JOINT IMPLEMENTATION PROJECT DESIGN DOCUMENT FORM
Version 01 - in effect as of: 15 June 2006

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Annexes

SECTION A. General description of the project

A.1. Title of the project:

Landfill gas recovery and flaring at the municipal solid waste site “Shirokorechenskiy”, Ekaterinburg, Russian Federation

Version: 04
Date: 17/01/2011

A.2. Description of the project:

The Project includes an installation of equipment for landfill gas (biogas) recovery with its consequent flaring for destruction of its methane component. Implementation of the Project will take place at the Shirokorechenskiy solid waste disposal site (SWDS) situated not far from a newly erected district of the city of Ekaterinburg, the Urals, Sverdlovsk Region, Russia.

The landfill site started operating in 1960. Total area of the waste site is 41 hectares, the waste layer thickness is 42m. On average 542,000 tonnes of waste are disposed at the landfill site annually. The waste is coming from the city of Ekaterinburg whose population is 1,340,000 people. Total volume of waste buried from the beginning of operation of Shirokorecheskiy landfill is about 24 million tons. By this moment 12 hectares of the site are out of use (reclamation was carried out in 2002). The area of 10 hectares is currently in operation while two hectares are still free. Closing of this area is planned in the first half of 2008.

In the beginning of 2007 the Ramenskiy Regional Environmental Center explored the Shirokirechenskiy landfill in order to estimate biogas reserves of this site. They conducted a spur survey and came to conclusion that active process of methanogenesis run in the body of the landfill causing formation of the biogas.

According to ex-ante estimation the average methane generation is about 37,4 million m^3 a year (26.8 ths tones)

The equipment designed for collection, recovery and destruction methane component of landfill gas (by flaring) will be installed at this area. A set of equipment is typical for such kinds of projects and includes the pipes for landfill gas collecting, vacuum-pumping equipment, flare device and the system of management and control.
At present a preparation of technical documentation is coming to an end. The equipment will be delivered to the landfill site in November 2008, and in January 2009 the Project will become operational.

All landfill gas captured will be burned in the flare leading thus to destruction of methane and reducing thus greenhouse gas emissions. The total emission reductions with estimated uncertainty 0,63 (you can see Section E) will be 958,868 tons of CO_2 equivalent during the 2009-2012 crediting period.

Besides the global climatic effect, this Project will contribute to sustainable development of Ekaterinburg and its environs since it will lead not only to elimination of undesirable odor but to reduction of emission of such harmful substances as ammonia, hydrogen sulfide, carbon monoxide, soot, dust etc. Presence of methane in the mass of the landfill is a potential source of inflammation, which is leading to air pollution by hazardous substances. In case of possible fire, this may constitute an additional threat to local population living in the neighborhood.

A.3. Project Participants:

Table A.3.1. Project Participants

Party involved	Project participants	Please indicate if the Party involved wishes to be considered as project participant (Yes/No)
Russian Federation (Host Party)	Center of Environmental Projects	No

A.4. Technical Description of the Project:

A.4.1. Location of the Project:

The Project will be implemented at the Shirokorechenskiy Solid Waste Disposal Site near to the city of Ekaterinburg, Sverdlovsk Region.

Figure A.4.1. Location of Shirokorechenskiy Site

A.4.1.1. Host Party(ies):

Russian Federation

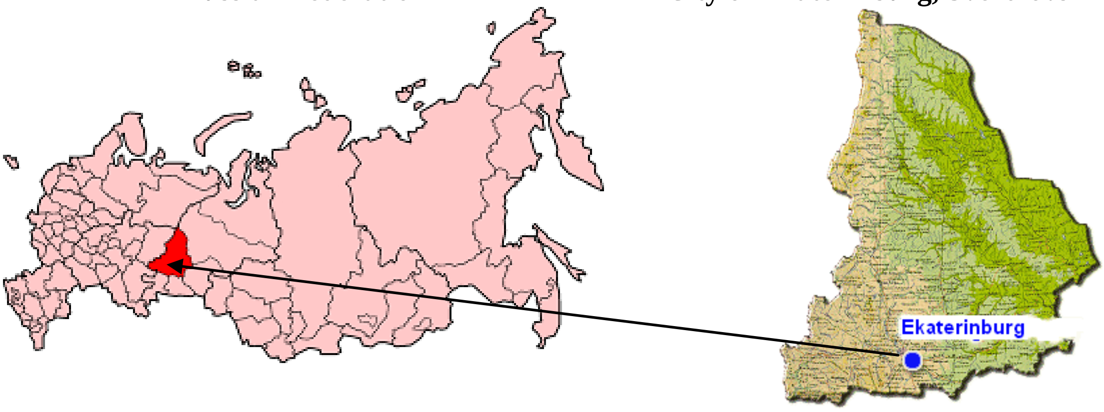
A.4.1.2. Region/State/Province etc.:

Sverdlovsk Region is a largest region of the Urals. Its territory covers almost 195,000km² (1.2 % of the area of the Russian Federation). The Region occupies a middle and northern parts of the Urals and also western margin of Western Siberian Plain.

Estimated population of Sverdlovsk Region was 4,399,700 people as of January 1, 2007 (5th in Russia). A population density is 22.6/km² (estimate of Jan 1, 2007) which is almost three times as much as the average of the RF. A share of urban population exceeds 83 % (estimate of Jan 1, 2006).

Table A.4.1.2 Sverdlovsk Region

Russian Federation **City of Ekaterinburg, Sverdlovsk Region**



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

Ekaterinburg is an administrative center of Sverdlovsk Region and Ural Federal Okrug. It is situated on eastern slope of the middle Urals on the shore of the River of Iset' which is in its turn a tributary of the River of Tobol, at the distance of 1,500 km of Moscow.

Ekaterinburg is a large transport and logistics communications hub on TransSiberian Trunk-Road, an important industrial center (metallurgy, light industry, food industry, printing, heavy engineering, military and chemical industry).

Ekaterinburg is one of few Russia's cities with population exceeding one million inhabitants where this population has recently increased and made about 1,300,000 people.

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

The Shirokorechenskiy landfill site near the city of Ekaterinburg, on the territory of Shirokorechenskiy Forestry.

The landfill site has the appearance of an artificial mound made of wastes and is situated on a flat slope of a tributary of Patrushikha River.

Figure A.4.1.4. Shirokorechenskiy landfill site

General Description of the Site:

- Owner: EMUE Specialized Motor-Transport Depot;
- Operator: EMUE Specialized Motor-Transport Depot;
- The Site is active and has been functioning since 1960;
- Total area of the dump is 41hectares;
- Thickness of the wastes is 42m.;
- Capacity of the object is 37,504,200.1t;
- Total volume of wastes buried is 23,961,117.6t;
- Annual volume of wastes to be buried is 542,000 t;
- Type of cover: soil and building refuse.

Functioning of the Site

The Site started to operate in 1960. For the time being a 12 hectares of the dump is not used (a land reclamation was carried out in 2002). The 10 hectare area is under operation, while a 2 hectare area is free and 14 hectares are in reserve. Administratives and technical buildings holds 3 hectares of the site. The site operates round-the-clock; the wastes are accepted from 8:00 a.m. to 8:00 p.m. A composition of wastes buried on the Site sections used is as follows:

- food waste - 30%;
- paper, packing board - 30%;
- wood - 20%;
- metal scrap - 2%;
- textile - 5%;
- glass - 3%;
- leather and rubber - 2%;
- stone and plaster - 5%;
- plastics - 1%;
- others - 1.5%; and

– siftings - 0.5%.

In the beginning of 2007 the Ramenskiy Regional Environmental Center explored the Shirokirechenskiy landfill in order to estimate biogas reserves of this site. They conducted a spur survey and came to conclusion that active process of methanogenesis run in the body of the landfill causing formation of the biogas. The average biogas composition is presented in the table below.

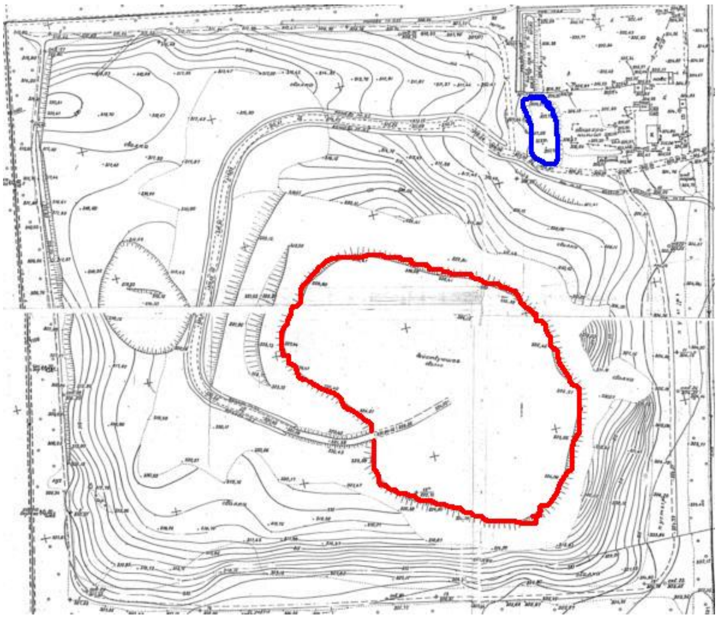
Table A.4.1.4. The biogas composition

Component	Proportion in the biogas composition, %
Methane	44.5
Carbon dioxide	33.5
Hydrogen	0.58
Nitrogen	21.4

According to ex-ante estimation the average methane generation is about 37.4 million m^3 a year (26.8 ths tones).

The area under operation is marked red on the site's map (16 ha of the total 22 ha) and there will be installed a gas collecting equipment after decommissioning of the site. The compressor and the flare device will be installed at the special designated area close to the artificial mound of wastes (marked blue).

Figure A.4.1.4.2. General layout of Shirokorechenskiy landfill site



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

Technology to be employed for collecting the landfill gas at the Shirokorechenskiy landfill site represents a system of vertical wells to be drilled in the rock mass of the site after its closing. A principle of vacuum pressurization is laid in the base of the landfill gas collecting system operation, thus allowing to pump out from the wells the landfill gas generated in the waste mass. Primary components of the system to be installed are as follows: vertical wells for gas collection, pumping equipment represented by mechanical pumps that are required for generation of reduced pressure in the system needed for pumping out the landfill gas. The system will also include some equipment for gas condensing as well as a combustion chamber. Also, a system of control and operation of equipment will be installed. Besides, a flare device required for combustion of landfill gas collected will be erected. Electric power required for operation of equipment will be imported from the grid.

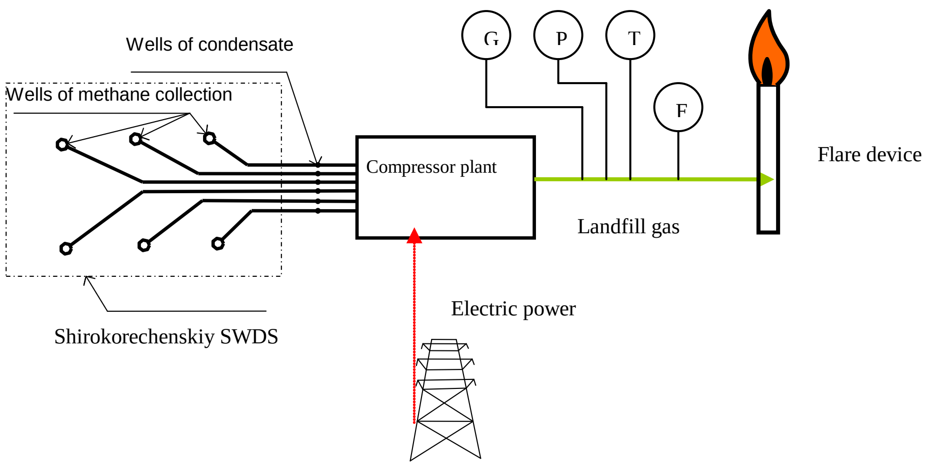
The list of equipment and its description are given in the Table below.

Table A.4.2. List of engineering equipment

Items	**Description**
Vertical wells for gas collecting and pipelines	Will be arranged on perimeter of the dump. The depth of the wells is 5 to 20m. A pipelines system will be connected with c central pipe that will transport the gas to a combustion chamber.
Pumping equipment	It includes a system of pumps and pipelines. The pumps are of one-level, centrifugal and required for transport of landfill gas from the Site to the burner (combustion chamber). They will also provide for relevant pressure and head of the gas. Volume and pressure will be controlled by electric motors. All pumping equipment will be equipped with protection system including the premises for reducing the noise level.
Flare Device	It is required for burning part of landfill gas in order to destroy the methane component and reduce a greenhouse effect. Burning will be carried out at a high firing temperature (>1000^{0}C).
System of control and operation	It includes installing the gas-analysing and gas-measuring equipment. It is required for providing safety and production control. The system contains some measuring instruments that control the concentration of methane, oxygen together with volume of gas, pressure and temperature.

