S&T
Annual Report
वार्षिक प्रतिवेदन
2011 – 2012

Ground Penetrating Radar (GPR) Developed under S&T Grant of Ministry of Coal

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 सम्पूर्ण विकास के लिये संगठित अनुसंधान 1975 में सरकार का योजनाबद्ध कार्यक्रम ''कोयला विज्ञान एवं प्रौद्योगिकी योजना'' के अपनाने के बाद ही प्रारम्भ हुआ। इसने कोयला गवेषण से लेकर खनन के पश्चात पर्यावर्णिक विषय तक में व्यापक रूप से अनुसंधान एवं विकास के क्रियाकलापों को सक्षम बनाया है।

सेंट्रल माइन प्लानिंग एण्ड डिजाईन इंस्टीच्यूट लिमिटेड (सी एम पी डी आई एल), कोयला विज्ञान एवं प्रौद्योगिकी परियोजना के समन्वयन एवं मॉनीटरिंग 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 तीन महत्वपूर्ण क्षेत्रों के प्रत्येक क्षेत्र से संबंधित तकनीकी उप समिति द्वारा सहायता प्रदान की जाती है, ये हैं :

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

1975 से कोयला एवं लिग्नाइट उत्पादक कम्पनियों की सक्रिय सहभागिता के साथ कोयला एवं सम्बद्ध उद्योगों से सम्बन्धित राष्ट्रीय अनुसंधान एवं शैक्षणिक संस्थाओं द्वारा कोयला मंत्रालय के विज्ञान एवं प्रौद्योगिकी अनुदान के तहत् वर्तमान में अनुसंधान परियोजनाएँ क्रियान्वित की जा रही हैं। इसके परिणामस्वरूप अभी तक 208 करोड़ रुपये की अनुमानित लागत से 302 परियोजनाएँ पूरी की जा चुकी हैं। कुछ परियोजनाओं की अनुसंधान उपलब्धियों का गवेषण, खनन, पर्यावरण, कोयले की धुलाई, उपयोग प्रौद्योगिकी के क्षेत्र में उद्योग पर महत्वपूर्ण प्रभाव पड़ा है।

इस वार्षिक रिपोर्ट में विवेच्य वर्ष के दौरान 14 चालू परियोजनाएँ एवं 07 पूरी की जा चुकी परियोजनाओं के संदर्भ में कोयला मंत्रालय के विज्ञान एवं प्रौद्योगिकी अनुदान के लिए ई. ओ. आई. जारी किया है।

आशा है, यह पुस्तिका कोयला तथा इससे सम्बन्धित उद्योगों में लगे सभी अनुसंधान कर्मियों, माइन प्लानरों/ 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।

(ए. के. सिंह)
अध्यक्ष-सह-प्रबंध निदेशक

FOREWORD

Organized research for all round development of the coal industry started only after adoption of Govt.'s Planned Programme "Coal Science & Technology Plan" in 1975. This has enabled research and development activities over a wide spectrum of subjects ranging from coal exploration to post mining environmental issues.

Central Mine Planning & Design Institute Limited (CMPDIL) is the nodal agency for co-ordinating and monitoring of coal S&T projects.

The Coal S&T Programme is presently adminstered through an Apex body known as the Standing Scientific Research Committee (SSRC). The SSRC in turn is assisted by a Technical sub-committee, which deals with the following three major areas of coal research :

- Production, Productivity & Safety
- Coal Beneficiation and Utilization
- Environment & Ecology

Research projects under S&T Grant of Ministry of Coal are presently being implemented by national research and academic institutions related to coal and allied industries with active participation of coal and lignite producing companies, since 1975. As a result, till date, 302 projects have been completed since inception at an approximate cost of Rs. 208 Crore. Research findings of some projects have made significant impact on the industry in the area of exploration, mining, environment, coal washing and utilization technologies.

This Annual Report describes the status of 14 on-going and 07 completed S&T projects during the year.

CMPDI has floated EoI for calling proposals on 13 selected topics related to Mining Methods, Strata Control and Mine Safety, Coal Bed Methan (CBM) etc., for funding under S&T Grant of Ministry of Coal.

It is hoped that this booklet would be useful to all the research personnel, mine planners/designers engaged in coal and allied industries.

Suggestions for improvement of the publication in presentation and content are most welcome to enrich future editions.

(A. K. Singh)
Chairman-Managing Director

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LIST OF COAL S&T PROJECTS COMPLETED DURING 2011-12

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LIST OF ABBREVIATIONS

ATPL	Adcept Technologies Pvt. Ltd., Kolkata
AU	Anna University, Chennai
BCCL	Bharat Coking Coal Limited, Dhanbad
BHU	Banaras Hundu University, Varanasi
CCL	Central Coalfields Limited, Ranchi
CECRI	Central Electrochemical Research Institute, Karaikudi
CIMFR	Central Institute of Mining and Fuel Research (erstwhile CMRI & CFRI), Dhanbad
CMPDI	Central Mine Planning & Design Institute, Ranchi
DGMS	Director General of Mines Safety, Dhanbad
ECL	Eastern Coalfields Limited, Sanctoria
IIT	Indian Institute of Technology, Kharagpur
IMMT	Institute of Minerals & Materials Technology, Bhubaneswar
ISM	Indian School of Mines, Dhanbad
JBEPL	Jaya Bharat Equipment Pvt. Ltd., Hyderabad
MCL	Mahanadi Coalfields Limited, Sambalpur
MEPCO	MEPCO Engineering College, Sivakasi
NCL	Northern Coalfields Limited, Singrauli
NEIST	North East Institute of Science and Technology, Jorhat
NIT	National Institute of Technology, Surathkat
NLC	Neyveli Lignite Corporation Limited, Neyveli
RDCIS	Research and Development Centre for Iron & Steel, Ranchi
RVCE	R. V. College of Engineering, Bangalore
SCCL	Singareni Collieries Company Limited, Kothagudem
SSRC	Standing Scientific Research Committee

1.	**Name of the Project**	:	**Integrated communication system to communicate and locate trapped underground miners**
2.	Date of Start	:	Sep 2011
3.	Scheduled date of completion	:	Aug 2013
4.	Implementing Agency	:	AdCept Technologies Pvt. Ltd., Kolkata
5.	Sub-Implementing Agency	:	(a) CMPDI Ltd., Ranchi (b) CCL, Ranchi
6.	Project Leader	:	Shri Soumaya K. De, AdCept Technologies Pvt. Ltd., Kolkata
7.	Total Approved Cost	:	Rs. 459.59 Lakh For AdCept – Rs. 407.95 lakh For CMPDI – Rs. 51.54 lakh

DESCRIPTION OF THE PROJECT

8. Objectives :

The project aims 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.

3. Integration of TTE messaging system & location tracking system.

9. Status as on 31.03.2012 :

Through The Earth (TTE) messaging system :

1. System has been redeveloped at multi-seam Bhurkunda colliery. Effective coverage area 4.5 Sq. Km. Now the messages can be sent to the entire Bhurkunda mines Lower Semana and additionally to the Hathidari seam below.

2. The same TTE system can be extended to cater to all adjacent mines within an area of 17 Sq. Kms by just deploying antenna cable. For e.g. this TTE system could serve nearby Saunda D, Central Saunda or any other closely located mines.

3. It was discovered that a single TTE system can easily cater to multiple nearby underground mines, thereby substantially reducing the price of deploying such TTE system per underground mine.

4. Successful messaging has been tested in multi-seam projects of Bhurkunda collieries.

Two-way Wireless Voice Communication

1. Digital wireless telephony now installed in Bhurkunda mines.

2. It is now possible to make a phone call from anywhere in the world to a miner in the underground and vice versa.

3. For Live Demo, please call 08521944102; and then dial the extension numbers 2222, 3333 or 4444 after the voice prompt to talk to a miner in the underground!

4. Possible benefits :

   i. Personnel in underground can now contact management on surface in cse of any emergency/advice/report, etc.

   ii. Eliminating the feeling of alienation of underground miners by remaining in touch with the outside world.

