**

Section B.4 discusses in detail the current practice of detecting leaks of natural gas and measures employed to eliminate leaks.

**Project Technology:**

The project involves state-of-the-art technology to detect, measure (via concentration and flow rate) and repair leaks. Detected and repaired leaks will be tagged, logged manually and electronically, and stored in the database every year. Digital photos of each leaking component shall also help in locating and knowing conditions before and after the repair of leaks have taken place. The section below explains briefly the technical highlights of the advanced equipment to be used in the project.

***1. Leak Detection technology:***

During the baseline survey, leaks were detected using catalytic oxidation/thermal conductivity detectors; GMI Gassurveyor™ (500 Series) (Figure 5). The GMI Gassurveyor™ (500 Series) is a highly flexible, portable gas detector designed as per latest standards and is certified for use in hazardous areas. The detector has LCD screen with automatic backlighting, audio, visual and fault alarms and are one of the state-of-the-art gas


**Figure 6 Gassurveyor Model**

detectors.[3] During the monitoring phase, all project inspections will be carried out with accuracy not less than that of the GMI Gassurveyor™ (500 Series).

***2. Leak Measurement technology:***

For leak measurements, Hi-Flow™ samplers will be applied.[4] Hi-Flow™ samplers (Figure 6) capture all the emissions from a leaking component to accurately quantify leak emissions rates. Leak emissions, plus a large volume sample of the air around the leaking component, are pulled into the instrument through a vacuum sampling hose. A dual-element hydrocarbon detector (catalytic-oxidation/ thermal-conductivity) measures hydrocarbon concentrations in the captured air stream ranging from 0.01 to 100 percent. Sample measurements are corrected for the ambient hydrocarbon concentration, and mass leak rate is calculated by multiplying the flow rate of the measured sample by the difference between the ambient gas concentration and the gas concentration in the measured sample. Hi-Flow™ samplers measure leak rates up to 10.5 cubic feet per minute (0.297 $m^3$), (equivalent to 15.1 thousand cubic feet (428.2 $m^3$) per day), with the accuracy of calculated leak rate of +/- 5%.

**Figure 7 High-flow Sampler**

***3. Advanced Leak Repair Material:***

After the leak is detected, the actual repair works on leaks can vary from replacing seals, fittings, valves and other leaking components or replacing entire equipment sets.

The project activity proposes to use advanced and environmentally safe materials made from expanded polytetrafluoroethylene (PFTE) under license of W.L. Gore & Associates, Inc. Technical features of this material are presented below based on excerpts from the manufacturer:

- GORE® Valve Stem Packing is a pliable, self-lubricating packing that eliminates stem wear and lasts indefinitely. This continuous-length packing installs easily and forms a cohesive cylinder when compressed, eliminating the need to cut and form rings. In most cases, it is not necessary to remove the valve form service, and no disassembly is required. When GORE® valve stem packing is wound around a valve stem, pushed into the stuffing box and compressed by tightening the gland nut, it is compacted into a high-density packing.


**Figure 8 GORE® sealing material**

[3] See technical details http://www.heathus.com/_hc/index.cfm/products/gas/gasurveyor-500-series

[4] See technical details http://www.heathus.com/_hc/index.cfm/products/gas/hi-flow-sampler

The result is a perfect, high-precision fit and a packing that fills flaws and irregularities — including those caused by wear. Once installed, a slight turn on the gland nut is all the maintenance that is usually required.

- GORE® Valve Stem Packing offers a high degree of pliability, allowing the packing to conform to worn valve stems and stuffing boxes. GORE® Valve Stem Packing will not deteriorate with age, has a low coefficient of friction, and withstands temperatures from -268°C to +343°C. This soft, flexible packing is unaffected by all common chemicals and will not contaminate product flow. The softness and self-lubricating nature of GORE® Valve Stem packing practically eliminates stem wear.[5]

Implementation of GORE® sealing material is a significant improvement compared to the current approach of tape, grease, graphite lubrication and other sealing materials. Implementation of this new sealing material that does not dry out is expected to significantly reduce re-emergence of leaks in the system between regular maintenance inspections. Manufacture performance data shows that seal integrity is maintained for up to 10 years, as opposed to 1-3 months for the currently used materials.

### A.4.4. Estimated amount of emission reductions over the chosen crediting period:

**Table 4 Estimation of Emission Reductions**

| Year | Annual estimation of emission reductions in tonnes of $CO_2e$ |
|---|---|
| **2012 (4 months)** | 54,681 |
| **2013** | 164,043 |
| **2014** | 164,043 |
| **2015** | 164,043 |
| **2016** | 164,043 |
| **2017** | 164,043 |
| **2018** | 164,043 |
| **2019** | 164,043 |
| **2020** | 164,043 |
| **2021** | 164,043 |
| **2022 (8 months)** | 109,362 |
| **Total estimated reductions** (tonnes of $CO_2e$) | **1,640,430** |
| **Total number of crediting years** | **10 years** |
| **Annual average over the crediting period of estimated reductions (tonnes of $CO_2e$)** | **164,043** |

### A.4.5. Public funding of the project activity:

No public funding has been provided.

[5] http://www.gore.com/en_xx/products/sealants/packing/gore-tex_valve_stem_packing.html

## SECTION B. Application of a baseline and monitoring methodology

### B.1. Title and reference of the approved baseline and monitoring methodology applied to the project activity:

Approved baseline and monitoring methodology AM0023 Version 03:
"Leak reduction from natural gas pipeline compressor or gate stations"

The methodology above refers also to the "Tool for the demonstration and assessment of additionality" Version 05.2.1.[6]

### B.2. Justification of the choice of the methodology and why it is applicable to the project activity:

The rationale behind the choice of the approved methodology AM0023 version 03 is that the project activity meets all its applicability conditions. Table 1 explains the relevancy of the selected methodology to the proposed project activity in Transnistria/Republic of Moldova.

**Table 5 Relevancy of the selected methodology to the proposed project activity**

| Applicability condition | Relevancy to the project activity |
|---|---|
| This methodology is applicable to project activities that reduce leaks in natural gas pipeline compressor stations and gate stations in natural gas long-distance transmission systems, as well as to other surface facilities in gas distribution systems including pressure regulation stations by establishing advanced leak detection and repair practices. | The scope of the project activity includes the reduction of gas leaks from the valves with tem packing installed at the surface facilities in the gas distribution systems of 'Tiraspoltransgaz-Pridnestrivie' LLC, including pressure gas regulation points; and stand-alone valves with stem packing.<br><br>Using the Hi-Flow Sampler and other advanced technologies provided by the project, the project developers have already undertaken an initial study to identify and quantify leak rates. Furthermore, the project activity includes equipping 'Tiraspoltransgaz-Pridnestrivie' LLC staff with advanced measurement, detection equipment and repair materials, and training them in the use of these equipment and materials. As a result of the project implementation, advanced leak detection and repair practices will be established, ensuring that repaired leaks do not re-emerge.<br><br>**Outcome**: The project activity meets the applicability condition. |
| This methodology is applicable to project activities that reduce leaks (…):<br>▪ Where natural gas pipeline operators have no current systems in place to systematically identify and repair leaks; | Currently, 'Tiraspoltransgaz-Pridnestrivie' LLC has no systematic methodology to identify and repair chronic leaks that are present in the distribution network. According to existing rules (e.g., «Safety Regulations in Gas Service», «Rules of the Technical Maintenance in Gas Industry») and established practice, leak detection and maintenance works are focused on ensuring reliable and safe transmission of gas to consumers. Existing regular inspection and maintenance (I&M) procedures only detect a fraction of leaks (mainly large leaks presenting an immediate safety hazard) occurring in the system and eliminate them temporarily. Leaks often re-occur between regular inspections because sealing materials of a relatively low quality are used. As a result of the project, a new systematic and rigorous program for leak identification, measurement and repair will be implemented using advanced, technologies, materials and techniques. This program will be designed on top of the existing minimal I&M procedures carried out by 'Tiraspoltransgaz-Pridnestrivie' LLC.<br><br>**Outcome**: The project activity meets the applicability condition. |

[6] http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-01-v5.2.1.pdf

| Applicability condition | Relevancy to the project activity |
|---|---|
| This methodology is applicable to project activities that reduce leaks (…):<br>▪ Where leaks can be identified and accurately measured; | The initial baseline survey of leaks in support of this PDD was carried out using, advanced equipment for gas leak detection and measurement; proving that leaks in 'Tiraspoltransgaz-Pridnestrivie' LLC distribution network can be identified and accurately measured (*see* Project Technology in Section A.4.3). This approach is in full accordance with AM0023 v3.<br><br>During the full scale project implementation and monitoring phases, the same leak detection and measurement technologies, as during the baseline survey, will be used (i.e. Hi-Flow™ samplers).<br><br>**Outcome**: The project activity meets the applicability condition. |
| This methodology is applicable to project activities that reduce leaks (…):<br>▪ Where a monitoring system can be put in place to ensure leaks repaired remain repaired. | The monitoring system to be employed by the project proponents will be in compliance with the monitoring methodology of AM0023. The system, which is described in further sections of this document (*see* B.7.2, Annex 4), will ensure that 100% of previously visited components will be re-visited to make sure that all the repaired leaks stay repaired and no new leaks have emerged.. That ensures that leak repaired remain repaired.<br><br>**Outcome**: The project activity meets the applicability condition. |

## B.3. Description of the sources and gases included in the project boundary:

AM0023 requires that the boundary will be the physical gate stations, and other surface facilities in the gas distribution system, including pressure regulation stations.

During baseline feasibility, all types of gas distribution equipment were checked for potential leaks:

- High pressure gas regulation points (GRPs) – 133 points:
- Cabinet type regulation points (CTRPs) – 2,549 points;
- Stand-alone valves with stem packing – 1,447 valves.

In total, approximately, 10.5 percent of all GRPs, 2.3 percent of all cabinet-type regulation points, and 1.5 percent of stand-alone valves with stem packing were inspected. Detailed information regarding the survey which was undertaken in provided in the Annex 3.

As such, this project boundary encompasses the following:

1. All valves with stem packing in high pressure gas regulation points (GRPs) and in cabinet type pressure regulating points (CTRPs) – 3,388 valves in total.
2. Stand-alone valves with stem-packing – 1,447 valves

The project boundary will not include new sections in the distribution network, constructed after CDM project baseline definition. Thus the number of components within the project boundary will always remain the same as at the start of project implementation.

Based on this classification, the following figure presents the gas distribution network components, and CDM project boundary.

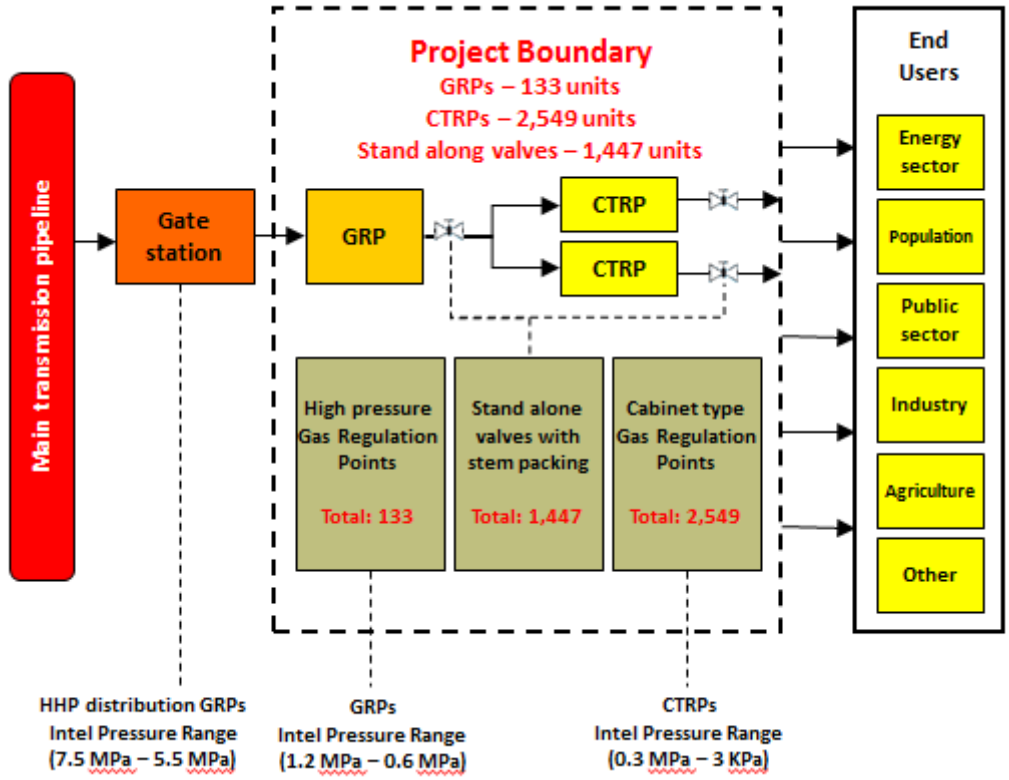



**Figure 9 'Tiraspoltransgaz-Pridnestrivie' LLC distribution network components and CDM project boundary**

During the full scale implementation of the project each above ground location will be tagged with unique number for the purposes of easy identification and monitoring, as required by the methodology.

