



**JOINT IMPLEMENTATION PROJECT DESIGN DOCUMENT FORM**  
**Version 01 - in effect from: 15 June 2006**

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**SECTION A. General description of the project****A.1. Title of the project:**

Upgrading of technological tube furnaces at the company “LUKOIL-Permnefteorgsintez” LLC, city of Perm, Russian Federation

Sectoral scope 3

PDD Version: 04

Date: 17.01.2011

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

The project’s purpose is the upgrading of equipment at “LUKOIL-Permnefteorgsintez” LLC. The project implementation leads to the GHG emissions reduction and decreasing of environmental impact.

The project is implemented at the production facilities of “LUKOIL-Permnefteorgsintez” LLC (the LUKOIL’s daughter enterprise).

The project started early in 01 August 2003 and will provide the upgrading of 18 furnaces. The project activity will result in following effects:

1. Decrease of consumption of the fuel with high carbon content;
2. Reduction of GHG emissions and air pollutant emission.

Using of existent equipment would have been continued in the absence of the project activity. Thus, the upgrading of equipment leads to GHG emissions reduction. The average reduction of GHG emissions of the project is 166,589 tCO<sub>2</sub>e per year or 832,946 tCO<sub>2</sub>e in the 2008-2012 crediting period.

The idea of the project (as a JI Project) was intended in 2005 in “LUKOIL-Permnefteorgsintez” LLC<sup>1</sup>. On July 2005 the company adopted the “Upgrading of technological tube furnaces at the “LUKOIL-Permnefteorgsintez” LLC up to the year of 2010” Program. This Program aims at the reduction of GHG emissions and air pollutant emission. The most part of the capital financing and the building work was performed in 2008.

**A.3. Project participants:**

Party involved	Legal entity project participant (as applicable)	Please, indicate if the Party wishes to be considered as project participant (Yes/No)
Party A - Russian Federation (host party)	JSC LUKOIL	No
Party B - No	-	-

LUKOIL is one of the world’s leading vertically integrated oil & gas companies. Main activities of the Company are exploration and production of oil & gas, production of petroleum products and petrochemicals, and marketing of these outputs. Most of the Company's exploration and production activity is located in Russia, and its main resource base is in Western Siberia. LUKOIL owns modern refineries, gas processing and petrochemical plants located in Russia, Eastern Europe and near-abroad countries. Most of the Company's production is sold on the international market. LUKOIL petroleum products are sold in Russia, Eastern and Western Europe, near-abroad countries and the USA.

<sup>1</sup> Minute of meeting of 21.07.2005



LUKOIL dominates the Russian energy sector, with almost 19% of total Russian oil production refining.

LUKOIL owns significant oil refining capacity both in Russia and abroad. In Russia the company owns four large refineries at Perm, Volgograd, Ukhta and Nizhny Novgorod. Total capacity of LUKOIL facilities in Russia is 44.5 mln tons of oil per year. LUKOIL also has refineries in Ukraine, Bulgaria, and Romania, with total capacity of 14.0 mln tons per year. In 2007 LUKOIL refined 52.16 mln tons of oil at its own refineries, including 42.55 mln tons at its Russian refineries.

In the beginning of 2008 the Company's marketing network encompassed 24 countries, including Russia, the near-abroad and European countries (Azerbaijan, Belarus, Georgia, Moldova, Ukraine, Bulgaria, Hungary, Finland, Estonia, Latvia, Lithuania, Poland, Serbia, Montenegro, Romania, Macedonia, Cyprus, Turkey, Belgium, Luxemburg, Czech Republic, and Slovakia) as well as the USA and includes 197 tank farm facilities with total capacity of 3.11 million cubic meters as well as 6,090 filling stations, including franchises.

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

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

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

Russian Federation.

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

Perm Krai.

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

Perm city.

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

*Fig. A.4.1.4.1 Perm Krai on the map of the Russian Federation*



Perm Krai is situated in the east of Eastern-European Plain and on the western slope of Middle and Northern Urals. Its surface equals to 160,600 square kms. Perm Krai borders in the north – with the Republic of Komi, in the west – with Kirov region and Udmurtia, in the south – with Bashkiria, in the east – with Sverdlovsk region. The territory stretches north to south for 645 km, west to east 417.5 km. The company “LUKOIL-Permnefteorgsintez” LLC is situated on the territory of the city of Perm, the capital of Perm Krai. Distance from Perm up to Moscow is 1522 km.

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

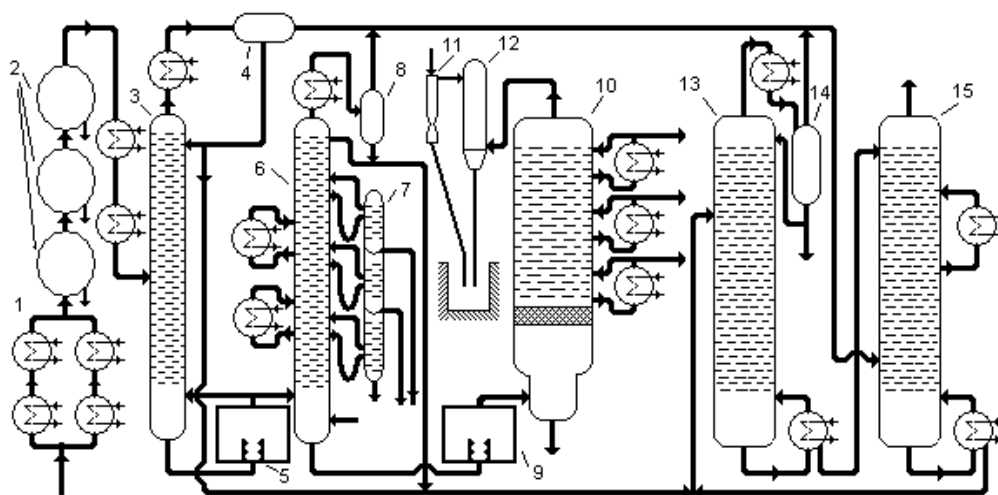
Process of primary refining of oil (straight distillation) with the purpose of obtaining oil fractions which vary in boiling points without thermal decomposition, is carried out in shell stills or in pipe stills under atmospheric and boost pressures or in vacuum. Pipe stills differ in lower sufficient temperature of the distilled basic material, smaller cracking of the basic material, and larger efficiency factor. For this reason at the up-to-date stage oil refining pipe stills have become a part of all the oil refineries. They are suppliers of both commercial oil products and basic material for secondary processes (catalytic cracking, reforming, hydrocracking, coking, isomerization and others).

Depending on a pressure in fractional (rectification) columns pipe stills subdivide into atmospheric, vacuum and atmospheric-vacuum. According to evaporation phase number (number of rectification columns) pipe stills may be as follows:

- flash (single) evaporation pipe stills: one rectification column gives all distillate products – from petrol to greasy cylinder stock. Distillation residue is tar oil.
- double evaporation pipe stills: first under atmospheric pressure oil is distilled over into fuel-oil residue which then is distilled over (in vacuum) over to get tar oil in residue. These processes go in two columns.
- triple evaporation pipe stills: two atmospheric and one vacuum columns are used. In the first column only petrol is extracted from oil, in the second column the topped crude is distilled over into fuel-oil residue, in the third column the fuel-oil residue is distilled over into tar oil.
- quadruple evaporation pipe stills: a still with residual evaporation vacuum column for tar oil in tail-piece.

A combination of atmospheric-vacuum pipe still with a reworking complex has found a widespread occurrence. Process sheet for a combined pipe still ELOU-AVT is given in Fig. A.4.2.1.

Fig. A.4.2.1 Process sheet for a combined pipe still



Oil warmed in heat interchangers – 1 of temperature 120—140°C goes into the complex of dehydrogenating agents – 2 where it is exposed to thermochemical and electric dehydration and desalination with the interference of water, demulsificator and alkali. Thus prepared oil is additionally warmed up again in heat interchangers and of temperature 220°C goes into the column – 3. From above of this column a fraction of benzine (light gasoline) is extracted and brought out through the heat interchanger and separator – 4 from where it is partially removed for refluxing of the column. Residue from below of the column goes into the furnace — 5 where it is heated up to 330°C and goes as an additional hot jet into the column – 3 and as a basic material into the column – 6. From above of column 6 heavy gasoline is extracted and brought out through the heat interchanger and gas separator – 8; then it partially goes back to the column as a refluxer. From the side of the column intermediate fractions are extracted; for this purpose there are temperature correctors and flash towers – 7 where fractions 140-240°C, 240-300°C, 300-350°C are extracted. Fuel-oil residue from below of column – 6 is fed to furnace 9 where it is heated up to the temperature 420°C and goes to the vacuum column – 10 which works under residual pressure 40 millimeters of mercury. Water vapours, light-end decomposition products and light vapours from above the column enter the barometric condenser – 12; non-condensed gases are pumped out by jet pump – 11. From the side of the column lateral products of the vacuum column are extracted; residue from below is tar oil. Benzines extracted in columns 3 and 6 go to stabilizer – 13. Gas from gas separators —4, 8 and 14 is fed into the absorber —15 refluxed by the stable gasoline from column – 13. Dry (residue) gas extracted from above of the column – 15 is discharged down to furnace jets.

Table A.4.2.1 Implementation schedule of furnaces

	Equipment	Furnace	Start of operation
1	35-20	P-101	20.10.2003
2	24-7	P-2	30.12.2004
3	AVT-4	P-403	14.04.2005
4	AVT-5	P-3	25.07.2008
5	36-30	P-2R	29.04.2005
6	24-9	P-1	22.03.2008



7	24-9	P-2	22.03.2008
8	AVT-4	P-1	16.04.2008
9	AVT-4	P-2	16.04.2008
10	AVT-5	P-4	25.07.2008
11	AVT-5	P-5	25.07.2008
12	37-40	P-3	30.07.2008
13	24-6	P-1	22.05.2009
14	37-10	P-2/3	01.01.2010
15	24-7	P-3	01.01.2011
16	AVT-5	P-1	01.01.2012
17	24-6	P-2	01.01.2012
18	37-10	P-1	01.01.2012

Basic factors which the upgraded furnaces should comply with, are as follows:

- Furnace efficiency 91-92%
- Use of home-produced materials
- Maximum maintainability. Access for diagnostics and repair to any element of the furnace avoiding destruction of the body and fettling of the furnace unit.
- Equipping by inspection tools for monitoring:
  - pressure and temperature of a heated product for every flow of furnace
  - temperature of heat flows throughout the furnace chain
- Use of up-to-date blow pipe devices

The upgraded furnaces don't require any extensive trainings for operating staff and maintenance efforts in order to work as presumed during the project period.

The main effect obtained due to the utilization of waste heat of gases. (It is planned to implement units for waste gases recuperation on the upgraded furnaces).

