

**S&T**  
**Annual Report**

**वार्षिक प्रतिवेदन**  
**2013-14**

**Government of India**  
**Ministry of Coal**  
**New Delhi 110 001**

**Central Mine Planning & Design Institute Limited**  
A Miniratna Company  
(A Subsidiary of Coal India Limited)  
Gondwana Place, Kanke Road, Ranchi 834 031

# प्राक्कथन

कोयला उद्योग के समग्र विकास के लिए सुव्यवस्थित अनुसंधान का कार्य 1975 में सरकार के योजनाबद्ध कार्यक्रम "कोयला विज्ञान एवं प्रौद्योगिकी योजना" अपनाने के बाद ही शुरू हुआ। इससे अनुसंधान एवं विकास कार्यों को कोयला गवेषण से लेकर खननोत्तर पर्यावरणीय मुद्दों तक के विषयों को व्यापक विस्तार मिला है।

सेन्ट्रल माइनप्लानिंग एण्ड डिजाइन इंस्टीच्यूट लिमिटेड (सीएमपीडीआईएल), कोयला विज्ञान एवं प्रौद्योगिकी परियोजना के समवयन एवं निगरानी के लिये नोडल एजेंसी है।

वर्तमान में कोयला विज्ञान एवं प्रौद्योगिकी कार्यक्रम का संचालन स्थायी वैज्ञानिक अनुसंधान समिति (एस. एस. आर. सी.) नामक एक शीर्ष वैज्ञानिक निकाय द्वारा किया जाता है। एस. एस. आर. सी. को कोयला अनुसंधान के निम्नलिखित महत्वपूर्ण क्षेत्रों से संबंधित एक तकनीकी उप समिति द्वारा सहायता प्रदान की जाती है :

- उत्पादन, उत्पादकता एवं सुरक्षा
- कोयला परिष्करण एवं उपयोग
- पर्यावरण एवं पारिस्थितिकी

कोयला मंत्रालय के विज्ञान एवं प्रौद्योगिकी अनुदान के तहत अनुसंधान परियोजनाएँ कोयला एवं लिग्नाईट उत्पादक कम्पनियों के सक्रिय सहयोग से कोयला एवं समबद्ध उद्योग में लगे नेशनल रिसर्च आर्गेनाइजेशन, शैक्षणिक संस्थानों तथा निजी संगठनों द्वारा कार्यान्वित की जा रही है। इसके फलस्वरूप आज तक स्थापनाकाल से अबतक लगभग 231 करोड़ रुपये की लागत वाली 310 परियोजनाएं पूरी की जा चुकी है। इनमें से कई परियोजनाओं से काफी लाभ मिला है जिसके फलस्वरूप गवेषण, परिचालन में सुधार, संरक्षण, अपेक्षाकृत सुरक्षित कार्य करने की स्थिति, बेहतर संसाधन प्राप्ति तथा पर्यावरण एवं पारिस्थितिकी का संरक्षण, कोयले की धुलाई एवं उपयोग प्रौद्योगिकी तथा अन्य सम्बद्ध सेवाओं से पर्याप्त लाभ मिला है (कुछ अनुसंधान परियोजनाओं से उद्योग पर प्रत्यक्ष रूप से ठोस प्रभाव पड़ा है जबकि कुछ अन्य से चालू खाने तथा भावी खनन परियोजनाओं दोनों द्वारा अपेक्षित माइन प्लानिंग डिजाइन तथा तकनीकी सेवाएं सशक्त हुई है।

इस वार्षिक रिपोर्ट में विवेच्य वर्ष के दौरान 12 जारी परियोजनाएं एवं 05 पूरी की जा चुकी परियोजनाओं की स्थिति को दर्शाया गया है।

आशा है, यह पुस्तिका कोयला तथा इससे सम्बन्धित उद्योगों में लगे सभी अनुसंधान कर्मियों, माइनप्लानरों/डिजाइनरों के लिये उपयोगी होगी।

भविष्य में संस्करण को समृद्ध बनाने के लिये प्रस्तुति एवं विषयवस्तु के प्रकाशन में सुधार लाने हेतु आपके महत्वपूर्ण सुझावों का स्वागत है।

स्थान : रांची

(ए के देबनाथ)

अध्यक्ष—सह—प्रबंध निदेशक

# INDEX

Sl. No.	Name of Project	Code No.	Impl. Agency	Page No.
1.	Development of Self Advancing (Mobile) Goaf Edge Supports (SAGES) for depillaring operations in underground coal mines	MT (EoI)/159	ISM, Dhanbad	
2.	Development of software for prediction of subsidence by 3D numerical modeling for SCCL mines	MT/160	Anna University, Chennai & SCCL, Kothagudem	
3.	Development of customized organic corrosion protection of special mining equipment at Neyveli Lignite mines	MT/161	NLC, Neyveli & CECRI, Karaikudi	
4.	Development of tele robotics and remote operation technology for underground coal mines	MT(EoI)/162	CMERI, Durgapur, CIMFR, Dhanbad & CMPDI, Ranchi	
5.	Enhancing life of de-watering pipes in coal/lignite mines by prevention of erosion-corrosion with nano-crystalline surface engineering treatments	MT/163	NLC, Neyveli & NITT, Tiruchirappalli	
6.	Blast design and fragmentation control-key to productivity	MT/164	CIMFR, Dhanbad	
7.	Shale gas potentiality evaluation of Damodar basin of India	CE(EoI)/30	NGRI, Hyderabad, CIMFR, Dhanbad & CMPDI, Ranchi	
8.	CBM reserves estimation for Indian Coalfields	CE(EoI)/31	IEST, Shibpur, TCE, Kolkata, CMPDI, Ranchi & NGRI, Hyderabad	