The following leaks at the indicated components are not included in the project boundaries:

- Leaks that should be repaired due to emergency/safety requirements;
- Leaks that would be repaired as a part of annual equipment replacement program;
- Leaks that can be detected and repaired with the use of existing leak detection and repair technologies**.**

More details regarding these criteria are provided in the Section B 6.1.

**Table 6 List of the Greenhouse Gasses Included in the Project Boundaries**

| | Source | Gas | Included? | Justification / Explanation |
|---|---|---|---|---|
| Baseline | Fugitive emissions | $CO_2$ | No | Not relevant |
| | | $CH_4$ | Yes | This project activity will reduce emissions of methane from gas distribution facilities, which are above ground. This project covers only unintentional fugitive methane emissions, which will be recorded during the full project implementation and monitoring stages. |
| | | $N_2O$ | No | Not relevant |
| Project Activity | Fugitive emissions | $CO_2$ | No | Not relevant |
| | | $CH_4$ | Yes | The monitoring system prescribed by the methodology is designed to ensure no methane is escaping from identified and repaired leaks. If a repaired leak re-emerges, it is conservatively assumed that that the leak resumed at the same flow rate the day after the last inspection, or in case of the first inspection, the day after the repair has taken place. Thus, leaks where the repair failed are excluded from emission reductions from the day after the last inspection. |
| | | $N_2O$ | No | Not relevant |

**B.4. Description of how the baseline scenario is identified and description of the identified baseline scenario:**

The approved methodology AM0023 (Version 03) requires project proponents to follow the latest approved version of the "Tool for the demonstration and assessment of additionality," in order to identify the most plausible baseline scenario for the project activity.

**Identification of candidate baseline scenarios**

The main services provided by 'Tiraspoltransgaz-Pridnestrivie' LLC are importing, transmission and delivery of natural gas to consumers at specified pressures and volumes. Given the nature of this type of project, the proposed project activity has only three feasible baseline scenario alternatives:

1. Continuation with existing practices of leak detection and routine maintenance;
2. The proposed project is not implemented as a CDM project; and
3. Similar efforts have been made or are expected to be made to reduce methane leaks from key components, using similarly capable leak detection and measurement technology as described in AM0023.

**Scenario 1: Continuation with existing practices of leak detection and routine maintenance**

Brief Description of Current Leak Detection and Repair Procedures

Current leak detection and repair practices are limited in scope. 'Tiraspoltransgaz-Pridnestrivie' LLC does have a "planned" maintenance schedule where teams within each of its subsidiaries are tasked with checking different parts of the network per according to an established schedule (e.g., gas regulation point (GRPs) and cabinet-type regulation points (CTRPs) are being inspected once or twice

per week). However, there is no rule or specification on what type of maintenance should actually be implemented. There is also no limit on how much a component can leak before it is declared un-safe. In practice, repairs are implemented mainly out of safety concerns, and due to compliance with legal requirements, including:

- «Safety Regulations in Gas Service»; Order # 477 Ministry of Justice of October 17, 2001;
- «Rules of the Technical Maintenance in Gas Industry», Order # 578 Ministry of Justice of December 28, 2001.

As defined by this regulation, the main reason to reduce gas leaks is to meet safety requirements. There are no taxes or penalties for distribution gas losses in Transnistria/ Republic of Moldova.

'Tiraspoltransgaz-Pridnestrivie' LLC operators do not currently possess advanced leak detection and measurement devices, such as the tools prescribed by AM0023, which would enable staff to effectively identify the source and accurately quantify the volume of leakage. Currently, all 'Tiraspoltransgaz-Pridnestrivie' LLC branches have hydrocarbon leak detectors in stock, such as: mine interferometers ShI-11, electronic detecting devices - STX 17-6; STX 17-80; SGG -20; IT-M; FP-12. However, these detection devices are technically old, and their quantities are insufficient for widespread use; consequently, the examination of leaks is primarily undertaken using soap solution.

If repair is required, work is carried out using outdated and ineffective materials. Specifically, valve stems are repaired using the following material: twisted cord of flax treated with oil. However, according to 'Tiraspoltransgaz-Pridnestrivie' LLC staff, these materials lose their sealing ability relatively quickly due to several factors, such as:

- Poor material quality and inadequate sealing;
- Differences in pressure (cyclic load on the seal); and
- Weather changes.

Despite the existence of a procedure for detecting gas leaks and eliminating them, 'Tiraspoltransgaz-Pridnestrivie' LLC does not apply systematic tagging and numbering of leaks, and there is no single leak database which would enable thorough analysis of the situation to inform decision making. Furthermore, in many instances, the maintenance teams do not report recurring leaks due to the incorrect perception that management may feel that they are underperforming and not carrying out their jobs properly. Thus current system fails to ensure systematic detection and repair of all the leaks at 100% of components, as was evidenced during the initial baseline survey conducted in support of this PDD. Even though 'Tiraspoltransgaz-Pridnestrivie' LLC has procedures in place, during the survey over 161 leaks at the valves with stem packing were found at 98 sites; highlighting the inadequacy of existing inspection and maintenance (I&M) methods.

Additionally, 'Tiraspoltransgaz-Pridnestrivie' LLC is not able to take necessary actions toward comprehensive leak elimination due to a constant lack of financial resources (see also additionality justification in B.5.), and leak elimination is mainly limited to low-cost measures like valve tightening, re-greasing or sealant replacement, which often fail to provide lasting solutions due to poor quality materials.

The continuation of the current practice described above is the most economically attractive course of action at present.

**Scenario 2: The proposed project is not implemented as a CDM project**

This scenario is discussed in detail in Section B.5 in relation to the additionality assessment of the proposed project activity. As described above, 'Tiraspoltransgaz-Pridnestrivie' LLC staff lacks technical resources to comprehensively and accurately detect, measure and repair leaks in the gas

distribution system. There is no systematic detection and repair program employed by 'Tiraspoltransgaz-Pridnestrivie' LLC operators, to effectively and comprehensively reduce chronic leaks from above-ground components. In addition, obsolete equipment is being used to perform routine inspections, which are driven by safety and equipment maintenance concerns, rather than leak quantification and minimization.

'Tiraspoltransgaz-Pridnestrivie' LLC recognizes the issue of gas leakage in its distribution system. However, 'Tiraspoltransgaz-Pridnestrivie' LLC lacks the necessary funding to implement these activities.

Therefore, this scenario although plausible is not realistic.

In fact, very few distribution companies in the developing world employ the state-of-the-art technology, as required by the methodology and proposed in the project, without CDM support. A fact illustrated by the CDM pipeline[7], where only a few similar projects are being implemented in developing countries (e.g., Uzbekistan, Georgia).

**Scenario 3: Similar efforts have been made or are expected to be made to reduce methane leaks from key components, using similarly capable leak detection and measurement technology as described in AM0023**

In the past, 'Tiraspoltransgaz-Pridnestrivie' LLC has not considered reducing gas leakages in their distribution system. Moreover 'Tiraspoltransgaz-Pridnestrivie' LLC lacks the technical and financial resources to implement a leak reduction program. This has been confirmed by interviewing 'Tiraspoltransgaz-Pridnestrivie' LLC staff. The identified barriers would remain applicable, if CDM revenue was not made available.

Furthermore, it is plausible that equipment currently leaking would be scheduled for replacement, regardless of CDM support. Yet, analyzing the past experience of 'Tiraspoltransgaz-Pridnestrivie' LLC this is unlikely to happen. If components are in a satisfactory condition, regardless of age, they continue to use it. Replacement only occurs if the equipment is worn out and not operational (or a hazard), otherwise it remains in service. For example, despite having a "planned" maintenance schedule, which requires all cabinet-type regulation points being inspected for their technical condition once or twice per week, and having to undergo maintenance once every 6 months, most of the facilities in the 'Tiraspoltransgaz-Pridnestrivie' LLC distribution network are between 20 and 45 years old.

In fact, 'Tiraspoltransgaz-Pridnestrivie' LLC is constrained by available funding to undertake any major investment in above-ground infrastructure, which makes this scenario unrealistic.[8]

Furthermore, without CDM assistance, the project company would continue using the equipment that is currently leaking. The repairs would continue being done as per the existing practice that allows gas system functioning within requirements, yet not preventing leaks from re-occurrence.

As such, the company has no other alternative than to continue with the existing practices.

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[7] Examples: Georgia (Project ID: 2404; Uzbekistan (Projects IDs: 3430; 3339; 3910, 4085); Armenia (http://cdm.unfccc.int/Projects/Validation/DB/AB9O2CQFPCMJS6BUWUCYGCF6G2XT4T/view.html); Serbia (http://cdm.unfccc.int/Projects/Validation/DB/TNEDB2TADG2FMTUGZT9KFGGXZCLS00/view.html).

[8] The investment priority for 'Tiraspoltransgaz-Pridnestrivie' LLC is the replacement of old underground gas pipelines and the extension of distribution networks to support consumer requirements

Given the above step-by-step analysis, Scenario 1: *Continuation with existing practices of leak detection and routine maintenance* has been identified as the baseline scenario.

**B.5. Description of how the anthropogenic emissions of GHG by sources are reduced below those that would have occurred in the absence of the registered CDM project activity (assessment and demonstration of additionality):**

**Early CDM consideration:**

Although an Certified Emission Reduction Project Investment Agreement was signed between 'Tiraspoltransgaz-Pridnestrivie' LLC and Danish Carbon Assets ApS on 30 May 2011, the first major expenditure on the project was the hiring a subcontractor, Anem Management Ltd. on July 14, 2011 to support the project development and implementation. As such, the start date for the project activity is taken as the date of first expenditure (July 14, 2011), which is when Danish Carbon Assets ApS and Quality Carbon Assets AG committed to fund and develop the CDM project. Following on from this, a feasibility study was conducted from August 08th through 18th, to evaluate the technical and financial conditions for the project implementation.

As per EB 41, Annex 46: the project proponent needs to demonstrate seriousness of CDM consideration by ensuring that they inform the Host Party/DNA and/or the UNFCCC secretariat in writing, within six months of commencement of the project activity, about their intention to seek CDM status. In line with this requirement Stakeholders consultation was conducted on September 27, 2011 (the summary of comments received is provided in the Section E.2). Thus, the project activity meets the prior CDM consideration requirement as laid out in EB 41, Annex 46.

The key milestones of the project development process are summarized in the table below.

**Table 7 Key Milestones of the Project Development Process**

| Date | Milestone |
|---|---|
| May 30, 2011 | Certified Emission Reduction Project Investment Agreement signing between 'Tiraspoltransgaz-Pridnestrivie' LLC and Danish Carbon Assets ApS |
| July 14, 2011 | Subcontractor (Anem Management Ltd.) hired; first major project expenditure |
| Sept 16, 2011 | Submission of PDD to DOE by Consultant |
| Sept 27, 2011 | Stakeholder consultation for the project |
| Nov 1, 2 , 2011 | On-site Audit |
| Dec, 2011 | Submission of Initial DVR / CAR by DOE |
| Feb, 2012 | Completion of Internal FDVR Review at DOE and Receipt of DNA approvals |
| Feb, 2012 | Submission for FVR to UNFCCC for completeness check |
| May 2012 | Project registration (expected date) |
| June –Aug 2012 | Project technical implementation (subject to the date of project registration) |

**Demonstration of project additionality:**

The additionality is determined following the "Tool for the Demonstration and Assessment of Additionality" version 05.2.1, as required by the AM0023. The additionality demonstration also takes into account considerations added in the AM0023 v.3 itself.

**Step 1: Identification of alternatives to the project activity consistent with current laws and regulations**

**Sub-step 1a: Define alternatives to the project activity**

In continuation with the discussion on baseline identification in the section B.4., the following three scenarios have been identified as plausible alternatives to the proposed project activity:

1. Continuation with existing practices of leak detection and routine maintenance;
2. The proposed project is not implemented as a CDM project;
3. Similar efforts have been made or are expected to be made to reduce methane leaks from key components, using similarly capable leak detection and measurement technology as described in AM0023

**Sub-step 1b: Consistency with mandatory laws and regulations:**

*Scenario 1:*
Continuation of the current leak detection and maintenance practices by 'Tiraspoltransgaz-Pridnestrivie' LLC is consistent with the existing laws and regulations in the gas sector of Transnistria/Republic of Moldova. 'Tiraspoltransgaz-Pridnestrivie' LLC meets all its current contractual and legal requirements, which are established by:

- «Safety Regulations in Gas Service»; Order # 477 Ministry of Justice of October 17, 2001;
- «Rules of the Technical Maintenance in Gas Industry», Order # 578 Ministry of Justice of December 28, 2001.

