CLEAN DEVELOPMENT MECHANISM
PROJECT DESIGN DOCUMENT FORM (CDM-PDD)
Version 03 - in effect as of: 28 July 2006

CONTENTS

Annexes

SECTION A. General description of project activity

A.1 Title of the project activity:

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Title: Shuixi Gou Coal Field Fire Extinguishing Project

PDD Version: 01

Date: December 20, 2007

A.2. Description of the project activity:

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The proposed coal field fire extinguishing project site is located in Jimsar County, Xinjiang, P.R. China, about 13 km southwest of the county town. From the time of the North Song Dynasty (982AD) until 2003, there had been small and disorderly coal mining activities, which resulted in burning coal seams and coal field fires up to the present day. Due to a lack of clear evidence, it is unknown when the fire started burning exactly. In recent years, the Chinese Government has strengthened the standardized administration in coal mining and prohibited disorderly and illegal mining activities. Xinjiang Administration of Land & Resources, Xinjiang Administration of Coal Industry and other local governmental agencies, as per the requirements of the Central Government, have enacted the overall planning measures for the coal mining industry and enforced a strict administration and supervision of the coalmine areas which will prevent the occurrence of new coal field fires.

In the north of Shuixi Gou fire zone, the ground subsidence takes place at a depth of 20 to 30m with the coal seams being almost vertical in inclination. In the south, the seams are dipping gently with a moisturized ground surface, covered by coal tar and Glauber salt crystals on the outcrop area, and a whirring sound can be heard on the south end of the fire zone due to underground burning. The burning depth in the south zone is 25m to 55m. The amount of annually burnt coal for the entire project area is estimated to be 166,061.05 tons.

This project will be implemented by Xinjiang Huayu Industry & Trade Inc. The project activity will include integrated coal fire extinguishing technology consisting of drilling, water and mud injections, and covering with loess to extinguish the burning coal seams in the coalfield in order to reach the goal of CO_2 emission reduction. With the coal fire extinction, it is estimated that an annual amount of CO_2 emissions of approximately 423,976.19 tons will be reduced by the project activities.

In addition to CO_2 emission reduction, the project will provide the following contributions to sustainable development:

· To reduce the emission of CO, hydrocarbon, NO_x, SO_2, H_2S, exhausted gas/dust and other pollutants generated by the coal fire, and thermal pollution, to eliminate the deterioration of vegetation and land degradation, and the pollution and negative impacts on water and ecological environment as well as on land resources in the surrounding areas.

· To promote sustainable pastural development and improve the living environment for the local people.

A.3. Project participants:

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Name of Party involved	Private and/or public entity(ies) project participants	Kindly indicate if the Party involved wishes to be considered as project participant (Yes/No)
P.R. China (host)	Xinjiang Huayu Industry & Trade Inc.	Yes
…	…	…

A.4. Technical description of the project activity:

A.4.1. Location of the project activity:

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A.4.1.1. Host Party(ies):

>>

P.R. China

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

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Xinjiang Uighur Autonomous Region

A.4.1.3. City/Town/Community etc:

>>

Jimsar County

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

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The fire zone is located 13km southwest of Jimsar County Town. The geographical coordinates are:

88°56′29″ eastern longitude 43°55′47″ northern latitude

The distance to Urumqi City is 160km as shown in the following maps.

Figure 1. Map of P.R. China

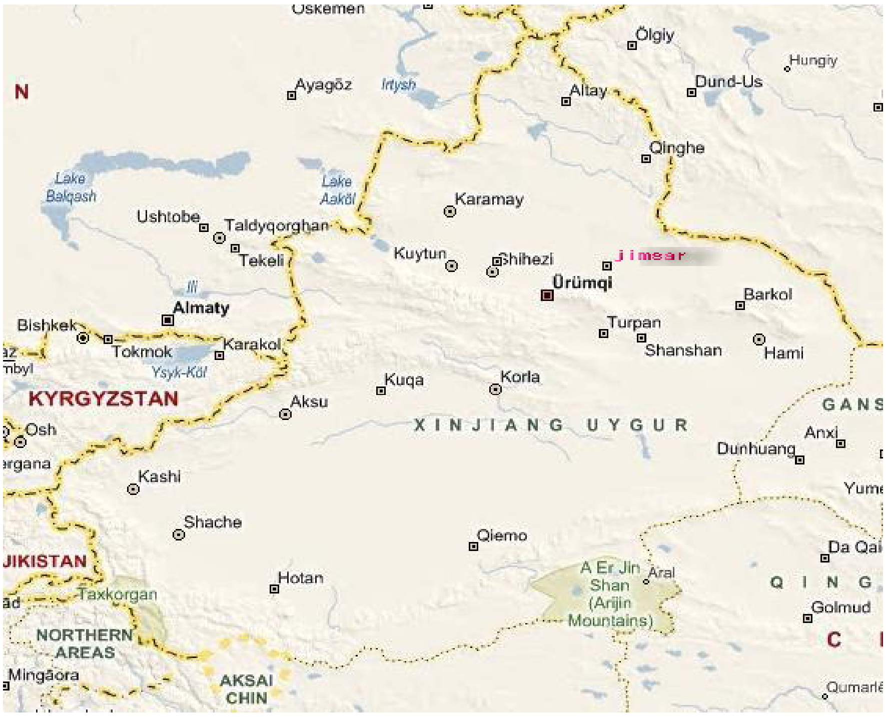

Figure 2. Map of Xinjiang Uighur Autonomous Region

Figure 3. Map of Jimsar County in Xinjiang Uighur Autonomous Region

A.4.2. Category(ies) of project activity:

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Sectoral Scope 10: Fugitive emissions from fuels (solid, oil and gas)

A.4.3. Technology to be employed by the project activity:

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In specific consideration of the deep depth of the acutely burning seams and the large extension of the coal fires in the Shuixi Gou fire zone, the fire extinguishment will employ an integrated extinguishing technology including stripping, drilling, injection of water and mud, and covering of the area with loess.

Based on the thermal anomaly distribution and the topography in the fire zone plus consideration of the availability of sufficient water and loess supplies in the surrounding area, an integrated and feasible technology for the fire extinguishing will be applied. At first, the hotspots will be watered for cooling the ground. Blasting operations on hard rocks embedding the coal seam tops or bottoms may be necessary to give access for the machinery to the site, in combination with removing the broken rocks by bulldozers, stripping and flattening the ground with excavators and refilling the collapsed cavities in and around the fire zone. Inclined slopes of more than 25 degrees will be stripped or reformed by making terraces. Then, drillings for water and mud injection boreholes will be conducted on those flattened grounds. Long term water injections through the boreholes down to the burning depths for cooling of the surrounding rock to below 100℃ will be performed. Subsequently, mud (mixture of water and loess) injections will be carried out to fill and seal open fissures within the fire zone. This procedure will be applied until all fissures and fractures are filled and sealed. After the mud injection, the ground will be covered with loess with a thickness of 0.5-1.5m, depending on the loess quality and the location of the covered area in the fire zone, additionally prior to that the observatory boreholes will be preinstalled. Finally, the covered soil will be compressed by using heavy machinery, and meanwhile the seeds of indigenous species will be sown.

Through the implementation of these operations, the underground coal fires will be extinguished and all fissures and fractures within the fire zone will be refilled and sealed by mud. With the seams isolated from any air supply, the coal field fire burning will be extinguished.

This project will use domestic technology and equipments. Only monitoring equipments for gas analysis, geodetic surveying and others will be imported, which does not constitute international technology transfer.

A.4.4 Estimated amount of emission reductions over the chosen crediting period:

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The renewable crediting period is chosen for this project activity through the prediction of burning years, and the crediting years are 7 years×3. During the first crediting period, the project activity is expected to lead to emission reductions of 423,976.19 tons CO_2 equivalent per annum, leading to a total reduction of **Error! No bookmark name given.** tons of CO_2 equivalent.

Table 1 Emission Reductions from the Project Activity over the 1st Crediting Period

Year	Estimated annual emission reductions Unit: t CO_2e
1	423,976.19
2	423,976.19
3	423,976.19
4	423,976.19
5	423,976.19
6	423,976.19
7	423,976.19
Estimated total emission reduction(t CO_2 e)	**Error! No bookmark name given.Error! No bookmark name given.**
Years of crediting period	7
Estimated annual average emission reduction in the crediting period (t CO_2e)	423976.19

A.4.5. Public funding of the project activity:

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There is no public funding of the Project Activity.

SECTION B. Application of a baseline and monitoring methodology

B.1. Title and reference of the approved baseline and monitoring methodology applied to the project activity:

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This project activity proposes to use a new baseline methodology titled "Baseline and Monitoring Methodologies for Coal Field Fire Extinguishing Project" which has been submitted on the appropriate CDM-NMB form through a DOE to the CDM EB.

B.2 Justification of the choice of the methodology and why it is applicable to the project activity:

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The methodology is applicable under the following conditions:

- Only anthropogenically induced coalfield fires are eligible;
- The coalfield fire was initiated prior to December 11, 1997;
- The fire zone is in the expanding stage or stable stage of combustion;
- The coal fire will remain burning for longer than the crediting period;
- The extinguishing materials applied for the fire extinguishing operations shall not generate GHG such as CO_2, CH_4, N_2O, etc. after their applications;
- After completion of the coalfield fire extinguishing project, the coal saved from potential burning within the crediting period shall not be mined and utilized in the future.

The new methodology is applicable to the project activity because:

1. According to the historical records as *Travelogue in Xizhou* by Wang Yande: "On the way to Beiting (nowadays Jimsar) there could be seen burnt rocks and ashes, and smoke like clouds in the hills. During sunset it flamed like a torch, illuminating wild animals all in crimson. One needs thick sole shoes to walk on such ground otherwise his feet would be burned." This scenario was witnessed and recorded by Mr. Wang Yande, the emissary of North Song, during the year 7 of Taiping Realm (982 AD) on his way from Gaochang (nowadays Turpan) to Beiting (nowadays Jimsar) when he passed by Shuixi Gou. This indicates besides other sources that there were coal mining activities and underground coal fires at that time in Shuixi Gou. *Smelt Activities in Shuixi Gou* by Shao Zhaoxi, *Changji Literary History Florilegium (V), Beiting Literary History*, etc. all recorded busy smelting and ceramic activities by using the coal as energy in Shuixi Gou. To this day, remaining potsherds can be found on the topline of A7 seams in the middle northern part of the fire zone, coal slag and cinders dumped in the subsidized area around A7 seams can be seen, and the opening of an abandoned small coalmine can be witnessed in the southern part of the fire zone. The historical records and relics provide evidence of early mining activities and coal utilization, which are the root causes of the coal field fires in Shuixi Gou;

2. In 1995-1996, a general survey of coalfield fire was conducted in whole Xinjiang by Coalfield Fire Extinguishing Department of Xinjiang. Based on the survey, *Xinjiang Coalfield Fire Investigation Report* was published in July 1997, in which Shuixi Gou coalfield fire zone was described, that proved Shuixi Gou coalfield fire was initiated prior to December 11, 1997.

3. According to the baseline methodology for the coal field fire extinguishing project, the fire zone was monitored four times from 2005 to 2007 to derive a calculation of the amount of burnt coal and CO_2 emission. The results show that 168,874.90t/a of coal were burned based on the monitored data in October 2005 and 163,335.91t/a in April 2006. The average amount of burnt coal calculated from the two monitoring data sets is 166,105.41t/a in one year. Based on the monitored data in November 2006 and March 2007, 164,090.43t/a, and 168,031.66t/a of coal were burned respectively. The average amount of burnt coal calculated from the two monitoring data sets is 166,061.05t/a in one year, a 0.03% decrease. This difference is much less than the 10% as

stipulated in the proposed methodology, therefore the fire zone in Shuixi Gou is currently in the stable burning stage;

4. This project will apply integrated fire extinguishing technology consisting of stripping operation, drilling operation, water injection, mud injection, and loess covering operation. The extinguishing materials involved in the project are mainly water and loess, which will not produce GHG such as CO_2, CH_4, N_2O, etc.;

5. Based on the exploration results and the estimated amount of annually burnt coal through calculations given in the methodology, it can be concluded that the coal field fire will continue burning for more than 135 years, which is far beyond the crediting period designated in the project;

6. The local government has announced commitment that after completion of the coalfield fire extinguishing project as a CDM project activity, the coal saved from potential burning within the crediting period will not be mined and utilized in the future (See attached *Document* in Annex).

B.3. Description of the sources and gases included in the project boundary

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According to the proposed baseline methodology, the project boundary includes:

- The coal fire zone which will carry out for the project activity is Shuixi Gou coalfield fire zone. This fire zone consists of fire sub-zone 1 on the south and fire sub-zone 2 on the north.
- The equipments which will consume fossil fuel for Shuixi Gou coal fire extinguishing include bulldozers, excavators, dumping trucks, drilling machines, diesel power generator, cranes, flat trucks, centrifugal water pumps, slurry mixers etc.
- The traffic and transport vehicles used for Shuixi Gou coal fire extinguishing include trucks, cars, tractor, etc.
- The power used for Shuixi Gou coal fire extinguishing is from in-situ movable diesel generator. The power from the grid will not be involved in the project.

The emission sources within the boundary are shown in Table 2:

Table 2 Emission Sources Included in or Excluded from the Project Boundary

	Sources	Gas	Included?	Verification/Explanation
Baseline	Coal Burning	CO_2	Yes	Major emission gas
		CH_4	No	Not taken into account for simplification reasons, leading to a conservative estimate

		N_2O	No	Not taken into account for simplification reasons, leading to a conservative estimate
Project Activity	Coal Fire Extinguishing Operations	CO_2	Yes	Major emission gas
		CH_4	No	Nominal, neglected for simplification
		N_2O	No	Nominal, neglected for simplification

B.4. Description of how the baseline scenario is identified and description of the identified baseline scenario:

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The baseline scenario is identified by using step 1 and step 2 or step 3 of the latest version of *Tools for Justification and Assessment of Additionality* assigned by the methodology.

