

**S&T**  
**Annual Report**  
**वार्षिक प्रतिवेदन**  
**2007 – 2008**

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

**Central Mine Planning & Design Institute Limited**

(A Subsidiary of Coal India Limited)

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## प्राक्थन

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 पर्यावरणिक विषय तक में व्यापक रूप से अनुसंधान एवं विकास के क्रियाकलापों के सक्षम बनाया है।

सेंट्रल माइन प्लानिंग एण्ड डिजाइन 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 उप-समिति द्वारा सहायता प्रदान की जाती है, ये हैं :

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

1975 लसे 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 तहत वर्तमान में अनुसंधान परियोजनाएँ क्रियान्वित की जा रही हैं। इसके परिणामस्वरूप अभी तक 165 करोड़ रुपये की अनुमानित लागत से 267 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 34 चालू परियोजनाएँ एवं 10 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, माइन प्लानरों/ डिजाइनरों के लिये उपयोगी होगी।

भविष्य के 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 administered 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 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, 267 projects have been completed since inception at an approximate cost of Rs. 165 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 34 on-going and 10 completed S&T projects during the year.

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*

(अधी. क. अ.)  
कार्यालय मेंबर - ३३-१३३३६

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## LIST OF COAL S&T PROJECTS COMPLETED DURING 2007-08

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## LIST OF ABBREVIATIONS

✓	AMU	Annamalai University, Annamalai Nagar, Chennai
✓	BCCL	Bharat Coking Coal Limited, Dhanbad
✓	BHU	Banaras Hindu University, Varanasi
✓	CCL	Central Coalfields Limited, Ranchi
✓	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
✓	IICT	Indian Institute of Chemical Technology
✓	IISc	Indian Institute of Science, Bangalore
✓	IIT	Indian Institute of Technology
✓	ISMU	Indian School of Mines University, Dhanbad
✓	MCL	Mahanadi Coalfields Limited, Sambalpur
✓	NEC	North Eastern Coalfields, Margerita
✓	NIRM	National Institute of Rock Mechanics, Kolar
✓	NLC	Neyveli Lignite Corporaation Limited, Neyveli
✓	NCL	Northern Coalfields Limited, Singrauli
✓	OU	Osmania University, Hyderabad
✓	RDCIS	Research and Develooppment Centre for Iron & Steel, Ranchi
✓	SSRC	Standing Scientific Research Committee
✓	SECL	South Eastern Coalfields Limited, Bilaspur
✓	SCCL	Singareni Collieries Company Limited, Kothagudem
✓	TNAU	Tamil Nadu Agricultural University, Coimbatore
✓	VBU	Vinoba Bhave University, Hazaribagh
✓	WCL	Western Coalfields Limited, Nagpur
✓	RSMML	Rajasthan State Mlnes & Minerals Limited
✓	CMERI	Central Mechanical Engineering Research Institute
✓	APHMEL	Andhra Pradesh Heavy Machinery & Engineering Limited
✓	AMPRI	Advance Materials & Process Research Institute
✓	NEIST	North East Institute of Science and Technology

*Production, Productivity & Safety*

**S&T Annual Report**

**2007-08**



1. **Name of the Project** : **Development of an experimental subterranean robot (SR) for feasibility study of robotic application in underground coal mines.**
2. **Date of Start** : May 2005
3. **Scheduled date of completion** : Apr 2007
4. **Revised date of completion** : June 2008/Oct 2007
5. **Implementing Agency** : CMERI, Durgapur
6. **Sub-implementing Agency** : CMPDI, Ranchi / CMRI, Dhanbad
7. **Project Leader** : Mr. A. Maity, CMERI, Durgapur
8. **Project Co-ordinator** : Dr. Somajyoti Majumder, CMERI, Durgapur
9. **Total Approved Cost** : Rs. 89.168 Lakh  
for CMERI – Rs. 85.168 lakh  
for CMPDI – Rs. 2.00 lakh  
for CMRI – Rs. 2.00 lakh

### DESCRIPTION OF THE PROJECT

10. **Objective**

- \* To study underwater acoustic communication across a few gallery.
- \* To develop an experimental robot vehicle for development of the equipment & study.
- \* To test the concept in a simulated environment created at CMERI.
- \* Limited field trial of the system in a suitable coal mine.

11. **Status as on 31.03.2008 :**

- (i) The Major manufacturing/fabrication work is over. The assembly work has been completed mostly with all the major equipments/instruments in their respective positions. The tilling mehanism for tilling the thrusts is yet to be assembled.
- (ii) Aport from the leakage test, test for floatation of the system as designed has been checked. The system has been tested using RF modem. The rial of the quipment has established the Ratio. controlled operation of the system on the dry land.
- (iii) The Command GUI for the safe operation of the system has been developed using VC++ environment.
- (iv) The field trial of sub-terrain robot has been done on the shore of Damodar river.
- (v) Experiments regarding the tilting operation, thrusters performance has performed.
- (vi) On the basis of observation during field trials some modification were suggested which needs redesign of some part of the equipment.

12. **Slippage, if any** : Vendors/manufacturers of the Aluminium shell faced difficulty. Due to these reasons the project got delayed. Problems needed to be throughly investigated. Necessary corrective action has been taken. These activities has been re-scheduled.

13. **Action Plan for 2008 - 09**

- 1. Preperation and limited field trials.
- 2. Preparation of final report & submission.

1. **Name of the Project** : **Studies on the advance detection of fires in coal mines with special reference to SCCL.**
2. **Date of Start** : Sep 2002
3. **Scheduled date of completion** : Aug 2005
4. **Revised Date of Completion** : Nov 2007/Aug 2007
5. a. **Implementing Agency** : Andhra University, Visakhapatnam  
b. **Sub-Implementing Agency** : Singareni Collieries Company Ltd.
6. **Project Leader** : Prof. Dr. N. Someswara Rao, Andhra University
7. **Total Approved Cost** : Rs. 166.5088 Lakh

### **DESCRIPTION OF THE PROJECT**

#### **8. Objective**

To assess the relation between fire in the mine with the composition of the evolved gases. From an understanding of such a relation it will be possible to predict the fire in the mine by analysing the composition of the gases with reference to their nature and concentrations.