10. Slippage, if any : Nil

11. Action Plan for 2012-13 :

Sl. No.	Activity	Date of start	Date of completion
1.	Field trial for Phase II equipment to be completed	Feb 2012	May 2012
2.	DGMS Approval for Phase II to be obtained	May 2012	Aug 2012
3.	Submission of Field Trial Report & Installation Report – Ph – II to CMPDI	Aug 2012	Sep 2012
4.	Performance Evaluation for Ph. II	Sep 2012	Sep 2012
5.	Application level integration	Sep 2012	Sep 2012
6.	Preparation of Final Report and submission	Jan 2013	Mar 2013

1.	**Name of the Project**	:	**Development of Self Advancing (mobile) Goaf Edge Supports (SAGES) for Depillaring Operations in Underground Coal Mines**
2.	Date of Start	:	Sep 2010
3.	Scheduled date of completion	:	Dec 2012
4.	Implementing Agency	:	ISM, Dhanbad
5.	Sub-Implementing Agency	:	M/s Jaya Bharat Equipment Pvt. Ltd. (JBEPL), Hyderabad
6.	Project Leader/Co-ordinator	:	Prof. (Dr.) Upendra K. Singh, Deptt. of Mining Engineering, ISM, Dhanbad Shri NVN Reddy, Director, M/s JBEPL., Hyderabad
7.	Total Approved Cost	:	Rs. 197.75 Lakh For JBEPL – 135.65 lakh For ISM – 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 capacity for depillaring operations in underground coal mines.

9. Status as on 31.03.2012 :

(i) Fabrication of 2nd set of 200 T SAGES was made based on the test results obtained from the test conducted on previously fabricated SAGES (1st SAGES).

(ii) The structural and hydraulic tests of two nos. of SAGES were carried out by ISM team in the hydraulic workshop of M/s JBEPL, Hyderabad. The structural test was carried out for both base and canopy of the support. The structural test consisted of Tip to Bending. Torsion and Bending and Transverse Edge Bending tests. Each test was carried out for 120 cycles. The Hydraulic test consisted of No Load Stroke Test for 5 cycles, Ccle Load test for 120 cycles at 350 Bar (110% of rated load), and 24 Hours static leakage test at 110 Bar. No sign of failure or permanent deformation in the canopy and base was observed after the structural tests. In the static leakage test, the actual pressure drop observed was 16 kg/cm^2 due to leakage over 24 hours which is about 15% of the initial pressure at which the static leakage test was started.

(iii) The both the supports SAGES – I and SAGES – II passed the structural and hydraulic tests and are suitable of the field trial.

(iv) 2 nos, of 200 T SAGES are ready for the field trials after the due approval from DGMS.

(v) Based on the result obtained from the structural and hydraulic tests of two nos, of SAGES, an application was submitted to DGMS (January 2012) alongwith the test report for getting approval from DGMS for the field trials of both the SAGES at depillaring panel of Bastacola Colliery, BCCL.

(vi) Development, design and fabrication of IS circuit of Data Display Unit, Data Logger and Handheld Data Transfer unit for downloading the stored data in the data logger are being done.

10. Slippage, if any : Delay in approval for field trial from DGMS.

11. Action Plan for 2012-13 :

Sl. No.	Activity	Date of start	Date of completion
1.	Development, design and fabrication of IS circuit of Data Display Unit, Data Logger and Handheld Data Transfer unit	Continuing	Oct 2012
2.	Transportation of SAGES at Mine Site	Continuing	Apr 2012
3.	Field trial of the 2 nos, of SAGES	May 2012	Aug 2012
4.	Final design of the 4 nos. of SAGES for commercial production	Jun 2012	Oct 2012
5.	Development of testing guidelines for testing of SAGES	Sep 2012	Oct 2012
6.	Report preparation	Nov 2012	Dec 2012

1.	**Name of the Project**	:	**Development of Software for Prediction of Subsidence by 3D Numerical Modelling for SCCL Mines**
2.	Date of Start	:	Aug 2011
3.	Scheduled date of completion	:	Jul 2014
4.	Implementing Agency	:	Anna University, Chennai
5.	Sub-Implementing Agency	:	SCCL
6.	Project Leader/Co-ordinator	:	Dr. L. Ajay Kumar
7.	Total Approved Cost	:	Rs. 53.80 Lakh

DESCRIPTION OF THE PROJECT

8. Objectives :

(i) To develop a subsidence prediction model and thereafter a handbook for the engineers and surveyors of SCCL, who are concerned with subsidence engineering. This book would aid in predicting subsidence and its associated phenomena of slope, strain and surface damage at any given site with speed and accuracy.

(ii) To decide the size and shape of protective pillars to safeguard against damage to surface structures. Also, to develop the concept of "non-effective width" for planning extraction below ground without any effects of subsidence on surface. This would facilitate carrying out mining extraction below rivers, nallahs, tanks, railway lines, townships and other protected structures.

(iii) To develop a reliable and easy to use software package for the determination of above mentioned subsidence parameters based on preliminary survey data of drill- long and plan layout information for new or future mines.

(iv) Development of user interface software for prediction of subsidence parameters by 3D numerical modeling techniques.

(v) Training of SCCL personnel on using the developed software.

9. Status as on 31.03.2012 :

1. Equipment Purchase

Based on the project requirements the equipment specifications were drawn, in addition discussion were held with vendors and experts in the field of survey. A global tender was published on 21st September 2011 for the purchase of the "Reflector less Automatic Target Recognition Total Station". All the technical details and tender details were published in leading local news papers and Tamil Nadu government adn Anna University official websites following

e-tender process. Three quotations were received and were scrutinized by the university technical and purchase committee. The order was placed with M/s. Trimble Europe B. V., The Netherlands.

2. Identification of the Mine and Data collection

Detailed discussions are being held with the officials of the Singareni Collieries Company Ltd. (sub-implementing agency) for the identification of mine for the implement of the project.

Data collection, from identified 24 mines of SCCL, the subsidence parameters – extraction thickness, depth, width to depth ratio, method of working, Rock Quality Designation, lithological composition and percentage of extraction have been collected.

10. Slippage, if any : NIL

11. Action Plan for 2012-13 :

Sl. No.	Activity	Date of start	Date of completion
1.	Carrying out subsidence surveys	Feb 2012	Jul 2013
2.	Determining subsidence parameters	Nov 2011	Apr 2013

1.	**Name of the Project**	:	**Development of customized organic coatings for corrosion protection of special mining equipment at Neyveli lignite mines.**
2.	Date of Start	:	Aug 2011
3.	Scheduled date of completion	:	Jul 2014
4.	Implementing Agency	:	NLC, Neyvelli
5.	Sub-Implementing Agency	:	CECRI, Karaikudi
6.	Project Co-ordinator	:	Dr. S. Santhanam, DGM/CARD
7.	Project Leader	:	Sri P. Veerabalu. CM
8.	Total Approved Cost	:	Rs. 46.41 Lakh

DESCRIPTION OF THE PROJECT

9. Objectives :

(i) To find out the root causes of the problem.

(ii) To assess corrosive environment and corrosion process mechanism.

(iii) To develop appropriate erosion – corrosion models.

(iv) To evolve suitable coating materials for critical SME components with proper methodology in association with CECRI. Evaluation of the corrosion coatings suggested by CECRI.

9. Status as on 31.03.2012 :

(i) Literature collection under progress.

(ii) Water and Soil samples collected from mines and analysed.

(iii) A tender is processed for engagement of a four-wheel drive vehicle for field activities in Mines.

(iv) Technical Specification for equipment is being prepared.

10. Slippage, if any : NIL

11. Action Plan for 2012-13 :

Sl. No.	Activity	Date of start	Date of completion
1.	Laboratory corrosion/erosion studies and characterization on samples and development of Corrosion Models.	Feb 2012	Jul 2012
2.	Basic corrosion studies	Nov 2011	Aug 2012
3.	Purchase of equipment	Nov 2011	Oct 2012
4.	Data collection and result analysis of bench scale/lab studies	May 2012	Jul 2012
5.	Discussion on surface modification for field trial sample	Aug 2012	Oct 2012

1.	**Name of the Project**	:	**Development and optimization of coal bed recovery process for CO_2 sequestration**
2.	Date of Start	:	Jan 2010
3.	Scheduled date of completion	:	Jun 2012
4.	Implementing Agency	:	ISM, Dhanbad
5.	Project Leader	:	Dr. Keka Ojha, Department of Petroleum Engineering ISM, Dhanbad
6.	Total Approved Cost	:	Rs. 26.98 Lakh

DESCRIPTION OF THE PROJECT

7. Objectives :

To develop cost effective technology for production of methane from CBM reservoirs.