*Table A.4.2.2 Technical solutions*

	<b>Equipment</b>	<b>Furnace</b>	<b>Technical solutions</b>
1	35-20	P-101	It was built the cylindrical furnace instead of the A-type furnace.
2	24-7	P-2	The furnace upgrading is scheduled to start 2010-11.
3	AVT-4	P-403	It was built the box furnace instead of the A-type furnace.
4	AVT-5	P-3	The furnace upgrading is scheduled to start 2010-11.
5	36-30	P-2R	It was upgraded the furnace convection and it was replaced the roof and the bottom of the furnace by the heatproof concrete.
6	24-9	P-1	It was upgraded burners and the furnace bottom. Upgrading of utilization of waste gases.
7	24-9	P-2	It was upgraded burners and the furnace bottom. Upgrading of utilization of waste gases.
8	AVT-4	P-1	It was built the box furnace instead of two the A-type furnaces.
9	AVT-4	P-2	
10	AVT-5	P-4	It was built the box-type furnace instead of two the A-type furnaces.
11	AVT-5	P-5	
12	37-40	P-3	It was built box-type furnace instead of the A-type furnace.
13	24-6	P-1	It was built the cylindrical vertical furnace with electroignition burners instead of the A-type furnace.



14	37-10	P-2/3	It was built box-type furnace with detached radiant chambers instead of the A-type furnace.
15	24-7	P-3	The furnace upgrading is scheduled to start 2010-11.
16	AVT-5	P-1	The furnace upgrading is scheduled to start 2010-11.
17	24-6	P-2	The furnace upgrading is scheduled to start 2010-11.
18	37-10	P-1	The furnace upgrading is scheduled to start 2010-11.

So, upgrading of pipe furnaces at the “LUKOIL-Permnefteorgsintez” LLC will lead to a substantial saving of fuel (the efficiency factor will advance from the average value of 65% up to 90%).

**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:**

By the project activity it is provided to construct new tube furnaces. New tube furnaces will have efficiency factor up to 91-92% and will consume less fuel, combustion of which results in GHG emission. So, it will be decreased GHG emissions.

Existent tube furnaces would be repaired in the absence of the project. Tube furnaces were put into operation in 1950-70s. Their average efficiency factor is 65%. There are no restrictive laws for the use of old-fashioned tube furnaces.

Based on preliminary estimations, implementation of the project will result in GHG emissions reduction at the average amount of 166,589 tCO<sub>2</sub>/year or 832,946 tCO<sub>2</sub> for 2008-2012.

The JI mechanism allows to get additional funds due to emission reduction units (ERU) sales. Below in section B.1. “Description and justification of the baseline chosen” the arguments to support the baseline scenario are discussed in greater detail.

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

Length of crediting period	Years
	2008-2012
Year	Annual emission reductions in tones of CO <sub>2</sub> e
2008	112,276
2009	166,522
2010	172,659
2011	176,687
2012	204,802
<b>Total emission reductions over the crediting period (tones of CO<sub>2</sub> e)</b>	<b>832,946</b>
<b>Annual average emission reduction over the crediting period (tones of CO<sub>2</sub> e)</b>	<b>166,589</b>

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

The project “Upgrading of technological tube furnaces at the company “LUKOIL-Permnefteorgsintez” LLC, city of Perm, Russian Federation” is approved as a JI project by the Order of Ministry of Economic Development #709 dated 30.12.2010.

**SECTION B. Baseline****B.1. Description and justification of the baseline chosen:**

The baseline is described and justified in line with JISC “Guidance for baseline setting and monitoring” (paragraph 20 b).

The procedure of the consideration and analysis of alternative scenarios for the Project activity is in conformity with the following stages:

1. Identification of alternative scenarios.
2. Analysis of barriers.
3. Investment analysis (if applicable).
4. Analysis of common practice.

**Step 1. Identification of alternative scenarios**

This step will help to define all the alternative scenarios in relation to this project, one of which will be defined as the baseline scenario with the help of the following substeps:

Step 1a. Identification of alternative scenarios in relation to this project.

Let us consider the following scenarios as the alternative ones:

1. Alternative scenario #1: continuing of practice of use and annual repairs of old furnaces without their upgrading and building new ones.
2. Alternative scenario #2: the Project itself not accounting the registration of the Project within the framework of the Joint Implementation mechanism.

Step 1b. Adherence of the selected alternatives to the active legislation and regulation.

In the Russian Federation there are no requirements confining the use and carrying out of repair works for technological tube furnaces which have long operating lives. The exploitation of furnaces is carried out in conformity with the “Program for the environmental safety of the LUKOIL group organization for years 2004-2008” i.e. the environmental standards have been observed.

Therefore, neither of the declared alternatives collides the legislation now in force and they can be considered in the further analysis.

**Step 2. Analysis of barriers.**

Within the bounds of the present stage, those barriers are considered which might hinder the development of the alternative scenarios.

Step 2a. Identification of barriers which might hinder the execution of the alternative scenarios.

For the purpose of this analysis an influence of the following barriers is considered:





Investment barrier: upgrading of technological tube furnaces is a non-commercial project<sup>2</sup> of the “Permnefteorgsintez” LLC and practically is not profitable from the financial point of view. The more detailed grounding for this barrier will be presented in the investment analysis.

Technological barrier: more liquid fuel for furnaces (baseline) is need and more gaseous fuel for furnaces (project activity) is need. Therefore it is necessary to check availability of fuel for either scenario.

Step 2b. Exclusion of the alternative scenarios the realization of which is prevented by the abovementioned barriers.

Alternative scenario #1: Continuation of practice of use and annual repairs of old furnaces without their upgrading and building new ones.

For this scenario the investment barrier is negligible, because repair works do not require considerable financial expenses.

#### *B.1.1. Repair costs\**

<b>Year</b>	<b>Unit</b>	<b>Volume</b>
2005	mln rub	2,49
2006	mln rub	-
2007	mln rub	5,07
2008	mln rub	1,52
2009	mln rub	5,26
2010	mln rub	3,00
2011	mln rub	6,01
2012	mln rub	3,45
<b>Total</b>	<b>mln rub</b>	<b>26.8</b>

\* *The data of the Company*

Keeping of existing furnaces in operable condition can be carried out in the period of up to 2012 and longer. But this would lead to great heat waste in environment in the form of emitted furnace gases, to large values of CO factor, to low values of excess air factor, to large excess fuel flow because of the poor efficiency.

The technological barrier is negligible for the alternative 2. It is need more liquid fuel for this scenario. This fuel is the by-product of the oil refining. It is available any volume of liquid fuel from the shop of preparing of fuels.

Alternative scenario #2: the Project itself not accounting the registration of the Project within the framework of the Joint Implementation mechanism.

Investment barrier is considerable for this alternative. Construction of a new furnace will cost about 50 mln rub. Furthermore, the erection of new furnaces would require the new monitoring equipment (sensor flame sensors, oxygen content sensors, etc.). The total cost of the program “Upgrading of technological tube furnaces” amounts to 1,548,830,000 rubles.

#### *B.1.2. Upgrading costs\**

<b>Year</b>	<b>Unit</b>	<b>Volume</b>
2005	mln rub	377,95

<sup>2</sup> According to the data of the Company.



2006	mln rub	245,00
2007	mln rub	390,00
2008	mln rub	358,88
2009	mln rub	62,00
2010	mln rub	115,00
2011	mln rub	-
2012	mln rub	-
<b>Total</b>	<b>mln rub</b>	<b>1548,83</b>

\* The data of the Company

The technological barrier is negligible for the alternative 2. It is need more gaseous fuel for this scenario. This fuel is supplied by “LUKOIL–Permnefgaspererabotka” LLC. It is available any volume of liquid fuel from this source.

**Conclusion:** The carried-out analysis of influence of barriers on development of alternative scenarios showed that both scenarios have overcome technological barrier. Scenario #2 (Project itself not accounting the registration of the Project within the framework of the Joint Implementation mechanism) failed to overcome the investment barrier, but scenario #1 (Continuation of use and annual repairs of old furnaces without their upgrading and building new ones) has overcome it. Therefore, scenario #1 is the **baseline scenario**, and the level of greenhouse gases emissions within the bounds of this scenario #1 is the **baseline**.

Also the alternative 2 is realizing owing to the possibly revenue from ERU sale. This will compensate some part of CAPEX.

### Step 3. Investment analysis.

This Project is non-commercial project for the “LUKOIL-Permnefteorgsintez” LLC. Economical attractiveness of the Project isn't the criterion of its implementation.

Table B 1.3. Indicators of economic effectiveness of the project

Item	Unit	Project without ERU's income	Project with ERU's income (400 rub per 1 t CO <sub>2</sub> -e)
CAPEX	mln rub	1 548.83	1 548.83
OPEX	mln rub	222.19	222.19
Hurdle discount rate	%	15	15
NPV	mln rub	-973	-902
IRR	%	N/A	N/A

The Project within JI can receive 339.41 mln rub from the sale of ERUs. Sensitivity analysis shows that the proponent effect has the change of CAPEX.

Table B 1.4. The sensitivity analysis

Item	Unit	CAPEX		Price of fuels	
		+10%	-10%	+10%	-10%
CAPEX	mln rub	1703.83	1393.83	1 548.83	1 548.83
OPEX	mln rub	222.19	222.19	222.19	222.19
Hurdle discount rate	%	15			
NPV	mln rub	-994	-786	-865	-939
IRR	%	N/A	N/A	1.18	N/A

**Step 4. Common practice analysis.**

This stage complements the research carried out at the previous stages (steps) with the analysis of occurrence of the upgrading of technological tube furnaces and represents the **additionality criterion** for the project activity.

The presented project is unique because:

- construction projects, drawings and specifications were especially designed for each furnace. Standard solutions cannot be implemented in such case project for furnaces<sup>3</sup>;
- designers should consider the general plan of LUKOIL-Permnefteorgsintez LLC and upgrade the furnaces without penetration in nearby processes (plant is not stopped while tube furnaces upgrading);
- the furnaces upgrading must not lead to significant changes of the productivity. During the upgrading plant is not stopped, moreover its productivity can't be reduced. So it is quite complicated.

**Conclusion:**

The project activity cannot be classified as *common practice*, therefore the Project is additional.