#### **9. Status as on 31.03.2007**

- \* Coal samples from SCCL mines have been collected and tested for Leachate analysis of organic components, inorganic components of coal and for Pyrolysis products of coal.
- \* Solid state  $C^{13}$  NMR & 2FT-IR spectral study of coal conducted to find out complex moieties present in coal which is responsible for emission of gases like  $H_2$ , Co etc.
- \* Thermo gravimetric analysis, Differential thermal analysis, Differential scanning calorimetry studies has been conducted.
- \* For assessing the composition of inorganic components trace components analysis by using Atomic Absorption Spectrometer (AAS) coupled with Plasma Spectrometer with Mass Spectrometry Detector has been completed.
- \* Studies on  $C_2 - C_{10}$  Hydrocarbons of different coal samples has been completed.
- \* It become clear that there are "organic radicals" in the raw coal. These organic radicals are highly reactive and in the presence of  $O_2$  can rapidly dissociate into smaller fragments which may be lighter ( $C_2 - C_{12}$  hydrocarbons) and hence may be become responsible for spontaneous heatings to some extent.

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

Most of the project activities have been completed and final project completion report is expected shortly.

#### **11. Action Plan for 2008-2009 :**

Preparation of final completion Report & submission.

1. **Name of the Project** : **Indigenous development of prototype longwall support (chock- shield)**
2. **Date of Start** : Aug 2004
3. **Scheduled date of completion** : July 2005
4. **Revised date of completion** : Nov 2008/Nov 2007/Dec 2006/Dec 2005
5. **Implementing Agency** : Singareni Collieries Company Ltd.
6. **Project Leader/co-ordinator** : Director Operation SCCL and MD. APHMEL, Kondapalli
7. **Total Approved Cost** : Rs. 228.47 Lakh  
S&T Grant- 197.97 Lakh  
Contribution SCCL - Rs. 30 .50 Lakh.

### DESCRIPTION OF THE PROJECT

8. **Objective**

To make longwall method of coal mining economically viable by :

- a. Developing and manufacturing indigenous chock shields of adequate capacity and compatible with Indian geo-mining conditions.
- b. To bring down the cost component of powered supports to about 50% of the imported cost.

9. **Status as on 31.03.2008 :**

After completion of torsional test, three weld cracks were observed in the rear shield at three places.

As per watchdog committee advise, fabrication of new rear shield and the repair of the existing shield is under progress.

10. **Slippage, if any :**

Project initially got delayed due to non-availability of high strength steel plate. The electrodes required were made as per order and hence supply of electrodes also took long time. After completion of 96% of life cycle testing, during torsional test, 3 weld cracks were developed in rear shield.

11. **Detailed action plan for 2008-09 :**

These following actions will be taken up during 2008-09.

- (i) Fabrication of new rear shield and the repair of the existing rear shield by taking help in welding procedure from BHEL.
- (ii) Remaining life cycle tests at ITF, Jessops, Kolkata
- (iii) Submission for DGMS approval
- (iv) Report preparations & submission

1. **Name of the Project** : **Stabiity of parting between coal pillar workings in level contiguous seams during depillaring.**
2. **Date of Start** : Oct 2004
3. **Scheduled date of completion** : Oct 2007
4. **Revised date of Completion** : Dec 2009/Sep 2008
5. **Implementing Agency** : CIMFR, Dhanbad
6. **Project Leader/co-ordinator** : Dr. Rajendra Singh, Scientist, CIMFR  
Dr. S.K. Singh, Scientist, CIMFR
7. **Total Approved Cost** : Rs. 50.54 Lakh

### **DESCRIPTION OF THE PROJECT**

#### **8. Objective**

- \* To develop guidelines for assessing parting stability taking the following factors into consideration.
  - (a) in situ stresses
  - (b) roadway width
  - (c) depth of cover
  - (d) parting thickness
  - (e) eccentricity and
  - (f) RMR
- \* The guidelines so developed as per first objective would be validated at four selected sites of depillaring. At all the sites, in-situ stresses, magnitudes and directions will be essentially measured.
- \* To do numerical modelling with an aim to derive a rational formulation for parting stability for depillaring situations.

#### **9. Status as on 31.03.2008**

The proposed Geo-technical instruments are yet to be received. Purchase delayed due to some technical reasons. Measurement of in-situ stresses at Shayam Sunderpur Colliery has been completed.

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

The project got baddly delay due to delay to procurement of Geo-technical instruments.

#### **11. Action Plan for 2008-09 :**

These following activities are expected to be completed during 2008-09 :

- (i) Procurement of geotechnical instruments
- (ii) Development of guidalines based on Numerical Modelling.
- (iii) Validation of guidelines at study site with instrumentation at ECL.

1. **Name of the Project** : **Efficacy of rock bolt support in underground fire zones and in water bearing excavations**
2. **Date of Start** : Nov 2003
3. **Scheduled date of completion** : Oct 2006
4. **Revised date of completion** : Oct 2008
5. **Implementing Agency** : Department of Mining Engineering  
Anna University, Chennai
6. **Project Leader/co-ordinator** : Prof. (Dr.) K Srinivas, Anna University
7. **Total Approved Cost** : Rs. 88.205 Lakh

### **DESCRIPTION OF THE PROJECT**

#### **8. Objective**

Laboratory and field investigations consists of the following two types of studies :

##### **Laboratory Investigations :**

A. To study the effectiveness of rock bolts in fire areas :

- To study the variation in anchorage capacity of rock bolts at high temperature i.e. from 100° to 900°C in steps of 100°C.
- To assess/determine the influence of fire on the anchorage capacity of rock bolts after the fire is quenched in air and water and also the effect of cyclic heating and cooling.
- To assess the influence of fire on the anchorage capacity of different types of rock bolts fixed in different types of rocks after fire is quenched by water.
- To study the influence of cyclic heating and cooling on the anchorage capacity of bolts.

B. To study the effectiveness of rock bolts in watery areas :

- To study the influence of varying flow rate of water on the effectiveness of grouted rock bolts fixed with different types of grouts.

##### **Field Investigations :**

- To study the influence of varying flow rates of water on the efficacy of grouted rock bolts fixed with different types of grouts in various rock types like sandstone, coal etc.

##### **Numerical Modeling :**

- To determine the influence of the strata temperature due to fire on the anchorage capacity of bolts by using finite element method.
- To compare laboratory and finite element analysis result.

### Analysis of data and recommendations :

- To find out on the basis of the above investigations the most effective type of rock bolt for providing support to the roof before, during and after fire and watery conditions.