The major objectives of the investigations are :

- Collection of CBM samples from nearby CBM fields and their characterization.
- To study the adsorption-desorption isotherm of methane and CO_2 with varying compositions at different pressure and temperature conditions. Desorption behavior of methane is the representation of primary recovery of CBM. Investigations will be carried out at dry as well as moist conditions as many Indian CBM reservoirs have high moisture content and required much study for efficient and economic recovery of methane from those.
- Experimentation on recovery of CBM by CO_2 injection with variable pressure, temperature, gas composition and flow rate conditions.
- Modeling and simulation of the system to optimize the CBM recovery.

8. Status as on 31.03.2012 :

Designing and fabrication of experimental setup has been completed. Purchase order has been placed for Gas Chromatogaph. Samples collected from SCCL, Kulti block of Raniganj coalfield & ONGC. Characterization of coal samples is in progress. Mathematical model is under development.

9. Slippage, if any :

Delay in procurement of equipment.

10. Action Plan for 2012-13 :

Sl. No.	Activity	Date of start	Date of completion
1.	Collection and Characterization of coal	Jul, 2010	Apr, 2012
2.	Experimental works for adsorption - desorption study, CO_2 injection and recovery of CBM	Aug, 2010	Apr, 2012
3.	Data analysis, model development and simulation and optimization study	Jun, 2010	May, 2012
4.	Report preparation	May, 2012	Jun, 2012

1.	**Name of the Project**	:	**Development of Tribo-electrostatic Separator for Beneficiation of High Ash Indian Coal Fines**
2.	Date of Start	:	Aug 2011
3.	Scheduled date of completion	:	Jan 2014
4.	Implementing Agency	:	Institute of Minerals & Materials Technology (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 :

To develop a tribo-electrostatic separator and to study the design characteristics for beneficiation of high ash Indian coking coals at finer sizes to reduce the ash content.

8. Status as on 31.03.2012 :

Literature survey has been completed. The tribo-electrostatic separator is designed and constructed. Work is under progress on the instrumentation of the equipment. Major equipment have been indented and under procurement stage. Climatic room have been constructed to maintain the humidity of atmosphere and to study its effect on electrostatic separation. Two samples one non coking coal (Hingula mines, Talcher) and one coking coal (Jharia coal) washery middling has been collected to test in the separator. The characterization studies of above two samples were carried out and preparation of feed material for the Tribo-electrostatic separator is going on. Samples from BCCL are yet to be collected.

9. Slippage, if any :

Samples are yet to be received from BCCL.

10. Action Plan for 2012-13 :

Sl. No.	Activity	Date of start	Date of completion
1.	Major equipment specification processing, indent and procurement for tribo-electrostatic separator	Continuing	Sep 2012
2.	Sample collection, characterization and preparation	May 2012	Oct 2012
3.	Installation of electrostatic separator and detail instrumentation and Commissioning of equipment	Oct 2012	Dec 2012
4.	Beneficiation study of coal using the electrostatic separator and change of design modification, if required	Dec 2012	Mar 2013

1.	**Name of the Project**	:	**Design & development of "Coal Winnowing System" for dry Beneficiatin of coal based on CFD modeling & simulation.**
2.	Date of Start	:	Aug 2011
3.	Scheduled date of completion	:	Jul 2013
4.	Implementing Agency	:	Central Institute of Mining & Fuel Research, Nagpur, Unit – II
5.	Sub-implementing Agency	:	National Chemical Laboratory (NCL), Pune
6.	Project Leader/Co-ordinator	:	Mr. Devendra Kumar Sakhre, Sr. Scientist/ Dr. Shripal Singh, Principal Scientist
7.	Total Approved Cost	:	Rs. 163.78 Lakh

DESCRIPTION OF THE PROJECT

8. Objectives :

(a) Design & development of new coal beneficiation equipment (Coal Winnowing System) for dry coal beneficiation based on winnowing technique.

(b) Design, fabrication and testing of the system based on CFD simulation software and validation of all technical parameters.

9. Status as on 31.03.2012 :

Literature survey, compilation of relevant research papers, Identification of the process parameters.

Design & drawing of lab scale experimental set up of coal winnowing machine is completed and supply order has been given.

(a) Coal samples collected from Wadha Valley Coalfields of Durgapur mines of Chandrapur area (WCL).

(b) Standard float & sink tests of the screened coal has been carried out.

(c) Experiments were conducted on two different feed size 50-25mm & 25-13mm.

10. Slippage, if any : Nil

11. Action Plan for 2012-13 :

Sl. No.	Activity	Date of start	Date of completion
1.	Design, Drawing, Tendering & Commissioning of Pilot Scale Plant	Apr 2012	Jun 2012
2.	Coal sample collection from different coal fields & sizing	Apr 2012	Jun 2012
3.	Analysis of coal & Washability studies	Apr 2012	Jun 2012
4.	Testing of coal samples in Coal winnowing machine	Apr 2012	Dec 2012
5.	Validation of result with designed technical parameters	Apr 2012	Dec 2012
6.	Report writing & submission	Jan 2013	Jun 2013

1.	**Name of the Project**	:	**Design & 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	:	Phase - I : Oct 2012 Phase - II : Jul 2013
4.	Implementing Agency	:	CIMFR, Dhanbad
5.	Sub-implementing Agency	:	M/s. Pranay Enterprises, Hyderabad & M/s SCCL, Kothagudem
6.	Project Leader/Co-ordinator	:	Mr. Sudhir Kumar Kashyap, Principal Scientist/ Mr. A. K. Ghosh, Chief Scientist, CIMFR, Dhanbad
7.	Total Approved Cost	:	Rs. 167.60 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 31.03.2012 :

(i) Purchase of equipment is in progress by M/s. Pranay Enterprises, Hyderabad.

(ii) Rs. 40.25 lakh has been transferred to M/s. Pranay Enterprises, Hyderabad as SSRC approved.

(iii) Project Fellow has been engaged by M/s. Pranay Enterprises, Hyderabad.

10. Slippage, if any :

(i) Delay in signing the agreement between CIMFR, Dhanbad & M/s. Pranay Enterprises, Hyderabad and thus transfer of fund.

(ii) Subsequently, delay in floating enquiries for procurement of equipment.

(iii) Change in administrative setup at ECIL from where equipment has to be procured as informed by M/s. Pranay Enterprises, Hyderabad.

11. Action Plan for 2012-13 (Phase – I) :

Sl. No.	Activity	Date of start	Date of completion
1.	Purchase of equipment will be done by M/s. Pranay Enterprises, Hyderabad	Aug 2011	Continued
2.	Sample analysis	Will be started after procurement of equipment	—

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	:	Dec 2012
4.	Implementing Agency	:	CIMFR, Dhanbad
5.	Sun-implementing Agency	:	CT Deptt., CMPDI, Ranchi
6.	a. Project Leader	:	Dr. Sudip Maity, Scientist, CIMFR, Dhanbad
	b. Project Co-ordinator	:	Dr. Amalendu Sinha, Director, CIMFR, Dhanbad
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. Objectives :

(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.

9. Status as on 31.03.2012 :

CTL Pilot Plant has been retendered for the third time due to inadequate response from the vendors. High surface area Alumina Spheres, Water Gas Shift catalysts and synthetic gas mixture equivalent to coal gasification product have been procured. Six Project Assistants have joined the project during May-June, 2010 and they have been trained to work for this project. The iron and cobalt based catalysts have been prepared and experimental run has been conducted in the existing reactor facility. The catalyst has shown activity towards liquid hydrocarbon and wax productions. Four continuous experimental runs of 120h each have been conducted in the exiting reactor were conducted on iron, cobalt and iron-cobalt mixed metal catalyst and appreciable success for liquid production is achieved. Experiment was conducted on synthetic gas mixture simulating the coal gasification product. Gas and liquid analyses are in progress to quantify the yield and selectivity of the catalyst.

10. Slippage, if any :

Due to non availability of competent firms for the CTL-PDU, installation of PDU is delayed.

