



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

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SECTION A. General description of the project

A.1. Title of the project:

”Capture and Use of Biogas at Solid Municipal Landfill of Chelyabinsk”

Document version number: 02

20th November 2007

A.2. Description of the project:

Purpose of the project:

The project proposes to build and operate installations for extraction and subsequently flaring of methane gas with production of electrical power and heating energy at the landfill site in Chelyabinsk.

Some basic information about the landfill follows:

The Landfill site is located in the urban area of Chelyabinsk.

Landfill owner:	Chelyabinsk city
Owner of the property/ territory:	Chelyabinsk city
Operator of the landfill:	Municipal unitary Enterprise (MUP) GORECOCENTR
Legal form:	Municipal unitary Enterprise (MUP) GORECOCENTR is the operator and tenant of the property / territory (City ordinance #1543-p 06.10.2003)
Totally dumped MSW according to the figures of GORECOCENTR (State 01.02.2007) since the year 1986:	6 509 300 tons
Free capacity:	about 1.860.000 tons till 2010 (State: 01.03.2007)
Yearly dumped waste:	about 310.000 tons till 2007
Type of waste:	Municipal Solid Waste (MSW)
Covering material:	Soil, more 30% the area
Ground water:	Intend that, a ground water-level is situated lower of the lower level at landfill foundation (we will know more at the time of test drilling)

Operation of the landfill:

The landfill with a size of 85 ha consists of a closed part (in the south-east of the landfill; 23,2 ha) and which are in operation at the moment.

The landfill site is divided into 14 separate compartments (sections).

Section 496-11	1,5 ha	in service
Section 496-12	4,65 ha	in service
Section 496-14	5,62 ha	in service
Section 496-15	6,25 ha	in service
Section 496-16	6,25 ha	in service
Section 497-9	4,5 ha	in service
Section 497-10	0,5 ha	not in service



Section 497-13	6,25 ha	in service
Section 497-14	4,0 ha	not in service
Section 526-2	6,25 ha	in service
Section 526-3	6,25 ha	in service
Section 526-4	6,25 ha	not in service
Section 527-1	6,25 ha	not in service
Section 527-2	6,25 ha	not in service

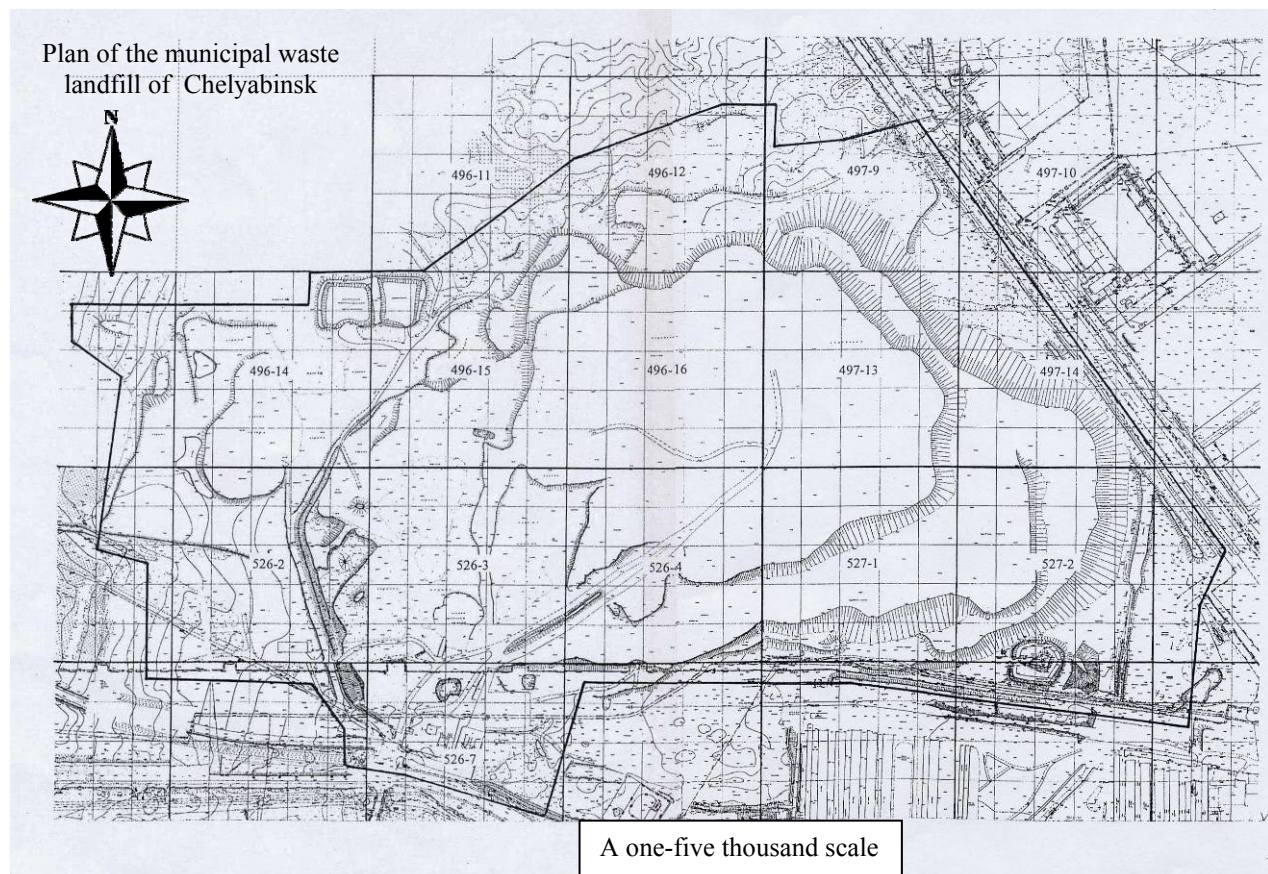
The landfill site of Chelyabinsk is in operation since the 1949 and it will be completely closed approximately in about two years. Annually there are dumped approx. 310.000 tons of municipal solid wastes.

Timetable of expected date of closure:

Section 497-9,10,13 – 31.04.2008;

Section 496-11,12,14,15,16 – 31.04.2009

Section 526-2,3 – 31.04.2010



Compacted solid waste in sanitation cars have a specific weight of 0,8 tons/m³

At the landfill the loose waste from the garbage trucks is unloaded and piled up to a layer of 0,5 m. This layer is then compacted with special compactors. The procedure is repeated until the compacted waste



layer attains a level of 2 meters. Then the waste layer is covered with a 0,2 m insulation layer of soil, which builds the basis for the next waste layer of 2 m height.

The dumping techniques are in accordance with the standards of the Russian Federation (waste filling technology worked out by the Academy for Communal Services of K. D. Pamfilov). Is till 2010 will be disposed at the landfill site of about 1.860.000 tons of MSW (State: 01.03.2007).

Feeding electricity into the grid has been taken into account for the proposed JI – project activity.

It is envisaged that a part of extracted landfill gas will be converted into electricity and heat by power gas engines and used for own needs of the landfill itself, according to the wishes of the landfill operators.

The project will be financed through the sales of ERU's generated from the collected and mitigated biogas (methane).

The landfill gas collection and utilisation equipment, which will be installed by an experienced company, will be a proven technology, including a piping and well network, blowers, flaring system and power gas engines and will represent the state of the art.

The project will result in greenhouse gas emission reductions by combusting the recovered methane contained in the landfill gas. It is estimated that the project will generate 895.995 tons of CO_{2eq} (ERU's) within the commitment period. The volume of landfill gas to be extracted during the first commitment period of the Kyoto Protocol is calculated at approx. 13.700 to 17.600 Nm³/hour.

A.3. Project participants:

Party involved	Legal entity <u>project participant</u> (as applicable)	Please indicate if the Party involved wishes to be considered as <u>project participant</u> (Yes/No)
Russian Federation (host Party)	<ul style="list-style-type: none"> City of Chelyabinsk 	No
Kingdom of Denmark	<ul style="list-style-type: none"> Danish Energy Agency 	No
One of the investor countries participating in the TGF, tbc. The investor countries in the TGF are: Kingdom of Denmark, Republic of Finland, Federal Republic of Germany, Republic of Iceland, Kingdom of Norway and Kingdom of Sweden.	<ul style="list-style-type: none"> Nordic Environment Finance Corporation NEFCO in its capacity as Fund Manager to the Baltic Sea Region Testing Ground Facility (TGF) 	No

The **developer of the project** "Capture and Use of Biogas at Solid Municipal Landfill of Chelyabinsk" is LLC Teplopribor-Eco. LLC Teplopribor-Eco is in charge of the project design, project financing and investment, project implementation, project management and operation.

The **owner of the landfill site** is the city of Chelyabinsk. The Department for the organisation of the Chelyabinsk industrial and consumption waste neutralization and treatment responsible for organizing the whole waste management of the City of Chelyabinsk including politics on waste tariffs and waste management development has charged and vested the Municipal unitary Enterprise of the city of Chelyabinsk „GorEcoCentr“ with managing and operating the landfill of Chelyabinsk". For this reason



“GorEcoCentr” is the legally empowered **landfill operator** of the landfill of Chelyabinsk responsible for all operational and legal decision making concerning the landfill. GorEcoCentr will provide on site know-how, partly personnel and the necessary construction tools for landfill rehabilitation works.

There are two **Project Emission Reductions Purchasers** in the project: Denmark through the Danish Energy Agency, and the Nordic Environment Finance Corporation NEFCO in its capacity as Fund Manager to the Baltic Sea Region Testing Ground Facility (TGF).

Danish Energy Agency (DEA)

The Danish Government is represented by the Danish Energy Agency (hereinafter referred to as "DEA"). DEA (www.ens.dk, www.danishcarbon.dk) is responsible for the Danish Ministry of Climate and Energy's efforts to develop and finance JI and CDM projects and is also the Danish Government's Designated National Authority.

Testing Ground Facility (TGF)

NEFCO, the Nordic Environment Finance Corporation, is a multilateral risk capital institution financing environmental projects in Central and Eastern Europe, increasingly with an emphasis on the Russian Federation and Ukraine. Its purpose is to facilitate the implementation of environmentally beneficial projects in the neighbouring region, with transboundary effects that also benefit the Nordic region. Today, NEFCO manages funds in an aggregate of approximately €300 million. NEFCO is located in Helsinki, in conjunction with the Nordic Investment Bank (NIB).

The Baltic Sea Region Testing Ground Facility (TGF) was established at the end of December 2003, to provide financial assistance to concrete projects by purchasing emission reduction credits. The TGF was initially set up by the governments of Denmark, Finland, Germany, Iceland, Norway and Sweden. The TGF is now a Public Private Partnership which acts as a compliance vehicle for its investors' Kyoto and EU Emissions Trading Scheme commitments. From June 2006, it includes the following Nordic and German companies from the energy sector as well as energy intensive industrial consumers: DONG Naturgas A/S (Denmark), Fortum Power and Heat Oy (Finland), Gasum Oy (Finland), Keravan Energia Oy (Finland), Kymppivoima Oy (Finland), Outokumpu Oyj (Finland), Vapo Oy (Finland), Vattenfall Europe Berlin AG & Co. KG (Germany) and Vattenfall Europe Generation AG & Co. KG (Germany). The TGF is currently capitalised at €35 million.

NEFCO is the Fund Manager of the TGF, and has been authorised by the governments investing in the TGF to participate on their behalf in actions leading to the generation, transfer and acquisition of ERUs under Article 6 of the Kyoto Protocol.

A.4. Technical description of the project:

A.4.1. Location of the project:

The project activities will take place at the landfill site, situated in the Chelyabinsk City, Russian Federation.



A.4.1.1. Host Party(ies):

The host country is the Russian Federation.

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

The landfill site is located in the city of Chelyabinsk (own subject of the Russian Federation).

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

The landfill site is located in the city of Chelyabinsk (web-site Chelyabinsk City: www.cheladmin.ru). The owner of the landfill site is the city of Chelyabinsk. The owner of the land (property) is the city of Chelyabinsk.