## LIST OF COAL S&T PROJECTS COMPLETED DURING 2013-14

Sl. No.	Name of Project	Code No.	Impl. Agency	Page No.
1.	Integrated communication system to communicate and locate trapped underground miners	MT(EoI)/158	Adept Technologies Pvt. Ltd., Kolkata & CMPDI, Ranchi	
2.	Development of tribo-electrostatic separator for beneficiation of high ash Indian coal fines	CP/44	IMMT, Bhubaneswar	
3.	Design and development of coal winnowing system for dry beneficiation of coal based on CFD modeling and simulation	CP/45	CIMFR, Nagpur Unit	
4.	An approach to explore the applicability of spectro-radiometry as a tool of coal quality	CU/58	CIMFR, Dhanbad	
5.	Development of methodology for estimation of Green House Gas (GHG) Emissions in mine fire areas and their mitigation through terrestrial sequestration	EE(EoI)/39	CIMFR, Dhanbad & BHU, Varanasi	



*Production, Productivity & Safety*

**S&T Annual Report  
2013-14**

## Field : Production, Productivity & Safety

Project Code : MT/159

1. Name of the Project : Development of Self Advancing (Mobile) Goaf Edge Support for depillaring operations in underground coal mines
2. Date of Start : September 2010
3. Scheduled date of Completion : Mar 2014/June 2013/December 2012
4. Implementing Agency : ISM, Dhanbad
5. Sub-implementing Agency : M/s JayBharat Equipment Pvt. Ltd, Hyderabad
6. Project leader /Co-ordinator : Prof. (Dr.) U. K. Singh, ISM, Dhanbad  
Shri NVN Reddy , Director , JBEPL, Hyderabad
7. Total Approved Cost : Rs. 197.75 lakh  
For JBEPL - Rs. 135.65 lakh  
For ISM - Rs. 62.10 lakh

## DESCRIPTION OF THE PROJECT

### 8. Objectives :

Design and develop Self Advancing Goaf Edge Support (SAGES) of Medium Duty: 2 x 200T load capacities for depillaring operations in underground coal mines.

### 9. Status as on 31.03.2014 :

Two (2) nos. of Self Advancing (mobile) Goaf Edge Supports (SAGES) are under field trial after modification based on the results of initial two SAGES. Fabrication of SAGES - 5 & 6 was completed based on the inputs from the analysis of results of field trial of SAGES - 3 & 4. These self propelled mobile supports of medium duty (2 x 200 Te.) has closed and extended height range of 1.85 to 3.2 m and can offer support resistance of 71.4 Te./m<sup>2</sup>.

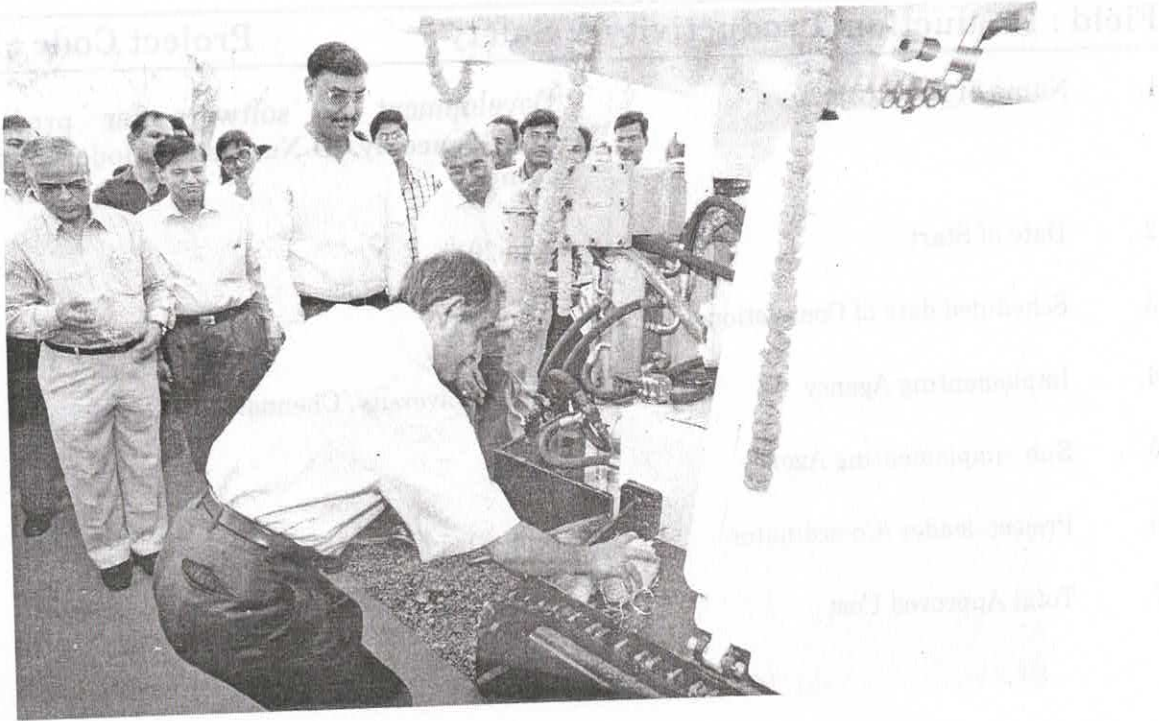
### 10. Slippage, if any :

Delay in approval for field trial from DGMS.

