MONITORING REPORT FORM (F-CDM-MR)
Version 02.0

MONITORING REPORT

Title of the project activity	Duerping Coal Mine Methane Utilization Project
Reference number of the project activity	1900
Version number of the monitoring report	01
Completion date of the monitoring report	07/09/2012
Registration date of the project activity	06/03/2009
Monitoring period number and duration of this monitoring period	07 19/10/2011 – 31/08/2012
Project participant(s)	Shanxi Coking Coal Group Company Ltd Sindicatum Carbon Capital Ltd
Host Party(ies)	P. R. China
Sectoral scope(s) and applied methodology(ies)	8, 10 ACM0008: Consolidated methodology for coal bed methane and coal mine methane capture and use for power (electrical or motive) and heat and/or destruction by flaring--- version 3.0
Estimated amount of GHG emission reductions or net anthropogenic GHG removals by sinks for this monitoring period in the registered PDD	329,978 tCO_2e
Actual GHG emission reductions or net anthropogenic GHG removals by sinks achieved in this monitoring period	279,794 tCO_2e

SECTION A. Description of project activity

A.1. Purpose and general description of project activity

The purpose of the project activity is the utilization and abatement of coal mine methane (CMM) captured in underground coal mine workings to allow safe coal extraction at Duerping coal mine.

The project activity has installed the necessary power generation and abatement equipment; control, monitoring and safety systems; pipe-work and power connections to ensure that a high proportion of the coal mine methane that would normally be released to atmosphere is combusted.

Investment in generation plant was phased. Three 1.7 MW gensets (combined capacity of 5.1 MW) were delivered to the site in November 2007 for installation and they started operation in May 2008. Another four 1.7MW gensets (combined capacity of 6.8 MW) were delivered to the site in October 2009 for installation and started operation in November 2010. The total combined capacity of the plant is 11.9 MW (5.1 MW Phase 1 plus 6.8 MW Phase 2). This matches the final capacity of nearly 12.0 MW stated within the registered PDD. There will be no development of further phases.

Waste heat from the exhaust of the generators will be used to provide heat to warm the intake of the mine during the winter months/heating season. The heating season started on the 23rd October 2011 to 20th April 2012. Therefore within the monitoring period covered in current verification ER generated from heat displacement were calculated from 23rd October 2011 to 20th April 2012.

The total emission reductions achieved in this monitoring period are 279,794 tCO_2e.

A.2. Location of project activity

The coal mine is located 20 km west of Taiyuan, the capital of Shanxi Province of the People's Republic of China.

The project site lies 8 km south west of the mine. The coal mine reserves are located within the area: Latitude: North 112° 14' 27" Longitude: East 37° 46' 52"

Figure A.3-1 Location of the project activity

A.3. Parties and project participant(s)

Party involved ((host) indicates a host Party)	Private and/or public entity(ies) project participants (as applicable)	Indicate if the Party involved wishes to be considered as project participant (Yes/No)
Party A (host) : People's Republic of China (host)	Public entity A: Shanxi Coking Coal Group Company Ltd	No
Party B: United Kingdom of Great Britain and Northern Ireland	Private entity B: Sindicatum Carbon Capital Ltd	No

A.4. Reference of applied methodology

- ACM0008: Consolidated methodology for coal bed methane and coal mine methane capture and use for power (electrical or motive) and heat and/or destruction by flaring--- version 3.0;
- ACM0002 Version 06 "Consolidated baseline methodology for grid-connected electricity generation from renewable sources"
- "Tool for the demonstration and assessment of additionality" Version 4
- "Tool to determine project emissions from flaring gases containing methane"

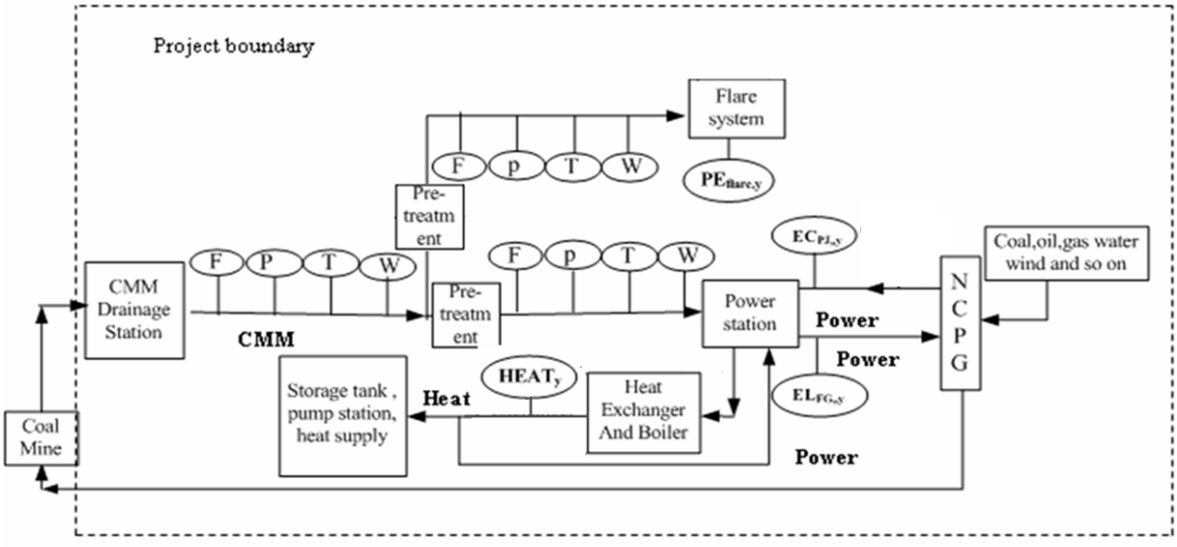
A.5. Crediting period of project activity

The fixed 10 years crediting period is chosen for the project activity. The starting date of the crediting period is 06/03/2009 which is the date of registration.

SECTION B. Implementation of project activity

B.1. Description of implemented registered project activity

This project involves container-type methane pre-treatment equipment, generator sets, power distribution system, an enclosed flare as well as relevant monitoring meters. Detailed information is as the follows:



P = Gas pressure
T = Gas temperature
W = Methane concentration
$EL_{FG,y}$ = Electricity generated
$PE_{flare,\ y}$ = Project emissions flare
NCPG = North China power grid

Figure B.1-1 Flow diagram and project boundary

1. Generator sets

Generator sets adopted by the project activity are manufactured by Deutz from Germany. Technical specifications of the generator sets are shown in Table B.1-1.

Table B.1-1 Technology specifications generator sets

Items	Parameter
A. Gas engine	
Sets	7
Model	TCG 2020V20
Cylinder numbers	20
Exhaust temperature	442°C
Rated rotational speed	1,500rpm
Manufacturer	Deutz
B. Generator	
Sets	7
Model	DIG 130k/4
Rated capacity	1,750kW
Output voltage	6.3kV
Rated frequency	50Hz
Rated rotational speed	1,500rpm
Power generating efficiency	41.6%
Total efficiency	84.5%
Life time of the gensets	>30 years

2. Heat recovery system

The heat will be recovered from two sections of the project activity, one is the engine water cooling system (no monitoring process associated with this heat displacement) and another is the flue gas (ER calculated from continuous monitoring of hot oil circuit during winter/heating season.

The excess heat from the cylinder cooling system will be recovered by the engine heat exchangers and provide hot water to the nearby drainage station heating system during winter months. This heat supply is not monitored and therefore no ER calculated as a consequence of the heat displacement.

Table B.1-2 Technical specifications for engine heat exchanger

Manufacturer	Incorporated in Deutz engines
Model	XG-40
Sets	7
Water flow rate	85t/h
Temperature of inlet water	70°C
Temperature of outlet water	78.5°C
Heat recovery capacity	850kW

The heat from the engine flue gas will be recovered by the flue gas/oil heat exchanger and then the heated oil will be transferred (in a closed circuit) to the coal mine shaft air intake during winter months by means of an oil/air heat exchanger.

Table B.1-3 Technical specifications for flue gas/oil heat exchanger

Manufacturer	Shanghai Eagle New Technology Engineering Co., Ltd
Sets	7
Model	EGS0.7-1.0/160/200-FF
Temperature of inlet gas	442°C
Temperature of outlet gas	≤180°C
Temperature of inlet oil	160°C
Temperature of outlet oil	200°C
Flow rate of inlet flue gas	9,480kg/h
Rated heat supply capacity	742kW

Table B.1-4 Technical specifications for oil/air heat exchanger

Manufacturer	Shanghai Eagle New Technology Engineering Co., Ltd
Sets	3
Model	EGS2-1.0/200/160-FF
Temperature of inlet air	-25°C
Temperature of outlet air	120°C
Temperature of inlet oil	200°C
Temperature of outlet oil	160°C
Flow rate of air	38,000Nm^3/h
Rated heat supply capacity	2,060kW

3. Flaring system

The surplus CMM that can't be utilized by gensets and CMM with CH_4 concentrations in the range of 25-30% will be destroyed by the enclosed flare. The combination of power generation and flaring will optimize the utilization of CMM.
The temperature of the flue gas of the enclosed flare will be continuously monitored in accordance with "Tool to determine project emissions from flaring gases containing methane" in order to ensure that the flare is in normal operation. Detailed information on the specifications of the enclosed flare is described below:

Table B.1-5 Technical specifications for the enclosed flare

Manufacturer	Nanjing Shunfeng-pioneer Air & Gas Purification Co. Ltd
Sets	1
Capacity	300-5,000 Nm3/h
Methane concentration in CMM	>25%
Flare temperature	500-1,350 °C
Methane combustion efficiency (%)	>90%

4. Monitoring system

A complete monitoring system is included in the project activity. The monitoring instruments installed include flow meters, methane meters, thermocouples, pressure and temperature gauges as well as electricity meters. All the monitoring instruments meet the relevant accuracy requirements and are regularly calibrated in accordance with the national standards or the manufacturers' specification.

5. Implementation project activity

The implementation of the project activity has been divided into two phases. The first phase (with three 1.7 MW gensets) started operation in May 2008. The second phase (with four additional 1.7MW gensets and a gas pre-treatment unit) started gas load commissioning in November 2010 of engines no.4, no.6 and no.7 and have been operational since December 2010. Engine no.5 started commissioning on 23th

of May 2011 and achieved continuous operation by 13th of June 2011. The total combined capacity of the plant is 11.9 MW. The waste heat from the installed generators will be recovered for heating the shaft air intake at the coal mine during the winter/heating season. During this monitoring period, no material changes occurred on Phases 1 and 2 of the project.

6. Technical events and maintenance requirements

Within this monitoring period, scheduled maintenance E30 and E40 following gensets maintenance manual recommendation was completed in different stages within current monitoring period according to dates in table below.

Table B.1-6 Scheduled maintenance E30 and E40

Item	Start	Stop	Description
Genset no. 5	7-Mar-2012	7-Mar-2012	E30 maintenance
Genset no. 1	10-Mar-2012	10-Mar-2012	E30 maintenance
Genset no. 7	23-Mar-2012	23-Mar-2012	E30 maintenance
Genset no. 4	25-Mar-2012	25-Mar-2012	E30 maintenance
Genset no. 6	18-Apr-2012	18-Apr-2012	E30 maintenance
Genset no. 6	21-Jun-2012	21-Jun-2012	E30 maintenance
Genset no. 2	8-May-2012	8-May-2012	E40 maintenance
Genset no. 3	17-May-2012	17-May-2012	E40 maintenance
Genset no. 5	8-Jun-2012	8-Jun-2012	E40 maintenance
Genset no. 1	15-Jun-2012	15-Jun-2012	E40 maintenance
Genset no. 7	24-Jun-2012	24-Jun-2012	E40 maintenance
Genset no. 4	26-Jun-2012	26-Jun-2012	E40 maintenance
Genset no. 6	21-Jul-2012	21-Jul-2012	E40 maintenance
Genset no. 3	25-Aug-2012	25-Aug-2012	E40 maintenance

E30 Maintenance is recommended by manufacturer to be performed every 2,000 operating hours and includes the following items:

- Visual check
- Check and regulate clearance of cylinder valves
- Check valve subsidence quantity
- Check the connecting rod of speed regulator
- Check the storage battery

E40 Maintenance is recommended by manufacturer to be performed every 4,000 operating hours and in addition to the items described in E30 it further includes the following:

- In addition to items covered by E30:
- Check or replace oil filters
- Check combustion chamber by endoscope
- Replace spark plug
- Check the ignition timing
- Maintenance ventilation system of crankcase
- Check ventilation system of crankcase (for UPF type)

- Replace outside primary filter every 4000 operating hours
- Replace inside secondary filter every 8000 operating hours

- Test auxiliary equipment by using TEM system

Further ad hoc repairs were performed within the current monitoring period:

Table B.1-7 Ad-hoc maintenance within MR7

Item	Start	Stop	Description
Genset no. 1	29-Nov-2011	12-Dec-2011	Starting motor fault
Gensets no. 1 and no.2	14-Dec-2011	31-Aug-2012	Cylinders knocking and load surging. Gensets no1 and no2 running reduced load.
Genset no. 4	29-Jan-2012	7-Feb-2012	A3 cylinder bore scuffing
Genset no. 3	31-Jan-2012	22-Jun-2012	Piston rings of A1 cylinder leakage which lead to high cylinder temperature. Operator control high temperatures by reducing load to 70% load running
Gensets no4, no5, no6 and no7	10-May-2012	10-Jun-2012	Improvements Phase 2 cooling system which led to gensets 4-5-6-7 being able to achieve 100% power load performance
Genset no. 3	22-Jun-2012	31-Aug-2012	High lube oil temperature due to oil cooler leakage and keep power load with 50%-80%,

Two months after the improvements to Phase 2 cooling system (see table above), the overall contractor is expected to complete 168hrs test at the beginning of September 2012, outside current monitoring period.

During short time periods the main 35kV grid system was not in operation due to fault or maintenance, instead 6kV grid system was utilized and 6kV power meter used to record power generation and consumption from the power plant as presented in tale below.

Table B.1-8 Grid use of 6KV instead of 35KV

From (GMT)	To (GMT)	Length (hh:mm)
23:00 14-03-2012	10:00 15-03-2012	11:00
00:00 06-04-2012	06:30 06-04-2012	06:30
00:20 09-04-2012	07:30 09-04-2012	07:10
00:30 14-04-2012	09:00 14-04-2012	08:30
00:30 17-04-2012	08:00 17-04-2012	07:30
00:30 18-04-2012	06:00 18-04-2012	05:30
05:30 02-05-2012	10:30 02-05-2012	05:00
01:00 22-05-2012	07:00 22-05-2012	06:00
01:00 23-05-2012	10:40 23-05-2012	09:40
From (GMT)	To (GMT)	Length (hh:mm)
01:00 24-05-2012	04:30 24-05-2012	03:30
00:00 25-05-2012	10:30 25-05-2012	10:30
01:00 23-07-2012	08:00 23-07-2012	07:00
05:50 28-08-2012	09:10 28-08-2012	03:20

Regular power plant maintenance takes place (when necessary) on 15th and 30th of each month when the drainage station switch pumps and therefore gas is not drained and delivered to the power plant for one to two hours each time. During those stoppages the power plant pre-treatment, flare andgensets usually undergo small maintenance checks. There have not been any events or situations that occurred during this monitoring period which may impact the applicability of the methodology.

B.2. Post registration changes

B.2.1. Temporary deviations from registered monitoring plan or applied methodology

There have been no temporary deviations from registered monitoring plan or applied methodology in this monitoring period.

B.2.2. Corrections

No corrections have been submitted or approved during this monitoring period with this monitoring report.

B.2.3. Permanent changes from registered monitoring plan or applied methodology

A request for revision of the monitoring plan was submitted on 07/07/2009, and approval by the UNFCCC was given on 13/12/2009. This monitoring report has been completed using the revised monitoring plan.