### 9. Status as on 31.03.2008

- (i) Rock samples from Mangura and Godavari Khani Opencast mines of SCCL have been collected and tested for physico-mechanical properties.
- (ii) Test rigs for installing the furnace and simulation of the watery conditions have been designed, fabricated and installed.

### 10. Slippage, if any :

Project got delayed due to :

- Delay in fabrication of furnace and its installation. The furnace is of special type and also huge in size and required to be mounted on a special frame permitting people to work under the same. The furnace was originally envisaged to be electric furnace, but finally converted into LPG.
- Theft of computers for which FIR was lodged. All the data related to the research work viz. numerical modeling carried out and the results are lost.
- Manpower problems.

### 11. Detailed action plan for 2008-09

Following activities will be completed during 2008-09 :

- \* Construction of laboratory building in University campus of Anna University.
- \* Drilling of holes and fixing rock bolts in the rock block.
- \* Determination of anchorage capacity of different types of rock bolts fixed in the rock block at room temperature.
- \* Determination of anchorage capacity of bolts grouted with different types of grouts with different flow rates of water in the laboratory.
- \* Determination of anchorage capacity of bolts grouted with different types of grouts with different flow rates of water in the field in different types of roof rocks.

1. **Name of the Project** : **Development of a micro seismic monitoring system for stability analysis of underground mine workings under "Difficult to cave" roof conditions**
2. **Date of Start** : Oct 2004
3. **Scheduled date of completion** : Mar 2006
4. **Revised date of completion** : Sep 09/Sep 08/Sep 2007/March 2007
5. **Implementing Agency** : CIMFR, Dhanbad
6. **Sub-implementing** : ECL, Sanctoria, WB.
7. **Project Leader** : Sri G. Banerjee, Scientist, CIMFR
8. **Total Approved Cost** : Rs. 47.849 Lakh

### **DESCRIPTION OF THE PROJECT**

9. **Objective**

- \* To develop a scientific method for assessing stability of mining areas being worked under "Difficult to cave roof condition".
- \* To assess the efficacy of stabilization in the areas where mining was done long back.

10. **Status as on 31.03.2008 :**

- (i) Although the Project was commenced in Oct. 2004, but the project progress is very slow, due to delay in procurement of equipment by CIMFR, Dhanbad.
- (ii) From the status report it is revealed that CIMFR has recently placed order for procurement of equipment after elapse of almost 3 years.
- (iii) The experimental work will be started only after purchase of equipment.

11. **Detailed action plan for 2008-09 :**

There following major activities will be completed during the period.

- (i) Procurement of equipment
- (ii) Field trial monitoring and analysis of date of site 'A'
- (iii) Field trial monitoring and analysis of date of site 'B'
- (iv) Compilation & analysis of data.

1. **Name of the Project** : **Characterization of rock and explosive parameter for optimal explosive energy utilization in opencast blasting.**
2. **Date of Start** : Apr 2005
3. **Scheduled date of completion** : Mar 2008
4. **Revised date or completion** : March 2010
5. **Implementing Agency** : Central Mine Planning & Design Institute Limited, Ranchi
6. **Sub-implementing** : CIMFR, Dhanbad
7. **a. Project Leader** : D. Basu, SOM, Blasting Cell, CMPDI, Ranchi  
Dr. P. K. Singh, Scientist, CMRI, Dhanbad  
Mr. M. P. Roy, Scientist, CMRI, Dhanbad  
**b. Project Co-ordinator** : Mr. S. C. Kar, SOM, Blasting Cell, CMPDI, Ranchi  
Dr. A. Sinha, Acting Director, CIMFR, Dhanbad  
Dr. P. Pal Roy, Scientist, CIMFR, Dhanbad
8. **Total Approved Cost** : Rs. 270.37 Lakh  
  
for CMPDI – Rs. 206.15 lakh  
for CIMFR – Rs. 64.22 lakh

### **DESCRIPTION OF THE PROJECT**

#### **9. Objective**

- \* Effect of detonator timings and delay sequences on blast vibration. Confirmation by measurement of near and far field vibrations for production blasts with well characterised explosive products.
- \* Effect of initiation mode on the release of explosive energy. Measurement of energy release partitioning and efficiency for confined and unconfined charges by means of under water test.
- \* Energy release characteristics of explosives and their effect on blast results.
- \* Effect of sympathetic pressure on energy release and VOD in the receptor explosives.
- \* To establish the relationship between rock geo-technical properties and the explosive properties.

#### **10. Status as on 31.03.2008 :**

- (i) Mine site selection in ECL, WCL & NCL completed. In addition to above sites, Mine 1 & 2 of NLC has been included in this study.
- (ii) Out of 9 equipment, 4 equipment are under final stages of procurement and other 5 are under process.



- (iii) Field investigation were carried out at Jayant OCP, NCL, where fine deep hole blasts were conducted at different benches of east & west sections.

11. **Slippage, if any** : The project got delayed due to delay in procurement of equipments.

12. **Action Plan for 2008-09**

**(a) CMRI - Part**

Sl. No.	Activity	Date of start	Date of completion
1.	Field investigation, collection of data and experimentation	Apr 2008	March 2009
2.	Compilation of data and their analyses	Apr 2008	March 2009

**(b) CMRI - Part :**

Sl. No.	Activity	Date of start	Date of completion
1.	Procurement of Capital Items	Apr 2008	Jan 2009
2.	Data generation and field experimentation	Apr 2008	March 2009
3.	Data analysis	Apr 2008	March 2009

1. **Name of the Project** : Establishment of standard method for assessment of incendivity characteristics of 32mm diameter permitted explosives.
2. **Date of Start** : May 2005
3. **Scheduled date of completion** : Apr 2008
4. **Revised date of completion** : Sep 2009
4. **Implementing Agency** : CIMFR, Dhanbad
5. **Project Leader/Project Co-ordinator** : Sri S. K. Roy, Scientist, CIMFR  
Sri R. R. Singh, Scientist, CIMFR
6. **Total Approved Cost** : Rs. 41.19 Lakh

**DESCRIPTION OF THE PROJECT**

**7. Objective**

Establishment of standard method for assessment of incendivity characteristics of 32mm diameter permitted explosives equivalent to the present method followed for 37mm diameter cartridges of permitted explosives.

