MONITORING REPORT

JI0105 - CMM utilisation on the Joint Stock Company "Coal Company Krasnoarmeyskaya Zapadnaya № 1 Mine"

Monitoring Report
Monitoring period
01/01/2008 to 31/03/2010

Version 6
24 November 2010

CONTENTS

<u>Annexes</u>

SECTION A. General project activity information

A.1 Title of the project activity:

CMM utilisation on the Joint Stock Company “Coal Company Krasnoarmeyskaya-Zapadnaya № 1 Mine”

Party involved (*) ((host) indicates a host Party)	Legal entity project participant (as applicable)	Please indicate if the Party involved wishes to be considered as project participant (Yes/No)
Ukraine (host)	Joint Stock Company “Coal Company Krasnoarmeyskaya-Zapadnaya № 1 Mine”	no
Netherlands	Carbon-TF B.V.	no

A.2. JI registration number:

UA2000016 / JI0105
The project is approved as JI-project since 09/11/2009.
(http://ji.unfccc.int/JI_Projects/DeterAndVerif/Verification/FinDet.html)

A.3. Short description of the project activity:

In this project CMM, which has been sucked out of the active coal mine “Krasnoarmeyskaya-Zapadnaya № 1”, has been utilised in a previous coal boiler, which has been upgraded with a CMM burning system. The methane has been burned to less harmful CO_2.

In this monitoring the gained emission reductions should be monitored for the purpose of the verification as Emission Reductions Units (ERU).

The CH_4 has been utilised in a boiler for heat generation only, so that natural fluctuations from day to day and year to year due to changing ambient temperature had wide influence on the total CH_4-amount utilised. Usually there is a high utilisation amount in the winter periods and a low utilisation amount in the summer periods. In winter 2008/2009 the available utilisable CMM amount was too low for the production of the heat needed, so that a part of the heat has been produced using coal fired boilers and the CH_4-utilisation decreased. In summer 2009 there have been some periods where no utilisation took place due to too low CH_4-concentrations.

A glance into the monitored data shows a lot of non-operation periods for the boiler, especially in summer periods. This is because the boiler is working in cycling mode, stop and go, depending on heat demand. Regular maintenance and inspection took place in February 2008 and July 2010 (after the monitoring period).

Table-1 Amount of methane utilised for heat generation

period	CH_4 [m³/period]	Heat generated [MWh]
01/01/2008-31/12/2008	3,777,395	17,564
01/01/2009-31/12/2009	4,556,274	21,654
01/01/2010-31/03/2010	3,149,699	14,283
Total 2008-2010	**11,483,368**	**53,501**

A.4. Monitoring period:

Start date 01/01/2008

End date 31/03/2010

Start day and end day included.

A.5. Methodology applied to the project activity (incl. version number):

A.5.1. Baseline methodology:

The approved consolidated methodology ACM0008 / Version 03 "Consolidated baseline methodology for coal bed methane and coal mine methane capture and use for power (electrical or motive) and heat and/or destruction by flaring") has been used to identify the baseline scenario of the proposed JI project [ACM0008].

A.5.2. Monitoring methodology:

A monitoring plan provided by the "Approved consolidated baseline methodology ACM0008", Version 03, Sectoral Scope: 8 and 10, EB28 is applied to the project [ACM0008].

Applicability requirements for the monitoring plan of the ACM008 methodology are identical to respective requirements of the baseline setting.

A.6. Status of implementation including time table for major project parts:

The project has not been installed as planned in the PDD. In the monitoring period only one upgrade boiler was working. The installation of further units as stated in the PDD is delayed due to the Global Financial Crisis and should follow in 2010 and 2011. See Table-3 for details.

The coordinates given in the PDD uses the SK-42 reference system which uses a slightly different reference ellipsoid than the WGS84 system used by Google. The SK-42 system and the substantial cartography are still in use in the most CIS countries and Ukraine too.
The WKS84 coordinates are:

Cental shaft: 48°15'31'' N, 36°59'30'' E
Air Shaft: 48°15'20'' N, 37°01'57'' E

Table-2 Status of Implementation

Unit: upgraded previously coal fired steam boiler at central shaft	
Manufacturer: Biysk Boiler Plant	
Type: KE-25-14KC	
Serial Number: 6827 (not visible)	
Inventar Number: 4022 (visible)	
Capacity: 25 t/h steam (approx. 25 MW)	
Activity	**Status**
year of construction	06/05/1986
last major overhaul	22/12/2002 - Ukrteploservis
Last inspection	05/02/2008 (01/07/2010) – OOO Mitsar
Commission of upgrade	20/03/2003
Official completion of upgrade	31/03/2003
Start of initial operation, first tests	summer 2003
Start of operation	October 2003
Planned installation date [PDD]	October 2003

Ukrteploservice is a private company, which has been commissioned by the coal mine for service and maintenance of the boilers.
Derzhpromnaglyad is a state owned controlling and supervising institute.

Table-3 Installation plan [PDD] –original and updated timeline

unit	installation date (PDD)	firing capacity	planned installation new timetable
Central Shaft			
upgraded boiler	Oct 2003	25 MW	October 2003
flare No: 1	Jan 2008	5 MW	1 Flare with 25 MW in August 2010
flare No: 3	Mar 2008	5 MW	See above
cogeneration units	Jul 2008	total of 48.8 MW	January 2011
Degassing wells			
flare/pump No: 2	Jan 2008	5 MW	January 2011
flare/pump No: 7	Apr 2008	5 MW	April 2011
Air Shaft № 2			
flares No: 4-6	Apr 2008	total of 15 MW	January 2011
cogeneration units	Jun-Oct 2008	total of 67.5 MW	March 2011
cogeneration units	Jan 2009	total of 30 MW	October 2011

A.7. Intended adjustments or revisions to the registered PDD:

In the PDD the start of operation of the boiler in October 2003 is given instead of the installation date. See Table-1 in A.6 for details. The installation of numerous units is delayed as stated under A.6. Instead of two flares with a capacity of 5 MW one flare with a capacity up to 25 MW has been installed at the central shaft.

A.8. Intended adjustments or revisions to the registered monitoring plan:

The electronically measuring and data storing monitoring system has been implemented first in 2009 and started operation beginning with 12/09/2009, 8:00 AM. Before this date only handwritten data (journals) are available.

Method 1 – Handwritten data
All boiler data are recorded manually in a 15 min. cycle in a boiler operation journal. The journals are stored only for the last six months, so that the data are not available for the monitoring period. The available data have been recorded manually by the coal mine personnel in a separate CMM journal. The recording cycle is 12h (one time per shift). Since 01/09/2008 until 12/09/2009 the CMM journal data are transferred regularly to Excel-sheets by Eco Alliance OOO.
The CMM flow has been recorded at operating conditions and has not been transferred to standard state conditions. The corrections can not be applied subsequently, because the necessary data for gas temperature and pressure have not been recorded. The resulting adjustments are discussed in the <Possible sources of error> document.
The heat produced by the project has not been measured but calculated using the utilised methane amount.

Method 2 –Electronically data
The electronically measuring and data storing monitoring system has been implemented as described in the PDD, started operation at 12/09/2009, 8:00 AM.