*Table B.1.3. Key information and data used for baseline*

Data/Parameter	Quantity of net energy for the process in furnace i;
Data unit	TJ
Description	Each furnace have to produce fixed net quantity of heat for the technological process
Time of determination/monitoring	monthly
Source of data (to be) used	Thermo technical laboratory
Value of data applied (for ex ante calculations/determinations)	This parameter is individual for each furnace
Justification of the choice of data or description of measurement methods and procedures (to be) applied	This parameter allows to calculate the consumption of fuels
QA/QC procedures (to be) applied	The equipment is calibrated and checked in accordance with regulations and quality control procedures. Maintenance is carried out in accordance with norms of their technical specifications.
Any comment	

Data/Parameter	Net calorific value of liquid fuel
Data unit	TJ/ton
Description	It is value describes the heat produced from the burning of 1 ton of fuel.
Time of determination/monitoring	weekly
Source of data (to be) used	Thermo technical laboratory
Value of data applied (for ex ante calculations/determinations)	0.04147 TJ/ton
Justification of the choice of data or description of measurement methods and procedures (to be) applied	This parameter is necessary for the calculation of fuel consumption in the baseline;

<sup>3</sup> Existing project documentation was developed by "Aliter-Aksi" LLC



QA/QC procedures (to be) applied	The equipment in laboratory is calibrate and checked in accordance with regulations and quality control procedures. The laboratory is accredited.
Any comment	

Data/Parameter	Net calorific value of gaseous fuel
Data unit	TJ/ton
Description	It is value describes the heat produced from the burning of 1 ton of fuel.
Time of determination/monitoring	weekly
Source of data (to be) used	Thermo technical laboratory
Value of data applied (for ex ante calculations/determinations)	0.03307 TJ/ton
Justification of the choice of data or description of measurement methods and procedures (to be) applied	This parameter is necessary for the calculation of CO <sub>2</sub> emissions from liquid fuel consumption;
QA/QC procedures (to be) applied	The equipment in laboratory is calibrate and checked in accordance with regulations and quality control procedures. The laboratory is accredited.
Any comment	

Data/Parameter	Proportion of fuel contribution in furnace <sub>i</sub> energy production from each fuel before the project
Data unit	%
Description	This parameter describes the proportion of type of fuel in energy production of every furnace
Time of determination/monitoring	yearly
Source of data (to be) used	Technical reports for the previous years
Value of data applied (for ex ante calculations/determinations)	This value is individual for every furnace
Justification of the choice of data or description of measurement methods and procedures (to be) applied	This parameter allows to calculate the consumption of fuels
QA/QC procedures (to be) applied	There are technical instructions for filling technical reports.
Any comment	

Data/Parameter	Efficiency coefficient for every furnace
Data unit	%
Description	These parameters are need for the calculation of quantity of net energy for the process in furnace i.
Time of determination/monitoring	yearly
Source of data (to be) used	Technological documentation for every furnace
Value of data applied (for ex ante calculations/determinations)	This value is individual for every furnace and vary between 50% and 75.49%
Justification of the choice of data or description of measurement methods and procedures (to be) applied	These parameters allow to calculate quantity of energy for the process in furnace i
QA/QC procedures (to be) applied	—
Any comment	

**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:**

This template shall not be altered. It shall be completed without modifying/adding headings or logo, format or font.



Analysis in B.1. demonstrates that the Project isn't the baseline scenario and that the Project activity is complementary in relation to the situation which could be in case of realization of the baseline scenario i.e. the continuation of annual repairs practice. The barrier analysis presented in subsection B.1. allowed to identify the alternative #1 as the scenario of baseline: continuing of practice of use and annual repairs of old furnaces without their upgrading. Such practice will allow to provide a timely (and in the necessary volume) production with minimum costs.

Emissions according to the baseline are presented below in Table B. 2.1

*Table B. 2.1 Emissions under the baseline*

Year	Emissions acc. to the baseline, t CO <sub>2</sub> /year
2008	494,154
2009	494,154
2010	494,154
2011	494,154
2012	494,154
Total in 2008-2012	2,470,770

In the course of the Project activity upgrading of 18 furnaces will allow to increase their efficiency factor up to 91-92% and therefore to increase the effectiveness of use of the fuel burned. This will lead to its economy as well as to the reduction of greenhouse gases emissions during its combustion and transportation.

Emissions acc. to the Project scenario are presented in Table B. 2.2

*Table B. 2.2 Emissions under the Project scenario*

Year	Emissions acc. to Project, t CO <sub>2</sub> /year
2008	381,878
2009	327,631
2010	321,495
2011	317,467
2012	289,351
Total in 2008-2012	1,637,822

Difference between emissions acc. to baseline and emissions acc. to Project gives the project reductions which are presented in Table B.2.3.

*Table B.2.3 Emission Reductions.*

Year	Reductions of GHG emissions acc. to Project, t CO <sub>2</sub> /year
2008	112,276
2009	166,522
2010	172,659
2011	176,687
2012	204,802
Total in 2008-2012	832,946

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



Bounds of the Project include all the sources of greenhouse gases emissions associated with the combustion of fuel in furnaces under upgrade as well as with the leakages in transportation of fuel to objects of the “Permnefteorgsintez” LLC. Inclusion of emission source in the bounds of the Project depends on such factors as significance of these emissions (more than 1% of the reductions volume<sup>4</sup>) and the capability of the Company to monitor them. Emissions of CH<sub>4</sub> and N<sub>2</sub>O are not significant (less than 1% of the reductions volume) during the combustion of fuel, so they are not taken into account. Below all the emission sources are considered with a view to including them in the bounds of the Project considering the abovementioned factors.

*Table B 3.1: Emission sources under the baseline scenario and the Project activity.*

	Source	Gas	Included/ Not included	Grounding / Explanation
Baseline	Combustion of fuel in furnaces (prior to upgrading)	CO <sub>2</sub>	Included	Emissions at combustion of fossil fuel (liquid, gaseous) in technological tube furnace. In use of existing furnaces the quantity of fossil fuel is greater than that after upgrading of equipment.
		CH <sub>4</sub>	Not included	Emissions are insignificant
		N <sub>2</sub> O	Not included	Emissions are insignificant
	Fuel supply	CO <sub>2</sub>	Not included	Not included as acc. to the baseline scenario more fuel is needed, so leakage values are greater respectively in comparison with the Project. Therefore, it would lead to increase of reductions, so leakage data are not taken into account in this Project (conservative approach).
Project	Combustion of fuel in furnaces (after upgrading)	CO <sub>2</sub>	Included	During carrying-out project arrangements, the quantity of burned fossil fuel in technological tube furnaces decreases.
		CH <sub>4</sub>	Not included	Emissions are insignificant
		N <sub>2</sub> O	Not included	Emissions are insignificant
	Fuel supply	CO <sub>2</sub>	Not included	Not included as acc. to the baseline scenario more fuel is needed, so leakage values are greater respectively in comparison with the Project. Therefore, it would lead to the increase of reductions, so leakage data are not taken into account in this Project (conservative approach).

<sup>4</sup> Guidance on criteria for baseline setting and monitoring. Version 01.



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

Commencement date of writing of the baseline: 31.10.2008

The baseline was developed by National Carbon Sequestration Foundation (NCSF);

Contact persons:

Daniil Ukhanov,  
Senior expert  
Project Development Department  
Tel. +7 499 788 78 35 ext. 102  
Fax +7 499 788 78 35 ext. 107  
e-mail: [UkhanovDM@ncsf.ru](mailto:UkhanovDM@ncsf.ru)

Bugdaeva Agrafena, PhD  
Senior expert  
Project Development Department  
Tel. +7 499 788 78 35 ext. 104  
Fax +7 499 788 78 35 ext. 107  
e-mail: [BugdaevaAV@ncsf.ru](mailto:BugdaevaAV@ncsf.ru)

NCSF is not a participant of the Project.



**SECTION C. Duration of the project / crediting period**

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

1 August 2003

**C.2. Expected operational lifetime of the project:**

20 years or 233 months: 1 August 2003 – 31 December 2022

**C.3. Length of the crediting period:**

5 years or 60 months: 1 January 2008 to 31 December 2012





**SECTION D. Monitoring plan**

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

Monitoring for the Project “Upgrading of technological tube furnaces at the “LUKOIL-Permnefteorgsintez” LLC, city of Perm, Russian Federation, was developed according to “Tool to calculate project or leakage CO<sub>2</sub> emissions from fossil fuel combustion” (Version 02) UN FCCC <http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-03-v2.pdf>. This guide allows to calculate emissions from fossil fuel combustion as well as gives recommendations on monitoring.

According to this guide monitoring will go as follows:

The Project in the “LUKOIL-Permnefteorgsintez” LLC will lead to enhancement of efficiency factor of functioning technological tube furnaces. That will result in decrease of the amount of consumed fuel and, therefore, will reduce greenhouse gases emissions in atmosphere. According to “Tool to calculate project or leakage CO<sub>2</sub> emissions from fossil fuel combustion” (Version 02), calculations of emissions after fossil fuel combustion are based on the amount of burned fuel and on the emission factor of CO<sub>2</sub>. Therefore, the monitoring plan for this Project must envisage the defining of these two critical parameters.

So, there will be carried out the monitoring of the following parameters:

1. Amount of fuel burned in technological tube furnaces;
2. Emission factor of CO<sub>2</sub> (using measurements of volume ratio of the component in the gas);
3. Quantity of energy for processing in furnaces;
4. Net calorific value for liquid and gaseous fuel;

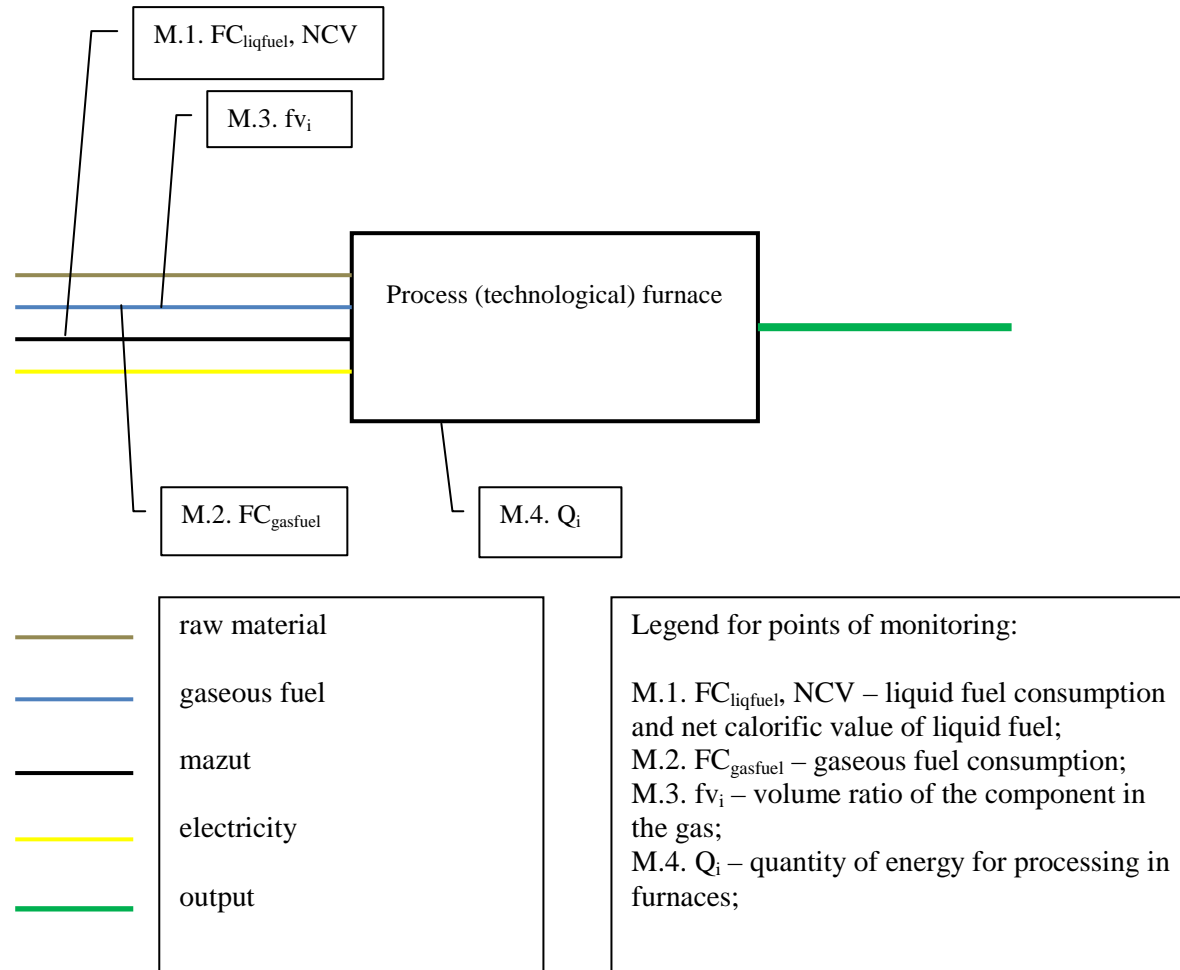
Within the bounds of monitoring of CO<sub>2</sub> emission factor there will be checked the composition of the used fuel. The control will be carried out by the accredited sanitary-hygienic laboratory of the “LUKOIL-Permnefteorgsintez” LLC (Accreditation Certificate N RU.0001.511707 of 20.06.05).