See below the engineering scheme of the Project:

Scheme A.4.2.



Legend

(red dotted line)	Electric power	F – Flow gage G – Gas analyzer
(green line)	Landfill gas	P – Pressure gage T – Temperature probe

In project equipment there will be applied enclosed flare.
So we use approach that default value of flare efficiency should be used. In 'Tool to determine project emissions from flaring gases containing methane's flare efficiency in the hour *h* is 90% if the temperature in the exhaust gas of the flare (T_{flare}) is above 500^0 C for more than 40 minutes during the hour *h* and the manufacturer's specification on proper operation of the flare are met continuously during the hour h.
In our case ECOCOM performs technical project. The company has a wide experience in LFG treatment projects in many countries (Latvia, the Ukraine, Russia). In Moscow region it implements three projects where the same equipment is planned to be set. All the equipment has 'Confirmation of Flare efficiency from Pro2 Anlagentechnik GmbH'.In this document flare efficiency is declared 99%, temperature of the flare >/= 1000^0C with monitoring, retention time >/= 0.3 s with 1000^0C.
So we use default value 90% as the equipment satisfies all the conditions (T_{flare} >/= 500^0C for more than 40 minutes during the hour h).
For the purpose of recovery of landfill gas the following procedure will be followed:

A network of vertical gas-draining wells will be connected by the gas pipelines where the compressor unit generates a negative pressure which is required for transport of landfill gas to the sites of its utilization. The units designed for collection and disposal will be mounted on a special ground outside the wastes body.

For the landfill gas recovery the vertical boreholes will be drilled. Usually the wells are evenly placed on the territory of wastes body at the distance of 50 to 100m between the neighboring wells. Their diameter varies within 200 to 600mm, and the depth depends on the thickness of landfill body and may achieve several tens meters. Standard drilling equipment will be used for drilling the boreholes along with specialized machinery that allow drilling the big diameter wells. Engineering development of boreholes includes several stages. First, a perforated steel or plastics pipe will be lowered into the well being blanked off at the bottom and equipped with a flange at the wellhead part. Then, a porous material (for instance, gravel) will be loaded into the tube space being subjected to a layerwise consolidation up to the depth 3 to 4m of the wellhead. At the last stage a 3 to 4m clay lock will be built in order to prevent penetrating the atmospheric air into the well.

Upon completion of construction of the well installing a wellhead will begin. The wellhead is a metal cylinder equipped with gas-locking fittings designed for control over well production and landfill gas composition as well as with a branch pipe for connecting the well to the gas pipeline.

After recovery of landfill gas from the site body and its delivery to the transporting pipelines a sharp drop of temperature occurs, thus leading to the condensate forming and sometimes in a rather large amount. Therefore a diversion of condensate with the aid of special devices is a first priority task, since its presence in the gas pipeline may hamper or even prevent the landfill gas recovery. The pipeline consisting of polyethylene pipes will be laid down in the trenches drifted at the depth where freezing is impossible in winter. A hot-well represents a tank for drain of condensate equipped with the system of hydraulic lock providing for minimum efforts needed for keeping the system in working conditions.

In order to control the gas pipeline operation the locking fittings made of anti-corrosion and biogas-resistant materials, i.e. valves, valve gates and slide valves will be used.

The landfill gas will come through the pipeline system to an accumulator tank of landfill gas. The gas gathering station will be designed for forced recovery of landfill gas from the wastes body. For this purpose a small depression (vacuum) will be generated in the system of gas pipelines with the use of special compressors.

Then, the landfill gas gathered will be burned at the high firing temperature (>1000^{0}C).

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

In the absence of the Project's activities (Baseline Scenario) the methane-containing biogas which would have been burned by flare device will leak to the atmosphere. According to a hands-on-experience of landfill sites management in Russia, the upper layer of waste is covered up by soil before closing the site with account of consequent land reclamation. Nevertheless, the landfill gas born in the mass of wastes comes out on the surface through the soil placed on and is partially oxidized during its passage through this soil. It leads to increased concentrations of methane in the atmosphere and gives rise to a greenhouse effect.

The Project proposed for implementation is aimed at destruction of methane present in the landfill gas. For this purpose within the framework of the Project it is supposed to collect and burn the landfill gas at the flare device resulting in destruction of methane contained in the gas[1].

[1] Landfill gas generated at Shirokorechenskiy Site consists of 45% of methane and 35% of carbon dioxide. But the carbon (CO_2) component of the landfill gas due to its biogenic origin and, consequently, being part of cycle of carbon, is not considered as antropogenic source of greenhouse gases.

Hence, due to Project activities the emission of methane (CH_4) into atmosphere with estimated uncertainty 0,63 (you can see Section E) will be reduced in the amount of 40,491 tones of CH_4 or **958,868 tones of CO_2-equivalent** within the period from 2009 to 2012.
In the absence of such Project activities it would be impossible to achieve such reductions, as the current management of landfill sites does not prevent the leaks of biogas formed the waste mass into atmosphere.

Current national policies provide no incentives in Russia to reduce methane emissions at landfill sites by flaring. The main obstacles for LFG flaring projects in Russia are as follows:

- There are no legislative acts in the Russian Federation that would regulate the collecting and burning the landfill gas;
- There are no programs at the federal and regional level to financially support such projects.

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

Table A.4.3.1. Estimated amount of emission reductions over the crediting period (with estimated uncertainty 0,63 (you can see Section E)

	Years
Length of the crediting period:	01.01.2009-31.12.2012
Year	**Estimate of annual emission reductions in tons of CO_2 equivalent**
2009	237,196
2010	238,914
2011	240,575
2012	242,182
Total estimated emission reductions over the crediting period (tons of CO_2 equivalent)	**958,868**
Annual average of estimated emission reduction over the crediting period (tons of CO_2 equivalent)	**239,717**

A.5. Project approval by the Parties involved:

The project “Landfill gas recovery and flaring at the municipal solid waste site “Shirokorechenskiy”, Ekaterinburg, Russian Federation” is approved as a JI project by the Order of Ministry of Economic Development #709 dated 30.12.2010.

SECTION B. Baseline

B.1. Description and Justification of the Baseline Chosen:

The baseline setting in this PDD follows procedures contained in the latest version of approved consolidated baseline methodology ACM 0001 “Consolidated baseline and monitoring methodology for landfill gas project activities” (Version 8).

Among other tools this methodology refers to there is the approved CDM “Combined tool to identify the baseline scenario and demonstrate additionality” (the latest version 02.1), which was applied for description and justification of the baseline.

A step-wise approach provided by this tool defines consideration and evaluation of alternative scenarios in respect to the Project implementation in accordance with the following steps:

1. Identification of alternative scenarios.
2. Barriers analysis.
3. Investment analysis.
4. Common practice analysis.

Step 1. Identification of alternative scenarios

Sub-step 1a. Determination of alternative scenarios with respect to the present Project:

Two alternative scenarios are proposed for consideration in this analysis.

1. Continuation of current situation followed by closing and conserving the landfill site without collecting and flaring of landfill gas.

Early in 2008, the height of Shirokorechenskiy landfill will reach the maximum that equals to 45 meters. Due to the fact that the landfill site will exhaust the limits for disposal of wastes, its conservation is planned, i.e. the coverage of the last layer of wastes with isolating layer of soil. Nevertheless, after completion of such measure the biogas generated within the mass of wastes will leak to atmosphere being partially oxidized in the upper layers. So, the methane leaks to atmosphere will go on after the closure of the site.

2. The Project itself, i.e. gathering and burning the landfill gas (without being registered as Joint Implementation).

Closure of the site may be accompanied by installation of equipment for gathering and burning the landfill gas at the flare device.

Sub-step 1b. Compliance of alternatives chosen with current legislation and regulation:

At present, in the Russian Federation there are no legislative acts that prevent gathering and utilization of landfill gas. Thus, the above mentioned alternatives comply with existent legislation.
On the federal level the regulation of solid waste disposal sites management is based on two main documents, which are:

1/ Sanitary regulations «Hygienic requirements to the arrangement and management of solid waste disposal sites» SP 2.1.7. 1038-01 dated 30/05/1996 and adopted by the Chief sanitary inspector of Russian Federation.

2/ Sanitary regulations and norms «Hygienic requirements to the disposal and sterilization of waste and consumption residue» SaN PiN 2.1.7. 1322-03 adopted by the Chief sanitary inspector of Russian Federation dated 30/04/2003.

These documents contain no provisions for capture/destroy LFG.

Besides, on the regional level, there is strategic plan of the city of Ekaterinburg development exist which is approved by the Decree #40/6 at 10.06.2003 issued by the legislative body of the Ekaterinburg City . This Plan contains strategic project "Waste management" which is also doesn't have any recommendations or requirements to capture/destroy LFG.

In the site level, the there is no options to capture/destroy LFG. You can see the scheme of basic operation translated from "Instruction of "Shirokorechensky landfill site operation" into English (you can see the Scheme of basic opration of the landfill in Annex 2).

So, these documents are obvious evidences that there are no legal requirements to capture/destroy LFG in the Russian Federation.

Conclusion: None of proposed alternatives contradict the current legislation and may be considered in the further analysis.

<u>Step 2. Analysis of barriers</u>

Within the framework of this Stage the barriers are analyzed that could have hampered a development of alternative scenarios.

Sub-step 2a. Identification of the barriers that would prevent the implementation of alternative scenarios

For the purposes of the present evaluation, the following barriers are considered:

- *Investment Barrier.* The following fact indicates a presence of such barrier for a certain alternative: No private capital is available from domestic or international capital matkets due to real or perceived risks associated with investments in the country where the project activity is implemented;
- *Technological Barrier.* The particular technology used in the proposed project activity is not available in the relevant geographical area. Skilled and /or properly trained labour to operate and maintain the technology is not available in the relevant geographical area, which leads to an unacceptably high risk of equipment disrepair, malfunctioning or other underperformance.
- *Lack of prevailing practice.* The alternative is the first of its kind.

Investment Barrier

Sub-step 2b *Elimination of alternative scenarios, which are prevented by the identified barriers*.

1. <u>Continuation of current situation followed by closing and conserving the landfill site without collecting and flaring of landfill gas.</u>

Influence of investment barrier on this scenario is not significant as no large investment is needed. All costs including operation, closure of the sites and land reclamation shall be covered from local budget that allocate the funds incoming from the landfill. The source of these funds are tariffs for disposal of waste at the landfill. So, the barrier for this scenario does not exist.

As evidence to support this argumentation Calculation of the financing requirement and tariffs for solid waste disposal presented by the entity operating solid waste site "Shirokorechenskiy"), EMUP " Spetsavtobaza**"** is attached. See Annex 2.
As can be seen from this document all expenses need for day-to-day management of Shirokorechenskiy landfill site covered by the tariff, which is calculated according to these expences. Also this document evidences that no sources for any other activity (i.e. the Project)

2. <u>The Project itself, i.e. gathering and burning the landfill gas (without being registered as Joint Implementation).</u>

Due to large capital investments in this Project and lack of clear commercial profit (beyond JI) the Project is not of interest for potential investors. From this point of view, there is a significant investment barrier for such scenario.
To confirm that the Project is really a large investment the commercial offer from a supplier of LFG capture and flaring technology, Ecocom Climate Protection Umweltschutz GmbH is attached. See Annex 2.

Technological Barrier

1. <u>Continuation of current situation followed by closing and conserving the landfill site without collecting and flaring of landfill gas.</u>

This scenario does not have a technological barrier as the continuation of current situation represented by closure and conservation of the landfill sites shall be carried out in accordance with regulations[2] related to the management of the solid waste disposal sites and is, in fact, usual practice in the Russian Federation. The entity that currently operates the landfill has the necessary personnel and equipment for fulfillment of this scenario. Thus, a realization of this alternative does not represent a technological risk and, respectively, in such case this barrier does not exist.
These regulations are "Instructions on "Shirokorechensky landfill site operation".

2. <u>The Project itself, i.e. gathering and burning the landfill gas (without being registered as Joint Implementation).</u>

On the way to development of this scenario there is a serious technological barrier as the technology to be used in the Project does not have analogue in the Russian practice. Because of lack of skills in operation of such equipment, the Project operators will face all the risks inherent in start-up, adjustment and operation of new equipment without having in place a tested process procedure.

Since this technology is innovative, the Project operator would need to recruit and train a technical personnel capable to provide for trouble-free operation of equipment. Lack of process procedure would cause some difficulties related to training the personnel.

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[2] http://www.recyclers.ru/files/idmswp.pdf (Instruction on designing, operating and reclaiming of solid waste disposal sites)

The existing legal base in the Russian Federation for landfill sites management does not require to capture and destroy LFG (please see sanitary regulations and norms indicated above). It means that such kind of projects are not developed in Russia so far as they have no rational without JI mechanism application. Therefore, the technology is technically innovative in Russia. That means no technological procedure; no trained staff are available for such projects nowadays.