As defined by this regulation, the main reason to reduce gas leaks is to meet safety requirements. There are no taxes or penalties for distribution gas losses in Transnistria/ Republic of Moldova.

*Scenario 2 and Scenario 3*:
Under existing laws and regulations in /Transnistria/Republic of Moldova, there is no threshold above which leaks are illegal. Furthermore, activities included in the proposed project activity (systematic leak detection and repair program) are neither prohibited nor required by the existing mandatory laws and regulations.

**Step 2: Financial incentive**

*Scenario 1:*
Scenario 1 does not entail additional financial costs in order to procure additional monitoring equipment, train staff, implement a leak monitoring system and repair leaks beyond business-as-usual.

'Tiraspoltransgaz-Pridnestrivie' LLC current leak detection and repair activities are satisfactory from its operational stand-point, and will continue to be primarily guided by personnel safety and operational maintenance concerns, not by leak reduction for economic and or environmental reasons.

*Scenario 2 and Scenario 3:*
Theoretically 'Tiraspoltransgaz-Pridnestrivie' LLC would benefit from distribution loss reductions, as these could potentially reduce the amount of gas being purchased from the transmission company.

However, 'Tiraspoltransgaz-Pridnestrivie' LLC do not available fund to implement such kind of the project It also does not have the opportunity to attract loans to implement the project. Additionally normative losses are included the gas tariffs and indirectly paid by the customers, so 'Tiraspoltransgaz-Pridnestrivie' LLC may not be interested to reduce these leaks if they are already paid for these losses.

As per the Tool, the project proponent can decide whether to follow the investment analysis (Step 2) or barrier analysis (Step 3), or use both.

Furthermore, if the investment analysis is applied, the methodology specifies that a gas leak reduction project can use simple cost analysis. Simple cost analysis is applicable when the project has no other financial incentive than potential CER revenue to implement the proposed project activity. In case of this project, 'Tiraspoltransgaz-Pridnestrivie' LLC is constrained by available funding, as mentioned above. Thus, the proposed project would have never happened without the potential of CDM credits. That would mean that 'Tiraspoltransgaz-Pridnestrivie' LLC would continue its current practices, which does not require any additional investment. However, project proponents face not only financial constraints, but also institutional and technical ones. Therefore, to show the full breadth of barriers and as allowed by the Tool, the project proponent have decided to apply the barrier analysis only to demonstrate the additionality.

**Step 3: Barrier analysis**

**Sub-step 3a: Identify barriers that would prevent the implementation of the proposed CDM project activity:**

The proposed CDM project activity faces numerous barriers which prevent its implementation without the incentive of CER revenues.

*Institutional barriers:*

Through interviews with 'Tiraspoltransgaz-Pridnestrivie' LLC personnel, it is clear that there is a lack of institutional procedures and technical capacity to establish and implement advanced leak detection and repair activities in the distribution network.

The type of leak detection, repair and monitoring activities, that are needed to be put in place in order to have CERs generated, will require a coordinated and well-funded program to train and certify staff in operating advanced measurement technologies and in repairing leaks using state-of-art materials and to implement advanced inspection and repair activities. This entails significant costs and managerial capacity. The fact that no such extensive leak detection and repair program has been undertaken to date demonstrates that the opportunity for CER revenue has raised the awareness and incentivized the project proponent to begin such an intensive effort.

*Technical familiarity and technology barriers:*

The project activity assumes the use of the advanced technology and materials for leak detection and repair. To date, 'Tiraspoltransgaz-Pridnestrivie' LLC operators are not familiar with advanced leak detection and measurement practices as prescribed by AM0023. In fact, their methods/equipment (e.g., soap solution) does not enable leak quantification, only leak identification. Also, materials used to seal the leaks are sourced locally, which, although cheaper than GORE® materials, are much less effective. Despite the fact that current practices have proved ineffective in preventing leaks over the long term, 'Tiraspoltransgaz-Pridnestrivie' LLC would continue following them; due to lack of funding needed to procure the equipment/ materials, train staff and implement an advanced system which, in fact, is beyond 'Tiraspoltransgaz-Pridnestrivie' LLC current operational needs.

During the baseline leak survey, leak detection at the facilities was conducted using GMI Gassurveyor™ (500 Series). All identified leaks (those that screened above 0.5% methane in air) were tagged and numbered. Once leaks were identified, leak rate measurements were made using the Hi-Flow™ sampler. Based on this approach, 161 leaking valves were identified over the interval of 2 weeks, correlating to over 600 000 $m^3$ of methane emissions per year. These leaks were not detected using existing 'Tiraspoltransgaz-Pridnestrivie' LLC business-as-usual methods.

As detailed in Section A.4.3, the Hi-Flow sampler provides an intrinsically safe method to accurately quantify component leakages. However, the **main disadvantage** of the Hi-Flow™ sampler is (1) the cost and (2) availability. The device is made only by one company (Bacharach, Inc.) in the US, and has never been used outside the US (with the exception of donor-funded programs in Ukraine, Kyrgyzstan, India, Brazil and other CDM/JI projects). At a cost of $18,800 per unit, for most gas companies – particularly distribution companies where the leaks would be lower than transmission companies – the potential level of leaks would not justify such a cost. This is particularly true if there are cheaper, albeit less accurate, alternatives.

Yet, due to the opportunity posed by registering the project, Danish Carbon Assets ApS, will provide the equipment/repair materials to conduct on-going leak measurements/ repairs, as well as the necessary training and certification for staff in how to use the equipment.

*Barriers to financing:*

The cost to implement the project will be significant. Based on the monitoring plan (see Annex 4), at least several Hi-Flow samplers will need to be purchased, at a cost of US$18,800 per device[9]. Leak detection devices (GMI Gassurveyor (500 series)) will cost on the order of US$3000 per unit[10]; although much cheaper, all monitoring teams will need to be equipped with these advanced equipment (GMI Gassurveyor (500 series) or similar). Additionally, the cost of GORE® valve stem packing materials is on the order of €5-15 per meter, depending on the valve diameter. Considering the project sample size and the leak statistics from the initial feasibility survey, a significant number of valves may need repair during project implementation; consequently, several kilometers of GORE® material will be required. Moreover, project implementation assumes significant costs for training, and labour costs for approximately 5 measurement teams to support project implementation.

Based on interviews with 'Tiraspoltransgaz-Pridnestrivie' LLC staff, investment priorities are focused on projects that support the operational viability of the gas network (i.e., replacing damaged underground pipelines), and increasing service to consumers (i.e., extending the pipeline network). Considering the lack of financing, it was confirmed that they lack the resources/funding to purchase leak detection equipment and implement other systems required to systematically identify and repair leaks. Consequently, these costs would never be financed under the baseline scenario due to budget constraints.

**Sub-step 3b: Show that the identified barriers would not prevent the implementation of at least one of the alternatives (except the proposed project activity):**

Scenario 1, continuation of 'Tiraspoltransgaz-Pridnestrivie' LLC current practice (Business as Usual) does not lead to additional procurement costs (e.g., materials and/or monitoring equipment, staff training), and thus does not require 'Tiraspoltransgaz-Pridnestrivie' LLC to seek additional financing in the local or international markets. Thus the implementation of Scenario 1 is not prevented by the barriers identified in Step 3a. Scenarios 2 and 3 are prevented by the aforementioned barriers.

[9] Quote from Heath Consultants, Inc (15/6/2011)

[10] http://www.ribble-enviro.co.uk/product/gmi-gasurveyor-500-series.htm#

**Step 4: Common practice analysis**

**Sub-step 4a: Analyze other activities similar to the proposed project activity:**
None of the gas companies in CIS has developed or introduced an advanced leak detection, monitoring and repair system within their networks, similar to the one envisaged by the proposed CDM project without carbon finance support. There are in fact, numerous examples of this methodology being exploited in the former Soviet Union countries through JI and CDM.

**Sub-step 4b: Discuss any similar Options that are occurring:**
As per sub-step 4a, the only similar options that are occurring in the region are taking place under JI and CDM. Therefore, the proposed project activity is not a common practice.

Based on the additionality analysis performed above we conclude that the Baseline Scenario is the continuation of the current inspection and maintenance practice. The proposed project is additional to the baseline scenarios and its implementation is only possible within the CDM framework.

## B.6. Emission reductions:

### B.6.1. Explanation of methodological choices:

*Determine if the leak repaired is part of the baseline activity or only is achieved as a result of the CDM Project*

The level of emission reductions is determined in several steps:

1. The current practice of leak detection and repair activities is assessed and described. Clear and transparent criteria are established to identify whether the detection and repair of leak would also have occurred in the absence of the project activity.
2. The time schedules for replacement of components in the absence of the project activity are determined.
3. Data on leaks is collected during the project implementation.
4. The functioning of leak repair is checked during monitoring.
5. Emission reductions are calculated ex-post based on data collected in the previous steps.

Step 1 and 2 should be undertaken as part of the preparation of the CDM-PDD. Steps 3, 4, and 5 are undertaken continuously during the crediting period.

Below we detail Steps 1 and 2.

**1.** ***Assessment and description of the current leak detection and repair practices***
In order to ensure as per the methodology, a clear distinction of leaks that would ("not included" in the project) and would not ("included") have been identified and repaired under existing practices prior to the project implementation, it is first necessary to assess and describe current leak detection and repair practices in the company. Only those types of leaks that are not detected and repaired under current practices are considered in the calculation of emission reductions.

The following criteria are relevant for classification of leaks in the 'Tiraspoltransgaz-Pridnestrivie' LLC system:

**Emergency/ safety repairs –** 'Tiraspoltransgaz-Pridnestrivie' LLC makes some repairs and component replacements in direct response to safety concerns connected to outright emergency situations. According to Transnistria/Republic of Moldova regulations, there is no specification on what exactly counts as a safety concern – this is left to the discretion of the gas company. However,

safety concerns for above ground leaks are defined by the 'Tiraspoltransgaz-Pridnestrivie' LLC operational staff as being cases where there is significant risk to public health and safety of the gas distribution system (e.g., explosion or inflammation risk, or where a high concentration of gas can accumulate in an enclosed space (risk of suffocation due to lack of oxygen)). However, the majority of the above ground leaks in the 'Tiraspoltransgaz-Pridnestrivie' LLC network do not fall into this category (i.e., components are typically located outdoors, in open spaces).

In order to deal with emergencies, there is a separate emergency team within each 'Tiraspoltransgaz-Pridnestrivie' LLC branches that is dedicated 24 hours a day to the implementation of repairs in these more dangerous emergency situations. The emergency services team that deals with these immediate safety concerns will continue to operate completely independently of the CDM project team at 'Tiraspoltransgaz-Pridnestrivie' LLC, throughout the course of the project. **None of the leaks identified or repaired by this team will be included in the CDM project.**

**Leaks detected by visibility, audibility and/or smell and use of existing leak detection technologies**

In line with existing regulation and standards in the gas industry («Safety Regulations in Gas Service», «Rules of the Technical Maintenance in Gas Industry») 'Tiraspoltransgaz-Pridnestrivie' LLC has a "planned" inspection and maintenance (I&M) schedule for its pressure regulator stations and points. This schedule includes maintenance activities, such as the examination of emergency valves, the lubrication and stuffing of stem packing, and checking the parameters of block valves. Furthermore, 'Tiraspoltransgaz-Pridnestrivie' LLC is obliged to implement some repairs on the annual basis. Examples include: disassembling leaking gate valves and repairing faulty elements; cleaning components from dirt and corrosion; and lubrication of friction surfaces. The schedule may also cover capital repairs; in theory, if a component exceeds its operational lifetime or its functions have been severely hindered and impacted proper and safe operations of the whole system. However, during the last 20 years, no GRPs and CTRPs replacement as a result of components reaching the end of their operational lifetime has been conducted.

Additionally, in theory this I&M procedure could eliminate most of the leaks. However, the teams making the inspections lack many of the basic tools and training required for proper leak identification. They have no access to advanced leak measurement equipment and training to be provided to the CDM detection and repair teams by Quality Carbon Assets AG, and can only primarily detect leaks that can be seen, heard, smelt, and detected using soap solution. Some leaks can also be detected using leak detection equipment available to 'Tiraspoltransgaz-Pridnestrivie' LLC staff; however, these equipment are technical old, and limited in supply. This means that many leaks are missed. This is reflected in the initial leak survey undertaken in preparation of this PDD where numerous leaks were identified using advanced equipment. Technically, these leaks should have been detected during the "planned" maintenance schedule; the fact that they were not detected illustrates the inadequate equipment and approach currently being implemented by 'Tiraspoltransgaz-Pridnestrivie' LLC.