The monitoring procedures applied during the monitoring period are described in Annex 3.

A.9. Changes since last verification:

Initial and first periodic verification took place in the context of greening AAU. Since then the installation of cogeneration units and a flare started (unfinished until the end of the monitoring period). An electronically measuring and data storing monitoring system for the boiler has been installed in September 2009 and started operation at 12/09/2009, 8:00 AM.

A.10. Person(s) responsible for the preparation and submission of the monitoring report:

Coal Company Krasnoarmeyskaya-Zapadnaya Nr.1 mine
- Anatoly Demchenko, Technical Director until January 2010
- Volodymyr Tymchenko, Technical Director since February 2010

Carbon-TF B.V
- Adam Hadulla, Consultant
- Karl Wöste, Senior Consultant

SECTION B. Key monitoring activities according to the monitoring plan for the monitoring period stated in A.4.

B.1. Monitoring equipment:

B.1.2. Table providing information on the equipment used (incl. manufacturer, type, serial number, date of installation, date of last calibration, information to specific uncertainty, need for changes and replacements):

Table-4 Monitoring equipment

ID	Data	Method	Manufacturer	Classification	Serial number	Range	Uncertainty level of data	Frequency of Measurement	Instal-lation
1	CMM amount to boiler Method 1	Orifice (diaphragm) with pressure difference meter and continuous chart recorder				n.a.	low	measurement continuous record period in journals 12 h	2003
1a		Orifice / diaphragm	Krasnoarmeysk Engineering Plant	(no documents)	none	n.a	low	measurement continuous not recorded	2003
1b		Pressure difference meter	VO "Promprylad" Ivano-Frankovsk	DM-3583M	81998	4 kPa	low	measurement continuous not recorded	2003
1c		Chart recorder		RP160-33	2034000	0-6,300 m³/h	Low	measurement continuous not recorded	2003
2a	CH_4 concentration	Infrared measurement	POLITRON - Drager	Gasanalisator	ARSK 0191	0-100 %	medium	measurement continuous record period in journals 12 h / 4/d	2002

2b	CH_4 concentration	interferometer	Azov optic-mechanics plant	SHI-12	800370	0-100%	low	control measurement	
2c	CH_4 concentration	Infrared measurement	Woelke	Annovex System		0-100%	low	for plausibility check only not recorded	
3	NMHC concentration	gas chromatography	Gazokhrom (MAKNII) Chromatograf (Respirator)	Modell 3700	75 TU25-0585.110-86	multiple ranges depending on component	low	Yearly spot measurement	-
4	CMM amount to boiler Method 2	Vortex flow meter	"Sibnefteavtoma-tika" IJSC, Tyumen, Russia	DRG.MZ-300	06136	562.5-22,500 m³/h	low	measurement continuous record period 15 min.	Sep 2009
5	CMM pressure	Ceramic pressure pick-up	Siemens	SITRANS P Serie Z	AZB/W 5132862	0-1.6 bar, abs	low	measurement continuous record period 15 min.	Sep 2009
6	CMM temperature	PT-100	JSC “Tera”, Chernigov	ТСПУ 1-3Н Pt-100 0,5% 80Ф8	09124	-50-250°C	low	measurement continuous record period 15 min.	Sep 2009
7	Steam amount to boiler Method 2	Vortex flow meter	"Sibnefteavtoma-tika" IJSC, Tyumen, Russia	DRG.MZ-200	06135	250-10,000 m³/h	low	measurement continuous record period 15 min.	Nov 2009
8	Steam pressure	Ceramic pressure pick-up	Siemens	SITRANS P Serie Z	AZB/W 4124010	0-1.6 bar, abs	low	measurement continuous record period 15 min.	Nov 2009

9	Steam Temperature	PT-100	JSC "Tera", Chernigov	ТСПУ 1-3Н Pt-100 0,5% 80Ф8	09125	-50-250°C	low	measurement continuous record period 15 min.	Nov 2009

B.1.3. Calibration procedures:

Table-5 Monitoring equipment

ID	Data	Uncertainty level of data (high/medium/ low)	Calibration procedure	Last calibration	Calibrator
1a	Orifice / diaphragm	Unknown Set to 2.5%	none	none	none
1b	Pressure difference meter	1.5 %	Calibration made using procedures of Ukrkotloservice	yearly	Ukrkotloservice Donetsk
1c	Chart recorder	0.5% of FSV*) analog input 1.5% of FSV*) analog root extraction	Calibration made using procedures of Ukrkotloservice	yearly	Ukrkotloservice Donetsk
2a	Methane concentration Draeger Politron ***)	4% absolute error in the range below 40% LEL**) 10% relative error in the range above 40% LEL**)	Calibration made using procedures of Donetskderzh-standartmetrologiya.	07/08/2008	Donetsk-derzhstandart-metrologiya
2b	Methane concentration SHI-12	2.5 %	Calibration made using procedures of Donetskderzh-standartmetrologiya	yearly	Donetsk-derzhstandart-metrologiya
3	NMHC concentration	Multiple, depending on component and concentration	The approved laboratory is responsible for regular recalibrations of the system.	2008, 2009 MAKNII Respirator unknown	Donetskderzh-standardmetro-logya, MAKNII Respirator unknown
4	CMM amount to boiler Method 2	1.5% in the range: 0.1 V_{max} to 0.9 V_{max} ****)	Calibration made using procedures of the manufacturer.	Manufac-turer	Manufacturer
5	CMM pressure	0.5%	Calibration made using procedures of the manufacturer.	Manufac-turer	Manufacturer
6	CMM temperature	0.5%	Calibration made using procedures of the manufacturer.	Manufac-turer	Manufacturer
7	Steam amount to boiler Method 2	1.5% in the range: 0.1 V_{max} to 0.9 V_{max} ****)	Calibration made using procedures of the manufacturer.	Manufac-turer	Manufacturer

8	Steam pressure	0.5%	Calibration made using procedures of the manufacturer.	Manufac-turer	Manufacturer
9	Steam Temperature	0.5%	Calibration made using procedures of the manufacturer.	Manufactu rer	Manufacturer

*) FSV – full scale value, maximum range

**) LEL - lower explosion limit; LEL is equivalent to 5% methane in air; 40% LEL is equivalent to a concentration of 2% CH_4 in air.

***) The Draeger Politron is mainly a CH_4 detection and warning system, which is normally utilised for the determination of dangerous methane concentrations up to the lower explosion limit LEL, for the avoidance of explosions. The analyser is designed and optimized for the exact determination of low methane concentrations. Despite that the range of the meter can be extended to the range of 0-100% CH_4 according to the Draeger manual.