The monitoring of these parameters will be carried out both acc. to the project scenario and acc. to the baseline.

Schematically the monitoring is shown in Figure D.1.



Figure D.1 Points of Monitoring





**JOINT IMPLEMENTATION PROJECT DESIGN DOCUMENT FORM - Version 03**

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

<b>D.1.1.1. Data to be collected in order to monitor emissions from the project, and how these data will be archived:</b>								
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
ID 1	$FC_{liqfuel,PJ,i}$ consumption of liquid fuel by furnace i	fuel flow meters: USA Micro Motion F100S129, Yokogawa EJA 530A-EAS4N07-NE-KS2	ton/year	m	hourly	100%	electronic	The instrument effects measures on a real-time basis, data are taken by an operator-engineer
ID 2	$FC_{gasfuel,PJ,i}$ consumption of gaseous fuel by furnace i	fuel flow meters: Rosemount 3051CO3, Yokogawa DY080-EBLBA2-2-N/KS1/MV	ton/year	m	hourly	100%	electronic	The instrument effects measures on a real-time basis, data are taken by an operator-engineer
ID 3	$fv_{i,PJ}$ volume ratio of the component in gas	Analysis carried out by the sanitary-hygienic laboratory	%	m	daily	100%	paper	This value will be rated by the specialized sanitary-hygienic laboratory of the “LUKOIL-Permnefteorgsintez” LLC. Daily measurements are aggregated in a month volume ratio of every component in gas and average value is used.

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ID 4	$Q_{net,i}$ quantity of net energy for the process in furnace i	Calculation is effected by thermotechnical laboratory	TJ	c	monthly	100%	paper	Calculation is effected by thermotechnical laboratory for every furnace.
ID 5	$NCV_{liqfuel}$ net calorific value of liquid fuel	Analysis carried out by the thermotechnical laboratory	TJ/ton	m	monthly	100%	paper	This value will be rated by the thermotechnical laboratory of the "LUKOIL-Permnefteorgsintez" LLC
ID 6	$NCV_{gasfuel}$ net calorific value of gaseous fuel	Analysis carried out by the thermotechnical laboratory	TJ/ton	m	monthly	100%	paper	This value will be rated by the thermotechnical laboratory of the "LUKOIL-Permnefteorgsintez" LLC

**D.1.1.2. Description of formulae used to estimate project emissions (for each gas, source etc.; emissions in units of CO<sub>2</sub> equivalent):**

Project emissions will exist due to the fossil fuel combustion in technological tube furnaces themselves  $PE_{burn}$ . That means that the project emissions  $PE$  will be calculated in the following way:

$$(D.1.1.2.1.) PE = PE_{burn}$$

Two types of fuel are used at the company: mazut (liquid fuel) and gas of the special composition<sup>5</sup>; therefore, greenhouse gases emissions will be added out of emissions from liquid fuel combustion  $PE_{liqfuel}$  and out of emissions from gaseous fuel combustion  $PE_{gasfuel}$ :

$$(D.1.1.2.2.) PE_{burn} = PE_{liqfuel} + PE_{gasfuel}$$

<sup>5</sup> The fuel composition is controlled by the accredited sanitary-hygienic laboratory of the "LUKOIL-Permnefteorgsintez" LLC (Accreditation Certificate # RU.0001.511707 of 20.06.05)



“Tool to calculate project or leakage CO<sub>2</sub> emissions from fossil fuel combustion” (Version 02) UN FCCC <http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-03-v2.pdf>. was used to rate emissions from the fossil fuel combustion in technological tube furnaces.

According to the project within the bounds of upgrade/replacement of technological tube furnaces, the efficiency factor will increase in average from 65% up to 92% and that will lead to decrease of fuel consumption by technological tube furnaces. So, the project emissions from liquid fuel combustion  $PE_{\text{liqfuel}}$  will be calculated using the formula:

$$(D.1.1.2.3.) PE_{\text{liqfuel}} = \sum FC_{\text{liqfuel,PJ,i}} * COEF_{\text{liqfuel,PJ}}$$

Where:

$FC_{\text{liqfuel,PJ,i}}$  – consumption of liquid fuel by process (technological) furnaces <sup>6</sup>, ton/year;

$COEF_{\text{liqfuel,PJ}}$  – emission factor CO<sub>2</sub> for liquid fuel per year, ton CO<sub>2</sub>/ton of fuel;

According to the methodological guide “Tool to calculate project or leakage CO<sub>2</sub> emissions from fossil fuel combustion” (Version 02) UN FCCC <http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-03-v2.pdf>. for calculation of greenhouse gases emissions it is necessary to define the factor (ratio)  $COEF_{\text{liqfuel,PJ}}$  which can be found in the variant A using the data on the consumed fuel chemical composition, or in the variant B using the data on NCV of fuel and the emission factor CO<sub>2</sub>. With a view to the absence of data for calculation on the variant A let's use the variant B. Therefore,  $COEF_{\text{liqfuel,PJ}}$  is calculated:

$$(D.1.1.2.4.) COEF_{\text{liqfuel,PJ}} = NCV_{\text{liqfuel}} * EF_{\text{liqfuel}}$$

Where:

$COEF_{\text{liqfuel,PJ}}$  – emission factor CO<sub>2</sub> for liquid fuel per year, ton CO<sub>2</sub>/ton of fuel;

$NCV_{\text{liqfuel}}$  – average calorific net-value of 1 ton of liquid fuel, TJ/ton;

$EF_{\text{liqfuel}}$  – average emission factor CO<sub>2</sub> from liquid fuel combustion <sup>7</sup>, ton CO<sub>2</sub>/TJ

<sup>6</sup> Acc. to the data received by an operator/engineer.

<sup>7</sup> The value is accepted on the data from the document 2006 IPCC Guidelines for National Greenhouse Gas Inventories. As according to the measurements of the thremotechnical laboratory NCV of the liquid fuel is in range from 0.04147 TJ/ton to 0.04165 TJ/ton and this is the same range as in 2006 IPCC Guidelines for National Greenhouse Gas Inventories Volume 2. Energy. Table 1.2, p.1.18 for residual fuel oil. Also the description of residual fuel oil according to this document is following “these heading defines oils that make up This template shall not be altered. It shall be completed without modifying/adding headings or logo, format or font.



Project emissions from gaseous fuel combustion are calculated using the following formula <sup>8</sup>:

$$(D.1.1.2.5.) PE_{\text{gasfuel}} = \sum FC_{\text{gasfuel,PJ,i}} * COEF_{\text{gasfuel,PJ}}$$

Where:

$FC_{\text{gasfuel,PJ,i}}$  – consumption of gaseous fuel by process (technological) furnaces <sup>9</sup>, ton/year;

$COEF_{\text{gasfuel,PJ}}$  – emission factor CO<sub>2</sub> for gaseous fuel per year, ton CO<sub>2</sub>/ton of fuel;

According to the methodological guide “Tool to calculate project or leakage CO<sub>2</sub> emissions from fossil fuel combustion” (Version 02) UN FCCC <http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-03-v2.pdf>, for calculation of greenhouse gases emissions it is necessary to define the factor (ratio)  $COEF_{\text{gasfuel,PJ}}$  which can be found in the variant A using the data on the consumed fuel chemical composition, or in the variant B using the data on NCV of fuel and the emission factor CO<sub>2</sub>. Due to the fact that the composition of gaseous fuel is defined by the accredited sanitary-hygienic laboratory of the “LUKOIL-Permnefteorgsintez” LLC it is possible to define accurately the carbonic constituent in each of its components and find the total carbon content in the fuel. Then in the variant A  $COEF_{\text{gasfuel,PJ}}$  is calculated:

$$(D.1.1.2.6.) COEF_{\text{gasfuel,PJ}} = \omega_C * 44/12$$

Where:

$COEF_{\text{gasfuel,PJ}}$  – emission factor CO<sub>2</sub> for gaseous fuel per year, ton CO<sub>2</sub>/ton of fuel;

$\omega_C$  – average mass ratio of carbon in the fuel, tC/ton of fuel;

**44/12** – scaling factor from carbon to carbon dioxide;

Average mass ratio of carbon in the fuel is calculated using the formula suggested in the methodological guide “Tool to determine project emissions from flaring gases containing methane”:

$$(D.1.1.2.7.) fm_i = (\sum fv_i * AM_i * NA_i) / MM_i$$

Where:

the distillation residue. It comprises all residual fuel oils, including those obtained by blending” this statement fits the description of liquid fuel that is used in technological furnaces. Considering all above mentioned we use emission factor for residual fuel oil from this document.

<sup>8</sup> According to the methodological guide “Tool to calculate project or leakage CO<sub>2</sub> emissions from fossil fuel combustion” (Version 02) UN FCCC <http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-03-v2.pdf>.

<sup>9</sup> Acc. to the data taken by an operator-engineer.



$fm_i$  – mass ratio of the element (carbon) in the gas component;

$fv_{i,PJ}$  – volume ratio of the component in gas;

$AM_i$  – atomic mass of the element (carbon), g/mol;

$NA_i$  – number of atoms of carbon in the gas component;

$MM_i$  – molar mass of the gas component, g/mol;

In order to find the average mass ratio of carbon in the fuel it is necessary to summarize mass ratios of carbon in each component, i.e.  $\omega_C$  is defined using the formula:

$$(D.1.1.2.8.) \omega_C = \sum fm_i$$

Where:

$\omega_C$  – average mass ratio of carbon in the fuel, tC/ton of fuel;

$fm_i$  - mass ratio of the element (carbon) in the gas component;

Also it is necessary to monitor  $Q_{net,i}$  – quantity of net energy for the process in furnace i. It can be calculated by the following formulae:

$$(D.1.1.2.9) Q_{net,i} = (FC_{gasfuel,PJ,i} * NCV_{gasfuel} + FC_{liqfuel,PJ,i} * NCV_{liqfuel}) * \eta_{PJ}$$

Where:

$Q_{net,i}$  – quantity of net energy for the process in furnace i, TJ;



$FC_{\text{gasfuel,PJ,i}}$  – consumption of gaseous fuel by process (technological) furnaces <sup>10</sup>, ton/year;

$NCV_{\text{liqfuel}}$ – average calorific net-value of 1 ton of liquid fuel, TJ/ton;

$FC_{\text{liqfuel,PJ,i}}$  – consumption of liquid fuel by process (technological) furnaces <sup>11</sup>, ton/year;

$NCV_{\text{gasfuel}}$ – average calorific net-value of 1 ton of gaseous fuel, TJ/ton;

$\eta_{\text{PJ}}$  – efficiency coefficient of the furnace i according to the Project;

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<sup>10</sup> Acc. to the data taken by an operator-engineer.