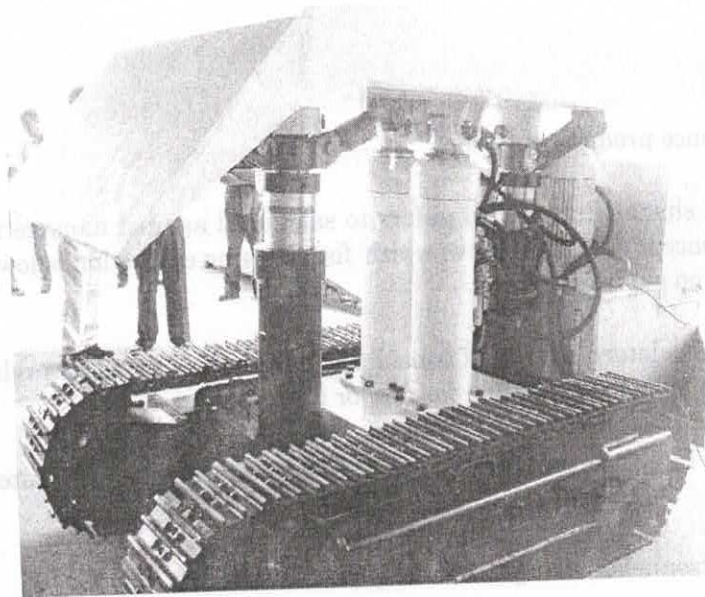
### 11. Action Plan for 2014 -15 :

Sl. No.	Activity	Date of Start	Date of Completion
1	Transportation and installation of SAGES '5' & '6' in Bastacola mine, BCCL	Continued	Apr 2014
2	Modification in improved digital display and alarm system of the SAGES by IIT, Bombay	Continued	Apr 2014
3	Development of testing guidelines for testing	Apr 2014	May 2014
			May 2014





*Release of SAGES to the industry by Shri A. K. Debnath, CMD, CMPDIL and other dignitaries on April, 24, 2014 — MT (EoI)/159*



for subsidence surveys. A comparative study has been done between the observed & theoretically calculated subsidence values and error percentage of the theoretical values were found in the range of 60 - 70% against the observed values. Empirical formula was derived after analysing the collected and measured data by statistical method. Subsidence surveys conducted at Mandamaari and Srirampur Areas of SCCL for defining influencing parameters. The models representing the panels of SCCL mines have been developed. Further calibration of the model and the equation are being carried out to reduce the error limits of the field and resulted data. Subsidence prediction software is being developed using suitable programming language incorporating derived empirical equation. Development of 3D software is in progress.

10. Slippage, if any: NIL

11. Action Plan for 2014 -15 :

Sl. No.	Activity	Date of Start	Date of Completion
1	Development of 3D Software for prediction of subsidence of SCCL mines	Continued	May 2014
2	Uploading of Software in SCCL survey and R&D Office and Training	May 2014	Jun 2014
3	Preparation of Project Report	Jun 2014	Jul 2014



10. Status as on 31.03.2014:

Collection of water & soil samples from SCCL mines completed. Nano Titanium-di-oxide particles were prepared by various routes and their characterisation is under progress. Development of Corrosion model has been completed. Abrasion studies were carried out with two paint formulations. Basic corrosion studies and modeling are completed. Equipment purchase are under progress. One of the coating components was lab. tested and evaluated for field application. A Titanium nano coating material is also under lab evaluation. These coatings were applied partially in Bucket Wheel Excavator 147 of Mine - I and Bucket Wheel Excavator 1422 of Mine - II for evaluation for abrasion corrosion study.

11. Slippage, if any : NIL

11. Action Plan for 2014 -15 :

Sl. No.	Activity	Date of Start	Date of Completion
1	Development of Top Coat	Apr 2014	May 2014
2	Application of the Coating system on SME structures	May 2014	Jun 2014
3	Evaluation of the Coating	Jul 2014	Dec 2014
4	Report Preparation	Dec 2014	Jan 2015

11. Slippage, if any : NIL

12. Action Plan for 2014 -15 :

**CMERI Part**

Sl. No.	Activity	Date of Start	Date of Completion
1.	Selection of equipment, sensors, hardware etc.	Continued	Aug 2014
2.	Procurement of equipment, sensors hardware etc.	Continued	Oct 2014
3.	Manufacturing, fabrication, assembly etc.	Continued	Oct 2014
4.	Sub-system testing & system integration	Continued	Dec 2014
5.	Interfacing electrical, mechanical & sensor modules	Continued	Oct 2014
6.	Lab-scale trial of various modules	Jul 2014	Oct 2014
7.	Limited field trial	Nov 2014	Apr 2015
8.	Necessary modifications	Jan 2015	Continued

**CIMFR Part**

Sl. No.	Activity	Date of Start	Date of Completion
1.	Development of the algorithm for WSN	Continued	In progress
2.	Development of modules for integrating sensors	Continued	In progress
3.	Development of modules for integrating sensors	Continued	In progress

- (iv) To develop appropriate flow models of slurry/slushy flow inside the pipe line using CFD.
- (v) To assess the mechanism of wear produced by existing laboratories scale wear test.
- (vi) To determine the physical and metallurgical details of how pipe material is degrading from erosive wear.
- (vii) To evaluate wear performance based on the methods currently used in the mining and mineral processing industries.
- (viii) To develop statistically-based procedures for efficient and cost-effective performance of pipelines.
- (ix) To conduct field trials of coated/treated pipe for a fixed length.