The conversion of the errors from LEL to % CH_4 in the gas mixture gives the following values:

Range	Range	Error	Error
< 40% LEL	< 2% CH_4	4% absolute of LEL	0.2 % CH_4 absolute
> 40% LEL	> 2% CH_4	10% relative	Linear error increase starting with 0.2 % CH_4 abs at 2% CH_4 concentration Ending with 10% CH_4 abs at 100% CH_4

****) The velocities are always in the specified range. The velocities correspond to the following gas flows:

ID 4 CMM flow: Q_{min} = 562.5 m³/h, Q_{max} = 22,500 m³/h
ID 7 steam flow: Q_{min} = 250.0 m³/h, Q_{max} = 10,000 m³/h

B.1.4. Involvement of Third Parties:

- a lab analysis for the determination of the NMHC concentration has been done by MAKNII in 2008
- the calibration of the gas chromatograph has been done by Donetskderzhstandartmetrologiya
- The lab analysis for the determination of the NMHC concentration has been done by Respirator in 2008, 2009 and 2010
- The calibration of the flow meter has been done by Ukrkotloservice
- Eco-Alliance OOO supported the coal mine with the collecting of the monitoring data.
- Carbon-TF B.V. has supervised the data for plausibility and completeness.

B.2. Data collection (accumulated data for the whole monitoring period):

B.2.1. List of fixed default values:

Table-6 List of ex-ante fixed values

ID number	Data variable	Source of data	Data unit	Comment
P19 Eff_{HEAT}	Efficiency of methane destruction / oxidation in heat plant	ACM0008 / IPCC	%	set at 99.5% (IPCC)
P23, B19 CEF_{CH4}	Carbon emission factor for combusted methane	ACM0008 / IPCC	t CO_2eq/t CH_4	set at 2.75 t CO_2eq/t CH_4
P28, B18 GWP_{CH4}	Global warming potential of methane	ACM0008 / IPCC	t CO_2eq/t CH_4	set at 21
B55 $EF_{CO2,Coal}$	CO_2 emission factor of fuel used for captive power or heat	IPCC 2006 1 Introduction Table 1.2	tCO_2/MWh	set to 0.3406 tCO_2/MWh Using the value for “Other Bituminous Coal” of 94,600 kg CO_2/TJ
B57 Ef_{HEAT}	Energy efficiency of heat plant	Boiler pass	%	set to 46.9%, see Annex 3.4 for justification

B.2.2. List of variables:

Table-7 List of variables

ID number	Data variable	Source of data	Data unit	Comment
P1 PE_y	Project emissions in year y	monitored data	t CO_{2eq}	calculated using formulae from the PDD
P3 PE_{MD}	Project emissions from methane destroyed	monitored data	t CO_{2eq}	calculated using formulae from the PDD
P4 PE_{UM}	Project emissions from uncombusted methane	monitored data	t CO_{2eq}	calculated using formulae from the PDD
P17 MD_{HEAT}	Methane destroyed by heat generation	monitored data	t CH_4	calculated using formulae from the PDD
P18 MM_{HEAT}	Methane sent to boiler	flow meter	t CH_4	handwritten journals / electronically data
P24 CEF_{NMHC}	Carbon emission factor for combusted non methane hydrocarbons (various)	lab analysis	-	calculated if applicable
P25 PC_{CH4}	Concentration of methane in extracted gas	IR measurement	%	handwritten journals / electronically data
P26 PC_{NMHC}	NMHC concentration in coal mine gas	lab analysis	%	used to check if more than 1% of emissions and to calculate r
P27 r	Relative proportion of NMHC compared to methane	lab analysis	%	calculated if applicable, based on the lab analysis.

B1 BE_y	Baseline emissions in year y	monitored data	t CO_{2eq}	calculated using formulae from the PDD
B3 $BE_{MR,y}$	Baseline emissions from release of methane into the atmosphere in year y that is avoided by the project activity	monitored data	t CO_{2eq}	calculated using formulae from the PDD
B4 $BE_{Use,y}$	Baseline emissions from the production of power, heat or supply to gas grid replaced by the project activity in year y	monitored data	t CO_{2eq}	calculated using formulae from the PDD
B14 $CMM_{PJ,y}$	CMM captured and destroyed in the project activity in year y	flow meter	t CH_4	equal to P17,MD_{HEAT}
B47 $HEAT_y$	Heat generation by project	monitored data	MWh	calculated using P17 and B57 from 01/01/2008 to 13/11/2009 17:30 measured using steam flow data since 13/11/2009 17:30

B.2.3. Data concerning GHG emissions by sources of the project activity

Table-8 GHG emissions by sources of the project activity

ID number	Data variable	Source of data	Data unit	Comment
P18 MM_{HEAT}	Methane sent to boiler	flow meters	t CH_4	handwritten journals / electronically data
P25 PC_{CH4}	Concentration of methane in extracted gas	IR measurement	%	handwritten journals / electronically data

B.2.4. Data concerning GHG emissions by sources of the baseline

Table-9 GHG emissions by sources of the baseline

ID number	Data variable	Source of data	Data unit	Comment
B14 $CMM_{PJ,y}$	CMM captured and destroyed in the project activity in year y	flow meter	t CH_4	equal to P17,MD_{HEAT}
B47 $HEAT_y$	Heat generation by project	calculatio n	MWh	calculated using P17 and B57 from 01/01/2008 to 13/11/2009 17:30 measured using steam flow data since 13/11/2009 17:30

B.2.5. Data concerning leakage

Not applicable.

B.2.6. Data concerning environmental impacts

Not applicable.

B.3. Data processing and archiving (incl. software used):

Method 1
Hand written journals as data records only (method 1a). Excel sheets since 01/09/2008 (method 1b). The record intervals are one time per shift (2 shifts per day) from 01/01/2008 to 31/08/2008 (method 1a) and four values per day (4:00, 8:00, 16:00 and 20:00) from 01/09/2008 to 12/09/2009.

Method 2
The data are collected, processed and stored using a Siemens SIMATIC PLC S7 system and Siemens WINCC programming software. All data is stored in the internal memory about 2 GB. One time per hour the data are sent via GPS to an Internet-based Server data base. The server provider ensures regular back ups and archiving. Further on the data is stored and archived by Eco-Alliance OOO.
The data can be read any time from the internet data base by authorised personnel. The utilised methane amount is automatically calculated and stored in the PLC. As all input data are stored, the automatically calculation can by checked in retrospect any time.

For plausibility checks and potential data back up the data logged in the hand written journals of the suction system can be taken.

B.4. Special event log:

In summer 2009 there have been some periods where no utilisation took place due to too low CH_4-concentrations.

SECTION C. Quality assurance and quality control measures

C.1. Documented procedures and management plan:

C.1.1. Roles and responsibilities:

The general project management is implemented by the Technical Director of the Krasnoarmeyskaya-Zapadnaya Nr.1 Coal Mine through supervising and coordinating activities of his subordinates, such as the degasification engineer, heating technician, and safety engineering departments.
Daily a group of mechanics and electricians who are responsible for the measures and maintenance of all technological equipment and measuring instruments are present on-site. There are two shifts, 12 h each. For every shift there is one person on-duty responsible for the proper operation and keeping of the journals.
Overview calculations about the methane amount utilised are made on a monthly and yearly basis and notified in the journal. The general supervision of the monitoring system is executed by the administration of the coal mine under the existing control and reporting system.