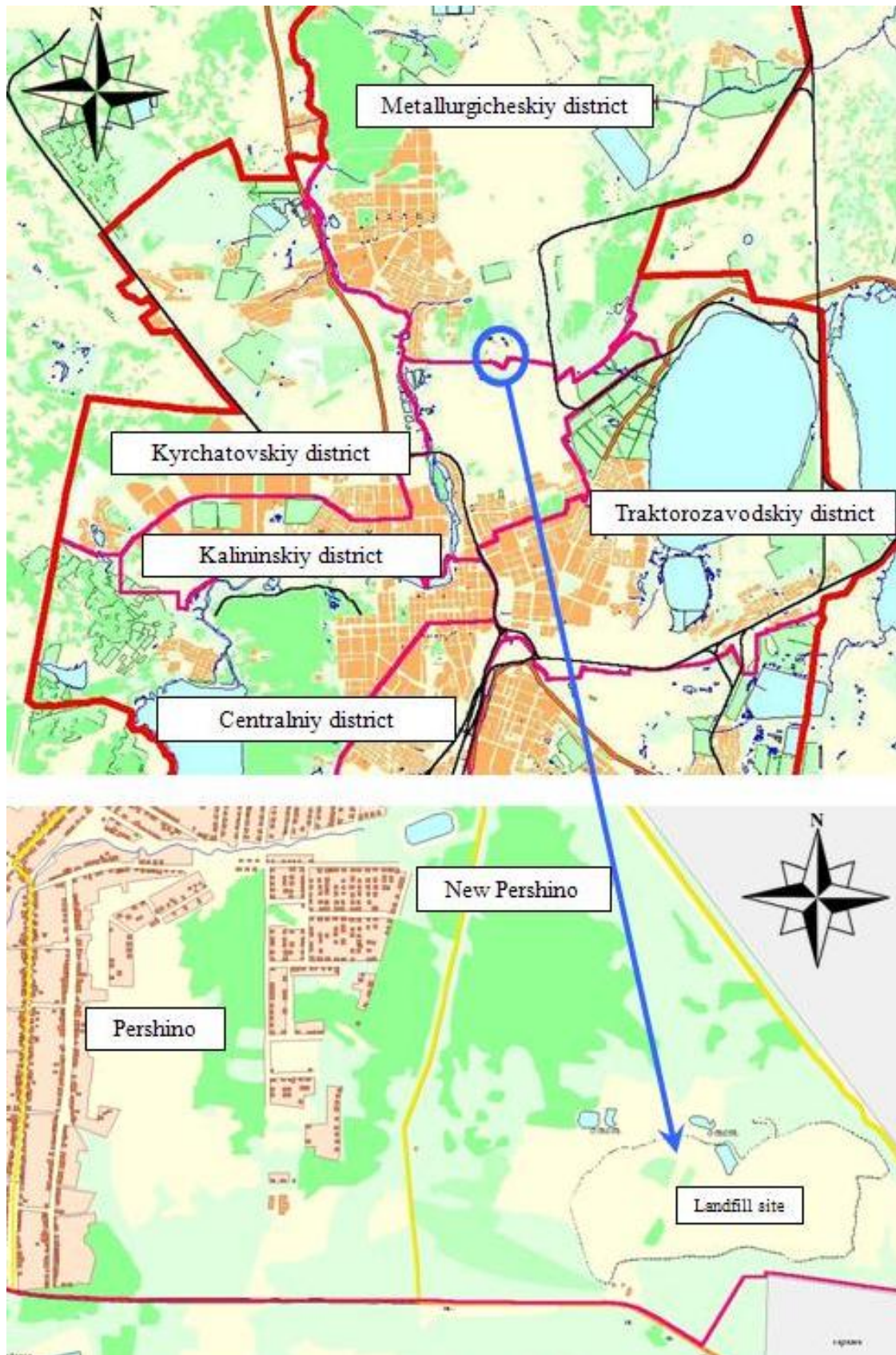
A.4.1.4. Detail of physical location, including information allowing the unique identification of the project (maximum one page):

Chelyabinsk Landfill is the largest landfill in Chelyabinsk Oblast. The landfill serves approximately 1.000.000 inhabitants of the Chelyabinsk City.



The landfill is located direct in the city. Due to the location direct in the city, the city administration plans to close down the landfill as the environmental impact to the city in terms of odours and other problems are not acceptable.

The landfill site has been in operation for very long time and no environmental protecting measures (liners, leachate collection system etc.) have been implemented. There are only very few permanent buildings at Chelyabinsk Landfill, namely the control and administration offices at the entrance of the landfill, where registration of incoming trucks is taking place.



The location of landfill site on a map of Chelyabinsk.

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

The technology that will be used to capture and destroy the methane currently generated at the landfill of Chelyabinsk consists of an active LFG collection and utilisation system, which is the most effective means of LFG collection.

The technology proposed for the extraction and utilisation of biogas can be regarded as standard technology. It is the most up-to-date technology that is fully in compliance with EU-legislation.

The basic operation principle is the generation of vacuum in the waste mass allowing extraction of landfill gas. The main components of the active collection system to be installed are the **gas extraction wells** and **collection piping, the gas pumping equipment** represented by mechanical blowers, which create a suction pressure in the system necessary for extraction of the LFG, **the gas treatment unit** including the condensate and flaring system, the **monitoring and control system** and the **gas utilization unit** (production of electricity).

- **The LFG extraction wells** and collection piping will be installed around the perimeter and in the centre of the landfill. Gas extraction wells will be connected to a master pipe that will carry the LFG to the blower facility. The gas collection system includes a network of vertical gas extraction wells dewatering units and HDPE pipelines.
- **The LFG pumping equipment** will include pipeline header system and blowers. A pipeline header system conveys the flow of collected LFG from the well system to the blower facility. The blowers to be installed will be single-stage centrifugal type blowers. The blowers will be used for transportation of the landfill gas from the landfill to the gas engines, under correct suction and pressure. Capacity and pressure will be adjusted through frequency controlled electro motors. Moreover, the blowers will be equipped with all the necessary safety equipment, including a noise reducing housing.

On the pressure side of the degassing installation, all kinds of gas analyzing and gas measuring instruments will be present. These instruments are very important for safety, process and operating purposes.

- **Gas treatment unit:** The landfill gas will be cooled down when transported from the landfill site, resulting in a production of condensate. This has to be drained to condensate shafts, to be placed nearby the gas pipes. Once in the degassing installations, the landfill gas will be cooled again to remove moisture. This is a very important step in the gas treatment process, since the condensate, which contains silicium components, could block the gas pipes and also damage gas engines, due to the silicium.

Considering demisting is fundamental for the energy generation, as per the reasons mentioned above, a demister will be installed for extra safety reasons. The demister is a stainless steel high density filter, which separates liquid particles (small amounts of condensate) from the landfill gas.

This liquid has to be drained off to a condensate shaft as well.

A closed flare will be installed to burn the LFG in a controlled environment to destroy methane and other harmful constituents and discharging them safely to the atmosphere. LFG will be flared in a 'low emission' with high temperature flare (>1000oC).

- **The monitoring and control system** will be used to measure actual LFG flow and composition to avoid the intrusion of ambient air into the extraction wells and thereby optimize the extraction of gas.

The projected plant is operated by an electrical control system equipped with a monitoring system for methane, oxygen, flow, pressure and temperature.

The control activities for this system consist of periodic adjusting of the gas wells by means of measuring equipment. The gas flow, the methane content and the oxygen content are very important

parameters. For the implementation of these activities local operators must be trained. Using the telephone helpdesk of the supplier the trained operators can always ask for technical support.

Experts of the supplier execute the maintenance works every half year.

The maintenance works mainly consist of controlling subsidence and/or distortion of the gas wells and the pipeline system. In case subsidence, distortion or flaws are detected, local companies will execute repair and refitting works.

- After above described treatment, analyzing and measurement, a small amount of the landfill (LFG) gas will be transported as a fuel to the gas engines. These will drive electrical generators in order to generate electrical power for on site use. The main part of the landfill gas will be burned off by the flares installed.

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:

Greenhouse gas (GHG) emissions from the “business as usual case (BAU)” currently employed by the municipal landfill of Chelyabinsk will be reduced through the collection of the landfill gas and the subsequent destruction of the methane component in a closed flare and in a gas engine, as described in Section A.4.2.

The current practice at this landfill is to allow the uncontrolled release of LFG into the atmosphere. The LFG generated at the site consists approximately of 50% methane and 50% carbon dioxide, both known GHG's with Global Warming Potentials (GWP) values of 21 and 1, respectively. However, the carbon dioxide portion of landfill gas is considered to be biogenic in origin and part of the natural carbon cycle, and thus not considered as an anthropogenic source of greenhouse gas.

The emission reduction units (ERUs) to be achieved with the proposed project activity will be directly measured according to the Monitoring Plan described in Section D of this document.

The estimated ERUs for the proposed project activity are about 895.995 tons CO_{2eq} over the 4-year crediting period starting in 2009.

The emission reductions would not occur in the absence of the project activity due mainly to financial barriers (the lack of economic benefits to develop this type of projects) and national circumstances such as the current legislation that does not require LFG capture and utilisation. These barriers are described in detail as follows:

- LFG recovery is not required under the current legislation established in the Russian Federation.
- The Government's future policy is to close down small landfills and to focus on larger, regional landfill sites. Simultaneously, the policy is to develop waste collection services according to modern standards, such as separated collection of organic wastes, plastics, glass etc.
- In addition to legal matters, for the proposed project activity there is no economic incentive for the capturing and combustion of methane from landfill gas since there will be no revenues from sources such as selling of electricity or thermal energy.

Therefore it is clear, that without the income from the sale of ERUs, the project activity would not be carried out because financing for the necessary investments is hardly available for the municipalities in the Russian Federation.

Based on the previous considerations, the BAU scenario (full release of the LFG to the atmosphere through the surface of the landfill without any treatment) is the most likely scenario without claiming emission reductions through the project activity.

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

By direct flaring of LFG generated at the landfill site and combustion of a part of the LFG in a gas engine for electricity production for on site use, the proposed project is expected to generate about 895.995 tons of emission reductions expressed as tons of CO_{2eq} over the crediting period.

Table A.1: Annual estimation of emission reductions in tons of CO_{2eq}

Please indicate the length of the crediting period and the length of the period within which ERUs are to be earned and provide estimates of total as well as annual emission reductions. Information shall be provided using the following tabular format.

–	Years
Length of the crediting period	4
Year	Estimate of annual emission reductions in tons of CO ₂ equivalent
2009	197 250
2010	204 915
2011	252 879
2012	240 951
Total estimated emission reductions over the <u>crediting period</u> (tonnes of CO ₂ equivalent)	895 995
Annual average of estimated emission reductions over the <u>crediting period</u> (tonnes of CO ₂ equivalent)	223 998

A.5. Project approval by the Parties involved:

The Russian Federation fully supports the JI - project “Capture and Use of Biogas at Solid Municipal Landfill of Chelyabinsk” and has endorsed the project as a Joint Implementation project. The Letter of No Objection can be found in the Appendix 4 of the PDD: Letter of No Objection; Moscow, December 08, 2005 signed by V. Gavrilov, Deputy Director of the Department of property and land relationships, environmental economics.

The Kingdom of Denmark also fully supports the current project. The Danish Energy Agency, is the successor to the Danish Ministry of the Environment which has signed an Letter of Intent (12.06.2006) with the Chelyabinsk City Administration. DEA and NEFCO in its capacity as Fund Manager to the Baltic Sea Region Testing Ground Facility (TGF) also intend to sign ERPAs with the Chelyabinsk City Administration to purchase Emission Reduction Units (ERUs) from this project.

The authorised Russian Designated JI Focal Point, the Danish Environmental Protection Agency and one of the Designated Focal Points of the TGF investor countries will be responsible for project approval and authorisation in the respective countries.

**SECTION B. Baseline****B.1. Description and justification of the baseline chosen:****Title and reference of the approved baseline methodology applied to the project:**

The approved baseline methodology applied to this project is the approved **ACM0001** – Consolidated Baseline Methodology for Landfill Gas Project Activities.

Justification of the choice of the methodology and why it is applicable to the project:

ACM0001 was developed as a consolidated document that incorporates all previously-approved methodologies applicable to landfill gas project activities where the baseline scenario is the partial or total atmospheric release of landfill gas and the project activities include situations such as:

- a) The captured gas is flared; or
- b) The captured gas is used to produce energy (e.g. electricity/thermal energy), but no emission reductions are claimed for displacing or avoiding energy from other sources; or
- c) The captured gas is used to produce energy (e.g. electricity/thermal energy), and emission reductions are claimed for displacing or avoiding energy generation from other sources. In this case a baseline methodology for electricity and/or thermal energy displaced shall be provided or an approved one used, including the ACM0002 “Consolidated Methodology for Grid-Connected Power Generation from Renewable”. If capacity of electricity generated is less than 15MW, and/or thermal energy displaced is less than 54 TJ (15GWh), small-scale methodologies can be used.

This baseline methodology shall be used in conjunction with the approved monitoring methodology ACM0001 (“Consolidated monitoring methodology for landfill gas project activities”).

For the proposed project activity, the baseline scenario is the partial total respectively atmospheric release of the gas, it is falling under the above mentioned point a) and b) and thus the ACM0001 is applicable to the project activity.