Barrier caused by lack of prevailing practice

1. Continuation of current situation followed by closing and conserving the landfill site without collecting and flaring of landfill gas.

The barrier does not exist as conservation of landfill sites with further reclamation is standard one and applied throughout the territory of the Russian Federation.

2. The Project itself, i.e. gathering and burning the landfill gas (without being registered as Joint Implementation).

The barrier exists as the technology of gathering and burning of landfill gas is not currently commonplace on the territory of the Russian Federation. Besides, there is no LFG project implemented in Russia that would be aimed at gathering and burning of landfill gas.

Conclusion: The performed analysis of impact of various barriers on development of alternative scenarios has showed that the Scenario No.2 could not overcome such barriers and the Scenario No.1 (Continuation of current situation followed by closing and conserving the landfill site without collecting and flaring of landfill gas) only did not have obstacles for its development. Thus, this alternative Scenario is a *Baseline Scenario*.

Nevertheless, Scenario No.2 (Gathering and burning the landfill gas) has been chosen for a further development. The reason for this was the opportunity to overcome above-mentioned barriers through the use of Joint Implementation mechanism (JI) of Kyoto Protocol. The use of this mechanism will provide the Project with a source of financing and allow to implement successfully a new technology and select and train an operating personnel.

Step3. Investment analysis

The economic survey given below shows that this Project can be implemented only if JI mechanism will be in place, as without this mechanism the Project makes no economic sense at all.

The comparison of Project’s internal rate of return (IRR) with and without influence of income from the sale of Emission Reduction Units (ERU) is considered in this analysis.

Table B.1. Input data for economic analysis

1. Capital expenditures, €10^3	2,120
2. Operation costs, €10^3/year	505
3. Discount rate, %	10
4. Price of ERU, €/tons CO_2	8

Table B.1.2. Results of economic analysis

Scenario	IRR (with ERU)	IRR (without ERU)
Gathering and burning the landfill gas	66.64%	n/a

The investment analysis was based on information presented in the Preliminary commercial offer submitted by Ecocom Climate Protection Umweltsutz GmbH to the Project owner, *Center of Ecological Projects (CEP)* from Ekaterinburg. The original offer in English is attached (see Annex 2).

Thus, as it is seen from the Table present, the Project without sales of ERU, from investment point of view, is not economically viable. Only in the case of realization of ERU on the carbon market, the Project will become financially viable providing with cash flow and IRR of 66.64%.

Possible risks observed.

There are three main kinds of risk associated with the project:
1) Construction risk. It means that project would start operating later than it was planned due to failure of meeting construction deadline. This risk was mitigated by collaborating with highly experienced company ECOCOM http://ecocom.at . The company has profound experience in LFG utilization in the Ukraine, Latvia and Russia.

2) Performance risk. This kind of risk is connected to lack of experienced staff who will operate the Project technological equipment. Under agreement with *CEP*, ECOCOM will train the staff so the risk will be mitigated considerably.

3) Financial risk. The risk is associated with the situation that due to lack of incomes the *CEP* will get a loss. The only source of income for this project is ERUs selling. For evaluation of this source ACM 0001 methodology was chosen and applied. Ramenskiy Regional Environmental Center explored the Shirokorechenskiy landfill in order to estimate biogas reserves of this site. Total amount of emission reductions is 958,868 tons of CO2 equivalent. It will allow to get 7,670,944 euro (with the average price 8 euro per ton). This sum will allow not only to recoup the project, but also to get profit.

Sensitivity analysis

The sensitivity analysis has been performed by varying the following key assumptions: Cost of investment and EUR price.

In the first upside scenario investment cost have been decreased on 10 % (up to 1,908 million Euro, instead of 2,120 million Euro), it would increase project IRR on 9.38 %, that would give essential economic advantages by realization of the project.(the project IRR will be 76.02%)

In the more pessimistic scenario, under negative tendencies of economy development, the investment cost has been required to increase. Their presumable increasing on 10 % (up to 2,322 million Euro) would lead to reduction of project IRR on 7.83 % that is rather essential.(the project IRR will be 58.81%)

The Influence on project economic attraction of EUR price less significant. In the optimistic scenario, with increasing EUR price on 10 %, the project IRR would increase on 6.3 % (the project IRR will be 72.94%). As a result of the pessimistic scenario, with EUR price reduction on 10 %, the project IRR would reduce on 6.35 % (the project IRR will be 60.29%).

The project is very capital intensive and also sensitive to the investment cost. The size of investments gives an essential influence on parameters of economic efficiency. EUR price changing give a less essential influence on the project.

Assumption	Investment cost up by 10%	Investment cost down by 10%	EUR price up by 10%	EUR price down by 10%
Project IRR %	58.81 %	76.02 %	72.94 %	60.29 %

Step 4. Common practice analysis

As stated in the Combined tool the previous steps shall be completed with an analysis of the extent to which the proposed project type (e.g. technology or practice) has already diffused in the relevant sector and geographical area. This test is **a credibility check** to demonstrate additionality which complements the barrier analysis.

Current situation in the sector
As for the 'Common practice' nowadays in Russia there is no such activity for capture/destroy LFG without JI. But in the past there were two examplesAccording to the document http://www.ogbus.ru/authors/Yagafarova/Yagafarova_1.pdf there were two projects of LFG capturing in Moscow region.
One of them was the "Kargashino" LFG- to- energy project and the other one the "Dashkova" LFG collection and utilization system. The systems installed included several vertical and horizontal gas wells and a landfill gas collection systems, which were connected to the gas wells. The landfill gas was either burned in a flaring system or in a gas engine depending on its quality.
The "Kargashino" LFG- to- energy system was situated not far from the city of Mytishi (Moscow region). It was in operation from 28.02.96 to 16.10.96 and worked 2,769 hours. 140,801 m^3 of landfill gas was extracted by using three landfill gas extraction wells installed on a waste mass of 61, 041 tones. The recovery rate was 60% and the gas generation potential of the degassed landfill part was assessed with 742,396 m^3 per year.
The "Dashkova" LFG collection and utilization system situated in the south-west of the city of Serpukhov (also Moscow region) was in operation from 17.01.95 to 13.12.96; it worked 9,616 hours and extracted 310,980 m^3 of LFG by using three landfill gas extraction wells installed on a waste mass of 62,250 tons. The recovery rate was 40% and the gas generation potential of the degassed landfill part was assessed with 708,242 m^3 per year.
After successful implementation of the LFG collection and utilization systems the systems worked between half a year and two years without major problems and were turning landfill gas to electricity. The electricity was used for operational needs of the landfill territory itself and supplied to the village situated next to the landfill.
Due to operation costs and maintenance works in connection with the very low tariffs for electricity in the Russian Federation the whole landfill gas collection and utilization systems were stopped after half a year and two years of successful operation. The main problem was that the grant used for financing the LFG collection and utilization systems financed only construction of the systems but not their operation and due to the low feed in tariffs for electricity and the problems occurring with the maintenance works the operation of the systems became unattractive for the operators.

Therefore this practice is not widely spread in Russia.

For the time being, a current practice of decommissioning of landfill sites in Russia envisages their conservation (cessation of waste disposal and coverage with a soil layer) followed by subsequent land reclamation.

The newly emerged projects in the field of landfill gas utilization in the Moscow Region including the projects on the sites of Dmitrov, Khmetievo and Timokhovo are realized exclusively within the framework of Kyoto Protocol, thus confirming the fact that such Project cannot be referred to the *common practice* category. Therefore, Project activity is not a common practice and thus *additional*.

B.2. Description of how the anthropogenic emissions of greenhouse gases by sources are reduced below those that would have occurred in the absence of the JI project:

The analysis present in sub-section **B.1.** demonstrates clearly that the Project is not a Baseline Scenario and the Project activities can be referred to additional ones with respect to the situation which could have taken place in the event of implementation of Baseline Scenario.

The Project generates GHG emission reductions in the following manner:

GHG baseline emissions

As per *Baseline Scenario*, the Shirokorechenskiy landfill site will be closed and abandoned. The landfill gas will be generated and emitted in atmosphere caused by anaerobic decomposition of organic wastes. The landfill gas gnerated there consists of about 44.5% of methane and 33.5% of carbon dioxide. But the CO_2 component of landfill gas due to its biogenic origin and, subsequently, being part of carbon circulation is not counted as anthropogenic source of GHG.

In conformity with Baseline Scenario, a source of GHG emissions, methane contained in the landfill gas, which is generated in the waste body and leaks to atmosphere in an uncontrolled way.

As a result of calculation performed (see Section "E"), the Baseline emissions will be as follows:

Table B.2. Emission of methane by Baseline Scenario

Year	2009	2010	2011	2012
Methane, tones of CH_4	26,639	26,832	27,019	27,199
Methane, tones of CO_2-eqv.	559,425	563,476	567,394	571,185

Project GHG emissions

By Project, the landfill gas (LFG) will be gathered and burned at the flare. Due to incomplete combustion, a part of methane contained in the LFG will vent into atmosphere just as it is, without oxidation[3].

[3] A default value of 90% is assumed for the flare efficiency. See section E for details.

Hence, the GHG emissions to atmosphere during the Project activities will happen due to- incomplete burning of landfill gas at the Flare Device.

Based on results of calculation (see Section “E”), the Project emissions will be as follows:

Table B.2.1. Emissions of GHG due to the Project activities

Year	**2009**	**2010**	**2011**	**2012**
Methane emissions due to incomplete buning at the flare device, tones of CH_4	2,664	2,683	2,702	2,720
Total Project emissions, tones of CO_2equivalent	55,943	56,348	56,739	57,119

Reduction of GHG emissions

Taking into account the said above, reduction of GHG emissions into atmosphere will be achieved due to destruction/combustion of methane in the landfill gas.

Thus, reduction of GHG emissions during the Project activities are evident and lead to a substantial mitigation of negative impact on climate.

Table B.2.2. Reduction of GHG emissions due to the Project activities

Year	**Baseline Emissions**	**Project Emissions**	**Emission reductions**
2009	281,950	44,754	237,196
2010	283,992	45,078	238,914
2011	285,966	45,391	240,575
2012	287,877	45,695	242,182
Total (2008-2012)	**1,139,785**	**180,918**	**958,868**

Due to implementation of the Project during 2009-2012 there will be reduction amounting to 958,868tones CO_2-equivalents.

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

The sources of GHG emissions related to the Project activities are included in the Project boundary. It is only those emissions that contribute considerably (over 1%) to a total volume of GHG emissions are included in the Project boundary and taken into account during estimates.

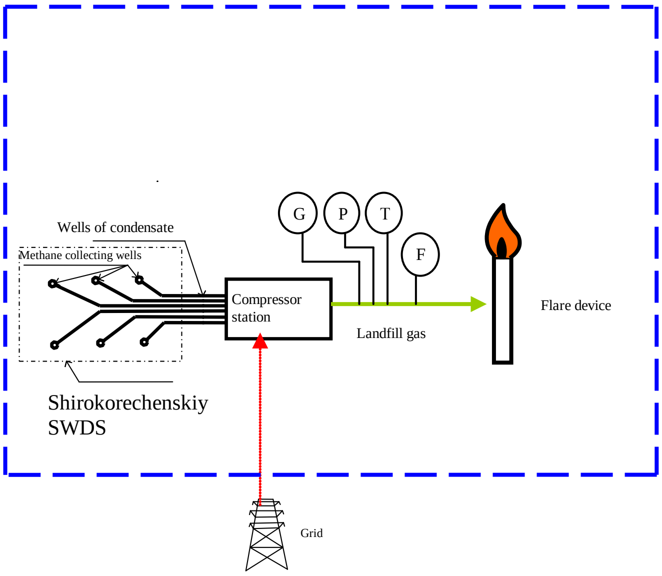
Implementation of the Project will lead to reduction of such greenhouse gas as methane CH_4. For more details see the sources of emissions described in the Table below:

Table B.3. GHG emission sources

	Source	Gas	Included?	Justification/Explanation
Baseline	Landfill gas emissions	CH_4	Yes	The CH_4 emissions are made from anaerobic decomposition of organic waste.
		CO_2	No	Because formed CO_2 is of biogenic origin.
		NO_2	No	Excluded for simplification. This is conservative.
Project activity	Burning the landfill gas at the flare device	CH_4	Yes	The CH_4 emissions are caused by incomplete burning of landfill gas.
		CO_2	No	Excluded for simplification. This is conservative.
		NO_2	No	Excluded for simplification. This is conservative.
	Emissions in the power grid due to electricity imports for Project needs	CO_2	No	The CO_2 emissions are made at the grid power stations during combustion of fossil fuels. They are not included in the Project boundary due to their insignificance[4]but included in Monitoring Plan.
		CH_4	No	Excluded for simplification. This is conservative.
		CO_2	No	Excluded for simplification. This is conservative.

[4] GHG emissions caused by imports of electricity from the grid during the project activities will amount to 1560tones CO_2 for the period of 2009 to 2012, or 0.16% of total amount of emissions of 958,868 tones of CO2 for the period of 2009 to 2012.(for the detailed estimation see Annex 5.)