**8. Status as on 31.03.2008 :**

- \* Trials were conducted for the incendivity characteristics of permadyne and pentadyne of M/s Gulf Oil Corporation Limited, Hyderabad and indocoal-1, indocoal-3 and indocoal-5 of M/s IBP Co. Ltd., Korba with varying charge weight using 32mm and 37mm dia cartridges in existing Canon of 55mm dia bore. In the existing Canon of 55mm dia bore, incendivity characteristics of P-501 were studied with change in diameter from 25mm to 50mm.
- \* As no trials in the Canon with 40mm dia bore under similar conditions were done because of delay in purchase of the Canon/inner most member of the Canon with 40mm bore, no comparative results could be generated.
- \* However, the trials so far conducted in the existing set up revealed that there is no significant difference in the incendivity behaviour of studied samples in 32mm and 37mm diameter cartridges. This preliminary results need to be incorporated or modified after further studies with more permitted explosive samples and after studies with 32mm cartridges in 40mm bore Canon.

**9. Slippage, if any :**

Project has got delayed by about 18 months due to

- \* Delay in purchase of Canon of special design proposed for this project because there was no response from any party in Global tender published twice.

\* Unavailability of compressed natural gas (CNG) used in testing of explosive due to delay in administrative process including amendment of licence from PESO, Nagpur for upgradation of CNG storage facility at CMRI.

\* After change in specification which was agreed by SSRC sub committee on 16.9.2006, purchase orders have been issued for supply of innermost member of Canon which is yet to come in CMRI.

10. **Action Plan for 2008 - 09**

Sl. No.	Activity	Date of start	Date of completion
1.	Purchase of equipment	May 2005	June 2008
2.	Determination of $W_{50}$ value of 37mm diameter explosives supplied by different manufacture in 55mm bore cannon	Sep 2007	Dec 2008
3.	Determination of $W_{50}$ value of 32mm diameter explosives supplied by different manufacture in 40mm bore cannon	July 2008	Dec 2008
4.	Determination of equivalent test method of 32mm dia cartridges	Nov 2007	June 2009

1.	<b>Name of the Project</b>	:	<b>Underground coal Gasification and its utilization for power generation studies in lignite deposits of Rajasthan – Phase-I</b>
2.	<b>Date of Start</b>	:	Sep 2005
3.	<b>Scheduled date of completion</b>	:	Apr 2009
4.	<b>Implementing Agency</b>	:	Neyveli Lignite Corporation Limited Neyveli - 607 807, Tamilnadu
5.	<b>Project Leader/Project Co-ordinator</b>	:	Sri K. S. Anandan Director (Mines), NLC Ltd.  Sri S. N. Sahay DGM (Geology), NLC Ltd.
6.	<b>Total Approved Cost</b>	:	Rs. 1125 Lakh  MoC Part – Rs. 562.50 lakh DST Part – Rs. 375.00 lakh Contribution of NLC – Rs. 187.50 lakh

**DESCRIPTION OF THE PROJECT**

**7. Objective**

- \* To study and evaluate the exploration data of certain lignite block and selection of a suitable lignite block of UCG studies.
- \* To undertake detailed exploration in selected lignite block and assess the deposit characteristics, quality and reserves and carryout specialized studies on lignite.
- \* To establish and carryout UCG pilot studies and evaluate the heat values and other characteristics of producer gas.

**8. Status as on 31.03.2008 :**

- \* All the available exploration reports of select lignite reports are segregated and kept ready for review & pre-selection study by the consultants. Exploration reports of DMGR, Govt. of Rajasthan has also been procured.
- \* As a first step, NLC floated global tender on 30.9.2005 for appointment of Consultant. But no one responded to the tender, even though tender submission date was extended 3 times with the last extension upto 29.4.06.
- \* Hence, during various international seminars/conferences, the matter was discussed with certain foreign agencies who have got expertise in the field. Some of the firms showed interest to provide

consultancy to UCG Projects, however they are reluctant due to NLC's general terms & conditions given in the tender document.

- \* As such, it proposed to appoint the consultant on LTE basis by issuing the tender to 1) M/s Geophysics international Ltd., 2) ONGC in association with SIM, Russia, 3) CSIRO, Australia, 4) Dr. Alexander A. Kuzetnov, Centre UCG, Russia with some relaxed tender conditions such as withdrawal of Bank Guarantee (BG), Contract Performance Guarantee (CPG) and Liquidated Damage (LD) clauses.
- \* One of four firms which were issued LTE, only two furnishing M/s IMC Geophysics international Limited and carbon energy Pvt. Ltd., Australia had submitted their offer. On examination of the bids, the offer submitted by M/s IMC Geophysics international Ltd. was found not valid as they have taken deviation to tender conditions, as such their price cover was not opened.
- \* The Price Cover of M/s. Carbon Energy Pvt. Ltd., Australia was opened on 06.09.2007 and they have quoted a lumpsum price of US\$ 4.74 million (inclusive of service tax) for consultancy for 3 stages of the project. The quoted price works to Rs. 1957.146 lakh @ 1 US\$ = Rs. 41.29 prevailing on 06.09.2007, the date of opening of Price Cover.
- \* Due to delay in appointment of consultant to the project, other immediate activities could not be taken up as scheduled, as such subsequent activities are also getting delayed.

**9. Slippage, if any :**

So far, no consultant has been appointed by NLC. So no substantial progress has been made under this project.

**10. Action Plan for 2008 - 09 :**

Three following activities are expected to be done during 2008-09 :

- (i) Appointment of international consultant.
- (ii) Preliminary exploration
- (iii) Sample testing and special characterizing studies etc.

1. **Name of the Project** : **Application of high pressure water injection for hard roof management at Churcha west Colliery, SECL.**
2. **Date of Start** : Sep 2002
3. **Scheduled date of completion** : Feb 2004
4. **Revised Date of Completion** : Dec 2007/Jun 2007/Dec 2006/Dec 2005/Dec 2004
5. **Implementing Agency** : CIMFR, Dhanbad
6. **Sub-Implementing Agency** : SECL, Bilaspur
- 7 (a). **Project Leader** : Sri G. Banerjee, Scientist, CIMFR  
(b). **Project Co-ordinator** : Sri A.K. Ghosh, Scientist, CIMFR
8. **Total Approved Cost** : Rs. 58.8 Lakh  
MoC - Rs. 55.90 Lakh  
Contribution SECL-Rs. 2.90 Lakh

### **DESCRIPTION OF THE PROJECT**

9. **Objective**

- \* To establish high pressure water injection technique to improve cavability of hard and massive roof overlying the coal seam.
- \* To formulate norms and guidelines for water injection procedure and its parameters.
- \* The study of the economic feasibility of this method.