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

Sub-step 1a: Draw up a list of possible realistic and credible alternatives available to the project participants or similar project developers that deliver similar outputs and services in a comparable service area as the project activity

Two optional baseline scenarios for the project are:

(1) The proposed project activity itself is not registered as a CDM project;

(2) The coal fire will not be extinguished and will continue to burn..

Sub-step 1b: Eliminate alternatives that are not complying with all applicable laws and regulations

The Chinese Government does not enforce by law any requirement to extinguish coal field fires. No other comparable legislation or official regulation is existent which indicates that non-action on the coal fires is illegal and against the law and regulations. Therefore, both options 1) and 2) comply with the relevant current law and regulations.

Step 2: Investment Analysis

Sub-step2a：Identifying appropriate analyzing methods

According to the requirements of the coal field fire extinguishing methodology, either a simple cost analysis (Option I) or an investment comparative analysis (Option II) or a baseline analysis (Option III) is necessary to be applied for the investment analysis. Since the coal field fire extinguishing project in Shuixi Gou has no financial or economic benefits except CDM related incomes, option I (simple cost analysis) will be applied.

Sub-step 2b：Application of the simple cost analysis

Because the local government has announced commitment that after completion of the coalfield fire extinguishing project as a CDM project activity, the coal saved from potential burning within the crediting period will not be mined and utilized in the future, there will be no any investment return from coal mining afterward. In addition, the coal field fire extinguishing project itself is a process which benefits the public and the environment only. There is no commercial output, and it is very difficult to raise funds by market means for the fire extinguishing operations. Therefore, the coal fire extinguishing agent has no capacity to cover the huge costs for the extinguishing operations. Allowing the current burning status, i.e. no extinguishing action on the fire is applied, requires no expenditure and costs. Furthermore, this does not violate any national laws and regulations. Therefore, taking no action is economically attractive and feasible.

Therefore, based on this analysis, option (2) is chosen as the baseline scenario.

B.5. Description of how the anthropogenic emissions of GHG by sources are reduced below those that would have occurred in the absence of the registered CDM project activity (assessment and demonstration of additionality):

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The methodology indicates “If the baseline determination (above) demonstrates that the baseline is different from the proposed project activity not undertaken as a CDM project activity it may be concluded that this project is additional”.

As shown in section B.4, it is concluded that the project baseline is the continuance of the burning status without fire extinguishing activity, whereas the project itself will cause a decrease of the baseline and therefore the coal field fire extinguishing project is additional.

B.6. Emission reductions:

B.6.1. Explanation of methodological choices:

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<u>Baseline Emission</u>

At first, the heat released per annum is calculated according to the measured ground temperature, the area of fire zone and the area of fractures, and the temperature, flow velocity and composition of gases from the fractures. From the correspondent energy, the thermal equilibrium is calculated, which determines the amount of annually burnt coal. Then the heat annually released by dispersedly emitted gases based on the gases generated from combustion of the coal is iteratively calculated to calibrate the amount of annually burnt coal. Finally the baseline emission is calculated according to the calibrated amount of annually burnt coal and the correspondent carbon content of the coal. The dispersed emission is defined as gas emission from ground surface excluding fractures. The logical framework for the calculation of heat release and CO_2 emission is demonstrated in Figure 2. According to the requirements of the monitoring methodology, the data shall be available twice a year, for at least two years, to calculate the amount of burnt coal respectively and arithmetic mean value of adjacent results within a year for the amount of annually burnt coal. As per the principle of conservative calculation, the lowest amount of annually burnt coal will be applied for the calculation of the baseline emissions.

According to the description of fire zone subdivision given in the methodology, Shuixi Gou fire zone is divided into two sub-zones in this project, the south zone, defined as Sub-zone 1, and the north zone, as Sub-zone 2. The heat released by radiation, convection, and concentrated and dispersed gas emissions in

each sub-zone are calculated respectively, and finally the total heat from the whole fire zone is worked out. The relationship of thermal equilibrium is presented in the following formula.

$$HC_{radiation,y} + HC_{convection,y} + HC_{carried\_concentrating,y} + HC_{carried\_dispersing,y} = FC_{coal,y} \cdot NCV_{coal} \cdot 1000 \quad \text{......} (1)$$

Where:

$HC_{radiation,y}$ = Annual heat released by radiation from the ground surface of the fire zone (kJ**Error! Not a valid embedded object.**yr^{-1})

$HC_{convection,y}$ = Annual heat released by convection through the ground surface of the fire zone (kJ**Error! Not a valid embedded object.**yr^{-1})

$HC_{carried\_concentrating,y}$ = Annual heat carried through concentrated gases emission (kJ**Error! Not a valid embedded object.**yr^{-1})

$HC_{carried\_dispersing,y}$ = Annual heat carried through dispersed gases emission (kJ**Error! Not a valid embedded object.**yr^{-1})

$FC_{coal,y}$ = Annually burnt coal (t**Error! Not a valid embedded object.**yr^{-1})

NCV_{coal} = Net calorific value as received base from the coal (kJ**Error! Not a valid embedded object.**kg^{-1})

1000 = Conversion from ton to kg

Step 1: Calculation of Heat Released from Coal Fire

During the process of coal combustion the heat is released by radiation at the ground surface, convection through the ground surface, heat transported by concentrated gases emission and dispersed gases emission. The following methods will calculate the four heat release processes respectively.

(I) Radiation

$$HC_{radiation,y} = \sum_i S_i \cdot \varepsilon \cdot \sigma_0 \cdot \left(T_i^4 - T_{air}^4\right) \cdot 3.1536 \times 10^7 \times 0.001 \quad \text{......} (2)$$

Where:

S_i = Surface area corresponding to temperature section i (m^2), i=1~10

ε = Darkness of the ground, dimensionless

σ_0 = Radiation constant of black body, it is 5.67 $\times 10^{-8}$ (W**Error! Not a valid embedded object.**(m^2**Error! Not a valid embedded object.**K^4)$^{-1}$)

T_i = Average ground surface radiant temperature of temperature section i (K)

$$T_i = \sqrt[4]{\frac{t_i^{\,4} + t_{i+1}^{\,4}}{2}}$$

t_i = The temperature of isothermal line i (K)

t_{i+1} = The temperature of isothermal line i+1 (K)

T_{air} = The maximal air temperature during monitoring (K)

3.1536×10^7 = Number of seconds in one year (s)

0.001 = Conversion from J to kJ

(II) Convection

$$HC_{convection,y} = \sum_j S_j \cdot \alpha_j \cdot (T_j - T_{air}) \cdot 3.1536\times10^7 \times 0.001 \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots(3)$$

Where:

S_j = Surface area of sub-zone j (m^2), j=1,2.

α_j = Thermal conductive coefficient of convection in sub-zone j (W**Error! Not a valid embedded object.**(m^2**Error! Not a valid embedded object.**K)$^{-1}$)

T_j = Average ground surface convective temperature in sub-zone j (K), weighed average according to the area of different temperature sections.

$$T_j = \frac{\sum S_{j,i} \times T_{j,i}}{S_j}$$

$S_{j,i}$ = The area of temperature section i in sub-zone j (m^2)

$T_{j,i}$ = The arithmetically averaged temperature of temperature section i in sub-zone j (K)

0.001 = Conversion from J to kJ

The method to calculate α_j is as the follows:

Firstly, the film temperature is calculated by the arithmetic mean of the average ground temperature in each sub-zone and the annual average air temperature in the fire zone. Then, based on the film temperature in each sub-zone, the air physical parameters (density, thermal conductivity, dynamic viscosity, and Prandtl number) can be determined, for the calculation of Reynolds number respectively in each sub-zone in the formula given below.

$$\mathrm{Re}_j = \frac{\rho_j \cdot FR_{air} \cdot L_j}{\mu_j} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots(4)$$

Where:

Re_j = Reynolds number of sub-zone j, dimensionless

ρ_j = Air density under film temperature of sub-zone j (kg**Error! Not a valid embedded object.**m^{-3})

μ_j = Air dynamic viscosity under film temperature of sub-zone j (Pa**Error! Not a valid embedded object.**s)

FR_{air} = Annual average wind speed where the fire zone situated (m**Error! Not a valid embedded object.**s^{-1})

L_j = Equivalent length of sub-zone j, L_j=**Error! Not a valid embedded object.** (m)

Input the data monitored by four times in Shuixi Gou fire zone into formula (4), Nusselt number is calculated as $\mathrm{Re}_j > 5\times10^5$, then Nusselt number is calculated according to formula (5) below:

Nu_j=0.0365**Error! Not a valid embedded object.**$\mathrm{Re}_j^{0.8}$**Error! Not a valid embedded object.**$\mathrm{Pr}_j^{1/3}$……………………………………………………..(5)

Where:

Nu_j = Nusselt number of sub-zone j, dimensionless

Pr_j = Prandtl number under film temperature of sub-zone j, dimensionless

The calculated Nusselt number is input into following equation for calculation of thermal conductivity of convection in sub-zone j.

$$\alpha_j = \frac{Nu_j \cdot \lambda_j}{L_j} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots(7)$$

Where:

λ_j = Air thermal conductivity under film temperature in sub-zone j (W**Error! Not a valid embedded object.**(m**Error! Not a valid embedded object.**K)$^{-1}$)

(III) Heat carried by concentrated gases emission

The calculation of heat carried out by concentrated gases emission is provided below:

$$HC_{carried\_concentrating,y} = (\sum_n \frac{S_n \cdot FR_{gases,n} \cdot (C_{P,gases,n} \cdot T_{gases,n} - C_{P,air} \cdot T_{air}) \cdot 273}{T_{gases,n}}$$

$$+ \sum_n \frac{S_n \cdot FR_{gases,n} \cdot \frac{X_{CO,n}}{100} \cdot NCV_{CO} \cdot 273}{T_{gases,n}}) \cdot 3.1536 \times 10^7 \text{.........................(8)}$$

Where:

S_n = Area of fracture n (m^2), Sub-zone 1: n=1～15; Sub-zone 2; n＝1～25

$FR_{gases,n}$ = Gas flow velocity of concentrated emission from fracture n (m**Error! Not a valid embedded object.**s^{-1})

$T_{gases,n}$ = Gas temperature of concentrated emission from fracture n (K)

$C_{P,gases,n}$ = Gas volumetric heat capacity at $T_{gases,n}$, the air volumetric heat capacity at normal pressure and the corresponding temperature are applied for this parameter (kJ**Error! Not a valid embedded object.**(m^3**Error! Not a valid embedded object.**K)$^{-1}$). The volumetric heat capacities of both concentrated emission and dispersed gas emission are higher than air volumetric heat capacity at normal pressure and the corresponding temperature. For simplified calculation and as per conservative principle, the air volumetric heat capacity at normal pressure and the corresponding temperature is applied for the volumetric heat capacities of concentrated gas emission and dispersed gas emission.

$C_{P,air}$ = Air volumetric heat capacity at normal pressure and T_{air} (kJ**Error! Not a valid embedded object.**(m^3**Error! Not a valid embedded object.**K)$^{-1}$)

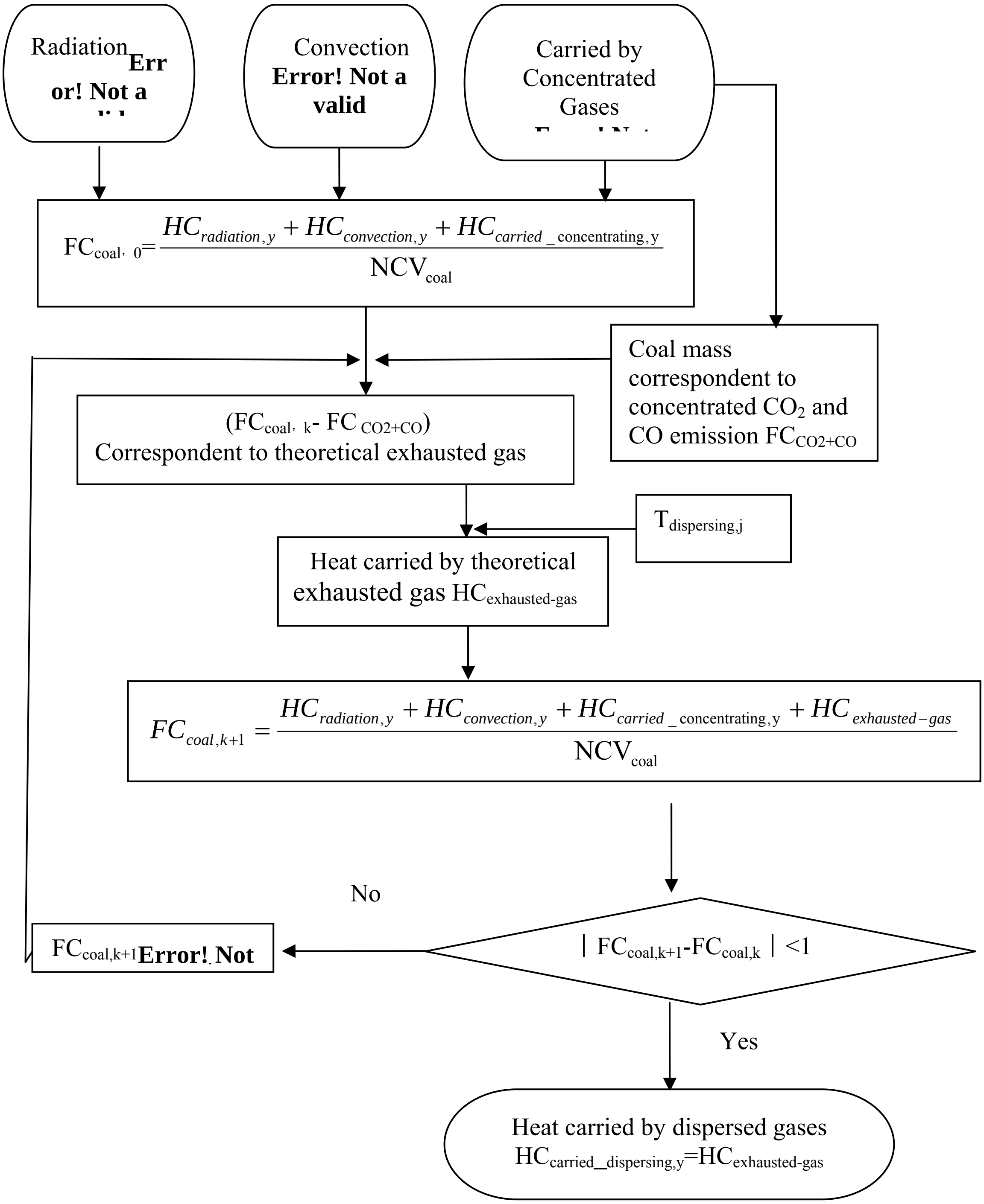
$X_{CO,n}$ = CO volumetric content in concentrated gas emission from fracture n (%)