Figure B.3. Boundaries of the Project



Legend

Electric power

Landfill gas

F – Flow gage

G – Gas analyzer

P – Pressure gage

T – Temperature probe

B.4. Further baseline information, including the date of baseline setting and the name(s) of the person(s)/entity(ies) setting the baseline:

Date of baseline setting: 14/02/2008

National Carbon Sequestration Foundation
Contact person: Mr. Marat Latypov, Head of Project Development Department
Tel.: +7 (495) 975 78 35 ext. 103
Fax: +7 (495) 975 78 35 ext. 107
E-mail: LatypovMF@ncsf.ru

The National Carbon Sequestration Foundation is not a project participant.

SECTION C. Duration of the project / crediting period

C.1. Starting date of the project:

November, 2008

C.2. Expected operational lifetime of the project:

Operational lifetime of landfill gas gathering system is 15 to 20 years depending on timely maintenance and servicing.

C.3. Length of the crediting period:

January 1, 2009 through December 31, 2012

SECTION D. Monitoring Plan

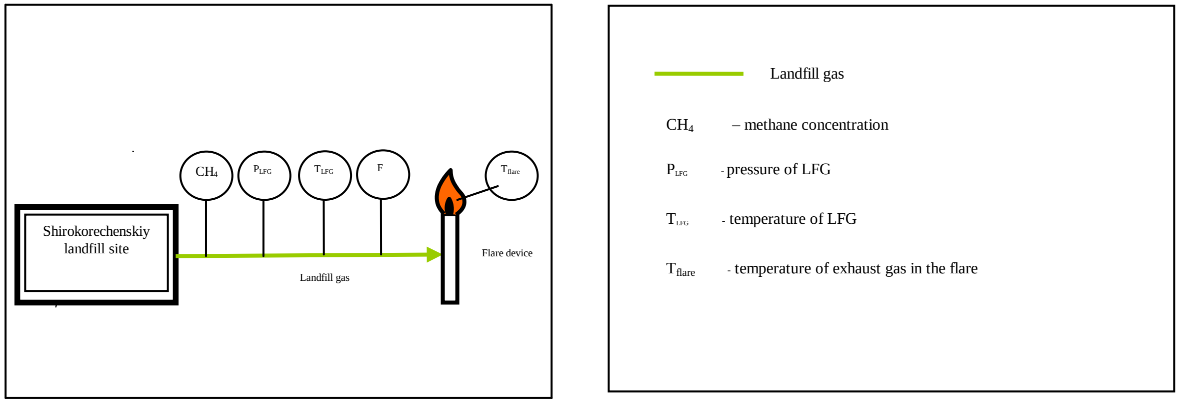
D.1. Description of monitoring plan chosen:

The monitoring plan for the "Landfill gas recovery and flaring at the municipal solid waste site "Shirokorechenskiy", Yekaterinburg, Russian Federation" project has been developed in accordance with the approved ACM0001 "Consolidated monitoring methodology for landfill gas project activities" methodology. The monitoring methodology is based on direct measurements of the amount of landfill gas captured and destroyed at the flare platform.
The main variables that need to be determined are the quantity of methane actually captured $MD_{project}$ and quantity of methane flared MD_{flared}. In order to define this variable the following parameters will be monitored:

- Quantity of landfill gas generated and fed to the flare which will be determined by flow meter on a permanent basis;
- Methane concentration in the landfill gas (w_{CH4}) will be measured by gas-analyzer operating on a permanent basis;
- Temperature (T_{LFG}) and pressure (P_{LFG}) of landfill gas will be measured to determine density of methane in the landfill gas;
- Temperature of the exhaust time gas stream (T_{flare}) in the flare by thermocouple will be measured to determine the flare efficiency.

The monitoring points applicable to the Project's monitoring plan are presented at the figure below.

Figure D.1. Monitoring Plan



D.1.1. Option 1 – Monitoring of the emissions in the project scenario and the baseline scenario:

Not applicable.

D.1.1.1. Data to be collected in order to monitor emissions from the project, and how these data will be archived:

ID number	Data variable	Source of data	Data unit	Measured (m), calculated (c), estimated (e)	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic / paper)	Comment

D.1.1.2. Description of formulae used to estimate project emissions (for each gas, source etc.; emissions in units of CO_2 equivalent):

Not applicable.

D.1.1.3. Relevant data necessary for determining the baseline of anthropogenic emissions of greenhouse gases by sources within the project boundary, and how such data will be collected and archived:

ID number	Data variable	Source of data	Data unit	Measured (m), calculated (c), estimated (e)	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	Comment

D.1.1.4. Description of formulae used to estimate baseline emissions (for each gas, source etc.; emissions in units of CO_2 equivalent):

Not applicable.

D. 1.2. Option 2 – Direct monitoring of emission reductions from the project (values should be consistent with those in section E.):

D.1.2.1. Data to be collected in order to monitor emission reductions from the project, and how these data will be archived:

ID number *(Please use numbers to ease cross-referencing to D.2.)*	Data variable	Source of data	Data unit	Measured (m), calculated (c), estimated (e)	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	Comment

ID 1	$LFG_{total,y}$, total quantity of landfill gas recovered	flow meter	m^3	m	permanently	100%	Daily: electronic; Monthly: paper	Data are collected monthly and aggregated annually. Measurements are conducted on dry basis.
ID 2	$LFG_{flare,y}$, quantity of landfill gas burnt at the flare	flow meter	m^3	m	permanently	100%	Daily: electronic; Monthly: paper	Data are collected monthly and aggregated annually
ID 3	T , landfill gas temperature	Temperature sensor	^0C	m	permanently	100%	Daily: electronic; Monthly: paper	Measured to define methane density $D_{CH4.}$
ID 4	P, landfill gas pressure	Pressure sensor	Pa	m	permanently	100%	Daily: electronic; Monthly: paper	Measured to define methane density $D_{CH4.}$
ID 5	D_{CH4} , methane density in landfill gas	Calculation	t CH_4/m^3CH_4	c	daily	100%	Daily: electronic; Monthly: paper	The data will be used for estimate of methane flared

ID 6	w_{CH4}, fraction of methane in landfill gas	Gas-analyzer	m^3CH_4/m^3 LFG	m	permanently	100%	Daily: electronic; Monthly: paper	Measured by permanent gas-analyzer . Measurements are conducted on dry basis.
ID 7	1. Flare availability 2. Combustion efficiency of the flare	Timer Samples	%	m c	(1) Permanently (2) Enclosed flares shall be monitored yearly, with the first measurement to be made at the time of installation	100%	Daily: electronic; Monthly: paper	The flare operation time shall be monitored by continuous measurement of the operation time of the flare. Methane fraction of flare exhaust gas will be measured periodically.
ID 8	$EC_{PJ,y}$, electricity consumed by the project activity	Electric meter	kWh	m	permanently	100%	Electronic	Data are collected daily and aggregated yearly

ID 9	$PE_{CO2e,flare}$ Project emissions from LFG flaring	Calculations	tCO2	c	monthly	100%	paper	Data are calculated monthly

D.1.2.2. Description of formulae used to calculate emission reductions from the project (for each gas, source etc.; emissions/emission reductions in units of CO_2 equivalent):

$$\mathbf{ER=BE-PE}$$

ER – emissions reductions, tones of CO_2e/year

BE – baseline emissions, tones of CO_2e/year

PE – project emissions, tones of CO_2e/year

The emissions caused by the Project activities take place due to burning the landfill gas at the Flare Devices. The landfill gas (LFG) will be gathered and burnt at the flare. Due to incomplete combustion, a part of methane contained in the LFG will vent into atmosphere just as it is, without oxidation.

Therefore Project GHG emissions will be pure methane emissions due to incomplete combustion:

$$\mathbf{PE= PE_{CO2e,\ flare} + PE_{EC,y}}$$

The methodological "Tool to determine project emissions from flaring gases containing methane" prescribes the following formulae for determination of project emissions.

$$\mathbf{PE_{CO2e,flare,y} = \sum_{h=1}^{8760} TM_{LFG,h} \cdot (1-\eta_{flare}) \cdot GWP_{CH4}/1000}$$

$PE_{CO2e,flare}$ – Project methane emissions due to incomplete combustion at the flare, tones of CO_2e equivalent

$TM_{LFG,x}$ – mass flow rate of methane in the landfill gas fed to the flare under the Project activity, tones CH_4/year

$TM_{LFG,h}$ – mass flow rate of methane in the LFG in an hour *h*, kg/h

η_{flare} – flare efficiency in hour *h*

GWP_{CH4} – Global Warming Potential of methane, tCO_2/tCH_4

$$\mathbf{TM_{LFG,h} = FV_{LFG,h} \cdot fv_{CH4,LFG,h} \cdot \rho_{CH4,n}}$$

$FV_{LFG,h}$ – volumetric flow rate of the landfill gas in dry basis at normal conditions fed to the flare, m^3/h ;

$fv_{CH4,RG,h}$ – volumetric fraction of methane in the LFG on dry basis in an hour,

ρ_{CH4} – methane density at normal conditions, kg/m^3 (0.716)

For estimation of emissions from electricity consumption of the grid was used methodological tool "Tool to calculate project emissions from electricity consumption" (version 01).

According to the methodology, in case when the electricity is obtaining from the grid we should use formula:

$$\mathbf{PE_{EC,y} = EC_{PJ,y} * EF_{grid,y} * (1+TDL_y)}$$

$PE_{EC,y}$ – project emissions from electricity consumption by the project activity during the year y, tCO2/year

$EC_{PJ,y}$ – quantity of electricity consumed by the project activity during the year y, MWh

$EF_{grid,y}$ – emission factor for the grid in year y, tCO2/MWh (the Tool proposes 1,3 value)

TDL_y – the average technical transmission and distribution losses in the grid in year y for the voltage level at which electricity is obtained from the grid at the project site (the Tool proposes 0,2 value)

According to the ACM 0001, the baseline emissions will be determined as th e difference between the amount of methane actually destroyed during the year $MD_{project}$,y and the amount of methane that would have been destroyed during the year in the absence of the project activity $MD_{reg,y}$, times the approved Global Warming Potential value for methane GWP_{CH4} , plus the net quantity of thermal energy displaced multiplied by the CO_2 emission factor, plus the quantity of thermal energy displaced multiplied by the CO_2 emission factor of the thermal energy displaced.

The proposed Project envisages no other activity except LFG flaring, therefore electricity and thermal generation component are excluded from consideration.

Therefore, the following formulae will be used for the calculation of the baseline emissions:

$$\mathbf{BEy= (MD_{\mathit{project,y}} - MD_{\mathit{reg,y}}) * GWP_{CH4}}$$

BE_y - baseline emissions, tones CO_2e

$MD_{project,y}$ - methane quantity destroyed by the Project activity, tones CH_4/year

$MD_{reg,y}$ – methane quantity that would have been destroyed during the year in the absence of the Project activity, tones CH_4/year

GWP_{CH4} - Global Warming Potential value for methane, 21 tones CO_2/ton CH_4

$$\mathbf{MD_{reg,y} = MDproject * AF}$$

AF - Adjustment Factor, for the proposed Project AF=0 as no legal requirements in Russian Federation exist which mandate collection and utilization of LFG

$$\mathbf{MD_{project,y} = MD_{flared}}$$

MD_{flared} - methane quantity destroyed by flaring, tones CH_4/year

$$\mathbf{MD_{flared} = (LFG_{flare} * \omega_{CH4} * D_{CH4}) - (PE_{flare}/GWP_{CH4})}$$

LFG_{flare} - quantity of landfill gas fed to the flare during the year, m^3

ω_{CH4} – average methane fraction of the landfill gas as measured during the year, m^3CH_4/m^3LFG

D_{CH4} – methane density, tCH_4/m^3CH_4

PE_{flare} – project emissions from flaring of the LFG in year *y* (tCO_2e).

D.1.3. Treatment of leakage in the monitoring plan:

In accordance with methodology ACM0001, no leakage effects need to be accouned.

D.1.3.2. Description of formulae used to estimate leakage (for each gas, source etc.; emissions in units of CO_2 equivalent):

In accordance with methodology ACM0001, no leakage effects need to be accouned.

D.1.4. Description of formulae used to estimate emission reductions for the project (for each gas, source etc.; emissions/emission reductions in units of CO_2 equivalent):

D.1.5. Where applicable, in accordance with procedures as required by the host Party, information on the collection and archiving of information on the environmental impacts of the project:

The Cental Laboratory For Analysis and Engineering Measurements of Ural Federal Okrug Production performs annual control over state of ambient air at the Shirokorechenskiy landfill site, including measurements of surface-level concentration of the following components:

- Suspended solids;
- Ammonia;
- Hydrogen sulfide;
- Carbon dioxide;
- Benzene;
- Trichloromethane; and
- Chlorinated carbon.