B.2.4. Changes to project design of registered project activity

Minor revisions to the initial monitoring plan included in the initial registered PDD were made on 18/02/ 2009. The revisions have been validated by TUV-Sued and their conclusions have been reported in validation report (nr. 600500291).

B.2.5. Changes to start date of crediting period

No changes to the start date of the crediting period have been submitted or approved during this monitoring period with this monitoring report.

B.2.6. Types of changes specific to afforestation or reforestation project activity

Not applicable to the project activity

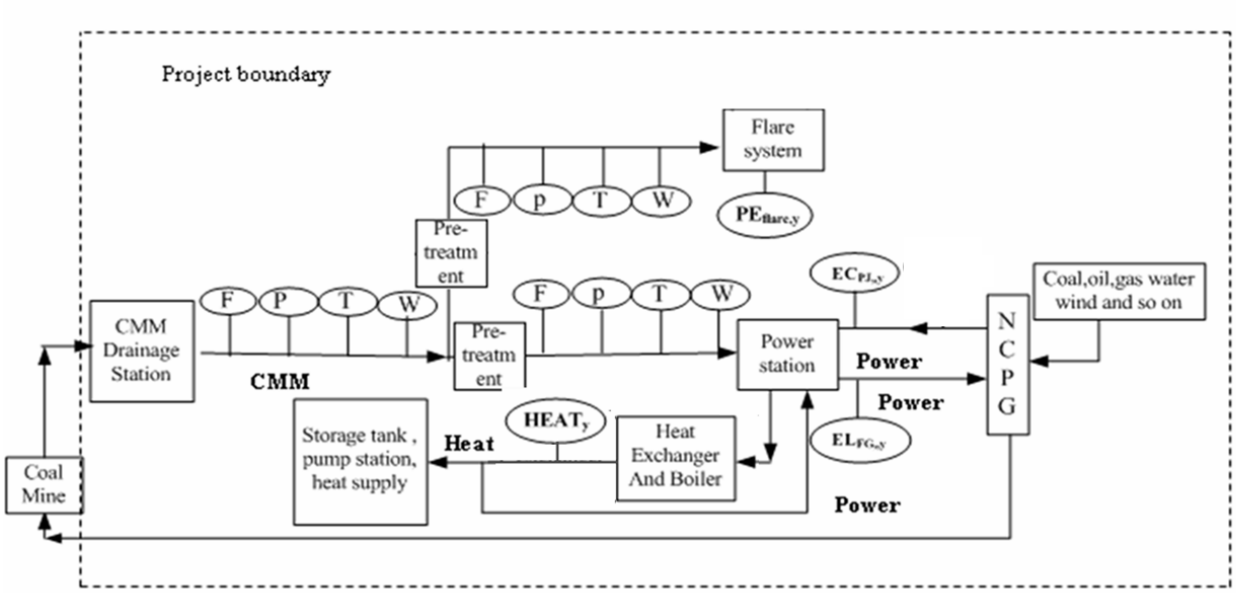
SECTION C. Description of monitoring system

In order to guarantee the quality of the data and data collection system, a detailed monitoring manual has been developed and implemented. This detailed monitoring manual (available for verification by the DOE) is based upon the requirements set out in the PDD and the revised monitoring plan and addresses as a minimum the items listed below:

- SCC CDM engineers record the value from each CDM monitoring instrument daily using a remote web page system to verify that the readings are within the range set by the manufacturer. Net power values are recorded by Duerping mine operators every day and handed to SCC CDM engineers on monthly basis. The monitoring instrument data is logged daily and it is available during verification. If the incorrect value persists for more than one hour SCC CDM engineers will ask the on-site operator to check the installation of the instrument and if the problem persists SCC will contact the installation company to replace the faulty instrument with an approved calibrated instrument in the shortest time possible.

- Analysis of CH_4 mass flow against Gross power is performed every month to confirm the back-calculating CH_4 mass flow equations are consistent month to month.

Figure C-1 is the line diagrams showing all relevant monitoring points as per registered PDD. Detailed monitoring diagrams for Phase I and Phase II of the project are included in Annex 6



P = Gas pressure
T = Gas temperature
W = Methane concentration
$EL_{FG,y}$ = Electricity generated
$PE_{flare,\ y}$ = Project emissions flare
NCPG = North China power grid

Figure C-1 Schematic line diagram showing relevant monitoring point

Figure C-2 is the organizational structure of the CDM team.

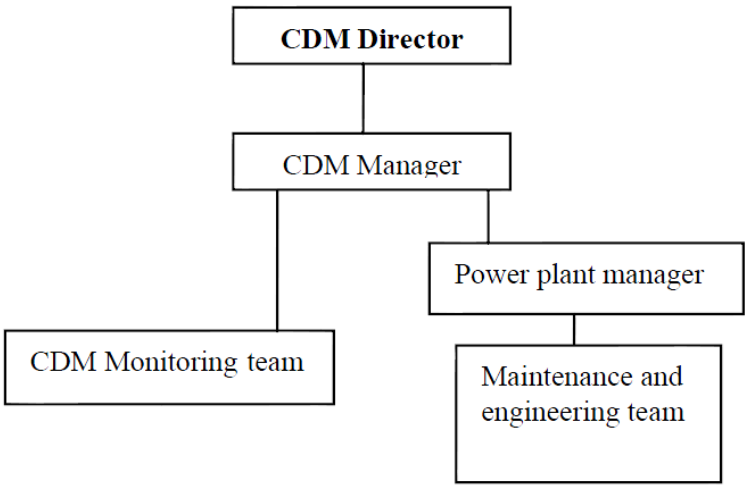


Figure C-2 Organizational structure

An overview of the data collection process is provided in Table C-1 and Annex 1.

Table C-1 Data collection process

Parameter	Reference	Procedure / Frequency	Registration	Check and correct primary measurements
Baseline Emissions	The baseline emissions are calculated using the formulae described in the PDD, section B6.1 - using the CDM spreadsheet	Primary data are electronically logged and stored together with keyboard entry data and processed electronically at the start of each month	CDM spreadsheet stored on SCC's Project File S-Server	The SCC project officer performs a consistency check based upon previous months. In case of irregularities data is double checked, corrected as necessary and the amendment logged
Leakage emissions	In accordance with ACM0008 version 3 no leakage is considered for the project activity			
Project Emissions	The project emissions are calculated using the formulae described in the PDD, section B6.1 - using the CDM spreadsheet	Primary data are electronically logged and stored together with keyboard entry data and processed electronically at the start of each month	CDM spreadsheet stored on SCC's Project File S-Server	The SCC project officer performs a consistency check based upon previous months. In case of irregularities data is double checked, corrected as necessary and the amendment logged
Emission Reductions	The emission reductions are calculated using the formulae described in the PDD, section B6.1 - using the CDM spreadsheet	Primary data are electronically logged and stored together with keyboard entry data and processed electronically at the start of each month	CDM spreadsheet stored on SCC's Project File S-Server	The SCC project officer performs a consistency check based upon previous month's records. In case of irregularities data is double checked, corrected as necessary and the amendment logged

Accuracy and calibration of instruments

All measurement devices are maintained to ensure a high level of accuracy. All meters are subject to a quality control regime that includes regular maintenance and are calibrated annually (in the case of V-cones every two years) by *Institute of Metrological Supervision and Measurement of Hebei Province* (flare, oil heating circuit and engine v-cones) and by *Shanxi Provincial institute of Metrology* (the rest of CDM instruments). A list of all CDM instruments, their accuracy levels and calibration certificate numbers are presented in Annex 2. Annex 3 presents all CDM instruments installation and removal dates during the period relevant to monitoring report.

A record is available showing the location and unique identification number of each meter, the calibration status of that meter (date of last calibration and date of next calibration). All CDM instruments have integrated a Serial Number which is used to track the calibration records and installation certificates.

All calibration records are retained two years after the end of the crediting period and are available for verification by the DOE.

Archiving of data

Data is archived periodically to a secure and retrievable storage format where it will be held for the crediting period plus 2 years.

Document Control

A document control system has been introduced ensuring that the current versions of necessary documents are available at the point of use. As a part of the document control system, an internal Technical Review Process has been established to ensure the quality of all relevant documents, including the CDM Monitoring Report.

Treatment of missing or corrupted data

Where data in the on-line system are corrupted or missing whilst the plant is operating, the corrupt or missing data can be corrected and justified using installed back-up metering devices, average previous hour readings and gross power readings.

In case errors are identified, both corrective and preventive actions are taken. Annex 7 includes a list of each period during which no CDM data was recorded (all data missing). Missing of all CDM data records were due to connectivity failure between the Master or Local System Control and Data Acquisition (SCADA) systems and the central computer, preventing the measured CDM value to be recorded in the CDM database system. Periods during which all CDM data was missing had no ER claim associated.

Internal Audit

An audit of the data collection and QC/QA system is performed periodically, at least once per year. An internal audit has been carried out in July 2009, November 2009, April 2010, December 2010, August 2011 and June 2012. A copy of the internal audit reports is available for verification by the DOE. Furthermore, a management review is carried out on a yearly basis to assess the operational/verification status, scheduling of audits and verifications, health and safety, improvements to be made and training updates and staffing.

Internal Training

Update 2011 training - Relevant process operators and CDM technical staff have received in-house refresher training on January 14th 2010 by Sven Starckx (Senior Technical Advisor on Monitoring and Verification, SCC) to ensure compliance with the tasks and procedures set out in the monitoring plan

New SCC staff received training on 26th and 27th February 2010 by Ruben Martinez Rubio (CDM Director of CMM Verification Team, SCC).

Advanced in-house training relevant to CDM technical staff by Sven Starckx (Senior Technical Advisor on Monitoring and Verification, SCC) took place in Beijing on 29th and 30th of August 2011. Training records are available for verification by the DOE.

SECTION D. Data and parameters

D.1. Data and parameters fixed ex ante or at renewal of crediting period

(Copy this table for each piece of data and parameter.)

Data/Parameter	**Eff_{ELEC}**
Unit	%
Description	Efficiency of methane destruction / oxidation in power plant
Source of data	Default value taken from ACM0008 version 03
Value(s) applied	99.5
Purpose of data	The data is used for project emissions calculation
Additional comment	No additional comment

Data/Parameter	Eff_{heat}
Unit	%
Description	Efficiency of heat conversion in the baseline scenario
Source of data	Default value taken from ACM0008 version 3.0
Value(s) applied	100
Purpose of data	The data is used for baseline emissions calculation
Additional comment	No additional comment

Data/Parameter	GWP_{CH4}
Unit	tCO_2e/tCH_4
Description	Global warming potential of methane
Source of data	2006 Revised IPCC Guidelines
Value(s) applied	21
Purpose of data	This data is used for baseline and project emissions calculation
Additional comment	No additional comment

Data/Parameter	CEF_{CH4}
Unit	tCO_2e/tCH_4
Description	Carbon emission factor for combusted methane
Source of data	2006 Revised IPCC Guidelines
Value(s) applied	2.75
Purpose of data	The data is used for project emissions calculation
Additional comment	No additional comment

Data/Parameter	CEF_{ELEC} (also EF_{ELEC})
Unit	tCO_2/MWh
Description	CO_2 emission factor of electricity used by coal mine (also CO_2 emission factor of the grid)
Source of data	Calculated by using ACM0002
Value(s) applied	1.03025
Purpose of data	This data is used for baseline and project emissions calculation
Additional comment	No additional comment

Data/Parameter	**Manufacturer's specification for the flare**
Unit	-
Description	The flare operation in normal conditions defined by the flare manufacturer specifications provided by Nanjing Shunfen-Pioneer (flow rate 300-5,000m^3/h and flame temp from 500 – 1,350 °C)
Source of data	Commissioning reports, certificates and approval notices provided by manufacturers or suppliers
Value(s) applied	-
Purpose of data	This data is not directly used but just as a reference for project emission calculations
Additional comment	Implementation of maintenance and calibrations schedules, with results (e.g. calibration certificates) to be stored for the longer of two years longer than the crediting period or two years after the last issuance of CERs.

Data/Parameter	**PEme**
Unit	tCO_2
Description	Project emissions from energy use to capture and use methane
Source of data	N/A
Value(s) applied	-
Purpose of data	This data is a part of project emissions
Additional comment	No additional energy is used. Capture and removal of methane is the business as usual scenario.

Data/Parameter	**MM_i**
Unit	tCH_4
Description	Methane measured sent to use i
Source of data	ACM0008 version 03
Value(s) applied	N/A
Purpose of data	N/A
Additional comment	No comment

Data/Parameter	**$PMM_{pj,iy}$**
Unit	tCH_4
Description	Post-mining CMM captured, sent to and destroyed by use *i* in the project activity in year *y*
Source of data	ACM0008 version 03
Value(s) applied	N/A
Purpose of data	The data would be used to calculate baseline emissions
Additional comment	In line guidance given in the EB 55 report[1], as the gas is extracted from the mine within the project boundary of the CDM project activity, and a connection between $CMM_{PJ,i,y}$ (pre-mining CMM captured, sent and destroyed) and $PMM_{PJ,i,y}$ (post-mining CMM captured, sent to and destroyed) is in the underground mine as specified in ACM0008 version 7, the practice of combined measurement and baseline emissions are determined ex post by measuring the methane emitted from the methane drainage system at the point where it enters the equipment.

D.2. Data and parameters monitored

(Copy this table for each piece of data and parameter.)

Data/Parameter	**MM_{ELEC}**
Unit	tCH_4
Description	Methane sent to power plant
Measured/Calculated /Default	Measured/Calculated
Source of data	Measured by a flow meter on the inlet to each generator and a methanometer on the manifold pipe to the generators and summed. For the ex ante prediction on conversion for NTP (given by the methodology as 0.67 kg/m^3 at 20°C and 1 atm)is required, but for ex post, temperature and pressure will be recorded and the volume adjusted to NTP using the gas law P1V1/T1=P2V2/T2.
Value(s) of monitored parameter	As per the spreadsheets in Annex 1
Monitoring equipment	Pressure, temperature, CH_4 concentration and flow meters with differential pressure measurement function are used to determine the amount of methane sent to generators, see Annex 2 for full details
Measuring/Reading/ Recording frequency	Measurements are taken continuously and logged at nominal 30 second intervals
Calculation method (if applicable)	The V-cone records gas volumes and the pressure gauge and temperature meter record the gas pressure and temperature. Methane concentration meter records the volumetric CH_4 concentration.
QA/QC procedures	Calculations are performed by spreadsheet, which are audited periodically and protected from being over-written or altered by unauthorized personnel. Data is backed up and archived in two different locations, where it will be stored for the longer of two years longer than the crediting period or two years after the last issuance of CERs. The volume of methane destroyed is correlated with gross power output from the generators.
Purpose of data	This data is used for baseline and project emissions calculation
Additional comment	No additional comment

[1] http://cdm.unfccc.int/UserManagement/FileStorage/JTV1YA8FCHR4W2GMEOQ53SK60P9DLX

Data/Parameter	PEy
Unit	tCO_2e
Description	Project emissions in period y
Measured/Calculated /Default	Calculated
Source of data	Calculated from sum of emissions from combustion of methane and emissions of un-combusted methane. 2.75 t CO_2 per tonne of methane combusted plus 0.005 t CO_2 per tonne of methane burnt in from un-combusted methane
Value(s) of monitored parameter	As per the spreadsheets in Annex 1
Monitoring equipment	Pressure, temperature, CH_4 concentration and flow meters with differential pressure measurement function are used to determine the amounts of methane combusted and un-combusted by the project activity. See Annex 2 for full details
Measuring/Reading/ Recording frequency	Measurements are taken continuously and logged at nominal 30-second intervals.
Calculation method (if applicable)	
QA/QC procedures	Calculations are performed by spreadsheet, which are audited periodically and protected from being over-written or altered by unauthorized personnel. Data is backed up and archived in two different locations, where it will be stored for the longer of two years longer than the crediting period or two years after the last issuance of CERs. The volume of methane destroyed is correlated with gross power output from the generators.
Purpose of data	This is project emission.
Additional comment	No additional comment