11. Action Plan for 2012-13 :

Sl. No.	Activity	Date of start	Date of completion
1.	Design, procurement , installation and commissioning of integrated CTL pilot plant	Jan 2010	Continuing
2.	Procurement of CTL. Bulk preparation of catalyst	Jun 2012	To continue
3.	Testing of catalysts in exiting facility	Jan 2010	Continuing

1.	**Name of the Project**	:	**An approach to explore the applicability of spectro-radiometry as a tool for assessment of coal quality.**
2.	Date of start	:	Jan 2010
3.	Scheduled date of completion	:	Dec 2012
4.	Implementing Agency	:	CIMFR, Dhanbad
5.	Project Leader	:	Dr. Ashok K. Singh, Scientist , CIMFR, Dhanbad
6.	Total Approved Cost	:	Rs. 147.61 Lakh

DESCRIPTION OF THE PROJECT

7. Objectives :

To establish the spectro-radiometry as an efficient handy tool for coal quality assessment in the field.

8. Status as on 31.03.2012 :

Agreement has been made for purchasing of spectro-radiometer. Purchase order for Multiple Spectro Photometer (MSP – 200) placed. Geological details of different coalfields gathered. Geo-referenced maps of different coalfields are being prepared.

9. Slippage, if any : Delay in procurement of equipment.

10. Action Plan for 2012-13 :

Sl. No.	Activity	Date of start	Date of completion
1.	Field work for mapping, collection of spectro-radiometric data and sample	Jul 2010	Dec 2012
2.	Sample preparation for different analysis/test	Jan 2011	Dec 2012
3.	Analysis/testing of prepared samples	Jan 2011	Nov 2012
4.	Interpretation and co-relation of the field spectroradiomatric and laboratory generated data	Jul 2011	Nov 2012
5.	Preparation and submission of project completion report	Nov 2012	Dec 2012

1.	**Name of the Project**	:	**Development of methodology for Estimation of Greenhouse Gas (GHG) 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.	Implementing Agency	:	CIMFR, Dhanbad
5.	Sub-Implementing Agency	:	Department of Botany, BHU, Varanasi
6.	Project Leader	:	Dr. Siddarth Singh, Scientist
7.	Project Co-ordinators	:	Dr. A. K. Singh, Scientist, CIMFR, Dhanbad Dr. B. K. Tewary, Scientist, CIMFR, Dhanbad
8.	Total Approved Cost	:	Rs. 341.77 lakh For CIMFR : Rs. 341.77 lakh For CMPDI : Rs. 12.72 lakh

DESCRIPTION OF THE PROJECT

9. Objectives :

(i) To estimate Greenhouse Gases (CO_2, CH_4 & N_2O) 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.

(iv) To develop GHG's Emission Factor for coal mine fires.

(v) To standardize terrestrial CO_2 sink management practices under Landuse, Landuse Change and Forestry and facilitate future emission trading.

10. Status as on 31.03.2012 :

- **Development of monitoring Protocol** was done and monitoring is initiated.
- **For the development of emission factor** gas sampling assembly and necessary instrumentation has been selected and being installed.

- **Recruitment of project staff** Advertised in February 2009 and selection has been made.
- **Procurement & Installation of Equipment**

Present status of the procurement is as follows :

- Most of the equipments are installed or being installed.
- So far two approved Software have been procured and installed.
- Black Carbon is being measured by *Aethalometer*.
- *Aerosol Spectrometer* and ELPI has been installed and engaged in data collection.
- Gas Chromatograph installation is about to complete.
- GPS has been installed and being used for data collection.
- AWS is being installed.
- PORTABLE PHOTOSYNTHESIS SYSTEM and Leaf Area Meter to measure Carbon Sequestration has been installed.

- *Aforestation & reforestation Activity flora inventory and RS / GIS date being analyzed.*
- **Base line data generatin for Terrestrial carbon sequestration :**

Following physical and chemical properties were evaluated :

PHYSICAL PROPERTIES

Following soil properties have been evaluated Soil Texture, Soil Classification, Bulk Density, Porosity, Water Holding Capacity, Moisture Content, Volume expansion.

CHEMICAL PROPERTIES

pH, Conductivity, Organic Carbon, Organic Matter, Available Phosphorus, Available Nitrogen, Exchangeable Ions (Sodium, Potassium, Calcium, Magnesium, Chloride & Sulphide).

Base line data generation for CDM Project/Carbon Credit :

For terrestrial carbon sequestration projects it very important to have baseline soil carbon status and other properties like soil texture, particle size, bulk density, WHC and chemical parameters like pH, EC, OC, OM and nutrients.

PHYSICAL PROPERTIES

Soil Texture

Total mass (percentage) of soil in each sieve size fraction: >2 mm, >1 mm, >0.5 mm, >0.25 mm, >0.125 mm, >0.075 mm, >0.062 mm and <0.062 mm was found as 16.49%, 16.28%, 21.16%, 15.19%, 15.47%, 6.25%, 3.36% and 5.03% respectively in Salanpur & Mugma areas of Raniganj Coalfield.

Soil Classification

Majority of soil samples were classified as Sandy Loam.

Soil Bulk Density

The average bulk density of soil was recorded as 1.26 gm/cm^3.

Porosity

The porosity of soil sample of winter season ranges from 31.12 to 42.12% and the average value was 38.37%.

Water Holding Capacity

The WHC of winter season ranges from 20.56 to 43.56% with an average value of 32.38%.

Moisture Content

The moisture content of soil samples of winter season ranges from 0.57% to 5.55%. With an average value of 2.30%.

Volume Expansion

The volume expansion was observed in the range of 0.00% to 10.70% with an average value of 4.12%.

CHEMICAL PROPERTIES

pH

The pH of the soil samples of winter season was found to vary from 4.9 to 7.2. The average pH value was found to be 6.0.

Conductivity

The conductivity of the soil sample of the winter season was found to vary from 80-517 µmhos/cm, the average EC value was 230.5 µmhos/cm, in the respective season.

Soil Organic Carbon

coalfields have been estimated and compared for manual and instrumental methodologies. Values of organic carbon of the soil samples in winter season ranges from 0.13 – 1.18%. In summer season it ranges between 0.15 to 0.91%. However, more soil samples of different soil horizons are being analyzed for more reliable result.

Organic Matter

Organic Matter of the soil samples of Winter Season ranges from 0.23 – 2.03%. In summer season it ranges between 0.15 to 0.91%. In summer season it ranges betwee 0.26 to 1.57%.

Available Phosphorus

The mean concentration of available phosphorus was observed as 5.05 kg/ha. And the range is

0.54 - 16.04 kg/ha in the winter season and 0.27 - 15.5 kg/ha in the summer season with average value of 3.2 kg/ha.

Available Nitrogen

The concentration of available nitrogen has been found in the range of 123 ppm to 252 ppm.

Exchangeable Ions

Sodium concentration in the soil samples ranges from 0.04 mg/g to 0.275 mg/g of dry soil.

Potassium concentration ranges from 0.013 mg/g to 0.160 mg/g, with an average of 0.042 mg/g.

Calcium concentration ranges from 0.007 mg/g to 0.282 mg/g of dry soil and the average concentration is 0.052 mg/g.

Magnesium concentration ranges from 0.010 mg/g to 0.130 mg/g, with an average of 0.039 mg/g.

Chloride concentration has been found in the range of 36 ppm to 107 ppm.

Sulphide concentration has been evaluated in the range of 4 ppm to 28 ppm.

Aforestation & reforestation Activity

Inventory of native flora of Jharia & Raniganj coalfields have being prepared for carbon sequestration.

Installation of equipment :

To measure aerosol size, concentration and count Aerosol Spectrometer, ELPI and FRM Sampler have been installed.

Aerosol Spectrometer (for acrood size, concentration and count)

The equipment is being used to collect datsa of aerosol in count, mass and occupational mode since second week of March. Particulates of other than mechanical origin have been found in the following range after taking the average of 200 data sets:

Size range in μm	0.22 to 0.3	0.3 to 0.5	05. to 10	1.0 to 2.5
Comc. in μg/m^2	301571.2	85874.27	3859.3	434.97

Data obtained from the Aerosol Spectrometer monitoring supports following interpretation:

With increase in the size range of aerosol samples from 0.22 pm to 2.5 pm or more, the number and concentration of aerosols decreases, It is in agreement with the findings of other studies.