The ERUs exchange mechanism provided under JI is considered as a real and concrete incentive in the decision to proceed with the project activity and the project activity will not be initiated without JI.

Description of how the methodology is applied in the context of the project:

According to the adopted methodology ACM0001, “the methane destroyed by the project activity ($MD_{project,y}$) during a year is determined by monitoring the quantity of methane actually flared and gas used and/or produce thermal energy, if applicable, and the total quantity of methane captured...”

In the proposed project activity, the actual methane destroyed will be obtained from direct measurements of key parameters that in turn will allow calculating the emission reductions.

Following the chosen methodology ACM0001, the emission reductions achieved by the project activity during a given year “y” (ER_y) will be calculated as the 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}).

$$ER_y = (MD_{project,y} - MD_{reg,y}) \times GWP_{CH4}$$

where:

ER_y emission reductions [tons CO₂eq/year]



$MD_{project,y}$	is the methane destroyed by flaring [tons CH ₄ /year]
$MD_{reg,y}$	is the methane that would have been destroyed during the year in the absence of the project activity, that is zero [tons CH ₄ /year], because there are currently no legal requirements to capture LFG on landfill sites in the Russian Federation.
GWP_{CH_4}	is the Global Warming Potential value for methane 21 [tons CO ₂ eq/ton CH ₄]

The methane destroyed by the project activity $MD_{project,y}$ during a year is determined by monitoring the quantity of methane actually flared and combusted in a gas engine:

$$MD_{project,y} = MD_{flared,y} + MD_{electricity}$$

$$MD_{flared,y} = LFG_{flared,y} \times w_{CH_4,y} \times D_{CH_4} \times FE$$

$$MD_{electricity} = LFG_{electricity} \times w_{CH_4,y} \times D_{CH_4}$$

where:

$MD_{flared,y}$	is the quantity of methane destroyed by flaring [ton CH ₄ /year]
$MD_{electricity}$	is the quantity of methane destroyed by generation of electricity [ton CH ₄ /year]
$LFG_{flared,y}$	is the quantity of landfill gas flared during the year (see section D.1.2.1. ID2)
$LFG_{electricity}$	is the quantity of landfill gas fed into the electricity generator (see section D.1.2.1. ID3)
$w_{CH_4,y}$	is the methane fraction of the landfill gas (see section D.1.2.1. ID7)
D_{CH_4}	is the methane density (see section D.1.2.1. ID6)
FE	is the flare efficiency (see section D.1.2.1. ID8)

No leakage effects need to be accounted under this methodology!

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:

Greenhouse gas emissions from the chosen municipal landfill will be reduced below those that would have occurred in the absence of the JI project activity through the collection of the landfill gas and the subsequent destruction of the methane in a closed flare or combustion in a gas engine, as technically described in Section A.2.

The emission reductions (ERs) to be achieved with the proposed project activity will be directly measured and then calculated according to the Monitoring Plan described in Section D of this document.

The ACM0001 methodology requires the use of the “Tool for the demonstration and assessment of additionality” to demonstrate and assess additionality, which is a step-wise approach that includes:

- Identification of alternatives to the project activity;
- Investment analysis to determine that the proposed project activity is not the most economically or financially attractive alternative (in the absence of the JI incentive);
- Common practice analysis;
- Impact of registration of the proposed project activity as a JI project activity.

The “Tool for the demonstration and assessment of additionality (version 2)” (UNFCCC, 28 November 2005) is applied as follows.

Step 0: Preliminary screening based on the starting date of the project activity

This step is not applicable since the project participants do not wish to have the crediting period starting prior to the registration of their project activity.

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

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

The Table B.1 below presents an analysis of different alternatives to the project activity along with a discussion of probable outcome.

Table B.1 Alternatives of proposed project activities

Alternatives of proposed project activity	Probability of scenario
Alternative 1: No capture of LFG from the landfill site (continuation of the current situation – BAU Business as usual scenario)	Most probable: this is the current situation and is considered as the baseline scenario. There are no regulations requiring the capture and destruction of landfill gas at the site. No economic benefits would be obtained from LFG capture and flare, and no legal bounds are established either.
Alternative 2: LFG capture and flare (project activity) outside JI	Very low probability: the high costs for the construction and operation for the LFG recovery plant are difficult to afford without financial assistance. There are no additional revenues (e.g. electricity generation) out of this project activity. Thus it is highly unlikely without significantly increasing waste management fees. Currently, an increase in waste management fees is politically difficult. Besides, currently, there are no legal requirements for LFG capture and flaring in the Russian Federation.
Alternative 3: LFG capture and electricity generation	Very low probability: high investment costs of construction and operation of the LFG recovery system and the power plant and low electricity prices make this alternative unlikely.

In the absence of JI project, an inducement to invest is absent in progress of electric energy from captured landfill gas and sale of electric energy to grids for public because electric energy has a low cost and big investments and taking into account that the legislation of the Russian Federation does not set legal requirements for landfill gas capture, the current landfill management in Chelyabinsk – with the LFG passively release to the atmosphere – would continue.

As a result, the project activity is the only viable alternative to address the reduction of greenhouse gas emissions at the site.

Sub-step 1b: Enforcement of applicable laws and regulations:

Each of the above alternatives complies with the applicable laws and regulations of the Russian Federation. In terms of the project activity, the active collection and flaring of LFG is not mandatory at the Chelyabinsk landfill site, as such, the site is currently in compliance with all local environmental regulations with respect to air emissions.

It is not expected that in the near future legal directives concerning the landfill gas recovery on landfill sites will take effect.

Moreover, and according to the Monitoring Plan ACM0001, relevant regulations for LFG extraction or combustion (even if these laws and regulations have objectives other than GHG reductions) will be



monitored yearly, and any implication on emissions should be taken into account when calculating actual emissions of the project activity.

Step 2: Investment analysis

Sub-step 2.a: Determine appropriate analysis method

The proposed project activity will not generate financial or economic benefits other than JI related income, therefore Sub-step 2b. Option I applies.

Sub-step 2.b: Option I: Apply simple cost analysis

The BAU (Alternative 1) doesn't imply any investment and it is the most probable scenario for the Russian Federation.

The project activity (Alternative 2) involves the implementation of a landfill gas collection and flaring system to combust the methane component of the landfill gas. This will require capital expenditures for the gas collection wells and piping, the mechanical instrumentation required to induce vacuum, the analytical instrumentation necessary to monitor landfill gas composition, and the enclosed flare to be used for destruction of the methane component of the landfill gas at the site. Additionally, on-going expenses will occur to operate the facilities and to maintain the system's components.

The destruction of methane via the project activity would not result in any income other than that derived through revenues generated from the JI exchange mechanism. The project activity is not financially attractive under any scenario except through JI related income.

The total investment to equip the Chelyabinsk landfill site with a LFG collection system and a power generator (Alternative 3) will be much higher than the equipment for capture and subsequent flaring. Moreover, taking into account the very low selling price of electricity (approx. 0,015 € / kWh) and the complex regulatory circumstances for power generation the feasibility of electricity generation could not be considered as a baseline.

For this reason the only remaining plausible baseline scenario is Alternative 1 (No capture of LFG from the landfill site).

Step 3: Barrier Analysis

Since the proposed project activity is not financially attractive, Step 4 follows.

Step 4: Common practice analysis

Sub-step 4a: Analyse other activities similar to the proposed project activity

There is no similar project like "Capture and Use of Biogas at Solid Municipal Landfill of Chelyabinsk", which is being carried out in the Russian Federation at the current date.

In 1995/96 the Dutch "Senter Novem" Bank financed the construction of two landfill gas collection and utilization systems in the 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 which were installed consist of several vertical gas wells and a horizontal landfill gas collection system, which is 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 is situated not far away from the city of Mytishi (Mytishi District, Moscow Oblast). It was in operation from 28.02.96 to 16.10.96, all in all it worked 2769 hours and extracted 140.801 m. of landfill gas by using three landfill gas extraction wells installed on a waste



mass of 61.041 tons. The recovery rate was 60% and the gas generation potential of the degassed landfill part was assessed with 742.396 m. per year. (Source: GUP MO "Ekosistema": Emission assessment for GHG and other harmful substances from landfills of the Moscow Region, 2005 – Volume 2, pp. 31-33)

The "Dashkova" LFG collection and utilization system situated in the south-west of the city of Serpuchov (Moscow oblast) was in operation from 17.01.95 to 13.12.96; all in all it worked 9616 hours and extracted 310.980 m. of landfill gas out of 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. per year. (Source: GUP MO "Ekosistema": Emission assessment for GHG and other harmful substances from landfills of the Moscow Region, 2005 – Volume 2, pp. 34-36)

After successful implementation of the LFG collection and utilization systems the systems worked between half a year and two years without mayor 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 maintenance works the operation of the systems became unattractive for the operators.

From this point of view the JI mechanism of the Kyoto Protocol gives a far more and stronger incentive to operate the installation from 2008-2012 as it generates income from selling ERUs.

It can be concluded that LFG recovery is not required in the Russian Federation. Therefore it is not considered as common practice in this country. There is just little local technology available and there are just few experts in the field to apply knowledge in actual projects.

Sub-step 4b: Discuss any similar options that are occurring

Considering there are no similar activities widely observed and commonly carried out, right now it is not necessary to perform an analysis at this point.

Step 5: Impact of JI

The proposed activity will reduce greenhouse gas emissions, thereby generating emission reduction units (ERUs). The income generated from the ERU sales will make it possible to eliminate the financial barriers preventing the implementation of this project. By participating in the carbon market through JI, the project becomes economically viable.

A financial evaluation of the project activity was conducted and shows the viability of the project activity with the revenues from the selling of ERUs created. The evaluation is kept confidential and not included in the Project Design Document.

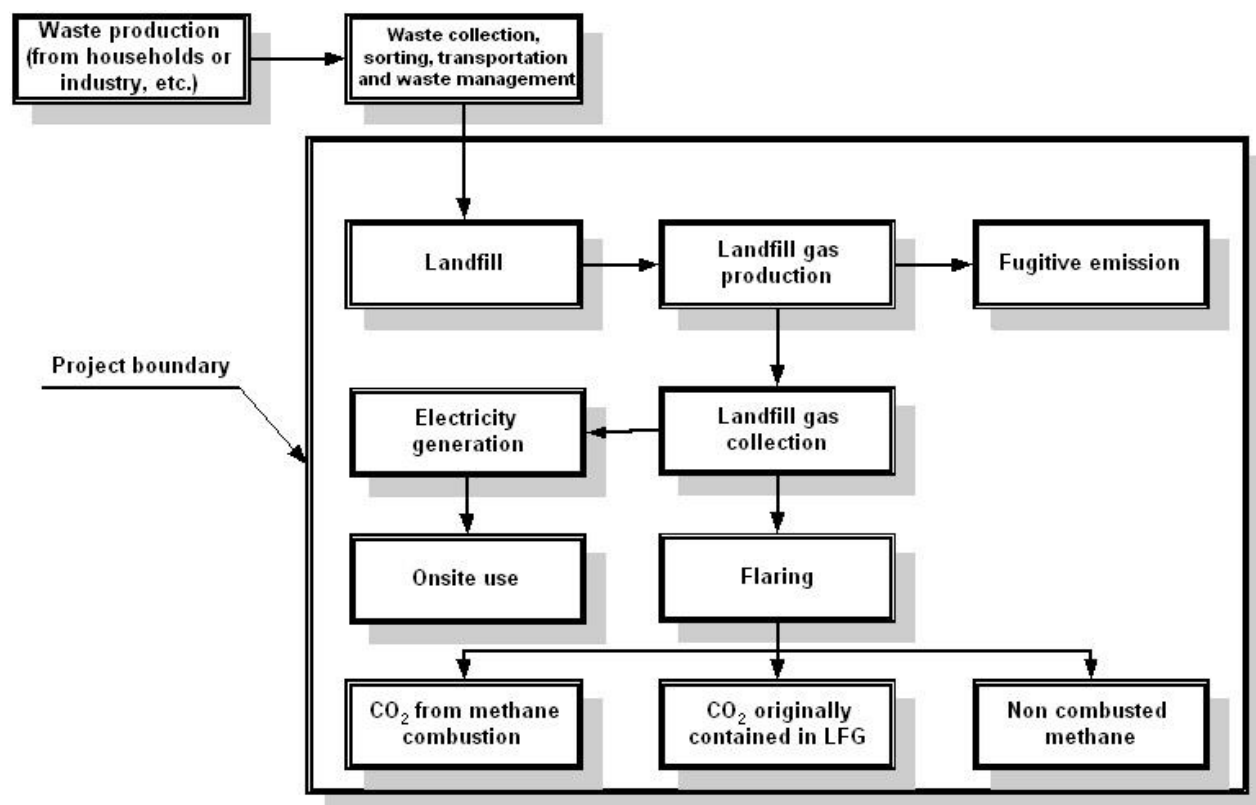
The project will also deliver local community benefits related to the creation of new jobs during the construction, operation and maintenance stages of the LFG recovery plant and to the possibility of using the captured LFG as renewable energy resource in future economic enterprises.