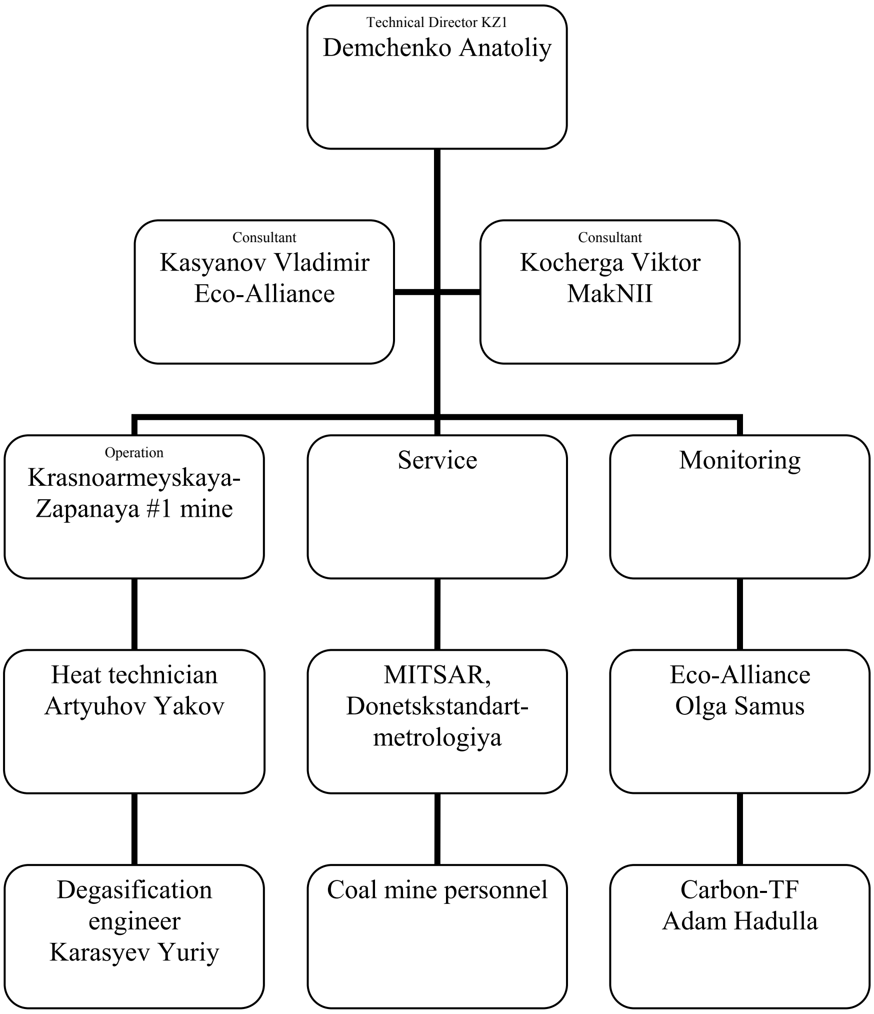

Figure 1 – Organigram

C.1.2. Trainings:

The employees responsible for the monitoring control have been trained on–the–job during the installation of the system. Eco-Alliance has provided a special course for the new monitoring system. A yearly safety training is provided by the coal mine.

C.2. Involvement of Third Parties:

- Donetskderzhstandartmetrolologiya, a is a subsidiary of the "Ukrainian Ukrainian Centre for Standardisation and Metrology", which is part of the "State Committee for Matters of Technical Regulations and Consumer Politics", which is part of the government, has been involved for the regular calibration of the on-line gas analysers.
- MakNII Institute, the "State Makeyevka Institute for Research and Education for Safe Work in the Coal Mining Industry", a subsidiary of the "Ukrainian Ministry for Fuel and Energy", has been involved for the lab analysis (NHMHC) of the CMM in 2008.
- Respirator has been involved for the lab analysis (NHMHC) of the CMM in 2008, 2009 and 2010.
- OOO Mitsar (МИЦАР) has been involved for the service of the boiler and calibration of the CMM flow meter.
- Eco-Alliance OOO provided the electronically data acquisition system and the monitoring activity together with the coal mine personnel

C.3. Internal audits and control measures:

The results of the upgraded boiler have been compared with the coal boilers. The data are plausible, no major deviations have been found. The efficiency of the upgraded boiler has been measured and has been found to be better than that for the coal boilers.
During the efficiency measurements the heat produced by the boiler has been measured and verified. The measurements confirm the plausibility of the flow and concentration measurement units and the calculation method for the produced heat amount (see Section D, Table-10, B47).

C.4. Troubleshooting procedures:

The general troubleshooting for the steam boiler hasn't changed. In case of disturbance the gas supply to the boiler is shut down by a quick acting valve and the CMM supplied by the degasification system of the coal mine is blown to the atmosphere.

SECTION D. Calculation of GHG emission reductions

D.1. Table providing the formulas used:

Table-10 Formulae used taken from the PDD, struck through symbols are not used in this monitoring report.

ID number	Data variable	Formula
P1 PE_y	Project emissions in year y	$PE_y =$ ~~PE_{ME} +~~ $PE_{MD} + PE_{UM}$
P3 PE_{MD}	Project emissions from methane destroyed	$PE_{MD}=$ ~~(MD_{FL} + MD_{ELEC} +~~ MD_{HEAT}) x (CEF_{CH4} ~~+ r x CEF_{NMHC}~~)
P4 PE_{UM}	Project emissions from uncombusted methane	$PE_{UM} = GWP_{CH4}$ x [~~(MM_{FL} x (1 - Eff_{FL}) + MM_{ELEC} x (1 - Eff_{ELEC}) +~~ MM_{HEAT} x (1 - Eff_{HEAT})]
~~P27~~ ~~r~~	~~Relative proportion of NMHC compared to methane~~	~~r = PC_{NMHC} / PC_{CH4}~~
B1 BE_y	Baseline emissions in year y	$BE_y = BE_{MR,y}$ ~~+ $BE_{Use,y}$~~
B3 $BE_{MR,y}$	Baseline emissions from release of methane into the atmosphere in year y that is avoided by the project activity	$BE_{MR,y} = CMM_{PJ,y}$ x GWP_{CH4}
B4 $BE_{Use,y}$	Baseline emissions from the production of power, heat or supply to gas grid replaced by the project activity in year y	$BE_{Use,y}$ = ~~GEN_y * EF_{ELEC} +~~ ($HEAT_y$ / $Eff_{HEAT,coal}$) * EF_{HEAT}
B14 $CMM_{PJ,y}$	CMM captured and destroyed in the project activity in year y	$CMM_{PJ,y}$= ~~(MD_{FL} + MD_{ELEC}~~ + MD_{HEAT})
ER	Emission reductions	$ER_y = BE_y - PE_y$

Table-10a – Additional formula

B47 $HEAT_y$	Heat generation by project from 01/01/2008 to 13/11/2009 17:30	$HEAT_y = (MD_{HEAT}$ x $Ef_{HEAT})$ x HV_{CH4}

The formula for calculation of HEAT until 13/11/2009 is not included in the original PDD.

D.2. Description and consideration of measurement uncertainties and error propagation:

In addition to the uncertainty of the measuring meters, the hand reading of the meters causes additional uncertainties, see <Possible sources of error> for detailed information.
Obvious errors in the journals have been corrected by Carbon-TF B.V. during the supervision of the documents. Corrected data are marked red.