NCV_{CO} = Net calorific value of carbon monoxide (kJ**Error! Not a valid embedded object.**m^{-3})

273 =Kelvin temperature under standard state (K)

(IV) Heat carried by dispersed gases emission

The heat carried by dispersed gases emission is calculated iteratively as follows:



$$FC_{CO2+CO}=\sum_n \frac{S_n \cdot FR_{gases,n} \cdot \left(X_{CO_2,n}+X_{CO,n}\right) \cdot 12 \times 273}{W_{coal,c} \cdot 22.4 \cdot T_{gases,n}} \cdot 3.1536 \times 10^7 \quad (9)$$

$HC_{exhausted\text{-}gas}$=($FC_{coal,k}$－$FC_{CO2+CO}$)**Error! Not a valid embedded object.**V_0**Error! Not a valid embedded object.**$(C_{P,dispersing,j} \cdot T_{dispersing,j} - C_{P,air} \cdot T_{air})$ ....(10)

With：

$$V_0 = \left[\left(\frac{W_{coal,C}}{12} + \frac{W_{coal,H}}{2} + \frac{W_{coal,S}}{32} + \frac{W_{coal,N}}{28} + \frac{W_{coal,M}}{18}\right) + \frac{0.79}{0.21}\left(\frac{W_{coal,C}}{12} + \frac{W_{coal,H}}{4} + \frac{W_{coal,S}}{32} - \frac{W_{coal,O}}{32}\right)\right] \times \frac{224}{100} \text{........(11)}$$

Where:

FC_{CO2+CO} = Coal mass correspondent to CO_2 and CO in the concentrated gases emission (kg**Error! Not a valid embedded object.**yr^{-1})

$T_{dispersing,j}$ =Temperature of dispersing emission gases in sub-zone j (K). This temperature is the weighted average of the average ground surface temperature (the area of concentrated gas emission is excluded) in sub-zone j and the boundary temperature of the fire zone.

k = iteration times

$X_{CO2,n}$ = CO_2 volumetric content in the concentrated gases from fracture n (%)

$HC_{exhausted\text{-}gas}$ = Heat carried by exhausted gas (kJ**Error! Not a valid embedded object.**yr^{-1})

V_0 = Theoretical exhausted gas from burning 1kg coal (m^3/kg)

$C_{P,dispersing,j}$ =Volumetric heat capacity of dispersing emission gases under temperature $T_{dispersing,j}$ in sub-zone j, the air volumetric thermal capacity at normal pressure and the corresponding temperature is applied for this parameter (kJ**Error! Not a valid embedded object.**(m^3**Error! Not a valid embedded object.**K)$^{-1}$).

Error! Not a valid embedded object. = Carbon content as received from the coal (%)

Error! Not a valid embedded object. = Hydrogen content as received from the coal (%)

Error! Not a valid embedded object. = Sulphur content as received from the coal (%)

Error! Not a valid embedded object. = Nitrogen content as received from the coal (%)

Error! Not a valid embedded object. = Oxygen content as received from the coal (%)

Error! Not a valid embedded object. = Water content as received from the coal (%)

22.4 = It is the volume of one kmole of an ideal gas at standard temperature and pressure (m^3/kmol)

0.21 = Oxygen content in the air

0.79 = Nitrogen content in the air

12 = Molecular weight of carbon

32 = Molecular weight of sulphur

28 = Molecular weight of nitrogen

18 = Molecular weight of H_2O

Step 2: Calculation of burnt coal

According to net calorific value of the coal and the heat released from the fire zone, the amount of burnt coal can be calculated by the formula as below:

$$FC_{coal,y} = \Big(\frac{HC_{radiation,y} + HC_{convection,y} + HC_{carried\_concentrating,y} + HC_{carried\_dispersing,y}}{NCV_{coal}} - \sum_n \frac{S_n \cdot FR_{gases,n} \cdot X_{CO,n} \cdot 12 \times 273}{W_{coal,C} \cdot 22.4 \cdot T_{gases,n}} \cdot 3.1536 \times 10^7\Big) \times 0.001 \qquad (12)$$

Where:

Error! Not a valid embedded object. = The amount of annually burnt coal in year y (t**Error! Not a valid embedded object.**yr^{-1})

0.001 = Conversion from kg to ton

Step 3: Calculation of baseline emissions

$$BE_y = \frac{FC_{coal,y} \cdot \frac{W_{coal,C}}{100} \cdot 44}{12} \qquad (13)$$

Where:

BE_y = Baseline emission in year y (tCO_2**Error! Not a valid embedded object.**yr^{-1})

44/12 = Ratio of molecular weights between CO_2 and carbon, dimensionless

Project Emission

Project emissions include:

·CO_2 emissions from the vehicles for transportation during fire extinguishing operation, monitoring before and during the extinguishing operation, and monitoring and maintenance after the extinguishing operation (PET).

·CO_2 emissions from on-site consumption of fossil fuels during fire extinguishing operation, monitoring before and during the extinguishing operation, and monitoring and maintenance after the extinguishing operation (PEFF).

·CO_2 emissions from consumption of electricity during fire extinguishing operation, monitoring before and during the extinguishing operation, and monitoring and maintenance after the extinguishing operation (PE_{EC}).

The calculation of emission produced by Coal Field Fire Extinguishing Project activities is as follows:

$$PE = PET + PEFF + PE_{EC} \text{ ....(14)}$$

Where:

PE = Total CO_2 emissions from the project activity (t)

PET = CO_2 emissions from the vehicles for transportation during fire extinguishing operation, monitoring before and during the extinguishing operation, and monitoring and maintenance after the extinguishing operation (t CO_2)

$PEFF$ = CO_2 emissions from on-site consumption of fossil fuels during fire extinguishing operation, monitoring before and during the extinguishing operation, and monitoring and maintenance after the extinguishing operation (t CO_2)

PE_{EC} = CO_2 emissions due to consumption of electricity during fire extinguishing operation, monitoring before and during the extinguishing operation, and monitoring and maintenance after the extinguishing operation (t CO_2)

<u>Leakage</u>

According to the proposed new methodology, there is no necessity for considering influence of leakage as all emissions sources have been covered within the project boundary.

$$LE_y = 0 \text{..(20)}$$

LE_y = Emission leakage in year y

<u>Calculation of Emission Reduction</u>

For a given year y, the project activity emission reductions equal to the annual project emissions and leakage deducted from the baseline emission, as shown in the formula below:

$$ER_y = BE_y - PE_y - LE_y \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots(21)$$

Where:

ER_y = Emission reduction for year y (tCO_2**Error! Not a valid embedded object.**yr^{-1})

PE_y = Project emissions in year y (tCO_2**Error! Not a valid embedded object.**yr^{-1})

The total project emissions are averaged by the first crediting period to calculate the annual project emission as the formula below:

$$PE_y = \frac{PE}{Years} \ldots\ldots\ldots(22)$$

Years = The first crediting period for a CDM project (yrs), renewable crediting period has been chosen in this project, and the first crediting period is 7 years.

B.6.2. Data and parameters that are available at validation:

(Copy this table for each data and parameter)

Data / Parameter:	ε
Data unit:	Dimensionless
Description:	Darkness of ground in the burning zone
Source of data used:	Warren M. Rohsenow, James P. Hartnett, Young I. Cho. Handbook of Heat Transfer, Third Edition. New York: McGraw-Hill, 1998.
Value applied:	*0.85*
Justification of the choice of data or description of measurement methods and procedures actually applied :	
Any comment:	

Data / Parameter:	λ_j (j=1~2)
Data unit:	W**Error! Not a valid embedded object.**(m**Error! Not a valid embedded object.**$K)^{-1}$
Description:	Air thermal conductivity at film temperature in sub-zone j
Source of data used:	Liu Guangqi, Ma Lianxiang, Liu Jie. Physical Data Manual for Chemistry and Chemical Engineering—Volume of Inorganic Chemistry. Chemical Industry Press, 1st Edition in April 2002
Value applied:	See Annex 3
Justification of the choice of data or description of measurement methods and procedures actually applied :	
Any comment:	

Data / Parameter:	ρ_j (j=1~2)
Data unit:	kg**Error! Not a valid embedded object.**m^{-3}
Description:	Air density at film temperature in sub-zone j
Source of data used:	Liu Guangqi, Ma Lianxiang, Liu Jie. Physical Data Manual for Chemistry and Chemical Engineering－Volume of Inorganic Chemistry. Chemical Industry Press, 1st Edition in April 2002
Value applied:	See Annex 3
Justification of the choice of data or description of measurement methods and procedures actually applied :	
Any comment:	

Data / Parameter:	μ_j (j=1~2)
Data unit:	Pa**Error! Not a valid embedded object.**s
Description:	Air dynamic viscosity at film temperature in sub-zone j
Source of data used:	Liu Guangqi, Ma Lianxiang, Liu Jie. Physical Data Manual for Chemistry and Chemical Engineering－Volume of Inorganic Chemistry. Chemical Industry Press, 1st Edition in April 2002
Value applied:	See Annex 3
Justification of the choice of data or description of measurement methods and procedures actually applied :	
Any comment:	

Data / Parameter:	Pr_j (j=1~2)
Data unit:	Dimensionless
Description:	Air Prandtl at film temperature in sub-zone j.
Source of data used:	Liu Guangqi, Ma Lianxiang, Liu Jie. Physical Data Manual for Chemistry and Chemical Engineering－Volume of Inorganic Chemistry. Chemical Industry Press, 1st Edition in April 2002
Value applied:	See Annex 3
Justification of the choice of data or description of measurement methods and procedures actually applied :	
Any comment:	

Data / Parameter:	$C_{P, gases, n}$ (Sub-zone 1：n＝1～15；Sub-zone 2：n＝1～25)
Data unit:	kJ**Error! Not a valid embedded object.**(m^3**Error! Not a valid embedded object.**K)$^{-1}$
Description:	Volumetric heat capacity of concentrated gas emission at temperature $T_{gases,n}$, substituted by air volumetric heat capacity at normal pressure and the corresponding temperature.
Source of data used:	Liu Guangqi, Ma Lianxiang, Liu Jie. Physical Data Manual for Chemistry and Chemical Engineering－Volume of Inorganic Chemistry. Chemical Industry Press, 1st Edition in April 2002
Value applied:	See Annex 3
Justification of the choice of data or description of measurement methods and procedures actually applied :	
Any comment:	

Data / Parameter:	$C_{P, air}$
Data unit:	kJ**Error! Not a valid embedded object.**(m^3**Error! Not a valid embedded object.**K)$^{-1}$
Description:	Air volumetric heat capacity at normal pressure and at temperature of T_{air}
Source of data used:	Liu Guangqi, Ma Lianxiang, Liu Jie. Physical Data Manual for Chemistry and Chemical Engineering－Volume of Inorganic Chemistry. Chemical Industry Press, 1st Edition in April 2002
Value applied:	October 27-31, 2005: $C_{P, air}$ ＝1.30268 April 1-5, 2006: $C_{P, air}$ ＝1.30264 November 4-9, 2006: $C_{P, air}$ ＝1.30360 March 20-25, 2007: $C_{P, air}$ ＝1.30272
Justification of the choice of data or description of measurement methods and procedures actually applied :	
Any comment:	

Data / Parameter:	NCV_{CO}
Data unit:	kJ**Error! Not a valid embedded object.**m^{-3}
Description:	Net calorific value of carbon monoxide
Source of data used:	Deng Yuan. Coal Gas Planning & Designing Handbook. China Architecture & Building Press, 1st Edition in January 1992
Value applied:	*12644*
Justification of the choice of data or description of	

measurement methods and procedures actually applied :	
Any comment:	

Data / Parameter:	$C_{P,dispersing,j}$
Data unit:	kJ**Error! Not a valid embedded object.**(m^3**Error! Not a valid embedded object.**K)$^{-1}$
Description:	Volumetric heat capacity of dispersing emission gases at temperature $T_{dispersing,j}$ in sub-zone j, substituted by air volumetric heat capacity at normal pressure and the corresponding temperature.
Source of data used:	Liu Guangqi, Ma Lianxiang, Liu Jie. Physical Data Manual for Chemistry and Chemical Engineering—Volume of Inorganic Chemistry. Chemical Industry Press, 1st Edition in April 2002
Value applied:	See Annex 3
Justification of the choice of data or description of measurement methods and procedures actually applied :	
Any comment:	