Also we need remark that, by realization of a project besides of system capture installation and flaring landfill gas for destruction of methane element of landfill gas will be installed a gas reciprocating generator, and this generator will be produced an electrical power and a heat energy for auxiliaries landfill and a part of electrical power will given to grid at total usage.

Besides, the replication of the project activities in other regions, cities and towns around the country will trigger environmental awareness related to waste management, renewable energy resources and climate change in the involved communities.

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

The following figure shows the basic operations involved in the MSW management on the Chelyabinsk landfill site including the proposed project activity.



According to the approved consolidated baseline methodology ACM0001 under the title Project Boundary, CO₂ emissions from the combustion of the methane shall not be accounted for as well as the emissions of CO₂ originally contained in LFG.

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 Completion: The baseline study was completed on 26/03/2007.

Name of Entities Determining the Baseline: The baseline was determined by the LLC Teplopribor-Eco (also a project participant listed in annex 1). Contact information is presented below:

LLC Teplopribor-Eco

Zip code + city postal address: II Paveletskaya 36, 454047 Chelyabinsk

Country: Russia

Telephone number: +7(351)725-76-50

Fax number: +7(351)725-75-90



Email: evklimov@tpchel-eco.ru

URL: www.tpchel-eco.ru

**SECTION C. Duration of the project / crediting period****C.1. Starting date of the project:**

The construction of the LFG equipment is envisaged to take place in autumn 2008 at the latest. The landfill gas extraction and flaring system will be operative in winter 2008 – 2009.

C.2. Expected operational lifetime of the project:

20 years.

C.3. Length of the crediting period:

4 years (1st January 2009 – 31st December 2012).

**SECTION D. Monitoring plan****D.1. Description of monitoring plan chosen:**

The Monitoring Plan (MP) for the Project “Landfill Capture and Use of Biogas at Solid Municipal Landfill of Chelyabinsk” was developed according to the approved consolidated monitoring methodology ACM0001: “Consolidated monitoring methodology for landfill gas project activities”.

Justification of the choice of the methodology and why it is applicable to the project:

ACM0001 was developed as a consolidated document that incorporates all previously-approved methodologies applicable to landfill gas activities where the baseline scenario is the partial or total atmospheric release of landfill gas. Scenarios contemplated by the methodology ACM0001 include the case, where the management of the LFG collected at the site includes direct flaring for emission reductions, which forms the basis of the project activity.

The monitoring methodology is based on direct measurement of the amount of landfill gas captured and destroyed at the flare platform and the electricity generating energy units, to determine the quantities.

The Monitoring Plan for the proposed project activity provides for direct measurement of the quantity and quality of LFG flared.

The main variables that need to be determined are the quantity of methane actually captured ($MD_{project,y}$) and the quantity of methane flared ($MD_{flared,y}$) and the quantity of methane used to generate electricity ($MD_{electricity,y}$) for onsite use.

To determine these variables, the following parameters will be monitored:

- The amount of landfill gas generated (in m^3 , using a continuous flow meter), where the total quantity ($LFG_{total,y}$) as well as the quantities fed to the flare ($LFG_{flare,y}$) and to the generation unit ($LFG_{electricity,y}$) will be measured continuously.
- The fraction of methane in the landfill gas ($w_{CH_4,y}$) will be measured with a continuous gas analyzer
- The continuous gas analyzer is the preferred option because the methane content of landfill gas captured can vary by more than 20% during a single day due to gas capture network conditions (dilution with air at wellheads, leakage on pipes, etc.).
- Temperature (T) and pressure (P) of the landfill gas will be measured to determine the density of methane in the landfill gas. No separate monitoring of temperature and pressure is necessary when using flow meters that automatically measure temperature and pressure, expressing LFG volumes in normalized cubic meters. This is the case in the current project activity!
- The flare efficiency (FE), measured as the fraction of time in which the gas is combusted in the flare multiplied by the efficiency of the combustion process. For this purpose, the methane content of the flare emissions should be analysed on a yearly basis, with the first measurement to be made at the time of installation. The combustion efficiency is initially assumed at 97% and will be periodically verified through laboratory analysis to determine the methane content in the flare exhaust gas.
- The quantities of electricity or any other fuels required to operate the landfill gas project, including the pumping equipment for the collection system.



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- Relevant regulations for LFG project activities will be monitored. Changes to regulation will be converted to the amount of methane that would have been destroyed/combusted during the year in the absence of the project activity ($MD_{reg,y}$).

Please, refer to the tables in section D 1.2 (Option 2) for detailed data measurement and recording frequency.



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

The section was left blank on purpose. See Option 2.

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 <i>(Please use numbers to ease cross-referencing to D.2.)</i>	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 CO₂ equivalent):

The section was left blank on purpose. See Option 2.

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 <i>(Please use numbers to ease cross-referencing to D.2.)</i>	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

The section was left blank on purpose. See Option 2.

D.1.1.4. Description of formulae used to estimate baseline emissions (for each gas, source etc.; emissions in units of CO₂ equivalent):



The section was left blank on purpose. See Option 2.

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 <i>LFG_{total,y}</i>	Total amount of LFG captured	On-line LFG flow meter	Nm ³	m	Continuously	100%	Daily: electronic Monthly: paper	Data will be aggregated monthly and yearly. Measured by a flow meter.
ID 2 <i>LFG_{flare,y}</i>	Amount of LFG flared	On-line LFG flow meter	Nm ³	m	Continuously	100%	Daily: electronic Monthly: paper	Data will be aggregated monthly and yearly. Measured by a flow meter.
ID 3 <i>LFG_{electricity,y}</i>	Amount of LFG combusted in power plant	On-line LFG flow meter	Nm ³	m	Continuously	100%	Daily: electronic Monthly: paper	Data will be aggregated monthly and yearly. Measured by a flow meter.
ID 4 <i>T</i>	Temperature of the LFG	Temperature sensor	°C	m	Continuously	100%	Daily: electronic Monthly: paper	Measured to determine the density of methane <i>D_{CH4}</i> .
ID 5 <i>P</i>	Pressure of the LFG	Pressure sensor	Pa	m	Continuously	100%	Daily: electronic Monthly: paper	Measured to determine the density of methane <i>D_{CH4}</i> .
ID 6 <i>D_{CH4}</i>	Methane density of the LFG	Calculation	ton CH ₄ /m ³ CH ₄	c	Daily	100%	Daily: electronic Monthly: paper	Data will be used to calculate the methane destroyed.



<i>ID 7</i> <i>W_{CH₄,y}</i>	<i>Methane fraction of the LFG</i>	<i>On-line LFG analyzer</i>	<i>m³CH₄/m³LFG</i>	<i>m</i>	<i>Continuously</i>	<i>100%</i>	<i>Daily: electronic Monthly: paper</i>	<i>Measured by continuous gas quality analyzer</i>
<i>ID 8</i> <i>FE</i>	<i>Flare availability / combustion efficiency</i>	<i>Operation hours (1) and the methane content in the exhaust gas (2)</i>	<i>%</i>	<i>m/c</i>	<i>(1) continuously (2) enclosed flares shall be monitored yearly, with the first measurement to be made at the time installation</i>	<i>100%</i>	<i>Daily: electronic Monthly: paper</i>	<i>Data will be aggregated monthly and yearly.</i>
<i>ID 9</i> <i>EL_{IMP}</i>	<i>Total amount of electricity and/or other energy carriers used in the project for gas pumping</i>	<i>Electricity meter</i>	<i>MWh</i>	<i>m</i>	<i>Continuously</i>	<i>100%</i>	<i>Electronic / paper</i>	<i>Required to determine CO₂ emissions from use of electricity or other energy carriers to operate the project activity. The records of any electricity imported in the baseline too should be recorded at the start of project.</i>
<i>ID 10</i>	<i>CO₂ emission intensity of the electricity and/or other energy carriers in ID 9</i>	<i>Calculation</i>	<i>ton CO₂ / MWh</i>	<i>c</i>	<i>Once before the crediting period</i>	<i>100%</i>	<i>Once on paper</i>	<i>Required to determine CO₂ emissions from use of electricity for the project activity.</i>

All data will be archived during the crediting period and for two years after.

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 CO₂ equivalent):



In this project and according to **ACM0001**, emission reductions will be directly measured. Formulae are provided in section D.1.4.

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

D.1.3.1. If applicable, please describe the data and information that will be collected in order to monitor leakage effects of the project:

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

No leakage effects need to be accounted under methodology **ACM0001**.

D.1.3.2. Description of formulae used to estimate leakage (for each gas, source etc.; emissions in units of CO₂ equivalent):

No leakage effects need to be accounted under methodology **ACM0001**.

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 CO₂ equivalent):

Following the chosen methodology **ACM0001**, the emission reductions achieved by the project activity during a given year “y” (ER_y) will be calculated as the 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 electricity displaced during the year (EL_y) multiplied by the CO₂ emissions intensity of the electricity displaced ($CEF_{electricity,y}$), plus the quantity of thermal energy displaced during the year (ET_y) multiplied by the CO₂ emissions intensity of the thermal energy displaced ($CEF_{thermal,y}$).

$$ER_y = (MD_{project,y} - MD_{reg,y}) \times GWP_{CH4} + EL_y \times CEF_{electricity,y} + ET_y \times CEF_{thermal,y}$$

$$EL_y = EL_{EX,LGFG} - EL_{IMP}$$

where:



ER_y	emission reductions [tons CO _{2eq} /year];
$MD_{project,y}$	is the methane destroyed by flaring [ton CH ₄ /year];
$MD_{reg,y}$	is the amount of methane, that would have been destroyed during the year in the absence of the project activity [ton CH ₄ /year] $MD_{reg} = MD_{project} * AF$, where for the proposed project activity AF is zero, because there are currently no legal requirements to capture LFG on the landfills in the Russian Federation;
GWP_{CH4}	is the Global Warming Potential value for methane 21 [ton CO _{2eq} / ton CH ₄];
EL_y	is net quantity of electricity displaced during a given period t, measured in [MWh];
$CEF_{electricity,y}$	is the CO ₂ emissions intensity of the electricity displaced, measured in [ton CO _{2eq} /MWh];
ET_y	is the quantity of thermal energy displaced, measured in TeraJoules [TJ];
$CEF_{thermal,y}$	is the CO ₂ emissions intensity of the thermal energy displaced, measured in [ton CO _{2eq} /TJ];
$EL_{EX,LGFG}$	net quantity of electricity exported during year y, produced using landfill gas, in megawatt hours (MWh);
EL_{IMP}	net incremental electricity imported, defined as difference of project imports less any imports of electricity in the baseline, to meet the project requirements (MWh).

In our case the term $EL_{EX,LGFG}$ is zero because no electricity will be fed into the grid. The electricity needed to meet the project requirements will either be produced by an gas engine onsite using collected landfill gas or will be imported from the grid. Therefore the equation $EL_y = EL_{EX,LGFG} - EL_{IMP}$ can be reduced to

$$EL_y = -EL_{IMP}$$

It is noted that while the terms for electricity and thermal energy have been included to be consistent with the overall formulation stated in ACM0001, energy displacement and production of heat are not components of the proposed project activity. As a result, the above equation is reduced to the following form for the project activity:

$$ER_y = (MD_{project,y} - MD_{reg,y}) \times GWP_{CH4} - EL_{IMP} \times CEF_{electricity}$$

For the proposed project activity the $MD_{reg,y} = 0$ because of $AF = 0$. As a result, the total actual quantity of methane captured and destroyed will be metered *ex post* once the project activity is operational, and:

$$MD_{project,y} = MD_{flared,y} + MD_{electricity}$$

and

$$MD_{flared,y} = LFG_{flared,y} \times w_{CH4,y} \times D_{CH4} \times FE$$

$$MD_{electricity} = LFG_{electricity} \times w_{CH4,y} \times D_{CH4}$$

where:

$MD_{flared,y}$	is the quantity of methane destroyed by flaring [ton CH ₄ /year];
$MD_{electricity}$	is the quantity of methane destroyed by generation of electricity [ton CH ₄ /year];



$LFG_{flared,y}$	is the quantity of landfill gas flared during the year (see section D.1.2.1. ID2);
$LFG_{electricity}$	is the quantity of landfill gas fed into the electricity generator (see section D.1.2.1. ID3);
$w_{CH_4,y}$	is the methane fraction of the landfill gas (see section D.1.2.1. ID7);
D_{CH_4}	is the methane density (see section D.1.2.1. ID6);
FE	is the flare efficiency (see section D.1.2.1. ID8).