The resulting uncertainty has been determined and subtracted from the results.

Table-11 Resulting uncertainties during the monitoring period

Monitoring Method	Monitoring period	Uncertainty
Method 1a	01/01/2008 to 31/08/2008	16.76%
Method 1b	01/09/2008 to 12/09/2009 8:00	13.47%
Method 2	12/09/2009 8:00 to 31/03/2010	10.35%

D.3. GHG emission reductions (referring to B.2. of this document):

D.3.1. Project emissions:

period	project emissions [t CO_{2eq}]
01/01/2008-31/12/2008	7,695
01/01/2009-31/12/2009	9,282
01/01/2010-31/03/2010	6,417
Total 2008-2010	**23,394**

D.3.2. Baseline emissions:

period	baseline emissions [t CO_{2eq}]
01/01/2008-31/12/2008	69,633
01/01/2009-31/12/2009	84,331
01/01/2010-31/03/2010	57,800
Total 2008-2010	**211,764**

D.3.3. Leakage:

Not applicable.

D.3.4. Summary of the emissions reductions during the monitoring period:

period	Emission reductions [t CO_{2eq}]
01/01/2008-31/12/2008	61,938
01/01/2009-31/12/2009	75,049
01/01/2010-31/03/2010	51,383
Total 2008-2010	**188,370**

The values have lowered since the first version of the MR, because of the recalculation of the uncertainties and lower boiler efficiency.

The total GHG emission reduction for the monitoring period 01/01/2008 - 31/03/2010 is 188,370 t CO_{2eq}.

This monitoring report has been prepared by Carbon-TF B.V.
Responsible person: Adam Hadulla

Venlo, 24/11/2010

Annex 1

REFERENCES

- Project Design Document; Version 04, dated 2008-10-22
- Final Determination Report for the project: JI0105 “CMM utilisation on the Joint Stock Company “Coal Company Krasnoarmeyskaya Zapadnaya № 1 Mine””; Report No: 2008-1279 Rev 01, by DNV Det Norske Veritas, dated 2008-08-30
- Letter of Approval, Nr. M000013, issued on 2008-02-22 by the Ukraine (host party)
- Letter of Approval, Nr. 2008JI02, issued on 2008-04-22 by the Kingdom of the Netherlands (investor party)
- supporting evidence documents provided by the coal mine

Annex 2

Technical drawing

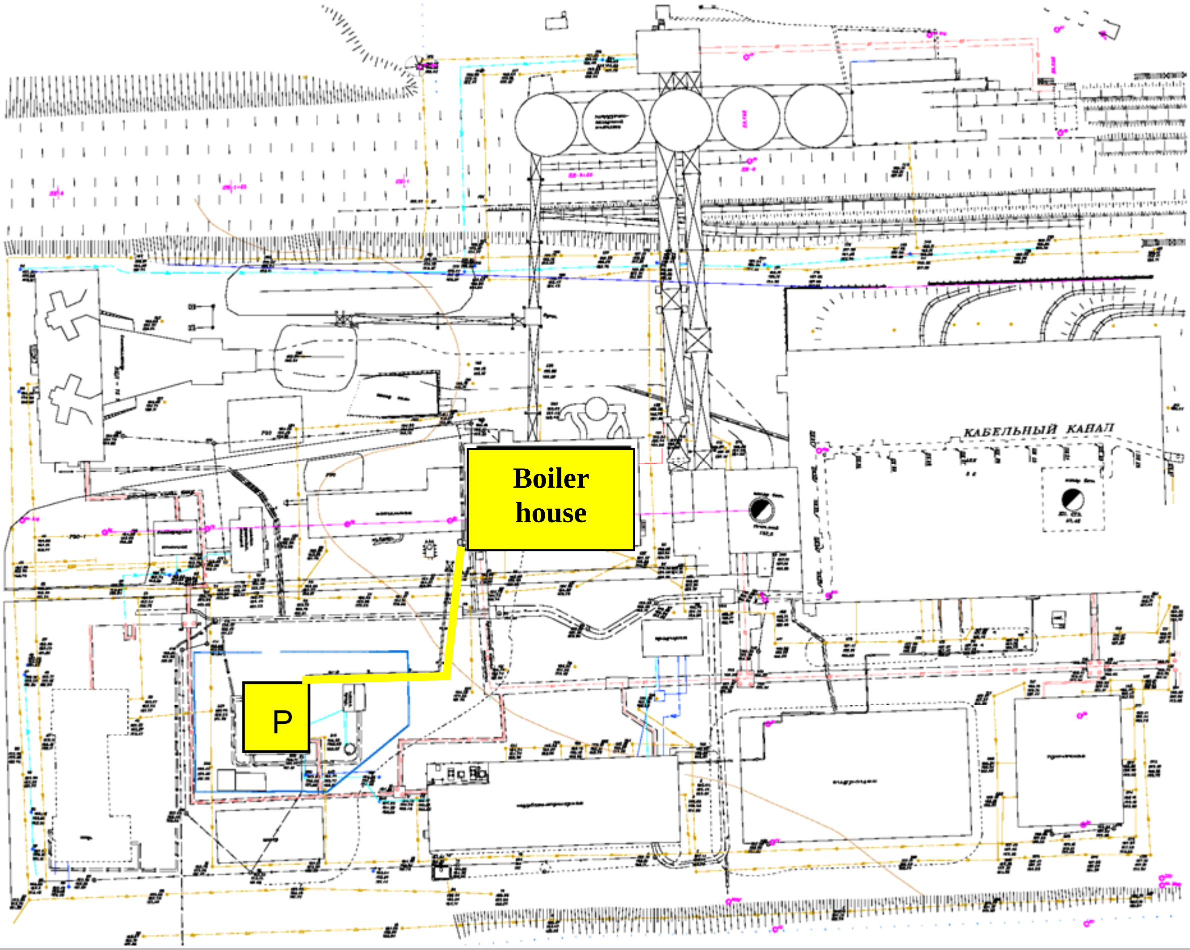

Figure-2 Location Plan – Coal Mine Krasnoarmeyskaya-Zapadnaya Nr.1, Central Shaft
P – degasification house with gas pumps and Woelke CH_4 measurement units
Piping

Annex 3

Energy and material flowchart including metering positions

A3.1 Monitoring plan applied

The monitoring plan applied during the monitoring period provides mainly handwritten data. Although the electronic equipment is installed since the beginning of the project, no electronic storage of the data took place in the beginning of the project. The data have been manually read from the electronic devices and hand written in journals. This method is the most common practice in Ukraine.
The electronically data storage system has been put in operation in September 2009.
So there are two monitoring procedures:

1) manual record of the monitored data from 01/01/2008
2) electronically record of the monitored data from 12/09/2009

Method 1 is still used by the coal mine and can be taken for backup.
Method 1 implies three deviations from the monitoring plan as stated in the PDD, see Table-12.
The impact of these deviations is discussed below and in the<Possible source of error document>

Table-12 List of deviations from the monitoring plan variables

ID number	Data variable	Deviations
P18 MM_{HEAT}	Methane sent to boiler	1) The data have not been recorded electronically but in handwritten journals only until 12/09/2009 2) The flow data have not been pressure and temperature corrected until 12/09/2009
P25 PC_{CH4}	Concentration of methane in extracted gas	1) The data have not been recorded electronically but in handwritten journals only until 12/09/2009
B47 $HEAT_y$	Heat generation by project	3) The heat data have not been measured but calculated until 13/11/2009

A3.2 Monitoring procedure 1:

The first procedure concerns the monitoring of the boiler operation data and is relevant for safety and proper operation of the boiler. The boiler data (temperatures, pressures etc.) are recorded manually in a 15 min. cycle in a boiler operation journal. These journals are stored only for the last six month, so that the data are not available for the monitoring period.
All data concerning the CMM, which is fed into the boiler, are stored in a separate hand written journal. The recording cycle is 12h (one time per shift). This data have been used for the monitoring period from 01/01/2008 to 31/08/2008 and are called method 1a. From 01/09/2008 to 12/09/2009 a slightly different, improved monitoring method 1b has been used, see below.