<sup>11</sup> Acc. to the data recieved by an operator/engineer.





<b>D.1.1.3. Relevant data necessary for determining the <u>baseline</u> of anthropogenic emissions of greenhouse gases by sources within the project boundary, and how such data will be collected and archived:</b>								
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	Proport ion of data to be monit ored	How will the data be archived? (electronic/ paper)	Comment
ID 7	$FC_{\text{liqfuel, BL, i}}$ consumption of liquid fuel in furnace i acc. to the baseline	Calculation is effected by thermotechnical laboratory	ton/year	c	hourly	100%	electronic	Calculation is based on the quantity of energy for the process in furnace i according to baseline, proportion of liquid fuel usage in furnace i, and net calorific value of the fuel.
ID 8	$FC_{\text{gasfuel, BL, i}}$ consumption of gaseous fuel in furnace i acc. to the baseline	Calculation is effected by thermotechnical laboratory	ton/year	c	hourly	100%	electronic	Calculation is based on the quantity of energy for the process in furnace i according to baseline, proportion of liquid fuel usage in furnace i, and net calorific value of the fuel.
ID 9	$f_{V_{i, PJ}}$ volume ratio of the component in gas	Analysis carried out by the sanitary- hygiene laboratory	%	m	daily	100%	paper	This value will be rated by the specialized accredited sanitary-hygienic laboratory of the "LUKOIL-Permnefteorgsintez" LLC. Daily measurements are aggregated in a month volume ratio of every component in gas and average value is used.
ID 10	$NCV_{\text{liqfuel}}$ net calorific value of liquid fuel	Analysis carried out by the thermotechnical laboratory	TJ/ton	m	monthly	100%	paper	This value will be rated by the thermotechnical laboratory of the "LUKOIL-Permnefteorgsintez" LLC



ID 11	NCV <sub>gasfuel</sub> net calorific value of gaseous fuel	Analysis carried out by the thermotechnical laboratory	TJ/ton	m	monthly	100%	paper	This value will be rated by the thermotechnical laboratory of the “LUKOIL- Permnefteorgsintez” LLC
ID 12	Q <sub>net,i</sub> quantity of net energy for the process in furnace i	Calculation is effected by thermotechnical laboratory	TJ	c	monthly	100%	paper	Calculation is effected by thermotechnical laboratory for every furnace
ID 13	Φ <sub>liqfuel,BL,i</sub> proportion of liquid fuel contribution in furnace i energy production	Analysis carried out by the thermotechnical specialists	---	e	yearly	100%	paper	This value is estimated based on the previous reports of thermotechnical specialists
ID 14	Φ <sub>gaseous,BL,i</sub> proportion of gaseous fuel contribution in furnace i energy production	Analysis carried out by the thermotechnical specialists	---	e	yearly	100%	paper	This value is estimated based on the previous reports of thermotechnical specialists

**D.1.1.4. Description of formulae used to estimate baseline emissions (for each gas, source etc.; emissions in units of CO<sub>2</sub> equivalent):**

Baseline emissions will exist due to the fossil fuel combustion in technological tube furnaces themselves  $BE_{burn}$ . That means that the baseline emissions  $BE$  will be calculated in the following way:

$$(D.1.1.4.1.) BE = BE_{burn}$$

Two types of fuel are used at the company: mazut (liquid fuel) and gas of the special composition<sup>12</sup>; therefore, greenhouse gases emissions will be added out of emissions from liquid fuel combustion  $BE_{liqfuel}$  and out of emissions from gaseous fuel combustion  $BE_{gasfuel}$ :

$$(D.1.1.4.2.) BE_{burn} = BE_{liqfuel} + BE_{gasfuel}$$

<sup>12</sup> The fuel composition is controlled by the accredited sanitary-hygienic laboratory of “LUKOIL-Permnefteorgsintez” LLC (Accreditation Certificate # RU.0001.511707 of 20.06.05)



“Tool to calculate project or leakage CO<sub>2</sub> emissions from fossil fuel combustion” (Version 02) UN FCCC <http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-03-v2.pdf>. was used to rate emissions from the fossil fuel combustion in technological tube furnaces.

According to the project within the bounds of upgrade/replacement of technological tube furnaces the efficiency factor will be increased from 65% up to 91-92% (in average) and that will lead to decrease of fuel consumption by technological tube furnaces. So, the baseline emissions from liquid fuel combustion  $BE_{liqfuel}$  will be calculated using the formula:

$$(D.1.1.4.3.) BE_{liqfuel} = \sum FC_{liqfuel,BL,i} * COEF_{liqfuel,BL}$$

Where:

$FC_{liqfuel,BL,i}$  – consumption of liquid fuel by process (technological) furnaces, ton/year;

$COEF_{liqfuel,BL}$  – emission factor CO<sub>2</sub> for liquid fuel per year, ton CO<sub>2</sub>/ton of fuel;

According to the methodological guide “Tool to calculate project or leakage CO<sub>2</sub> emissions from fossil fuel combustion” (Version 02) UN FCCC <http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-03-v2.pdf>. for calculation of greenhouse gases emissions it is necessary to define the factor (ratio)  $COEF_{liqfuel,PJ}$  which can be found in the variant A using the data on the consumed fuel chemical composition, or in the variant B using the data on NCV of fuel and the emission factor CO<sub>2</sub>. With a view to the absence of data for calculation on the variant A let’s use the variant B. Therefore,  $COEF_{liqfuel,BL}$  is calculated:

$$(D.1.1.4.4.) COEF_{liqfuel,BL} = NCV_{liqfuel} * EF_{liqfuel}$$

Where:

$COEF_{liqfuel,BL}$  – emission factor CO<sub>2</sub> for liquid fuel per year, ton CO<sub>2</sub>/ton of fuel;

$NCV_{liqfuel}$  – average calorific net value of 1 ton of liquid fuel, TJ/ton;

$EF_{liqfuel}$  – average emission factor CO<sub>2</sub> from liquid fuel combustion<sup>13</sup>, ton CO<sub>2</sub>/TJ

Baseline emissions from gaseous fuel combustion are calculated using the following formula<sup>14</sup>:

<sup>13</sup> Used value from the 2006 IPCC Guidelines for National Greenhouse Gas Inventories. For the explanation see reference 7.

<sup>14</sup> Acc. to the methodology guide “Tool to calculate project or leakage CO<sub>2</sub> emissions from fossil fuel combustion” (Version 02) UN FCCC <http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-03-v2.pdf>.



Consumption of liquid fuel in furnace i in the baseline will be calculated by the formula:

$$(D.1.1.4.5.) FC_{\text{liqfuel,BL},i} = Q_i * \varphi_{\text{liqfuel,BL},i} / NCV_{\text{liqfuel}}$$

Where:

$FC_{\text{liqfuel,BL},i}$  – consumption of liquid fuel in furnace i in the baseline, tons/year;

$Q_i$  – quantity of energy for the process in furnace i according to baseline, TJ;

$\varphi_{\text{liqfuel,BL},i}$  – proportion of liquid fuel contribution in furnace i energy production;

$NCV_{\text{liqfuel}}$  - net calorific value of liquid fuel, TJ/ton;

Quantity of energy for the process in furnace i according to baseline will be calculated by the formula:

$$(D.1.1.4.6.) Q_i = Q_{\text{net}} / \eta_{\text{BL},i}$$

Where:

$Q_{\text{net}}$  – quantity of net energy for the process in furnace i, TJ;

$\eta_{\text{BL},i}$  – efficiency factor of the furnace i in baseline scenario;

$$(D.1.1.4.7.) BE_{\text{gasfuel}} = \sum FC_{\text{gasfuel,BL},i} * COEF_{\text{gasfuel,BL}}$$

Where:

$FC_{\text{gasfuel,BL},i}$  – consumption of gaseous fuel by process (technological) furnaces, ton/year;

$COEF_{\text{gasfuel,BL}}$  – emission factor  $CO_2$  for gaseous fuel per year, ton  $CO_2$ /ton of fuel;

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According to the methodological guide “Tool to calculate project or leakage CO<sub>2</sub> emissions from fossil fuel combustion” (Version 01) UN FCCC [http://cdm.unfccc.int/Reference/Guidclarif/EB32\\_repan09\\_Tool\\_proj\\_emiss.pdf](http://cdm.unfccc.int/Reference/Guidclarif/EB32_repan09_Tool_proj_emiss.pdf) for calculation of greenhouse gases emissions it is necessary to define the factor (ratio)  $COEF_{gasfuel,BL}$  which can be found in the variant A using the data on the consumed fuel chemical composition, or in the variant B using the data on NCV of fuel and the emission factor CO<sub>2</sub>. Due to the fact that the composition of gaseous fuel is defined by the accredited sanitary-hygienic laboratory of the “LUKOIL-Permnefteorgsintez” LLC it is possible to define accurately the carbonic constituent in each of its components and find the total carbon content in the fuel. Then in the variant A  $COEF_{gasfuel,BL}$  is calculated:

$$(D.1.1.4.8.) COEF_{gasfuel,BL} = \omega_C * 44/12$$

Where:

$COEF_{gasfuel,BL}$  – emission factor CO<sub>2</sub> for gaseous fuel per year, ton CO<sub>2</sub>/ton of fuel;

$\omega_C$  – average mass ratio of carbon in the fuel, tC/ton of fuel;

**44/12** – scaling factor from carbon to carbon dioxide;

Average mass ratio of carbon in the fuel is calculated using the formula suggested in the methodological guide “Tool to determine project emissions from flaring gases containing methane”:

$$(D.1.1.4.9.) fm_i = (\sum fv_{i,PJ} * AM_i * NA_i) / MM_i$$

Where:

$fm_i$  – mass ratio of the element (carbon) in the gas component;

$fv_{i,PJ}$  – volume ratio of the component in gas;

$AM_i$  – atomic mass of the element (carbon), g/mol;

$NA_i$  – number of atoms of carbon in the gas component;

$MM_i$  – molar mass of the gas component, g/mol;

This template shall not be altered. It shall be completed without modifying/adding headings or logo, format or font.