The volumetric flows of landfill gas ($LFG_{flared,y}$) to the flare and to the gas engine ($LFG_{electricity}$), as well as the methane content in the landfill gas ($w_{CH_4,y}$) are continuously measured. The density of the methane can be calculated from the equation

$$D_{CH_4}(T, p) = D_{CH_4}(T_0, p_0) \times (p_1 - p_0) / (T_1 - T_0),$$

where

$$D_{CH_4}(T_0, p_0) = 0.0007168 \text{ t}_{CH_4}/\text{m}^3_{CH_4} \text{ (Density of methane at normal temperature and pressure } T_0 = 273.15 \text{ K, } p_0 = 101300 \text{ Pa)}$$

Sensors pressure and temperature measure pressure and temperature. The measurements are sent to computers which convert the gas flow from m^3 to Nm^3/h . So the equation shown above has just theoretical character.

The Flare efficiency FE is measured as the fraction of time the flare is functioning (burning the gas) multiplied by the efficiency of the flaring process.

$$FE = T_{flare} \times (I_{-,flare}),$$

where

$$T_{flare} = \text{Flare operating time in \%}$$

$$\eta_{flare} = \text{Measured flare combustion efficiency as of amount of } CH_4 \text{ left in the flare gas from the amount going into the flare in \%}$$

It is envisaged that the electricity needed for operation of the landfill gas recovery equipment will be produced by combustion of LFG in the gas engine. During shutdown periods the electricity has to be taken from the grid. The emissions caused by the consumed electricity taken from the grid will be calculated as:

$$EL_y = -EL_{IMP} \times CEF_{electricity},$$

where

$$EL_{IMP} \text{ (ID9)} = \text{the electricity consumption from the grid measured in MWh}$$

$$CEF_{electricity} \text{ (ID10)} = \text{CO}_2 \text{ emission intensity of the electricity consumed in tCO}_2/\text{MWh}$$



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:

According to the responsible ministry for JI Projects (Ministry for Economic Development and Trade) in the Russian Federation there are no requirements of monitoring environmental impacts of the project.

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.1.2.1 ID 1-3	Low	Flow meter will be subject to regular maintenance according to the technical specifications from the manufacturers to ensure accuracy and good performance.
Table D.1.2.1 ID 4-5	Low	Sensors pressure and temperature will be subject to regular maintenance according to the technical specifications from the manufacturers to ensure accuracy and good performance. The measurements are sent to computers which convert the gas flow from m ³ to Nm ³ /h.
Table D.1.2.1 ID 7	Low	Gas analyzers (LFG quality) will be subject to regular maintenance and calibration procedures according to the technical specifications from the manufacturers to ensure accuracy and good performance.
Table D.1.2.1 ID 8 (Flare availability)	Low	Timer will be subject to regular maintenance to ensure accuracy.
Table D.1.2.1 ID 8 (Combustion efficiency)	Medium	Regular maintenance will ensure optimal operations of the flare. Flare efficiency will be checked annually to verify deviation from the estimated value.
Table D.1.2.1 ID 9	Low	Calibration of equipment as per manufacturer specifications to ensure validity of data measured. Use meters and ancillary equipment complying with Russian Federation standards.
Table D.1.2.1 ID 10	Low	Not applicable.

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

The following Organization Chart shows the management structure that LLC Teplopribor-Eco (Teplopribor-Eco) will use for organizing and operating LFG capture and utilization projects at Solid Municipal Landfill of Chelyabinsk.

For each operators, Teplopribor-Eco 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:

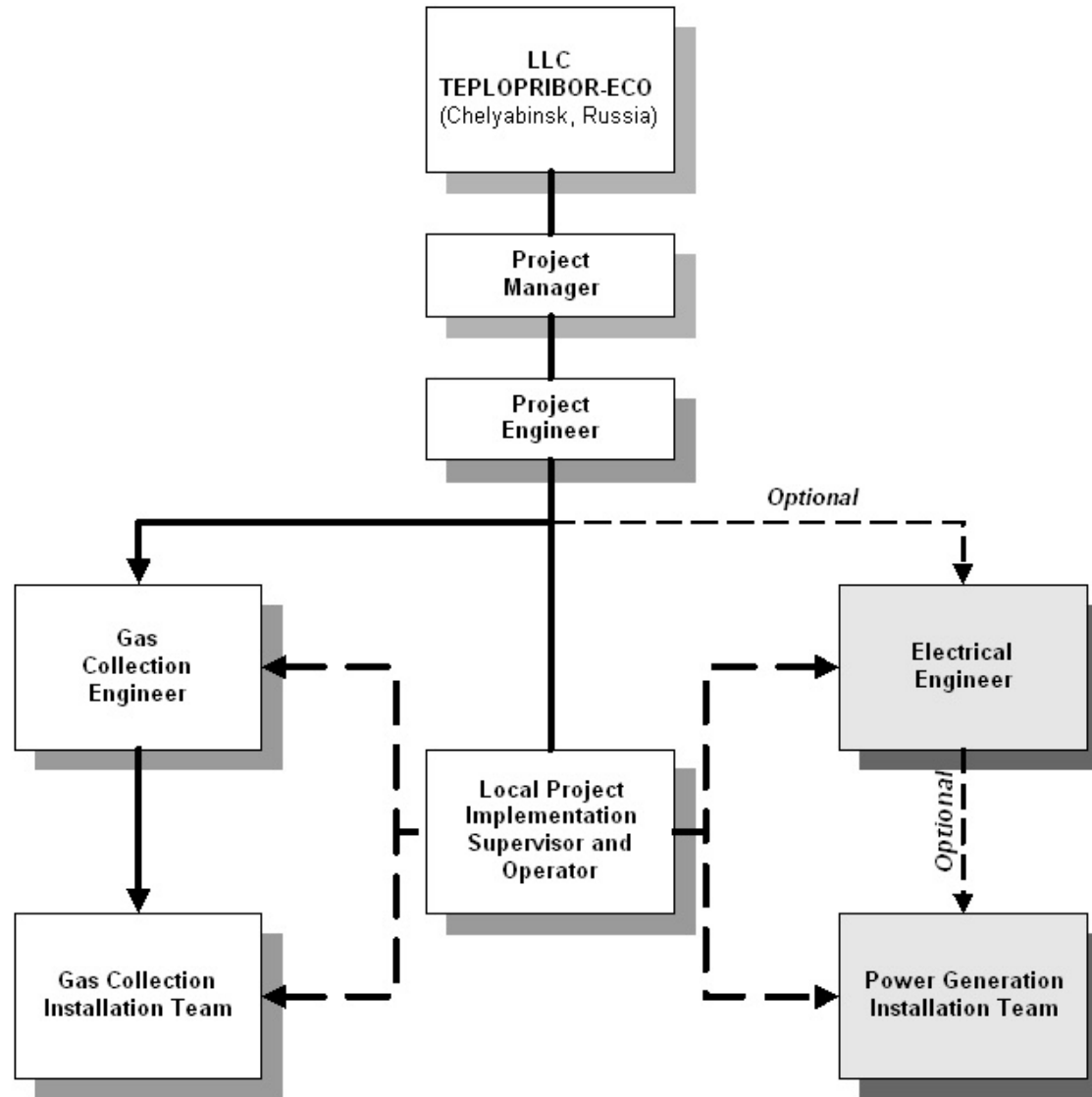
- general technology of LFG generation, safety of gas handling in equipment and problems with uncontrolled emissions

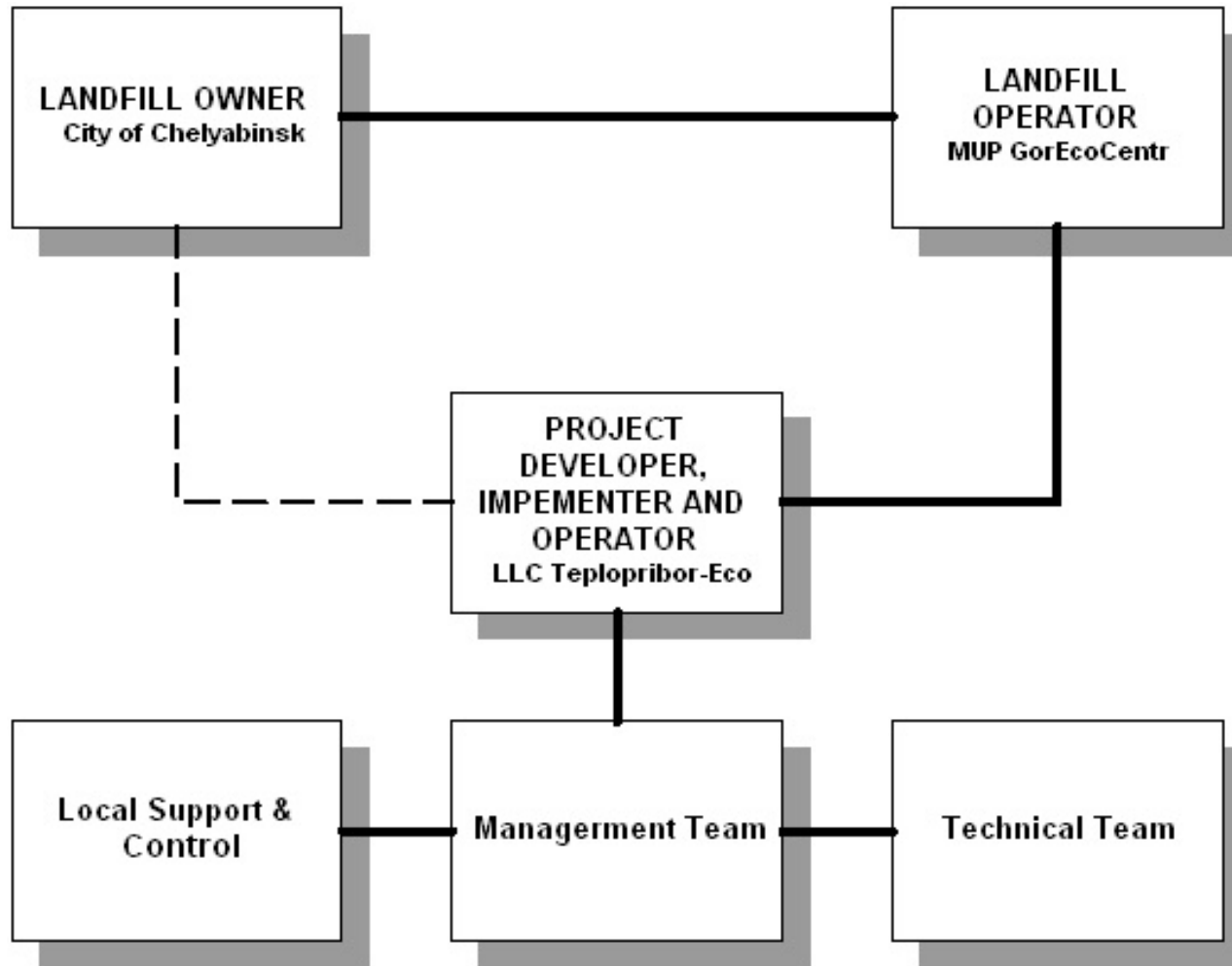


- general knowledge regarding the equipment at each individual site and operational techniques
- reading, recording and interpreting data on the site
- control system function and emergency situations
- maintenance procedures and actions
- calibration methodology

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.





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

Name of Entities Determining the Monitoring plan: The Monitoring plan was determined by the LLC Teplopribor-Eco (also a project participant listed in annex 1). The details of the Monitoring plan are provided in Annex 3, contact information is presented below:

LLC Teplopribor-Eco

Zip code + city postal address: II Paveletskaya 36, 454047 Chelyabinsk

Country: Russia

Telephone number: +7(351)725-76-50

Fax number: +7(351)725-75-90

Email: evklimov@tpchel-eco.ru

URL: www.tpchel-eco.ru

**SECTION E. Estimation of greenhouse gas emission reductions****E.1. Estimated project emissions:**

The anthropogenic emissions that would occur within the boundary of the project when the project activities (LFG capture and destruction) are in operation can be described as follows:

1. methane emissions due to not captured LFG (*I-RE*);
2. methane emissions in the flare due to the flare efficiency (*I-FE*);
3. CO₂ emissions in the flare due to the CO₂ contained in the captured LFG that remain unchanged during the combustion process;
4. CO₂ emissions in the flare due to the combustion of methane;
5. CO₂ emissions resulting from electricity used by LFG pumping equipment.