The data in the CMM journal are prepared using the recorded data of the boiler journal. The journals consist of six columns. The data in columns 2, 4 and 5 are average values, the data in column 3 – the total CMM amount per shift - are cumulated values.
As stated above the recording period in the boiler journal is 15 min., so that 48 values from the boiler journal are condensed into one value of the CMM journal.
The data from column 2 and 3 are not matching at first glance. The CMM flow from column 2 in [m³/h] multiplied with 12 hours does not obviously give the value recorded for the total CMM amount in [m³ per shift] from column 3. This is because the boiler is producing heat on demand. The heat production of the

boiler can be lowered down to 30%. During periods with lower heat demand the boiler is periodically switched on and off. In the example above the boiler was 6 hours in operation during the first shift and 5.33 hours during the second shift. The value in column 2 is not the average value for 12 hours but an average value for those time periods in whose gas has been supplied to the boiler. If the boiler was only 6 or 5.33 hours in operation, like in the example above, only this 6 or 5.33 hours are taken for the calculation of the average value.

The sum value of CMM utilised during the shift (column 3) is calculated by the coal mine personnel using the actual CMM flow and the actual operating hours from the boiler journal. The operating hours are recorded in the boiler journal only and not available in the CMM journal.

From 01/09/2008 to 12/09/2009 a slightly different, improved monitoring method has been used. Four values per day are recorded (4:00, 8:00, 16:00 and 20:00); the operation time of the boiler is recorded in column (9). The total amount auf CMM and methane utilised is calculated one time per day, using average CMM / methane flow m³/h and the number of operation hours. This is more transparent than method 1a.
The monitoring equipment not been changed.

A3.3 Measurement unit installation, method 1

The gas installation scheme is shown in Figure-3.

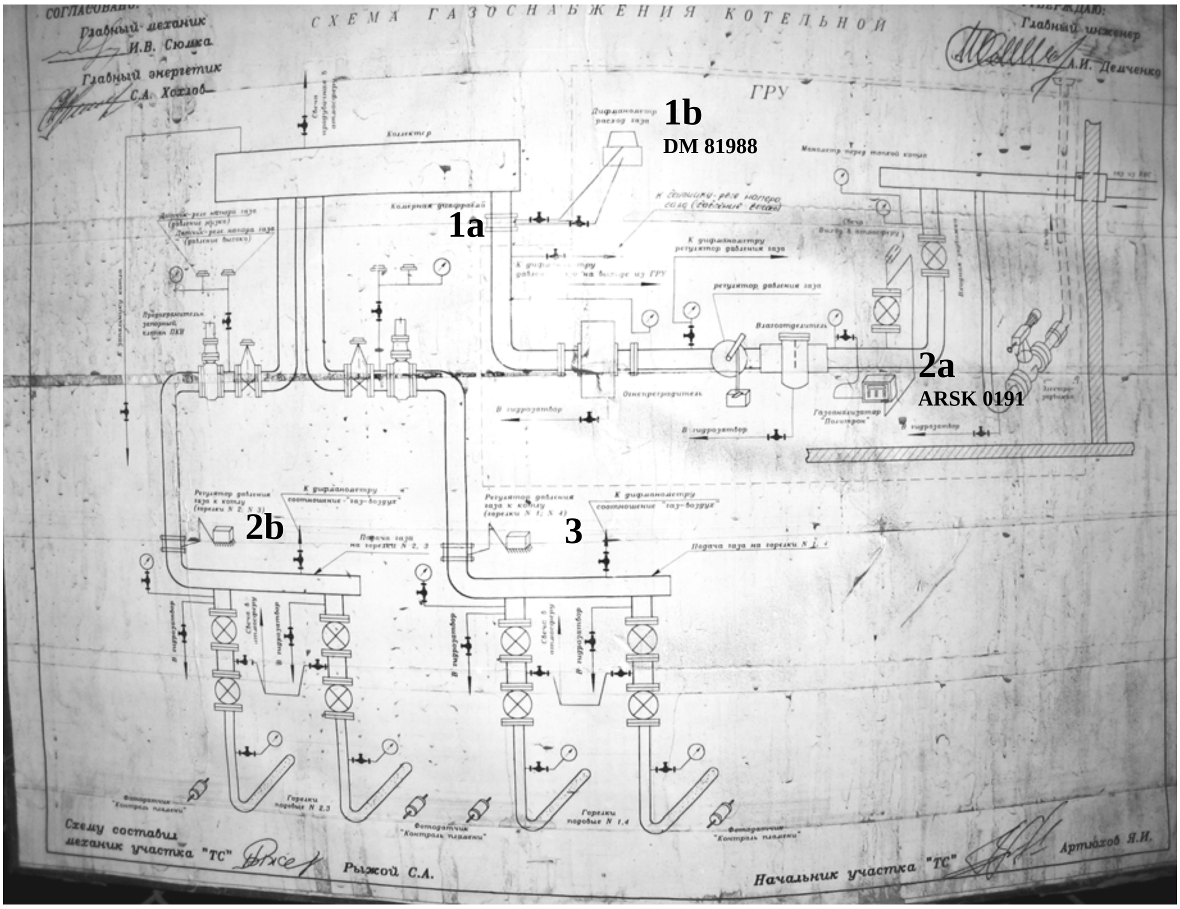

Figure-3 Gas installation scheme, method 1 (a+b)
2a) concentration measurement – Draeger Politron
1a) orifice / diaphragm

1b) pressure difference meter
2b) nozzle for SHI-12 CH_4 hand measurement
3) nozzle for NMHC samples

A3.4 Measurement units

The measurements relevant for the monitoring of emissions reduction units are the concentration measurements (2a) and (2b) and the flow measurement (1a, 1b and 1c). The indication unit (1c) is not shown in Figure 4, it's built in in a control cabinet.

Concentration measurement

The CH_4 concentration is measured by a Draeger Politron meter which is fixed installed in the gas inlet pipe and a SHI-12 hand meter, which is manually connected to the system using one of the small nozzles in the gas inlet pipes to the boiler short before the burners. Further on a third measurement unit by "Woelke" is installed in the central suction system outside the boiler house.