In order to find the average mass ratio of carbon in the fuel it is necessary to summarize mass ratios of carbon in each component, i.e.  $\omega_C$  is defined using the formula:

$$(D.1.1.4.10.) \omega_C = \sum \mathbf{f}m_i$$

Where:

$\omega_C$  – average mass ratio of carbon in the fuel, tC/ton of fuel;

$\mathbf{f}m_i$  - mass ratio of the element (carbon) in the gas component;

Consumption of gas fuel in furnace i in the baseline will be calculated by the formula:

$$(D.1.1.4.11.) \mathbf{F}C_{\text{gasfuel,BL,i}} = \mathbf{Q}_i * \phi_{\text{gasfuel,BL,i}} / \mathbf{N}C\mathbf{V}_{\text{gasfuel}}$$

Where:

$\mathbf{F}C_{\text{gasfuel,BL,i}}$  – consumption of gaseous fuel in furnace i in the baseline, tons/year;

$\mathbf{Q}_i$  – quantity of energy for the process in furnace i according to baseline, TJ;

$\phi_{\text{gasfuel,BL,i}}$  – proportion of gaseous fuel contribution in furnace i energy production;

$\mathbf{N}C\mathbf{V}_{\text{gasfuel}}$  - net calorific value of gaseous fuel, TJ/ton;

Quantity of energy for the process in furnace i according to baseline can be calculated with the following formulae:

$$(D.1.1.4.12.) \mathbf{Q}_i = \mathbf{Q}_{\text{net,i}} / \eta_{\text{BL,i}}$$

Where:

$\mathbf{Q}_{\text{net}}$  – quantity of net energy for the process in furnace i, TJ;

$\eta_{\text{BL,i}}$  – efficiency factor for the furnace i according to baseline;

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

This option is not applied because Option 1 was applied: Monitoring of emissions acc. to the project scenario and acc. to the baseline scenario.

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

**D.1.2.2. Description of formulae used to calculate emission reductions from the project (for each gas, source etc.; emissions/emission reductions in units of CO<sub>2</sub> equivalent):**

Was not applied.

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

Leakage treatment was not applied in the project<sup>15</sup>

**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)

<sup>15</sup> See explanation in section E.2. of the PDD.



**D.1.3.2. Description of formulae used to estimate leakage (for each gas, source etc.; emissions in units of CO<sub>2</sub> equivalent):**

**D.1.4. Description of formulae used to estimate emission reductions for the project (for each gas, source etc.; emissions/emission reductions in units of CO<sub>2</sub> equivalent):**

Emission reductions acc. to the Project are calculated in the following way:

$$(D.1.4.1.) \text{ER} = \text{BE} - \text{PE}$$

Where:

**ER** – Emission reductions acc. to the Project per year, ton CO<sub>2</sub>/year;

**BE** – emissions acc. to the baseline scenario per year, ton CO<sub>2</sub>/year;

**PE** – emissions acc. to the project scenario per year, ton CO<sub>2</sub>/year;

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

The basic objectives for monitoring of sources of pollutant emissions in atmosphere are:

- Evaluating of qualitative and quantitative composition of emissions directly at the source;
- Assessment of impact on atmosphere air associated directly with the source of man's impact (in measurement points at the border of sanitary protection area, in the dwelling housing system).

The following materials are available at the company for organizing of monitoring:

- Data of inventory of sources of pollutant emissions in atmosphere air carried out in 2006 and containing the table “Parameters of pollutant emissions in atmosphere” in conformity with GOST 17.2.3.02-78 “Nature conservancy. Atmosphere. Regulations for determination of allowable pollutant emissions of harmful substances by industrial enterprises”, Moscow, Publishing House for Standards, 1991.





- Cards of adjustment for pollutant emission sources. The enterprise is a subscriber for the dynamic analysis system for the atmospheric air pollution and normalizing of pollutant emissions “LADA”. Annually the “LUKOIL-Permnefteorgsintez” LLC provides information about variation of parameters of pollutant emission sources in due form of cards of adjustment. Cards of adjustment go for approval and concordance to the Center for laboratory analyses and technical measurements for Perm Krai (region). The approved card of adjustment is furnished to the system administrator for dynamic analysis of atmospheric air pollution and normalizing of pollutant emissions “LADA” for the record of changes at effecting of summary calculations for scattering and preparing of proposal for the normatives for pollutant emissions in atmosphere air for the enterprise.
- The results of measurement of parameters of gas-and-dust flows branching from stationary pollution sources: pressure (vacuum-gauge pressure), temperature of gas-and-dust flows in conformity with GOST 17.2.4.07-90 “Nature conservancy. Atmosphere. Methods for determination of pressure and temperature of gas-and-dust flows branching from stationary pollution sources”; velocity of gas-and-dust flows in conformity with GOST 17.2.4.06-90 “Nature conservancy. Atmosphere. Methods for determination of velocity and flow rate of gas-and-dust flows branching from stationary pollution sources”.
- Permission for pollutant emission in atmosphere air #1 of 01.01.2006. So far normatives for maximum permissible emissions do not currently exist as far as the permission for exceeding emissions is concerned.
- Plan of measures for the period of adverse weather conditions for the year 2006 approved by the Center of laboratory analysis and technical metrology for Perm krai (region). The company is included in the system of notification about modes of adverse weather conditions based on the agreement with the Perm Center of hydrometeorology and environmental monitoring.
- Sanitary protection area for the “LUKOIL-Permnefteorgsintez” LLC developed as a part of the general sanitary protection area of the “Osentsy” industrial hub. The project was developed by the government institution “Scientific-manufacturing center of environmental safety for the Ministry of Health of Russia”, the city of Perm.

<b>D.2. Quality control (QC) and quality assurance (QA) procedures undertaken for data monitored:</b>		
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.
ID 1, ID 2 table D.1.1.1	low <sup>16</sup>	Differential manometer calibration (3051 CD 2A, 1151 DP3, 3095 MV, CMF200S) is effected once in four years by the accredited agency.
ID 1, ID 2 table D.1.1.1	low <sup>17</sup>	Differential manometer calibration (Sapphir 22-DD-Ex, Sapphir 22 MT, Sapphir 22 M-DD) is effected once in two years by the accredited agency. Differential manometer calibration for Micro Motion and DY – once in four years.

<sup>16</sup> Basic overall error is 1.3-2%.

<sup>17</sup> Basic overall error is 1.5-2%.



ID 3 и ID 9 table D.1.1.1 and D.1.1.3	Low	Is effected by the sanitary-hygienic laboratory of the “LUKOIL-Permnefteorgsintez” LLC. This laboratory is accredited for the technical expertise in the accreditation system for analytical laboratories and is registered in the public register under number N RU.0001.511707 of 20.06.05. The validity period for the accreditation certificate is till 20.06.2010.
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**D.3. Please describe the operational and management structure that the project operator will apply in implementing the monitoring plan:**

Each furnace is equipped by sensors measuring the consumed fuel and heat.

Half-monthly an operator-engineer takes readings of instruments at each object and calculates a specific fuel rate by which the efficiency factor is defined. Frequency of taking measurements 2 times a month.

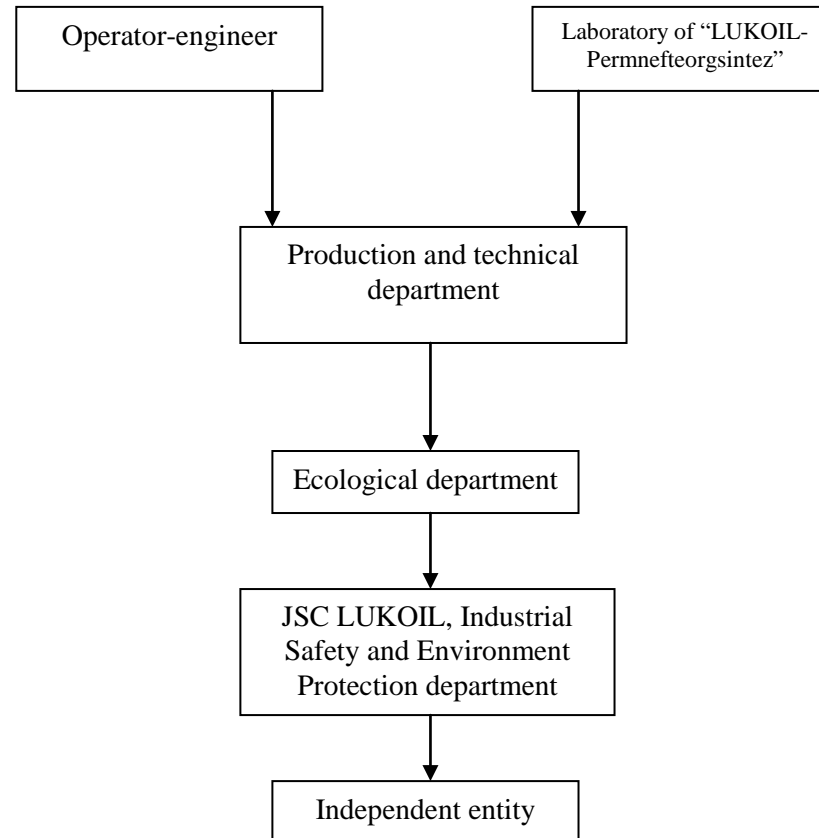
The fuel composition for technological tube furnaces is defined by the accredited sanitary-hygienic laboratory of the “LUKOIL-Permnefteorgsintez” LLC (Accreditation Certificate # RU.0001.511707 of 20.06.05). These measurements for gas are taken on a daily basis, for mazut – weekly. Also, the laboratory determines the fuel calorific value and measures its density.

Information from operator-engineer and from the laboratory is aggregated in Production and technical department (“LUKOIL-Permnefteorgsintez”). After that the information enters the Ecological department of “LUKOIL-Permnefteorgsintez”. After processing of information in Ecological department of “LUKOIL-Permnefteorgsintez” data enters the Industrial Safety and Environment Protection department of JSC LUKOIL that is to calculate the actual GHG emissions reductions in accordance with Section D formulae, and prepare annual monitoring reports. The collection, transfer and archiving of data, as well as calculation of GHG emission reductions procedures are incorporated into the existing reporting system JSC LUKOIL and its affiliate organizations.



The chart of the monitoring organization at the “LUKOIL-Permnefteorgsintez” LLC is presented on the Figure:

FigureD.3.1 The chart of the monitoring organization at the “LUKOIL-Permnefteorgsintez” LLC





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

The monitoring planner:

- “National Carbon Sequestration Foundation” – (NCSF, Moscow);
- Contact person:  
Ukhanov Daniil, senior expert of Project Development Department;  
Tel. +7 499 788 78 35 ext. 102  
Fax +7 499 788 78 35 ext. 107  
e-mail: [ukhanovDM@ncsf.ru](mailto:ukhanovDM@ncsf.ru)

NCSF is not a participant of the Project.