In addition, even when a leak is identified, there is no requirement that the leak be repaired using appropriate materials. According to interviews with managers of the 'Tiraspoltransgaz-Pridnestrivie' LLC team, the repair materials currently available to the repair teams (linen twisted cord filled with oil) are ineffective at repairing leaks and repairs undertaken with these materials continue to have significant leak rates.

Without the Hi-Flow samplers or other similar technology, 'Tiraspoltransgaz-Pridnestrivie' LLC staff has little opportunity to judge the size and importance of the leaks they find, and do not systematically repair all or even most leaks they identify. As a result, the only leaks that can be effectively IDENTIFIED and REPAIRED under existing non-emergency practices are those leaks that can be

fixed by tightening connections and tightening thread fittings. These are the only types of leaks that can be both:

a. IDENTIFIED using 'Tiraspoltransgaz-Pridnestrivie' LLC existing leak detection equipment (smell and soap solution) – Per the US EPA's *Directed Inspection and Maintenance at Gate Stations and Surface Facilities* Lessons Learned document[11] it states that "Soaping is effective for locating loose fittings and connections, which can be tightened on the spot to fix the leak, and for quickly checking the tightness of a repair". More advanced leak screening techniques are required to identify other types of leaks, such as valve stem packing. Leak detection equipment available to 'Tiraspoltransgaz-Pridnestrivie' LLC personnel are technically old, and not in sufficient quantities for widespread use.
b. REPAIRED using the only effective technology typically available to the staff – wrenches to tighten the fittings.

In order to be conservative, **ALL repairs composed of simply tightening loose fittings and connections (e.g., threaded fittings, unions) are excluded from the project as it is plausible that they could be detected and repaired under the current practices.** This type of leak is excluded from the project.

This conservative approach will ensure that leaks which could have been identified and repaired under Transnistria/Republic of Moldova regulations are not included in the project, irrelevant of whether or not the company actually fulfils these requirements (e.g., during the initial feasibility study, approximately 10% of the leaks detected were on threaded fittings; these have been excluded from the CER estimates presented in A.4.4 and B.6.4).

However, all other leaks (e.g., valve steam packing) require more advanced technologies and practices to identify them, and repairs that require new materials, seals, etc. and will therefore continue to leak as long as advanced equipment and materials are not part of the 'Tiraspoltransgaz-Pridnestrivie' LLC teams' tool kit.

The key facts documenting this assessment are to be demonstrated to the Validator through:

- Interviews with key staff,
- Documentation on the current technologies used to measure leaks, and
- Leak repair material used.

Furthermore, in order to ensure the environmental additionality of the project (i.e., the project delivers emission reductions over and above those in the baseline scenario) the project teams will be separated in space and time from the regular 'Tiraspoltransgaz-Pridnestrivie' LLC I&M teams. The project detection and repair (D&R) teams will do their work in a pre-defined interval of time at different 'Tiraspoltransgaz-Pridnestrivie' LLC regional branches. Their work will be done in a fully independent mode so that their operations will not in any way or form overlap or interfere with regular 'Tiraspoltransgaz-Pridnestrivie' LLC activities, including regular I&M and capital repair works.

[11] http://www.epa.gov/gasstar/documents/ll_dimgatestat.pdf

**2. *Documentation of the replacement schedules for components***

With regards to the expected time schedules for replacement of components that may be subject to leaks – there is no existing long-term component replacement schedule at 'Tiraspoltransgaz-Pridnestrivie' LLC for above ground components in the regular budget. The replacement of components follows existing industry standards, which require only ad-hoc replacement in case of emergencies, or if there has been significant component deterioration, which is impacting its effective technical operation. Therefore, for most components of the system, no long-term replacement schedule/plan exists.

Due to a lack of resources, the company does not have the option to retire the components in a planned manner and 'Tiraspoltransgaz-Pridnestrivie' LLC does not see the need to schedule additional replacements under current practice and existing regulations. Replacements are done solely on an unforeseen emergency basis when the component has completely ceased to function, or if significant wear and tear has been reported. In these situations, 'Tiraspoltransgaz-Pridnestrivie' LLC branches develop annual plans for replacement/repair activities. These plans require approval from the Ministry of Industry; which allocate budgets based on system priorities (i.e., emergency repairs will take priority over planned maintenance) and available financial resources.

It should be noted that just because a component is leaking, this does not mean it is not capable of functioning – this is true in both developing and developed world as leaks abound in all systems, which, in spite of leakage, continue to function safely and properly. As such, the focus of 'Tiraspoltransgaz-Pridnestrivie' LLC is repairs, with replacements only made when there is a complete breakdown of the component and it is not functioning. This is best illustrated by the current in-service lifetimes of component included in the project boundary (below). In particular, during the last 20 years, although repairs for maintenance have been undertaken, no GRPs and CTRPs replacement has been conducted.

The above-ground equipment includes:

- High pressure gas regulation points – 133 units, with an average in-service life of greater than 20 years;
- Cabinet-type gas regulation points – 2,549 units; including , with an in-service life of up to 45 years;
- Stand-alone valves with stem packing– 1,447 units, which have been in-service up to 45 years.

Thus, the majority of 'Tiraspoltransgaz-Pridnestrivie' LLC above ground gas distribution infrastructure has not been replaced since it was first constructed.

The theoretical lifetime of the components is not relevant for 'Tiraspoltransgaz-Pridnestrivie' LLC to develop a replacement schedule. Although leaky, the component continues to carry out its core purpose and its current condition is sufficient to allow continued operations of the gas network. This is expected to continue to be the case for a period greater than CDM crediting period. Instead, replacement of components is only done in emergencies, or if the component's technical performance has deteriorated sufficiently to impact gas supply operations. Thus, if components are identified for repair, they are included in annual capital repair budgets and schedules.

Thus, the two scenarios in which the component would have been replaced under normal practice are, as detailed above:

a. In emergency situations when the component has ceased to function; and
b. Those components in the priority list that can be replaced based on annual budget allocations as they are made known.

Therefore, leaks that are stopped due to replacement of component that has entirely ceased to function will not be included in the CDM project, as it will be assumed that this component would have been replaced under normal practice.

Similarly, annual budget allocations as they are made known each year will be matched with the actual components to be replaced. These lists will be provided to the verifier when they have been compiled by the company on an ongoing basis. The dates the work is done will also be provided to the validator/verifier to ensure that credits are no longer counted for repairs made to component, after the component is replaced using ongoing budget funds.

The project developer will follow the decision tree, which corresponds with the criteria above, for each leak, in order to determine if that particular leak reduction can be counted as additional. To be completely clear the purpose of this decision tree is to ensure that the existing teams, their findings, and their limited repair activities are not included in the project if they are considered part of the baseline.

- The first batch of the decision tree determines if the leak was identified and repaired as part of an emergency event. For the avoidance of doubt, repairs required for the continued operation of the system, such as repairs to correct an excessive drop in pressure that prevents normal system operation, are included as emergency repairs. Repairs made in this category, as mentioned above, are excluded.
- The next query asks that the components being repaired to be cross-referenced with the list of components subject to capital repair/replacement schedule. Leaks from components that are scheduled for replacement are excluded from the project activity.
- The decision tree then concludes with the question “can the leak be detected and repaired effectively with existing technologies, such as tightening loose fittings?” The additional detail provided above should clarify that ‘Tiraspoltransgaz-Pridnestrivie’ LLC currently only has the capacity to identify and repair leaks involving connections and thread fittings that require simple tightening.

Once the leaks have been repaired, each repair case will be entered into the leak database. These records will ensure that there is clarity on which leaks have been repaired as part of the baseline, and which are additional as part of the CDM project.

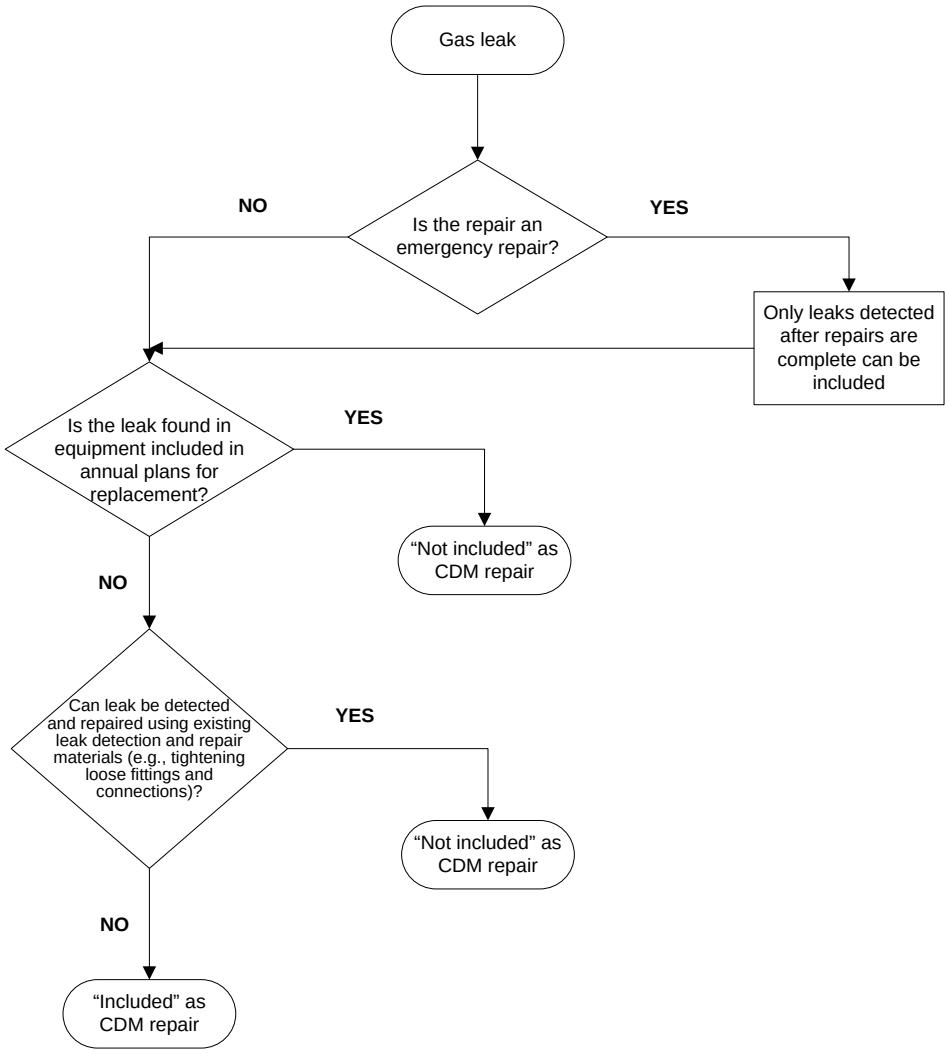


**Figure 10 Decision tree to include leaks in the Project boundaries**

**Baseline emissions** are calculated in the following manner:

In general, leaks are detected using a variety of tools, many of which have been made available through CDM, such as the GMI Gassurveyor, other electronic screening tools and soap solution. For each leak identified, the Hi-Flow sampler captures all emissions from a leaking component to accurately quantify leak flow rates. Leak emissions, plus a large volume sample of the air around the leaking component, are pulled into the instrument through a vacuum sampling hose. High volume samplers are equipped with dual hydrocarbon detectors that measure the concentration of hydrocarbon gas in the captured sample, as well as the ambient hydrocarbon gas concentration. Sample measurements are corrected for the ambient hydrocarbon concentration, and the leak rate is calculated by multiplying the flow rate of the measured sample by the difference between the ambient gas concentration and the gas concentration in the measured sample. Methane emissions are estimated by calibrating the hydrocarbon detectors to a range of concentrations of methane-in-air. High volume samplers are equipped with special attachments designed to ensure complete emissions capture and to prevent interference from other nearby emissions sources. The hydrocarbon sensors are used to measure the exit concentration in the air stream of the system. The sampler essentially makes rapid vacuum enclosure measurements. The leak flow rate of methane is calculated as follows:

$$F_{CH4,i} = F_{sample,i} \times \left(C_{sample,i} - C_{back,i}\right) \quad (1)$$

Where:

$F_{CH4,i}$ = The leak flow rate of methane for leak *i* from the leaking component ($m^3CH4/h$)
$F_{sampler,i}$ = The sample flow rate of the sampler for leak *i* ($m^3/h$)
$C_{sample,i}$ = The concentration of methane in the sample flow from leak *i* (volume percent)
$C_{back,i}$ = The concentration of methane in the background near the component (volume percent)

For each leak that is detected and repaired as part of the project activity, project participants will:

- Apply the established criteria in Decision Tree #1 in order to identify whether the leak would also have been detected and repaired in the absence of the project activity;
- Note the date of leak detection;
- Note the date of leak repair;
- Note the exact location of the leak;
- Measure the leak flow rate (volume per time), as described above;
- Note the measurement method in order to determine the uncertainty range of measurement;
- In cases where the repair involves a replacement of any component: note the date when the component would be replaced if the leak would not have been detected, using either the annual replacement schedule by the company or the difference between the average lifetime and the age of the component, whatever is earlier.