The Draeger Politron is mainly a CH_4 detection and warning system, which is normally utilised for the determination of dangerous methane concentrations up to the lower explosion limit LEL, for the avoidance of explosions. The analyser is designed and optimized for the exact determination of low methane concentrations. Despite that the range of the meter can be extended to the range of 0-100% CH_4 according to the Draeger manual.
The SHI-12 meters are mainly used as a personal safety unit; the units are handed over to the personnel at the beginning of the shift and taken back at the end of the shift, so that usually different units are used. The coal mine posses more than 3,000 of these units. Starting with summer 2008 one of these units has been designated to be used for the control measurement only.

According to the manufacturer data, which are confirmed by the calibration protocols by Donetskstandart-metrologiya, the Draeger unit has a relative error of 10%, corresponding to an absolute error of 2.5% at 25% CH_4 and 5% at 50% CH_4; the SHI-12 unit has an absolute error of 2.5%. So the SHI-12 units are more accurate in the relevant CH_4 concentration range.
In the CMM journal it is not stated which of the two concentration meters is taken, so the higher error of the Draeger Politron has been taken into account.

The general plausibility of the concentration measurement is verified from time to time using the CH_4 measurement of the central suction system (Woelke-measurement unit). The plausibility measurement is not recorded in the journals.

Flow measurement

The CMM flow is measured using an orifice; the pressure difference at the orifice is transferred to a 4-20 mA signal using a pressure difference transmitter and visualised on a chart recorder. The momentary flow is read every 15 min from the personnel and recorded manually in the boiler journal.

The calculation of the shift/day sum values in the CMM journal has been described above.

Heat generation

In the period from 01/01/2008 to 13/11/2009 17:30 the heat amount has not been measured but calculated using the utilised CH_4 amount, the boiler efficiency and the heating value of methane:

$$HEAT = (MD_{HEAT} \times Ef_{HEAT}) \times HV_{CH4}$$

with
HEAT heat generated by the project [MWh]

MD_{HEAT}	methane amount destroyed by boiler [t CH_4]
Ef_{HEAT}	efficiency of heat production by boiler, set to 46.9%*)
HV_{CH4}	heating value of methane [9.965 kWh/m³ DIN ISO 6976]; m³ at standard state conditions, equal to [13.899 kWh/kg]

*) The efficiency of the boiler has been re-calculated using the electronically recorded data from Method 2 (period from 13/11/2009 17:30 to 31/03/2010 24:00). In the PDD a value of 73.5 % for the old coal boiler and 86 % for the upgraded boiler is given. The re-calculation is using the total cumulated amount of CH_4 utilised and total cumulated HEAT amount produced within that period. The resulting efficiency is 46.9 % and has been put into account for the calculation of the heat amount in Method 1. This is conservative as the value is lower than the values given in the PDD.

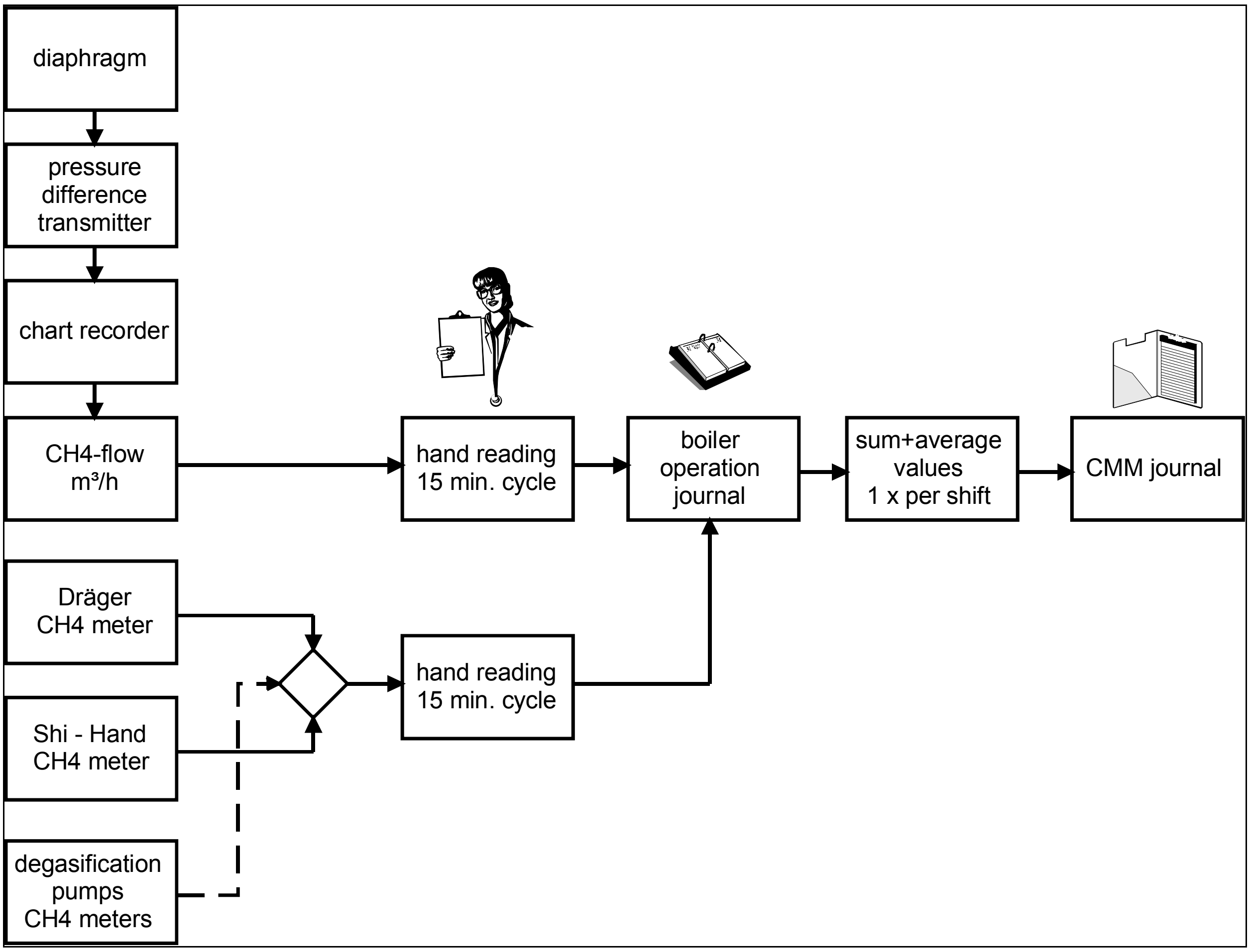

Figure-4 – Data flow sheet for method 1a, all data acquisition units are located in the boiler house with the exception of the CH_4 meters from the degasification pumps, which are located in the degasification house