Data/Parameter	PEmd
Unit	tCO_2e
Description	Project emissions from destruction of methane
Measured/Calculated /Default	Calculated
Source of data	Calculated from volume of methane at normal temperature and pressure combusted by generators and flares multiplied by 2.75. Ex ante volume of methane consumed is in Nm^3, therefore no conversion is necessary before applying the density. For the ex ante prediction no conversion for NTP is required, but ex post, temperature and pressure will be recorded and the volume adjusted to NTP using the gas law P1V1/T1=P2V2/T2
Value(s) of monitored parameter	As per the spreadsheets in Annex 1
Monitoring equipment	Pressure, temperature, CH_4 concentration and flow meters with differential pressure measurement function are used to determine the project emissions from destruction of methane by the project activity, as per Annex 2 for full details
Measuring/Reading/ Recording frequency	Measurements are taken continuously and logged at nominal 30 second intervals
Calculation method (if applicable)	Volume of pure methane destroyed is calculated from volume and concentration measurements taken every 30 seconds at the inlet to the generators and flare. See MDelec and MDfl below
QA/QC procedures	Calculations are performed by spreadsheet, which are audited periodically and protected from being over-written or altered by unauthorized personnel. Data is backed up and archived in two different locations, where it will be stored for the longer of two years longer than the crediting period or two years after the last issuance of CERs. The volume of methane destroyed is correlated with gross power output from the generators.
Purpose of data	This is part of project emission.
Additional comment	No additional comment

Data/Parameter	**PEum**
Unit	tCO_2e
Description	Un-combusted methane emitted from the generators, flare
Measured/Calculated /Default	Calculated
Source of data	Calculated from mass of methane burnt in generators, flare
Value(s) of monitored parameter	As per the spreadsheets in Annex 1
Monitoring equipment	Pressure, temperature, CH_4 concentration and flow meters with differential pressure measurement function are used to determine PEmd, the amount of methane combusted by engines and flare. See Annex 2 for full details. Default efficiency is 99.5%, therefore un-combusted methane from generators is: (0.005 * methane sent to generator sets and the flare). Default efficiency for flares is 90%, therefore un-combusted methane from flare is (0.1* methane sent to generator sets and the flare)
Measuring/Reading/ Recording frequency	Measurements are taken continuously and logged at nominal 30 second intervals
Calculation method (if applicable)	
QA/QC procedures	Calculations are performed by spreadsheet, which are audited periodically and protected from being over-written or altered by unauthorized personnel. Data is backed up and archived in two different locations, where it will be stored for the longer of two years longer than the crediting period or two years after the last issuance of CERs. The volume of methane destroyed is correlated with gross power output from the generators
Purpose of data	This is part of project emission.
Additional comment	No additional comment

Data/Parameter	**MD_{ELEC}**
Unit	tCH_4
Description	Methane destroyed by power generators
Measured/Calculated /Default	Measured/Calculated
Source of data	Calculated from the flow and concentration of methane at the inlet to the generators and methane concentration at the manifold to the generators
Value(s) of monitored parameter	See MM_{ELEC} and PC_{CH4}
Monitoring equipment	See MM_{ELEC} and PC_{CH4}. As per Annex 2 for details
Measuring/Reading/ Recording frequency	Measurements are taken continuously and logged at nominal 30 second intervals
Calculation method (if applicable)	See MM_{ELEC} and PC_{CH4}
QA/QC procedures	Calculations are performed by spreadsheet, which are audited periodically and protected from being over-written or altered by unauthorized personnel. Data is backed up and archived in two different locations, where it will be stored for the longer of two years longer than the crediting period or two years after the last issuance of CERs. The volume of methane destroyed is correlated with gross power output from the generators.
Purpose of data	This data is used for baseline emission and project emission calculations
Additional comment	No additional comment

Data/Parameter	MM_{FL}
Unit	tCH_4
Description	Methane sent to flare(s)
Measured/Calculated /Default	Measured/Calculated
Source of data	Measured continuously using flow meters and CH_4 levels on the inlet to the flares. Flow, temperature and absolute pressure will be recorded and the volume normalised as per Flaring tool.
Value(s) of monitored parameter	As per the spreadsheets in Annex 1
Monitoring equipment	V-cone with differential pressure flow meters as per Annex 2 for details
Measuring/Reading/ Recording frequency	Continuously, recorded every 30 seconds
Calculation method (if applicable)	Pressure, temperature, CH_4 concentration and flow meters with differential pressure measurement function are used to determine the amount of methane sent to the flares. Mass of methane sent to the flares is determined taking into account the density of methane under normal conditions of temperature and pressure. Density of methane under normal conditions of temperature and pressure is 0.67 kg/m^3 (revised 1996 IPCC Reference manual p.1.24 and 1.16).
QA/QC procedures	Refer to MM_{ELEC}
Purpose of data	This data is used for baseline and project emissions calculation
Additional comment	No additional comment

Data/Parameter	MD_{FL}
Unit	tCH_4
Description	Methane sent to flare(s)
Measured/Calculated /Default	Measured/Calculated
Source of data	Calculated from MM_{FL} and $\eta_{flare,h}$
Value(s) of monitored parameter	As per the spreadsheets in Annex 1
Monitoring equipment	As per MM_{FL} and $\eta_{flare,h}$
Measuring/Reading/ Recording frequency	N/A
Calculation method (if applicable)	See MM_{FL} and $\eta_{flare,h}$
QA/QC procedures	Calculations are performed by spreadsheet (at least monthly) which are audited periodically and protected from being over-written or altered by unauthorized personnel. Data is backed up and archived in two different locations, where it will be stored for a period of two years after the crediting period or two years after the last issuance of CERs.
Purpose of data	This data is used for project emissions calculation
Additional comment	No additional comment

Data/Parameter	**GEN_y**
Unit	MWh
Description	Electricity generated by the project
Measured/Calculated /Default	Measured
Source of data	Net power is calculated from the difference between gross power from all the generators (positive active power) and the power consumption by the project (negative active power).
Value(s) of monitored parameter	As per the spreadsheets in Annex 1
Monitoring equipment	6kV Power Meter DSSD71 manufactured by Jiangsu Linyang and 35kV Power meter DSSD331 manufactured by Weisheng Electronic Company DSSD331, as per Annex 2 for further details.
Measuring/Reading/ Recording frequency	Continuously measured but manually recorded everyday by a site operator.
Calculation method (if applicable)	Positive active power (gross power) and negative active power (power consumed by the project) are both measured continuously with a single power meter located at the link from the generators to the power grid. Net power is calculated from the difference of these two readings.
QA/QC procedures	Calculations are performed by spreadsheet, which are audited periodically and protected from being over-written or altered by unauthorized personnel. Data is backed up and archived in two different locations, where it will be stored for the longer of two years longer than the crediting period or two years after the last issuance of CERs. The net export meter power meter has been approved by the local power company and calibrated and monitored in accordance with their instructions.
Purpose of data	This data is used for baseline emissions calculation
Additional comment	No additional comment

Data/Parameter	**$CONS_{ELEC,PJ}$**
Unit	MWh
Description	Additional electricity consumption for capture and use or destruction of methane, if any (MWh) in year *y*
Measured/Calculated /Default	Measured
Source of data	Electricity meter readings
Value(s) of monitored parameter	As per the spreadsheets in Annex 1
Monitoring equipment	Electricity meter installed in the substation As per Annex 2 for details
Measuring/Reading/ Recording frequency	Continuously measured but manually recorded everyday by a site operator.
Calculation method (if applicable)	N/A
QA/QC procedures	Calculations are presented by spreadsheet which are audited periodically and protected from being over-written or altered by unauthorized personnel. Data is backed up and archived in two different locations, where it will be stored for the longer of two years longer than the crediting period or two years after the last issuance of CERs. The volume of methane destroyed is correlated with gross power output from the generators.
Purpose of data	This data is used for project emissions calculation
Additional comment	No additional comment

Data/Parameter	**$HEAT_y$**
Unit	GJ
Description	Heat generation by project
Measured/Calculated /Default	Measured/Calculated
Source of data	Measurement of flow rate on the oil heating circuit and the oil temperatures on the outward and returning heating Pipes
Value(s) of monitored parameter	
Monitoring equipment	V-cone flow meter and Temperature meter As per Annex 2 for details
Measuring/Reading/ Recording frequency	Continuously, recorded every 30 seconds
Calculation method (if applicable)	During heating season waste heat is transferred from the generators to the mines ventilation, heater and building by way of closed circuit heat transfer system. The circuits are fitted with constant flow pumps, thermocouples in the flow and return pipes and flow meter. Actual heat transferred is determined by measuring the flow, inlet and return temperatures and logging the data.
QA/QC procedures	Temperature and flow rate data is used to calculate heat supplied and this is fed into a data logger for determination of heat supply. Heat will be supplied to meet demand (in winter months) which is determined by need for compliance with mine air temperature regulations and hence on ambient temperature which will also be recorded. Measurement equipment is calibrated and monitored in accordance with manufacturer instructions.
Purpose of data	This data is used for baseline emissions calculation
Additional comment	No additional comment

Data/Parameter	**PC_{CH4}**
Unit	%
Description	Percentage of pure methane (wet basis) in drained gas (by volume)
Measured/Calculated /Default	Measured
Source of data	Methanometer at the manifold to the generator
Value(s) of monitored parameter	As per the spreadsheets in Annex 1
Monitoring equipment	Methane concentration is measured by proprietary infrared instrumentation mounted in the gas pipe work at the gas treatment units. Accuracy of analysis +/-2.5%FSD. Gas analyzed as sample (gas dried by pretreatment). Measurements are taken continuously and logged at nominal 30-second intervals. Annex 2 for details
Measuring/Reading/ Recording frequency	Continuously, recorded every 30 seconds
Calculation method (if applicable)	Not applicable
QA/QC procedures	Calculations are performed by spreadsheet, which are audited periodically and protected from being over-written or altered by unauthorized personnel. Data is backed up and archived in two different locations, where it will be stored for the longer of two years longer than the crediting period or two years after the last issuance of CERs.
Purpose of data	This data is used for both baseline and project emissions calculation
Additional comment	No additional comment

Data/Parameter	**PC_{NMHC}**
Unit	%
Description	Percentage of non-methane hydrocarbons in CMM, by mass coal mine gas
Measured/Calculated /Default	Measured
Source of data	Tube sample analysis as per Annex 4
Value(s) of monitored parameter	Not applicable at this stage because the sum of all non-methane hydrocarbons in gas samples is less than 1% and therefore can be ignored.
Monitoring equipment	N/A
Measuring/Reading/ Recording frequency	Annually, samples of gas were extracted into gas sampling bottles using the appropriate procedures and analyzed by qualified laboratory such as TES Bretby in the UK.
Calculation method (if applicable)	N/A
QA/QC procedures	A minimum of 3 samples is collected in secure gas sample vessels, suitable for storage and transport to the selected laboratory. Samples are taken in accordance with protocol procedures in the CDM monitoring manual and analyzed in a qualified laboratory. If one or more samples are found to be faulty (i.e. leaked) replacement samples will be taken. Scanned copies of the analyses are backed up and archived in two different locations, where they will be stored for the longer of two years longer than the crediting period or two years after the last issuance of CERs.
Purpose of data	This data is used for project emissions calculation
Additional comment	No additional comment
Data/Parameter	**CEF_{NMHC}**
Unit	$tCO_2e/tNMHC$
Description	Carbon emission factor for combusted non-methane hydrocarbons
Measured/Calculated /Default	Calculated
Source of data	If necessary, the value for specific non-methane hydrocarbons will be determined by stoichiometric calculation.
Value(s) of monitored parameter	Not applicable at this stage because the sum of all non-methane hydrocarbons in gas samples is less than 1% and therefore can be ignored. (See results of gas analysis in Appendix 2)
Monitoring equipment	N/A
Measuring/Reading/ Recording frequency	N/A
Calculation method (if applicable)	Derived using measurements described in PC_{NMHC}
QA/QC procedures	N/A
Purpose of data	This data is used for project emissions calculation
Additional comment	No additional comment

Data/Parameter	**r**
Unit	%
Description	Relative proportion of NMHC compared to methane
Measured/Calculated /Default	Calculated
Source of data	Calculated from PC_{NMHC}/ PC_{CH4}
Value(s) of monitored parameter	Determined from annual tests of samples of coalmine methane. Not applicable at this stage because the sum of all non-methane hydrocarbons in gas samples is less than 1%, as per tube samples SCC3, SCC5 and SCC42 taken on 30 July 2012 and analyzed in the UK on 10 August 2012 by TES Bretby.
Monitoring equipment	N/A
Measuring/Reading/ Recording frequency	Annually, samples of gas were extracted into gas sampling bottles using the appropriate procedures and analyzed by qualified laboratories such as TES Bretby in the UK
Calculation method (if applicable)	N/A
QA/QC procedures	If applicable, this figure will be built into a spreadsheet for calculating emissions (not applicable – sum of all non-methane hydrocarbons in any of the tube samples was found less than 1% as per Annex 4).
Purpose of data	This data is used for project emissions calculation
Additional comment	No additional comment

Data/Parameter	**$FV_{RG,h}$**
Unit	m^3/h
Description	volumetric flow rate of the residual gas at normal conditions in the hour h (residual gas to flare)
Measured/Calculated /Default	Measured
Source of data	Measured using a flow meter.
Value(s) of monitored parameter	As per the spreadsheets in Annex 1
Monitoring equipment	Flow meter instrument as per Annex 2
Measuring/Reading/ Recording frequency	Measurements are taken continuously and logged at nominal 30-second intervals.
Calculation method (if applicable)	N/A
QA/QC procedures	Flow meters are periodically calibrated according to the manufacturer's recommendation. Ensure that the same basis is considered for this measurement and the measurement of the volumetric fraction of all components in the residual gas when the residual gas temperature exceeds 60 °C.
Purpose of data	This data is used for both baseline and project emissions calculation
Additional comment	No additional comment

Data/Parameter	$fv_{CH4,RG,h}$
Unit	%
Description	volumetric fraction of methane in the residual gas on dry basis in the hour h
Measured/Calculated /Default	Measured
Source of data	Measured by project participants using a continuous gas analyzer
Value(s) of monitored parameter	As per the spreadsheets in Annex 1
Monitoring equipment	Gas monitoring instrument as per Annex 2
Measuring/Reading/ Recording frequency	Ensure that the same basis is considered for this measurement and the measurement of the volumetric fraction of all components in the residual gas when the residual gas temperature exceeds 60 °C.
Calculation method (if applicable)	N/A
QA/QC procedures	Analyzers are periodically calibrated according to the manufacturer's recommendation. A zero check and a typical value check is performed by comparison with a standard certified gas.
Purpose of data	This data is used for both baseline and project emissions calculation
Additional comment	No additional comment

Data/Parameter	T_{flare}
Unit	^{o}C
Description	Temperature of the flue gas of the flare
Measured/Calculated /Default	Measured
Source of data	Flare thermocouple(s)
Value(s) of monitored parameter	As per the spreadsheet in Annex 1
Monitoring equipment	Flare thermocouple(s) type N as per Annex 2 for details
Measuring/Reading/ Recording frequency	Continuously, recorded every 30 seconds. Monitored continuously by a Type N thermocouple. A temperature above 500 degrees Celsius indicates that a significant amount of gases are being burnt and that the flare is operating.
Calculation method (if applicable)	N/A
QA/QC procedures	Data is backed up and archived where it will be stored for the longer of two years longer than the crediting period or two years after the last issuance of CERs. Thermocouples are calibrated according to the manufacturer's specifications.
Purpose of data	This data is not directly used for project emissions calculation but used for the determination of the flare efficiency.
Additional comment	No additional comment