10. **Status as on 31.03.2008**

- Data analysis regarding effects of high pressure water injections on caving characteristics of overlying roof rock has been done.
- Numerical model for study of effect of hydrofracturing has been prepared.
- Water injection parameters have been optimised.
- Final report preparation is in Progress.

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

1. **Name of the Project** : **Investigation of Cavability of Overlying Strata and Development of Guidelines for Estimation of Support Capacity for Longwall Faces.**
2. **Date of Start** : Nov 2005
3. **Scheduled date of completion** : Oct 2008
4. **Revised date of completion** : Mar 2010
5. **Implementing Agency** : NIRM, CIMFR, ISMU, Dhanbad & CMPDI.
6. **Sub-implementing Agency** : SECL, Bilaspur; SCCL, Kothagudem; ECL, Sanctoria, W.B.; BCCL, Koyala Bhawan, Dhanbad and CMPDIL, Ranchi.
7. **Project Leader** : Dr. V. Venkateswaran, Scientist, NIRM  
Prof. U. K. Singh, Deptt. of Mining Engg., ISMU, Dhanbad  
Mr. G. Banerjee, CIMFR, Dhanbad
8. **Project Co-ordinator** : Mr. A. K. Ghosh, CIMFR, Dhanbad  
Prof. S. N. Mukherjee, ISMU, Dhanbad
9. **Total Approved Cost** : Rs. 461.3674 Lakh

CIMFR – Rs. 200.142 lakh  
 NIRM – Rs. 187.910 lakh  
 ISM – Rs. 63.3154 lakh  
 CMPDI – Rs. 10.00 lakh

**DESCRIPTION OF THE PROJECT**

10. **Objective**

"Development of an integrated approach for selection of the capacity of powered support and formulation of a strata and support behaviour monitoring scheme for longwall operation in Indian coal mines."

The work aims in analysing a few previously worked out and presently running longwall panels and studying the sequence and nature of caving of overlying rocks by numerical modelling techniques. The steps to achieve the above objectives are as follows :

- \* Develop a suitable method for the assessment of cavability of overlying roof rocks.
- \* Categorize the coal measure rock, rock beds based on its caving behaviour.
- \* Develop guidelines for estimation of support capacity for longwall faces and gate roads.
- \* Evolve a safety factor for estimation of support capacity.
- \* Suggest guidelines and requirement of hard roof management techniques for difficult to cave roof conditions.

\* Standardization of support condition monitoring techniques to be implemented for the longwall faces and gate roads.

\* Standardization for monitoring techniques of strata in and around longwall faces and support behaviour at caving longwall faces and its instrumentation.

11. **Status as on 31.03.2008 :**

\* Numerical model for identification of immediate roof, main roof completed. Simulation of caving behaviour and support load completed.

\* Using the data of past and running longwall Panels of GDK-IOA and PUK-5 incline, Numerical modelling studies have been conducted for simulation of caving behaviour of overlying roof rocks and load on support for longwall Panels under different Geo-mining conditions.

12. **Slippage, if any :** The project got delayed by almost 17 month due to delay in procurement of Geotechnical instruments. They have been re-tendered second time due to insufficient quotations received.

13. **Detailed Action Plan for 2008 - 00**

**A. NIRM**

Sl. No.	Activity	Date of start	Date of completion
1.	3-dimensional numerical modelling of the longwall panel	May 2008	Dec 2008
2.	Preliminary studies in one longwall panel	Nov 2008	Feb 2009
3.	Instrumentation and monitoring in one longwall panel	Nov 2008	March 2009

**B. CMRI**

Sl. No.	Activity	Date of start	Date of completion
1.	Procurement of instruments	Apr 2008	Dec 2008
2.	Collection of data from past and present longwall faces	Apr 2008	June 2008
3.	Collection and testing of coal and rock samples from different longwall panels	Apr 2008	Aug 2008
4.	Analysis of previous longwall panels with existing supports	Apr 2008	Oct 2008
5.	Simulation at caving behaviour by numerical modelling	May 2008	March 2009
6.	Field investigation and modelling (site A)	Sep 2008	March 2009



1. **Name of the Project** : **Development of room temperature sensors for Methane using Carbon Nanotubes and Nanofibres.**
2. **Date of Start** : Nov 2005
3. **Scheduled date of completion** : Oct 2008
4. **Implementing Agency** : Jadavpur University, Kolkata
5. **Sub-implementing Agency** : Indian School of Mines University, Dhanbad
6. **Project Leader** : Prof. A. K. Pal, Jadavpur University, Kolkata
7. **Project Co-ordinator** : Prof. P. S. Gupta, ISM, Dhanbad
8. **Total Approved Cost** : Rs. 85.6805 Lakh  
for Jadavpur University – Rs. 71.2045 lakh  
for ISM – Rs. 14.476 lakh

### **DESCRIPTION OF THE PROJECT**

9. **Objective**

The research will be directed towards the synthesis & characterization of Carbon Nanotubes and Nanofibers by adopting cost effective & scaleable electro-deposition technique for methane gas sensor applications. The highly sensitive sensors based on Carbon nanotubes and nanofibers to be developed under this project for detection of methane in underground. Hence will be unique in nature and these sensors will work at room temperature. This would enhance safety in underground mines.

10. **Status as on 31.03.2008 :**

- (i) Sealing up of electro-deposition unit has been completed taken into account of the design aspect to handle 3"Si wafers.
- (ii) Disposition of smaller Si substracts with increased surface coverage of deposit is nearly completed. This film has been characterized by XRD, FTIR and UV-Vis-NIR studies to modify the deposition parameters for improving the quality of coating.
- (iii) The design and fabrication of the simulation chamber for sensing methane gas has been carried out. This chamber is well developed for controlled variation of the inner atmospheric temperature and pressure.
- (iv) Coal block collected from Kusmunda mines, Dhanbad, a coal chamber using these has been fabricated. Preliminary tests have been conducted with some other material sensors ( $\text{SnO}_2$ , developed in laboratory of ISMU) to study the gas sensing capabilities using the chamber.
- (v) The final prototype sensors using CNTS when developed at Jadavpur university will be tested successfully using the coal simulation chamber.