**9. Status as on 31.03.2014 :**

Characterisation on water and soil samples is in progress. Field visit conducted to assess corrosion level at different mine benches and samples of eroded pipe lines were collected for evaluation. Design of various types of nano material /coating mix is also under progress. Procurement of equipment is under progress. Modeling of pipe line corrosion completed. Laboratory evaluation of pipe samples under progress.

**10. Slippage, if any : NIL**

**11. Action Plan for 2014 -15 :**

Sl. No.	Activity	Date of Start	Date of Completion
1.	Purchase of Cavitation Erosion tester	Jul 2014	Sep 2014
2.	Lab scales studies on coated pipe samples	Jan 2014	Sep 2014
3.	Field trials	Jul 2014	Jan 2016





*The views of the charging of blast holes at Hard overburden bench of East section of Nigahi Project, Northern Coalfields Limited — MT/164*



*View of the blasted muck resulted due to shovel bench blasting at Nigahi Project, NCL — MT/164*

- In first phase it is plan to study two to five bore hole from Damodar basin. Number of shale samples from each bore hole will depend on the thickness of the shale. Core library will be maintained at NGRI and the core will be available for any academic interest.
- Collected shale samples will be analysed for total organic content and their characterization, maturity of organic matter through TOC, pyrolysis test and isotopic measurements at NGRI geochemical lab.
- To measure petrophysical properties (density, porosity, shear and compressional wave velocities) of sedimentary rocks from the deep boreholes and supplement the measurements in the geophysical modeling of the gas bearing shale beds.

**9. Status as on 31.03.2014 :**

22 shale samples from Dharma block of Raniganj and West Mahuda, Singra, Kapuria of Jharia coalfields and 4 samples from Bokaro coalfields were collected and send to CMPDI & NGRI, Hyderabad for petrographic, TOC and Rock eval pyrolysis tests. Proximate analysis was carried out for 51 shale core samples and adsorption isotherm of 20 shale core samples was conducted by CIMFR, Dhanbad. Investigated megascopic properties of shale samples and processed for different analysis. Geo-chemical analysis of shale samples for Rock eval pyrolysis tests is under progress at NGRI, Hyderabad. Procurement of equipment is under progress.

**10. Slippage, if any : Nil**

**11. Action Plan for 2014 -15 :**

**CIMFR Part**

Sl. No.	Activity	Date of Start	Date of Completion
1.	Procurement of equipment	Continued	Jan 2015
2.	Field work of collection of primary data	Continued	Dec 2014
3.	Geological modeling and identification shale formation	Continued	Dec 2014
4.	Assessment of gas in place resource including in situ reservoir characteristic	Jan 2015	Continue
5.	Report preparation	Jan 2015	Continue

1.	Name of the Project	:	CBM reserves estimation for Indian Coalfields
2.	Date of Start	:	Mar 2014
3.	Scheduled date of Completion	:	Feb 2017
4.	Implementing Agency	:	IEST, Shibpur.
5.	Sub-Implementing Agency	:	CMPDI, Ranchi, TCE, Kolkata and NGRI, Hyderabad.
6.	Project leader /Co-ordinator	:	(i) Dr Pratik Dutta, IEST, Shibpur (ii) GM/Dy. GM (CBM), CMPDI, Ranchi (iii) Shri Ranjan Bhattacharya, TCE, Kolkata (iv) Dr. T. Seshunarayana, NGRI, Hyderabad
7.	Total Approved Cost	:	Rs. 2069.91 lakh For IEST – Rs. 763.12 lakh For NGRI – Rs. 457.06 lakh For CMPDI – Rs. 592.73 lakh For TCE – Rs. 257.00 lakh

## DESCRIPTION OF THE PROJECT

### 8. Objectives :

The objectives of the project are:

- To generate an accurate geological model of a study area with associated coal Seams by 2D/3D seismic survey and acquisition of conventional surface / subsurface information and validation of the model by drilling core holes.
- To determine various in situ coal properties for coal characterization within the study area.
- To find out the in-situ gas content and establish adsorption isotherms for estimation of gas saturation.
- To calculate CBM reserve estimate by volumetric method followed by uncertainty analysis by probabilistic method.
- To calibrate the information generated through the steps above by conducting flowing material balance and production decline curve analysis



***Coal Beneficiation & Utilisation***

**S&T Annual Report  
2013-14**

1. **Name of the Project** : Design and Development of truck mounted mobile coal sampler for instant coal ash & moisture analyzer at site from railway wagon/truck
2. **Date of Start** : Aug 2011
3. **Scheduled date of Completion** : Jul. 2015/Oct. 2013
4. **Implementing Agency** : CIMFR, Dhanbad
5. **Sub-Implementing agency** : M/s Pranay Enterprises, Hyderabad
6. **Project leader /Co-ordinator** : (i) Dr. Sudhir Kumar Kashyap, Principal Scientist  
(ii) Shri A. V. L. Narasimha Rao, M/s Pranay Enterprises, Hyderabad
7. **Total Approved Cost** : Rs. 167.60 lakh  
For CIMFR – Rs. 8.85 lakh  
For M/s Pranay Enterprises – Rs. 158.75 lakh

## DESCRIPTION OF THE PROJECT

### 8. Objectives :

To design & develop a truck mounted mobile coal sampler for instant coal ash & moisture analyzer at site from railway wagon/truck

### 9. Status as on 31.03.2014 :

Phase - I study completed and project completion report of Phase -I study submitted. Phase - I study completed and project completion report of Phase -I study submitted. Under this project it was establish the feasibility of nuclear technique method with dual gamma-ray transmission for analysis of coal for ash and moisture content . Phase-II of the project started from Jan 2014 for a duration of 1 year 6 months.