All data collected during project implementation would be entered into a database. The database will be continuously updated during the crediting period, including new leaks detected and repaired during the crediting period. The data in the database will also be included in each monitoring report.

**Leakage:** no leakage emissions are expected from this project.

**Emission reductions** are calculated as per the following formula:

$$ER_y = ConvFactor \times \sum_i [F_{CH4,i} \times T_{i,y} \times (1 - UR_i)] \times GWP_{CH4} \quad (2)$$

Where:

$ER_y$ = The methane emission reductions of the project activity during the period y ($tCO_{2equivalents}$). In the case, the component is replaced due to the project activity at an earlier point in time than in the absence of the project activity, emission reductions from that component should only be accounted until the components would have been replaced in the absence of the project activity.
ConvFactor = The factor to convert $m^3$ $CH_4$ into $tCH_4$. At standard temperature and pressure (0 degree Celsius and 101.3 kPa) this factor amounts to $0.0007168 tCH_4/m^3$ $CH_4$.
*i* = All leaks eligible towards accounting of emissions reductions, taking into account the guidance described above.
$F_{CH4,i}$ = The leak flow rate of methane for leak i from the leaking component ($m^3CH4/h$)
$UR_i$ = The uncertainty range for the measurement method applied to leak i, determined, where possible, at a 95% confidence interval, from guidance provided in chapter 6 of the 2000 IPCC Good Practice Guidance. If leak measurement equipment manufacturers report an uncertainty range without specifying a confidence interval, a confidence interval of 95% may be assumed.
$T_{i,y}$ = The time (in hours) the relevant component for leak i has been operating during the monitoring period y, taking into account the guidance described above (e.g. regarding deductions for broken leaks).
$GWP_{CH4}$ = The global warming potential for methane ($tCO_{2eq}/tCH_4$).

### B.6.2. Data and parameters that are available at validation:

**Table 8 Data and Parameters That are Available at Validation**

| **Data / Parameter:** | **$GWP_{CH4}$** |
|---|---|
| Data unit: | Tonnes of $CO_2$ equivalent |
| Description: | Global warming potential |
| Source of data to be used: | 2006 IPCC Guidelines for National Greenhouse Gas Inventories |
| Value of data applied for the purpose of calculating expected emission reductions in section B.5 | 21 |
| Justification for choice of data: | Data is well established and used in the first crediting period |
| Any comment: | In the second crediting period and changes in global warming potential will be incorporated |

In accordance with the *Guidelines for Completing the Project Design Document (CDM-PDD)*, data that is not available at the time of validation shall be included in Section B.7.1.

### B.6.3. Ex-ante calculation of emission reductions:

'Tiraspoltransgaz-Pridnestrivie' LLC above ground infrastructure consists of 133 GRPs, 2,549 CTRPs, and 1,447 stand-alone valves with stem-packing that are not part of these regulation points. Roughly, 10.5 percent of the GRPs, 2.3 percent of the CTRPs, and 1.5 percent of the stand-alone valves with stem packing have been surveyed so far. Results from this initial baseline survey have been extrapolated to the whole 'Tiraspoltransgaz-Pridnestrivie' LLC system. Measurement results and extrapolations, which can be found in the spreadsheet to be provided to the DOE, utilised the following equation:

Ex-ante **Emission Reductions** were calculated as per the formula (2) above.

1. First step was to calculate leak flow rate ($F_{CH4,i}$ ). This parameter was taken from the Hi Flow Sampler reading which is automatically adjusted for background concentration.

Then $F_{sample,i}$ has been determined by multiplying average valve leak rate per valve type (liters per minute) and total number of each type of valve (Table 9):

**Table 9 Determination of $F_{sample,i}$ parameter**

| Type of Valve | Average leak per valve, liters per minute (L/min) | Number of valves with stem packing | Covert from L/min, in to m3CH4/h 60/1000 | F sample,i m3CH4/h |
|---|---|---|---|---|
| Number of valves with stem packing in GRPs and CTRPs | 3.48 | 3,388 | 0.06 | 707.84 |
| Number of stand alone valves with stem packing | 6.24 | 1,447 | 0.06 | 541.59 |
| Total | | | | 1,249 |

2. Average leak rates were calculated on the basis of the baseline study when 285 valves with stem packing at GRPs and CTRPs and 21 stand-alone valves with stem packing were inspected (see more details in the Annex 3).Since the High-Flow sampler automatically accounts for standard temperature and pressure in data readings, the conversion factor (ConvFactor) of 0.00071168t$CH_4/m^3$ $CH_4$ was used.
3. Since the system is in continuous operation, time (T) was considered to be 8760 for the purpose of this estimate. However, actual emissions will incorporate real operational hours.
4. The uncertainty range (UR) was calculated as per the IPCC "Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories" Chapter 6, page 12, Equation 6.3, which provides an approach for combining uncertain quantities. An estimate of this is extrapolated from the August 2011 data set and used to estimate the final baseline results. This is provided in the CER calculation data sheet provided to the DOE.

**Uncertainty Range:**

$$UR_i = \frac{\sqrt{(UR_1 \times F_{CH4,2})^2 + (UR_2 \times F_{CH4,2})^2 + \ldots + (UR_n \times F_{CH4,n})^2}}{(F_{CH4,1} + F_{CH4,2} + \ldots + F_{CH4,n})} \quad (3)$$

Where

$UR_i$ =the percentage uncertainty in the sum of the quantities (half the 95% confidence interval divided by the total (i.e. mean) and expressed as a percentage);

$F_{CH4,n}$ and $UR_n$ = the uncertain quantities (leak rates) and the percentage uncertainties associated with them, respectively.

Firstly, the "sum of the squares' has been calculated, using the results of the feasibility survey (i.e. each recorded leak rate of each component surveyed, $F_{CH4,n}$) and multiplying each by 5% (i.e. at 95% confidence interval as per IPCC Guidance, $UR_n$). Then, the square root of the resulting sum has been derived, and divided by the sum of recorded leak rate of each component surveyed (Table 10).

**Table 10 Determination of uncertainty range, $UR_i$**

| $\Sigma(F_{CH4,n}*UR_n)^2$ | Square root of $\Sigma(F_{CH4,n}*UR_n)^2$ | $\Sigma F_{CH4,n}$ | $UR_i$ |
|---|---|---|---|
| 23.4 | 4.8388 | 1,123.1 | 0.0043 |

The resulting estimate ($UR_i$) has been used to estimate the final baseline results. Detailed calculations are provided in the CER calculation data sheet provided to the DOE.

5. Global Warming Potential (GWP) for $CH_4$ is 21, as adopted by COP.
6. Leakage and Project Emissions at this stage are assumed to equal 0, as repairs are made and maintained. However, during project implementation, actual project emissions (including re-emerging leaks) will be reported.

Summary data based on results from the feasibility study is presented in the table below:

**Table 11 Calculation of expected emission reductions volume**

| Conversion Factor $tCH_4/m^3CH_4$ | Leak flow rate $F_{CH4,i}$, $m^3/h$ | Time of use (estimated) $T_{i,y}$; h | Uncertainty range $UR_i$ | $GWP_{CH4}$, $tCO_{2e}/tCH_4$ | Total emission reductions, $tCO_{2e}$ |
|---|---|---|---|---|---|
| 0.0007168 | 1,249 | 8,760 | 0.00430844 | 21 | 164,043 |

## B.6.4 Summary of the ex-ante estimation of emission reductions:

The 2012 estimate of emission reduction is based on the assumption that the project will start generating emission reductions from September 1, 2012. By this time, it has been assumed that the baseline study will be completed and project will be registered (Note: baseline study is assumed to take place after project registration by the UNFCCC Secretariat and CDM Executive Board).

However, this estimated date is subject to change, depending on the actual date of validation completion, actual date of submission of complete request for registration, actual date of baseline study start and its completion.

**Table 12 Summary of the ex-ante estimation of emission reductions**

| Year | Estimation of project emission (tonnes of $CO_2e$) | Estimation of baseline emission (tonnes of $CO_2e$) | Estimation of leakage (tonnes of $CO_2e$) | Estimation of emission reductions (tonnes of $CO_2e$) |
|---|---|---|---|---|
| **2012 (4 months)** | 0 | 54,681 | 0 | 54,681 |
| **2013** | 0 | 164,043 | 0 | 164,043 |
| **2014** | 0 | 164,043 | 0 | 164,043 |
| **2015** | 0 | 164,043 | 0 | 164,043 |
| **2016** | 0 | 164,043 | 0 | 164,043 |
| **2017** | 0 | 164,043 | 0 | 164,043 |
| **2018** | 0 | 164,043 | 0 | 164,043 |
| **2019** | 0 | 164,043 | 0 | 164,043 |
| **2020** | 0 | 164,043 | 0 | 164,043 |
| **2021** | 0 | 164,043 | 0 | 164,043 |
| **2022 (8 months)** | | 109,362 | | 109,362 |
| **Total (tonnes of $CO_2e$)** | **0** | **1,640,430** | **0** | **1,640,430** |

## B.7. Application of the monitoring methodology and description of the monitoring plan:

### B.7.1 Data and parameters monitored:

**Table 13 List of the Data and Parameters Monitored**

| **Data / Parameter:** | ***i*, Total number of leaks** |
|---|---|
| Data unit: | Number |
| Description: | Number of leaks identified, repaired and re-surveyed |
| Source of data to be used: | Initial feasibility survey |
| Value of data applied for the purpose of | Not used in CER calculation estimate (average leak rate was used in the calculation) |

| | |
|---|---|
| calculating expected emission reductions in section B.5 | |
| Description of measurement methods and procedures to be applied: | Measured with Hi-Flow sampler and recorded in the project leak database |
| QA/QC procedures to be applied: | Each leak will be tagged and assigned a unique number which will be recorded in the database for follow-up monitoring to enable unique identification of the detected leak |
| Any comment: | NA |

| **Data / Parameter:** | $\mathbf{T_{i,y}}$ |
|---|---|
| Data unit: | Hours |
| Description: | Total hours during the reporting period that the leaking components is in the status in which leaks are detected. |
| Source of data to be used: | 'Tiraspoltransgaz-Pridnestrivie' LLC operation log |
| Value of data applied for the purpose of calculating expected emission reductions in section B.5 | 8760 hours |
| Description of measurement methods and procedures to be applied: | Any outages will be recorded. Otherwise the regulators operate on a continuous basis until a scheduled replacement |
| QA/QC procedures to be applied: | Any outages resulting from system repairs will be documented and logged in the project database. |
| Any comment: | Hours of operation will end when components concerned is replaced for a non-leak related reason (e.g., it breaks down), or when the date of predicted replacement as identified in the PDD is reached (whatever is earlier). |

| **Data / Parameter:** | **Date** |
|---|---|
| Data unit: | Day/ Month/ Year |
| Description: | Date of leak detection, repair, follow-up monitoring |
| Source of data to be used: | Monitoring and repair team logs |
| Value of data applied for the purpose of calculating expected emission reductions in section B.5 | Based on date leak is measured/monitored, and when leak it was repaired |
| Description of measurement methods and procedures to be applied: | Based on date leak is measured/monitored, and when leak it was repaired |
| QA/QC procedures to be applied: | Work orders, receipts, etc., in addition to repair logs |
| Any comment: | In cases of re-emerging leaks, it will be assumed to have occurred the day after the most recent measurement which showed no leak |

| Data / Parameter: | $F_{CH4,i}$ |
|---|---|
| Data unit: | m³CH4/h |
| Description: | Leak flow rates based on Hi-Flow sampler reading |
| Source of data to be used: | From Hi-Flow sampler readings during initial feasibility survey by Anem Management Ltd |
| Value of data applied for the purpose of calculating expected emission reductions in section B.5 | 1,249.4 $m^3$ $CH_4$/h (total leak rate from feasibility study extrapolated to the whole system)<br>Explanation on how this value has been derived is given in B.6.3.<br><br>The measurement accuracy is +/-5%, as per the technical specification of a Hi-Flow sampler. |
| Description of measurement methods and procedures to be applied: | Measurements with Hi-Flow Sampler are automatically adjusted to the methane content, temperature and pressure and, thus, will directly yield methane leak flow rates.<br><br>Based on the initial feasibility survey. Approximately, 10.5 percent of the GRPs, 2.3 percent of the CTRPs, and 1.5 percent of the valves were surveyed. Results have been extrapolated to the whole 'Tiraspoltransgaz-Pridnestrivie' LLC system |
| QA/QC procedures to be applied: | The Hi Flow Sampler automatically takes 2 samples of the leak (at the higher and lower flow rate) within one measurement and automatically provides final leak rate estimation. If the deviation between two samples is greater than 10%,<br><br>then another measurement will be performed to ensure accuracy of the measurement results. Prior to measurements, the measuring devices will checked for compliance with calibration requirements as appropriate; if needed, the devices will be re-calibrated in line with manufacturers' recommendations. Each leak will be measured with a Hi Flow Sampler; measurement readings will be recorded in the monitoring report and the device data-logger where appropriate. |
| Any comment: | Values for individual leaks are included in the CER calculation spreadsheet provided to the DOE. |