The samples and masurements are taken on the boundary of control area of Shirokorechenskiy Site.
The monitoring of the environmental impacts including control over the state of the ambient air and soil on Shirokorechenskiy landfill site is provided by the Central Laboratory For Analysis and Engineering Measurements of Ural Federal Okrug (the regional body of the Federal Office for Environmental, Technological and Nuclear Supervision - ROSTECHNADZOR).

Annual control over state of ambient air at the Shirokorechenskiy landfill site, including measurements of surface-level concentration of the following components: suspended solids, ammonia, hydrogen sulphide, carbon dioxide, benzene, trichlormethane and chlorinated carbon. The samples and measurements are taken on the boundary of the control area of Shirokorechenskiy site. Emissions of these substances must not exceed norms established by ROSTECHNADZOR and stated in the permit for such emissions.

The control over the state of soil is carried out for determine the content of metals, mercury, oil products, nitrates, nitrogen ammonium. The assessment of soil contamination within the boundary of the control area is compared against the values of maximum permissible concentrations.

The measurements are filled in the established formats and issued by the Laboratory as environmental control reports. The paper copies of the reports are kept (archived) in the EMUE “Spetsavtobaza” and available on request.

By limiting and monitoring the emissions of hazardous these substances (under the ecological legislation) the Russian state realizes the sustainability concept as uncontrolled emissions will threaten the development of local society and of the environment. Thus the maximum permissible concentrations of such emissions are the sustainability indicators that accommodate environmental, social and economic impacts.

The implementation of LFG utilization project will improve the environmental situation on Shirokorechenskiy landfill site as destruction of LFG will diminish the emissions of above hazard substances and undesired odor. The Lab will monitor the positive effects (that will be brought about by Project) under their routine measurement process on the Shirokorechenskiy landfill site.

Apart from that the Project will prevent inner combustion of methane in the waste body and causing thus formations of fires and smoke. This will also contribute to the improvement of environment situation and of living and health conditions of local inhabitants.

Considering all above, the Projects will bear its social and economic function the monitoring of which is implemented via the control over the level of hazardous emissions.

D.2. Quality control (QC) and quality assurance (QA) procedures undertaken for data monitored:		
Data *(Indicate table and ID number)*	Uncertainty level of data (high/medium/low)	Explain QA/QC procedures planned for these data, or why such procedures are not necessary.
Table D.1.1.1 ID 1-2	Low	Flow meter shall be subject to regular control depending technical conditions
Table D.1.1.1 ID 3-4	Not applicable	According to Supplier’s data, the flow meter used contains sensors of pressure and temperature. The data shall be sent to computers for conversion of gas flow from m^3 to nm^3/hr

Table D.1.1.1 ID 6	Low	Gas-analyzer (to determine landfill ages quality) shall be regularly checked for operation quality and calibration according to its technical features and instructions of manufacturers in order to provide for accuracy and reliability of data obtained
Table D.1.1.1 ID 7 (combustion efficiency)	Medium	Regular servicing will ensure optimal operation of the flare device. Burning efficiency will be annually checked for verification of deviations from the value estimated.
Table D.1.1.1 ID 7 (flare efficiency)	Low	Timer shall be regularly checked to provide for accuracy of recording procedure.
Table D.1.1.1 ID 8	Low	Electric meter shall be regularly checked for operation quality and calibration according to its technical features and instructions of manufacturers in order to provide for accuracy and reliability of data obtained

D.3. Please describe the operational and management structure that the project operator will apply in implementing the monitoring plan:

The Center of Environmental Projects located inEkaterinburg (CEP) coordinates and controls all the aspects relating to the management process of the Projects. For this purpose CEP will hire technical staff (technicians and operators) for operation of the LFG capture and utilization system (Project facilities) and enters in contractual arrangements with a supplier of the technology and equipment and with National Carbon Sequestration Foundation (NCSF) located in Moscow for preparation of the monitoring reports and facilitating verification procedure.

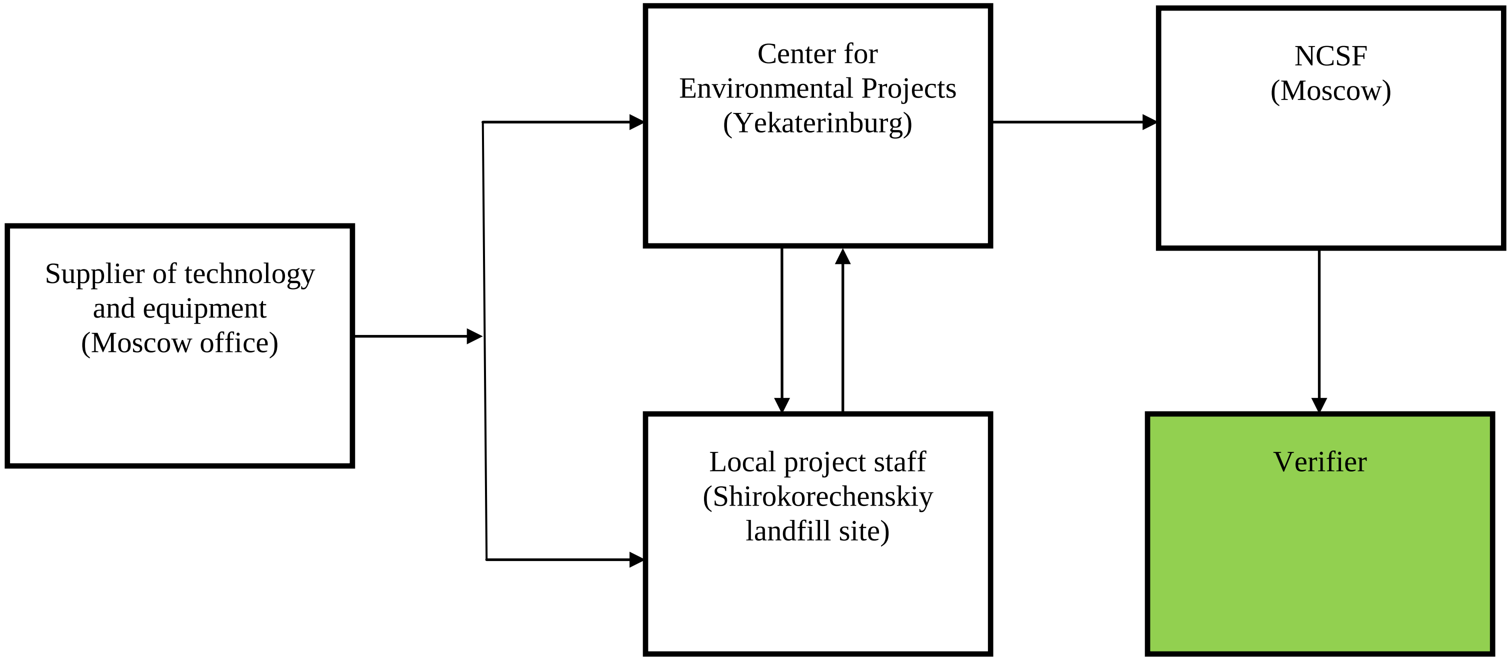
Supplier of technology and equipment for the Project will deliver and install Project equipment at the Shirokorechenskiy landfill site. The supplier will provide training for local project staff (technicians and opereators) to enable them to undertake the tasks required for both proper operation of the Project facilities and implementation of the monitoring plan before the Project become operational.

Local project staff will be responsible for proper operation of the Project facilities. The operators will gather data indicated in the table D.1.1.1. of this monitoring plant and calculate actual emission reductions on a yearly basis. The results will be submitted to the CEP office in Ekaterinburg for consideration and approval.

NCSF will prepare the monitoring report based on the results of actual emission reductions achieved during the previous year. The monitoring plan will be submitted to the independent entity for verification.

Graphically the operational and management structure is presented on the below figure.

Figure 3.1. Operational and management structure in implementing of the monitoring plan



Operational and management structure the project operator will implement in order to monitor emission reductions and any leakage effects, generated by the project activity. The following monitoring activities will be established:

- Data handling. The proven and qualified monitoring equipment including flow meter and gas analyser will be installed in place. The systems will allow automated and continuous recording and reporting of data. These readings will be checked for any anomalies before being field for future reference.
- Quality assurance. “Centre of environmental projects” will designate a LFG system manager to be in charge of and accountable for the generation of ERs including monitoring, record keeping, computation and recording of ERs, audits and verification.
  The general director will officially sign off on all worksheets used for the recording and calculation of ERs.

Well-defined protocols and routine procedures, with good, professional data entry, extraction and reporting procedures will make it considerably easier for the auditor and verifier to do their work.
Proper management processes and systems records will be kept by the project. The auditors can request copies of such records to judge compliance with the required management systems.

- Reporting. The local LFG capture and utilization system operator will report to “Centre of environmental projects” and also to the Emissions Buyer as per the Emission reduction Purchase Agreement with the Buyer.
  The local LFG capture and utilization system operator will prepare reports as needed for audit and verification purposes.

ECOCOM company will provide the following: a training program for each operator before assuming responsibility for the LFG capture and utilization operations. This training program will cover:

- General technology of LFG generation, safety of gas handling in equipment and problems with uncontrolled emissions;
- General knowledge regarding the equipment at each individual site and operation techniques;
- Reading, recording and interpreting data on site;
- Control system function and emergency situations;
- Maintenance procedures and actions;
- Calibration methodology

Each site will have a comprehensive operating guide for LFG capture and utilization system operation in English and in Russian that will contain details on the following: operation manual, maintenance manual, drawings and specifications, equipment supplier manuals, parameters for landfill gas composition, temperature and pressure and corrective actions if the parameter limits are violated.

Emergency cases:
No electrical power:
When no electrical power is available the blower of the degassing installation cannot operate. So no LFG-stream is available. The flow-meter detects no LFG-stream and no CO2-eq. will be counted. No special actions are possible to avoid this.
Failure flow meter:
To limit the time of operating with no flow signal in case of failure, the flow meter will be exchanged by a spare flow meter as soon as possible. Despite this quick exchange the degassing installation operates a short time without flow signal and CO2-eq. values. To determine the flow during this time span the average flow of the last seven days will be used and so it is possible to calculate the reduced CO2-eq. (the chance of failure of the flow meter is very small).
Failure methane analyzer (Ultramat 23):
To limit the time operating with no kWh meter in case of failure, this kWh meter will be exchanged by a spare kWh meter as soon as possible. Despite this quick exchange the degassing installation operates a short time without measuring the electrical power consumption. To determine the consumed electrical

power consumption during this time span the average electrical power consumption of the last 7 days will be used. (the chance of a failure of the kWh meter is very small).

LFG quantity: According to the specifications of flow meter, every four years the flow meter has to be calibrated. The flow meter will be sent to the supplier for calibration. Meanwhile, during calibration, the flow will be measured by means of temporary flow meter (same type). The results of the 2 flow meters and the beginning and ending gas quantity will be stored separately in the data base. Calibration reports of the supplier with the beginning and ending gas quantities will be sent to buyer of the certificates.
The condition of correct logged CH4-values is the calibration of the Ultramat 23 according the calibration protocol. In the calibration protocol 3 main issues are important for correct calibration:

- The calibration frequency has to be correct;
- The quality of the calibration gas has to be according the standard;
- The calibration procedure carried out by the operator has to be correct;

The calibration frequency can easily be checked in the database. Before calibration the analyzing system has to be switched in position calibration. This status of switch calibration will be stored in the database.
During the calibration LFG will not be sampled because calibration gas streams through the Ultramat 23 instead of LFG. To calculate the CO2-eq. during calibration the average CH4-content of the last hour will be used.
The calibration gases will be purchased from certified gas suppliers. All in gas bottles stored calibration gases will be provided with a quality certificate. The quality certificate indicates the quality of calibration gas is according the standard.
To prove the calibration procedure will be carried out correctly, the skilled operator demonstrates this procedure to the authorized validator at the installation. The operators are well trained and possess the necessary certificate.

All the parameters are monitored every hour and saved on the control panel of operation system and in data registration device of equipment. Once a day all the data send to the monitoring station. The monitoring station is a personal computer equipped with:

- Modem;
- System of visualization for operating purposes;
- Data base for saving process' data;
- Alarm emergency system for operators;

Monitoring system can be placed all over the world.

The proven and qualified monitoring equipment including flow meter and gas analyser will be installed in place. The systems will allow automated and continuous recording and reporting of data. These readings will be checked for any anomalies before being filed for future reference.

"Centre of environmental projects" will designate a LFG system manager to be in charge of and accountable for the generation of ERs including monitoring, record keeping, computation and recording of ERs, audits and verification.
The general director will officially sign off on all worksheets used for the recording and calculation of ERs.
Well-defined protocols and routine procedures, with good, professional data entry, extraction and reporting procedures will make it considerably easier for the auditor and verifier to do their work.
Proper management processes and systems records will be kept by the project. The auditors can request copies of such records to judge compliance with the required management systems.