Data / Parameter:	T_{air}
Data unit:	K
Description:	The maximal air temperature where the fire zone situated during monitoring
Source of data used:	Xinjiang Climate Center
Value applied:	See Annex 3
Justification of the choice of data or description of measurement methods and procedures actually applied :	
Any comment:	

Data / Parameter:	FR_{air}
Data unit:	m**Error! Not a valid embedded object.**s^{-1}
Description:	Annual average wind speed where the fire zone situated
Source of data used:	Xinjiang Climate Center
Value applied:	See Annex 3
Justification of the choice of data or description of	

measurement methods and procedures actually applied :	
Any comment:	

Data / Parameter:	NCV_{coal}
Data unit:	KJ**Error! Not a valid embedded object.**kg^{-1}
Description:	Net calorific value as received base from the coal
Source of data used:	China National Center for Coal Quality Supervision and Test
Value applied:	28870
Justification of the choice of data or description of measurement methods and procedures actually applied :	The coal rocks were sampled according to the standard in ISO14180:1998, and analyzed according to the standard stipulated in ISO1928:1995.
Any comment:	

Data / Parameter:	**Error! Not a valid embedded object.**
Data unit:	%
Description:	Carbon content as received from the coal
Source of data used:	China National Center for Coal Quality Supervision and Test
Value applied:	69.74
Justification of the choice of data or description of measurement methods and procedures actually applied :	The samples were analyzed according to the methods stipulated in ISO625 for ultimate analysis of coal.
Any comment:	

Data / Parameter:	**Error! Not a valid embedded object.**
Data unit:	%
Description:	Hydrogen content as received from the coal
Source of data used:	China National Center for Coal Quality Supervision and Test
Value applied:	4.85
Justification of the choice of data or description of measurement methods and procedures actually applied :	The samples were analyzed according to the methods stipulated in ISO625 for ultimate analysis of coal.
Any comment:	

Data / Parameter:	**Error! Not a valid embedded object.**
Data unit:	%
Description:	Sulphur content as received from the coal

Source of data used:	China National Center for Coal Quality Supervision and Test
Value applied:	0.29
Justification of the choice of data or description of measurement methods and procedures actually applied :	The samples were analyzed according to the methods stipulated in ISO334 for ultimate analysis of coal.
Any comment:	

Data / Parameter:	**Error! Not a valid embedded object.**
Data unit:	%
Description:	Nitrogen content as received from the coal
Source of data used:	China National Center for Coal Quality Supervision and Test
Value applied:	1.21
Justification of the choice of data or description of measurement methods and procedures actually applied :	The samples were analyzed according to the methods stipulated in ISO333 for ultimate analysis of coal.
Any comment:	

Data / Parameter:	**Error! Not a valid embedded object.**
Data unit:	%
Description:	Oxygen content as received from the coal
Source of data used:	China National Center for Coal Quality Supervision and Test
Value applied:	10.81
Justification of the choice of data or description of measurement methods and procedures actually applied :	The samples were analyzed according to the methods stipulated in ISO17247:2005 for the ultimate analysis of coal.
Any comment:	

Data / Parameter:	**Error! Not a valid embedded object.**
Data unit:	%
Description:	Water content as received from the coal
Source of data used:	China National Center for Coal Quality Supervision and Test
Value applied:	8.3
Justification of the choice of data or description of measurement methods and procedures actually applied :	The samples were analyzed according to the methods stipulated in ISO589 for proximate analysis of coal.

Any comment:	

Data / Parameter:	$S_{coal\ field}$
Data unit:	m^2
Description:	Projected area above the phreatic water surface of the coalfield where the fire zone is situated
Source of data used:	The Geological Information Archives of Xinjiang Uighur Autonomous Region
Value applied:	Sub-zone 1: A6 Stratum: 690289; A7 Stratum: 667215 Sub-zone 1: A6 Stratum: 278252; A7 Stratum: 278252
Justification of the choice of data or description of measurement methods and procedures actually applied :	
Any comment:	

Data / Parameter:	$S_{coal\ fire}$
Data unit:	m^2
Description:	Projected area of the burning coal seams
Source of data used:	The Geological Information Archives of Xinjiang Uighur Autonomous Region
Value applied:	Sub-zone 1: A6 Stratum: 66732; A7 Stratum: 43658 Sub-zone 2: A6 Stratum: 28375; A7 Stratum: 28375
Justification of the choice of data or description of measurement methods and procedures actually applied :	
Any comment:	

Data / Parameter:	h
Data unit:	m
Description:	Thickness of the burning coal seams in the fire zone
Source of data used:	The Geological Information Archives of Xinjiang Uighur Autonomous Region
Value applied:	Sub-zone 1: A6 Stratum: 10.49; A7 Stratum: 3.23 Sub-zone 2: A6 Stratum: 10.49; A7 Stratum: 3.23
Justification of the choice of data or description of measurement methods and procedures actually applied :	
Any comment:	

Data / Parameter:	**Error! Not a valid embedded object.**

Data unit:	t**Error! Not a valid embedded object.**m^{-3}
Description:	Apparent density of the burning coal seams in the fire zone
Source of data used:	China National Center for Coal Quality Supervision and Test
Value applied:	1.33
Justification of the choice of data or description of measurement methods and procedures actually applied :	
Any comment:	

Data / Parameter:	**Error! Not a valid embedded object.**
Data unit:	°
Description:	Dipping angle of the burning coal seams in the fire zone
Source of data used:	The Geological Information Archives of Xinjiang Uighur Autonomous Region
Value applied:	Sub-zone 1: A6 Stratum: 48; A7 Stratum: 48 Sub-zone 2: A6 Stratum: 89; A7 Stratum: 89
Justification of the choice of data or description of measurement methods and procedures actually applied :	
Any comment:	

Data / Parameter:	NCV_{diesel}
Data unit:	TJ/kg
Description:	Net calorific value of diesel
Source of data used:	*China Energy Statistical Yearbook 2006*, page 287
Value applied:	4.2652×10^{-5}
Justification of the choice of data or description of measurement methods and procedures actually applied :	
Any comment:	

Data / Parameter:	$EF_{CO2, diesel}$
Data unit:	$kgCO_2$**Error! Not a valid embedded object.**TJ^{-1}
Description:	CO_2 emission factor of diesel
Source of data used:	IPCC 2006 Guidelines
Value applied:	74100
Justification of the choice of data or description of	

measurement methods and procedures actually applied :	
Any comment:	IPCC 2006 default values can be applied.

Data / Parameter:	$NCV_{gasoline}$
Data unit:	TJ/kg
Description:	Net calorific value of gasoline
Source of data used:	*China Energy Statistical Yearbook 2006*, page 287
Value applied:	4.3070×10^{-5}
Justification of the choice of data or description of measurement methods and procedures actually applied :	
Any comment:	

Data / Parameter:	$EF_{CO2,\ gasoline}$
Data unit:	kg CO_2**Error! Not a valid embedded object.**TJ^{-1}
Description:	CO_2Emission factor of gasoline
Source of data used:	IPCC 2006 Guidelines
Value applied:	69300
Justification of the choice of data or description of measurement methods and procedures actually applied :	
Any comment:	IPCC 2006 default values can be applied

B.6.3 Ex-ante calculation of emission reduction:

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(1) Baseline Emissions

As mentioned above, baseline emissions (BE, tCO2e/year) are determined as the following equations:

$$BE_y = \frac{FC_{coal,y} \cdot \frac{W_{coal,C}}{100} \cdot 44}{12} \quad \text{.......(13)}$$

$$FC_{coal,y} = (\frac{HC_{radiation,y} + HC_{convection,y} + HC_{carried\_\text{concentrating},y} + HC_{carried\_dispersing,y}}{\text{NCV}_{\text{coal}}} - FC_{CO}) \times 0.001$$

Where,

$$HC_{radiation,y} = \sum_i S_i \cdot \varepsilon \cdot \sigma_0 \cdot \left(T_i^4 - T_{air}^4\right) \cdot 3.1536 \times 10^7 \times 0.001 \quad \text{..(2)}$$

$$HC_{convection,y} = \sum_j S_j \cdot \alpha_j \cdot (T_j - T_{air}) \cdot 3.1536 \times 10^7 \times 0.001 \quad \text{..(3)}$$

$$HC_{carried\_concentrating,y} = (\sum_n \frac{S_n \cdot FR_{gases,n} \cdot (C_{P,gases,n} \cdot T_{gases,n} - C_{P,air} \cdot T_{air}) \cdot 273}{T_{gases,n}} + \sum_n \frac{S_n \cdot FR_{gases,n} \cdot \frac{X_{CO,n}}{100} \cdot NCV_{CO} \cdot 273}{T_{gases,n}}) \cdot 3.1536 \times 10^7 \quad \text{.........................(8)}$$

$HC_{carried\_dispersing,y}$ =HC$_{\text{exhausted-gas}}$=(FC$_{\text{coal, k}}$ − FC $_{\text{CO2+CO}}$)**Error! Not a valid embedded object.** V$_0$**Error! Not a valid embedded object.** $(C_{P,dispersing,j} \cdot T_{dispersing,j} - C_{P,air} \cdot T_{air})$ ...(10)

The iteration convergence condition of equation (10) as follows:

$$|\, FC_{coal,k+1} - FC_{coal,k} \,| < 1$$

Where:

$$FC_{coal,k} = \frac{HC_{radiation,y} + HC_{convection,y} + HC_{carried\_\text{concentrating},y} + HC_{exhausted-gas}}{\text{NCV}_{\text{coal}}}$$

$$FC_{CO2+CO} = \sum_n \frac{S_n \cdot FR_{gases,n} \cdot \left(X_{CO_2,n} + X_{CO,n}\right) \cdot 12 \times 273}{W_{coal,c} \cdot 22.4 \cdot T_{gases,n}} \cdot 3.1536 \times 10^7 \quad \text{................................(9)}$$

$$V_0 = \left[\left(\frac{W_{coal,C}}{12} + \frac{W_{coal,H}}{2} + \frac{W_{coal,S}}{32} + \frac{W_{coal,N}}{28} + \frac{W_{coal,M}}{18}\right) + \frac{0.79}{0.21}\left(\frac{W_{coal,C}}{12} + \frac{W_{coal,H}}{4} + \frac{W_{coal,S}}{32} - \frac{W_{coal,O}}{32}\right)\right] \times \frac{224}{100} \quad \text{....(11)}$$

$$FC_{CO} = \sum_n \frac{S_n \cdot FR_{gases,n} \cdot X_{CO,n} \cdot 12 \times 273}{W_{coal,C} \cdot 22.4 \cdot T_{gases,n}} \cdot 3.1536 \times 10^7$$

The parameters/variables are provided in Annex 3 : Table 1～Table 11. The calculation results of $HC_{radiation,y}$, $HC_{convection,y}$, $HC_{carried\_\text{concentrating},y}$, $HC_{carried\_dispersing,y}$ and FC_{CO} during the period from Oct. 27, 2005 to March 25, 2007 are showed in Table 3.

Table 3 Calculation of Heat Release from Shuixi Gou Fire Zone

Date	Fire Sub-zone 1					Fire Sub-zone 2				
	$HC_{radiation,y}$ KJ/yr	$HC_{convection,y}$ KJ/yr	$HC_{carried\_concentrating,y}$ KJ/yr	$HC_{carried\_dispersing,y}$ KJ/yr	FC_{CO} Kg/yr	$HC_{radiation,y}$ KJ/yr	$HC_{convection,y}$ KJ/yr	$HC_{carried\_concentrating,y}$ KJ/yr	$HC_{carried\_dispersing,y}$ KJ/yr	FC_{CO} Kg/yr
2005.10.27 -2005.10.31	5.95E+11	1.44E+11	4.51E+11	1.15E+10	5.30E+04	2.74E+12	4.33E+11	2.67E+11	3.95E+10	1.70E+05
2006.04.01 -2006.04.05	6.27E+11	1.39E+11	4.04E+11	1.22E+10	4.99E+04	2.66E+12	3.96E+11	2.54E+11	3.58E+10	1.86E+05
2006.11.04 -2006.11.09	6.47E+11	1.44E+11	4.36E+11	1.27E+10	7.53E+04	2.66E+12	3.68E+11	2.48E+11	3.72E+10	1.61E+05
2007.03.20 -2007.03.25	6.90E+11	1.45E+11	4.80E+11	1.42E+10	5.71E+04	2.63E+12	3.83E+11	2.75E+11	3.89E+10	2.19E+05

Sub-zone 1:

October 2005:

$$FC_{coal,y} = (\frac{5.95\times10^{11}+1.44\times10^{11}+4.51\times10^{11}+1.15\times10^{10}}{28870} - 52990\times3.1536\times10^{7})\times0.001$$

$=4.34\times10^{4}$t/yr

April 2006:

$$FC_{coal,y} = (\frac{6.27\times10^{11}+1.39\times10^{11}+4.04\times10^{11}+1.22\times10^{10}}{28870} - 49900\times3.1536\times10^{7})\times0.001$$

$=4.27\times10^{4}$t/yr

Nov. 2006:

$$FC_{coal,y} = (\frac{6.47\times10^{11}+1.44\times10^{11}+4.36\times10^{11}+1.27\times10^{10}}{28870} - 75300\times3.1536\times10^{7})\times0.001$$

$=4.47\times10^{4}$t/yr

March 2007:

$$FC_{coal,y} = (\frac{6.90\times10^{11}+1.45\times10^{11}+4.80\times10^{11}+1.42\times10^{10}}{28870} - 57100\times3.1536\times10^{7})\times0.001$$