11. **Slippage, if any :**

- (i) Shortage of Si wafers posed problem. During scaling up of the deposition technique, consumption of Si wafers was large, Jadavpur University has been imported new batch of Si wafers, but the deposition on them was not up to mark. So University has desiphered the specifications of the wafers giving good results and contacted the venders to supply. This took considerable time.
- (ii) Contact problems on the Si wafers were noticed. Stable and rigid space contract on Si wafers for

prototype development of this coverage >95% in needed . To shortout this problem considerable time consumed which delayed other related activities.

**12. Action Plan for 2008 - 09 :**

These following major activities will be taken-up during 2008-09 :

- (i) Other necessary tests will be carried out in the coal simulation chamber before final testing.
- (ii) Protatype CNT sensors will be subjected to test in the coal simulation chambers to measure the gas sensing capabilities.
- (iii) Protatype sensors will be tested inside mines and the data is to be analyzed for necessary improvements after which final report will be prepared.

**DESCRIPTION OF THE PROJECT**

**Objective**

- 10. Status as on 31.03.2008  
 The research will be directed towards the synthesis & characterization of Carbon Nanotubes and functionalized by adopting cost effective & scalable electro-deposition technique for methane gas sensor applications. The highly sensitive sensors used on Carbon nanotubes and nanotubes to be developed under this project for detection of methane in underground. Hence will be unique in nature and these sensors will work at room temperature. This would enhance safety in underground mines.
- 11. (i) Sealing up of electro-deposition unit has been completed, taken into account of the design aspect to handle 1.5 liter water.  
 (ii) Deposition of smaller Si substrates with increased surface coverage of deposit is nearly completed. The film has been characterized by XRD, FTIR and UV-Vis-IR studies to modify the deposition parameters for improving the quality of coating.  
 (iii) The design and fabrication of the simulation chamber for sensing methane gas has been started. This chamber is well developed for controlled variation of the over atmospheric temperature and pressure.  
 (iv) Coal block collected from Kuzbass mines, Dhanbad, a coal chamber using these has been fabricated. Preliminary tests have been conducted with some other material sensors (GO) developed in laboratory of ISM) to study the gas sensing capabilities using the chamber.  
 (v) The first prototype sensors using CNTs when developed at Jadavpur university will be tested successfully using the coal simulation chamber.
- 12. (i) Storage of Si water posed problem. During scaling up of the deposition technique, consumption of Si water was large. Jadavpur University has been reported new batch of Si water, but the deposition on film was not up to mark. So University has designated the specifications of the water's giving good results and contacted the vendor to supply. The took considerable time.  
 (ii) Contact problems on the Si water were noticed. Stable and rigid space contact on Si water for

1. **Name of the Project** : **Delineation of barrier thickness against water logged working in underground Coal Mines.**
2. **Date of Start** : **May 2007**
3. **Scheduled date of completion** : **Apr 2009**
4. **Implementing Agency** : **CIMFR, Dhanbad**
5. **Project Leader/Co-ordinator** : **Dr. K.K.K. Singh, Scientist CIMFR, Dhanbad**  
**Dr. A. Sinha, Director, CIMFR, Dhanbad**
6. **Total Approved Cost** : **Rs. 342.3692 Lakh**

**DESCRIPTION OF THE PROJECT**

**7. Objectives :**

- (i) Establishment of GPR signatures for different geological formations, cavities and waterlogged workings.
- (ii) Delineation of galleries and pillar from the surface and form underground with the help of GPR survey.
- (iii) Delineation of barrier thickness of 60 m from the approachable location to unapproachable workings and extend the same study for unknown working in underground coal mines.
- (iv) Verification of GPR survey results with the help of integrated geophysical survey like multi electrodes resistivity imaging survey along with some bore hole data.

**8. Status as on 31.03.2008 :**

- Literature review has been completed.
- A technical committee constituted to evaluate technical specification of the proposed GPR system, has recommended to go for Expression of Interest (Eoi) globally with detailed technical specification of purposed GPR system having depth of peneretration 60m or more. The Eoi for development of GPR had been floated globally. But , response was very poor. Eoi for development of GPR has been retendered on Sep 2007.
- Team has visited some mines of ECL and BCCL for location of known 60m coal barrier thicknes in underground under different conditions like fully waterlogged/partially waterlogged for experimental study.

**9. Slippage, if any :**

The project got delayed due to poor response of Eoi for the development of GPR System having depth of penetration 60 m or more.

**10. Detailed Action Plan for 2008 - 09**

Sl. No.	Activity	Date of start	Date of completion
1.	Floating of Global tender and selection of suitable firm for development of specified GPR system.	in the process	Apr 2008
2.	Field investigation, collection of date and experimentation with developed GPR system.	Apr 2008	Oct 2008
3.	Compilation of data and their analyses and report preparation	Oct 2008	Apr 2009

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. **Date of Start** : **March 2008**
3. **Scheduled date of completion** : **Feb 2011**
4. **Implementing Agency** : **IIT, Kharagpur**
5. **Project Leader/Co-ordinator** : **Dr. Samir Kr. Pal, Deptt of Mining Engineering, IIT Khagpur**
6. **Total Approved Cost** : **Rs. 395.18 Lakh**

**DESCRIPTION OF THE PROJECT**

7. **Objectives :**
  - \* Validating the findings on 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 boreholes at shortest possible time.
  - \* To validate the empirical relationship on the estimation of the slope 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 based of the slurry with 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 modification of this "Pre-Jamming Indicator" will also be done for field applicability.

8. **Status as on 31.03.2008 :**

Location has been identified and permission of carry out project activities obtained. Planning and design of optimum filling parameters is being carried out.

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

10. **Detailed Action Plan for 2008 - 09**

These following main activities will be carried out during 2008-09

1. Identification of a suitable location for field trial of gravity blind backfilling technique.
2. Planning & design of optimum filling parameters.
3. Selection and surveying the location of different boreholes and drilling of a few initial bore holes for slurry feeding, water pumping air-outlet and large sized boreholes for video camera insertion.