As described earlier the following parameters and items will be checked by the authorized validator once a year at the installation (LFG quantity, methane content LFG, calibration procedure methane analyzer, log book operating and maintenance).
The parameters will be written down on a special document by the validator. Additional the statement 'the calibration protocol is carried out correctly' will be mentioned on this document. This document will be signed by the validator and sent to the buyer of the certificate.

Ecocom company will provide necessary training program for each operator before assuming responsibility for the LFG capture and utilization operations. This program includes also: reading, recording and interpreting data on site; control system function and emergency situations; maintenance procedures and actions;
Moreover, each site will have a comprehensive operating guide for LFG capture and utilization system operation in English and in Russian that will contain details on the following: operation manual, maintenance manual, drawings and specifications, equipment supplier manuals, parameters for landfill gas composition, temperature and pressure and corrective actions if the parameter limits are violated.

D.4. Name of person(s)/entity(ies) establishing the monitoring plan:

National Carbon Sequestration Foundation
Contact person: Marat Latypov, Head of Project Development Department
Tel.: +7 (495) 975 78 35 ext. 103
Fax: +7 (495) 975 78 35 ext. 107
E-mail: LatypovMF@ncsf.ru

SECTION E. Estimation of greenhouse gas emission reductions

The approaches contained in the ACM 0001 “Consolidated baseline and monitoring methodology for landfill gas project activities” were used for estimations of project and baseline emissions presented in this Section.

E.1. Estimated project emissions:

By Project, the landfill gas (LFG) will be gathered and burnt at the flare. Due to incomplete combustion, a part of methane contained in the LFG will vent into atmosphere just as it is, without oxidation.

No other activities including electricity generation or producing thermal energy are considered under this Project. Therefore, the methological “Tool to determine project emissions from flaring gases containing methane” was used for estimation of project GHG emissions. The tool proposes the formulas:

Determination of the mass flow rate of the residual gas that is flared:

$FM_{RG,h} = \rho_{RG,n,h} *FV_{RG,h}$

$FM_{RG,h}$ – mass flow rate of the residual gas in hour h;

$\rho_{RG,n,h}$ – density of the residual gas at normal conditions in hour h;

$FV_{RG,h}$ – volumetric flow rate of the residual gas in dry basis at normal conditions in the hour h

Determination of the mass fraction of carbon, hydrogen, oxygen, and nitrogen in the residual gas:

$Fm_{j,h} = \sum fv_{i,h}*AM_j*NA_{j,i}/MM_{RG,h}$

$Fm_{j,h}$ – mass fraction of element j in the residual gas in hour h;

$fv_{i,h}$ – volumetric fraction of component i in the residual gas in the hour h;

AM_j – atomic mass of element j;

$NA_{j,I}$ – number of atoms of element j in component i;

$MM_{RG,h}$ – molecular mass of the residual gas in hour h;

j – the elements carbon, hydrogen, oxygen and nitrogen;

i – the components CH4, CO, CO2, O2, H2, N2;

Determination of the volumetric flow rate of the exhaust gas on a dry basis:

$TV_{n,FG,h} = V_{n,FG,h}*FM_{RG,h}$

$TV_{n,FG,h}$ – volumetric flow rate of the exhaust gas in dry basis at normal conditions in hour;

$V_{n,FG,h}$ – volume of the exhaust gas of the flare in dry basis at normal conditions per kg of residual gas in the hour h;

$FM_{RG,h}$ – mass flow rate of the residual gas in the hour h;

$V_{n,FG,h} = V_{n,CO2,h}+ V_{n,O2,h}+ V_{n,N2,h}$

$V_{n,FG,h}$ – volume of the exhaust gas of the flare in dry basis at normal conditions per kg of residual gas in the hour h;

$V_{n,CO2,h}$ – quantity of CO2 volume free in the exhaust gas of the flare at normal conditions per kg of residual gas in the hour h;

$V_{n,O2,h}$ - quantity of O2 volume free in the exhaust gas of the flare at normal conditions per kg of residual gas in the hour h;

$V_{n,N2,h}$ - quantity of N2 volume free in the exhaust gas of the flare at normal conditions per kg of residual gas in the hour h;

Determination of methane mass flow rate in the exhaust gas on a dry basis:

$TM_{FG,h}=TV_{n,FG,h}*fv_{CH4,FG,h}/1000000$

$TM_{FG,h}$ – mass flow rate of methane in the exhaust gas of the flare in dry basis at normal conditions in the hour h;
$TV_{n,FG,h}$ – volumetric flow rate of the exhaust gas in dry basis at normal conditions in hour h;
$fv_{CH4,FG,h}$ – concentration of methane in the exhaust gas of the flare in dry basis at normal conditions in hour h;

Determination of methane mass flow rate in the residual gas on a dry basis:
$TM_{RG,h} = FV_{RG,h} * fv_{CH4,RG,h} * \rho_{CH4,n}$
$TM_{RG,h}$ – mass flow rate of the methane in the residual gas in the hour h;
$FV_{RG,h}$ – volumetric flow rate of the residual gas in dry basis at normal conditions in hour h;
$fv_{CH4,RG,h}$ – volumetric fraction of methane un the residual gas on dry basis in hour h;
$\rho_{CH4,n}$ – density of methane at normal conditions;

Determination of the hourly flare efficiency:
$\eta_{flare,h} = 1- TM_{FG,h}/TM_{RG,h}$
$\eta_{flare,h}$ – flare efficiency in the hour h;
$TM_{FG,h}$ – methane mass flow rate in exhaust gas averaged in a period of time t;
$TM_{RG,h}$ – mass flow rate of methane in the residual gas in the hour h;

Calculation of annual project emissions from flaring:
$PE_{CO2e,flare} = TM_{LFG,x} \cdot (1-\eta_{flare}) \cdot GWP_{CH4}$
$TM_{LFG,x}$ - mass flow rate of methane in the landfill gas fed to the flare under the Project activity, tones CH_4/year;
η_{flare} – flare efficiency;
GWP_{CH4} – Global Warming Potential for methane;
Mass flow rate of methane in the LFG is the quantity of gas that will be transported into flare device. Not all the methane will be flared as the device hasn't 100% efficiency (we assume flare efficiency is 90% this is conservative)[5]. When we multiply these two variables we can find the quantity of methane that wasn't burnt, by multiplying this quantity with GWP of methane we can find project emissions from LFG flaring ($PE_{CO2e, flare}$)

Project GHG emissions will be pure methane emissions due to incomplete combustion:

E.1.1. $$\mathbf{PE = PE_{CO2e, flare}}$$

$PE_{CO2e,flare}$ – Project methane emissions due to incomplete combustion at the flare, tones of CO_2e equivalent

E.1.2. $$\mathbf{PE_{CO2e,flare} = TM_{LFG,x} \cdot (1-\eta_{flare}) \cdot GWP_{CH4}/1000}$$

$TM_{LFG,x}$ - mass flow rate of methane in the landfill gas fed to the flare under the Project activity, tones CH_4/year (see the subsection E4 for details)

---

[5] In project equipment there will be applied enclosed flare.
So we use approach that default value of flare efficiency should be used. In 'Tool to determine project emissions from flaring gases containing methane's flare efficiency in the hour *h* is 90% if the temperature in the exhaust gas of the flare (T_{flare}) is above 500^0 C for more than 40 minutes during the hour *h* and the manufacturer's specification on proper operation of the flare are met continuously during the hour h.
In our case ECOCOM performs technical project. The company has a wide experience in LFG treatment projects in many countries (Latvia, the Ukraine, Russia). In Moscow region it implements three projects where the same equipment is planned to be set. All the equipment has 'Confirmation of Flare efficiency from Pro2 Anlagentechnik GmbH'.In this document flare efficiency is declared 99%, temperature of the flare >/= 1000^0C with monitoring, retention time >/= 0.3 s with 1000^0C.
So we use default value 90% as the equipment satisfies all the conditions (T_{flare} >/= 500^0C for more than 40 minutes during the hour h).For detailed description you can see section A.4.2

η_{flare} – flare efficiency (0.9[6])

GWP_{CH4} – Global Warming Potential for methane (21)

E.1.3. $\mathbf{TM_{LFG,x} = MD_{project}}$

$MD_{project}$ - the amount of the methane that would have been destroyed/combusted during the year under the Project scenario, tones of CH_4 (for details see the subsection E4 below)

Table E.1. Methane mass flow rate

Year	$BE_{CH4,flare}$ tones CO_2e	GWP_{CH4} -	TM tones of CH_4
2009	559,425	21	26,640
2010	563,476	21	26,830
2011	567,394	21	27,020
2012	571,185	21	27,200
Total	**2,261,480**	**21**	**107,690**

Project GHG emissions during the crediting period of 2008-2012 presented in the table below

Table E.2. Project GHG emissions

Year	TM tones of CH_4	η_{flare} -	GWP_{CH4} -	$PE_{CO2,flare}$ tones of CO_2e
2009	26,640	0.9	21	55,943
2010	26,830	0.9	21	56,348
2011	27,020	0.9	21	56,739
2012	27,200	0.9	21	57,119
Total	**107,690**	**0.9**	**21**	**226,148**

E.2. Estimated leakage:

Under ACM0001 methodology no leakage effects need to be accounted.

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

Table E.3. Total Project GHG emissions and leakages

Year	$PE_{CO2,flare}$ tones of CO_2e	Leakages, tones of CO_2e	Total, tones of CO_2e
2009	55,943	0	55,943
2010	56,348	0	56,348
2011	56,739	0	56,739
2012	57,119	0	57,119

[6] The choice of this value is based on the minimal temperature of LFG combustion (900 ^{0}C) and that the manufacturer's specifications on proper operation of the flare will be met continuously during the hour.

Total	226,148	0	226,148

E.4. Estimated baseline emissions:

Baseline emissions section of ACM0001 v8 embraces all activities on the landfill whatever they might be in the absence of the project activity including methane destruction, electricity and heat generation utilizing LFG. All these activities are adopted in the formula:

$BE_y = (MD_{project,y} – MD_{BL,y})*GWP_{CH4}+EL_{LFG,y}*CEF_{elec,BL,y}+ET_{LFG,y}*CEF_{ther,BL,y}$

Where:
BE_y – baseline emissions in year y (tCO2e);
$MD_{project,y}$ – the amount of methane that would have been destroyed/combusted during the year, in tones of methane in project scenario;
$MD_{BL,y}$ – the amount of methane that would have been destroyed/combusted during the year in the absence of the project due to regulatory and/or contractual requirement, in tones of methane*;
GWP_{CH4} – Global Warming Potential value for methane for the first commitment period is 21 tCO2e/tCH4;
$EL_{LFG,y}$ – net quantity of electricity produced using LFG, which in the absence of the project activity would have been produced by power plants connected to the grid or by an on-site/off-site fossil fuel based captive power generation, during year y, in megawatt hours (MWh);
$CEF_{elec,BL,y}$ – CO2 emissions intensity of the baseline source of electricity displaced, in tCO2e/MWh;
$ET_{LFG,y}$ – the quantity of thermal energy produced utilizing the landfill gas, which in the absence of the project activity would have been produced from onsite/offsite fossil fuel fired boiler, during the year y in TJ;
$CEF_{ther,BL,y}$ – CO2 emissions intensity of the fuel used by boiler to generate thermal energy which is displaced by LFG based thermal energy generation, in tCO2e/TJ
*As no regulatory and/or contractual requirements exist to destruct/combust methane in the absence of the project activity neither estimation of Adjustment Factor nor destruction efficiency of the system was done.
In baseline scenario of Shirokorechenskiy LFG utilization project there would be neither capturing nor utilisation of landfill gas for electric or thermal power generation. So the formula in *Baseline emissions* section of ACM0001 ,v 8 shrinks to the equation:

$BE_y=MD_{project,y} *GWP_{CH4}$

BE_y – baseline emissions in the year y, tCO2-eq.;
$MD_{project,y}$ – the amount of methane that would have been destroyed/combusted during the year in the absence of project activity, tCH4;
GWP_{CH4} – Global Warming Potential for methane, tCO2-eq./tCH4

The baseline GHG emissions are the amount of the methane that would have been destroyed/combusted during the year under the Project scenario. As per ACM 0001, *ex-ante* estimation of such emissions is done with latest version of the approved “Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site”.