$=4.80\times10^{4}$t/yr

Sub-zone 2:

October 2005:

$$FC_{coal,y} = (\frac{2.74\times10^{12}+4.33\times10^{11}+2.67\times10^{11}+3.95\times10^{10}}{28870} - 170130\times3.1536\times10^{7})\times0.001$$

$=1.25\times10^{5}$t/yr

April 2006:

$$FC_{coal,y} = (\frac{2.66\times10^{12}+3.96\times10^{11}+2.54\times10^{11}+3.58\times10^{10}}{28870} - 186000\times3.1536\times10^{7})\times0.001$$

$=1.21\times 10^5$t/yr

Nov. 2006:

$$FC_{coal,y} = (\frac{2.66\times10^{12}+3.68\times10^{11}+2.48\times10^{11}+3.72\times10^{10}}{28870} - 161000\times3.1536\times10^{7})\times0.001$$

$=1.19\times 10^5$t/yr

March 2007:

$$FC_{coal,y} = (\frac{2.63\times10^{12}+3.83\times10^{11}+2.75\times10^{11}+3.89\times10^{10}}{28870} - 219000\times3.1536\times10^{7})\times0.001$$

$=1.20\times 10^5$t/yr

Total burnt coal of two sub-zones in October 2005: $4.34\times10^4+1.25\times10^5$ ＝168874.90t/yr

Total burnt coal of two sub-zones in April 2006:$4.27\times10^4+1.21\times10^5$＝163335.91t/yr

Total burnt coal of two sub-zones in November 2006:$4.47\times10^4+1.19\times10^5$＝164090.43t/yr

Total burnt coal of two sub-zones in March 2007: $4.80\times10^4+1.20\times10^5$＝168031.66t/yr

Average burnt coal of two sub-zones during the period from October 2005 to April 2006:

（168874.90＋163335.91）/2＝166105.41 t/yr

Average burnt coal of two sub-zones during the period from November 2006 to March 2007:

（164090.43＋168031.66）/2＝166061.05 t/yr

As mentioned in methodology, the lowest amount of annually burnt coal will be applied for the calculation of emission, so the value of $FC_{coal,y}$ in equation should be 166,061.051t/yr. Therefore:

$FC_{coal,y}$ ＝166061.05 t/yr

$$BE_y = \frac{166061.05\cdot\frac{69.74}{100}\cdot44}{12}$$

=424640.24(tCO2**Error! Not a valid embedded object.**yr^{-1})

(2)Project Emissions

The energy consumptions for Shuixi Gou Coalfield Fire Extinguishing Project are divided into two parts, viz. gasoline and diesel consumptions for transportations and gasoline and diesel consumptions in on-site equipments for the fire extinguishing operations and living purposes. The estimation of energy consumption for Shuixi Gou Coalfield Fire Extinguishing Project is presented in Table 4.

a) The diesel and gasoline consumptions for transportation are presented respectively as under:

$FC_{TR,diesel}$=2520（kg）

$FC_{TR,gasoline}$ ==7740（kg）

Based on formula (16), the emission from traffic and transportation is calculated as below:

$$PET = FC_{TR,diesel} \cdot NCV_{diesel} \cdot EF_{CO2,diesel} + FC_{TR,gasoline} \cdot NCV_{gasoline} \cdot EF_{CO2,gasoline}$$

$=2520 \times 4.2652 \times 10^{-5} \times 74100+7740 \times 4.3070 \times 10^{-5} \times 69300$

=31066.466 (kgCO2)

=31.07 (tCO2)

b) The gasoline and diesel consumptions in on-site equipments for the fire extinguishing operations and living purposes are presented respectively as under:

$FC_{on-site,diesel}$=1460912（kg）

$FC_{on-site,gasoline}$ = 0（kg）

Based on formula (17), the emission from on-site fissil fuel consumption is calculated as below:

$$PEFF = FC_{on-site,diesel} \cdot NCV_{diesel} \cdot EF_{CO2,diesel} + FC_{on-site,gasoline} \cdot NCV_{gasoline} \cdot EF_{CO2,gasoline}$$

$=1460912 \times 4.2652 \times 10^{-5} \times 74100+0$

=4617.2317（kgCO2）

=4617.24（tCO2）

Table 4 Estimation of Energy Consumption for Shuixi Gou Coalfield Fire Extinguishing Project

Project Phase	Operational Item		Work Amount		Unit Energy Consumption		Diesel Consumption (kg)	Gasoline Consumption (kg)	Electricity Consumption (KWH)
	Activity	Category	Unit	Value	Unit	Value			
Monitoring before Extinguishing Operations	Personnel Transportation	Traffic and Transportation	km	7200	kg/km	0.2	0	1440	0
Extinguishing Operations	Simple road construction	On-site operation	km	5	kg/km	1855.8	9279	0	0
	Striping/levelling ground	On-site operation	m^3	229669	kg/ m3	1.0486	240831	0	0
	Loess covering (average distance of 2.5km)	On-site operation	m^3	218411	kg/ m3	1.3033	284655	0	0
	Water injection	On-site operation	m^3	215467	kg/ m3	0.479	103209	0	0
	Mud injection	On-site operation	m^3	58642	kg/ m3	0.5968	34998	0	0
	Geophysical exploration	On-site operation	m	5070	kg/ m	6.3	31941	0	0
	Power generation	On-site operation	h	15120	kg/h	50	756000	0	0
	Transportation of Materials	Traffic and Transportation	km	12600	kg/km	0.3	0	3780	0
	Personnel Transportation	Traffic and Transportation	km	12600	kg/km	0.2	2520	0	0
Monitoring during Extinguishing Operations	Personnel Transportation	Traffic and Transportation	km	4200	kg/km	0.2	0	840	0
Monitoring & Maintenance after Extinguishing Operations	Personnel Transportation	Traffic and Transportation	km	8400	kg/km	0.2	0	1680	0
	Total						1463432	7740	0

Note: The unit energy consumption for simple road construction, stripping/levelling ground, loess covering, water injection, mud injection, and geophysical exploration equal to shift hour per equipment/unit work × energy consumption of equipment/unit shift (refer to *Budget Manual for Highway Construction*). Two SUVs are considered for the monitoring before fire extinguishing operation, one round trip per day, 15 days each time, one-trip distance as 30km, totally 4 times. One SUV is considered for the monitoring during fire extinguishing operations, two round trips per day, one trip distance as 5km, totally 210 days and 420 times. Two SUVs are considered for the monitoring after fire extinguishing operation, one round trip per day, 5 days each time, 2 times each year for 7 years, one-trip distance as 30km, totally 14 times. During fire extinguishing operations, transportation is mainly for materials, it is considered that one round trip per day per truck with load of 10 tons, totally 210 days, one-trip distance as 30km, totally 210 round trips. Three vans are considered for personnel transportation, 2 round trips per day, totally 210 days, one-trip distance as 5km, totally 210 round trips.

The total emission of the project activity is calculated based on formula (14) below:

$$PE = PET + PEFF + PE_{EC}$$

=31.07+4617.24+0

=4648.31 (tCO2)

(3)Leakage

Because all emission sources have been covered within the project boundary, leakage is zero tCO_2**Error! Not a valid embedded object.**yr^{-1}.

$LE_y=0$ (tCO_2**Error! Not a valid embedded object.**yr^{-1})

(4) Emission reduction

According to the proposed methodology, the total project emissions are averaged by the first crediting period (seven years) to calculate the annual project emission as the formula below:

$PE_y = \frac{PE}{Years}$ =4648.31/7=664.05 (tCO_2**Error! Not a valid embedded object.**yr^{-1})

The calculation of emission reduction is as per equation 21 below:

$$ER_y = BE_y - PE_y - LE_y \text{ ....(21)}$$

$$= \frac{FC_{coal,y} \cdot \frac{W_{coal,C}}{100} \cdot 44}{12} - PE_y - LE_y$$

=166061.05×69.74÷100×44÷12－664.05－0

=424640.24-664.05-0

=423976.19 （tCO_2**Error! Not a valid embedded object.**yr^{-1}）

Throughout the calculation the emission reduction of the project is 423976.19tCO_2**Error! Not a valid embedded object.**yr^{-1}.

According to the requirements in the methodology, the crediting period for the coal field fire extinguishing project shall be within the span of the predicted burning years. The predicted burning years are calculated by the formula below:

For Fire Sub-zone 1 the seams' dipping angle is 48°, the burning years can be calculated by the formula below:

$$BC = \frac{(S_{coalfield} - S_{coalfire}) h \cdot \rho_{coal}}{FC_{coal,y} \cdot |\mathrm{Cos}\alpha|} \quad \text{……………(18)}$$

Where:

BC = Predicted burning years of the coal field fires (yrs)

$S_{\text{coal field}}$ = Horizontally projected area above phreatic water surface of the coal field where the fire zone is situated (m^2)

$S_{\text{coal fire}}$ = Horizontally projected area of the burning coal seams (m^2)

h = Thickness of the burning coal seams (m)

Error! Not a valid embedded object. = Apparent density of the coal from the burning coal seams (t**Error! Not a valid embedded object.**m^{-3})

Error! Not a valid embedded object. = Dipping angle of the burning coal seams (degrees)

For Fire Sub-zone 2 the seams' dipping angle is 89°, the burning years can be calculated as formula below:

$$BC = \frac{(S_{coalfield} - S_{coalfire}) h \cdot \rho_{coal}}{FC_{coal,y} \cdot |\mathrm{Sin}\alpha|} \quad \text{……………(19)}$$

Where:

$S_{\text{coal field}}$ =Vertically projected area above phreatic water surface of the coal field where the fire zone is situated (m^2)

$S_{\text{coal fire}}$ = Vertically projected area of the burning coal seams (m^2)

That is to satisfy:

The crediting period<BC……………………………………………………………….……..(20)

The calculated result BC=135 years, whereas the crediting period=7years×3=21years, thus satisfies the requirement in the methodology that the crediting period shall be less than the predicted burning years.

B.6.4 Summary of the ex-ante estimation of emission reduction:

>>

Table 5 Emission Reductions

Year	Estimation of Project Activity Emissions (tons of CO_2e)	Estimation of Baseline Emissions (tons of CO_2e)	Estimation of Leakage Emissions (tons of CO_2e)	Estimation of Overall Emission Reductions (tons of CO_2e)
1	664.05	424640.24	0	423976.19
2	664.05	424640.24	0	423976.19
3	664.05	424640.24	0	423976.19
4	664.05	424640.24	0	423976.19
5	664.05	424640.24	0	423976.19
6	664.05	424640.24	0	423976.19
7	664.05	424640.24	0	423976.19
Total (tCO_2e)	**Error! No bookmark name given.**1	**Error! No bookmark name given.**	0	**Error! No bookmark name given.**

B.7 Application of the monitoring methodology and description of the monitoring plan:

B.7.1 Data and parameters monitored:

(Copy this table for each parameter)

Data / Parameter:	$FC_{TR,diesel}$
Data unit:	kg
Description:	Diesel consumption in vehicles for transportation during fire extinguishing operation, monitoring before and during the extinguishing operation, and monitoring and maintenance after the extinguishing operation.
Source of data to be used:	Purchase receipts and storage inventory
Value of data applied for the purpose of calculating expected emission reductions in section B.5	2520
Description of measurement methods and procedures to be applied:	By using flowmeter for the measurement
QA/QC procedures to be applied:	Measurement equipment will be subject to yearly checks and calibration
Any comment:	-

Data / Parameter:	$FC_{TR,gasoline}$
Data unit:	kg
Description:	Gasoline consumption in vehicles for transportation during fire extinguishing operation, monitoring before and during the extinguishing

	operation, and monitoring and maintenance after the extinguishing operation.
Source of data to be used:	Purchase receipts and storage inventory
Value of data applied for the purpose of calculating expected emission reductions in section B.5	7740
Description of measurement methods and procedures to be applied:	By using flowmeter for the measurement
QA/QC procedures to be applied:	Measurement equipment will be subject to yearly checks and calibration
Any comment:	-

Data / Parameter:	$FC_{on-site,diesel}$
Data unit:	kg
Description:	Diesel consumption in on-site equipments during fire extinguishing operation, monitoring before and during the extinguishing operation, and monitoring and maintenance after the extinguishing operation.
Source of data to be used:	Purchase receipts and storage inventory
Value of data applied for the purpose of calculating expected emission reductions in section B.5	1460912
Description of measurement methods and procedures to be applied:	By using flowmeter for the measurement
QA/QC procedures to be applied:	Measurement equipment will be subject to yearly checks and calibration
Any comment:	-

Data / Parameter:	$T_{surface,i}$
Data unit:	K
Description:	Ground surface temperature on point i in fire zone after fire extinguishing operations completed
Source of data to be used:	On-site measurements records.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Not applicable.
Description of measurement methods and procedures to be applied:	The ground surface temperature is measured by CEM DT-8859 IR thermal pistol with a range of −50～1600℃ and a precision of ±1℃.
QA/QC procedures to be applied:	Periodical maintenance and calibration of the monitoring equipments, and measurement scheme established for securing precision.

Any comment:	To determine if the coal fire is under the extinguished stage，the monitoring data will be applicable after the extinguishing project

Data / Parameter:	$T_{gases\text{-}in\text{-}hole,i}$
Data unit:	K
Description:	Gas temperature inside the observatory borehole i
Source of data to be used:	On-site measurements records.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	No applicable.
Description of measurement methods and procedures to be applied:	The observatory boreholes shall be evenly laid out in the fire zone for periodical observations, and generally each borehole can control 25～50m in radius.
QA/QC procedures to be applied:	Periodical maintenance and calibration of the monitoring equipments, and measurement scheme established for securing precision.
Any comment:	To determine if the coal fire is under the extinguished stage，the monitoring data will be applicable after the extinguishing project.