1. **Name of the Project** : **High resolution seismic monitoring for early detection and slope failures in opencast mines.**
2. **Date of Start** : **March 2008**
3. **Scheduled date of completion** : **Feb 2011**
4. **Implementing Agency** : **Anna University, Chennai**
5. **Sub-Implementing Agency** : **Singareni Collieries Company Ltd. (SECL)**
6. **Project Leader/Co-ordinator** : **Dr. L. Ajay Kumar, Deptt of Mining Engineering, Collage of Engineering, Anna Uni Chennai.**
7. **Total Approved Cost** : **Rs. 124.30 Lakh**  
S&T Grant : Rs. 99.44 Lakh  
Contribution SCCL : Rs. 24.86 Lakh

### **DESCRIPTION OF THE PROJECT**

7. **Objectives :**

The objectives of this study are :

- \* Advanced detection and analysis of slope failures of dumps and pit benches
- \* Continuous micro-seismic monitoring of pit slopes.
- \* Slope stability studies in high wall mining
- \* Suggesting control measures for slope failure and high walls.

8. **Status as on 31.03.2008 :**

- Detailed discussions held with the official of Singareni Coallieries Company Ltd., the sub-implementing agency. Managuru OCP-II mine of SCCL is proposed for the study.

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

10. **Action Plan for 2008 - 09**

These following main activities will be carried out during 2008-09

- (i) Literature study.
- (ii) Recruitment of research associates and purchase of equipment.
- (iii) Identification of Mine and selection of site for the sensors.
- (iv) Drilling & placement of trial sensors.

1. **Name of the Project** : **Coalbed Methane (CBM) Recovery & Commercial Utilisation**
2. **Date of Start** : Sep 1999
3. **Scheduled date of completion** : Aug 2004
4. **Revised date of completion** : Dec 2009/Dec 2007/Oct 2006/Feb 2006
5. **i. Implementing Agency** : Central Mine Planning & Design Institute Ltd.
- ii. Sub-implementing** : Bharat Coking Coal Ltd.
6. **Project Leader/Co-ordinator** : Chief Project Manager (CBM Cell), CMPDI
7. **Total Approved Cost** : Rs.9242.70 Lakh
- Funding Agencies** : (a) Global Environment Facility (GEF), USA  
                                  (b) United National Development Programme (UNDP)  
                                  (c) Govt. of India (GoI-S&T)  
                                  (d) ONGC
- Contribution:**  
        S&T Grant – Rs.1805.80 Lakh  
        GOI (kind) – Rs.699.40 Lakh  
        UNDP/India – Rs.545.10 Lakh  
        UNDP/GEF – Rs.4143.70 Lakh  
        ONGC Co-sharing – Rs.1215.70 Lakh  
        Part of the Revenue – Rs.833.00 Lakh  
        Cost met out of the income generated from the Project

### **DESCRIPTION OF THE PROJECT**

8. **Objective**
  - (i) Strengthen and increase capacity of CMPDIL, BCCL, ISM, CMRI, Ministry of Coal, CIL and the Ministry of Environment to develop and Support mine associated CBM recovery and use, and experience in the identification, design, and implementation of programmes to recover and use coalbed methane in a safe, cost effective, and environmentally acceptable manner.
  - (ii) Prepare and execute demonstration Projects at the Moonidih and Sudamdih coal mines located in the Jharia Coalfields for the recovery and use of mine associated CBM in the Jharia Coalfields. Design and execute CBM resource recovery programmes using three different drilling technologies at two proposed demonstration sites.
  - (iii) Use gas recovered from successful execution of the above objectives for vehicle refueling and electric power generation.
  - (iv) Develop and adopt action plan for replication of successful aspects of demonstration projects. Use the CBM Clearing house to disseminate information, educate, promote, and facilitate interaction with potential foreign investors.

9. **Status as on 31.03.2008 :**

- (i) Drilling of 2 bore holes completed.
- (ii) Gas -Gen set is under installation.
- (iii) Pipe line lying on surface completed
- (iv) Pipe line lying in underground is in progress
- (v) Steering vehicle is yet to be procured.

10. **Slippage, if any :**

There has been delay in procurement of various equipment packages due to repeated retendering by UNIDO, which has resulted in project time over run.

11. **Action Plan for 2008 – 09**

- (i) Procurement of remaining equipment
- (ii) Drilling will continue at different identified sites.
- (iii) Lying of pipe line in underground.
- (iv) Recovery of gas and its utilization.

1. **Name of the Project** : Hydrogeological studies for control of ground water for safe and economic mining of Lignite Deposits in Nagpur district of Rajasthan.
2. **Date of Start** : May 2007
3. **Scheduled date of completion** : Apr 2008
4. **Revised date of completion** : March 2009
5. **Implementing Agency** : Rajasthan State Mines and Minerals Ltd. (RSMML), Udaipur
6. **Project Leader/Co-ordinator** : Shri L.S. Rathore, Group General Manager (Lignite)
7. **Total Approved Cost** : Rs.182. 12 Lakh  
S&T Grant - Rs. 145.696 Lakh  
Cont. RSMML - Rs. 36.424 Lakh

### DESCRIPTION OF THE PROJECT

8. **Objective**
  - \* Detailed evaluation of ground water potential of water bearing horizons associated with lignite deposits. Method and extent of ground water control operations for safe and economic mining of lignite deposits.
  - \* Estimation of static and dynamic ground water reserves and yield potential for 25 years.
  - \* Effect of pumping on water quality in long run and probable change in underground water balance.
  - \* Assessing the full economic impact of ground water management for mining lignite resource in the area.
  - v. Environmental impact assessment of lignite mining arising out of ground water control operations.
9. **Status as on 31.03.2008 :**

Interim report submitted by NIH incorporating the data collected and results of study on environmental isotopes.
10. **Slippage, if any :**

Work related to construction of exploratory tube wells and observation wells could not be carried out within time as MOU entered between Central Ground water Board (CGWB) and RSMML expired in Sep 2007.
11. **Action Plan for 2008 – 09**
  - (i) Construction of exploratory wells (4 nos) and observation well (8 nos) 150 to 175 m depth.
  - (ii) Construction of piezometers (6" diameter, 6 Nos, 150 to 175 m depth)
  - (iii) Drilling & construction of recharge wells (2 nos)
  - (iv) conducting aquifer performance tests.
  - (v) Collection and analysis of water samples.
  - (vi) Preparation of mathematical model & Report preparation.