Data/Parameter	$\eta_{flare,h}$
Unit	%
Description	Flare efficiency in hour *h*
Measured/Calculated /Default	Calculated
Source of data	Flare thermocouple(s)
Value(s) of monitored parameter	0, if the temperature in the exhaust gas of the flare (T_{flare}) is below 500 °C for more than 20 minutes during the hour h. 50, if the temperature in the exhaust gas of the flare (T_{flare}) is above 500 °C for more than 40 minutes during the hour h, but the manufacturer's specifications on proper operation of the flare are not met at any point in time during the hour h. 90, if the temperature in the exhaust gas of the flare (T_{flare}) is above 500 °C for more than 40 minutes during the hour h and the manufacturer's specifications on proper operation of the flare are met continuously during the hour h.
Monitoring equipment	Flare thermocouple(s) type N as per Annex 2 for details
Measuring/Reading/ Recording frequency	Measurements are taken continuously and logged at nominal 30 second intervals.
Calculation method (if applicable)	$\eta_{flare,h}$ cannot be directly monitored. Therefore, the parameter T_{flare} is instead monitored in order to measure the flare combustion efficiency (refer to the "Tool to determine project emissions from flaring gases containing methane").
QA/QC procedures	Data is backed up and archived in two different locations, where it will be stored for a period of two years after the crediting period or two years after the last issuance of CERs.
Purpose of data	This data is not directly used for project emissions calculation but used for the determination of the flare efficiency.
Additional comment	No additional comment

Data/Parameter	T
Unit	Kelvin
Description	Temperature of CMM
Measured/Calculated /Default	Measured
Source of data	Temperature sensor on gas pipework between the treatment unit and the generators
Value(s) of monitored parameter	As per the spreadsheets
Monitoring equipment	Flare thermocouple(s) type N as per Annex 2 for details
Measuring/Reading/ Recording frequency	Measurements are taken continuously and logged at nominal 30 second intervals.
Calculation method (if applicable)	$\eta_{flare,h}$ cannot be directly monitored. Therefore, the parameter T_{flare} is instead monitored in order to measure the flare combustion efficiency (refer to the "Tool to determine project emissions from flaring gases containing methane").
QA/QC procedures	Data is backed up and archived in two different locations, where it will be stored for a period of two years after the crediting period or two years after the last issuance of CERs.
Purpose of data	This data is used for baseline emissions calculation
Additional comment	No additional comment

D.3. Implementation of sampling plan

Not applicable to the project activity

SECTION E. Calculation of emission reductions or GHG removals by sinks

E.1. Calculation of baseline emissions or baseline net GHG removals by sinks

The formulae used for determination of the baseline emissions are described in section B.6.1 of the registered PDD for the project activity. It is available on the UNFCCC website.
http://cdm.unfccc.int/UserManagement/FileStorage/Q3PBR459OM8KI0Y6FATGX1SJW27HNC

Baseline emissions are calculated as follows:

$$BE_y = BE_{MD,y} + BE_{MR,y} + BE_{Use,y} \quad \textbf{(1)}$$

Where

BE_y Baseline emissions in year y (tCO_2e)
$BE_{MD,y}$ Baseline emissions from destruction of methane in the baseline scenario in year y (tCO_2e)
$BE_{MR,y}$ Baseline emissions from release of methane into the atmosphere in year y that is avoided by the project activity (tCO_2e)
$BE_{Use,y}$ Baseline emissions from the production of power, heat or supply to gas grid replaced by the project activity in year y (tCO_2e)

$BE_{MD,y}$ Baseline emissions from destruction of methane in the baseline scenario in year y

No methane is destroyed in the baseline scenario therefore $BE_{MD,y}$ are zero.

$BE_{MR,y}$ Baseline emissions from release of methane into the atmosphere in year y that is avoided by the project activity

The original formula used for $BE_{MR,y}$ calculation in ACM0008/version 03 is as the following:

$$BE_{MRy} = GWP_{CH4} \times [\sum_i (CBMe_{i,y} - CBM_{BLi,y}) + \sum_i (CMM_{PJi,y} - CMM_{BLi,y}) + \sum_i (PMM_{PJi,y} - PMM_{BLi,y})] \quad \textbf{(2)}$$

Where,

$BE_{MR,y}$	Baseline emissions from release of methane into the atmosphere in year y that is avoided by the project activity (tCO_2e)
I	Use of methane (flaring, power generation, heat generation, supply to gas grid to various combustion end uses)
$CBMe_{i,.y}$	Eligible CBM captured, sent to and destroyed by use *i* in the project for year y (expressed in tCH_4) = 0
$CBM_{BLi,y}$	CBM that would have been captured, sent to and destroyed by use *i* in the baseline scenario in the year y (expressed in tCH_4) = 0
$CMM_{PJ,i,y}$	Pre-mining CMM captured, sent to and destroyed by use *i* in the project activity in year y (expressed in tCH_4)
$CMM_{BL,i,y}$	Pre-mining CMM that would have been captured, sent to and destroyed by use *i* in the baseline scenario in year y (expressed in tCH_4) = 0
$PMM_{PJ,i,y}$	post-mining CMM captured, sent to and destroyed by use *i* in the project activity in year y (tCH_4)
$PMM_{BLi,,y}$	post-mining CMM that would have been captured, sent to and destroyed by use *i* in the baseline scenario in year y (tCH_4) = 0
GWP_{CH4}	Global warming potential of methane (21 tCO_2e/tCH_4)

In practice, the pre-mining and post-mining methane are indistinguishable, being extracted through the same pumping system in proportions that vary depending on mining activities, atmospheric pressure changes and day to day management of the ventilation systems. In line guidance given in the EB 55 report[2], as the gas is extracted from the mine within the project boundary of the CDM project activity, and a connection between $CMM_{PJ,i,y}$ (pre-mining CMM captured, sent and destroyed) and $PMM_{PJ,i,y}$ (post-mining CMM captured, sent to and destroyed) is in the underground mine as specified in ACM0008 version 7, the practice of combined measurement and baseline emissions are determined ex post by measuring the methane emitted from the methane drainage system at the point where it enters the equipment.

The release of methane into the atmosphere is avoided by the project activity through power generation and destruction in the enclosed flare. Therefore formula (2) can be simplified to:

$$BE_{MR,y} = GWP_{CH4} \times (MM_{ELEC} + MM_{FL}) \quad \textbf{(3)}$$

Where:

[2] http://cdm.unfccc.int/UserManagement/FileStorage/JTV1YA8FCHR4W2GMEOQ53SK60P9DLX

MM_{ELEC} Methane measured sent to power plant (tCH_4)
MM_{FL} Methane measured sent to the flare (tCH_4)

$BE_{Use,y}$ Baseline emissions from the production of power, heat or supply to gas grid replaced by the project activity in year y

Electricity and heat will be generated by the project activity, therefore baseline emissions from the production of power and heat replaced by the project activity in year y (tCO_2e) is:

$$BE_{use,y} = GEN_y \times EF_{ELEC} + HEAT_y \times EF_{HEAT} \quad \textbf{(4)}$$

Where:
GEN_y Electricity generated by project activity in year y (MWh)
EF_{ELEC} Emissions factor of gird electricity replaced by the project activity (tCO_2/MWh)
$HEAT_y$ Heat generation by project activity in year y (GJ)
EF_{HEAT} Emissions factor for heat production replaced by project activity (tCO_2/GJ)

The EF_{ELEC} is calculated as per ACM0002 version 6, from the average of the operating margin and build margin in the North China Power Grid.

EF_{OM}	1.1208
EF_{BM}	0.9397

According ACM0002, the baseline grid emission factor is the simple average of BM and OM:
1.1208+0.9397/ 2 = 1.03025 tCO_2/MWh

The emissions factor for displaced heat generation is calculated as follows:

$$EF_{heat,y} = \frac{EF_{CO2,i}}{Eff_{heat}} \times \frac{44}{12} \times \frac{1TJ}{1000GJ} \quad \textbf{(5)}$$

Where:
$EF_{heat,y}$ Emissions factor for heat generation (tCO_2/GJ)
$EF_{CO2,i}$ CO_2 emissions factor of fuel used in heat generation (tC/TJ)
Eff_{heat} Boiler efficiency of the heat generation (%)
44/12 Carbon to Carbon Dioxide conversion factor
1/1000 TJ to GJ conversion factor

Boiler efficiency is taken as 100%.

Sample calculation for BE_y during the period 01/08/2012 – 31/08/2012:

Sample calculation for $BE_{MR,y}$ during the period 01/08/2012 – 31/08/2012:

Symbol	Value	Units
ρ (CH_4) at 101.325Pa and 273 K	0.000716	t/m^3
GWP_{CH4}	21	tCO_2e/tCH_4
CEF_{CH4}	2.75	tCO_2e/tCH_4
$V_{CMM,ELEC}$	4,095,547	m^3
$PC_{CH4,ELEC}$	34.9	%
$V_{CMM,FL}$	683	m^3
$PC_{CH4,FL}$	38.4	%
$MM_{ELEC} = V_{CMM,ELEC} \times PC_{CH4,ELEC} \times \rho_{CH4}$	1,024	tCH_4
$MM_{FL} = V_{CMM,FL} \times PC_{CH4,FL} \times \rho_{CH4}$	0.187	tCH_4
$BE_{MR} = GWP_{CH4} \times (MM_{ELEC} + MM_{FL})$	21,497.92	tCO_2e

Where :

$V_{CMM,ELEC}$ = cumulative volume of CMM measured sent to the power engines during the period 01/08/2012 – 31/08/2012 (m^3)
$V_{CMM,FL}$ = cumulative volume of CMM measured sent to the flare during the period 01/08/2012 – 31/08/2012 (m^3)
$PC_{CH4,ELEC}$ = Concentration of methane of CMM measured sent to the power engines during the period 01/08/2012 – 31/08/2012 (%)
$PC_{CH4,FL}$ = Concentration of methane of CMM measured sent to the flares during the period 01/08/2012 – 31/08/2012 (%)

Sample calculation for $BE_{Use,y}$ during the period 01/08/2012 – 31/08/2012:

Symbol	Value	Units
EF_{ELEC}	1.03025	tCO_2/MWh
EF_{HEAT}	0.0946	tCO_2/GJ
GEN_y	5563.25	MWh
$HEAT_y$	0	GJ
$BE_{Use,y}=GEN_y \times EF_{ELEC} + HEAT_y \times EF_{HEAT}$	5,731.54	tCO_2e

So that $BE_y=BE_{MD,y} + BE_{MR,y} + BE_{Use,y}=0+ 21,498+5,732=27,229\ tCO_2e$.

The baseline emissions are calculated in the attached ER calculation excel spreadsheets, and a summary of the results are provided in section E.4.

E.2. Calculation of project emissions or actual net GHG removals by sinks

The formulae used for determination of the project emissions are described in section B.6.1 of the registered PDD for the project activity. It is available on the UNFCCC website.
http://cdm.unfccc.int/UserManagement/FileStorage/Q3PBR459OM8KI0Y6FATGX1SJW27HNC

Project emissions are calculated as follows:

$$PE_y = PE_{ME} + PE_{MD} + PE_{UM} \quad \textbf{(6)}$$

Where:

PE_y Project emissions in year y (tCO_2e)
PE_{ME} Project emissions from energy use to capture and use methane (tCO_2e)
PE_{MD} Project emissions from methane destroyed (tCO_2e)
PE_{UM} Project emissions from un-combusted methane (tCO_2e)

PE_{ME} Project emissions from energy use to capture and use methane

The project activity will consume some electricity during operation. No additional heat or fossil fuel will be consumed Therefore:

$$PE_{ME}= CONS_{ELEC,PJ} \times EF_{ELEC} \quad \textbf{(7)}$$

But in practice only the readings of the net electricity output (GEN_y-$CONS_{ELEC,PJ}$) is recorded
So:

$BE_{use,y}$-PE_{ME}=$GEN_y \times EF_{ELEC} + HEAT_y \times EF_{HEAT} - CONS_{ELEC,PJ} \times EF_{ELEC}$

=$(GEN_y - CONS_{ELEC,PJ}) \times EF_{ELEC} + HEAT_y \times EF_{HEAT}$

Hence in the emission reduction calculations, the PE_{ME} can be treated as zero.

PE_{MD} Project emissions from methane destroyed

Only gensets and flare is installed for the project activity, CMM is not used directly in CMM boilers or distributed into the gas pipelines. Therefore:

$$PE_{MD} = (MD_{FL} + MD_{ELEC}) \times (CEF_{CH4} + r \times CEF_{NMHC}) \quad \textbf{(8)}$$

with:

$$r = PC_{NMHC} / PC_{CH4} \quad \textbf{(9)}$$

Where:[3]

PE_{MD}	Project emissions from CMM destroyed (tCO_2e)
MD_{FL}	Methane destroyed through flaring (tCH_4)
MD_{ELEC}	Methane destroyed through power generation (tCH_4)
CEF_{CH4}	Carbon emission factor for combusted methane (2.75 tCO_2e/tCH_4)
CEF_{NMHC}	Carbon emission factor for combusted non methane hydrocarbons (the concentration varies and, therefore, to be obtained through periodical analysis of captured methane) (tCO_2e/tNMHC)
R	Relative proportion of NMHC compared to methane
PC_{CH4}	Concentration (in mass) of methane in extracted gas (%)
PC_{NMHC}	NMHC concentration (in mass) in extracted gas (%)

As the volumetric fraction of NMHC measured in the external lab is lower than 1% in this monitoring period, it can be ignored. Hence formula can be simplified as:

$$PE_{MD} = CEF_{CH4} \times (MD_{FL} + MD_{ELEC}) \quad \textbf{(10)}$$

Not all of the methane sent to power plant and flare will be combusted, so a small amount will escape to the atmosphere. The combusted methane is calculated using the following formulas:

$$MD_{ELEC} = MM_{ELEC} \times Eff_{ELEC} \quad \textbf{(11)}$$

Where:

MD_{ELEC}	Methane destroyed through power generation (tCH_4)
MM_{ELEC}	Methane measured sent to power plant (tCH_4)
Eff_{ELEC}	Efficiency of methane destruction/oxidation in power plant (taken as 99.5% from IPCC)

$$MD_{FL} = MM_{FL} - PE_{flare}/GWP_{CH4} \quad \textbf{(12)}$$

[3] Note that throughout this baseline methodology, it is assumed that measured quantities of coal mine gas are converted to tonnes of methane using the measured methane concentration of the coal mine gas and the density of methane.

Where:

MD_{FL} Methane destroyed through flaring (tCH_4)

MM_{FL} Methane measured sent to flare (tCH_4)

PE_{flare} Project emissions of non-combusted CH_4, expressed in terms of CO_2e, from flaring of the residual gas stream (tCO_2e), calculated according to the "*Tool to determine project emissions from flaring gases containing Methane*"

GWP_{CH4} Global warming potential of methane ($21tCO_2e/tCH_4$)

The project emissions from flaring of the residual gas stream (PE_{flare}) shall be calculated following the procedures described in the "Tool to determine project emissions from flaring gases containing Methane".

To determine project emissions from flaring gases containing methane

For the enclosed flares: Option (a) in the flaring tool of a 90% efficiency default value is used to determine the flare efficiency. Continuous monitoring of compliance with manufacturer's specification of flare (temperature, flow rate of residual gas at the inlet of the flare) must be performed. If in a specific hour any of the parameters are out of the limit of manufacturer's specifications, a 50% default value for the flare efficiency is used for the calculations for the specific hour.

Applicable steps are:

STEP 1: Determination of the mass flow rate of the residual gas that is flared

STEP 2: Determination of the mass fraction of carbon, hydrogen, oxygen and nitrogen in the residual gas

STEP 5: Determination of methane mass flow rate of the residual gas on a dry basis

STEP 6: Determination of the hourly flare efficiency

STEP 7: Calculation of annual project emissions from flaring based on measured hourly values or based on default flare efficiencies.