The sources of emissions (3. and 4.) are part of the natural CO₂ biological cycle and considered neutral to the atmosphere; therefore these CO₂ emissions are not considered in this project.

The methane emissions due to the not captured LFG (*PE_{y1}*) can be estimated from the following equation:

$$PE_{y1} \text{ (ton CO}_{2eq}/\text{year)} = CH_{4,y} \times D_{CH4} \times (I-RE) \times GWP_{CH4}$$

The methane emissions in the flare due to the flare efficiency (*PE_{y2}*) can be estimated from the following equation:

$$PE_{y2} \text{ (ton CO}_{2eq}/\text{year)} = CH_{4,y} \times D_{CH4} \times RE \times (I-FE) \times GWP_{CH4}$$

Sum of above mentioned CH₄ - Emissions

Both sources of anthropogenic GHG are defined as the project emissions (*PE_y*) and can be estimated from the following equation:

$$PE_y = PE_{y1} + PE_{y2} = CH_{4,y} \times D_{CH4} \times (I-RE) \times GWP_{CH4} + CH_{4,y} \times D_{CH4} \times RE \times (I-FE) \times GWP_{CH4}$$

where:

<i>PE_y</i>	estimated project emissions from non captured and due to non combusted methane in [tons CO _{2eq}];
<i>CH_{4,y}</i>	is the total methane generated at the landfill in [m ³ of CH ₄] and is obtained by using the FOD model explained in section E.4;
<i>D_{CH4}</i>	is the methane density in [kg/m. of CH ₄];
<i>RE</i>	is the recovery rate of the LFG;
<i>FE</i>	is the flare efficiency (combustion of the methane);
<i>GWP_{CH4}</i>	is the global warming factor of methane (GWP = 21).

Table E.1 below presents the MSW waste tonnage accepted at Chelyabinsk landfill site (according to figures from the MUP "GORECOCENTR") and the methane emission estimates based on the FOD model described below in section E.4. It is noted that the values presented in Table E.1 represent modeled quantities of methane generation for the stated time period.

According to the description of the project activity under section A.2 there is till 2010 will be disposed at the landfill site of about 1.860.000 tons of MSW (State: 01.03.2007).

The actual amount of GHGs reduced will be calculated based on the actual quantities of LFG collected and flared.

Table E.1: Methane emissions estimate for the landfill of Chelyabinsk

<i>Waste</i>		<i>Emissions</i>
<i>Year</i>	<i>tons MSW</i>	tons CH ₄ /year
1986	347 434	
1987	329 156	
1988	336 699	
1989	340 233	
1990	323 817	
1991	363 261	
1992	304 494	
1993	282 416	
1994	290 643	
1995	285 304	
1996	289 123	
1997	267 216	
1998	257 393	
1999	211 679	
2000	244 359	
2001	258 096	
2002	253 764	
2003	280 364	
2004	302 100	
2005	408 112	
2006	495 667	
2007	495 667	
2008	495 667	
2009	495 667	17 958
2010	495 667	18 687
2011	0	19 380
2012	0	18 434
Sum		74 459

The total methane emissions in the absence of the project activity during the crediting period (2009 – 2012) are calculated as 185.448,2 tons of methane (CH₄) for the landfill of Chelyabinsk. This is equal to **1 563 639** tons of CO_{2eq} over the crediting period. The figures above are calculated under assumption that generated LFG is composed of 50% methane.

The landfill gas collection system will capture only a portion of the generated landfill gas. The other part is one source of methane project emissions due the not-captured LFG [(1-RE) PE_{y,I}]. Due to the fact, that parts of the landfill site will still be in operation at the beginning of the commitment period a conservative estimate of 50% LFG collection was applied for the years 2009 to 2010 and a still conservative estimate of 60% LFG collection was applied for the years 2011 to 2012 of the estimated amount of produced LFG (see section E.4.). During operation phase, no landfill gas recovery systems will be installed on those parts because of the danger of breakdowns of piping systems.

Table E.6 illustrates the quantities of methane captured and not captured (depending on the recovery rate RE) by the project activity during the crediting period.

**Table E.2: Estimated quantities of methane captured and not captured by the LFG collection system**

Year	Percentage of methane captured (RE)	Amount of methane captured by project activity	Amount of methane not captured by project activity	Amount of methane captured by project activity	Amount of methane not captured by project activity
		(tons CH ₄ /year)	(tons CH ₄ /year)	(tons CO _{2eq} /year)	(tons CO _{2eq} /year)
2009	50%	8 979	8 979	188 559	188 559
2010	50%	9 343	9 343	196 203	196 203
2011	60%	11 628	7 752	244 188	162 792
2012	60%	11 061	7 374	232 281	154 854
Sum		41 011	33 448	861 231	702 408

The total methane captured on the landfill of Chelyabinsk during the crediting period is estimated as 41.011 tons of methane (CH₄), which is equal to 702.408 tons of CO_{2eq}.

The flare efficiency (FE) is assumed to be approximately 90 %. A second source of project emissions is the not combusted methane in the flare. These project emissions can be described as (*I-FE*) [*PE_{yI}*]. As required, not combusted methane will be measured and accounted for according to the requirements set forth in methodology ACM0001.

In case of combusting landfill gas (LFG) in gas engines a flare efficiency must not be considered.

We are planning on the Municipal solid waste landfill, that for partial utilization of methane will be used a gas piston power plant with power 3329 KW. Wherein at the time of crediting period 2009-2012 will be utilised 180 400 tons CO₂ eq.

Since *ex ante* the amount of LFG, which is flared is not known, it was estimated that all of the LFG will be flared. This represents a conservative estimation.

Quantity substitute methane in CO_{2eq} production electrical power and heat energy, summarized in table E3.

Table E.3: Estimates of quantity methane in CO_{2eq} substituted in consequence of project activity

years	Quantity methane in CO _{2eq} substituted by production of electrical power (CO _{2eq} /year)	Quantity methane in CO _{2eq} substituted by production of heat energy (CO _{2eq} /year)	Estimates substitute methane (tons CO _{2eq} /year)
2009	8 789	280	9 069
2010	8 789	280	9 069
2011	8 789	280	9 069
2012	8 789	280	9 069
Total :	35 156	1 120	36 276

As a result over the duration of the crediting period., total quantity of methane in CO_{2eq} substituted by production electrical power and heat production by realisation of the project for Chelyabinsk landfill site are estimated as 36 276 tons CO_{2eq}.

It is envisaged that the electricity needed for operation of the landfill gas recovery equipment will be produced by combustion of LFG in the gas engine. During shutdown periods of the gas engine the electricity has to be taken from the grid.

Because of the lack of official grid emission factors $CEF_{electricity}$ for the Russian Federation the following approach was chosen by the project developer:

Electricity production out of 100% Coal, which has a fuel emission factor of 25,8 tons C / TJ (default value from the IPCC). The outcome of this is an Emission Factor $EF_{fuel} = 25,8 \times 44/12 \times 0,98 = 92,7$ t $CO_2/TJ = 92.700$ kg $CO_2/277,78MWh = 333,75$ kg CO_2/MWh (1 TJ = 277,78 MWh).

Taking into account thermal efficiencies utilised by the US Energy Information Administration (EIA) in their Energy Outlook an efficiency of 38,6% can be reached for state of the art steam turbines . (Source: *BASREC Regional Handbook on Procedures for Joint Implementation in the Baltic Sea Region – Version 2 – November 2005 (draft final), Commissioned by Nordic Council of Ministers, prepared by ECON Analysis, <http://www.econ.no>*)

Therefore the resulting Electricity Emission Factor $EF_{electricity} = 333,75/0,386 = 864$ kg CO_2/MWh . This is a very conservative approach in order not to underestimate the project emissions.

In order to stay on the conservative side it was assumed that the electricity has to be taken from the grid during the whole year. By choosing this approach, the CO_2 emissions resulting from electricity used by LFG pumping equipment [(5.)] were estimated based on an electricity consumption of 438 MWh/year (50kW, 8760 h) and the above calculated electricity emission factor for the Russian Federation. The calculation yields project emissions of 1.892 tons of CO_{2eq} . These project emissions are summarized in Table E.4 below.

Table E.4: Emission factors and estimated project emissions from LFG pumping equipment for the landfill of Chelyabinsk

<i>Emission factor for the Russian Federation for JI-projects generating electricity</i>		<i>Estimated emissions from the project activity on site</i>
<i>Year</i>	<i>kgCO₂/MWh</i>	<i>tons CO₂/year</i>
2008	864	378,4
2009	864	378,4
2010	864	378,4
2011	864	378,4
2012	864	378,4
Sum		1 892,1

Table E.5 shows the summary of all the Project emissions (E1) mentioned above.

Table E.5: Summary of the project emissions (E1)

<i>Year</i>	<i>Amount of methane not captured by project activity (tons CO_{2eq}/year)</i>	<i>Estimated emissions from the project activity on site (tons CO_{2eq}/year)</i>	<i>Estimates substitute methane (tons CO_{2eq}/year)</i>	<i>Estimated project emissions (tons CO_{2eq}/year)</i>
2009	188 559	378	9 069	179 868
2010	196 203	378	9 069	187 512
2011	162 792	378	9 069	154 101
2012	154 854	378	9 069	146 163
Sum	702 408	1 512	36 276	667 644

E.2. Estimated leakage:

No leakage effects need to be accounted under methodology ACM0001 (E.2 = 0).

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

Table E.6 presents the total project activity emissions, attributable to non captured methane emissions, not combusted methane release and emissions associated with electrical consumption during the crediting period. As mentioned above E.2 = 0. Therefore Table E.6 is equivalent to Table E.5 in section E.1.

Table E.6: Total Project Activity Emissions

Year	Amount of methane not captured by project activity (tons CO _{2eq} /year)	Estimated emissions from the project activity on site (tons CO _{2eq} /year)	Estimates substitute methane (tons CO _{2eq} /year)	Estimated project emissions (tons CO _{2eq} /year)
2009	188 559	378	9 069	179 868
2010	196 203	378	9 069	187 512
2011	162 792	378	9 069	154 101
2012	154 854	378	9 069	146 163
Sum	702 408	1 512	36 276	667 644

E.4. Estimated baseline emissions:

The GHG emissions by sources of the baseline are represented by the amount of methane contained in the landfill gas (CH_{4,y}) that is currently released to the atmosphere.

The model which is chosen for the landfill gas potential calculation is the approved FOD (First Order Decay) methodology for Emission Calculation of „Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories”.

The purpose of the equation is to estimate current annual emissions from waste disposal in current year.

$$\text{Methane emissions (Gg/yr)} = (MSW_T \times MSW_F \times MCF \times DOC \times DOC_F \times F \times 16/12 - R) \times (1-OX)$$

where:

<i>MSW_T</i>	total MSW generated [Gg/yr];
<i>MSW_F</i>	fraction of MSW disposed to solid waste disposal sites (<i>MSW_F</i> = 1);
<i>MCF</i>	methane correction factor (fraction) (Type of site: Unmanaged – deep >5 m waste. The IPCC default value MFC=0.9);
<i>DOC</i>	degradable organic carbon (fraction) (The IPCC default value for Russian Federation is 0.17);
<i>DOC_F</i>	fraction DOC dissimilated (The IPCC Guidelines provide a default value of 0.77 for <i>DOC_F</i>);
<i>F</i>	fraction of CH ₄ in landfill gas (default is 0.5);
<i>R</i>	recovered CH ₄ [Gg/yr] (The default value for methane recovery is zero);
<i>OX</i>	oxidation factor (fraction - default is zero).