The higher concentration of aerosols in lower size ranges i.e. 1.0 pm and below, confirms the domination of aerosols of combustion origin. The source of combustion aerosols is site specific and for Ena colliery it is principally being contributed by the combustion of fossil fuels like diesel (transport of coal & OB) and coal (mine fire). Contribution of biomass burning by surrounding inhabitants should be accounted.

The concentration of aerosols measured in the size range of 1.0 pm or below is very high in comparison to measurement done by other researchers for non mining areas.

Data collection for entire coalfield is in progress.

Aethalmeter

Aethalmeter takes the measurement of Black carbon by optical attenuation method. Two equipments

of such type have been taken in this study. One is portable (AE-42) and another is rack mounted controlled site (CIMFR) as per the guidelines of manufacturer. The portable one has been taken to the field and installed at various places in Jharia Coalfield.

Controlled Site

Aethalometer (AE-31) is collecting data since third week of march. We have chosen CIMFR Headquarter as controlled site, since this area is less disturbed, and environmental conditions are in contrast to the coalfield. After continuous monitoring for about 54 days we have collected around 235334 data sets.

No. Data Sets	Minimum Value (μg/m³)	Maximum Value (μg/m³)
23534	2.19	11.52

The data obtained from the above mentioned monitoring shows following facts:

Two prominent peaks have been observed during this period.

The first peak is in the morning.

The second peak is in the evening.

The Concentration of Black Carbon is stable throughout the day. The diurnal pattern of BC can be correlated to the metrological phenomenon of temperature inversion.

The data at controlled site is quite high as compared to the published literature of other places. In the preliminary investigation the source may attributed to bioimass combustion by surrounding villagers.

City traffic an mining operations amy also be the contributors depending upon the prevailing wind directions.

Mining Site (Jharia Coalfield)

Three sites were selected for better comparative studies as to know whether the increasing concentration of black carbon is air is die mine fire in coalfield or for vehicles.

Hall Road- Heavy vehicles are continuously running for transportation of coal and OB. The load of dust of mechanical origin is relatively very high than particles of combustion origin.

Mining Area (Phase zone) – Active fire zone where mining activities are in progress.

Abandoned Mine – Fumes are coming out of cracks and subsidence is clearly observed.

Portable Aethalometer (AE-42) is collecting data since third week of March. After monitoring for 16 days we have collected a total of 1059 data sets.

Sites	Minimum (μg/m³)	Maximum (μg/m³)
Ena Collieary	4.04	15.63
Coalfield roads	7.47	16.87

In the colliery monitoring sites the difference of minimum and maximum is low (4.04 – 15.63) as compared to the controlled site. Contribution of vehicular traffic and mine fire is clearly visible. The data is being further collected and analyzed to find the contribution of mine fire in the loa of BC in ambient air in mining areas.

For comparison point of view the data has also been collected along the road with vehicle mounted analyzer in the Jharia Coalield command area. Here the margin between minimum and maximum has further reduced.

11. Slippage, if any : Project got delayed due to procurement of equipment and related aspects.

12. Action Plan for 2012-13:

Sl. No.	Activity	Date of start	Date of completion
1.	Installation of weather station and *on line GHG* monitoring equipments and aerosol monitoring equipments and particl sizing instrument in the field and GC in the laboratory and data collection.	Apr. 2012	Nov. 2012
2.	Characterization and quantification of GHG sink from existing land use pattern through suitable RS data and ground truth realization.	Apr. 2012	Nov. 2012
3.	Initiate the Selection of the Project Developer to develop Project Idea Note (PIN) and Project Concept Note (PCN) and prepare Project Design Document (PDD) for the submission at UNFCCC.	Apr. 2012	Nov. 2012

1.	**Name of the Project**	:	**Treatment of acid mine drainage generated in Indian coal mines using low cost material.**
2.	Date of start	:	Jan 2010
3.	Scheduled date of completion	:	Dec 2012
4.	Implementing Agency	:	CIMFR, Dhanbad
5.	Project Leader	:	Dr. (Mrs.) Bably Prasad / Dr. B. K. Tewary
6.	Total Approved Cost	:	Rs. 44.17 Lakh

DESCRIPTION OF THE PROJECT

7. Objectives :

To investigate into treatment of acid mine water generated in Indian coalmines using low cost material, the objectives have been made as follows :

- Characterisation of acid mine water of few Indian coalmines (underground and opencast).
- Conversion of fly ash into zeolitic mineral to be used for treatment of acid mine water.
- Treatment of acid mine water by fly ash zeolites.
- Evaluation of effectiveness and cost of acid mine water treatment by fly ash zeolite.

8. Status as on 31.03.2012 :

Purchase of ion chromatograph is in progress. Recollection of AMD from Gorbi mines of NCL has been done and characterization of AMD has been carried out. Characterisation of AMD with respect to anions and cations has been done using conventional analytical technique. Analysis of heavy metals in AMD has been carried out using Atomic Absorption Spectrophotometer. AMD samples and Fly ash have been collected from Neyveli lignite mines and characterization of mine water of Neyveli has been carried out similar to Gorbi mine water sample analysis. Preparation of fly ash zeolite from Talcher, Chandrapur and Neyveli fly ash has been done using hydrothermal technique. Characterisation of FAZ with respect to XRD, XRF and SEM analysis is under progress. Treatment of Gorbi mine water and Neyveli Lignite mine water has been carried out using fly ash and fly ash zeolite in batch experiment. Batch experiment to know the efficiency of fly ash and fly ash zeolite in treatment of acid mine water has been evaluated. The treatment of Gorbi mine water using fly ash zeolite in column experiment is under progress and the treatment will continue for further few months.

9. Slippage, if any : Nil.

10. Action Plan for 2012-13 :

Sl. No.	Activity	Date of start	Date of completion
1.	Purchase of Instrument (Ion Chromatograph)	Jan, 2010	Jul, 2012
2.	Gorbi mine water sample recollection and laboratory column experiment using fly ash zeolite for mine water treatment	Jul, 2011	Oct, 2012
3.	Data analysis & evaluation of FAZ efficiency for AMD treatment	Aug, 2012	Oct, 2012
4.	Compilation of result and report preparation	Oct, 2012	Dec, 2012

1.	**Name of the Project**	:	**Emissions from coal based industries – development of predictive models.**
2.	Date of start	:	Jan 2010
3.	Scheduled date of completion	:	Dec 2012
4.	Implementing Agency	:	NEIST, Jorhat
5.	Project Leader / Co-ordinator	:	Dr. Puja Khare / Dr. B.P. Baruah
6.	Total Approved Cost	:	Rs. 82.46 Lakh

DESCRIPTION OF THE PROJECT

7. Objectives :

- To quantify the particulate matter (SPM, $PM_{2.5}$ and PM_{10}) and toxic gas emissions from coal mining and utilization industries.
- Chemical characterization and mass size distribution of particulate matter ($PM_{2.5}$ and PM_{10}) from coal based industries.
- Evolving relationship between the coal quality parameters emissions.
- Identification of the factors that contribute towards emission of particulates (SPM, $PM_{2.5}$ and PM_{10}) and toxic gases depending upon the type of mining methodologies and utilization techniques.
- Emission inventory for coal based industries.
- Modeling and suggestive measures to regulate the emission from coal from coal mining and utilization industries like coke ovens, mining etc.

8. Status as on 31.03.2012 :

Procurement of SPM, $PM_{2.5}$ and PM_{10} sampler have been completed. Procurement of gas analyser and Ion chromatograph is in progress. Sample collection and analysis has been completed. Preparation of emission inventory has been initiated from the data generated. Emission inventory from various processes and fuel has been made. Analysis of particulate matter (SPM, $PM_{2.5}$ and PM_{10}) and gases (SO_2, NO_2, NH_3 and SO_4^{2-}) of collected samples has been done. Chemical characterizatin (PAH, Metal, ions) of particulate samples is in progress.

9. Slippage, if any : Nil

10. Detailed Action Plan for 2012-13 :

Sl. No.	Activity	Date of start	Date of completion
1.	Sample Collection analysis	Continuing	Sep, 2012
2.	Emission inventory	Continuing	Oct, 2012
3.	Data Compilation and analysis interpretation	Continuing	Dec, 2012
4.	Report preparation	Oct, 2012	Dec, 2012

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, Suratkhal
5.	Project Leader/Co-ordinator	:	Prof. (Dr.) V R Sastry, NIT, Suratkhal
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 31.03.2012 :

Procurement of equipment is under process. The project is progressing as per schedule.