Option (b) Continuous monitoring of the methane destruction efficiency of the flare (flare efficiency).

The project activity follows the approach described as Option (a) using of 90% default flare efficiency. The manufacturer's specifications for the operation of the flare and the required data and procedures to monitor the flare operation are documented in the EB approved revised monitoring plan. .

STEP 1. Determination of the mass flow rate of the residual gas that is flared

This step calculates the residual gas mass flow rate in each hour *h*, based on the volumetric flow rate and the density of the residual gas. The density of the residual gas is determined using the simplified approach as described in the methodology where only the volumetric fraction of methane is measured and the difference to 100% is considered as nitrogen.

$$FM_{RG,h} = \rho_{RG,n,h} \times FV_{RG,h} \quad (1)$$

Where:

Variable	SI Unit	Description
$FM_{RG,h}$	kg/h	Mass flow rate of the residual gas in hour *h*
$\rho_{RG,n,h}$	kg/m^3	Density of the residual gas at normal conditions in hour *h*
$FV_{RG,h}$	m^3/h	Volumetric flow rate of the residual gas in dry basis at normal conditions in the hour *h*

and:

$$\rho_{RG,n,h} = \frac{P_n}{\frac{R_u}{MM_{RG,h}} \times T_n} \quad (2)$$

Where:

Variable	SI Unit	Description
$\rho_{RG,n,h}$	kg/m^3	Density of the residual gas at normal conditions in hour *h*
P_n	Pa	Atmospheric pressure at normal conditions (101 325)
R_u	Pa.m^3/kmol.K	Universal ideal gas constant (8 314)
$MM_{RG,h}$	kg/kmol	Molecular mass of the residual gas in hour *h*
T_n	K	Temperature at normal conditions (273.15)

and:

$$MM_{RG,h} = \sum_i (fv_{i,h} * MM_i) \quad (3)$$

Where:

Variable	SI Unit	Description
$MM_{RG,h}$	kg/kmol	Molecular mass of the residual gas in hour *h*
$fv_{i,h}$	-	Volumetric fraction of component *i* in the residual gas in the hour *h*
MM_i	kg/kmol	Molecular mass of residual gas component *i*
I		The components CH_4, CO, CO_2, O_2,H_2, N_2

STEP 2. Determination of the mass fraction of carbon, hydrogen, oxygen and nitrogen in the residual gas

Determine the mass fractions of carbon, hydrogen, oxygen and nitrogen in the residual gas, calculated from the volumetric fraction of each component *i* in the residual gas (taken as only methane and nitrogen in accordance with the simplification in the methodology), as follows:

$$fm_{j,h} = \frac{\sum_i fv_{i,h} \cdot AM_j \cdot NA_{j,i}}{MM_{RG,h}} \quad (4)$$

Where:

Variable	SI Unit	Description
$fm_{j,h}$	-	Mass fraction of element *j* in the residual gas in hour *h*
$fv_{i,h}$	-	Volumetric fraction of component *i* in the residual gas in the hour *h*
AM_j	kg/kmol	Atomic mass of element *j*
$NA_{j,i}$	-	Number of atoms of element *j* in component *i*
$MM_{RG,h}$	kg/kmol	Molecular mass of the residual gas in hour *h*
j		The elements carbon, hydrogen, oxygen and nitrogen
i		The components CH_4, CO, CO_2, O_2,H_2, N_2

STEP 5. Determination of methane mass flow rate in the residual gas

The quantity of methane in the residual gas flowing into the flare is the product of the volumetric flow rate of the residual gas ($FV_{RG,h}$), the volumetric fraction of methane in the residual gas ($fv_{CH4,RG,h}$) and the density of methane ($\rho_{CH4,n}$) in the same reference conditions (normal conditions and dry or wet basis). If the residual gas moisture is significant (temperature greater than 60ºC), the measured flow rate of the residual gas that is usually referred to wet basis should be corrected to dry basis due to the fact that the measurement of methane is usually undertaken on a dry basis (i.e. water is removed before sample

analysis). In this case the gas temperature throughout the monitoring period is always less than 60ºC and measurements are made as received, i.e. wet.

$$TM_{RG,h} = FV_{RG,h} \times fv_{CH4,RG,h} \times \rho_{CH4,n} \quad (13)$$

Where:

Variable	SI Unit	Description
$TM_{RG,h}$	kg/h	Mass flow rate of methane in the residual gas in the hour *h*
$FV_{RG,h}$	m^3/h	Volumetric flow rate of the residual gas in dry basis at normal conditions in hour *h*
$fv_{CH4,RG,h}$	-	Volumetric fraction of methane in the residual gas on dry basis in hour *h* (NB: this corresponds to $fv_{i,RG,h}$ where *i* refers to methane).
$\rho_{CH4,n}$	kg/m^3	Density of methane at normal conditions (0.716)

STEP 6. Determination of the hourly flare efficiency

The project has an enclosed flare and the flare efficiency in the hour *h* ($\eta_{flare,h}$) has been calculated after applying the following conditions:

- 0% if the temperature in the exhaust gas of the flare (T_{flare}) is below 500 °C for more than 20 minutes during the hour *h*.
- 50%, if the temperature in the exhaust gas of the flare (T_{flare}) is above 500 °C for more than 40 minutes during the hour *h,* but the manufacturer's specifications on proper operation of the flare are not met at any point in time during the hour *h*.
- 90%, if the temperature in the exhaust gas of the flare (T_{flare}) is above 500 °C for more than 40 minutes during the hour *h* and the manufacturer's specifications on proper operation of the flare are met continuously during the hour *h*.

STEP 7. Calculation of annual project emissions from flaring

Project emissions from flaring are calculated as the sum of emissions from each hour *h*, based on the methane flow rate in the residual gas ($TM_{RG,h}$) and the flare efficiency during each hour *h* ($\eta_{flare,h}$), as follows:

$$PE_{flare,y} = \sum_{h=1}^{8760} TM_{RG,h} \times (1 - \eta_{flare,h}) \times GWP_{CH4} / 1000 \quad \textbf{(18)}$$

Where:

$TM_{RG,h}$ Mass flow rate of methane in the residual gas in the hour h（$kgCH_4/h$）

$\eta_{flare,h}$ Flare efficiency in hour h（%）

GWP_{CH4} Global warming potential of methane valid for the first commitment period（$21tCO_2e/tCH_4$）.

The calculation for $TM_{RG,h}$ is shown below:

$$TM_{RG,h} = FV_{RG,h} \times \omega_{CH4,y} \times D_{CH4} \quad \textbf{(19)}$$

Where:

$FV_{RG,h}$ Volumetric flow rate of the residual gas in dry basis at normal conditions in hour h（m^3/h）

$\omega_{CH4,y}$ *(also PC_{CH4})* Volumetric fraction of methane in the residual gas on dry basis in hour h（%）

D_{CH4} Methane density (tCH_4/m^3CH_4), density of methane under normal conditions of temperature and pressure (20°C and 1atm) is $0.67kg/m^3$ (Revised 1996 IPCC Reference Manual p 1.24 and 1.16)

PE_{UM} Project emissions from un-combusted methane

Not all of the methane sent to power plant and flare will be combusted, so a small amount will escape to the atmosphere. These emissions are calculated using the following:

$$PE_{UM} = GWP_{CH4} \times MM_{ELEC} \times (1 - Eff_{ELEC}) + PE_{flare} \quad \textbf{(20)}$$

Where:

PE_{UM}	Project emissions from un-combusted methane (tCO_2e)
GWP_{CH4}	Global warming potential of methane (21 tCO_2e/tCH_4)
MM_{ELEC}	Methane measured sent to power plant (tCH_4)
Eff_{ELEC}	Efficiency of methane destruction in power plant (%) (taken as 99.5% from IPCC)
PE_{flare}	Project emissions from flaring of the residual gas stream (tCO_2e), calculated inaccordance with formulas (18) and (19)

For the enclosed flares, option a) of the flare tool where a 90% efficiency value is used to determine the flare efficiency. Continuous monitoring of compliance with manufacturer's specification of flare (temperature, flow rate) is performed For temperature, the following efficiencies will be used:

- 0% if the temperature in the exhaust gas of the flare (T_{flare}) is below 500 °C for more than 20 minutes during the hour *h.*
- 50%, if the temperature in the exhaust gas of the flare (T_{flare}) is above 500 °C for more than 40 minutes during the hour *h,* but the manufacturer's specifications on proper operation of the flare are not met at any point in time during the hour *h*.
- 90%, if the temperature in the exhaust gas of the flare (T_{flare}) is above 500 °C for more than 40 minutes during the hour *h* and the manufacturer's specifications on proper operation of the flare are met continuously during the hour *h*.

Sample calculation for PE_y during the period 01/08/2012 – 31/08/2012:

Sample calculation for PE_{ME} during the period 01/08/2012 – 31/08/2012:

Symbol	Value	Units
EF_{ELEC}	1.03025	tCO_2/MWh
$CONS_{ELEC,PJ}$	0	MWh
$PE_{ME}=CONS_{ELEC,PJ} \times EF_{ELEC}$	0	tCO_2e

Sample calculation for PE_{MD} during the period 01/08/2012 – 31/08/2012:

Symbol	Value	Units
CEF_{CH4}	2.75	tCO_2/tCH_4
r	0(as of PC_{NMHC}<1% by lab tests of CMM samples)	MWh
Eff_{ELEC}	99.5	%
MM_{ELEC}	1024	tCH_4
MM_{FL}	0	tCH_4
$MD_{ELEC}=MM_{ELEC} \times Eff_{ELEC}$	1018	tCH_4

$MD_{FL}=\sum_h MMFL,h \times \eta_{flare,h}$	0	tCH_4
$PE_{MD}=(MD_{FL}+MD_{ELEC})\times(CEF_{CH4}+r\times CEF_{NMHC})$	2801	tCO_2e

Sample calculation for PE_{UM} during the period 01/08/2012 – 31/08/2012:

Symbol	Value	Units
GWP_{CH4}	21	tCO_2e/tCH_4
Eff_{ELEC}	99.5	%
MM_{ELEC}	1024	tCH_4
MM_{FL}	0.2	tCH_4
$MD_{ELEC}=MM_{ELEC}\times Eff_{ELEC}$	1018	tCH_4
$MD_{FL}=\sum_h MMFL,h \times \eta_{flare,h}$	0	tCH_4
PE_{flare}	4	tCO_2e
$PE_{UM}=GWP_{CH4}\times MM_{ELEC}\times(1-Eff_{ELEC})+PE_{flare}$	111	tCO_2e

So that $PE_y=PE_{ME}+PE_{MD}+PE_{UM}=0+2{,}801+111=2{,}824\ tCO_2e$

The project emissions are calculated in the attached ER calculation excel spreadsheets, and a summary of the results are provided in section E.4.

E.3. Calculation of leakage

There is no overlap usage between methane consumption in the baseline and the methane consumption by the project activity during the monitoring period therefore there is no leakage to consider in this category

E.4. Summary of calculation of emission reductions or net anthropogenic GHG removals by sinks

Time Period	Baseline emissions or baseline net GHG removals by sinks (tCO_2e)	Project emissions or actual net GHG removals by sinks (tCO_{2e})	Leakage (tCO_2e)	Emission reductions or net anthropogenic GHG removals by sinks (tCO_2e)
19/10/2011-31/08/2012	314,342	34,549	0	279,794

E.5. Comparison of actual emission reductions or net anthropogenic GHG removals by sinks with estimates in registered PDD

Item	Values estimated in ex-ante calculation of registered PDD	Actual values achieved during this monitoring period
Emission reductions or GHG removals by sinks (tCO_2e)	Pro-rata estimate for the current monitoring period of 318 days: 378,748 x 318/365 = 329,978tCO_2e	279,794 tCO_2e

E.6. Remarks on difference from estimated value in registered PDD

There is no **increase** in the actual emission reductions achieved during the current monitoring period from that stated in the registered CDM-PDD. The ex-ante emission reduction calculation of the registered PDD estimates a total of 329,978 tCO_2e for the current monitoring period (calculation as per

table in section E.5), however only 279,794 tCO_2e have actually been generated due to gensets no1, no2 and no3 performance with load reduction during current monitoring period.

History of the document

Version	Date	Nature of revision
02.0	EB 66 13 March 2012	Revision required to ensure consistency with the "Guidelines for completing the monitoring report form" (EB 66, Annex 20).
01	EB 54, Annex 34 28 May 2010	Initial adoption.
Decision Class: Regulatory **Document Type**: Form **Business Function**: Issuance		

Annex 1 Monitoring and Calculation Details

POWER GENERATION

Date / Time Stamp		A	B	C	D	E	F	G	H
Parameter		Volume of gas extracted (m^3)	Average CH_4 concentration (%)	Volume of CH_4 extracted (m^3)	MM_{ELEC} (tCH_4)	MD_{ELEC} (tCH_4)	MM_{ELEC} x (1 - Eff_{ELEC}) (tCH_4)	GEN (MWh)	HEAT (GJ)
from	to	C / B x 100	B	C	C x ρ_{CH4}	D x Eff_{ELEC}	D x (1 - Eff_{ELEC})	∑{GEN(h)}	∑{HEAT(h)}
19-Oct-11	31-Oct-11	1,793,591	34.9	626,742	449	447	2.2	2,568	1,436
01-Nov-11	30-Nov-11	4,288,930	36.2	1,552,613	1,112	1,106	5.6	6,093	5,582
01-Dec-11	31-Dec-11	4,580,582	34.7	1,587,187	1,136	1,131	5.7	6,062	7,570
01-Jan-12	31-Jan-12	4,467,641	37.3	1,665,292	1,192	1,186	6.0	6,416	7,829
01-Feb-12	29-Feb-12	4,293,016	36.3	1,559,484	1,117	1,111	5.6	5,839	7,197
01-Mar-12	31-Mar-12	4,493,484	35.4	1,590,444	1,139	1,133	5.7	6,116	6,870
01-Apr-12	30-Apr-12	4,122,643	34.9	1,438,768	1,030	1,025	5.2	5,479	3,821
01-May-12	31-May-12	3,982,729	35.9	1,430,690	1,024	1,019	5.1	5,251	-
01-Jun-12	30-Jun-12	4,442,761	35.7	1,586,804	1,136	1,130	5.7	5,752	-
01-Jul-12	31-Jul-12	4,351,163	34.6	1,504,881	1,077	1,072	5.4	5,694	-
01-Aug-12	31-Aug-12	4,095,547	34.9	1,429,501	1,024	1,018	5.1	5,563	-

Date / Time Stamp		I	J	K	L	M	N	O	P	Q
Parameter		GEN x EF_{ELEC} (tCO_2e)	HEAT x EF_{HEAT} (tCO_2e)	BE_{USE} (tCO_2e)	BE_{MR} (tCO_2e)	BE (tCO_2e)	PE_{MD} (tCO_2e)	PE_{UM} (tCO_2e)	PE (tCO_2e)	ER (tCO_2e)
from	to	G x EF_{ELEC}	H x EF_{HEAT}	I + J	D x GWP_{CH4}	K + L	E x CEF_{CH4}	F x GWP_{CH4}	N + O	M - P
19-Oct-11	31-Oct-11	2,646	135	2,781	9,424	12,204	1,228	47	1,275	10,929
01-Nov-11	30-Nov-11	6,277	525	6,802	23,345	30,147	3,042	117	3,159	26,989
01-Dec-11	31-Dec-11	6,245	712	6,957	23,865	30,822	3,110	119	3,229	27,593
01-Jan-12	31-Jan-12	6,610	736	7,346	25,039	32,386	3,263	125	3,388	28,998
01-Feb-12	29-Feb-12	6,015	677	6,692	23,448	30,140	3,055	117	3,173	26,968
01-Mar-12	31-Mar-12	6,301	646	6,947	23,914	30,861	3,116	120	3,235	27,625
01-Apr-12	30-Apr-12	5,644	359	6,004	21,633	27,637	2,819	108	2,927	24,710
01-May-12	31-May-12	5,410	-	5,410	21,512	26,922	2,803	108	2,911	24,012
01-Jun-12	30-Jun-12	5,926	-	5,926	23,859	29,785	3,109	119	3,228	26,557
01-Jul-12	31-Jul-12	5,866	-	5,866	22,627	28,494	2,948	113	3,061	25,432
01-Aug-12	31-Aug-12	5,732	-	5,732	21,494	27,226	2,801	107	2,908	24,317

Constants:

Density Methane at normal conditions (ρ_{CH4} = 0.716 kg/m3 at 101,325Pa and 273K as per Flaring tool)
GWP_{CH4} is the Global Warming Potential (GWP) for methane = 21 tCO_2e/tCH_4
CEF_{CH4} is the carbon emission factor of coal mine methane = 2.75tCO_2e/tCH_4
EFF_{ELEC} is efficiency of the methane destruction in the power plant = 99.5% (IPCC)
EF_{ELE} is the emissions factor of electricity (grid, captive or a combination) replaced by project = 1.03025 tCO_2/MWh
EF_{HEAT} is the emissions factor for heat production replaced by project activity = 0.09405 tCO2/GJ
PC CH4 is the methane concentration of CMM gas delivered to the engines
The percentage of non-methane hydrocarbons in the coal mine gas NMHC have been below 1% during the whole monitoring period and, in accordance with the methodology, can be ignored for the emission reduction calculations. See gas analysis laboratory results in Annex 4 (originals will be provided during verification)

Data Collection Process Gensets

The continuous CDM monitoring system at site records data every 30 seconds.