| Data / Parameter: | $UR_i$ |
|---|---|
| Data unit: | Fraction |
| Description: | Reflects uncertainty in Hi-Flow sampler measurement accuracy |
| Source of data to be used: | Manufacturer's data for Hi-Flow Sampler |
| Value of data applied for the purpose of calculating expected emission reductions in section B.5 | 0.0043 for measurements with Hi-Flow Sampler |
| Description of measurement methods and procedures to be applied: | Estimate calculated using results of the initial feasibility survey, and the following assumptions:<br><br>Given there will be a large number of leak measurements that are uncorrelated variables, the IPCC "Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories" approach to combining uncertain quantities by addition (Page 12, Rule A from Chapter 6, Equation 6.3) is used. This rule denotes the 'square root of the sum of the squares' for total UR. This will be calculated using leakage flow rates and the respective UR of the Hi- |

| | |
|---|---|
| | Flow sampler used for the leak. |
| QA/QC procedures to be applied: | IPCC best practice guidance on uncertainties estimation will be taken into account. |
| Any comment: | A confidence interval of 95% is assumed, per IPCC "Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories" |

| **Data / Parameter:** | **Temperature and pressure** |
|---|---|
| Data unit: | Degree Celsius and bar |
| Description: | Temperate of gas and ambient air pressure at leak source. The values are needed to calculate the methane density at standard conditions when converting volume into mass. |
| Source of data to be used: | Measured during leak survey by Hi-Flow sampler |
| Value of data applied for the purpose of calculating expected emission reductions in section B.5 | The Hi-Flow sampler automatically takes these measurements into account in the data it provides/reports. |
| Description of measurement methods and procedures to be applied: | Hi-Flow Sampler automatically adjusts readings to standard temperature and pressure. Where necessary, temperature of gas and ambient air pressure will be obtained from 'Tiraspoltransgaz-Pridnestrivie' LLC, and/or measured during leak measurement surveys. |
| QA/QC procedures to be applied: | Hi-Flow Sampler will be calibrated as per manufacturers' requirements. The values (temperature and pressure) will be compared against 'Tiraspoltransgaz-Pridnestrivie' LLC process control data, as relevant, to ensure there is no major discrepancy. |
| Any comment: | NA |

### B.7.2. Description of the monitoring plan:

Annex 4 presents a detailed overview of the monitoring plan. A summary is provided below.

Staff within 'Tiraspoltransgaz-Pridnestrivie' LLC (TTG-P) will implement the Project operations and monitoring activities by performing detection, measurement, repair and documentation of leaks throughout the crediting period. Danish Carbon Assets ApS (DCA) together with Quality Carbon Assets AG will provide CDM methodological supervision and support to the TTG-P team. As per Annex 4, the project implementation management and execution will be completely separated in time and space from regular inspection & maintenance (I&M) and emergency/capital repairs implemented by TTG-P. Project leak detection and repair crews will be dispatched to facilities at different times from the regular I&M crews.

**Training Program**
A training program will be conducted to train local staff at TTG-P on how to use advanced detection and measurement equipment, how to execute effective repairs, and how to document the leaks found in an effective manner. The training will be conducted by the project manager in collaboration with technical experts with experience in gas leak detection and measurement, and advanced repair materials to be used in the project. These experts will provide detailed instructions and written materials on how to conduct the leak detection, measurements and repairs.

**Calibration of equipment**
All Hi-Flow Samplers will be calibrated to ensure accuracy in their measurements. The TTG-P Technical Teams will be provided with calibration kits and spare part kits. The calibration is done as per the Hi-Flow manual which suggests a 30 day calibration period by certified staff. The calibration

is done as per field specifications. The TTG-P Technical Teams (with Anem Management Ltd. support) will calibrate their detectors at least once a month following the same procedures for each Hi-Flow sampler. The calibration records will be documented each month and maintained by the technical operators together with the Database Management Team.

**Leak Measurement**
The Technical Teams will survey the components in the project boundary using advanced leak detection instruments, such as the GMI Gassurveyor (500 series). Once identified, the leaks will be tagged, and numbered. The flow rate for each leak will then be quantified using the Hi-Flow sampler. A digital photograph will be taken of the leaking component, tag and Hi-Flow sampler reading. These photographs will be archived by the Database Management Team. In addition, the type of repair expected given the nature of the leak and its location will be categorised for future repair planning.

After leaks have been detected and measured, they will be repaired. Before each repair is made, another Hi-Flow sampler measurement will be taken. In the case there is any discrepancy between the final measurement and the original measurement a third measurement will be taken to confirm the change. The final, confirmed leak rate will be used to determine baseline leakage as per the AM0023 methodology, regardless of whether the leak rate is lower or higher than the original leak measurement. After the repair, a new leak measurement will be carried out to ensure that the leak was properly repaired. If required, additional repairs will be made until no further leak can be detected. If leaks cannot be eliminated remaining leaks will be measured and recorded. The date of the repair (or discovery of remaining leak) will be recorded in the Project Database.

**Monitoring Repaired Leaks**
All leaks that have been subject to repair will be monitored – using the same leak detection technologies on each leak identified in the baseline (detector with at least the same accuracy as GMI Gassurveyor (500 series) will be used) – to ensure they are maintained, on an annual basis. Where a leak repair fails, it is conservatively assumed that the leak resumed the day after the last inspection, or in case of the first inspection, the day after the repair has taken place. Emission reductions are counted from the date of subsequent repair of that same leak, and are measured using the same type of equipment as in the initial survey (Hi-Flow sampler). Such leaks will be repaired again followed by new leak measurements. Data collected will be included in the periodic monitoring reports stored in the Database.

**Quality Assurance/Quality Control**
After data collection and collation by the Technical Teams, the Database manager will review the data and checks that it has been recorded correctly. Procedures will include: 1) tracing data from individual spreadsheets to the collated spreadsheet; 2) identify outliers and verify the measurement with the responsible technical operator to double check the number; and 3) reviews measurements by each individual Hi-Flow Sampler to ensure that no one Hi-Flow Sampler in particular is making measurements that appear to be outliers on a consistent basis. If such discrepancies are found, the Hi-Flow Sampler will be recalibrated and checked immediately, and any erroneous leaks will be re-measured.

Additionally, to ensure leak tags are not damaged or lost, digital photo are accidently deleted, and/or there are problems with the database, three concurrent ways of tagging leak locations and tracking leak measurements will be implemented: 1) a digital photo of the leak; 2) the physical tag on-site and the leak rate and measurement date are written on the tag; and 3) when the leak measurement and date are entered into the database, the location of the leak is documented.

The project will also include QA/QC oversight for the project. These procedures will include: 1) verify that maintenance and monitoring of leaks is being conducted in accordance with the Monitoring Plan; 2) observe database team to ensure that data is being recorded and handled as per the requirements of this Monitoring Plan; and 3) conduct audits of the data to ensure that adequate records are being kept, and that leaks found and leaks repaired have been accurately documented in the database.

See Annex 4 for further details on the Monitoring Plan.

**B.8. Date of completion of the application of the baseline study and monitoring methodology and the name of the responsible person(s)/entity(ies):**

The date of baseline setting: 16/09/2011

The baseline was developed by Anem Management Ltd. (Anem Management Ltd is not the project participant listed in Annex 1 to the PDD) based on the results of a feasibility study between August 8th and 18th, 2011.

## SECTION C. Duration of the project activity / crediting period

### C.1. Duration of the project activity:

#### C.1.1. Starting date of the project activity:

14/07/2011 – The first major expenditure on the CDM project was the hiring of Anem Management Ltd., to support the project development and implementation.

This is the date when the Project Participants committed to expenditure and is therefore the date project activity began.

#### C.1.2. Expected operational lifetime of the project activity:

10 years (120 months)

### C.2. Choice of the crediting period and related information:

#### C.2.1. Renewable crediting period:

##### C.2.1.1. Starting date of the first crediting period:

Not applicable

##### C.2.1.2. Length of the first crediting period:

Not applicable

#### C.2.2. Fixed crediting period:

##### C.2.2.1. Starting date:

01/09/2012 (expected date when project will start generate emission reduction).

**C.2.2.2. Length:**

10 years (120 months).

## SECTION D. Environmental impacts

**D.1. Documentation on the analysis of the environmental impacts, including transboundary impacts:**

The project is focused on reducing natural gas losses from the distribution network of /Transnistria/Republic of Moldova.

As such, the project does not require any infrastructure or components that would create any local or regional air/water/pollution impacts. In particular, materials and equipment used in this project do not emit harmful substances into the atmosphere, and are not a source of noise, vibration, or any other harmful physical impact. The project activity has no transboundary environmental impacts, and requires no environmental impact assessment (EIA) per /Transnistria/Republic of Moldova environmental legislation.

**D.2. If environmental impacts are considered significant by the project participants or the host Party, please provide conclusions and all references to support documentation of an environmental impact assessment undertaken in accordance with the procedures as required by the host Party:**

Environmental impact assessment is not required by Transnistria/Republic of Moldova environmental legislation for such type of project activity. The project also complies with the environmental legislation of the Host country.

## SECTION E. Stakeholders' comments

**E.1. Brief description how comments by local stakeholders have been invited and compiled:**

A public forum was held on September 27, 2011 in conjunction with the requirement for a consultation of local stakeholders in the design for the CDM Project 'Reducing gas leakages within 'Tiraspoltransgaz-Pridnestrivie' LLC gas distribution network, Transnistria/Republic of Moldova. The meeting was held at the Central office of 'Tiraspoltransgaz-Pridnestrivie' LLC company in Tiraspol.

'Tiraspoltransgaz-Pridnestrivie' LLC involved different stakeholders that would be impacted by the project. These included:

1. Ministry of Economy
2. Ministry of Ecology
3. Ministry of Industry
4. Local residents in the operational regions
5. Public corporation, TERMAKOM
6. Moldavian Thermal Power Plants
7. Representative of each branch of 'Tiraspoltransgaz-Pridnestrivie' LLC
8. Organization on Ecological movement in Republic of Moldova
9. Alliance to Save Energy Regional Office – Republic of Moldova
10. Representative of Moldavian DNA

Invitations were sent to these stakeholder groups through a combination of:

1. A bilingual announcement about the meeting that was published in the "Dnestrovskaya Pravda", the local newspaper on September 10, 2011.
2. Letters of invitation that were sent to the listed state and non-governmental institutions

Please find below the scan of the announcement published in "Dnestrovskaya Pravda" on September 10, 2011.

**ОБЪЯВЛЕНИЕ**

ООО «ТИРАСПОЛЬТРАНСГАЗ-ПРИДНЕСТРОВЬЕ» объявляет о проведении совещания заинтересованных сторон проекта в рамках **Механизма Чистого Развития (МЧР) «Сокращение утечек газа в газораспределительных сетях ООО «Тираспольтрансгаз-Приднестровье».**

Совещание состоится **27 сентября 2011 года**, в 10.00 по адресу: г. Тирасполь, Октябрьская промзона, «Тираспольтрансгаз-Приднестровье».

Приглашаются все заинтересованные стороны. Предварительная регистрация участников по телефону: **(533) 38207.**

Контактное лицо: Сергей Витальевич Бушуев, тел.: 777-89025.

Участники проекта: ООО «Тираспольтрансгаз-Приднестровье» и Дэниш Карбон Ассетс АпС.

**ANNOUNCEMENT**

LLC "TIRASPOLTRANSGAZ-PRIDNESTROVIE" is holding Stakeholder Consultations under the frameworks of **Clean Development Mechanism (CDM) investment project "Reducing gas leakages within "Tiraspoltransgaz-Pridnestrovie" gas distribution network".**

The meeting will take place on **September 27, 2011 at 10** AM: Tiraspol, October Industrial Unit, Tiraspoltransgas-Pridnestrovie.

All stakeholders and interested parties are invited. Preliminary registration on the following telephone number: **533-38207.**

Contact person: Sergey Bushuev, 777-89025.

Project Participants: LLC Tiraspoltransgaz-Pridnestrovie and Danish Carbon Assets Aps.

**Figure 11 Stakeholders meeting announcement. Newspaper "Dnestrovskaya Pravda", September 10, 2011**

At the meeting, an agenda, project details and other documents (e.g., evaluation forms) were distributed among the participants before the beginning of the meeting.
The meeting was held by Nikolay Mitsinsky (General director of 'Tiraspoltransgaz-Pridnestrivie' LLC) and also Mardan Kerimov and Tatyana Seu who represented Investor of the project.