E.4.1. $\mathbf{MD_{project,y}= BE_{CH4,SWDS,y}/GWP}$

$MD_{project}$ - the baseline GHG emissions (the amount of the methane that would have been destroyed/combusted during the year under the Project scenario), tones of CH_4

$BE_{CH4,SWDS}$ –methane generation from the landfill site in the absence of the Project activity in year *y*

y

E.4.2. $\mathbf{BE_{CH4,SWDS} = \varphi\ (1\text{-}f)\ GWP_{CH4}\ (1\text{-}OX)\ 16/12\ F\ DOC_f\ MCF \sum_{X=1} \sum_{j} W_{jx}\ DOC_j\ e^{-k_j(y-x)}\ (1\text{-}\ e^{-k_j})}$

φ – model correction factor to account for model uncertainties (0.9)

GWP_{CH4} – Global Warming Potential (GWP) of methane, valid for the relevant commitment period (21)

OX – oxidation factor reflecting the amount of methane from SWDS that is oxidized in the soil or other material covering the waste (0.1)

F – volume fraction of methane in the SWDS gas (0.445[7])

DOC_f – fraction of degradable organic carbon (DOC) that can decompose (0,5[8])

MCF – methane correction factor (1[9])

W_{jx} – amount of organic waste type *j* disposed at the SWDS in the year *x* (tones)

DOC_j – fraction of degradable organic carbon (by weight) in the waste type *j* (see the table below)

Waste type	Fraction of carbon[10],% weight
Wood, wood waste	43
Pulp, paper, cardboard	40
Textiles	24
Food, food waste	15

k_j – decay rate for the waste type *j* (see the table below)

Waste type	Decay rate[11],
Wood, wood waste	0.02
Pulp, paper, cardboard	0.04
Textiles	0.04
Food, food waste	0.06
Other organic waste	0.05

x – the year from which the landfill started receiving waste

y – the year for wich methane emissions are calculated.

Amount of organic waste type j disposed at the SWDS in the year x (tones)

E.4.2. $\mathbf{W_{j,x} = W_x \cdot i/100;}$

W_x – amount of organic waste disposed at the SWDS in the year *x* (542 thousand tones/year[12])

[7] According to Report of Ramenskiy Environmental Center, 2007

[8] Tool to determine methane emissions avoided from disposal of waste at a solid waste diposal site

[9] For anaerobic managed solid waste disposal sites, Tool to determine methane emissions avoided from dumping waste at a solid waste diposal site

[10] Tool to determine methane emissions avoided from disposal of waste at a solid waste diposal site

[11] Tool to determine methane emissions avoided from disposal of waste at a solid waste diposal site

[12] This information was presented by a present operator of the 'Shirokorrechenskiy' SWDS

i – fraction of organic waste disposed at the SWDS, % (see the table below)

Waste type	Fraction of organic waste[13], %
Wood, wood waste	20
Pulp, paper, cardboard	30
Textiles	5
Food, food waste	30
Other organic waste	1

Baseline GHG emissions within the crediting period of 2009-2012 are:

Table E.4 Baseline GHG emissions ($BE_{CH4,flare}$)

Year	$BE_{CH4,SWDS}$ tones CO_2e	$MD_{project}$ tones CO_2e	$MD_{project}$ tones of CH_4
2009	559,425	55,943	2,664
2010	563,476	56,348	2,683
2011	567,394	56,739	2,702
2012	571,185	57,119	2,720
Total	**2,261,480**	**226,149**	**10,769**

E.5. Difference between E.4. and E.3. representing the emission reductions of the project:

Emission reductions of the Project will be obtained by deducting E.3 from E.4.

Table E 5. Emission Reductions due to the Project activities

Year	Baseline GHG emissions (E.4.) tones of CO_2e	Project GHG emissions (E.3.) tones of CO_2e	Emission Reductions (E.4. – E.3.) tones of CO_2e
2009	559,425	55,943	503,482
2010	563,476	56,348	507,128
2011	567,394	56,739	510,655
2012	571,185	57,119	514,066
Total	**2,261,480**	**226,148**	**2,035,332**

[13] This information was presented by a present operator of the ‘Shirokorrechenskiy’ SWDS

E.6. Table providing values obtained when applying formulae above:

Table E.6. Results of calculation of emission reductions

Year	Estimated project emissions (tCO_2-eq.)	Estimated baseline emissions (tCO_2-eq.)	Estimated emission reduction (tCO_2-eq.)
2009	55,943	559,425	503,482
2010	56,348	563,476	507,128
2011	56,739	567,393	510,655
2012	57,119	571,185	514,066
Total	**226,149**	**2,261,479**	**2,035,330**

Uncertainty adjustments

The results provided in the table E.6. represent "ideal" situation that all the LFG generated in the landfill body would be captured and destroyed. In fact, there are uncertainties associated with data on collection of waste, waste composition, degradable organic carbon, fraction of degradable organic carbon decomposed, methane correction factor and so on. To estimate the influence of such uncertainties on the quantity of emission reductions generated by the project, an expert judgment contained in the IPCC 2006was used. This judgment proposes to assess uncertainties associated with the default activity data and parameters in the FOD method for CH4 emissions from SWDS.

Based on that judgment the following uncertainty values[14] were used:

Table.E.7 Uncertainty values

Activity data and emission factors	Uncertainty value
Total municipal waste (MSW_T)	30% is a typical value for countries which collect waste generation data on regular basis
Fraction of MSW_T send to SWDS (MSW_F)	+/-30% for countries collecting data on disposal at SWDS
Total uncertainty of waste composition	+/-30% for countries with country-specific data based on studies including periodic sampling
Degradable Organic Carbon (DOC)	For IPCC default values: +/-20%
Fraction of Degradable Organic Carbon Decomposed (DOC_f)	For IPCC default values: +/-20%
Methane Correction Factor (MCF)	For IPCC default values: +/-10%
Half-life ($t_{1/2}$)	20%[15]

Total uncertainty is estimated with use of standard deviation formula[16]: $U_{total} = (U_1^2+U_2^2+\dots U_n^2)^{0.5}$

[14] For reference see table 3.5. on the page 3.27, Chapter 3.7.2.2., Volume 5, Waste. This table is provided in the Annex 6 of the PDD

[15] Ranges for the IPCC default values are provided in the table 3.4.

[16] Zaidel A.N. Elementary estimations of deviations of measurements.-L.1968

$U_{total}= (0.3^2+0.3^2+0.3^2+0.2^2+0.2^2+0.1^2+ 0.2^2)^{0.5}=0.63$

For the conservatism sake basekine emissions resulted in the table E. 6 must be multiplied by this uncertainty factor (0.63).

Moreover, as per the Preliminary business offer from Ecocom company the contracted equipment will cover only 16 ha out of 22 ha, so it is assumed that gas collection system will be able to capture LFG with the efficiency of 80 %, i.e. LFG extraction wells can be providing coverage of 80 % of waste accumulated. Both factors were taken into account in the evaluation process.
So we use data from the table E 6 in the following formulas:
PE(table 8) = PE (table 6)*0.8
BE(table 8) = BE (table 6)*0.63*0.8
ER(table 8) = BE (table 8) – PE (table 8)

The evaluation results are provided in table E.8.

Table E.8. Results of estimated emission reductions

Year	**Estimated project emissions (tCO_2-eq.)**	**Estimated baseline emissions (tCO_2-eq.)**	**Estimated emission reduction (tCO_2-eq.)**
2009	44,754	281,950	237,196
2010	45,078	283,992	238,914
2011	45,391	285,966	240,575
2012	45,695	287,877	242,182
Total	**180,918**	**1,139,785**	**958,868**

SECTION F. Environmental impacts

F.1. Documentation on the analysis of the environmental impacts of the project, including transboundary impacts, in accordance with procedures as determined by the host Party:

Environment protection section (EP) is currently being developed within the technical documentation for this Project in accordance with requirements of "Instruction on procedure of development, agreement, approval and composition of the project documentation for construction of enterprises, buildings and facilities", SNiP 11-01-95. Development is carried out pursuant to a feasibility study of construction approved with account of requirements of territorial schemes of nature protection, basin schemes of complex use and protection of water resources as well as materials of engineering and environmental surveys carried out for preparation of the project.

The EP section is an integral and mandatory part of project documentation for construction, expansion, reconstruction etc of economic or industrial facility.

Under EP the issues of ecological safety related to Project activities will be considered. It contains the project designs related to nature protection with some elements of enviromental impact evaluation that should be taken into account during designing, implementing and controlling the Project activities planned.

The EP section must contain a set of proposals for rational use of nature resources in the construction process together with engineering solutions to prevent a negative impact of the object projected on the environment.

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

Environmental impact of the Project is expressed by the fact that the Project reduces quantity of free methane which is a main "fuel" for fires at the Shirokorechenskiy landfill site, thus reducing their number; subsequently, a smoke formation at the site is reduced also, amount of harmful substances emitted during burning decreased as well (especially, halogen-hydrogens, dioxine, benzapyrene etc.); environmental heat contamination is reduced; also, amount of unpleasant odor will be decreased at the sie and its vicinity.

In EIA was given estimation of possible environmental impact of proposed activity on the landfill site "Shirokorechensky" in Yekaterinburg. We propose experts' conclusion here.

Estimations showed that pollutant emissions into the atmosphere won't exceed the permitted emission levels when LFG is flared.

Industrial wastewater producing as a result of LFG extraction from the landfill are used for wetting of it. In this process, there are no discharges in ground water or surface water.

Degassing system doesn't produce any wastes. Construction of it does not need extra land, there is no need in forest cuttings, changes in the land treatment. Wildlife won't be damaged and disturbed.

All this statements allow to make a conclusion that allocation of degassing system on landfill site "Shirokorechensky" will not posed any serious threat on environment of the territory.

The construction of capture/utilization system on landfill site "Shirokorechensky" will have positive environmental effect on the city. It will cause considerable methane emission reductions into the atmosphere and make the environment of the dump territory better. This project will help to fix the problem of climate change and help Russia to keep its promises of GHG reductions.

SECTION G. Stakeholders' comments

G.1. Information on stakeholders' comments on the project, as appropriate:

The stakeholders' comments is integral part of the state environmental expertise. Stakeholders comments process have been carried out in conformity with Russian official consultation procedure. The letter signed by the Chairman of Committee for Environment and Nature Management of the Ekaterinburg City states that information on the project activity at Shirokorechenskiy project was published in the local newspaper "Vecherny Ekaterinburg" #42 27.02.2008. There were no comments received.

Annex 1

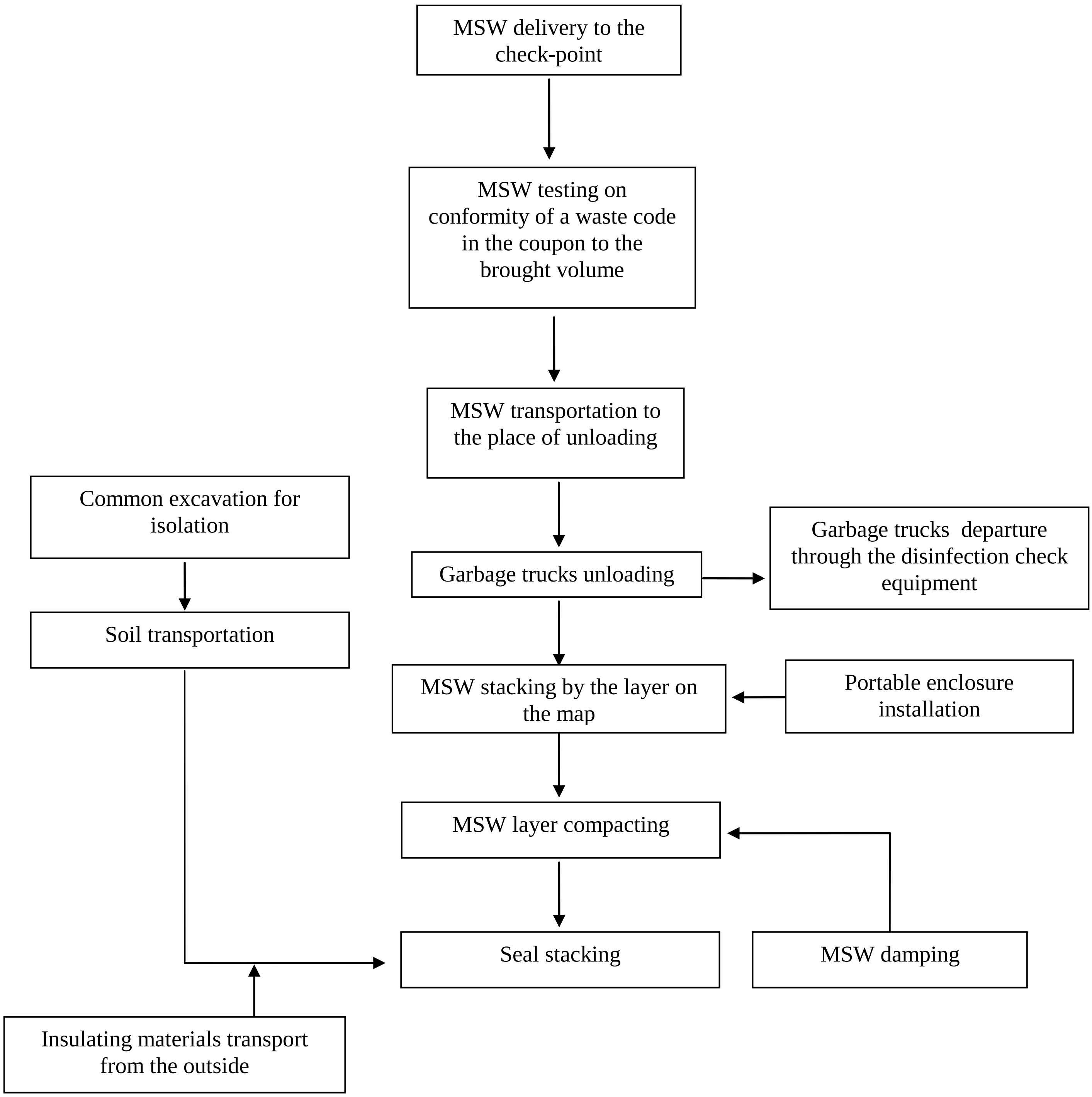
CONTACT INFORMATION ON PROJECT PARTICIPANTS

Organisation:	Center of Environmental Projects
Street/P.O.Box:	Dobrolyubova st.
Building:	16
City:	Ekaterinburg
State/Region:	Sverdlovskay oblast
Postal code:	620014
Country:	Russia
Phone:	(343) 344-27-72
Fax:	(343) 344-27-72
E-mail:	cep.ekb@mail.ru
URL:	
Represented by:	
Title:	
Salutation:	Mr.
Last name:	Demin
Middle name:	
First name:	Alexander
Department:	General Director
Phone (direct):	
Fax (direct):	
Mobile:	
Personal e-mail:	