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

Project emissions will exist due to the fossil fuel combustion in technological tube furnaces themselves  $PE_{burn}$ . That means that the project emissions  $PE$  will be calculated in the following way:

$$(E.1.1.) PE = PE_{burn}$$

Two types of fuel are used at the company: mazut (liquid fuel) and gas of the special composition<sup>18</sup>; therefore, greenhouse gases emissions will be added out of emissions from liquid fuel combustion  $PE_{liqfuel}$  and out of emissions from gaseous fuel combustion  $PE_{gasfuel}$ :

$$(E.1.2.) PE_{burn} = PE_{liqfuel} + PE_{gasfuel}$$

“Tool to calculate project or leakage CO<sub>2</sub> emissions from fossil fuel combustion” (Version 02) UN FCCC <http://cdm.unfccc.int/methodologies/PAMethodologies/tools/am-tool-03-v2.pdf>. was used to rate emissions from the fossil fuel combustion in technological tube furnaces.

According to the project within the bounds of upgrading of technological tube furnaces the efficiency factor will be increased in average from 65% up to 91-92% and that will lead to decrease of fuel consumption by technological tube furnaces. So, the project emissions from liquid fuel combustion  $PE_{liqfuel}$  will be calculated using the formula:

$$(E.1.3.) PE_{liqfuel} = \sum FC_{liqfuel,PJ} * COEF_{liqfuel,PJ}$$

Where:

$FC_{liqfuel,PJ}$  – consumption of liquid fuel by process (technological) furnaces<sup>19</sup>, ton/year;

$COEF_{liqfuel,PJ}$  – emission factor CO<sub>2</sub> for liquid fuel per year, ton CO<sub>2</sub>/ton of fuel;

According to the methodological guide “Tool to calculate project or leakage CO<sub>2</sub> emissions from fossil fuel combustion” (Version 02) UN FCCC <http://cdm.unfccc.int/methodologies/PAMethodologies/tools/am-tool-03-v2.pdf>. for calculation of greenhouse gases emissions it is necessary to define the factor (ratio)  $COEF_{liqfuel,PJ}$  which can be found in the variant A using the data on the consumed fuel chemical composition, or in the variant B using the data on NCV of fuel and the emission factor CO<sub>2</sub>. With a view to the absence of data for calculation on the variant A let's use the variant B. Therefore,  $COEF_{liqfuel,PJ}$  is calculated:

$$(E.1.4.) COEF_{liqfuel,PJ} = NCV_{liqfuel,PJ} * EF_{liqfuel}$$

Where:

$COEF_{liqfuel,PJ}$  – emission factor CO<sub>2</sub> for liquid fuel per year, ton CO<sub>2</sub>/ton of fuel;

$NCV_{liqfuel,PJ}$  – average calorific net-value of 1 ton of fuel<sup>20</sup>, TJ;

$EF_{liqfuel}$  – average emission factor CO<sub>2</sub> from liquid fuel combustion, ton CO<sub>2</sub>/TJ

Project emissions from gaseous fuel combustion are calculated using the following formula<sup>21</sup>:

<sup>18</sup> The fuel composition is controlled by the accredited sanitary-hygienic laboratory of the “LUKOIL-Permnefteorgsintez” LLC (Accreditation Certificate # RU.0001.511707 of 20.06.05)

<sup>19</sup> Acc. to the data received by an operator/engineer.

<sup>20</sup> The data are furnished by the thermotechnical laboratory of the “LUKOIL-Permnefteorgsintez” LLC which effects daily measurements of the gaseous fuel and weekly measurements of the liquid fuel.

<sup>21</sup> According to the methodological guide “Tool to calculate project or leakage CO<sub>2</sub> emissions from fossil fuel combustion” (Version 02) UN FCCC <http://cdm.unfccc.int/methodologies/PAMethodologies/tools/am-tool-03-v2.pdf>.



$$(E.1.5.) PE_{\text{gasfuel}} = \sum FC_{\text{gasfuel,PJ}} * COEF_{\text{gasfuel,PJ}}$$

$FC_{\text{gasfuel,PJ}}$  – consumption of gaseous fuel by process (technological) furnaces<sup>22</sup>, ton/year;

$COEF_{\text{gasfuel,PJ}}$  – emission factor CO<sub>2</sub> for gaseous fuel per year, ton CO<sub>2</sub>/ton of fuel;

According to the methodological guide “Tool to calculate project or leakage CO<sub>2</sub> emissions from fossil fuel combustion” (Version 02) UN FCCC

<http://cdm.unfccc.int/methodologies/PAMethodologies/tools/am-tool-03-v2.pdf>. for calculation of greenhouse gases emissions it is necessary to define the factor (ratio)  $COEF_{\text{gasfuel,PJ}}$  which can be found in the variant A using the data on the consumed fuel chemical composition, or in the variant B using the data on NCV of fuel and the emission factor CO<sub>2</sub>. Due to the fact that the composition of gaseous fuel is defined by the accredited sanitary-hygienic laboratory of the “LUKOIL-Permnefteorgsintez” LLC it is possible to define accurately the carbonic constituent in each of its components and find the total carbon content in the fuel. Then in the variant A  $COEF_{\text{gasfuel,PJ}}$  is calculated:

$$(E.1.6.) COEF_{\text{gasfuel,PJ}} = \omega_C * 44/12$$

Where:

$COEF_{\text{gasfuel,PJ}}$  – emission factor CO<sub>2</sub> for gaseous fuel per year, ton CO<sub>2</sub>/ton of fuel;

$\omega_C$  – average mass ratio of carbon in the fuel, tC/ton of fuel;

$44/12$  – scaling factor from carbon to carbon dioxide;

Average mass ratio of carbon in the fuel is calculated using the formula suggested in the methodological guide “Tool to determine project emissions from flaring gases containing methane”:

$$(E.1.7.) fm_i = (\sum fv_i * AM_i * NA_i) / MM_i$$

Where:

$fm_i$  – mass ratio of the element (carbon) in the gas component;

$fv_{i,PJ}$  – volume ratio of the component in gas;

$AM_i$  – atomic mass of the element (carbon), g/mol;

$NA_i$  – number of atoms of carbon in the gas component;

$MM_i$  – molar mass of the gas component, g/mol;

In order to find the average mass ratio of carbon in the fuel it is necessary to summarize mass ratios of carbon in each component, i.e.  $\omega_C$  is defined using the formula:

$$(E.1.8.) \omega_C = \sum fm_i$$

Where:

$\omega_C$  – average mass ratio of carbon in the fuel, tC/ton of fuel;

$fm_i$  - mass ratio of the element (carbon) in the gas component;

Also it is necessary to calculate  $Q_{\text{net},i}$  – quantity of net energy for the process in furnace i. It can be calculated by the following formulae:

$$(E.1.9.) Q_{\text{net},i} = (FC_{\text{gasfuel,PJ},i} * NCV_{\text{gasfuel}} + FC_{\text{liqfuel,PJ},i} * NCV_{\text{liqfuel}}) * \eta_{PJ,i}$$

Where:

<sup>22</sup> Acc. to the data taken by an operator-engineer.



$Q_{net,i}$  – quantity of net energy for the process in furnace i, TJ;  
 $FC_{gasfuel,PJ,i}$  – consumption of gaseous fuel by process (technological) furnaces <sup>23</sup>, ton/year;  
 $NCV_{liqfuel}$  – average calorific net-value of 1 ton of liquid fuel, TJ/ton;  
 $FC_{liqfuel,PJ,i}$  – consumption of liquid fuel by process (technological) furnaces <sup>24</sup>, ton/year;  
 $NCV_{gasfuel}$  – average calorific net-value of 1 ton of gaseous fuel, TJ/ton;  
 $\eta_{PJ,i}$  – efficiency coefficient of the furnace i according to the Project;

Table E.1. Project Emissions.

Year	Expected greenhouse gases emissions acc. to the Project, tons CO <sub>2</sub> eq.
2008	381,878
2009	327,631
2010	321,495
2011	317,467
2012	289,351
<b>Total for 2008-2012</b>	<b>1,637,822</b>

**E.2. Estimated leakage:**

Estimated leakage was not carried out.

According to the baseline, liquid and gaseous fuel are delivered in large volumes. Therefore, the number of leakages is then greater than that of during the project activity. So, this may result in increasing of the number of reductions. Therefore, in terms of a conservative assessment, the leakage data are not taken into account.

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

Table E.3. Summarized emissions from leakages and from the Project..

Year	Expected greenhouse gases emissions acc. to the Project, tons CO <sub>2</sub> eq.	Expected "leakage" effect, tons CO <sub>2</sub> eq.	Expected greenhouse gases emissions acc. to the Project, tons CO <sub>2</sub> eq.
2008	381,878	0	381,878
2009	327,631	0	327,631
2010	321,495	0	321,495
2011	317,467	0	317,467
2012	289,351	0	289,351
<b>Total in 2008-2012</b>	<b>1,637,822</b>	<b>0</b>	<b>1,637,822</b>

**E.4. Estimated baseline emissions:**

<sup>23</sup> Acc. to the data taken by an operator-engineer.

<sup>24</sup> Acc. to the data received by an operator/engineer.



Baseline emissions will exist due to the fossil fuel combustion in technological tube furnaces themselves  $BE_{burn}$ . That means that the baseline emissions  $BE$  will be calculated in the following way:

$$(E.4.1.) BE = BE_{burn}$$

Two types of fuel are used at the company: mazut (liquid fuel) and gas of the special composition<sup>25</sup>; therefore, greenhouse gases emissions will be added out of emissions from liquid fuel combustion  $BE_{liqfuel}$  and out of emissions from gaseous fuel combustion  $BE_{gasfuel}$ :

$$(E.4.2.) BE_{burn} = BE_{liqfuel} + BE_{gasfuel}$$

“Tool to calculate project or leakage CO<sub>2</sub> emissions from fossil fuel combustion” (Version 02) UN FCCC <http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-03-v2.pdf>. was used to rate emissions from the fossil fuel combustion in technological tube furnaces.