1.	Name of the Project	:	Development of an on-line coal washability analyzer.
2.	Date of Start	:	Mar 2014
3.	Scheduled date of Completion	:	Feb 2016
4.	Implementing Agency	:	CIMFR, Dhanbad
5.	Sub-Implementing agency	:	M/s Ardee Hitech Pvt. Ltd., Kolkata
6.	Project leader /Co-ordinator	:	(i) Mr. K.M.P. Singh, CIMFR, Dhabad (ii) Dr. S. A. Khayyom, M/s Ardee Hi-tech Pvt. Ltd., Vishakhapatanam (iii) Mr. T. Gouri Charan , CIMFR, Dhanbad
7.	Total Approved Cost	:	Rs. 849.00 lakh For CIMFR – Rs. 505.80 lakh For Ardee Hitech – Rs. 343.20 lakh

## DESCRIPTION OF THE PROJECT

### 8. Objectives :

- (i) To develop a X –ray based, online coal washability analyzer and demonstrate the capabilities of the analyzer by comparing efficiency data from traditional float-sink tests with efficiency data generated by the washability analyzer.
- (ii) To develop a laboratory scale model initially to establish the concept and derive the required parameters and to develop suitable software.

The second phase the system may be upgrade for online operations



1. **Name of the Project** : Development of indigenous catalyst through Pilot Scale Studies of Coal-To-Liquid (CTL) conversion technology
2. **Date of Start** : Jan 2010
3. **Scheduled date of completion** : Feb 2015/Jun 2013/Dec 2012
4. **Implementing Agency** : CIMFR, Dhanbad
5. **Sub-Implementing Agency** : CMPDI Ranchi
6. a. **Project Leader** : Dr. Sudip Maity, Scientist  
 b. **Project Co-ordinator** : Dr. Amalendu Sinha, Director
7. **Total Approved Cost** : Rs. 805.40 lakh

For CIMFR – Rs. 688.50 lakh

For CMPDI – Rs. 116.90 lakh

## DESCRIPTION OF THE PROJECT

**8. Objective :**

- (i) developing suitable catalysts and to study the coal-to-liquid conversion technology in Pilot Scale in an integrated plant consisting of low cost air blown gasifier and a multi-tubular fixed bed reactor (Catalyst Capacity: 10.0 L).
- (ii) testing high ash Indian coals in the gasifier.
- (iii) generating basic design & process parameters for further scale-up to commercialization.
- (iv) characterizing the products (liquid and gaseous) and its up-gradation/processing for commercial use.

*Environment & Ecology*

**S&T Annual Report**  
**2013-14**

1.	Name of the Project	:	Modeling of Airborne dust in opencast coal mines
2.	Date of Start	:	Aug 2011
3.	Scheduled date of Completion	:	Jul 2014
4.	Implementing Agency	:	NIT , Suratkhali
5.	Project leader /Co-ordinator	:	Prof. (Dr.)V R Sastry , NIT , Suratkhali
6.	Total Approved Cost	:	Rs. 77.04 lakh

## DESCRIPTION OF THE PROJECT

### 7. Objectives :

To analyze the dust generation from different sources and dispersion in terms of different particulate matter at various places and horizons, and develop a model based on the field data to predict dust concentration and software appropriate for Indian metrological and mining conditions for devising effective mitigation measures.

### 8. Status as on 31.03.2014 :

Except Dosimeter all other equipment were procured. Data collected in first phase study at PK OC-II project and Manuguru, SCCL. Analysis of collected data is under progress.

### 9. Slippage, if any :

Delay in procurement of equipment



***S&T Completed Projects during 2013-14***

**S&T Annual Report  
2013-14**

1. Name of the Project : Integrated communication system to communicate and locate trapped underground miners
2. Date of Start : September 2010
3. Scheduled date of Completion : August 2013
4. Implementing Agency : AdCept Technologies Private Limited ,Kolkata
5. Sub -implementing Agency : CMPDIL , Ranchi
6. Project leader /Co-ordinator : Shri Soumya K. De, AdCept Technologies Private Limited ,Kolkata
7. Total Approved Cost : Rs. 459.59 lakh  
For AdCept – Rs. 407.95 lakh  
For CMPDIL Rs. 51.64 lakh

## **DESCRIPTION OF THE PROJECT**

### **8. Objectives :**

The objective of this project is to introduce communication systems that would :

(i) be able to rescue workforce in case of an underground accident and be able to communicate from surface to underground miners and (ii) to locate/track miners involved in the incidence, besides, providing communication for day to day activities in underground mines. The project work will be conducted at Bansgarha Seam, Central Saunda Colliery of Central Coalfields Limited.

The complete communication System will be based on :

1. Through-the earth (TTE) one way messaging system with all communication infrastructure on the surface, including the antenna
2. Tracking system with location readers deployed in the underground



Through The Earth (TTE) ULF based PED system to provide mine wide coverage for the Lower Semana seam. The antenna, much longer run than what was deployed in Central Saunda, had to be re-deployed by trenching (1.5m depth) almost 5Km based on the findings of the survey.