They provided detailed data about the project to all participants, including information about its expected economic, ecological and social impacts, the Clean Development Mechanism, and the project development/ implementation. The summary of the received questions and answers are provided below.

## E.2. Summary of the comments received:

**Table 14 Summary of the comment received during the stakeholders meeting**

| Name | Question | Answer by Project Management Team |
|---|---|---|
| Ponomarenko Valery<br>Finance and Economy director of 'Tiraspoltransgaz-Pridnestrivie' LLC | What staff will be involved for the measurement works under the project?<br>Will it be spot check or will the survey cover all valves in the system?<br>Will equipment be in use of Investor staff or 'Tiraspoltransgaz-Pridnestrivie' LLC staff? | Initial survey was performed by the technical specialists from Moscow which will support further measurement works at 100% of components including the training of the local staff.<br>Measurement works will be performed by the personal of your company. They will be trained to work with the modern and precise equipment which will be provided to each working team. After the measurement works also repair materials will be provided.<br>Additionally Mitsinsky N. added that |

| Name | Question | Answer by Project Management Team |
|---|---|---|
| | | equipment will be certified in accordance with the local legislation. There will be Russian certificates which are accepted in Transnistria/Republic of Moldova. |
| Cheban Vladislav<br><br>Ministry of Natural Resources and Environmental Control of Pridnestrovian Moldavian Republic<br>Head of Environmental Safety Department | What is expected amount of leakage reduction as the result of the project implementation?<br>Are there any methods to reduce leakages not only on the valves? | Expected volume of emission reduction is 160 000 tCO2e/year. Expected volume of leakage reduction in the gas distribution system is about of 2-3% of total volume of transmitted gas. There are methods to reduce leakages not only at the valves but they are not included in the boundaries of CDM project.<br>Additionally Mitsinsky N. described the methods that are used 'Tiraspoltransgaz-Pridnestrivie' LLC apart from proposed CDM activity. |
| Rozhka Andrey<br><br>Head of the legal department of TIROTEX company | What is expected time from the project registration to issuance of the first credits for the project? What party will be the seller of the credits? | Under existing UN procedures two parties are required to implement the project, namely the host country and investor. There are no procedures for companies in developing countries to trade credits directly without the project investor. Accordingly the seller of the reduction will be Denmark (as the country) and Danish Carbon Assets as the project investor that will get rights for the credits.<br>Approximate time of all procedures "before the CER will be issued" is about one year. Works on the registration and project implementation are planned for 2012. |
| Taran Andrey<br><br>Director of Tiraspol branch 'Tiraspoltransgaz-Pridnestrivie' LLC | How CER are quantified? | The mechanism for CER calculation is as follows.<br>First measurements of the methane leaks are performed. Then volume of the saved gas is recalculated into tones of CO2e. This amount of CER will be verified in the future.<br>Verification is performed on the basis of regular project monitoring. If any additional emissions are identified Investor should invest additional funds to repair these leaks. Within 10 years |

| Name | Question | Answer by Project Management Team |
|---|---|---|
| | | after the project registration amount of actual emission reductions should be regular verified.<br>Additionally project participants explained that repair materials (that are going to be implemented in the framework of the project) has very long life and are very wearproof. Nevertheless, monitoring of the project will be conducted with attraction of international DOE accredited in UN. |
| Rozhka Andrey<br><br>Head of the legal department of TIROTEX company | Is the project registered at the moment? | No, the project is not registered yet. Under existing UN procedures the project will be submitted for registration only after receiving letters of approvals by the Host country and Investor. Letters of approval and support will be available only after completion of all necessary procedures.<br>Additionally project participant informed that Moldavian DNA treat Transnistria projects on the equal terms with other Moldavian projects. Starting from 2005 when Republic of Moldova ratified Kyoto protocol Moldavian DNA considered 5 CDM projects implemented on the territory of Transnistria and have good attitude to these projects as they are in line with the region development priorities. |
| Taran Andrey<br><br>Director of Tiraspol branch 'Tiraspoltransgaz-Pridnestrivie' LLC | What is the period of CER issuance? Is it once per year? Is there direct correlation between volume of reductions and volume of certificates to be issued?<br>. | Yes, the period of the CER issuance is once per year. Every year there will be monitoring activities as well as verification which will be performed by the independent DOE and registration of monitoring and verification report in CDM Board. The credits will be issued only after registration of monitoring and verification report in CDM Board.<br>Independent verifier will review and confirm annually volume of emission reductions. International control is performed at every stage of CDM project including the stages of certification and issuance of the credits. |

| Name | Question | Answer by Project Management Team |
|---|---|---|
| | | Project participants also added that advantage of the project is that emission reductions are estimated on the basis of the actual measurements, not on the basis of the settlement method. |
| Ponomarenko Valery<br><br>Finance and Economy director of 'Tiraspoltransgaz-Pridnestrivie' LLC | You informed us that the baseline study measurements are already performed. Did these works also include repair of the leaks? | No, only leak rate measurements were performed. At the moment PDD for the project is being developed. Only measurements are required at this stage. |
| Kokul Vladimir<br><br>Director of Slobodzeya branch 'Tiraspoltransgaz-Pridnestrivie' LLC | Are repaired materials that are going to be provided adapted/applicable for our equipment? | Repair materials that are going to be provided are completely applicable for 'Tiraspoltransgaz-Pridnestrivie' LLC equipment.<br>Gas distribution systems in Russia and CIS countries which are very similar to Moldavian gas distribution system already implemented this material.<br>Specific feature of the material is that after installation it forms a homogeneous mass, which provides a high quality seal. In addition, the repair material (which will be provided) can withstand a wide range of temperatures and is very climate tolerant. |
| Mihaluk Nikolay<br><br>Director of Rybnitsa branch 'Tiraspoltransgaz-Pridnestrivie' LLC | Does the project involve replacement of the valves themselves or only replacement of the sealing materials? What diameters of the valves are included in the project? Are façade valves near the houses and flats included in the project boundaries? | The project involves only replacement of the sealing materials. If it is discovered that the valve should be replaced completely, it will be individually assessed whether it should be included in the project boundaries or not.<br>Sealing materials will be replaced at all valves will stem packing. Façade valves near the houses and flats are not included in the project boundaries. Only valves at the gas distribution network will be repaired. |
| Cheban Vladislav<br><br>Ministry of Natural | Does your company implement project only in the gas sphere? | Danish Carbon Assets company implements CDM projects only related to gas leakages reduction. |

| Name | Question | Answer by Project Management Team |
|---|---|---|
| Resources and Environmental Control of Pridnestrovian Moldavian Republic<br>Head of Environmental Safety Department | | Project participants also added that there are a lot of approved CDM methodologies and every CDM project should be developed in accordance with these methodologies. It is not possible to grasp all of them, that is why Danish Carbon Assets chose quite narrow specialisation. In the same time Denmark as a country of the Annex I took very active part in implementation of different CDM project including Moldavian. |
| Rozhka Andrey<br><br>Head of the legal department of TIROTEX company | What approach is sued in your company for calculation of CER self-costs? | To assess the costs (in addition to the direct costs of providing new technologies and the cost of their implementation) it is necessary to account consultancy services, costs of validation, verification and project registration in UN (there is a registration fee). Commercial risks are also included in the assessment. Specifically for this project these risks are quite high, so Danish Expert fund is going to be involved to insure the risks.<br>In its turn the price of allowances are determined by market conditions. And during forthcoming 10 years there could be significant fluctuations of the price. |
| Mihaluk Nikolay<br><br>Director of Rybnitsa branch 'Tiraspoltransgaz-Pridnestrivie' LLC | Does the program include only methane emission reduction or also include propane emission reductions? | The project included only methane emission reductions. |
| Ponomarenko Valery<br><br>Finance and Economy director of 'Tiraspoltransgaz-Pridnestrivie' LLC» | Why the project involves only medium and low pressure gas distribution network? | Project boundaries were determined on the basis of the following criteria:<br>- To ensure non-stop gas supply (not interrupt gas supply to the customers);<br>- To include points which most likely have leaks.<br>On the basis of these criteria project boundaries were determined as medium |

| Name | Question | Answer by Project Management Team |
|---|---|---|
| | | and low gas distribution network. |
| Ponomarenko Valery<br><br>Finance and Economy director of 'Tiraspoltransgaz-Pridnestrivie' LLC» | Does repair material allow to disassemble and maintain the valves in the future? | Yes, it allows. The material is more flexible and durable compared to currently used material. If necessary it can be easily dismounted. |
| Cheban Vladislav<br><br>Ministry of Natural Resources and Environmental Control of Pridnestrovian Moldavian Republic<br>Head of Environmental Safety Department | Does material contain any hazardous substances, does it influence to the staff health or environment? | The material does not contain any hazardous substances and is certified in accordance with the legislation.<br>This is one of the advantages of prosed sealing material. |
| Ponomarenko Valery<br><br>Finance and Economy director of 'Tiraspoltransgaz-Pridnestrivie' LLC» | Does material require any specific utilization? | No, specific utilization is not required. |

## E.3. Report on how due account was taken of any comments received:

No negative comments were received which required further clarification.

## Annex 1

## CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

| | |
|---|---|
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## Annex 2

## INFORMATION REGARDING PUBLIC FUNDING

No public Financing was used for this project.

## Annex 3

## BASELINE INFORMATION

Field Program Description

The feasibility study to identify and quantify leaks in sections of the 'Tiraspoltransgaz-Pridnestrivie' LLC distribution network was conducted from August 08, 2011 through August 18, 2011. Measurements were conducted in all branches of 'Tiraspoltransgaz-Pridnestrivie' LLC by specialists of Anem Management Ltd. Methane leaks detected during the study were tagged and measured. Identified sources of leaks included only valves with stem packing. Small amount of leaks were detected at other components, but they were not tagged as they were not included in the project boundaries. Measurements were performed using the Hi Flow Sampler.

The Hi-Flow Sampler makes leak rate measurements with the same accuracy as enclosure measurements but at a speed approaching that of leak detection screening instruments (Howard et al., 1994; Lott et al., 1995 Howard, 1995). The Hi-Flow Sampler uses a high flow rate of air combined with a rapid enclosure to completely capture the gas leaking from the component. A catalytic oxidation/thermal conductivity sensor is used to measure the sample concentration in the air stream of the high flow system. The Hi Flow Sampler methane sensors have been calibrated throughout the project and calibration details have been provided to the validator.

A random sampling of measurements were conducted at 1) High pressure gas regulation points; 2) Cabinet-type regulation point (CTRP); and 3) Stand-alone valves with stem packing. A total of 94 individual sites were inspected over the course of the project with a total of 160 separate leak measurements taken.
Total number of valves with stem packing at this gas distribution equipment were estimated by 'Tiraspoltransgaz-Pridnestrivie' LLC in the amount of 4,835 units. Table 12 below presents a summary of the feasibility study results, and project CER estimates. Table 15 below provides additional statistical information on each site type surveyed.

**Table 15 Feasibility study measurements and CER estimates per site category**

| Type of valves | Number of surveyed valves with stem packing | Average leak rate per valve, L/min | Total number of valves | Volume of gas emissions, $m^3$/year[a] | Estimated CER volume, $tCO_2e$/year[b,c] |
|---|---|---|---|---|---|
| Valves with stem packing at GRPs and CTRPs | 285 | 3.48 | 3,388 | 6,200,699 | 92,871 |
| Stand-alone valves with stem packing | 21 | 6.24 | 1,447 | 4,744,341 | 71,059 |

[a]Operational hours per year = 8760

[b]Uncertainty = 0.5% (estimated per *IPCC Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories*)

[c]Global warming potential = 21 (*2006 IPCC Guidelines for National Greenhouse Gas Inventories*)

**Table 16 Statistical Information on Each Site Type Surveyed**

| | |
|---|---|
| Total number of GRPs | 14,0 |
| Average leak per GRPs, L/min | 14,31 |
| Median, L/min | 12,25 |
| Stdev | 7,27 |
| | |

| | |
|---|---|
| Total number of CTRPs | 59 |
| Average leak per CTRPs, L/min | 13,43 |
| Median, L/min | 11,10 |
| Stdev | 8,29 |
| | |
| Total number of SAV | 21 |
| Average leak per SAV, L/min | 6,24 |
| Median, L/min | 1,10 |
| Stdev | 8,58 |

Feasibility study results and calculations are presented in the attached spreadsheet.

A complete feasibility report has been submitted to the DOE for validation of estimated baseline emissions.

## Annex 4

## MONITORING INFORMATION

The monitoring plan below will be used as an introduction to the periodic monitoring reports, in order to ensure that the monitoring report is in compliance with the monitoring plan.