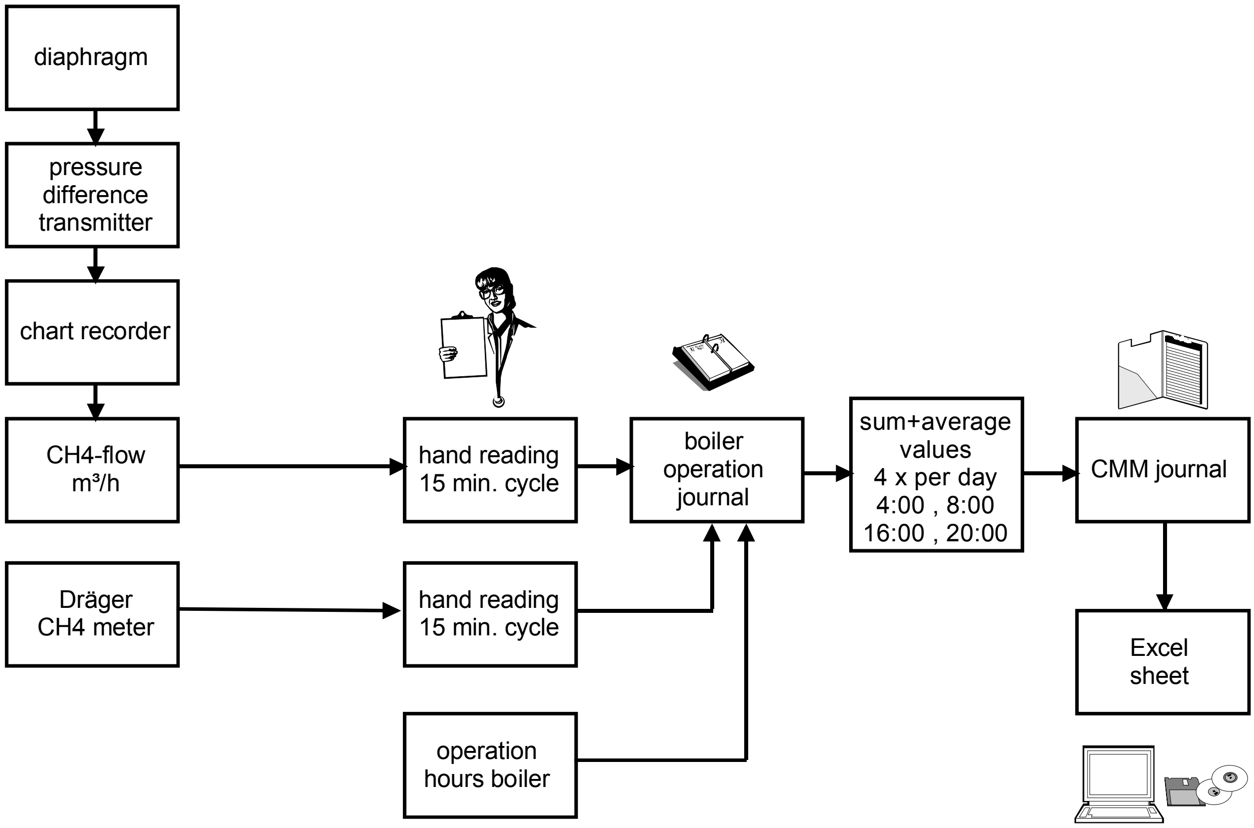

Figure-5 – Data flow sheet for method 1b, all data acquisition units are located in the boiler house, which

A3.5 Monitoring procedure 2:

The measurement procedure 2, applied since 12/09/2009, is according to the monitoring plan as described in the PDD. A Vortex flow meter instead of a standard orifice has been used for the measurement of the CMM amount; the flow meters are on par.
The CH_4 concentration is further on measured by the same Draeger Politron meter used for method 1. The NMHC measurement remains unchanged.

A3.6 Measurement unit installation, method 2

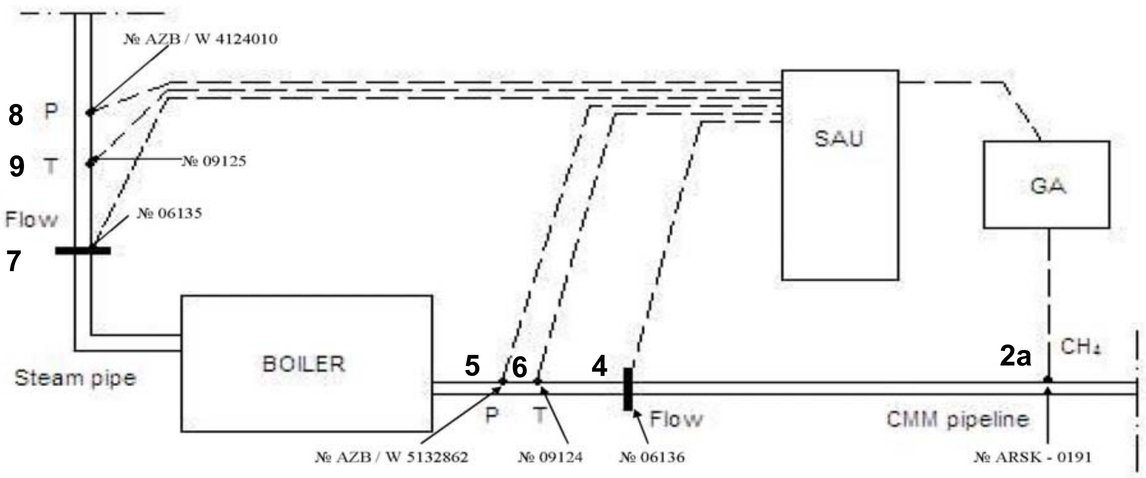

Figure-6 – Installation scheme for method 2

2a) concentration measurement – Draeger Politron
4) CMM flow meter - Vortex
5) CMM pressure
6) CMM temperature
7) steam flow meter - Vortex
9) steam pressure
9) steam temperature

A3.7 Uncertainties during the monitoring period

Starting with Method 1a with the highest uncertainty, the uncertainty has been lowered implementing Method 1b and later Method 2. The uncertainty of Method 2 is still too high due to the high uncertainty of the used CH_4-meter.

Manually recorded data are the most common method in Ukraine as well as in the other CIS-Countries. The main idea is that every recorded value is checked by the personnel for plausibility and the records have a higher quality than electronic records. In general this method provides more consistent data than electronic records. As shown in the <Possible source of error> document the electronically recorded data have been compared with the handwritten journals.
The electronically recorded data have a wider fluctuation range and obvious malfunctions are not corrected, while the average values are in the same range as the manually recorded values.

Both methods give similar results and are comparable.

Table-13 Resulting uncertainties

monitoring method	uncertainty
Method 1a	16.76%
Method 1b	13.47%
Method 2	10.35%

See <Possible source of error> document and the <Propagation of uncertainty>Excel table for the detailed calculation of the uncertainties.

Annex 4

History of the Document

Version	Date	Nature of Revision
1	7 April 2010	Initial adoption. Published at the JISC website
2	27 May 2010	Revised version, after verification
3b	05 Oct 2010	Finalised version, revised values for GHG emission reductions including the impact of the error analysis
4	02 Nov 2010	Revised version after 1st TÜV Süd CB review
5	10 Nov 2010	Revised version after 2nd TÜV Süd CB review
6	24 Nov 2010	Revised version after 3rd TÜV Süd CB review