ANNEX 2

BASELINE INFORMATION

The basic operation of the landfill



Calculation of the financial assets requirement and tariffs for solid waste recycling corresponding them EMUE " Specavtobaza" (Ekaterinburg municipal unitary enterprise "Specavtobaza" - an enterprise, operating solid waste site "Shirokorechenskiy")

№	Index	Fact				Approved in tariff on 2006 year		Calculation period on 2008 year	
		2006 year		2007 year (prospective)					
		Th of rubles	Rub/m^3	Th of rubles	Rub/m^3	Th of rubles	Rub/m^3	Th of rubles	Rub/m^3
1	MSW volume, th of m^3	3 826,1		3 836,9		3 836,9		4 002,0	
2	**Direct costs**	**24 074,0**	**6,29**	**27 449,9**	**7,15**	**23 404,6**	**6,10**	**28 070,7**	**7,01**
2.1	Salary, basic and extra	7 435,4	1,94	7 255,0	1,89	5 794,2	1,51	6 466,6	1,62
2.2	Social assessments	1 923,5	0,5	1 908,1	0,5	1 523,9	0,4	1 700,7	0,42
2.3	Fuel and lubricants	5 562,1	1,45	7 726,0	2,01	6 723,0	1,75	8 414,8	2,10
2.4	Amortization	30,0	0,01	30,6	0,01	30,6	0,01	1 040,6	0,26
2.5	Maintenance cost and all kind of bulldozer repairing	5 047,4	1,32	5 994,3	1,56	3 453,6	0,90	5 513,9	1,38
2.6	Bulldozer major repairs					1 487,0	0,39		
2.7	Services buying (other direct costs)	4 043,7	1,06	4 507,3	1,17	4 392,3	1,14	4 902,0	1,22
2.8	Transport charges	31,9	0,01	28,7	0,01			32,1	0,01
3	**Overhead costs**	**5 007,2**	**1,31**	**6 342,2**	**1,65**	**9 770,0**	**2,55**	**10 453,9**	**2,61**
3.1	Shop costs	3 226,0	0,84	3 689,4	0,96	3 704,0	0,97	3 963,3	0,99
3.2	**Operating costs**					**6 066,0**	**1,58**	**6 490,6**	**1,62**
4	Other costs (new project of ecological landfill monitoring)	258,3	0,07	85,6	0,02	0,0	0,0	550,0	0,14
5	**TOTAL costs**	**29 339,5**	**7,67**	**33 877,7**	**8,83**	**33 174,6**	**8,65**	**39 074,6**	**9,76**
6	Profit	1 035,1	0,27	1 195,2	0,31	1 658,7	0,43	1 953,7	0,49
7	Necessary gross receipt	30 374,6	7,94	35 072,9	9,14	34 833,3	9,08	41 028,4	10,25
8	Constructed fare		**7,94**		**9,14**		**9,08**		**10,25**

Notice:
The payments for waste disposal on the landfill sites EMUE " Specavtobaza" in the tariff is not included.
Deputy Director
Lyashenko.M.A
Head of Economy Department
Sinicina M.V

ecocom
CLIMATE PROTECTION
UMWELTSCHUTZ GMBH

Fax. +43–512–272921-3
office.kayser@inode.at-oliver.kayser@chello.at
Mob. +43-664-4153143 • Mob. +43-676-6221373
Mob. Russia +7-926-5375651 • +7-926-5362462
Höhenstraße 100d • 6020 Innsbruck • AUSTRIA

Comp.reg.nr: FN 265164y – Handelsgericht Innsbruck

bank name: Bank Austria - Creditanstalt
bank sorting code: 12000
account number: 52035297101
IBAN: AT751200052035297101

Outgoing number 20070913-1
Moscow, 2007,September, 13

Preliminary business offer

About construction Landfill gas recovery system at the municipal solid waste site "Shirokorechenskiy", Ekaterinburg, and/or supporting of JI project realization

1. **Equipment (means of production):**
    - gas-collecting system
    - high-temperature flare

estimated cost of Landfill gas recovery system **– € 1.237.000**

2. **Support of JI project registration before reception of the letter of approval from Austria and the Russian Federation**

    Estimated service cost:
    - Determination, determination support - €22.500
    - Support of the letter of approval getting - €30. 000
    - **Total - €52. 500**

3. **Project planning/designing:**
    - Project - €36. 000
    - Working draft – 5% from Investment - €61. 850
    - Coordination and adaptation - €23. 520
    - **Total - € 121. 370**

4. **Construction administration:**

    - construction administration (foreign part) - €49. 480
    - construction administration (Russian part) – €68. 480
    - **Total - € 117. 960**

5. **Operating cost of landfill gas recovery system**

    - Service engineer (electrical engineer) - € 162. 000
    - Service engineer assistant - € 30. 000

- Verification (10 times) - € 60. 000
- JISC due – € 48. 500
- **Total - € 300. 500**

Notice: guarding is granted by the landfill site

5.1 Support on operation by “Ecocom” firm:

Engineer (electrical engineer) – € 80. 000

Annex 3

MONITORING PLAN

The monitoring plan for the "Landfill gas recovery and flaring at the municipal solid waste site "Shirokorechenskiy", Yekaterinburg, Russian Federation" project has been developed in accordance with the approved ACM0001 "Consolidated monitoring methodology for landfill gas project activities" methodology. The monitoring methodology is based on direct measurements of the amount of landfill gas captured and destroyed at the flare platform.

The main variables that need to be determined are the quantity of methane actually captured $MD_{project}$ and quantity of methane flared MD_{flared}. In order to define this variable the following parameters will be monitored:

- Quantity of landfill gas generated and fed to the flare which will be determined by flow meter on a permanent basis;
- Methane concentration in the landfill gas (w_{CH4}) will be measured by gas-analyzer operating on a permanent basis;
- Temperature (T_{LFG}) and pressure (P_{LFG}) of landfill gas will be measured to determine density of methane in the landfill gas;
- Temperature of the exhaust time gas stream (T_{flare}) in the flare by thermocouple will be measured to determine the flare efficiency.

Table 1. Annex 3. Data to be collected in order to monitor emission reductions from the project

Data variable	Source of data	Data unit	Recording frequency	How will the data be archived? (electronic/ paper)	Comment
$LFG_{total,y}$, total quantity of landfill gas recovered	flow meter	m^3	permanently	Daily: electronic; Monthly: paper	Data are collected monthly and aggregated annually
$LFG_{flare,y}$, quantity of landfill gas burnt at the flare	flow meter	m^3	permanently	Daily: electronic; Monthly: paper	Data are collected monthly and aggregated annually
T , landfill gas temperature	Temperature sensor	^0C	permanently	Daily: electronic; Monthly: paper	Measured to define methane density $D_{CH4.}$
P, landfill gas pressure	Pressure sensor	Pa	permanently	Daily: electronic; Monthly: paper	Measured to define methane density $D_{CH4.}$
D_{CH4}, methane density in landfill gas	Calculation	t CH_4/m^3 CH_4	daily	Daily: electronic; Monthly: paper	The data will be used for estimate of methane flared
w_{CH4}, fraction of methane in landfill gas	Gas-analyzer	$m^3CH_4/$ m^3LFG	permanently	Daily: electronic; Monthly: paper	Measured by permanent gas- analyzer

2. Flare availability 2. Combustion efficiency of the flare	Timer Samples	%	(3) Permanently (4) Enclosed flares shall be monitored yearly, with the first measurement to be made at the time of installation	Daily: electronic; Monthly: paper	The flare operation time shall be monitored by continuous measurement of the operation time of the flare. Methane fraction of flare exhaust gas will be measured periodically.
$EC_{PJ,y}$, electricity consumed by the project activity	Electric meter	kWh	permanently	Electronic	Data are collected daily and aggregated yearly
$PE_{CO2e,flare}$ Project emissions from LFG flaring	Calculations	tCO2	monthly	paper	Data are calculated monthly

Annex 4

Shirokorechenskiy LFG flaring project

See separate Excell file.

Annex 5

Calculations of CO_2 grid emissions

See separate Excel file.

Gas booster station for landfill gas with high temperature flare HTN 12.5 with capacity of 2.500 nm3/h

Installed capacity (KW)	37
Electricity consumption (KWh):	
per hour	25-37
per year	250000

Year	2007	2008	2009	2010	2011	2012
Emission factor for electricity generation (tCO2/MWh)	1,3	1,3	1,3	1,3	1,3	1,3
Electricity consumption (MWh/year)	250	250	250	250	250	250
Average technical transmission and distribution losses	0,2	0,2	0,2	0,2	0,2	0,2
Emission for electricity consumption (t.CO2/year)	390	390	390	390	390	390
TOTAL emission for electricity consumption (t.CO2) (2009-2012)	1560					
% from the total emissions	0,16					

Annex 6

Letter of information

Local Authority of Yekaterinburg
Environmental and natural resources protection
Committee
from 28.03.2008 №26.2-17/317
about social poll

To deputy head of MTU
Rostechnadzor of Ural
Federal okrug
N.Y. Krupinin

Dear, Nikolai Yakovlevich!

JSC “Center of environmental projects” plans to perform landfill gas capture/utilization project on “Shirokorechenskiy” landfill site. Newspaper “Vecherniy Yekaterinburg” #42 27.02.2008 was used for a social poll. There were no comments received. Thus the result should be appreciated as positive.

Chairman of the committee S.A. Arkhipov

Annex 7.

Table of Uncertainties from the IPCC 2006

Estimates of uncertainties associated with the default activity data and parameters in the FOD method for CH4 emissions from SWDS. IPCC2006 Volume 5. Page 27.

TABLE 3.5
ESTIMATES OF UNCERTAINTIES ASSOCIATED WITH THE DEFAULT ACTIVITY DATA AND PARAMETERS IN THE FOD METHOD FOR CH_4 EMISSIONS FROM SWDS

Activity data and emission factors	Uncertainty Range
Total Municipal Solid Waste (MSW_T)	**Country-specific:** 30% is a typical value for countries which collect waste generation data on regular basis. ±10% for countries with high quality data (e.g., weighing at all SWDS and other treatment facilities). For countries with poor quality data: more than a factor of two.
Fraction of MSW_T sent to SWDS (MSW_F)	±10% for countries with high quality data (e.g., weighing at all SWDS). ±30% for countries collecting data on disposal at SWDS. For countries with poor quality data: more than a factor of two.
Total uncertainty of Waste composition	±10% for countries with high quality data (e.g., regular sampling at representative SWDS). ±30% for countries with country-specific data based on studies including periodic sampling. For countries with poor quality data: more than a factor of two.
Degradable Organic Carbon (DOC)[7]	**For IPCC default values** : ±20% **For country-specific values**: Based on representative sampling and analyses: ±10%
Fraction of Degradable Organic Carbon Decomposed (DOC_f)	**For IPCC default value (0.5)**: ± 20% **For country-specific value** ± 10% for countries based on the experimental data over longer time periods.
Methane Correction Factor (MCF) = 1.0 = 0.8 = 0.5 = 0.4 = 0.6	**For IPCC default value:** –10%, +0% ±20% ±20% ±30% –50%, +60%
Fraction of CH_4 in generated Landfill Gas (F) = 0.5	**For IPCC default value**: ±5%
Methane Recovery (R)	The uncertainty range will depend on how the amounts of CH_4 recovered and flared or utilised are estimated: ± 10% if metering is in place. ± 50% if metering is not in place.
Oxidation Factor (OX)	Include OX in the uncertainty analysis if a value other than zero has been used for OX itself. In this case the justification for a non-zero value should include consideration of uncertainties.
half-life ($t_{1/2}$)	Ranges for the IPCC default values are provided in Table 3.4. Country-specific values should include consideration of uncertainties.