9. Slippage, if any :

Nil.

10. Action Plan for 2012-13 :

Sl. No.	Activity	Date of start	Date of completion
1.	Generation of metrological data	Feb 2012	Jan 2013
2.	Monitoring of dust	Feb 2012	Jul 2013
3.	Analysis of dust in laboratory	Feb 2012	Jul 2013
4.	Development of model results	Feb 2012	Jan 2014

1.	**Name of the Project**	:	**Model studies on gravity blind back filling method and evaluation of a pre jamming indication parameters in the field.**
2.	Implementing Agency	:	Indian Institute of Technology, Kharagpur
3.	Project Leader/Co-ordinator	:	Dr. Samir Kr. Pal, IIT, Kharagpur
4.	Date of Start	:	Mar 2008
5.	Date of completion	:	Nov 2011
6.	Approved Cost	:	Rs. 402.66 Lakh

DESCRIPTION OF THE PROJECT

7. Objectives :

- Validating the findings of the laboratory model by carrying out field trials on simple hydraulic back filling method by gravity and measuring its efficiency in terms of large area coverage from a single borehole at shortest possible time.
- To validate the empirical relationships on the estimation of the shape and size of the filled out area in terms of relative spreads in strike and rise direction as obtained from the experimental model study at IIT, Kharagpur.
- Study the variation of inlet pressure head of the slurry with time during the progress of filling work and to validate the effectiveness of the proposed "Pre-Jamming Indicator" to mark the arrival of final phase of filling. If necessary, suitable modifications of this "Pre-Jamming Indicator" will also be done for field applicability.

8. Work Done :

- Identification of a suitable location for field trial of gravity blind backfilling technique.
- Planning and design of optimum filling parameters.
- Selecting and surveying the locations of different boreholes and drilling of a few initial boreholes for slurry feeding, water pumping, air outlet, and large sized boreholes for video camera insertion.
- Design and fabrication of the self-powered, fully equipped mixing chamber with full internal

electrical system and climate control facility for regular operation of different sophisticated for their protection equipment against dust, heat and humidity.

- Procurement borehole pumps, water flowmeters, sand conveyor, water level monitoring devices and data acquisition system.
- Installation and test runs of pumps and all the above measuring devices.
- Procurement and installation of remote operated video camera and image recording devices.
- Installation of data acquisition system.
- Drawing electrical power lines to pump room and mixing chamber, and installation of related accessories.
- Field experimentation of gravity blind backfilling method for the designed flow rate and concentration from a single feeding borehole.
- Verification and modification of empirical relationships on shape, size and extent of filling as obtained from laboratory model studies.
- Studies on 'pressure signature' variation and evaluation of pre-jamming indication parameter applicable for field conditions and ascertain the time elapsed between the prediction on arrival of final phase of filling and the occurrence of actual jamming of the borehole.
- Selecting location and drilling of the next feeder borehole and other accessory boreholes.
- Repeat action of steps (x) to (xii) for the next feeding borehole, and continuation in the same way till 30,000m^3 of sand is filled into the underground voids.

9. Findings

Under this project, abandoned Krishnanagar Colliery of ECL has been identifiedto verify the findings obtained in the laboratory scale model study conducted by IIT, Kharagpur. Filling of sand was done by simple gravity backfilling, which is an efficient method of back filling. It was revealed that filling may start with 15% sand concentration and then gradually be reduced to 9% or less, as and when the pre-jamming indication arises. Under favorable geo mining conditions about 6000m^3 of sand can be delivered through a single mother borehole using gravity hydraulic backfilling techniques. Sand packing in the filled-up area occurs tight up to the roof as monitored by the underwater ROV Camera.During field trial of sand stowing, it has been noticed that the shape of filled-up area was very similar to that obtained in the model study.

The above technique may be used in future for filling existing voids in water-filled abandoned mines with proper scientific monitoring arrangements.

1.	**Name of the Project**	:	**Fly ash characterization for mine void reclamation**
2.	Implementing Agency	:	CMPDI, Ranchi.
3.	Project Leader	:	General Manager (Env.), CMPDI, Ranchi
4.	Date of start	:	Nov 2003
5.	Date of completion	:	Jun 2011
6.	Approved Cost	:	Rs. 287.684 Lakh

DESCRIPTION OF THE PROJECT

7. Objectives :

- To characterize the fly ash produced from coal from identified mines and establishes relationship between trace elements present in coal and its fly ash (PFA).
- To carry out standard leaching test on ash samples and characterize the leachate produced to its potentialities in polluting ground water.
- To test the properties of PFA to assess its suitability as material for structural fill so that end uses of reclaimed land other than growing plantation, can be thought including development of townships on such land.

8. Work Done

Literature Survey

Literature survey was carried for the approved project by interacting with various reputed institutes and surfing the Internet.

Procurement, Installation and Commissioning of Equipment

The following equipment were procured and installed under the project.

Sl.No.	Instrument
1.	Inductively Coupled Plasma (ICP-OES). Thermo Fisher Scientific, UK
2.	Microwave digestor, Anton Paar – GmbH
3.	TCLP, Millipore, India

4. High Purification Lab Water System, Elge, U. K.

5. Micro-processor based photometer, HACH DR – 2800, India

6. Auto Digital Furnace, CEM

7. Mercury Analyser, ECIL, India

8. Personal Computer – Pentium 4 with printer

9. Air-conditioner

Sampling

Coal samples from 14 mines and fly ash samples from nine thermal power stations (TPS) were collected. Mine water samples were collected from mines where the fly ash samples are proposed to be dumped. The list of mines along with their linked thermal power stations from where coal and fly ash samples were collected and list of mines from where mine water samples were collected are given below :

Sl. No.	Identified Mine for Coal	Related Identified TPS	Mine Void for dumping fly ash
1.	Amlo OC, CCL	Chandrapura TPS, DVC	Madhuban, BCCL
2.	Selected Dhori, CCL	Bokaro TPS, DVC	Bokaro OC, CCL
3.	KDH, CCL	Patratu TPS, JSEB	Sayal "D" OC, CCL
4.	Churi Mines		
5.	Kedla, CCL	Tenughat TPS, Tenughat Vidhyut Nigam	Sawang OC, CCL
6.	Gevra OC, SECL	Korba STPS, NTPC	Manikpur OC, SECL
7.	Dhapuri OC, SECL	Amarkantak TPS, MPEB	Dhanpuri OC, SECL
8.	Bangwar OC, SECL		Sharda OC, SECL
9.	Amlai OC, SECL		Amlai OC, SECL
10.	Jayant, NCL	Singrauli Super TPS, NTPC	Jhingurda OC, NCL Bina OC, NCL
11.	Lakhanpur, MCL	Ib TPS, OPGC	Lilari OC, Belpahar OC
12.	Lingraj, MCL	Talcher TPS, NTPC	Jagannath OC
13.	Bharatpur, MCL		Ananata OC
14.	Bhubaneswari, MCL		Ananta OC

Laboratory Testing and Analysis

Slope stability analysis was outsourced to BIT Mesra along with physical characterization of coal and fly ash samples and the chemical analysis was outsourced to ISM, Dhanbad.

9. Findings :

Under this project, fly ash characterization of mine voids reclamation study, fly ash samples were collected from 14 thermal power stations. After detailed analysis of the above samples, it was found that fly ash of these plants were not suitable for backfilling of mine voids of selected mines, as the concentration of Mn, Cu were found to be in excess of drinking water standard.

In view of above, the report suggests that mine specific studies are to be carried out before fly ash is to be backfilled in any mine.

1.	**Name of the Project**	:	**Delineation of Barrier Thickness Against Water-logged Workings in Underground Coal Mines.**
2.	Implementing Agency	:	Central Institute of Mining & Fuel Research, Dhanbad
3.	Project Leader/Co-ordinator	:	Dr. K.K.K. Singh / Dr. A. Sinha
4.	Date of Start	:	May 2007
5.	Date of completion	:	Mar 2012
6.	Approved Cost	:	Rs. 382.1192 Lakh

DESCRIPTION OF THE PROJECT

7. Objectives

- Establishment of GPR signatures for different geological formations, cavities and waterlogged workings.
- Delineation of galleries and pillars from the surface and from underground with the help of GPR survey.
- Delineation of barrier thickness of 60m from the approachable locations to unapproachable workings and extend the same study for unknown workings in underground coal mines.
- Verification of GPR survey results with the help of integrated geophysical survey like multi-electrode Resistively Imaging survey along with some borehole data.