The purpose of the equation is to estimate current annual emissions from waste disposal previous years.

$$CH_4 \text{ generated in year } t \text{ (Gg/yr)} = \sum_x [(A \times k \times MSW_T(x) \times MSW_F(x) \times L_0(x)) \times e^{-k(t-x)}]$$

for *x* = initial year to *t*

where:

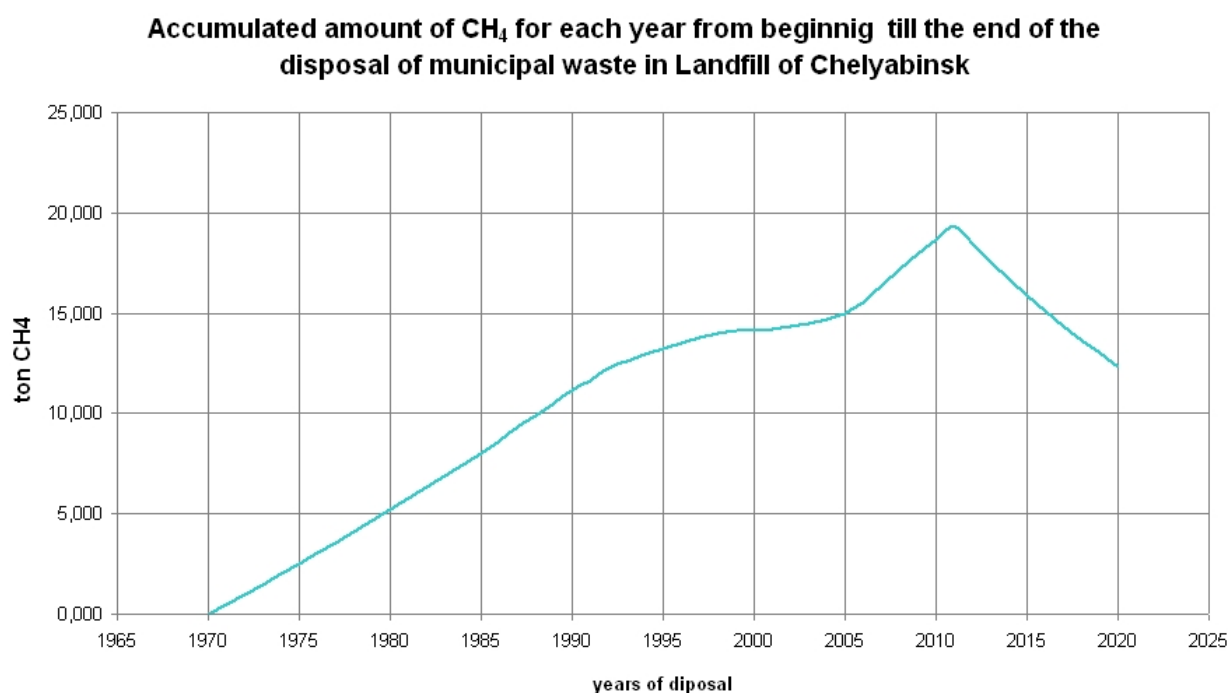
<i>t</i>	year of inventory;
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- x years for which input data should be added;
- A normalisation factor which corrects the summation $A = (1 - e^{-k}) / k$;
- k methane generation rate constant (1/yr);
- $MSW_T(x)$ total municipal solid waste (MSW) generated in year x (Gg/yr);
- $MSW_F(x)$ fraction of MSW disposed at solid waste disposal site in year x ;
- $L_0(x)$ methane generation potential [$MCF(x) \times DOC(x) \times DOCF \times F \times 16 / 12$ (Gg CH₄/Gg waste)];
- $MCF(x)$ methane correction factor in year x (fraction);
- $DOC(x)$ degradable organic carbon (DOC) in year x (fraction) (Gg C/Gg waste);
- $DOCF$ fraction of DOC dissimilated;
- F fraction by volume of CH₄ in landfill gas;
- $16 / 12$ conversion from C to CH₄.

Sum the obtained results for all years (x).

To determine the total amount of landfill gas emissions during the commitment period the amounts generated between the years 2009 and 2012 and calculated as shown above are to be summed up.

The following figure shows the results of above mentioned approach.



Based on the FOD model projections of total emissions illustrated above, for the landfill site of Chelyabinsk the total methane emissions in the baseline scenario (no collection or destruction of methane at the site) for the crediting period are **1.563.639** tons of CO_{2eq}.

Table E.7: Estimated emissions according to baseline scenario (full release of LFG to the atmosphere)

Year	Estimated baseline emissions in (ton CH ₄ /year)	Estimated baseline emissions in (ton CO _{2eq} /year)
2009	17 958	377 118
2010	18 687	392 427
2011	19 380	406 980
2012	18 434	387 114



Sum	74 459	1 563 639
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E.5. Difference between E.4. and E.3. representing the emission reductions of the project:

The total emission reduction of the project activity at the landfill of Chelyabinsk is the difference between E.4 and E.3 and results in an estimated emission reduction of **895.995** tons of CO_{2eq} between 2009 and 2012.

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

Table E.8 summarizes the net emission reduction associated with the project activity.

Table E.8: Total Project Activity Emissions for the landfill of Chelyabinsk

<i>Year</i>	<i>Estimated project emissions (tons CO_{2eq}/year)</i>	<i>Estimation of leakage (tons CO_{2eq})</i>	<i>Estimated baseline emissions in (tons CO_{2eq}/year)</i>	<i>Estimation of net emission reduction (tons CO_{2eq})</i>
2009	179 868	0	377 118	197 250
2010	187 512	0	392 427	204 915
2011	154 101	0	406 980	252 879
2012	146 163	0	387 114	240 951
Total (tons CO_{2eq})	667 644	0	1 563 639	895 995

**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:**

In the baseline situation landfill gas is generated as a result of decomposition of municipal waste under anaerobic conditions. It is mainly composed of carbon dioxide and methane. Carbon dioxide and methane are greenhouse gases, which do not cause harmful effects to the local environment, but rather affect global warming and economic value of the area where the landfill is implemented.

In Table F.1 typical potential significant environmental effects from landfills are listed in general terms and the impact from implementation of a LFG utilisation or flaring system is presented.

Table E.8: Typical potential significant Environmental effects of landfills and effects due to implementation of a LFG utilization

<i>Indicator</i>	<i>Typical potential significant environmental effects from landfills</i>	<i>Effects due to LFG utilisation</i>
Human beings	<ul style="list-style-type: none"> • Health and Safety • Nuisance • Residential amenity 	Active abstraction of LFG from a landfill will reduce the risks for uncontrolled gas migration e.g. into constructions and buildings. This will reduce the risks for explosions or poisoning
Flora	<ul style="list-style-type: none"> • Obliteration by development or site drainage • Opportunities following rehabilitation 	No negative or positive effects from LPG plant.
Fauna	<ul style="list-style-type: none"> • Impact on existing terrestrial and aquatic fauna • Birds, rodents and insects as pests and disease vectors • Scavengers attracted • Indirect effects from surface water pollution • Hazards to farm stock 	Abstraction of LPG and capping of the waste will prevent self ignition in the waste body and avoiding fires etc.
Soils and geology	<ul style="list-style-type: none"> • Need for material capping • Deterioration of capping soils due to upward migration of contaminants 	Implementation of abstraction wells will promote final capping of the landfill and soil is required (~700,000 m ³). The possibility to procure soil from other construction works (road construction, major basement excavations for buildings etc.) should be examined.
Water	<ul style="list-style-type: none"> • Contamination by uncontrolled surface run-off 	Implementation of abstraction wells will promote final capping of the landfill and by that reduce leachate



<i>Indicator</i>	<i>Typical potential significant environmental effects from landfills</i>	<i>Effects due to LFG utilisation</i>
	<ul style="list-style-type: none"> Contamination of groundwater by leachate Movements of contaminated groundwater 	generation and increase clean surface water run-off.
Air	<ul style="list-style-type: none"> Generation of methane with fire and explosion hazards Odours Dust Noise of equipment/traffic 	Reduce GHG emissions Implementation of abstraction wells will promote final capping of the landfill and by that reduce odours.
Climate	<ul style="list-style-type: none"> Odour dispersal Rainfall infiltration Dispersal of flammable gases 	Implementation of abstraction wells will promote final capping of the landfill and by that reduce dispersal of odour and flammable gases as well as reduce rainfall infiltration.
The landscape	<ul style="list-style-type: none"> Visual impact and change in character due to: Perimeter fences, bunds and signs Access roads, entrances Exposed waste, windblown litter Flares, smoke, fires Site structures 	Visible features from a LPG utilisation plant will be a steel containers (20 or 30 foot container) and the flaring stack (typical 5-10 m high) These features will not significantly alter the visible impression of the landfill, while capping and planting of the landfill site will improve the visible impression.
Material assets	<ul style="list-style-type: none"> Diminution of amenities for residential and leisure land uses Disruption to adjacent agriculture (e.g. due to increased bird population) Contamination of aquifers 	No negative or positive effects from LFG plant
The interaction of the foregoing	<ul style="list-style-type: none"> Climatic effect can concentrate or disperse airborne impacts and nuisances Landscaping and screening can be uncharacteristic of surroundings 	No negative or positive effects from LFG plant
Cultural heritage	<ul style="list-style-type: none"> Degradation of the context of monuments Loss of remains during surface obliteration caused by cell construction or capping soils acquisitions 	No negative or positive effects from LFG plant

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:

In the Russian Federation every project with the mere potential of having an impact on the environment is likely to go through an ecological project assessment procedure, with the aim to obtain project implementation permission.

In fact the whole ecological project assessment procedure consists of three parts which are strongly interconnected. It starts with the Environmental Impact Assessment (EIA), which in Russian administrative law procedure is called “OVOS” (Ocenka Vozdejstvija na Okrujajushuju Sredu). This assessment forms an integral part of any pre- and project documentation. The main task of the EIA is to reveal the environmental situation and all the potential and likely impact before, during and after project implementation. Project documentation without or without a sound EIA is considered incomplete and not accepted by any concerned department during project approval procedure. During the EIA (“OVOS”) public hearings (Stakeholder Consultations) are mandatory by law.

Step two and three are combined in the so called Ecological Assessment (EA), which is lead by a specially formed commission with members from all different sides of project interests.

Ecological Assessment (EA) comprises the “State” - Ecological Assessment (SEA) in Russian “Gosudarstvenaja Ekologitsheskaja Ekspertiza (GEE) (Governmental Ecological Expertise)” and the “Public” - Ecological Assessment (PEA) in Russian “Obshestvenaja Ekologitsheskaja Ekspertiza (OEE) (Public Ecological Expertise)”. The Governmental Ecological Expertise is to be conducted in the Federal ministry of ecological, technological and nuclear control (Gov-t Resolution #401 dd 30.07.2004)

The PEA, in which civil society through neighbours and NGOs should play an active role, is not mandatory and may be proceeded in parallel with the governmental ecological expertise. PEA is not in all the cases obligatory and depends mainly on project size and impact risks.

The SEA is obligatory and always taking place. Its main task is to lead the whole assessment project, also the public one and to take into consideration and check the EIA (OVOS) on its soundness, clearness, state-of-the art level and data basis.

In brief, it can be said that the whole process starts with the working out of the EIA, by a scientific institute, which forms an essential part of the project documentation. Then a state commission is formed to asses the project during the so called “State”- Ecological Assessment (SEA). A public ecological expertise (PEA) can take place dependent of the project type and size. The whole process ends with a negative or positive project assessment by the state commission.

The whole procedure finds its legitimacy in the following laws and regulations:

- “**The Federal Law on Environmental Protection** from January 10th 2002”, Nr. 7-FZ (with amendments from August 22nd, December 29th 2004 and May 9th, December 31st 2005);
- “**The Federal Law on Ecological Assessment** from November 23rd 1995”, Nr. 174-FZ (with amendments form April 15th 1998, August 22nd, December 21st, 29th 2004 and December 31st 2005);
- “**The Regulation on Environmental Impact Assessment of Planed Economical and other Activities in the Russian Federation (2002)**” enacted by an Order of the State Committee for Ecology of the RF on May 16th 2000, Nr. 372;
- Decrees of the Government of the RF as for example the Regulations “**on the State - Ecological Assessment Procedure**” from June 11th 1996, Nr. 698 and “**on the Federal ministry of ecological, technological and nuclear control**” form July 30th 2004, Nr. 401;
- Additional regulations, which were enacted by an Order of the State Committee for Ecology of the RF (Goskomekologija) as for instance the Regulations “**(Reglament) on the State - Ecological Assessment Procedure**” from June 17th 1997 Nr. 280; “**on tariffs of payment for State - Ecological Assessment Documentation**” form April 22nd 1998, Nr. 238; “**on**



Environmental Impact Assessment of Planned Economical and other Activities” from May 16th 2000, Nr. 372 (see above);

- And an explicatory interpretation **“On State-Ecological Assessment concerning companies with foreign investment”** proclaimed by the Ministry of Natural Resources of the RF and the Russian Agency for International Cooperation and Development from 19th, 20th May 1993 Nr. 02-12/65-1571, 3.14.2-3/312;
- Pure technical documents and materials are taken into consideration during EIA and EA procedures. Mainly they consist of State Standards and classificatory lists as the well known GOST, SNIIP, SP, SanPiN - Rules and Standards. Instructions, methodical documents and recommendations are also part of this group of pure technical documents. These normative-technical documents contain specific quantitative norms, indices and other criteria to control conformity of the proposed solutions with ecological requirements.

Although it can be concluded that the project impact will be positive in any case because it will strongly improve the ecological situation on and around the landfill site, the project activity bears an impact potential, which will have to be assessed. Thus an EA (Ecological Assessment) including the EIA (Environmental Impact Assessment) has to be conducted for the project activity.