Data / Parameter:	$X_{CO\text{-}in\text{-}hole,i}$
Data unit:	ppm
Description:	CO concentration inside the observatory borehole i
Source of data to be used:	On-site measurements records.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	No applicable.
Description of measurement methods and procedures to be applied:	The observatory boreholes shall be evenly laid out in the fire zone for periodical observations, and generally each borehole can control 25～50m in radius.
QA/QC procedures to be applied:	The measurement shall be conducted when the climatic condition is as the daily average air temperature mostly close to the annual average air temperature and with fluctuation of ±5℃, twice a year with an interval no less than three months.
Any comment:	To determine if the coal fire is under the extinguished stage，the monitoring data will be applicable after the extinguishing project.

B.7.2 Description of the monitoring plan:

>>

The coal fire monitoring includes three stages: before, during, and after the coal fire extinguishing project.

The monitoring before the fire extinguishing operations is based on the direct measurement of ground temperature and areas of fire zone, and the areas, gas temperature, flow rate and compositions (CO_2, CO) of concentrated emission (fractures). For calculating the baseline emissions and predicting the number of burning years, the following parameters will be applied:

- The net calorific value, ultimate analysis, and moisture of the coal as received base
- The thickness and dipping angle and apparent density of the burning coal seams
- The annual average air temperature, annual average wind speed and the maximal air temperature during monitoring where the fire zone is situated.

This data will be measured on-site or collected from the relevant agencies of the coalfield area.,

For monitoring during the fire extinguishing operations, the fuel consumption for the fire extinguishing operations for calculating the project emissions will be measured. All these monitoring parameters are illustrated in Figure 4.

For monitoring after the fire extinguishing operations, the ground surface temperature, and the temperature and CO concentration inside the observatory boreholes in the fire zone after the fire extinguishing operations will be measured. To determine if the coal fire is under the extinguished stage the following criteria shall be fully satisfied.

(1)The ground firing signs ceased and the ground temperature of fire zone ($T_{surface,i}$, ℃) ≤70℃;

(2)The gases temperature ($T_{gases\text{-}in\text{-}hole,i}$ ℃) inside observatory boreholes is decreasing steadily below 70℃;

(3)Carbon monoxide concentration ($X_{CO\text{-}in\text{-}hole,i}$, ppm) inside observatory boreholes is decreasing steadily below 100ppm.

Monitoring Plan:

Before the project, periodically monitor the parameters via direct measurement of ground surface temperature of the fire zone, volumetric contents of CO_2, CO etc., gas flow velocity and gas temperature in the gas emission from the fractures.

During the project, continuously measure the parameters via direct measurement of diesel consumption for the project activities.

After the project, periodically monitor the parameters via direct measurement of ground surface temperature of the fire zone, gas temperature and CO concentration inside the observatory boreholes.

The data acquisition for the monitoring of the fire zone, including the surface temperature and the area of fire zone, the area of fracture, gas temperature and gas composition (CO_2, CO), gas flow velocity, etc., will be entrusted to Xinjiang Coal Field Fire Extinguishing Department. The average annual air temperature and annual average wind speed in the fire zone and other meteorological data will be collected from Xinjiang Climate Center. The data of diesel consumption during the fire extinguishing operations will be measured and recorded by the Project Implementing Agency. All the data will be saved in electronic format and under consolidated management of the Project Implementing Agency.

Monitoring Instruments, Meters (Specifications, Models, and Precisions, etc.):

1. Point Measurement

   Leica SR530 GPS and Leica TCRA1202 R300 Total Station will be applied for the measurement of anomaly areas, fracture ranges, and positioning of temperature and gas measurement points.

   Specifications of Leica SR530 GPS

Receiver of Satellite Signal: 24 Channels Dual Frequency Receiver
Precision of Real Time Baseline Measurement: Fast Static 5mm+2ppm, Kinematic 10mm+2ppm
Post Processing Precision: Static (long baseline, long period of time) 3mm+0.5ppm (rms); Fast Static (<20km) 5mm+1ppm

Specifications of Leica TCRA1202 R300 Total Station
Precision (ISO 17123-3)：2"
Standard Mode/Measurement Time: 2mm+2ppm/1.5s
Fast Mode/Measurement Time: 5mm+2ppm/0.8s
Tracking Mode/Measurement Time: 5mm+2ppm/<0.15s
Minimal Display Unit: 0.1 m
Round Prism (GPR1): 3000 m/3500m
360° Prism (GRZ4): 1500 m/2000m
Small Prism (GMP101): 1200m 2000m
Reflector (60mm x 60mm): 250m
Minimal Range: 1.5m

2. Ground Surface Temperature Measurement

The ground surface temperature is measured by CEM DT-8859 IR thermal pistol with a range of −50～1600℃ and a precision of ±1℃. Temperature measurements will be carried out within the defined boundary or adjoining area with a distance of no more than 5m between the points and the distance between the IR pistol and the points no more than 1m apart, measured by GPS position simultaneously.

3. Gas Sampling and Analysis

Gas composition analysis will apply a exhausted gas analyzer (MRU NOVA H8).
Measurement Range and Precision:
O_2 (0–21.0%) Precision: <0.2% (absolute value)
CO (0–10000ppm) Precision: <400ppm±20ppm, >400ppm±5%
CO_2 (0–20%) Precision: 2% of the measured value
NO (0– 4000ppm) Precision: <100ppm±5ppm, >100ppm±5%
NO_2 (0–1000ppm) Precision: <100ppm±5ppm, >100ppm±5%
SO_2 (0–2000ppm) Precision: <100ppm±5ppm, >100ppm±5%
Exhausted gas Temperature (0～650□) Precision: ±1%
Pressure Measurement (−100.00 to +100.00hPa) Precision: ±1%
Differential Pressure Measurement (−100mbar to +100mbar) Precision: ±1%

The requirements for acquisition of the monitoring data:

1. The ground surface temperature is measured periodically while the climatic condition taken as the air temperature closest to annual average air temperature and with a fluctuation less than ±5℃, twice a year with an interval of no less than three months. During temperature measurement the normal ground temperature shall be no more than the maximal air temperature during the day. The temperature measurement points shall be equably distributed within the defined boundary and with distance of no more than 5m between the points, positioning the points simultaneously, with at least five repeats of temperature measurement at each point and time interval of no less than 1 minute between the repeats. The results are calculated by arithmetical mean.

2. The fracture gas temperature, composition (CO_2, CO) and gas flow velocity are measured periodically while the climatic condition is taken as the air temperature closest to annual average air temperature and with a fluctuation of ±5℃, twice a year with an interval of no less than three months. At normal conditions, the gases measurement sites in each fracture shall be no less than three with a distance no more than 1m, which are equably distributed in the scope of fracture. In case of extremely high temperature or difficult topography leading to the sites not being accessible, it can be determined to be void for safety reasons. The gas measurement at each site shall be at least five repeats and time interval of no less than 2 minutes between the repeats. The results are calculated by arithmetical mean. The positions of gas measurement sites, and the length and width of fractures are measured simultaneously.

3. The observatory boreholes shall be evenly laid out in the fire zone for periodical observations, and generally each borehole can control 25～50m in radius. The observatory boreholes must be mounted with casings perforated in seams section and covered on the opening that can be sealed after measurement and sampling. The casings may directly be buried inside the outcrops of burning seams or fractures in the fire zone, over 1.0m in depth and 0.5m perforated at the bottom with 10mm diameter of perforation and 45perforations/m^2.

4. Coal rock samples must be from the burning seams and the sampling method shall comply with the standard of ISO14180-1998.

5. Coal rock samples are analyzed in parameters of net calorific value, coal proximate analysis and ultimate analysis, for net calorific value according to ISO1928: 1995, coal proximate analysis to ISO17246: 2005, and coal ultimate analysis to ISO17247: 2005.

Quality Assurance and Quality Control (QA/QC) procedures have been formulated in this project, which will be strictly enforced throughout the monitoring. For Quality Assurance and Quality Control (QA/QC) procedures see details in Annex 4.

B.8 Date of completion of the application of the baseline study and monitoring methodology and the name of the responsible person(s)/entity(ies)

>>

Date of completion: 12/20/2007

Name of the responsible persons/entities:

Yu Zhufeng

Beijing Researh Institute of Coal Chemistry, China Coal Research Institute

No.5 Qingniangou Road, Hepingli Chaoyang District

100013 Beijing, China

Tel: +86-10- 8426 2327

Fax: +86-10- 8426 2097

Mobile +86 13601314397

E-mail: zfyu@cct.org.cn

Cai Zhongyong

Xingjian Coal Field Fire Extinguishing Project Department

No.318 Southlake East Road, Urumqi

830063 XinJiang, China

Tel: +86-991-466 3204

Fax: +86-991- 461 1651

Mobile +86 13999895009

E-mail: wwpczy@163.com

Wei Zhihong

Global Climate Change Institute, Tsinghua University

C-405 Energy Science Building

100084 Beijing，China

Tel: +86-10- 6278 8096

Fax: +86-10- 6277 2759

Mobile +86 13910826619

E-mail: weizhihong@tsinghua.edu.cn

Joerg Moczadlo

Director of Environmental Protection in the Energy Industry (EPEI) Programme

Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ) GmbH

Coal Tower, Unit 601,Block 13 Hepingjie, Chaoyang District

100013 Beijing, PR China

Tel: +86-10-8426 4080 ext. 25

Fax: +86-10-8426 4070; +1 41 3803 5357

Mobile +86 13910826619; +49 1713457558 (Germany)

E-mail: Joerg.Moczadlo@gtz.de

The aforementioned responsible person(s)/entity(ies) are not the participants of the Project.

SECTION C. Duration of the project activity / crediting period

C.1 Duration of the project activity:

C.1.1. Starting date of the project activity:

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The envisaged starting date of the Project Activity is April 1, 2008.

C.1.2. Expected operational lifetime of the project activity:

>>

The expected operational duration of the Project is to exceed 30 years.

C.2 Choice of the crediting period and related information:

C.2.1. Renewable crediting period

C.2.1.1. Starting date of the first crediting period:

>>

April 1, 2009

C.2.1.2. Length of the first crediting period:

>>

Seven years

C.2.2. Fixed crediting period:

C.2.2.1. Starting date:

>>

Not applicable.

C.2.2.2. Length:

>>

Not applicable.

SECTION D. Environmental impacts

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D.1. Documentation on the analysis of the environmental impacts, including transboundary impacts:

>>

This will be completed in the final PDD.

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

>>

This will be completed in the final PDD.

SECTION E. Stakeholders' comments

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This will be completed in the final PDD.

E.1. Brief description how comments by local stakeholders have been invited and compiled:

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This will be completed in the final PDD.

E.2. Summary of the comments received:

>>

This will be completed in the final PDD.

E.3. Report on how due account was taken of any comments received:

>>

This will be completed in the final PDD.

References:

• Tool for the Demonstration and Assessment of Additionality, Version 03.

• IPCC Guidelines for National Greenhouse Gas Inventories, 2006

• ACM0002 "Consolidated Baseline Methodology for Grid-connected Electricity Generation from Renewable Sources", Version 6.

• Warren M. Rohsenow, James P. Hartnett, Young I. Cho. Handbook of Heat Transfer, Third Edition. New York: McGraw-Hill, 1998.

• Gas Encyclopaedia [M]. France: Elsevier Science Publishers, 1976.

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

Organization:	Xinjiang Huayu Industry & Trade Inc.
Street/P.O. Box:	Nanhu Road E
Building:	307
City:	Urumqi
State/Region:	Xinjiang Uighur Autonomous Region
Postfix/ZIP:	830063

Country:	China
Telephone:	086-991-4642190
FAX:	086-991-4663208
E-Mail:	cjw7716@163.com
URL:	
Represented by:	
Title:	Chairman of Board
Salutation:	Mr.
Last Name:	Ren
Middle Name:	
First Name:	Xinmin
Department:	
Mobile:	086-13999895009
Direct FAX:	086-991-4663208
Direct Tel:	086-991-4663205
Personal E-Mail:	cjw7716@163.com

Annex 2

INFORMATION REGARDING PUBLIC FUNDING

Annex 3

BASELINE INFORMATION

The following tables include data statistically analyzed from the monitored data by Xinjiang Coal Field Fire Extinguishing Department. All the raw data have been properly saved and are available for inquiry in Xinjiang Coal Field Fire Extinguishing Department.

Table 1 Horizontally Projected Areas of Different Temperature Sections in Shuixi Gou Fire Zone, Jimsar County Unit: (m^2)

No	Temperature Section °C	Fire Sub-zone 1				Fire Sub-zone 2			
		October 2005	April 2006	November 2006	March 2007	October 2005	April 2006	November 2006	March 2007
1	21-50		5644				16300		
2	22-50	6625				15062			
3	23-50				3577				13584
4	25-50			3946				12608	
5	50-100	3182	3666	5094	5951	19814	19796	19068	19300
6	100-150	3214	3516	3670	3755	8475	8278	7976	7426
7	150-200	714	789	846	903	3589	3598	3592	3776
8	200-250	410	434	451	467	1757	1754	1754	1931
9	250-300	330	334	335	337	906	905	905	1013
10	300-350	242	256	268	274	415	414	415	588
11	350-400	166	174	181	186	252	253	253	243
12	400-450	120	124	125	126	167	166	166	146
13	＞450	162	173	181	188	388	389	388	384
14	Total	**Error! No bookmark name given.**	**Error! No bookmark name given.**	**Error! No bookmark name given.**	**Error! No bookmark name given.**	**Error! No bookmark name given.**	**Error! No bookmark name given.**	**Error! No bookmark name given.**	**Error! No bookmark name given.**

Note: Fire sub-zone 1 is sloping at 12°and 2 at 14°, the area of each temperature section is the horizontally projected area of the corresponding temperature section calibrated by the slope.