8. Work Done

Literature review and preliminary visit to mines have been completed. Five mines of BCCL and three mines of ECL were experiment sites. M/s International Groundradar Consulting Inc. Canada has been assigned to develop the desired GPR system to delineate barrier thickness up to 60m.

In the first visit (During March 15 – 19, 2010), the scientists of M/s Groundradar, Canada has visited experimental sites for tasting of the prototype GPR system at the selected locales in India. Extensive tests of prototype GPR system at East Basuria colliery of BCCL, Shyampur B and Barmundia collieries of ECL were performed. In this visit, the recorded depth of penetration of GPR system was found up to 30m.

In the second visit (During July 30 – August 8, 2010), extensive testing at East Basuria & Tetulmari Collieries of BCCL and Shyampur B & Dabor collieries of ECL were performed using prototype GPR system having antenna frequency of 40 MHz, the weight of the system was about 40 Kg. A detailed presentation was made on 8th August, 2010 at CIMFR, Dhanbad in presence of senior executives of CMPDI, Ranchi. It was opined that the results are encouraging but further development should be made to reduce the weight of the system so that the system becomes portable.

In the third visit, the surveys were conducted at East Basuria, Basudevpur & Tetulmari collieries of BCCL, the presentation was made based on the find studies carried out with development GPR system during 15th & 16th February, 2010. Scientists from CIMFR, Dhanbad, Officials of CMPDI, Ranchi & Asansol and faculty members of ISM, Dhanbad were present in the said presentation. After detailed deliberations, the participants appreciated the outcomes of the study, particularly the effort made to develop a GPR which can delieate the barrier thickness up to 60m.

In the fourth visit (During June 20 – 24, 2011), the presentation was made on 23rd June 2011 based on the studies carried out with developed GPR system (Non-ATEX version) at Tetulmari and Basudevpur collieries of BCCL. During the presentation, the representatives from CMPDI, Ranchi, DGMS, ISM, BCCL and CIMFR were present. It was agreed upon by all in the meeting that the development GPR system (non-ATEX version) is capable to delineate barrier thickness of 60m from the approachable locations to unapproachable workings.

The development GPR system, Non-ATEX and ATEX versions were received by CIMFR after incorporating the necessary modification, as suggested during the earlier meeting. The developed system (ATEX & Non-ATEX versions) has been finally demonstrated at K. B. and Bhagabandh collieries, BCCL on 29.02.2012 in presence of DGMS, ISM, BCCL, CIMFR, Dhanbad and CMPDIL, Ranchi. A review meeting was held at CIMFR, Dhanbad on 02.03.2012, the meeting was chaired by Shri A. K. Singh, CMD, CMPDIL, Ranchi. The experts and representatives from CMPDIL S&T Division and RI – 2, Dhanbad, DGMS, ISM, BCCL, CIMFR, Dhanbad discussed in detail in this meeting about the validation of data collected by developed GPR with both the system (ATEX & Non-ATEX versions) at K. B. and Bhagabandh collieries, BCCL. This is first low frequency (40 MHz) shielded GPR system having real time stacking of 64000 for better quality of data collection and for best.

9. Findings

Under this project, a new Ground Penetrating Radar (GPR) system namely 'Mine Vue' having a depth of penetration of 60m was developed by CIMFR, Dhanbad in association with M/s International Ground Radar Inc, Canada. This is the world's longest range and lowest frequency shielded radar system designed specifically for gaseous under ground coal mines. Extensive field trial, wore concluded in three (3) Mines of ECL and 5 mines of BCCL. After field trieal at East Bassuria, Tetulmari and Basudeiopur collieries of BCCL & Shyampur B & Dabor collieries of ECL, it was found that 'Mine Vue' system can identify the barrier thickness up to 60m. The analysis of recorded data and subsequent outputs were verified with existing data base of the respective mines. The developed system is able to predict the barrier thickness towards blind water logged headings with an accuracy of ±10%.

1.	**Name of the Project**	:	**Application of high strength steel roof bolts in underground coal mines.**
2.	Implementing Agency	:	RDCIS, Ranchi
3.	Sub-implementing Agency	:	DGMS, Dhanbad & CMPDI, Ranchi
4.	Project Leader	:	Dr. B. K. Jha, DGM RDCIS/ Director (S&T), DGMS, Dhanbad
5.	Date of Start	:	Jan 2010
6.	Date of completion	:	Dec 2011
7.	Total Approved Cost	:	Rs. 103.22 Lakh For RDCIS – Rs. 89.02 lakh For CMPDI – Rs. 14.20 lakh

DESCRIPTION OF THE PROJECT

8. Objectives

- Application of high strength (YS: 600 MPa minimum) 20 mm diameter roll threaded rock bolts for roof support in underground coal mines.
- Evaluate effectiveness of 16mm diameter rock bolts for similar application.

9. Work Done

(a) Joint Selection of underground coalmines of different roof conditions and collection of mines related date.

(b) Rolling of high strength steel root bolt rebars in 16mm and 20mm diameters.

(c) Fabrication of cold Roll threaded bolts.

(d) Installation of roof bolts at selected mines.

(e) Monitoring performance of bolted roofs in terms of its displacement.

10. Findings

Under the project, systematic approach was adopted to increase acceptability of high strength roof bolts in underground coal mines by application of high strength (Ys : 6000 Mpa Minimum) 20mm dia roll treaded roof bolts for roof supports in underground coal mines. The effectiveness of 16mm dia roof bolts for similar purpose was also evaluated. The field trial was conducted at Jhanjra Mine, ECL. During field trials, 20mm roll treaded roof bolts passes the DGMS criteria for 16 T load on roof bolts and corresponding deflection were within permissible limits. Through this study it has been concluded that saving of more than 18% in cost of bolts can be achieved through replacement of 22mm bolts with high strength bolts of 20mm. Effectiveness study revealed that 16mm bolts may be used in cement grouting/resin grouting where load requirement is less than 8T.

High strength and elongation was achieved through design of chemistry and by adhering to proper technological parameters during processing.

1.	**Name of the Project**	:	**Biological Production of Clean Fuels from Lignite**
2.	Implementing Agency	:	RV College of Engineering, Bangalore
3.	Project Leader/Co-ordinator	:	Prof. (Dr.) Pushpa Agrawal Head of Deptt of Biotechnology RV College of Engineering, Bangalore
4.	Date of start	:	Feb 2009
5.	Scheduled date of completion	:	Jan 2012
6.	Approved Cost	:	Rs. 45.36 Lakh

DESCRIPTION OF THE PROJECT

7. Objectives

- To design the anaerobic bioreactors for the conversion of lignite into clean fuels.
- Optimization of the parameters such as amount of moisture content, temperature, pH and hydrogen concentration.
- Isolation of the bacteria from the gut of the termites and their pure culture and maintenance of their population.
- Utilization of the isolated bacteria for the conversion of the lignite under optimized conditions.
- Estimation of the byproduct obtained after the lignite.
- Complete elimination of reductions of the impurity like sulphur.
- Cost effective production of the fuels using the existing and modified organisms.
- Estimation of the efficiency of the clean fuels that are environmental friendly.

8. Work Done

- Isolation of bacterial organisms.
- Optimization of the parameters.
- Design of a bioconverter plant (Anaerobic reactor).

- Fuel accomplishment.
- Investigation of qulity of Fuel.
- By product analysis.
- Economic analysis.
- Study of environmental issues.

9. Findings

Under the project it has been established that Alcohol and methane as a clean fuels obtained from biological conversion of lignite. However, methane promises the source of clean fuel when compared to alcohol. Methane accounts for 25-30% of the total gas produced during the process of bio-methanation. It has been observed also that CO_2 produced during the process of bio-methanation accounts for 40% and which can be used as a carbon source for growth of Algae. This can also be used in the extraction of Algal biodiesel. The pesence of alcohol is confirmed at a level of 0.3-0.5% per gram of lignite used as feed.