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

The by now meetings were held with following institutions:

- Ministry of ecological and radiation safety, Chelyabinsk Oblast;
- Chelyabinsk City administration;
- MUP GORECOCENTR.

All above institutions have expressed their support to the project in letter or during their participation in meetings etc.

Further stakeholders will be addressed by publication of the project proposal on the website of the Chelyabinsk Oblast and Chelyabinsk City.

Stakeholders to be addressed will be municipalities, NGO and the public. However, any stakeholder is invited to submit any support to the project or objection against the project at any time.

There are no existing local planning/approval/permitting procedures for public consultation in Chelyabinsk Oblast or in Russia.

The public consultation process in Chelyabinsk Oblast is planned to be carried out as presented in Table G.1.

Table G.1: Public Consultation Process

Activity	Accomplished/comments
Identify all local stakeholders affected or likely to be affected by the JI project activity.	Potential stakeholders: <ul style="list-style-type: none"> • Ministry of ecological and radiation safety, Chelyabinsk Oblast; • Chelyabinsk City administration; • MUP GORECOCENTR.
Announcement of the project on the website of Chelyabinsk Oblast and Chelyabinsk City for invitation of further stakeholders and for comments	Will be carried out when draft PDD and Baseline Study is ready (in English and Russian). The documents will be handed over by request. The announcement will include an invitation to participate in a workshop and call for written or verbal comments.
Workshop	All stakeholders will be invited to attend in a workshop regarding the project. Workshop organiser will record all responses in minutes of meeting or via written responses.
Report on the consultation exercise	All written and verbal responses will be included in the final report. The final report will be available for all stakeholders.



Annex 1

CONTACT INFORMATION ON PROJECT PARTICIPANTS

Organisation:	Administration of Chelyabinsk city
Street/P.O.Box:	Revolution Square
Building:	2
City:	Chelyabinsk
State/Region:	Chelyabinsk Oblast
Postal code:	454113
Country:	Russian Federation
Phone:	+7 (351) 263 34 60
Fax:	+7 (351) 263 38 05
E-mail:	oir@chel.org.ru
URL:	www.cheladmin.ru
Represented by:	Yurevich Michael
Title:	Head of Chelyabinsk city
Salutation:	Mr.
Last name:	Yurevich
Middle name:	
First name:	Michael
Department:	
Phone (direct):	+7 (351) 263 34 60
Fax (direct):	+7 (351) 263 38 05
Mobile:	
Personal e-mail:	

Organisation:	MUP GORECOCENTR
Street/P.O.Box:	Pereselencheskiy Punkt
Building:	26
City:	Chelyabinsk
State/Region:	Chelyabinsk Oblast
Postal code:	454091
Country:	Russian Federation
Phone:	+7 (351) 261 9477
Fax:	+7 (351) 261 9477
E-mail:	gor@ecocentr.ru
URL:	www.ecocentr.ru
Represented by:	Galichin Alexander
Title:	
Salutation:	Mr.
Last name:	Galichin
Middle name:	
First name:	Alexander
Department:	
Phone (direct):	+7 (351) 261 9477
Fax (direct):	+7 (351) 261 9477
Mobile:	
Personal e-mail:	



Organisation:	LLC Teplopribor-Eco	
Street/P.O.Box:	2 nd Paveletskaya	
Building:	36	
City:	Chelyabinsk	
State/Region:	Chelyabinsk Oblast	
Postal code:	454047	
Country:	Russian Federation	
Phone:	+7 (351) 725 8901	
Fax:	+7 (351) 725 7590	
E-mail:	eco@tpchel-eco.ru	
URL:		
Represented by:	Starodubcev Sergey	Klimov Evgeniy
Title:		
Salutation:	Mr.	Mr.
Last name:		
Middle name:		
First name:		
Department:		
Phone (direct):		+7 (351) 725 7650
Fax (direct):		+7 (351) 725 7590
Mobile:		+7 922 7000 288
Personal e-mail:		evklimov@tpchel-eco.ru

Organisation:	Danish Energy Agency	
Street/P.O.Box:	Amaliegade	
Building:	44	
City:	Copenhagen K.	
State/Region:		
Postal code:	DK-1256	
Country:	Denmark	
Phone:	+45 33 92 67 00	
Fax:	+45 33 11 47 43	
E-mail:	ubb@ens.dk	
URL:	http://www.danishcarbon.dk	
Represented by:	Ulla Blatt Bendtsen	
Title:	Programme Director, Climate Department	
Salutation:		
Last name:	Iversen (Project Manager)	
Middle name:		
First name:	Johnny	
Department:	Climate	
Phone (direct):	+45 33 92 67 88	
Fax (direct):	+45 33 11 47 43	
Mobile:	+45 22 29 02 69	
Personal e-mail:	jiv@ens.dk	



Organisation:	Nordic Environment Finance Corporation, NEFCO in its capacity as Fund Manager to the Baltic Sea Region Testing Ground Facility
Street/P.O.Box:	Fabianinkatu 34, P.O. Box 249
Building:	34
City:	Helsinki
State/Region:	
Postal code:	FI-00171
Country:	Finland
Phone:	+358 9 18 001
Fax:	+358 9 630 976
E-mail:	
URL:	www.nefco.org/tgf
Represented by:	Ash Sharma
Title:	Senior Investment Manager, Carbon Finance and Funds
Salutation:	Mr.
Last name:	Sharma
Middle name:	
First name:	Ash
Department:	
Phone (direct):	+358 40 08 11 327
Fax (direct):	+358 9 630 976
Mobile:	+358 40 08 11 327
Personal e-mail:	ash.sharma@nefco.fi



Annex 2

BASELINE INFORMATION

The baseline scenario for the project activity is the uncontrolled release of landfill gas (LFG) to the atmosphere. The total estimated emissions of landfill gas to the atmosphere in the baseline scenario are estimated as 3 894 412 tons of CO_{2eq} during the crediting period from 2008 to 2012 for the landfill of Chelyabinsk.

At present there are no measures in place to reduce methane emissions and there are no current or pending regulations that would require the specified site to reduce emissions.



Annex 3

MONITORING PLAN

1. Introduction

The two primary purposes of a landfill gas monitoring plan are:

- To collect the necessary system data required for the determination and validation of certified emissions reductions (ERUs);
- To demonstrate successful compliance with established operating and performance criteria for the system, and to verify that the ERUs have been generated.

The operational system data that is collected will be used to support the periodic report that will be required for the auditing and verification of ERUs. The monitoring plan discussed herein is designed to meet or better the UNFCCC requirements.

The routine system monitoring program required for the determination and verification of ERUs is discussed in Section 2, while the additional system data that is collected to ensure the safe, correct, and efficient operation of the landfill gas management system is discussed in Section 3.

An operations and maintenance manual together with general performance guidelines are developed. The expected performance guidelines in accordance with the data collection procedures described below will be provided with trigger levels that will be indicative, if necessary, for any follow-up assessment and possible remedial response measures.

2. Monitoring Work Program

The landfill gas monitoring program is a relatively simple, straight forward program designed to collect system operation data required for safe operation of the system and for the verification of ERUs. The data is collected in real time, and will provide a continuous record easy to monitor, review, and validate.

The following sections will outline and discuss following key elements of the program:

- Flow measurement;
- Gas quality measurements;
- Data records;
- Data assessment and reporting.

2.1. Flow Measurement

The flow of landfill gas collected by the system and subsequently flared or utilized is measured via a flow measuring device suitable for measuring the velocity and volumetric flow of a gas. Two examples for such devices commonly in use are an annular or an orifice plate. The flow measurements are taken within the piping itself, and the flow sensors are connected to a transmitter capable of collecting and sending continuous data to a recording device such as a data logger.

The flow sensors are calibrated in accordance to a specified temperature, pressure and gas composition. For this reason the flow actually measured must be corrected according to the actual temperature, pressure and gas composition of the measured gas. The equipment selected will allow dynamic compensation of these parameters in relation to a standard temperature, pressure, and gas composition. For reporting purposes, the flows are generally required to be normalized to 0°C and 1 atm at a standard gas composition of 50% methane and carbon dioxide each by volume.

Specific calibration procedures are dependent on the actual equipment selected. However, calibration of the sensors is required on a regular basis to ensure the quality and validity of the data. The accuracy of a



flow meter is dependent on the design of the equipment, and the specific type of sensor used. However, equipment is available that will provide a minimum accuracy of +/- 2% by volume. Again dependent on the equipment selected, the measured flow is aggregated approximately once per second.

All data collected will be recorded to a permanent record. Both electronic and hard copies of the data will be maintained for auditing purposes, and for calculating the ERUs.

2.2. Gas Quality

The two parameters being the most pertinent and important to the verification of ERUs, as well as the safety and efficiency of the operating system are the concentration of methane and oxygen in the gas stream. These two parameters are measured via a common sample line that is run to the main collection system piping. They are measured in real time by two separate sensors, one for methane and one for oxygen.

Although the methane and oxygen sensors do not require compensation for temperature and pressure alterations, the sensors are designed to operate under specified temperature and pressure conditions. Again, specific calibration procedures are dependent on the actual equipment selected. However, calibration of the sensors is required on a regular basis to ensure the quality and validity of the data. Regular calibration of the equipment is of utmost importance, as accuracy of methane and oxygen measurements is best in the gas stream.

Equipment is available that will provide an accuracy of +/- 1% by volume. Dependent on the equipment selected gas compositions are aggregated approximately once per second.

2.3. Data Records

Data collected from each of the sensors is transmitted directly to an electronic database on which basis ERU quantity calculations may be carried out, and a hard copy backup of the data may be printed. Electronic data backup may be carried out on a daily basis, and a hard copy of the data may be printed weekly or monthly. As back up will be performed independent from the main recording system, no more than data of one day would be lost at a time due to a system malfunction. Calibration records will be kept for all instrumentation.

2.4. Data Assessment and Reporting

Assessment of the flow and composition data described above in connection with the operating hours of the flare and flare destruction efficiency are used to determine the quantity of ERUs generated. The destruction efficiency of the flare is dependent on internal combustion temperature and resident holding time, which are generally measured by the flare system controller, and recorded for auditing purposes. Comprehensive technical documentation is available documenting the destructive efficiency of the installed drum flares that will be used and which are subject to the flow rate and combustion temperature verification. Destruction efficiency will also be assessed periodically through measurements of emissions of not combusted methane.

As discussed in Section 2.1, flow data is normalized to standard temperature, pressure and gas composition for reporting purposes. The data will be compiled and assessed to produce the required quantification and verification. The annual monitoring report will contain the data required for the verification of the ERUs, and additionally may contain other operational data from the collection and flaring system described below to illustrate that the system is well maintained and operating at peak efficiency. Records of regular maintenance works performed will also be part of the annual report.

3. Related Monitoring

Additional operational monitoring of the landfill gas extraction and collection well field is conducted in order to optimize the system and ensure that it is operating both correctly and efficiently. Periodic adjustments to the landfill gas extraction wells will be required to optimize the collection system effectiveness. Such adjustments to the landfill gas extraction wells are undertaken upon a review of their performance history considered in the context of the overall field operation in order to maximize the



extraction and collection of methane balanced against the minimization of any oxygen in the system which could introduce unsafe operating conditions. Monitoring of each landfill gas extraction well will consist of the following parameters: valve position, individual well flow, individual well vacuum, and composition of the gas collected, i.e., methane, carbon dioxide, and oxygen, using a portable measuring device.

At the time the definite landfill gas collection and utilization facility will be designed and commissioned, a specific monitoring plan tailored to the collection and utilization technology selected will be developed for this system.



Annex 4

LETTER OF NO OBJECTION

National Emblem

Moscow, 8 December 2005

The Ministry of Economic Development and Trade has received an appeal from the JSC “Teplopribor-Eco” (Chelyabinsk city) with a request to support its application for the participation in a tender organized by the Danish Environment Protection Agency (DEPA) on purchase of the Emission Reduction Units to be generated from Project “LFG collection and utilization at the landfill in Chelyabinsk”.

Herewith we do confirm absence of any objections for further development of above project, taking into consideration that the JI project status in pursuance of the Article 6 of the Kyoto Protocol will be attributed to the Project according to International (adopted by the Kyoto Protocol parties) and National (adopted in the Russian Federation and Denmark) procedures.

TO MR. HANS JAKOB ERIKSEN
DANISH ENVIRONMENT PROTECTION AGENCY
COPENHAGEN

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After the documents regulating procedures for the JIPs consideration and approval in pursuance of the Article 6 of Kyoto Protocol are adopted by the Government of the Russian Federation, the Ministry of Economic Development and Trade will consider presented documentation related to JI project and will issue a conclusion.

Best regards,
Vsevolod V. Gavrilov

Deputy Director of the Department
of property and land relationships,
environmental economics