Table 2 Maximal Ground Temperature of the Fire Zone from 2005 to 2007

Monitoring Date	Sub-zone 1	Sub-zone 2
	K	K
October 27-31, 2005	1059	1476
April 1-5, 2006	1048	1453
November 4-9, 2006	1036	1468
March 20-25, 2007	1054	1448

Table 3 Maximal Air Temperature Where the Fire Zone Situated from 2005 to 2007

Monitoring Date	Air Temperature (K)
October 27-31, 2005	289.3
April 1-5, 2006	289
November 4-9, 2006	292.1
March 20-25, 2007	290.5

Table 4 Parameters of Fire Zone Monitored in October 2005

j	λ_j W**Error! Not a valid embedded object.**(m**Error! Not a valid embedded object.**K)$^{-1}$	ρ_j kg**Error! Not a valid embedded object.**m^{-3}	μ_j Pa**Error! Not a valid embedded object.**s	Pr_j	$C_{P,dispersing,j}$ kJ**Error! Not a valid embedded object.**(m^3**Error! Not a valid embedded object.**K)$^{-1}$
1	0.02875	1.0699	1.98×10^{-5}	0.6966	1.3044
2	0.02882	1.0666	1.99×10^{-5}	0.6964	1.3044

Table 5 Parameters of Fire Zone Monitored in April 2006

j	λ_j W**Error! Not a valid embedded object.**(m **Error! Not a valid embedded object.**K)$^{-1}$	ρ_j kg**Error! Not a valid embedded object.**m^{-3}	μ_j Pa**Error! Not a valid embedded object.**s	Pr_j	$C_{P,dispersing,j}$ kJ**Error! Not a valid embedded object.**(m^3**Error! Not a valid embedded object.**K)$^{-1}$
1	0.02889	1.0633	1.99×10^{-5}	0.6962	1.30448
2	0.02868	1.0732	1.98×10^{-5}	0.6968	1.30436

Table 6 Parameters of Fire Zone Monitored in November 2006

j	λ_j W**Error! Not a valid embedded object.**(m**Error! Not a valid embedded object.**K)$^{-1}$	ρ_j kg**Error! Not a valid embedded object.**m^{-3}	μ_j Pa**Error! Not a valid embedded object.**s	Pr_j	$C_{P,dispersing,j}$ kJ**Error! Not a valid embedded object.**(m^3**Error! Not a valid embedded object.**K)$^{-1}$
1	0.029135	1.0755	2.02×10^{-5}	0.6955	1.30501
2	0.028995	1.0631	2.00×10^{-5}	0.6959	1.30489

Table 7 Parameters of Fire Zone Monitored in March 2007

j	λ_j W**Error! Not a valid embedded object.**(m**Error! Not a valid embedded object.**K)$^{-1}$	ρ_j kg**Error! Not a valid embedded object.**m^{-3}	μ_j Pa**Error! Not a valid embedded object.**s	Pr_j	$C_{P,dispersing,j}$ kJ**Error! Not a valid embedded object.**(m^3**Error! Not a valid embedded object.**K)$^{-1}$
1	0.02804	1.0476	2.02×10^{-5}	0.6952	1.30476
2	0.02896	1.06	1.997×10^{-5}	0.696	1.304586

Table 8 Parameters of Fractures Monitored in October 2005 (Fire Sub-zone 1: n＝1～15; Fire Sub-zone 2: n＝1～25)

n	Fire Sub-zone 1						Fire Sub-zone 2					
	$X_{CO2, n}$ (%)	$X_{CO, n}$ (%)	$FR_{gases,n}$ (m · s^{-1})	$T_{gases,n}$ (K)	S_n (m^2)	$C_{P, gases,n}$ (kJ**Error! Not a valid embedded object.**(m^3**Error! Not a valid embedded object.**K)$^{-1}$)	$X_{CO2, n}$ (%)	$X_{CO, n}$ (%)	$FR_{gases,n}$ (m · s^{-1})	$T_{gases,n}$ (K)	S_n (m^2)	$C_{P, gases,n}$ (kJ**Error! Not a valid embedded object.**(m^3**Error! Not a valid embedded object.**K)$^{-1}$)
1	2.30	0.001	1.75	621	0.50	1.3248	2.80	0.008	1.40	325	3.67	1.3041
2	1.02	0	2.03	495	2.98	1.3128	2.57	0.008	1.63	329	3.57	1.3042
3	0.60	0	1.91	416	10.07	1.3082	2.47	0.009	1.57	337	1.34	1.3046
4	1.07	0.001	2.37	539	0.83	1.3163	2.44	0.015	2.16	351	1.31	1.3051
5	1.48	0	2.46	576	1.19	1.3194	2.43	0.016	1.75	364	1.28	1.3056
6	1.90	0	2.30	657	0.18	1.3291	2.40	0.016	2.00	374	0.58	1.3061
7	2.15	0	2.15	588	0.70	1.3208	2.30	0.016	1.74	376	1.46	1.3062
8	3.90	0.056	1.85	470	1.96	1.3109	2.20	0.017	1.65	379	1.86	1.3063
9	0.31	0	1.83	387	2.90	1.3067	2.11	0.016	1.80	382	1.44	1.3065
10	2.75	0.004	1.87	443	2.73	1.3095	2.05	0.016	2.10	385	0.44	1.3066
11	2.60	0	1.70	799	8.93	1.3471	2.10	0.016	2.10	391	0.53	1.3069
12	1.90	0.029	2.00	413	0.99	1.3080	0.48	0.005	2.25	354	1.50	1.3052
13	1.71	0.002	1.82	612	5.37	1.3237	0.28	0.001	1.83	394	6.24	1.3071
14	1.06	0.005	1.90	499	5.88	1.3131	0.40	0.005	2.15	362	0.58	1.3056
15	0.53	0.002	2.02	411	4.01	1.3079	4.18	0.025	1.87	468	6.82	1.3108
16							2.18	0.041	1.25	423	3.00	1.3085
17							2.58	0.038	1.88	453	1.75	1.3100
18							2.83	0.009	2.03	364	2.41	1.3056
19							0.92	0	2.10	357	5.46	1.3054
20							0.85	0	2.13	403	1.16	1.3075
21							1.80	0	1.97	545	0.81	1.3168
22							2.06	0	1.98	378	2.14	1.3063
23							1.20	0	1.75	353	1.00	1.3052
24							1.67	0	2.03	423	0.88	1.3085
25							2.40	0	2.30	415	0.75	1.3081

Table 9 Parameters of Fractures Monitored in April 2006 (Fire Sub-zone 1: n＝1～15; Fire Sub-zone 2: n＝1～25

n	Fire Sub-zone 1						Fire Sub-zone 2					
	$X_{CO2, n}$ (%)	$X_{CO, n}$ (%)	$FR_{gases,n}$ (m · s^{-1})	$T_{gases,n}$ (K)	S_n (m^2)	$C_{P, gases,n}$ (kJ**Error! Not a valid embedded object.**(m^3**Error! Not a valid embedded object.**K)$^{-1}$)	$X_{CO2, n}$ (%)	$X_{CO, n}$ (%)	$FR_{gases,n}$ (m · s^{-1})	$T_{gases,n}$ (K)	S_n (m^2)	$C_{P, gases,n}$ (kJ**Error! Not a valid embedded object.**(m^3**Error! Not a valid embedded object.**K)$^{-1}$)
1	2.30	0.001	1.75	610	0.46	1.3234	2.88	0.008	1.98	314	3.39	1.3036
2	1.02	0	1.42	483	2.90	1.3118	2.57	0.008	1.90	317	3.35	1.3037
3	0.60	0	1.90	404	9.14	1.3076	2.47	0.009	1.83	325	1.28	1.3041
4	1.07	0.001	2.20	527	1.02	1.3153	2.44	0.015	2.16	339	1.58	1.3047
5	1.48	0	2.00	564	1.51	1.3183	2.43	0.016	2.35	352	1.37	1.3051
6	1.90	0	2.20	654	0.17	1.3276	2.47	0.016	2.40	363	0.58	1.3056
7	2.15	0	2.00	576	0.56	1.3194	2.30	0.016	2.20	364	1.51	1.3056
8	3.90	0.056	1.88	458	1.68	1.3103	2.20	0.017	1.85	368	1.48	1.3058
9	0.31	0	2.00	375	2.49	1.3061	2.10	0.016	1.97	370	1.14	1.3059
10	2.75	0.004	1.90	431	2.94	1.3089	2.05	0.016	1.85	373	0.41	1.3060
11	3.00	0.001	1.80	803	6.55	1.3476	2.10	0.016	1.90	379	0.50	1.3063
12	1.93	0.029	1.53	401	0.91	1.3074	0.48	0.005	1.78	368	1.42	1.3058
13	1.79	0.002	1.85	595	4.73	1.3216	0.28	0.001	1.87	382	5.79	1.3064
14	1.06	0.005	2.11	487	5.26	1.3121	0.40	0.005	1.95	350	0.54	1.3051
15	0.51	0.002	1.82	400	7.17	1.3074	4.18	0.025	1.90	457	6.59	1.3102
16							2.18	0.041	1.58	426	2.63	1.3086
17							2.58	0.038	1.95	441	1.93	1.3094
18							2.83	0.009	1.87	352	2.46	1.3052
19							0.92	0	2.00	345	6.38	1.3049
20							0.85	0	2.08	392	1.26	1.3069
21							1.80	0	2.07	533	0.70	1.3158
22							1.88	0	2.00	376	1.55	1.3062
23							1.50	0	2.15	341	0.84	1.3047

24							1.67	0	1.83	411	1.88	1.3079
25							2.40	0	2.10	404	0.73	1.3075

Table 10 Parameters of Fractures Monitored in November 2006 (Fire Sub-zone 1: n＝1～15; Fire Sub-zone 2: n＝1～25)

n	Fire Sub-zone 1						Fire Sub-zone 2					
	$X_{CO2, n}$ (%)	$X_{CO, n}$ (%)	$FR_{gases,n}$ (m · s^{-1})	$T_{gases,n}$ (K)	S_n (m^2)	$C_{P, gases,n}$ (kJ**Error! Not a valid embedded object.**(m^3**Error! Not a valid embedded object.**K)$^{-1}$)	$X_{CO2, n}$ (%)	$X_{CO, n}$ (%)	$FR_{gases,n}$ (m · s^{-1})	$T_{gases,n}$ (K)	S_n (m^2)	$C_{P, gases,n}$ (kJ**Error! Not a valid embedded object.**(m^3**Error! Not a valid embedded object.**K)$^{-1}$)
1	2.40	0.002	1.75	621	0.41	1.3248	2.90	0.006	1.97	321	3.24	1.3039
2	1.12	0.001	1.78	495	2.86	1.3128	2.68	0.007	1.83	331	3.58	1.3043
3	0.70	0.001	1.95	416	9.42	1.3082	2.63	0.008	2.00	339	1.14	1.3046
4	1.17	0.002	2.10	539	0.79	1.3163	2.54	0.014	2.04	348	1.22	1.3050
5	1.40	0.001	2.45	553	1.20	1.3174	2.53	0.015	1.75	361	1.33	1.3055
6	2.00	0.001	2.30	657	0.20	1.3291	2.50	0.015	2.00	371	0.57	1.3059
7	2.25	0.001	2.15	588	0.78	1.3208	2.40	0.015	1.74	373	1.36	1.3060
8	4.00	0.069	1.85	470	2.23	1.3109	2.30	0.016	1.65	376	1.74	1.3062
9	0.41	0.001	1.83	387	2.75	1.3067	2.20	0.015	1.80	379	1.32	1.3063
10	2.85	0.005	1.87	443	2.66	1.3095	2.15	0.015	2.10	382	0.41	1.3065
11	2.70	0.001	1.70	799	8.04	1.3471	2.20	0.015	2.10	388	0.53	1.3068
12	2.03	0.030	2.00	413	1.09	1.3080	0.58	0.004	2.25	424	1.28	1.3086
13	1.67	0.002	1.94	599	4.93	1.3221	0.38	0.002	1.83	394	5.92	1.3071
14	1.09	0.005	1.93	504	5.60	1.3135	0.50	0.006	2.15	366	0.50	1.3057
15	0.71	0.003	2.04	404	6.19	1.3076	4.28	0.026	1.87	469	6.10	1.3108
16							2.28	0.042	1.63	461	2.06	1.3104
17							2.68	0.039	2.13	447	1.59	1.3079
18							2.93	0.009	1.83	358	2.25	1.3054
19							1.02	0.001	1.88	351	5.00	1.3051
20							0.95	0.001	1.80	397	1.13	1.3072
21							1.90	0	2.03	539	0.93	1.3163
22							1.20	0	1.98	382	2.19	1.3065
23							0.75	0	1.35	347	1.17	1.3050
24							1.95	0.001	1.58	415	1.86	1.3081