1.	**Name of the Project**	:	**Carbon Sequestration in Re-vegetated Coal Mine Wastelands.**
2.	Implementing Agency	:	Central Institute of Mining and Fuel Research, Dhanbad
3.	Project Leader / Co-ordinator	:	Dr. Raj Shekhar Singh, Scientist, CIMFR, Dhanbad Dr. (Mrs.) Asha Gupta, Scientist, CIMFR, Dhanbad
4.	Date of start	:	Feb 2009
5.	Date of completion	:	Jan 2012
6.	Approved Cost	:	Rs. 64.76 Lakh

DESCRIPTION OF THE PROJECT

7. Objectives

- To quantify the carbon storage in soils of different aged re-vegetated mine spoils.
- To estimate the carbon storage by different plant species in the re-vegetated mine spoils along an age gradient.
- To explore the amount of soil biomass carbon in diferent aged mine spoils.
- Estimation of carbon in different component of plants of re-vegetated mine spoils.
- To estimate the carbon storage and flux potential of the re-vegetated waste land.

8. Work Done

Carbon capture and storage, CCS technologies aim to sequester carbon that would otherwise be emitted to or remain in the atmosphere and enhance the greenhouse effect. The potential for sequestration of carbon (C) in re-vegetated mine soils is high and thus is an important management option for mitigation of the negative impacts of mining and initiate ecosystem recovery. Soil restoration measures can reverse the degradation trends leading to positive changes in the ecosystem and SOC sequestration. It is estimated that a reclaimed soil can sequester Soil Organic Carbon(SOC) up to 30 Mg C ha-1 in 25 year.

In the present study an effort was made to assess the total carbon stored in Jayant, Nigahi and ECL mine spoils through carbon sequestration, contributed by above and below ground biomass. Soil organic carbon and soil microbial biomass C. The study sites were selected along an age gradient of re-vetation in ECL (Mugma area, Jharkhand) and NCL (Nigahi and Jayant area, M. P.).

9. Findings

Under the project, efforts were made to assess the total carbon stored in Jayant, Nigahi and ECL mine spoils through carbon sequestration, contributed by above and below ground soil organic carbon and soil microbial biomass carbon. The study sites were selected in Kapasara Project of Mugma area of Raniganj Coalfields, ECL and Nigahi and Jayant projects of NCL with different ages of revegetation.

From the above study, the following facts were revealed :

- The maximum total carbon sequestration in all the components viz. above ground biomass, littermass and belowground biomass in 19 years re-vegetated site was 36.45 t/ha, 2.80 t/ha and 5.28 t/ha, respectively.
- It can be translated into cabon sequestration potential of re-vegetated mine spoil is 3.57 t/ha/yr.
- The sequestered carbon in re-vegetated mine spoil is equivalent to 13.09 t/ha capture of carbon dioxide from the atmosphere.
- This indicates that mine spoil can act as a significant sink for atmospheric carbon dioxide (CO_2) through vegetational development along with redevelopment of soil formation.
- Total carbon sequestration in naturally vegetated sites were 8.94 and 11.33 t/ha and revegetated site were 11.78 and 22.38 t/ha after 5 and 10 years respectively.
- Re-vegetation enhanced 11.05 t/h additional carbon sequestration in re-vegetated sites, hence re-vegetation is one of the best natural tool for the sequestration of carbon in the plant and soil.
- Carbon sequestrations were enhanced with increasing age or re-generated mine spoil and decreased with increasing depth of soil.
- Re-vegetation is a management tool for sustainable development of mining industries. It will provide economic benefits in addition to a cleaner environment.
- Re-vegetation increases soil organic & inorganic nutrients and root and microbial biomass with a span of time.

1.	**Name of the Project**	:	**Catalytic Liquefaction of Neyveli Lignite**
2.	Implementing Agency	:	Mepco Schlenk Engineering College, Sivakasi
3.	Project Leader	:	Dr. N. Krishnamurthy Mepco Schlenk Engineering College, Sivakasi
4.	Date of start	:	Feb 2009
5.	Date of completion	:	Jan 2012
6.	Approved Cost	:	Rs. 14.00 lakh

DESCRIPTION OF THE PROJECT

7. Objectives

The scope of this project is as follows :

- Preparation of MCM-41 supported HPA and suphated zirconia catalyst and characterization of them the instrumental methods.
- Study of deploymerilisation of Neyveli Lignite using phenol and catalysts such as p-toluenesupphonic acid, sulphated zirconia dn MCM-41 supported HPA.
- Characterization of the products of deploymerization.
- Liquefaction of the deploymerized product by alkaylation over the above solid acid catalysts using olefins as the alkaylating agents.
- Analysis of the products of GC/MS.
- Optimization of the reaction parameters for high conversion and better liquefaction.
- Consolidation of reports and submission of the same to DSCT.

8. Work Done

Optimizing the conditions of depolymerisation carried out in autoclave to increase the extractability of depolymerised Neyveli lignite in organic solvent using Phenol and HPA catalyst and other catalyst

like clay supported phosphotungstic acid and phosphomolybdic acid and sulfated zirconia but no significant increase in extractability observed. De-polymerised lignites are alkylated using short chain alcohols as alkylating agents.

9. Findings

Under this project, optimal conditions deploymerisation carried out in autoclave to increase the extractability of deploymerized Neyveli lignite using organic solvents (Phenol) and HPA catalyst and other catalyst like clay supported phosphotungstic acid and phosphomolybdic acid and sulfated zirconia. From the depolymerisations study following facts have been established :

(i) With the increase in amount of phenol, the pyridine extractability increased up to 56% and then decreased.

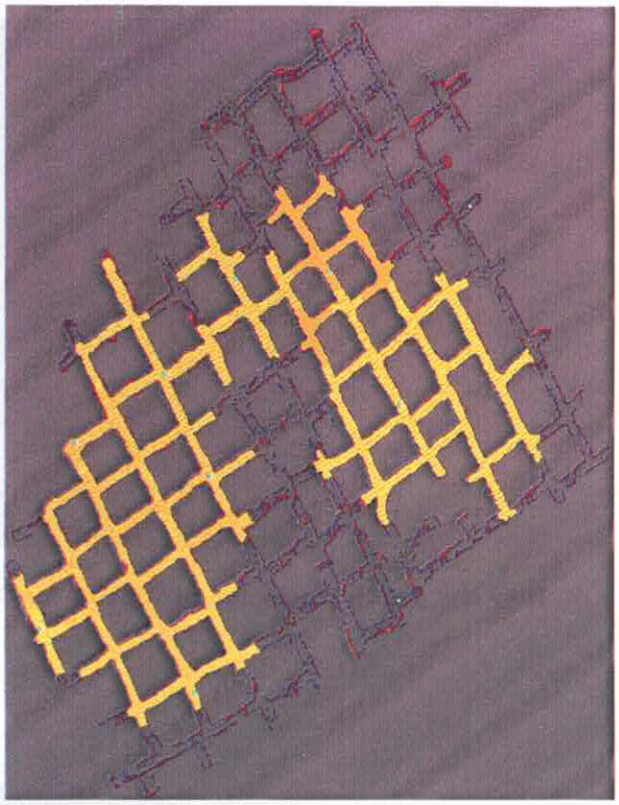
(ii) Pysidine extractability increased, with the increase in Catalyst content, but at certain stage it decreased due to agglomeration optimization of loading of catalyst has been established for maximum pyridine extractability.

(iii) Depolymerization increased with increase in time and attained maximum conversion of 59.6% at the end of 18 hours. Therefore, the pyridine extractability remained almost constant.

(iv) Depolymerization of Neyveli Lignites was also carried out using catalyst like clay supported heteropoly acids and sulphated zirconia. But no significant increase in pyridine extractability.

(v) Depolymerised lignite is a solid freely soluble in tolune. The gross calorific value of t-butylated depolymerised lignite on air dry basis was found 9158 Kcal/Kg whereas, GCV of ra lignite on dry basis was 6101 Kcal/kg.

Effusive release of air bubbles and water — MT/154



Constructed Sonar map of filled-up portion of u/g mines — MT/154

Photograph of inside Mixing Chamber — MT/154

New and young cracks found suitable for Green House Gases (GHG) measurement — EE/39

Mature and old cracks unsuitable for Green House Gases (GHG) sampling — EE/39

Monitoring of Dust and Black Carbon at mine site by upwind and downwind method — EE/39

Upwind :

Downwind :