- V-cone differential pressure (dP) to engines (7 V-cones)
- Methane concentration (CH4%) gas delivered to engines (at the manifold pipes on pre-treatment systems for Phase 1 and Phase 2)
- Gauge pressure (P) gas to engines (at the manifold pipes on pre-treatment systems for Phase 1 and Phase 2)
- Barometric pressure
- Gas temperature (T) gas delivered to engines (at the manifold pipes on pre-treatment systems for Phase 1 and Phase 2)

30 seconds input data are used for calculation and outcome is aggregated into hourly, daily etc.

The only CDM parameter that is not recorded with the 30s frequency is the net power output
which although is measured continuously it is manually recorded everyday by a site operator.

Back up data (generators running hours and generators gross power) is continuously recorded from the site PLCs in case CDM monitoring instruments fail to record the gas delivery to the power plant or flare.

Spreadsheets containing 30' readings and calculations are available for verification by the DOE

FLARING

Date / Time Stamp		R	S	T	U	V	W	X
Parameter		Volume of gas extracted (m3)	Average CH4 concentration (%)	Volume of CH4 extracted (m3)	MMFL (tCH4)	MDFL (tCH4)	MMFL x (1 - EffFL) (tCH4)	CONS (MWh)
from	to	T / S x 100	S	T	∑{MMFL(f, h)}	∑{MMFL(f, h) x EffFL(f, h)}	∑{MMFL(f, h) x (1 - EffFL(f, h))}	∑{CONS(h)}
19-Oct-11	31-Oct-11	15822	35.1	5,548	4.0	3.25	0.72	0
01-Nov-11	30-Nov-11	108907	36.3	39,492	28.3	23.61	4.66	0
01-Dec-11	31-Dec-11	18392	34.3	6,308	4.5	3.20	1.32	2
01-Jan-12	31-Jan-12	80751	38.5	31,129	22.3	19.66	2.62	0
01-Feb-12	29-Feb-12	518671	35.3	183,141	131.1	116.07	15.06	0
01-Mar-12	31-Mar-12	261958	34.2	89,615	64.2	54.90	9.27	3
01-Apr-12	30-Apr-12	57729	34.9	20,135	14.4	9.23	5.18	3
01-May-12	31-May-12	162335	35.1	56,966	40.8	34.26	6.53	8
01-Jun-12	30-Jun-12	204971	35.4	72,490	51.9	43.10	8.81	0
01-Jul-12	31-Jul-12	22029	37.4	8,234	5.9	4.11	1.79	4
01-Aug-12	31-Aug-12	683	38.4	262	0.2	-	0.19	0

Date / Time Stamp		Y	Z	AA	AB	AC	AD	AE	AF
Parameter		BEMR (tCO2e)	BE (tCO2e)	CONS x EFELEC (tCO2e)	PEME (tCO2e)	PEMD (tCO2e)	PEUM (tCO2e)	PE (tCO2e)	ER (tCO2e)
from	to	U x GWPCH4	Y	X x EFELEC	AA	V x CEFCH4	W x GWPCH4	AB + AC + AD	Z - AE
19-Oct-11	31-Oct-11	83	83	0	0	9	15	24	59
01-Nov-11	30-Nov-11	594	594	0	0	65	98	163	431
01-Dec-11	31-Dec-11	95	95	2	2	9	28	39	56
01-Jan-12	31-Jan-12	468	468	0	0	54	55	109	359
01-Feb-12	29-Feb-12	2754	2754	0	0	319	316	635	2118
01-Mar-12	31-Mar-12	1347	1347	3	3	151	195	348	999
01-Apr-12	30-Apr-12	303	303	3	3	25	109	137	166
01-May-12	31-May-12	857	857	8	8	94	137	240	617
01-Jun-12	30-Jun-12	1090	1090	0	0	119	185	303	787
01-Jul-12	31-Jul-12	124	124	4	4	11	38	53	71
01-Aug-12	31-Aug-12	4	4	0	0	0	4	4	0

Constants:

Density Methane at normal conditions (ρ_{CH4} = 0.716 kg/m3 at 101,325Pa and 273K as per Flaring tool)
fv CH_4 volumetric fraction of methane in the residual gas delivered to the flare
GWP_{CH4} is the Global Warming Potential (GWP) for methane = 21 $tCO2e/tCH_4$
$CEFCH_4$ is the carbon emission factor of coal mine methane = 2.75$tCO2e/tCH_4$

Data Collection Process Flare

The continuous CDM monitoring system at site records data every 30 seconds.

- V-cone differential pressure (DP) to flare (2 V-cones)
- Methane concentration (CH4%) gas delivered to flare (one at the manifold pipe)
- Gauge pressure (P) gas to flare (one at the manifold)
- Barometric pressure
- Gas temperature (T) gas delivered to flare (one at the manifold pipe)

The methane destruction efficiency of the flare in the hour h is defined (Flaring Tool, Annex 13 of EB28) as the ratio between the mass flow rate of methane delivered to the flare and the mass flow rate of methane in residual gas stream that is flared (both on dry basis and normal conditions).

In the case of enclosed flares there is a set of default values for the flare efficiency according to the performance of the flare. These sets values are:

- Eff_{flare} = 0% if the temperature in the exhaust gas of the flare (Tflare) is below 500 °C for more than 20 minutes during the hour h.

- Eff_{flare} = 50%, if the temperature in the exhaust gas of the flare (Tflare) is above 500 °C for more than 40 minutes during the hour h, but the manufacturer's specifications on proper operation of the flare are not met at any point in time during the hour h.

- Eff_{flare} = 90%, if the temperature in the exhaust gas of the flare (Tflare) is above 500 °C for more than 40 minutes during the hour h and the manufacturer's specifications on proper operation of the flare are met continuously during the hour h.

Spreadsheets containing 30'' readings and calculations are available for verification by the DOE

Annex 2 CDM Monitoring equipment calibration dates

Table 2.1 CDM monitoring equipment calibration prior monitoring period MR7

No.	Name	Instrument type	SN	scale	calibration certificate	Calibration date	Calibration validity	Accuracy class	
								accuracy class	Reference source
1	flare gas T	WZPK-340 (Pt100)	1	0-100 C	JZRX20115250	2011-6-21	1 year	Class A (allowable deviation ±(0.15+0.002ltl))	Manufacturer Technical Specification
2	phase 1 engine gas T	WZP-240(PT100)	908273	-200-450 C	JZRX20115249	2011-6-21	1 year	Class A (allowable deviation ±(0.15+0.002ltl))	Manufacturer Technical Specification
3	phase 2 engine gas T	Honeywell STT830-171-TC.M1.W1.CD-WEEO-H06S-R2U6-A05TR080-2D-000	080625368	0-100C	JZRX20115320	2011-8-3	1 year	0.3Cor ±0.1% of span	Manufacturer Technical Specification
6	Flare thermal couples	Honeywell STT830-173-TC.M3.W1.CD-WEEO-H10S-T7G6-A05T(Y)240-2D-000	070668960	0-1300 C	JZRX20115318	2011-8-3	1 year	Class I (allowable deviation ±(0.0075ltl))	Manufacturer Technical Specification
			080609834	0-1300 C	JZRX20115239	2011-6-8	1 year		
			0931800104 (080104620)	0-1300 C	JZRX20115336	2011-8-11	1 year		
7	flare gas P	3051 TG1A2B21AB4E5M5	4793856	0-207 kPa	JZYL20116180	2011-7-14	1 year	±0.075%	Manufacturer Technical Specification
8	phase 1 engine gas P	KH-AFY801	72848	0-40 kPa	JZYL20116181	2011-7-15	1 year	±0.5%	Manufacturer Technical Specification
		KH-AFY801	114932	0-40 kPa	JZYL20116262	2011-9-8	1 year	±0.5%	Manufacturer Technical Specification
9	phase 2 engine gas P	Rosemount 3051 TG1A2B21AE5Q4	5659587	-20-20 kPa	JZYL20100311	2011-12-13	1 year	±0.075%	Manufacturer Technical Specification
10	Flare CH4%	Guardian plus, model:97460	32624	0-100%	JZYL20116124	2011-6-1	1 year	±2.5%	Manufacturer Technical Specification

11	phase 1 engine CH4%	Guardian plus, model:97460	26062	0-100%	JZYL20116173	2011-7-15	1 year	±2.5%	Manufacturer Technical Specification
12	phase 2 engine CH4%	Guardian plus, model:97460	29782	0-100%	JZYL20116120	2011-6-1	1 year	±2.5%	Manufacturer Technical Specification
13	barometric pressure	Rosemount TA1A2B21JE5Q4	4980061	0-141.33 kPa	JZYL20116171	2011-7-7	1 year	±0.075%	Manufacturer Technical Specification
15	V-cone engine 1	MOORE-KINGWAYS (SHANGHAI)CONTROL SYSTEM CO.,LTD KVW08IIKC24FWN	7092005	237.5-1900 m3/hr	TE10-JZ0013	2010-7-27	2 years	±0.5%	Manufacturer Technical Specification
16	DP engines 1	Rosemount 3051 CD1A22A1AM5B4K5	4879836	0-6.22 kPa	JZYL20116175	2011-7-14	1 year	±0.075%	Manufacturer Technical Specification
17	V-cone engine 2	MOORE-KINGWAYS (SHANGHAI)CONTROL SYSTEM CO.,LTD KVW08IIKC24FWN	7092003	237.5-1900 m3/hr	TE10-JZ0015	2010-7-27	2 years	±0.5%	Manufacturer Technical Specification
18	DP engines 2	Rosemount 3051 CD1A22A1AM5B4K5	4879835	0-6.22 kPa	JZYL20116176	2011-7-14	1 year	±0.075%	Manufacturer Technical Specification
19	V-cone engine 3	MOORE-KINGWAYS (SHANGHAI)CONTROL SYSTEM CO.,LTD KVW08IIKC24FWN	7092004	237.5-1900 m3/hr	TE10-JZ0014	2010-7-27	2 years	±0.5%	Manufacturer Technical Specification
20	DP engines 3	Rosemount 3051 CD1A22A1AM5B4K5	4870527	0-6.22 kPa	JZYL20116177	2011-7-14	1 year	±0.075%	Manufacturer Technical Specification
21	V-cone 1# for flare	MOORE-KINGWAYS (SHANGHAI)CONTROL SYSTEM CO.,LTD KVW10IIAB24FWN	7102301	250-3000 m3/hr	TE10-JZ0012	2010-7-27	2 years	±0.5%	Manufacturer Technical Specification
22	DP 1# for flare	Rosemount 3051 CD1A22A1AM5B4K5	4870526	0-6.22KPa	JZYL20116179	2011-7-14	1 year	±0.075%	Manufacturer Technical Specification

23	V-cone 2# for flare	MOORE-KINGWAYS (SHANGHAI)CONTROL SYSTEM CO.,LTD KVW10IIAB24FWN	7102302	250-3000m3/hr	TE10-JZ0011	2010-7-27	2 years	±0.5%	Manufacturer Technical Specification
24	DP 2# for flare	Rosemount 3051 CD1A22A1AM5B4K5	4870528	0-6.22 kPa	JZYL20116178	2011-7-14	1 year	±0.075%	Manufacturer Technical Specification
25	V-cone engine 4	Moore-Kingways (ShangHai) control system Co, Ltd. KVS06ⅡKC23FSN	9061201	200-2000 m3/hr	TE10-JZ0003	2010-4-20	2 years	±0.5%	Manufacturer Technical Specification
26	DP engines 4	Rosemount 3051 CD1A22A1AM5B4K5	5058739	0-6.216 kPa	JZYL 20116054	2011-4-13	1 year	±0.075%	Manufacturer Technical Specification
27	V-cone engine 5	Moore-Kingways (ShangHai) control system Co, Ltd. KVS06ⅡKC23FSN	9061203	200-2000 m3/hr	TE10-JZ0001	2010-4-20	2 years	±0.5%	Manufacturer Technical Specification
28	DP engines 5	Rosemount 3051 CD1A22A1AM5B4K5	5058740	0-6.216 kPa	JZYL 20116055	2011-4-13	1 year	±0.075%	Manufacturer Technical Specification
29	V-cone engine 6	Moore-Kingways (ShangHai) control system Co, Ltd. KVS06ⅡKC23FSN	9061204	200-2000m3/hr	TE10-JZ0004	2010-4-20	2 years	±0.5%	Manufacturer Technical Specification
30	DP engines 6	Rosemount 3051 CD1A22A1AM5B4K5	5058741	0-6.216 kPa	JZYL 20116056	2011-4-13	1 year	±0.075%	Manufacturer Technical Specification
31	V-cone engine 7	Moore-Kingways (ShangHai) control system Co, Ltd. KVS06ⅡKC23FSN	9061202	200-2000m3/hr	TE10-JZ0002	2010-4-20	2 years	±0.5%	Manufacturer Technical Specification
32	DP engine 7	Rosemount 3051 CD2A22A1ADFE5Q4	5525313	0-6.216 kPa	JZYL20100288	2010-11-30	1 year	±0.075%	Manufacturer Technical Specification
33	6.3KV power meter	Jiangsu linyang Electronics Co., Ltd DSSD71	0073		JZDN 20101030	2010-7-21	1 year	Active power：0.5S/1.0	Manufacturer Technical Specification
		Jiangsu linyang Electronics Co., Ltd DSSD71	0040		JZDN20111010	2011-7-19	1 year	Active power：0.5S/1.0	Manufacturer Technical Specification

34	35KV power meter	Weisheng Group DSSD331	09080130690001		JZDN 20101057	2010-8-18	1 year	Active power：0.2S	Manufacturer Technical Specification
		Weisheng Group DSSD331	11030599360019		JZDN20111009	2011-7-11	1 year	Active power：0.2S	Manufacturer Technical Specification
35	V-cone for oil	MOORE-KINGWAYS (SHANGHAI)CONTROL SYSTEM CO.,LTD KVW06IIAB24FWN	9102801	18000-180000 Kg/hr	TE11-JZ0008	2011-8-12	2013-8-11	±0.5%	Manufacturer Technical Specification
36	DP for oil	Rosemount: 3051CD2A22A1AM5B4K5	4870525	0-62.2 kPa	TE11-JZ0009	2011-8-12	2012-8-11	±0.075%	Manufacturer Technical Specification
37	T- Oil outlet	SBWZPK-241	611052	0-300 C	JZRX20115321	2011-8-3	2012-8-2	Class A (allowable deviation ±(0.15+0.002ltl))	Manufacturer Technical Specification
38	T- Oil return	Shanghai Hongda WZPK（Pt100）	070907964	0-200 C	JZRX20115319	2011-8-3	2012-8-2	Class A (allowable deviation ±(0.15+0.002ltl))	Manufacturer Technical Specification