A new 5000m surface antenna (with a loop diameter of 800m) providing approximate 3.2Sq. Km. signal coverage was deployed taking into consideration following on-ground conditions, including surface fire, housing colonies, other limitations due to terrain conditions. The system provided mine wide coverage to the Lower Semana seam of Bhurkunda mines. The frequency used for transmission of PED messages is 372 Hz. Also the new LED based cap lamps that enhanced the light for miners by several factors and increased battery life of the ICCLs, were introduced in this phase. The miners who have experienced the new generation ICCLs, have received the LED light's performance in great spirit.

#### *Field testing and observation at Bhurkunda Mines*

Through The Earth Messages were sent as and when required to the supervisors who were equipped with the Integrated Communications Cap Lamp (ICCL) when going to the underground as part of their daily duties. It was noted and verified that all messages that were sent from the surface control center were received by the supervisors in the underground. In this case, it was observed that messages were received through the earth when supervisors travelled to Hathidari mines (another seam)! Hence, multi-seam messaging was demonstrated by this installation. A log sheet of records of messages sent and received were kept. Study of the same has ascertained 100% successful receipt of messages sent from surface control center.

### **Phase II - Miner Tracking System at Bhurkunda Mines**

The Location Readers were placed based on the mine's coverage requirement. As the mines' working zone changes, the Location Readers have to be re-located to provide coverage to miners.

#### *Field testing and observation Tracking System*

The Digital Wireless Network Miner Tracking System was deployed per the suggestion of the mine management to provide coverage in the main tunnel and working zones. The Tracking software at the surface control center, displays the last known location of the miners carrying either the ICCL cap lamps (with integrated RFID) or self-contained RFID tags. The records are stored in the database for future analyses. Since all the records are stored in the database, one could search through the history records for their whereabouts during a shift for each or a group of miners on any particular date/time. This system has helped the Project office to know the location of all miners carrying the ICCLs or Tags.

### **Phase III - Application Level Integration of TTE Messaging and Location Tracking System**

A new hardware platform with integrated system was deployed on site. The systems interfaces were configured to match the site requirements. After successful testing and trial in sending messages



1. Name of the Project : Development of Tribo-electrostatic Separator for Beneficiation of High Ash Indian Coal Fines
2. Date of Start : August 2011
3. Scheduled date of Completion : January 2014
4. Implementing Agency : IMMT , Bhubaneswar
5. Project leader /Co-ordinator : Dr. R.K. Dwari, Scientist/  
Sri PSR Reddy, HoD, MPD, IIMT, Bhubaneswar
6. Total Approved Cost : Rs. 47.67 lakh

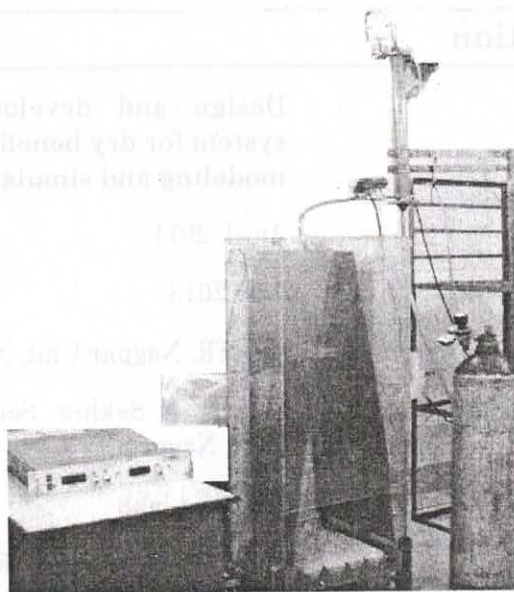
## **DESCRIPTION OF THE PROJECT**

### **7. Objectives :**

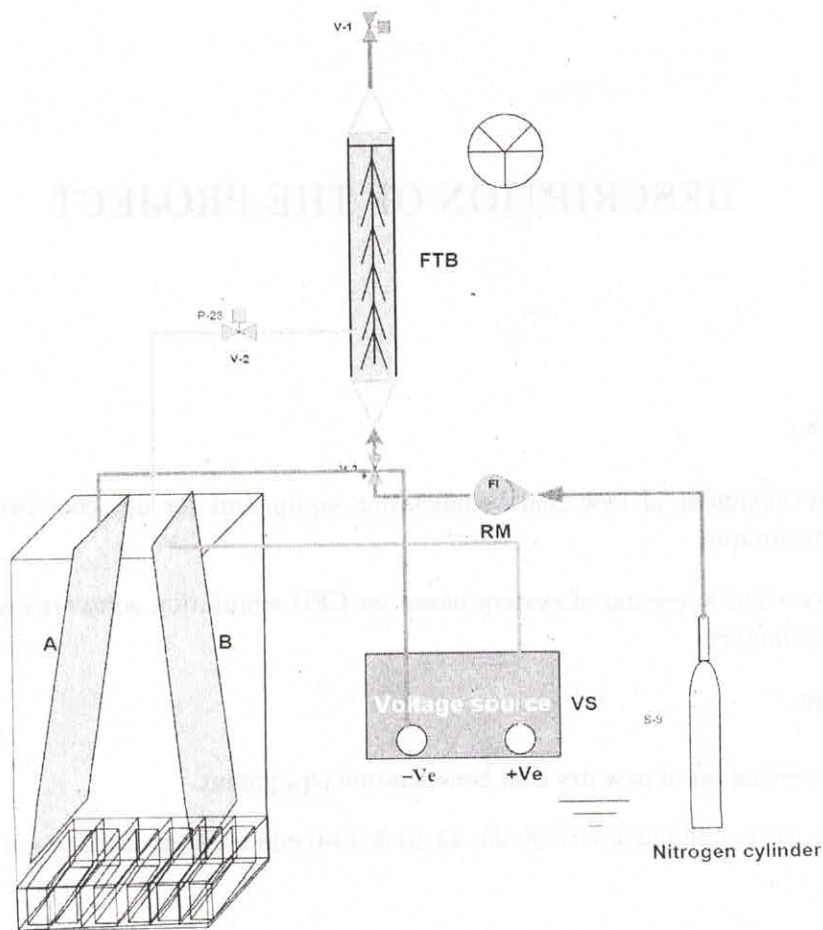
The main objective of this project is to develop a tribo-electrostatic separator and to study the design characteristics for beneficiation of high ash Indian coking coal at finer sizes to reduce the ash content.