**Management and Operational Systems**

In order to ensure successful operation of the Project and the credibility and verifiability of the CERs achieved, the Project will have a well-defined management and operational system, and the Project Participants will work together to implement a comprehensive monitoring program.

Staff within 'Tiraspoltransgaz-Pridnestrivie' LLC (TTG-P) will implement the Project operations and monitoring activities by performing detection, measurement, repair and documentation of leaks throughout the crediting period. Quality Carbon Assets AG together with Danish Carbon Assets ApS will provide CDM methodological supervision and support to Project Teams.

Project Teams will be composed of a number of sub-teams, as follows:

Leak Detection, Measurement and Repair Technical Teams
'Tiraspoltransgaz-Pridnestrivie' LLC has 7 branches. To ensure good coordination between the branches, a centralised approach will be implemented. The Project Team will be independent from the branches staff and will report directly to Project Investors and Senior management of TTG-P. This structure will ensure that data is compiled and analysed centrally, and that all decision making occurs with senior management oversight. Additionally, project staff gain experience in all the subsidiary networks and can more easily disseminate knowledge across the organisation.

All project operations and monitoring activities will be overseen by a project manager (PM), who will report directly to Project Investors and Senior management of TTG-P. He will supervise all leak detection, measurement and repair teams covering the branches of 'Tiraspoltransgaz-Pridnestrivie' LLC.

The operators for implementing this CDM activity will be formally trained and certified by technical experts in leak detection and measurement techniques, and advanced repair techniques. The teams will be equipped with:

- 1 Hi-flow™ sampler
- Digital camera
- 1 GMI Gassurveyor™ (500 Series)
- Soap solution
- Tags (or technical markers)
- Ladder (as needed)
- GORE® Repair materials (e.g., GORE® Valve Stem Packing)
- Other materials (Teflon thread tape, valves)

After the baseline study has been completed, and after leak repairs have been made, regular monitoring of the components and repair of any new leaks will be required on an ongoing basis throughout the term of the project.

Database Management Team
Dedicated specialists, supervised by the PM, will be responsible for documenting the leak measurement data, and ensuring that it is correctly entered into an Excel database. The data will be entered on a daily basis, during the leak detection, measurement and repair phases of the project. After that it will be entered as and when monitoring and maintenance works are conducted. One of the

database specialists will be designated "Leader" with responsibility for checking the data and for managing the collection, storage and archiving of all data records.

Project Manager
The Project Manager (PM) will be responsible for coordinating the overall CDM project. The PM will oversee the Technical Teams and Database Management, and will also be responsible for coordinating all other project logistics, including:

- Working with Quality Carbon Assets AG and Danish Carbon Assets ApS to procure equipment and resources
- Ensuring staffing needs for the Technical and Database Management Teams are met
- Engaging with the community and stakeholders
- Evaluating training needs and carrying out training programs
- Monitoring and reviewing safety and environmental aspects of the CDM operations
- Coordinating with any relevant Transnistria/Republic of Moldova government bodies
- Liaising with TTG-P senior management to ensure smooth implementation of the CDM project

The PM will also be the first line of responsibility for implementing project operations on a day-to-day basis.

Project Investors Team
Project Investors will provide the capital necessary to hire labour and equipment to implement the Project, to pay for leak detection and measurement training for TTG-P staff.

Project Investors will coordinate with TTG-P to ensure the Project is compliant with Transnistria/Republic of Moldova regulations. Project Investors will also involve independent third parties on an ongoing basis. Specifically, Anem Management Ltd. will be hired to support project implementation and monitoring.

Project Investors will provide project management assistance, and CDM methodological supervision, to ensure that the Project is implemented in-line with CDM requirements.

**Training Program**

A training program will be conducted to train local staff at TTG-P on how to use advanced detection and measurement equipment, how to execute effective repairs, and how to document the leaks found in an effective manner. The training will be managed by the PM in collaboration with technical experts with significant experience in gas leak detection and measurement, and advanced repair materials to be used in the project. These experts will provide detailed instructions and written materials on how to conduct the leak detection, measurements and repairs. Specific training and expertise elements to be addressed include:

- **Instrument Training**: The DI&M teams will be trained in the use of advanced leak detection and measurement technologies, with certification provided upon completion of the course. Training will cover the following topics:

  *Leak detection approaches*
  - Methods to conduct leak detection (soap solution, gas surveyor)
  - Reporting requirements (tagging, data collection, digital picture)

  *High Flow Sampler operation*
  - Basic High Flow Sampler Setup and Operation
  - High Flow Sampler Applications Overview Basic
  - Instrument Calibration
  - Fundamentals and Theory of Operation

- High Flow Sampler Safety Considerations
- Setup and Calibration
- High Flow Sampler Workshops/Field Exercise

- **Repair Training**: The DI&M teams will be trained in the use of the specific repair strategies/approaches, safety requirements, including:

  *Repair approaches*
  - Understanding valve technology
  - GORE® repair materials
  - Implementing repairs
  - Safety requirements
- **Reporting**: Survey teams will be informed on the procedure for conducting and reporting findings from baseline and subsequent surveys, such as use of a standardized data sheet and procedures for electronic reporting of field data.

The PM will verify that all technical team members have been appropriately trained by monitoring which team members are new, as well as observing the teams out in the field to ensure that all members are appropriately trained.

**Calibration of equipment**

All Hi-Flow samplers will be calibrated to ensure accuracy in their measurements. The TTG-P Technical Teams will be provided with calibration kits and spare part kits. The calibration is done as per the Hi-Flow manual which suggests a 30 day calibration period by certified staff. The calibration is done as per field specifications. The TTG-P Technical Teams will calibrate their detectors at least once a month following the same procedures for each Hi-Flow sampler. The calibration records will be documented each month and maintained by the technical operators together with the Database Management Team.

**Leak Measurement**

The Technical Teams will survey the components in the project boundary using advanced leak detection instruments, such as the GMI Gassurveyor 500. Once identified, the leaks will be tagged, and numbered. The flow rate for each leak will then be quantified using the Hi-Flow sampler. A digital photograph will be taken of the leaking component, tag and Hi-Flow sampler reading. These photographs will be archived by the Database Management Team. In addition, the type of repair expected given the nature of the leak and its location will be categorised for future repair planning.

All leaks that will be detected and measured will be repaired. Repairs may be done not immediately after the measurement, but within certain period of time by the separate repairs teams. After the repair, new leak detection will be carried out to ensure that the leak was properly repaired. If required, additional repairs will be made until no further leak can be detected. If leaks cannot be eliminated remaining leaks will be measured and recorded. The date of the repair (or discovery of remaining leak) will be recorded in the Project Database.

**Monitoring Repaired Leaks**

All leaks that have been subject to repair will be monitored – using the same leak detection technologies on each leak identified in the baseline – to ensure they are maintained, on an annual basis. Where a leak repair fails, it is conservatively assumed that the leak resumed the day after the last inspection, or in case of the first inspection, the day after the repair has taken place. Emission reductions are counted from the date of subsequent repair of that same leak, and are measured using the same type of equipment as in the initial survey (Hi-Flow sampler). Such leaks will be repaired

again followed by new leak measurements. Data collected will be included in the periodic monitoring reports stored in the Database.

**Quality Assurance and Corrective Action**

The Project Participants have taken a number of steps to ensure that the Project data is of a high quality. These steps will include the following activity:

- Verify that maintenance and monitoring of leaks is being conducted in accordance with the Monitoring Plan.
- Observe database team to ensure that data is being recorded and handled as per the requirements of this Monitoring Plan.
- Conduct audits of the data to ensure that adequate records are being kept, and that leaks found and leaks repaired have been accurately documented in the database.
- Observe technical teams to ensure that they are operating equipment and conducting leak detection, monitoring and repair works in the correct manner, and advise on any training needs required.
- Conduct on the ground assessment to verify that project implementation is on schedule and highlight any risks of delay.
- Verify repair/replacement schedule of any regulators that are due to be replaced or repaired for the coming year.

Any issues or problems detected during QC/QA procedures will be reported back to Project Investors and Senior management of TTG-P who will then conduct corrective actions as detailed below.

Corrective Actions and Emergencies
At the end of each yearly monitoring period, draft monitoring report (including comments and irregularity checks) will be submitted for review and approval to Project Investors and Senior management of TTG-P. In the event that such irregularities are observed:

- An analysis of the irregularities and their causes will be carried out immediately.
- The management of TTG-P will make a decision, in consultation with Project Investors, on appropriate corrective actions to eliminate the non-conformity and its causes.
- Corrective actions will be executed under the supervision of the team leader, and any necessary amendments will be made.

**Data Flow, Storage and Management**

A Microsoft Excel database will be used to track leak and repair data. The data parameters tracked will be as follows:

1. *(i)* Total number of leaks – each leak will be tagged with a number and monitored after repair for any additional leaks.
2. *T(i)* Hours of operation, during which time the leak is venting gas
3. Date of leak repair.
5. Leak Rate $F_{CH4,i}$ (litres per minute) – Leak rates will be measured and double checked before repair – major discrepancies will warrant a third test. In other words, if a Hi-Flow Sampler is used to measure the rate of a leak, if the results of two tests are far apart, the testing should continue until two measurements have results very close together (to reduce any inaccuracies in the testing process). Should the Hi-Flow Sampler or other equipment need recalibration or adjustment to ensure their accuracy, the project participants will take the necessary action to do so.

6. Temperature and Pressure – Temperature and pressure are measurements taken into account by the Hi-Flow Sampler at the time of measurement and are integrated into the results from the Hi-Flow Sampler device. The devices will be calibrated on a regular basis.
7. Uncertainty factor – The IPCC Good Practice Guidance will be consulted in compiling uncertainty estimates.

In order to ensure complete record keeping and proper identification of leaks, the following data will also be tracked:

- Number and location of the regulator system (street address and building number)
- Region
- Names of lead technical operator
- Leak tag number
- Type of facility surveyed (gate station / cabinet / station within a building etc)
- Digital photo number
- Any other relevant observations

The data will be entered every 1 to 2 days, during the leak detection and measurement phase of the project, and this will continue during the initial repair phase. After that, data will be entered on an annual basis as and when monitoring and maintenance works are conducted. The database will include records of re-emerging leaks and records performed by Verification teams.

Data will be processed as follows:

1. Technical operator will record data while out in the field for each component separately, using handwritten notes and digital photographs
2. At the end of each day on which measurements have been taken, the technical operator will bring their handwritten notes and digital photograph data to the Database Management team at head office, and they will enter the data collected that day into an excel spreadsheet.
3. On a monthly basis, the Database Management team will collate the data from each day into a master spreadsheet, containing data from all operators on all days

<u>Quality Control, Discrepancies, and Data Security</u>
After the monthly data collation, Database Manager will review the data and check that it has been recorded correctly.

- As leaks can be traced from the individual spreadsheets to the collated spreadsheet, any discrepancies can be easily observed.
- For the individual leaks that appear to be outliers, the Database Manager will verify the measurement with the responsible technical operator to double check the number, and any discrepancies are simply remeasured.
- In addition, Database Manager will review measurements by each individual Hi-Flow Sampler to ensure that no one Hi-Flow Sampler in particular is making measurements that appear to be outliers on a consistent basis. If such discrepancies are found, the Hi-Flow Sampler will be recalibrated and checked immediately, and any erroneous leaks will be re-measured.

There are three concurrent ways of tagging leak locations and tracking leak measurements. Each method by itself would satisfy the needs of identification. However, three methods of identification system that is almost impossible to marginalize:

- Firstly a digital photo of the leak itself is taken and this photograph is then documented on the computer with the actual leakage rate and measurement date
- Second the leak itself is physically tagged on-site and the leak rate and measurement date are written on the tag; and

- Third when the leak measurement and date are entered into the database, the location of the leak is documented.

As a result, if due to unforeseen circumstances, a tag is damage or lost, or a digital photo is accidently deleted, or there are problems with the excel database, there are other sources of information and documentation about the leak as a backup. In addition, this system ensure that leaks can be easily identified and repaired, with the data actually being vital to the repair team to quickly and accurately identify the leak needing repair.

Since the project also relies heavily on electronic data storage, the project managers will employee the following measures to ensure its physical protection.

1. All data (final database) will be stored on site by TTG-P, and also separately by Amen Management Ltd.

All parties will establish back-up procedure and use backup locations for all data. All data will be archived for at least two years after the end of the crediting period both at TTG-P and Anem Management Ltd.These measures should ensure beyond a reasonable doubt the continued existence of all the electronic data for the project.

**Ex-ante calculation of emission reductions**

Please see section B.6.3 above for detail on how the project participants will calculate emission reductions.

**Data and parameters monitored**

Please see section B.7.1. above for detail on the data and parameters that will be tracked, and information on how they will be monitored.

This monitoring plan is summarised in section B.7.2. of the PDD above.