Table 2.2 CDM monitoring equipment calibration during monitoring period MR7

No.	Name	Instrument type	SN	scale	calibration	Calibration	Calibration	Accuracy class

					certificate	date	validity	accuracy class	Reference source
1	Flare gas T	shanghai Hongda WZPK（Pt100）	070907963	0-100 C	JZRX20122125	2012-6-5	1 year	Class A (allowable deviation ±(0.15+0.002ltl))	Manufacturer Technical Specification
2	Phase 1 engine gas T	Anhui Tiankang WZP-240 (Pt100)	----	-200-450 C	JZRX20122402	2012-6-5	1 year	Class A (allowable deviation ±(0.15+0.002ltl))	Manufacturer Technical Specification
3	Phase 2 engine gas T	Zhejiang Lunte WZPK-270	2012031768	-200-350 C	JZRX20122401	2012-6-5	1 year	Class A ± (0.15+0.002 ltl)	Manufacturer Technical Specification
4	Flare thermal couples	Honeywell STT830-173-TC.M3.W1.CD-WEEO-H10S-T7G6-A05T(Y)240-2D-000	080609834	0-1300 C	JZRX20122128	2012-6-5	1 year	Class I (allowable deviation ±(0.0075ltl))	Manufacturer Technical Specification
			09-3180-01-04	0-1300 C	JZRX20122127	2012-6-5	1 year	Class I (allowable deviation ±(0.0075ltl))	Manufacturer Technical Specification
		Zhejiang Lunte H-WRNK-240-J	2012031767	0-1300 C	JZRX20121462	2012-3-23	1 year	Class I ± 1.5 or ± 0.4%ltl	Manufacturer Technical Specification
5	Flare gas P	Rosemount 3051 TG1A2B21AB4E5M5	4793856	0-207 kPa	JZYL20129546	2012-5-8	1 year	±0.075%	Manufacturer Technical Specification
6	Phase 1 engine gas P	Hefei Keheng Automation Instrument KH-AFY801	114932	0-40 kPa	JZYL20129545	2012-5-8	1 year	±0.5%	Manufacturer Technical Specification
7	Phase 2 engine gas P	Rosemount 3051 TG1A2B21AE5Q4	5659587	-20-20 kPa	JZYL20116411	2011-11-14	1 year	±0.075%	Manufacturer Technical Specification
8	Flare CH4%	Guardian plus, model:97460	32624	0-100%	JZYL20129536	2012-5-8	1 year	±2.5%	Manufacturer Technical Specification

9	Phase 1 engine CH4%	Guardian plus, model:97460	26062	0-100%	JZYL20129537	2012-5-8	1 year	±2.5%	Manufacturer Technical Specification
10	Phase 2 engine CH4%	Guardian plus, model:97460	29782	0-100%	JZYL20129538	2012-5-8	1 year	±2.5%	Manufacturer Technical Specification
11	Barometric pressure	Rosemount 3051 TA1A2B21AB4E5Q4	1794561	0-207 kPa	JZYL20126563	2012-6-6	1 year	±0.075%	Manufacturer Technical Specification
12	V-cone engine 1	MOORE-KINGWAYS (SHANGHAI)CONTROL SYSTEM CO.,LTD KVW08IIKC24FWN	7092005	237.5-1900 m3/hr	TE12-JZ1007	2012-4-18	2 year	±0.5%	Manufacturer Technical Specification
13	DP engines 1	Rosemount 3051 CD1A22A1AM5B4K5	4879836	0-6.22 kPa	JZYL20129542	2012-5-8	1 year	±0.075%	Manufacturer Technical Specification
14	V-cone engine 2	MOORE-KINGWAYS (SHANGHAI)CONTROL SYSTEM CO.,LTD KVW08IIKC24FWN	7092003	237.5-1900 m3/hr	TE12-JZ1009	2012-4-18	2 year	±0.5%	Manufacturer Technical Specification
15	DP engines 2	Rosemount 3051 CD1A22A1AM5B4K5	4879835	0-6.22 kPa	JZYL20129543	2012-5-8	1 year	±0.075%	Manufacturer Technical Specification
16	V-cone engine 3	MOORE-KINGWAYS (SHANGHAI)CONTROL SYSTEM CO.,LTD KVW08IIKC24FWN	7092004	237.5-1900 m3/hr	TE12-JZ1008	2012-4-18	2 year	±0.5%	Manufacturer Technical Specification
17	DP engines 3	Rosemount 3051 CD1A22A1AM5B4K5	4870527	0-6.22 kPa	JZYL20129544	2012-5-8	1 year	±0.075%	Manufacturer Technical Specification
18	V-cone 1# flare	MOORE-KINGWAYS (SHANGHAI)CONTROL SYSTEM CO.,LTD KVW10IIAB24FWN	7102301	250-3000 m3/hr	TE12-JZ1006	2012-4-18	2 year	±0.5%	Manufacturer Technical Specification

19	DP 1# flare	Rosemount 3051 CD1A22A1AM5B4K5	4870526	0-6.22 kPa	JZYL20129540	2012-5-8	1 year	±0.075%	Manufacturer Technical Specification
20	V-cone 2# flare	MOORE-KINGWAYS (SHANGHAI)CONTROL SYSTEM CO.,LTD KVW10IIAB24FWN	7102302	250-3000 m3/hr	TE12-JZ1005	2012-4-18	2 year	±0.5%	Manufacturer Technical Specification
21	DP 2# flare	Rosemount 3051 CD1A22A1AM5B4K5	4870528	0-6.22 kPa	JZYL20129541	2012-5-8	1 year	±0.075%	Manufacturer Technical Specification
22	V-cone engine 4	Moore-Kingways (ShangHai) control system Co, Ltd. KVS06Ⅱ KC23FSN	9061201	200-2000 m3/hr	TE12-JZ1003	2012-4-18	2 year	±0.5%	Manufacturer Technical Specification
23	DP engines 4	Rosemount 3051 CD1A22A1AM5B4K5	5058739	0-6.216 kPa	JZYL20129548	2012-4-10	1 year	±0.075%	Manufacturer Technical Specification
24	V-cone engine 5	Moore-Kingways (ShangHai) control system Co, Ltd. KVS06Ⅱ KC23FSN	9061203	200-2000 m3/hr	TE12-JZ1001	2012-4-18	2 year	±0.5%	Manufacturer Technical Specification
25	DP engines 5	Rosemount 3051 CD1A22A1AM5B4K5	5058740	0-6.216 kPa	JZYL20129549	2012-4-10	1 year	±0.075%	Manufacturer Technical Specification
26	V-cone engine 6	Moore-Kingways (ShangHai) control system Co, Ltd. KVS06Ⅱ KC23FSN	9061204	200-2000 m3/hr	TE12-JZ1004	2012-4-18	2 year	±0.5%	Manufacturer Technical Specification
27	DP engines 6	Rosemount 3051 CD1A22A1AM5B4K5	5058741	0-6.216 kPa	JZYL20129547	2012-4-10	1 year	±0.075%	Manufacturer Technical Specification
28	V-cone engine 7	Moore-Kingways (ShangHai) control system Co, Ltd. KVS06Ⅱ KC23FSN	9061202	200-2000 m3/hr	TE12-JZ1002	2012-4-18	2 year	±0.5%	Manufacturer Technical Specification
29	DP engines 7	Rosemount 3051 CD2A22A1ADFE5Q4	5525313	0-20 kPa	JZYL20116410	2011-11-14	1 year	±0.075%	Manufacturer Technical Specification

30	V-cone for oil	MOORE-KINGWAYS (SHANGHAI)CONTROL SYSTEM CO.,LTD KVW06IIAB24FWN	9102801	18000-180000 Kg/hr	TE11-JZ0008	2011-8-12	2 year	±0.5%	Manufacturer Technical Specification
31	DP for oil	Rosemount: 3051CD2A22A1AM5B4K5	4870525	0-62.2 kPa	JZYL20129539	2012-5-8	1 year	±0.075%	Manufacturer Technical Specification
32	T- Oil outlet	SBWZPK-241	611052	0-300 C	JZRX20122198	2012-6-10	1 year	Class A (allowable deviation ±(0.15+0.002ltl))	Manufacturer Technical Specification
33	T- Oil return	Shanghai Hongda WZPK（Pt100）	070907964	0-200 C	JZRX20122197	2012-6-10	1 year	Class A (allowable deviation ±(0.15+0.002ltl))	Manufacturer Technical Specification
34	6.3KV power meter	Jiangsu linyang Electronics Co., Ltd DSSD71	0073		JZDN20121526	2012-6-13	1 year	Active power：0.5S/1.0	Manufacturer Technical Specification
35	35KV power meter	Weisheng Group DSSD331	09080130690001		JZDN20121525	2012-6-13	1 year	Active power：0.2S	Manufacturer Technical Specification

Annex 3 CDM instruments removal and installation dates

Table 3.1 CDM instruments removal and installation dates for CDM Instrumentation

No.	Location	Instrument type	SN	scale	2011 Calibration Date	Removal Date for calibration	2012 Calibration Date	Installation Date after calibration
1	flare gas T	WZPK-340 (Pt100)	1	0-100 C	2011-6-21	2012-6-7	-	-
		shanghai Hongda WZPK（Pt100）	070907963	0-100 C	-	-	2012-6-5	2012-6-7
2	phase 1 engine gas T	WZP-240(PT100)	908273	-200-450 C	2011-6-21	2012-6-7	-	-
		Anhui Tiankang WZP-240 (Pt100)	----	-200-450 C	-	-	2012-6-4	2012-6-7
3	phase 2 engine gas T	Honeywell STT830-171-TC.M1.W1.CD-WEEO-H06S-R2U6-A05TR080-2D-000	080625368	0-100 C	2011-8-3	2012-6-7	-	-
		Zhejiang Lunte WZPK-270	2012031768	-200-350 C	-	-	2012-6-4	2012-6-7
4	Flare thermocouple	Honeywell STT830-173-TC.M3.W1.CD-WEEO-H10S-T7G6-A05T(Y)240-2D-000	070668960	0-1300 C	2011-8-3	2012-2-11	-	-
		Zhejiang Lunte mechanical and electrical Limited company H-WRNK-240-J	2012031767	0-1300 C	-	-	2012-3-23	2012-3-29
		Honeywell STT830-173-TC.M3.W1.CD-WEEO-H10S-T7G6-A05T(Y)240-2D-000	080609834	0-1300 C	2011-6-8	2012-6-2	2012-6-4	2012-6-7
			09-3180-01-04	0-1300 C	2011-8-11	2012-6-2	2012-6-4	2012-6-7
5	flare gas P	Rosemount 3051 TG1A2B21AB4E5M5	4793856	0-207 kPa	2011-7-14	Calibrated on site	2012-5-8	Calibrated on site
6	phase 1 engine gas P	Hefei Keheng Automation Instrument KH-AFY801	114932	0-40 kPa	2011-9-8	Calibrated on site	2012-5-8	Calibrated on site

7	phase 2 engine gas P	Rosemount 3051 TG1A2B21AE5Q4	5659587	-20-20 kPa	2011.11.14	Calibrated on site	-	Calibrated on site
8	Flare CH4%	Guardian plus, model:97460	32624	0-100 %	2011-6-1	Calibrated on site	2012-5-8	Calibrated on site
9	phase 1 engine CH4%	Guardian plus, model:97460	26062	0-100 %	2011-7-15	Calibrated on site	2012-5-8	Calibrated on site
10	phase 2 engine CH4%	Guardian plus, model:97460	29782	0-100 %	2011-6-1	Calibrated on site	2012-5-8	Calibrated on site
11	barometric pressure	Rosemount TA1A2B21JE5Q4	4980061	0-141.33 kPa	2011-7-7	2012-6-13	-	-
		Rosemount 3051 TA1A2B21AB4E5Q4	1794561	0-207 kPa	-	-	2012-6-6	2012-6-13
12	V-cone engine 1	MOORE-KINGWAYS (SHANGHAI)CONTROL SYSTEM CO.,LTD KVW08IIKC24FWN	7092005	237.5-1900 m3/hr	2010-7-27	2012-4-14	2012-4-18	2012-4-19
13	DP engines 1	Rosemount 3051 CD1A22A1AM5B4K5	4879836	0-6.22 kPa	2011-7-14	Calibrated on site	2012-5-8	Calibrated on site
14	V-cone engine 2	MOORE-KINGWAYS (SHANGHAI)CONTROL SYSTEM CO.,LTD KVW08IIKC24FWN	7092003	237.5-1900 m3/hr	2010-7-27	2012-4-14	2012-4-18	2012-4-19
15	DP engines 2	Rosemount 3051 CD1A22A1AM5B4K5	4879835	0-6.22 kPa	2011-7-14	Calibrated on site	2012-5-8	Calibrated on site
16	V-cone engine 3	MOORE-KINGWAYS (SHANGHAI)CONTROL SYSTEM CO.,LTD KVW08IIKC24FWN	7092004	237.5-1900 m3/hr	2010-7-27	2012-4-14	2012-4-18	2012-4-19
17	DP engines 3	Rosemount 3051 CD1A22A1AM5B4K5	4870527	0-6.22 kPa	2011-7-14	Calibrated on site	2012-5-8	Calibrated on site
18	V-cone 1# for flare	MOORE-KINGWAYS (SHANGHAI)CONTROL	7102301	250-3000 m3/hr	2010-7-27	2012-4-14	2012-4-18	2012-4-19

		SYSTEM CO.,LTD KVW10IIAB24FWN						
19	DP 1# for flare	Rosemount 3051 CD1A22A1AM5B4K5	4870526	0-6.22 kPa	2011-7-14	Calibrated on site	2012-5-8	Calibrated on site
20	V-cone 2# for flare	MOORE-KINGWAYS (SHANGHAI)CONTROL SYSTEM CO.,LTD KVW10IIAB24FWN	7102302	250-3000 m3/hr	2010-7-27	2012-4-14	2012-4-18	2012-4-19
21	DP 2# for flare	Rosemount 3051 CD1A22A1AM5B4K5	4870528	0-6.22 kPa	2011-7-14	Calibrated on site	2012-5-8	Calibrated on site
22	V-cone engine 4	Moore-Kingways (ShangHai) control system Co, Ltd. KVS06Ⅱ KC23FSN	9061201	200-2000 m3/hr	2010-4-20	2012-4-15	2012-4-18	2012-4-19
23	DP engines 4	Rosemount 3051 CD1A22A1AM5B4K5	5058739	0-6.216Kpa	2011-4-13	Calibrated on site	2012-4-10	Calibrated on site
24	V-cone engine 5	Moore-Kingways (ShangHai) control system Co, Ltd. KVS06Ⅱ KC23FSN	9061203	200-2000 m3/hr	2010-4-20	2012-4-15	2012-4-18	2012-4-19
25	DP engines 5	Rosemount 3051 CD1A22A1AM5B4K5	5058740	0-6.216Kpa	2011-4-13	Calibrated on site	2012-4-10	Calibrated on site
26	V-cone engine 6	Moore-Kingways (ShangHai) control system Co, Ltd. KVS06Ⅱ KC23FSN	9061204	200-2000 m3/hr	2010-4-20	2012-4-15	2012-4-18	2012-4-19
27	DP engines 6	Rosemount 3051 CD1A22A1AM5B4K5	5058741	0-6.216 kPa	2011-4-13	Calibrated on site	2012-4-10	Calibrated on site
28	V-cone engine 7	Moore-Kingways (ShangHai) control system Co, Ltd. KVS06Ⅱ KC23FSN	9061202	200-2000 m3/hr	2010-4-20	2012-4-15	2012-4-18	2012-4-19
29	DP engines 7	Rosemount CD2A22A1ADFE5Q4	5525313	0-6.216 kPa	2011-11-14	Calibrated on site	-	Calibrated on site
30	V-cone for oil	MOORE-KINGWAYS (SHANGHAI)CONTROL SYSTEM CO.,LTD KVW06IIAB24FWN	9102801	18000-180000 Kg/hr	2011-8-12	-	-	-