### **8. Work Done :**

- Developed tribo-electrostatic free fall separator with vibratory feeder with copper liner tribo-charger and fluidized bed tribo-charger with internal baffle system.
- ROM coal, rejects and slurry fines samples were collected from Dugda II washery, Dugda Area, BCCL.
- Detailed physico-chemical characterization, petrography analysis and washability characteristics of all the three samples were carried out.
- Tribo-charging characteristic of ash forming minerals and carbon particles were carried out at different humidity condition.
- Proto type bench scale tribo-electrostatic separation experimental system was designed with all facilities. fabricated and installed with successes.



*Fluidized bed tribo-electrostatic separator*



*Schematic representation of tribo-electrostatic separator with fluidized bed tribo-charger with internal baffle system*

## 9. Findings :

- (a) Bench scale Coal winnowing plant of 3.5 TPH is capable of spreading the coal particles as per their specific gravity.
- (b) ROM coal having average ash of 47.4% & GCV 2967 Kcal/kg (G15) has given clean coal of average ash 43.1% with 3219 Kcal/kg GCV (G14) & reject has average ash of 64.6% (below G17).
- (c) This means that the process is efficient to separate ROM coal into cleans & reject. The yield of cleans is 79.5% and reject is 20.5%.
- (d) By increasing the air velocity or increasing the separating plate distance ash% of cleans can be reduced further by losing in yield%.
- (e) Winnowing index or effectiveness of separation was found to be 41.12%.
- (f) Coal winnowing technique can be effectively applied to physically separate the coal & shale particles

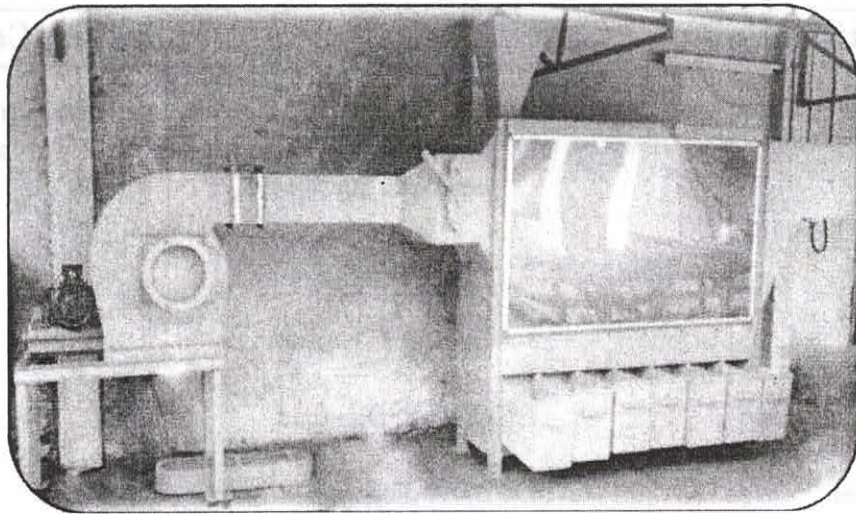
### Advantages of Coal winnowing system :

- Simple, innovative, low cost system for Dry Coal beneficiation.
- Air is being used as separation medium, which is free & abundant.
- Low processing cost due to absence of water circuit. As per one estimate the washing cost can be reduced to 50% of conventional plant.
- No water use and water or land pollution problem.
- Pit head & movable plant can be possible.
- Product coal can be used in the conventional Thermal power plants & reject coal can be used in the reject based power plants.

Under this project, Bench scale Coal winnowing plant of 3.5 TPH was developed which is capable of spreading the coal particles as per their specific gravity. The developed coal winnowing system is a simple and low cost system in which the shale particles from coal are segregated easily. The system is based on the principles of horizontal winnowing. The average ash percentage of the obtained cleans is well within the demand of modern days thermal power stations i.e. 34%. The study is based on 25-13 mm coal size fraction at 30-35 m/sec air velocity.