25							2.50	0.001	1.90	409	0.76	1.3078

Table 11 Parameters of Fractures Monitored in March 2007 (Fire Sub-zone 1: n＝1～15; Fire Sub-zone 2: n＝1～25)

n	Fire Sub-zone 1						Fire Sub-zone 2					
	$X_{CO2,n}$ (%)	$X_{CO,n}$ (%)	$FR_{gases,n}$ (m · s^{-1})	$T_{gases,n}$ (K)	S_n (m^2)	$C_{P,gases,n}$ (kJ**Error! Not a valid embedded object.**(m^3**Error! Not a valid embedded object.**K)$^{-1}$)	$X_{CO2,n}$ (%)	$X_{CO,n}$ (%)	$FR_{gases,n}$ (m · s^{-1})	$T_{gases,n}$ (K)	S_n (m^2)	$C_{P,gases,n}$ (kJ**Error! Not a valid embedded object.**(m^3**Error! Not a valid embedded object.**K)$^{-1}$)
1	2.50	0.004	1.75	623	0.49	1.3250	3.00	0.011	2.00	326	3.04	1.3041
2	1.22	0.005	2.07	496	2.96	1.3129	2.77	0.011	1.67	330	3.41	1.3043
3	0.78	0.004	2.02	414	10.57	1.3080	2.67	0.012	1.70	338	1.49	1.3046
4	1.27	0.005	2.37	541	0.88	1.3164	2.64	0.018	2.16	353	1.39	1.3052
5	1.68	0.004	2.22	577	1.22	1.3195	2.63	0.019	1.85	365	1.11	1.3057
6	2.10	0.004	2.10	658	0.18	1.3292	2.60	0.019	2.00	375	0.49	1.3061
7	2.35	0.004	1.95	589	0.77	1.3210	2.50	0.019	1.74	377	1.76	1.3062
8	4.10	0.004	1.80	471	1.91	1.3109	2.40	0.020	1.65	381	1.68	1.3064
9	0.51	0.005	1.83	389	2.80	1.3068	2.30	0.019	1.83	383	1.30	1.3065
10	2.95	0.004	1.87	445	2.73	1.3096	2.25	0.019	1.90	386	0.49	1.3066
11	2.90	0.004	1.80	805	8.09	1.3478	2.30	0.019	1.95	393	0.48	1.3070
12	2.13	0.004	2.00	415	0.85	1.3081	0.68	0.008	2.00	356	1.49	1.3053
13	2.10	0.004	2.18	620	5.46	1.3246	0.48	0.004	1.90	395	6.50	1.3071
14	1.26	0.005	1.89	500	6.14	1.3132	0.60	0.008	1.85	363	0.61	1.3056
15	0.88	0.005	1.86	443	5.70	1.3095	4.60	0.031	1.86	474	6.46	1.3110
16							2.38	0.044	1.25	425	2.78	1.3086
17							2.78	0.041	1.88	454	1.70	1.3101
18							3.03	0.011	2.03	365	2.49	1.3057
19							1.12	0.003	2.10	358	5.53	1.3054
20							1.05	0.003	2.13	405	1.15	1.3076
21							2.00	0.003	1.97	547	0.85	1.3169

22							1.30	0.003	1.95	390	2.06	1.3068
23							0.85	0.003	1.75	354	0.83	1.3052
24							1.87	0.003	2.03	424	2.07	1.3086
25							2.45	0.003	2.25	420	0.73	1.3084

Table 12 Statistics of Heat Released from Shuixi Gou Fire Zone

Unit: KJ/yr

Date	Fire Sub-zone 1				Fire Sub-zone 2				Total
	$HC_{radiation，y}$	$HC_{convection，y}$	$HC_{carried\_concentrating,y}$	$HC_{carried\_dispersing,y}$	$HC_{radiation，y}$	$HC_{convection，y}$	$HC_{carried\_concentrating,y}$	$HC_{carried\_dispersing,y}$	
2005.10.27 -2005.10.31	5.95E+11	1.44E+11	4.51E+11	1.15E+10	2.74E+12	4.33E+11	2.67E+11	3.95E+10	4.68E+12
2006.04.01 -2006.04.05	6.27E+11	1.39E+11	4.04E+11	1.22E+10	2.66E+12	3.96E+11	2.54E+11	3.58E+10	4.53E+12
2006.11.04 -2006.11.09	6.47E+11	1.44E+11	4.36E+11	1.27E+10	2.66E+12	3.68E+11	2.48E+11	3.72E+10	4.55E+12
2007.03.20 -2007.03.25	6.90E+11	1.45E+11	4.80E+11	1.42E+10	2.63E+12	3.83E+11	2.75E+11	3.89E+10	4.66E+12

Table 13 Statistics of Annual Burnt Coal in Shuixi Gou Fire Zone

Unit: t/a

Date	Fire Sub-zone 1				Fire Sub-zone 2				Corresponding to emitted CO	Burnt Coal
	Via Radiation	Via Convection	Via Concentrated Emission	Via Dispersed Emission	Via Radiation	Via Convection	Via Concentrated Emission	Via Dispersed Emission		
2005.10.27 - 2005.10.31	21505.31	5206.53	16309.81	413.72	98958.55	15637.88	9638.01	1428.21	223.12	168874.90
2006.04.01 - 2006.04.05	22666.74	5019.64	14582.00	439.58	96085.11	14298.56	9187.70	1292.13	235.55	163335.91
2006.11.04 - 2006.11.09	23365.68	5201.14	15744.18	457.82	95980.29	13277.04	8956.82	1343.51	236.04	164090.43
2007.03.20 -	24918.65	5251.51	17343.76	511.69	95088.29	13843.79	9945.43	1404.56	276.02	168031.66

2007.03.25										

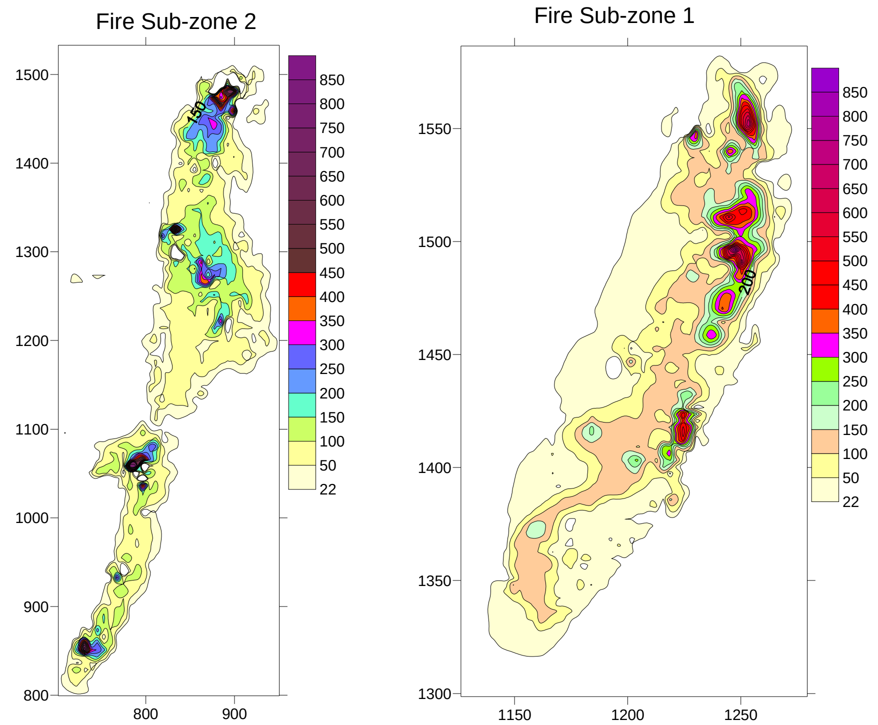

Figure 1 Isothermal Chart of the Fire Zone during Monitoring in October 27-31, 2005

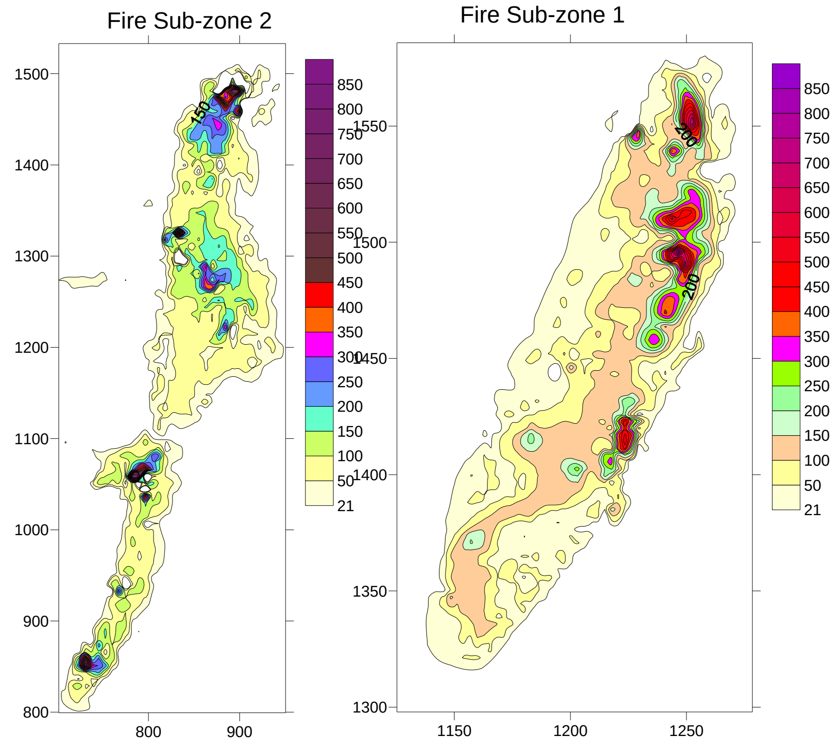

Figure 2 Isothermal Chart of the Fire Zone during Monitoring in April 1-5, 2006

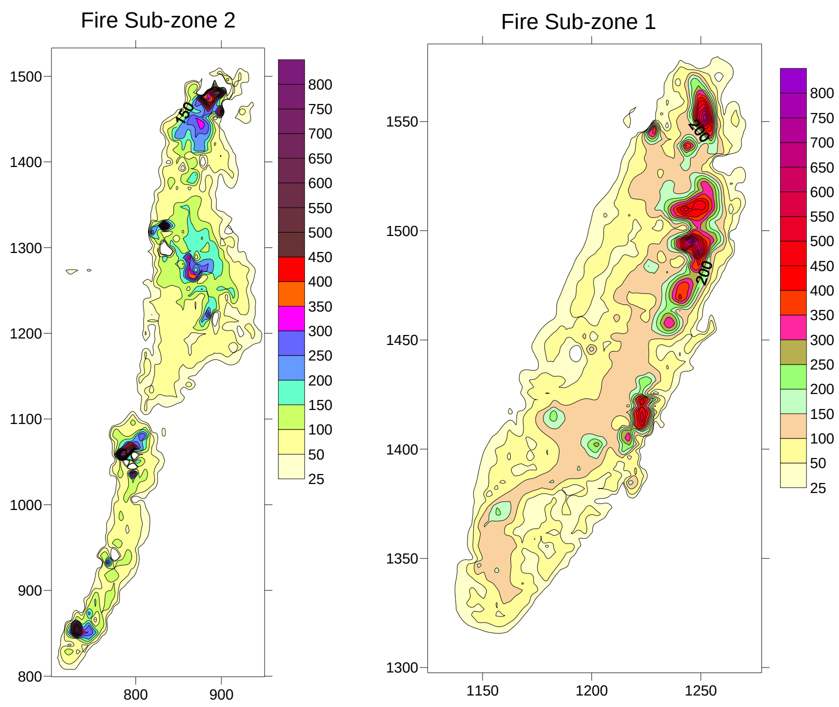

Figure 3 Isothermal Chart of the Fire Zone during Monitoring in November 4-9, 2006

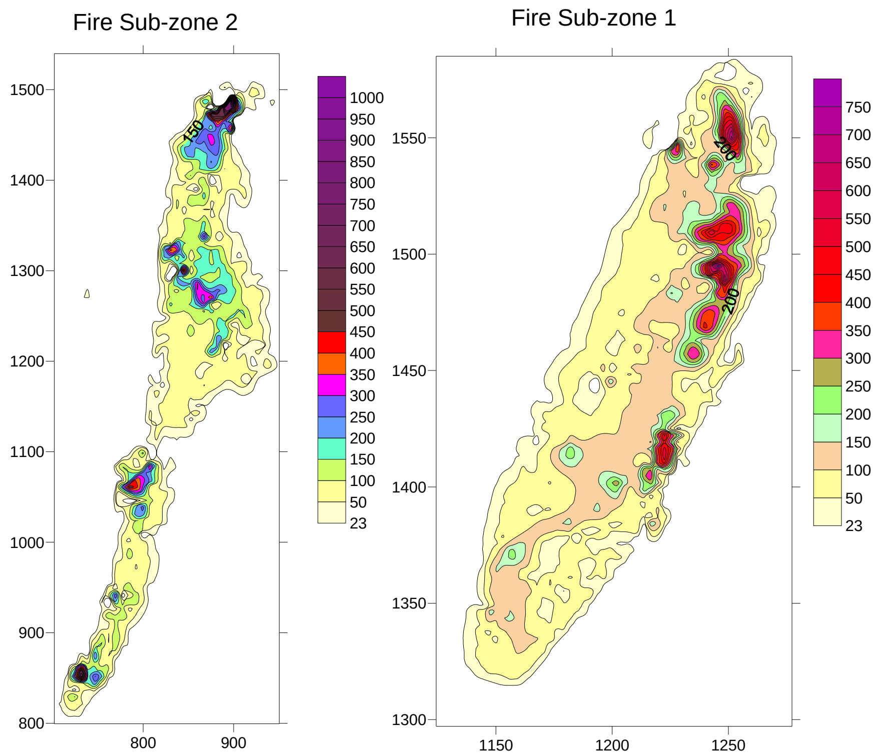

Figure 4 Isothermal Chart of the Fire Zone during Monitoring in March 20-25, 2007

Annex 4

MONITORING INFORMATION

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