31	DP for oil	Rosemount: 3051CD2A22A1AM5B4K5	4870525	0-62.2 kPa	2011-8-12	Calibrated on site	2012-5-8	Calibrated on site
32	T- Oil outlet	SBWZPK-241	611052	0-300 C	2011-8-3	2012-6-7	2012-6-8	2012-6-13
33	T- Oil return	Shanghai Hongda WZPK（Pt100）	070907964	0-200 C	2011-8-3	2012-6-7	2012-6-8	2012-6-13
34	6.3KV power meter	Jiangsu linyang Electronics Co., Ltd DSSD71	0040	-	2011-7-19	2012-6-19	-	-
		Jiangsu linyang Electronics Co., Ltd DSSD71	0073	-	-	-	2012-6-13	2012-6-19
35	35KV power meter	Weisheng Group DSSD331	11030599360019	-	2011-7-11	2012-6-13	-	-
			09080130690001	-	-	-	2012-6-13	2012-6-13

Annex 4 Gas analysis Duerping drainage station results by TES Bretby

ESG Environmental Scientifics Group

TEST REPORT

UKAS TESTING 1205

Customer: Sindicatum Sustainable Resources, 34 Highland Road, Mansfield, Nottingham, NG18 4PT
Date Received: 10 August 2012 Date Sampled: 30 July 2012
Date Analysed: 10 August 2012 Site: Beishigou Report № 45019

Tube Number	Sample Reference	Analysis % v/v							
		Methane (CH_4)	Ethane (C_2H_6)	Propane (C_3H_8)	n-Butane (n-C_4H_{10})	n-Pentane (n-C_5H_{12})	n-Hexane (n-C_6H_{14})	n-Heptane (n-C_7H_{16})	n-Octane (n-C_8H_{18})
SCC42	Beishigou	37	0.0548	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
SCC5	Beishigou	36	0.0539	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
SCC3	Beishigou	36	0.0545	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Accuracy of Analytical Method		±1.0	±0.0005	±0.0005	±0.0005	±0.0005	±0.0005	±0.0005	±0.0005
Method of Analysis		3	3	3	3	3	3	3	3

Method of Analysis: 1 Infra Red 2 Paramagnetic 3 G.C. with F.I.D.
Analyst: D. Rayson

Customer Analytical Requirements	Requirements requested via	Authorised by:
CH_4, C_2H_6, C_3H_8, n-C_4H_{10}, n-C_5H_{12}, n-C_6H_{14}, n-C_7H_{14}, n-C_8H_{18}	Phone	B. Royals

Authorised by:

B. Royals
Technical Manager

Issue Date: 16 August 2012

Page: 3 of 3
END OF REPORT

Annex 5 Special CDM data events

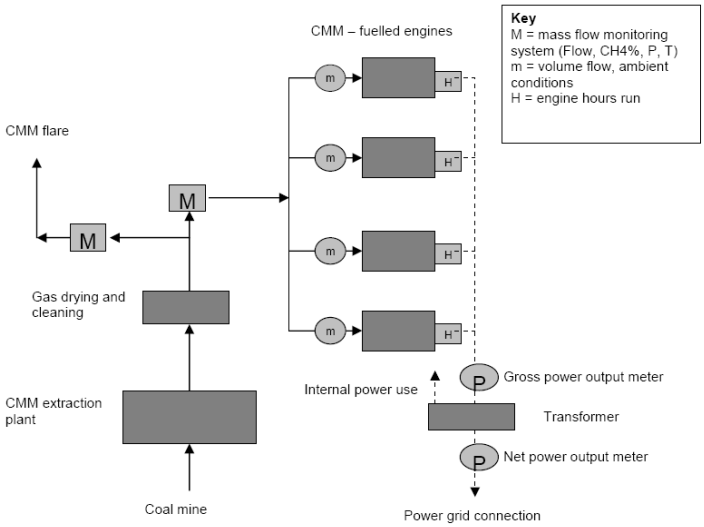
Table 5.1 Special CDM data events

Start time (GMT)	End time (GMT)	Length of event (hh:mm:ss)	Event / Cause	Action taken
01-02-2012 17:14:00	01-02-2012 21:23:00	04:09:00	No flare CH4% while flare running	Replace CH4% from phase 1 engines
01-02-2012 21:58:30	01-02-2012 23:35:30	01:37:00	No flare CH4% while flare running	Replace CH4% from phase 1 engines
20-02-2012 19:17:30	20-02-2012 22:47:00	03:29:30	No flare CH4% while flare running	Replace CH4% from phase 1 engines
21-02-2012 19:21:30	21-02-2012 21:29:30	02:08:00	No flare CH4% while flare running	Replace CH4% from phase 1 engines
03-08-2012 06:03:30	03-08-2012 06:50:00	00:46:30	Phase 2 engine pressure display -20kPa while engines running	Back calculation from Gross Power
14-04-2012 09:09:00	19-04-2012 02:29:00	113:20:00	No engine1 DP recorded during v-cone removal for calibration	Back calculation from Gross Power
14-04-2012 09:50:30	19-04-2012 03:43:30	113:53:00	No engine2 DP recorded during v-cone removal for calibration	Back calculation from Gross Power
14-04-2012 09:13:30	19-04-2012 05:58:30	116:45:00	No engine3 DP recorded during v-cone removal for calibration	Back calculation from Gross Power
15-04-2012 16:33:30	19-04-2012 04:40:00	84:06:30	No engine4 DP recorded during v-cone removal for calibration	Back calculation from Gross Power
15-04-2012 03:11:30	19-04-2012 07:23:00	100:11:30	No engine5 DP recorded during v-cone removal for calibration	Back calculation from Gross Power
15-04-2012 04:23:00	19-04-2012 08:07:30	99:44:30	No engine6 DP recorded during v-cone removal for calibration	Back calculation from Gross Power
15-04-2012 05:11:00	19-04-2012 08:44:00	99:33:00	No engine7 DP recorded during v-cone removal for calibration	Back calculation from Gross Power

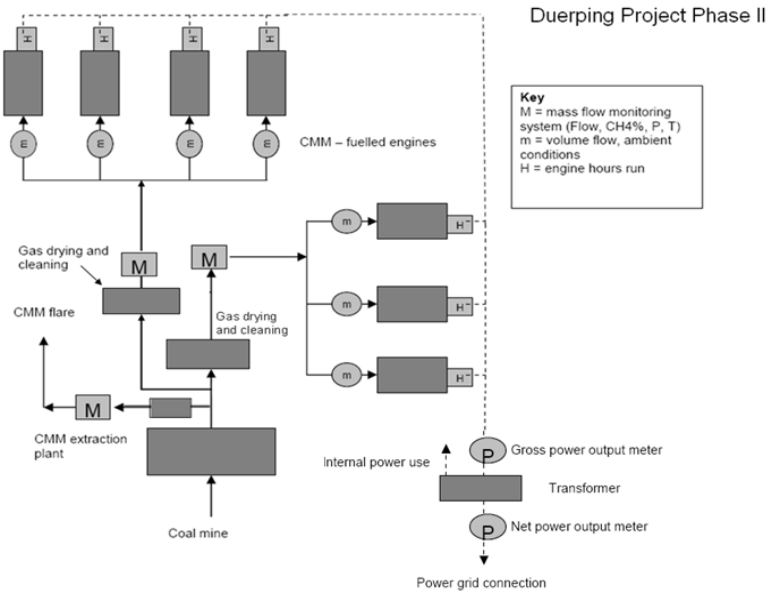
Annex 6 Process flow diagrams

The locations of methane flow monitoring to the CMM utilization plant are shown in the schematic below. Monitoring of the waste heat supply from the engines to the shaft heater has been excluded from the diagram for clarity.

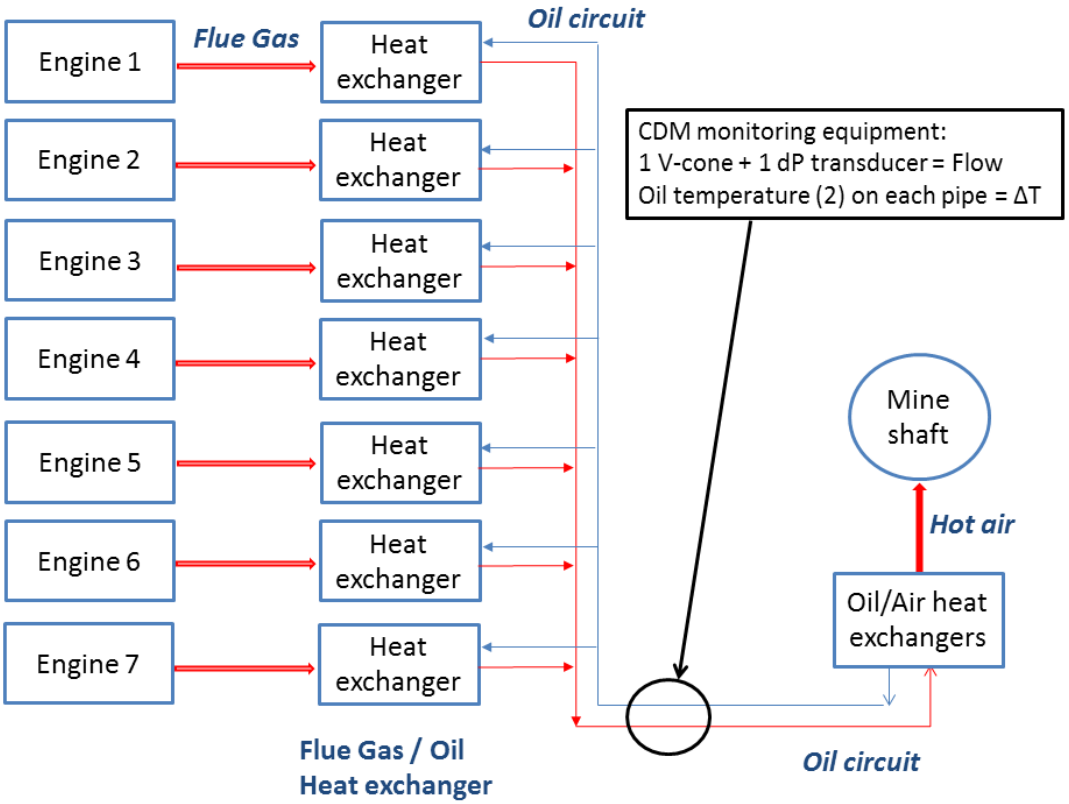
Schematic Flow Diagram showing completed project:



Detailed flow diagram showing completed project:



Detailed flow diagram showing heat recovery system:



Annex 7 Missing CDM data

Table Annex 7 CDM Missing data within MR7 monitoring period		
Start Time	**End Time**	**Length (hh:mm:ss)**
10:30:30 24-10-2011	10:30:30 24-10-2011	00:00:00
22:18:30 09-11-2011	22:20:30 09-11-2011	00:02:00
03:10:30 11-01-2012	03:10:30 11-01-2012	00:00:00
13:48:30 11-01-2012	13:51:30 11-01-2012	00:03:00
08:14:30 29-02-2012	08:44:00 29-02-2012	00:29:30
23:18:30 14-03-2012	00:37:30 15-03-2012	01:19:00
09:26:30 15-03-2012	10:03:30 15-03-2012	00:37:00
23:00:30 15-03-2012	23:23:00 15-03-2012	00:22:30
10:04:30 16-03-2012	10:18:00 16-03-2012	00:13:30
13:00:30 18-03-2012	13:02:00 18-03-2012	00:01:30
14:24:30 19-03-2012	14:26:30 19-03-2012	00:02:00
08:54:30 20-03-2012	08:56:30 20-03-2012	00:02:00
01:18:30 28-03-2012	01:38:00 28-03-2012	00:19:30
03:44:30 28-03-2012	03:55:00 28-03-2012	00:10:30
09:38:30 03-04-2012	09:38:30 03-04-2012	00:00:00
00:08:30 06-04-2012	01:04:00 06-04-2012	00:55:30
06:12:30 06-04-2012	06:28:00 06-04-2012	00:15:30
00:18:30 09-04-2012	00:55:30 09-04-2012	00:37:00
06:44:30 09-04-2012	07:25:30 09-04-2012	00:41:00
08:43:30 12-04-2012	08:57:30 12-04-2012	00:14:00
14:16:30 12-04-2012	14:16:30 12-04-2012	00:00:00
00:30:30 14-04-2012	00:56:00 14-04-2012	00:25:30
07:52:30 14-04-2012	08:04:30 14-04-2012	00:12:00
08:14:30 16-04-2012	08:16:00 16-04-2012	00:01:30
00:32:30 17-04-2012	01:15:30 17-04-2012	00:43:00
03:32:30 17-04-2012	03:33:30 17-04-2012	00:01:00
03:34:30 17-04-2012	03:36:00 17-04-2012	00:01:30
07:40:30 17-04-2012	07:58:30 17-04-2012	00:18:00
08:10:30 17-04-2012	08:12:00 17-04-2012	00:01:30
00:34:30 18-04-2012	01:00:30 18-04-2012	00:26:00
06:06:30 18-04-2012	06:20:30 18-04-2012	00:14:00
23:34:30 25-04-2012	07:48:00 26-04-2012	08:13:30
00:30:30 27-04-2012	00:57:00 27-04-2012	00:26:30
03:36:30 27-04-2012	03:46:00 27-04-2012	00:09:30
05:30:30 02-05-2012	05:49:00 02-05-2012	00:18:30
10:04:30 02-05-2012	10:16:30 02-05-2012	00:12:00
01:22:00 07-05-2012	01:22:00 07-05-2012	00:00:00
01:04:30 22-05-2012	01:21:00 22-05-2012	00:16:30
07:50:30 22-05-2012	08:02:00 22-05-2012	00:11:30
01:04:30 23-05-2012	02:10:30 23-05-2012	01:06:00
06:28:30 23-05-2012	06:36:00 23-05-2012	00:07:30
01:08:30 24-05-2012	01:36:00 24-05-2012	00:27:30

03:56:30 24-05-2012	04:25:30 24-05-2012	00:29:00
00:14:30 25-05-2012	00:35:30 25-05-2012	00:21:00
10:08:30 25-05-2012	10:25:30 25-05-2012	00:17:00
00:22:30 31-05-2012	00:49:00 31-05-2012	00:26:30
10:30:30 31-05-2012	10:46:30 31-05-2012	00:16:00
03:14:30 07-06-2012	04:06:30 07-06-2012	00:52:00
13:20:30 21-06-2012	13:22:00 21-06-2012	00:01:30
00:04:30 23-06-2012	23:59:30 23-06-2012	23:55:00
01:28:30 04-07-2012	01:28:30 04-07-2012	00:00:00
03:26:30 23-07-2012	04:19:30 23-07-2012	00:53:00
08:22:30 23-07-2012	08:57:00 23-07-2012	00:34:30
08:22:30 26-07-2012	11:30:00 26-07-2012	03:07:30
22:58:30 27-07-2012	22:59:00 27-07-2012	00:00:30
23:00:30 27-07-2012	03:40:30 28-07-2012	04:40:00
04:16:30 28-07-2012	04:35:00 28-07-2012	00:18:30
05:20:30 28-08-2012	05:48:00 28-08-2012	00:27:30
09:10:30 28-08-2012	09:20:30 28-08-2012	00:10:00