According to the project within the bounds of upgrading of technological tube furnaces the efficiency factor will be increased in average from 65% up to 91-92% and that will lead to decrease of fuel consumption by technological tube furnaces. So, the baseline emissions from liquid fuel combustion  $BE_{liqfuel}$  will be calculated using the formula:

$$(E.4.3.) BE_{liqfuel} = \sum FC_{liqfuel,BL} * COEF_{liqfuel,BL}$$

Where:

$FC_{liqfuel,BL,i}$  – consumption of liquid fuel by process (technological) furnaces, ton/year;

$COEF_{liqfuel,BL}$  – emission factor CO<sub>2</sub> for liquid fuel per year, ton CO<sub>2</sub>/ton of fuel;

Consumption of liquid fuel in furnace i in the baseline will be calculated by the formula:

$$(E.4.4.) FC_{liqfuel,BL,i} = Q_i * \Phi_{liqfuel,BL,i} / NCV_{liqfuel}$$

Where:

$FC_{liqfuel,BL,i}$  – consumption of liquid fuel in furnace i in the baseline, tons/year;

$Q_i$  – quantity of energy for the process in furnace i according to baseline, TJ;

$\Phi_{liqfuel,BL,i}$  – proportion of liquid fuel contribution in furnace i energy production;

$NCV_{liqfuel}$  - net calorific value of liquid fuel, TJ/ton;

Quantity of energy for the process in furnace i according to baseline can be calculated with the following formulae:

$$(E.4.5.) Q_i = Q_{net,i} / \eta_{BL,i}$$

Where:

$Q_{net,i}$  – quantity of net energy for the process in furnace i, TJ;

$\eta_{BL,i}$  – efficiency factor for the furnace i according to baseline;

According to the methodological guide “Tool to calculate project or leakage CO<sub>2</sub> emissions from fossil fuel combustion” (Version 02) UN FCCC

<http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-03-v2.pdf>. for calculation of greenhouse gases emissions it is necessary to define the factor (ratio)  $COEF_{liqfuel,PJ}$  which can be found in the variant A using the data on the consumed fuel chemical composition, or in the variant B using the data on NCV of fuel and the emission factor CO<sub>2</sub>. With a view to the absence of data for calculation on the variant A let's use the variant B. Therefore,  $COEF_{liqfuel,BL}$  is calculated:

$$(E.4.6.) COEF_{liqfuel,BL} = NCV_{liqfuel,BL} * EF_{liqfuel}$$

<sup>25</sup> The fuel composition is controlled by the accredited sanitary-hygienic laboratory of the “LUKOIL-Permnefteorgsintez” LLC (Accreditation Certificate # RU.0001.511707 of 20.06.05)





Where:

$COEF_{liqfuel,BL}$  – emission factor  $CO_2$  for liquid fuel per year, ton  $CO_2$ /ton of fuel;

$NCV_{liqfuel,BL}$  – average calorific net-value of 1 ton of fuel, TJ;

$EF_{liqfuel}$  – average emission factor  $CO_2$  from liquid fuel combustion, ton  $CO_2$ /TJ

Baseline emissions from gaseous fuel combustion are calculated using the following formula<sup>26</sup>:

$$(E.4.7.) BE_{gasfuel} = \sum FC_{gasfuel,BL} * COEF_{gasfuel,BL}$$

Where:

$FC_{gasfuel,BL}$  – consumption of gaseous fuel by process (technological) furnaces, ton/year;

$COEF_{gasfuel,BL}$  – emission factor  $CO_2$  for gaseous fuel per year, ton  $CO_2$ /ton of fuel;

Consumption of gas fuel in furnace i in the baseline will be calculated by the formula:

$$(E.4.8.) FC_{gasfuel,BL,i} = Q_i * \varphi_{gasfuel,BL,i} / NCV_{gasfuel}$$

Where:

$FC_{gasfuel,BL,i}$  – consumption of gaseous fuel in furnace i in the baseline, tons/year;

$Q_i$  – quantity of energy for the process in furnace i according to baseline, TJ;

$\varphi_{gasfuel,BL,i}$  – proportion of gaseous fuel contribution in furnace i energy production;

$NCV_{gasfuel}$  - net calorific value of gaseous fuel, TJ/ton;

Quantity of energy for the process in furnace i according to baseline can be calculated with the following formulae:

$$(E.4.9.) Q_i = Q_{net,i} / \eta_{BL,i}$$

Where:

$Q_{net,i}$  – quantity of net energy for the process in furnace i, TJ;

$\eta_{BL,i}$  – efficiency factor for the furnace i according to baseline;

According to the methodological guide “Tool to calculate project or leakage  $CO_2$  emissions from fossil fuel combustion” (Version 02) UN FCCC <http://cdm.unfccc.int/methodologies/PAMethodologies/tools/am-tool-03-v2.pdf>. for calculation of greenhouse gases emissions it is necessary to define the factor (ratio)  $COEF_{gasfuel,BL}$  which can be found in the variant A using the data on the consumed fuel chemical composition, or in the variant B using the data on NCV of fuel and the emission factor  $CO_2$ . Due to the fact that the composition of gaseous fuel is defined by the accredited sanitary-hygienic laboratory of “LUKOIL-Permnefteorgsintez” it is possible to define accurately the carbonic constituent in each of its components and find the total carbon content in the fuel. Then in the variant A  $COEF_{gasfuel,BL}$  is calculated:

$$(E.4.10.) COEF_{gasfuel,BL} = \omega_C * 44/12$$

Where:

$COEF_{gasfuel,BL}$  – emission factor  $CO_2$  for gaseous fuel per year, ton  $CO_2$ /ton of fuel;

$\omega_C$  – average mass ratio of carbon in the fuel, tC/ton of fuel;

$44/12$  – scaling factor from carbon to carbon dioxide;

Average mass ratio of carbon in the fuel is calculated using the formula suggested in the methodological guide “Tool to determine project emissions from flaring gases containing methane”:

$$(E.4.11.) fm_i = (\sum fv_{i,Pj} * AM_i * NA_i) / MM_i$$

<sup>26</sup> Acc. to the methodology guide “Tool to calculate project or leakage  $CO_2$  emissions from fossil fuel combustion” (Version 02) UN FCCC <http://cdm.unfccc.int/methodologies/PAMethodologies/tools/am-tool-03-v2.pdf>



Where:

$fm_i$  – mass ratio of the element (carbon) in the gas component;

$fv_{i,PJ}$  – volume ratio of the component in gas;

$AM_i$  – atomic mass of the element (carbon), g/mol;

$NA_i$  – number of atoms of carbon in the gas component;

$MM_i$  – molar mass of the gas component, g/mol;

In order to find the average mass ratio of carbon in the fuel it is necessary to summarize mass ratios of carbon in each component, i.e.  $\omega_C$  is defined using the formula:

$$(E.4.12.) \omega_C = \sum fm_i$$

Where:

$\omega_C$  – average mass ratio of carbon in the fuel, tC/ton of fuel;

$fm_i$  - mass ratio of the element (carbon) in the gas component;

Table E.4. Baseline Emissions.

Year	Expected greenhouse gas emissions acc. to the Baseline scenario, tons CO2 eq.
2008	494,154
2009	494,154
2010	494,154
2011	494,154
2012	494,154
<b>Total in 2008-2012</b>	<b>2,470,770</b>

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

Reductions acc. to the Project are calculated in the following way:

$$(E.5.1.) ER = BE - PE$$

Where:

**ER** – emission reduction acc. to the Project per year, tons CO2/year;

**BE** – emissions acc. to the Baseline scenario per year, tons CO2/year;

**PE** – emissions acc. to the Project scenario per year, tons CO2/year;

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

The result of reduction calculation is presented in the Table E.6.

Table E.6. The result of emission reductions from the Project activity

Year	Expected greenhouse gases emissions acc. to the Project scenario (tons CO2 eq.)	Expected "leakage" effect (tons CO2 eq.)	Expected greenhouse gases emissions acc. to the Baseline scenario (tons CO2 eq.)	Expected greenhouse gases emissions volume reduction (tons CO2 eq.)



2008	381,878	0	494,154	112,276
2009	327,631	0	494,154	166,523
2010	321,495	0	494,154	172,659
2011	317,467	0	494,154	176,687
2012	289,351	0	494,154	204,803
<b>Total in 2008-2012</b>	<b>1,637,822</b>	<b>0</b>	<b>2,470,770</b>	<b>832,948</b>

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

Environment impact assessment in a form of state ecological expertise must be done for every project before the year 2007. Since the year 2007 state ecological expertise was abolished and ecological assessment has become a part of technical project documentation. But this documentation must include section of environment protection. There are conclusions of state ecological expertise for the projects started before 2007 (for instance: Conclusion of expert commission of state ecological expertise for the project “Further equipping of AVT-4 unit aiming to increase material resources for the KGPN, LUKOIL-PNOS LLC (first stage)” from 24-th January 2003). For the projects started since the year 2007 section of environmental protection is included in technical project documentation (as an example: “LUKOIL-Permnefteorgsintez” LLC machine 37-40 furnace P-3 description note 0148636-1281/2007.PZ)

**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:**

&gt;&gt;

Conclusion of expert commission of state ecological expertise for the project “Further equipping of AVT-4 unit aiming to increase material resources for the KGPN, LUKOIL-PNOS LLC (first stage)” from 24-th January 2003 doesn't have any objections and allows implementation of project activity.

Technical documentation: “LUKOIL-Permnefteorgsintez” LLC machine 37-40 furnace P-3 description note 0148636-1281/2007.PZ developed by “ALITER-AKSI” LLC was approved by chief engineer of the project as satisfying all the regulations and standards for furnace operating.

Also “LUKOIL-Permnefteorgsintez” has all necessary permissions for Air Emission approved by Rostekhnadzor:

Permission #1 for emission of pollutants in the air from 29.08.07 №52-g (for a period 29.08.2007 – 01.07.2008) signed by deputy head of Perm regional survey of ecological, technological and nuclear control;

Permission #201 for emission of pollutants in the air from 26.06.2008 №416 (for a period 01.07.2008 – 01.07.2009) signed by deputy head of Perm regional survey of ecological, technological and nuclear control.

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

Federal law "About the environment protection" #7-FZ Article 20 determines the participation of citizens and public organizations in effecting of the public environmental impact assessment.

For this Project public hearings were carried out jointly with discussing of the "Project of environmental safety program for the organizing of the "LUKOIL" group for the years 2009-2013 and forecast until 2017" which includes environmental safety measures on "LUKOIL-Permnefteorgsintez" LLC and realization of Kyoto Protocol provisions.

The program was approved by Federal Survey for Environment managing (Rosprirodnadzor) in Perm Krai<sup>27</sup>.

The program was evaluated by Mr. Viseman, PhD. Chief of Environmental protection department from Perm State Technological University<sup>28</sup>.

Also chairman of Perm Krai organization "Russian society of nature protection" visited these hearings and supported the program.

According to the activity of "LUKOIL – Permnefteorgsintez" LLC and its upgrading of the furnaces there were no objections received.

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<sup>27</sup> Letter of approval of "Environmental safety program for the organizing of the "LUKOIL" group for the years 2009-2013" dated 23.10.2008 #VP/07-2453.

<sup>28</sup> Letter of evaluation results about the "Environmental safety program for the organizing of the "LUKOIL" group for the years 2009-2013" dated 6.11.2008 #172.

Annex 1**CONTACT INFORMATION ON PROJECT PARTICIPANTS**

Organization:	JSC "LUKOIL"
Street/P.O.Box:	Sretensky bulvar,11
Building:	
City:	Moscow
State/Region:	-
Postal code:	101000
Country:	Russian Federation
Phone:	
Fax:	
E-mail:	-
URL:	<a href="http://www.lukoil.com">www.lukoil.com</a>
Represented by:	Zagvozdkin Viktor Konstantinovich
Title:	Head of Department for environment protection Department for industrial safety and ecology Main engineering office of OJSC "LUKOIL"
Salutation:	
Last name:	Zagvozdkin
Middle name:	Konstantinovich
First name:	Viktor
Department:	Department for industrial safety and ecology
Phone (direct):	+ 7 499 973 7677, + 7 495 980 3432
Fax (direct):	-
Mobile:	-
Personal e-mail:	-

NCSF is not the project participant.



Annex 2

**BASELINE INFORMATION**

Annex 3

**MONITORING PLAN**

The detailed information with regard to the plan of monitoring is presented in Section D.

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