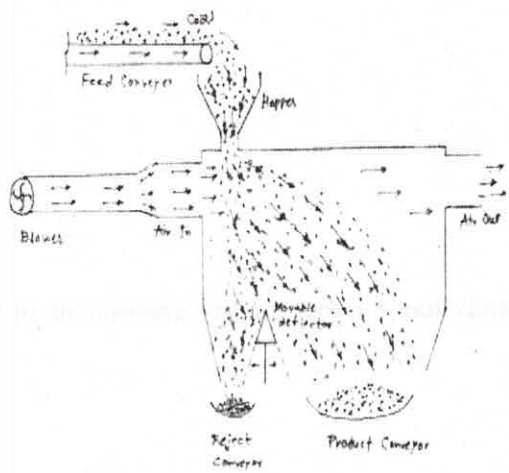
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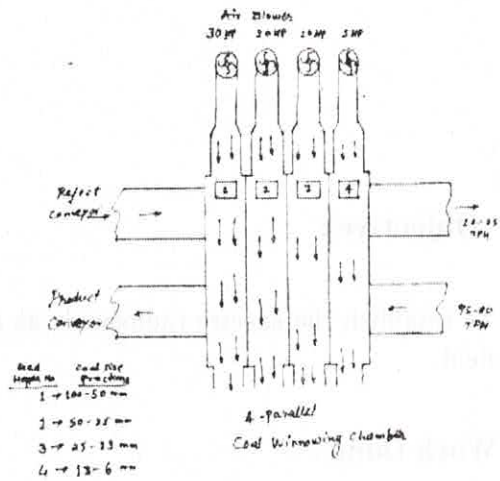


Coal Winnowing System — CP/45

Proposed 100 TPH Coal winnowing system (Side view)



Proposed 100 TPH Coal winnowing system (Top view)



- For determination of ultimate constituents such as carbon, hydrogen, nitrogen, sulphur, oxygen, the IS 1350-Part-2 was followed manually; where as automatic elemental analyzer (make Elementar, Germany) was also used.
- Calorific value was done following Indian Standard, IS 1350-(Part-II, 1970). Petrography / microscopic study of the samples was done following IS 9127, for petrography of normal coaly fragments (1 mm) were taken for preparing polished pellets [embedded in Carnauba wax with dyeing agent (Nigrocine powder)] to be studied under microscope. Petrography was done using advanced DMRXP & DM4500 (Leica make, Germany) Polarizing microscope.
- Spectral emissivity data/curve was obtained in the field and laboratory using the Spectro-radiometer (102 Portable FTIR, D&P make USA). It has inbuilt CCD detectors, maintained at around minus 200 degree centgrade through liquid nitrogen gas.
- Readings were taken from the objects/litho-units from a distance of 1 to 30 meters. All-out effort was made to minimize the noise & disturbances such as: sound from mining machinery/dumpers/excavators, blasting explosions, mine fires, noise for man power at site, etc. Some times weathered zones at considerable height could not be isolated from Field of View (FOV) of observation of the instrument while taking the readings from faces.
- After the spectral reading was taken from the available faces in respective mines, the samples were collected for petrographic and chemical analyses for correlation with special signatures.
- The samples received at CIMFR were initially air dried and crushed to 50 mm in a continuously operated single roll crusher. The crushed sample was thoroughly mixed and after proper sampling it was powdered in different sizes for various tests.
- There is very significant correlation among different parameters with emissivity values, which was obtained from the field under diverse geo-climatic and operational conditions, also off course diverse locational conditions.
- Some correlation values ( $R^2$ ) obtained are as given below :
  - ❖ Correlation values ( $R^2$ ) between Emissivity and Ash content was 0.801,
  - ❖ Emissivity and Volatile Matter 0.910 (On DMF basis 0.850),
  - ❖ Emissivity and Carbon 0.791 (On DMF basis 0.862),
  - ❖ Emissivity and Gross Calorific Value (GCV) 0.723 (On DMF basis 0.778,

1. **Name of the Project** : **Development of Methodology for Estimation of Greenhouse Gas Emissions in Mine Fire Areas and their Mitigation through Terrestrial Sequestration.**
2. **Date of Start** : Feb. 2009
3. **Scheduled date of Completion** : Jan. 2012
4. **Revised date of Completion** : Jun 2013
5. **Implementing Agency** : CIMFR, Dhanbad
6. **Sub-Implementing Agency** : BHU, Varanasi
7. **Project leader** : Dr. Siddharth Singh
8. **Project Co-ordinator** : Dr. A.K. Singh Scientist EI  
Dr. B.K. Tewary, Scientist F
9. **Total Approved Cost** : Rs. 354.49 lakhs

## **DESCRIPTION OF THE PROJECT**

### **10. Objectives :**

- (i) To estimate Greenhouse Gases (CO<sub>2</sub>, CH<sub>4</sub> & N<sub>2</sub>O) emission from coal mine fire areas, inventorization and its temporal and spatial dispersion at ground level.
- (ii) To estimate in real time the load of combustion aerosol (black carbon, sulphates and nitrate) emissions from mine fire area.
- (iii) To quantify the existing greenhouse gases sinks using space born data and estimate its carbon sequestration potential.



Carbon dioxide and methane emissions data were subjected to ANN model and from the outputs of ANN model it can be concluded that.

## 12. Findings :

Under this project, a monitoring protocol has been developed to synchronize the gas sampling with varying rate of mine fire gas emission which includes the development of appropriate flux chamber to suite diverse shape and size of cracks and fissures and can be manoeuvred accurately across the mine fire areas. Further, in-situ mine fire gas sampling has been complemented with greenhouse gas analytical protocol developed at the laboratory. Calculated value of per hectare CO<sub>2</sub> fixation by a specific tree reveals that during all the Seasons *F. religiosa* captured the highest CO<sub>2</sub>. Despite of differences in photosynthetic rate of trees and their density at different measurement sites, area wise CO<sub>2</sub> assimilation per year showed more or less similar values, suggesting that tree species have greater potential for sequestering carbon dioxide in mining areas.