# *Coal Beneficiation & Utilisation*

**S&T Annual Report**

**2007-08**

1. **Name of the Project** : **Application of vorsyl separator for recovery of clean coal from middlings and rejects**
2. **Date of start** : Oct 2004
3. **Scheduled date of completion** : Sep 2006
4. **Revised date of completion** : March 2009/March 2008
5. **Implementing Agency** :
  - a. Advanced Materials & Process Research Institute (AMPRI) (formerly RRL), Bhopal
  - b. Central Mine Planning & Design Institute Ltd., Ranchi
6. **Project Leader/Co-ordinator** :
  - a. Dr. J.P. Barnwal, RRL, Bhopal
  - b. General Manager (CMP), CMPDI, Ranchi
7. **Total Approved Cost** : Rs. 125.40 lakh  
S&T Grant : Rs. 94.765 lakh  
DST Contribution - Rs. 30.635 lakh  
For AMPRI, Bhopal : Rs. 85.40 Lakh  
For CMPDI : Rs. 40.00 Lakh

### **DESCRIPTION OF THE PROJECT**

#### **8. Objectives**

- \* Install 300-400mm dia Ni Hard Vorsyl Separator with necessary instrumentation.
- \* Conducting test on vorsyl separator using three widely varying feed characteristics of washery middlings/rejects samples.
- \* Optimizing the performance of vorsyl separator
- \* Development of mathematical models and scale up strategy for vorsyl separator vis-a-vis feed coal characteristics.
- \* Evaluate the performance vorsyl separators.
- \* Demonstrate the application of vorsyl separator to the coal industry for recovering coal from washery middlings and rejects.

#### **9. Status as on 31.03.2008**

Dugda Coal Washery has been selected for implementation of the project. Design of vorsyl separator has changed and finally it has been decided to install 450 mm vorsyt supinator at Dudda washery, BCCL. No substantial work has been done under the project.

10. **Slippage, if any :**

Initially, the project has got delayed due to finalisation of size of the Vorsyl Separator. Finally it has been decided to install 450mm Vorsyl Separator at Dugda Washery, BCCL. The project implementation got badly delayed due to delay in procurement of equipment and poor response the tenders floated by RRL, Bhopal.

11. **Action Plan for 2008 – 09**

The following activities will be carried out during 2008–09

- (i) Tendering for installation of vorsyl separator plant
- (ii) Installation of plant
- (iii) Procurement of coal samples and its charaterisation studies.
- (iv) Test operation & Modelling studies.
- (v) Report preparation.

1. **Name of the Project** : **Development of user friendly models for design and operation of jigs and heavy media cyclones for treatment of different coals.**
2. **Date of Start** : Sep 2005
3. **Scheduled date of completion** : Aug 2007
4. **Revised date completion** : Feb 2009
5. **Implementing Agency** : Advanced Material and Processes Research Institute (formerly known as Regional Research Labr.) Bhopal
6. **Sub-implementing Agency** : Central Mine Planning & Design Institute Ltd., Ranchi  
Indian School of Mines University, Dhanbad
7. **Project Leader** : Dr. A. K. Majumder  
Regional Research Laboratory, Bhopal
8. **Project Co-ordinator** : Dr. J. P. Barnwal  
Regional Research Laboratory, Bhopal
9. **Total Approved Cost** : Rs. 61.14 lakh  
for AMPRI (B) : Rs. 34.22 lakh  
for ISM : Rs. 14.22 lakh  
for CMPDI : Rs. 12.70 lakh

### **DESCRIPTION OF THE PROJECT**

#### **10. Objective**

- \* To establish the usefulness of the newly developed washability index termed as NGMI.
- \* To develop appropriate models correlating washability characteristics of feed coal and process variables in jig and a HMC with their perform areas based on laboratory scale experimental data.
- \* Demonstration of the application of the developed models in a coal washery to identify suitable operating conditions for performance optimization of the washing circuit.

#### **11. Status as on 31.03.2008**

- (i) Review of existing washability quantification methods is continue.
- (ii) Analysis of existing data base and development of new washability index as well as establishing its usefulness for practical use is going on.
- (iii) A software has been developed to generate the washability curves and the NGMI from the float-sink data of any coal samples.

- (iv) A simple but new methodology has been developed to quickly optimize the performance of a DMC with variation in feed coal characteristics. The advantages associated with this new methodology have been demonstrated in Mohuda coal washery, BCCL.
- (v) Laboratory model centric jig has been procured and installed. Suitable mathematical models has been developed based on the experimental data generated.

12. **Slippage, if any** : The project initially got delayed due to the non response from the prospective suppliers/ fabricators to supply the desired equipment.

13. **Action Plan for 2008 – 09**

- \* Analysis the existing data base and development of New Washability index as well as establishing its usefulness for practical use.

DESCRIPTION OF THE PROJECT

Sl. No.	Objective	Status as on 31.03.2008
1	To establish the usefulness of the newly developed washability index termed as NGMI.	
2	To develop appropriate models containing washability characteristics of feed coal and process variables in jig and a HMC with their perform areas based on laboratory scale experimental data.	
3	Demonstration of the application of the developed models in a coal washery to identify suitable operating conditions for performance optimization of the washing circuit.	
4	Review of existing washability quantification methods is continue.	
5	Analysis of existing data base and development of new washability index as well as establishing its usefulness for practical use is going on.	
6	A software has been developed to generate the washability curves and the NGMI from the feed sink data of any coal samples.	

1. **Name of the Project** : **Development of cheap, energy efficient by-product coke oven for production of hard coke for Steel/Metallurgical use.**
2. **Date of start** : Oct 2003
3. **Scheduled date of completion** : Sep 2005
4. **Revised date of completion** : Dec 2008/Sep 2008/May 2008/Nov 2007/July 2006
5. **Implementing Agency** : CIMFR, Dhanbad
6. **Sub-implementing Agency** : Central Mine Planning & Design Institute, Ranchi
7. **Project Leader/Co-ordinator** : Mr. R. N. P. Sinha / Dr. A. K. Sharma  
Dr. S.K. Hazra, CFRI (Project Co-ordinator)
8. **Total Approved Cost** : Rs. 286.67 lakh  
For CIMFR - Rs. 240.60 Lakh  
For CMPDI - Rs. 46.07 Lakh

### **DESCRIPTION OF THE PROJECT**

9. **Objective**

The objectives of the present investigation are to design and develop a semi-by-product coke oven utilizing the potentials of beehive coke-oven to make it cheap & energy efficient and subsequently to utilize the concept in the development of a demonstration/commercial plant.

10. **Status as on 31.03.2008**

- (i) The Process flow sheet is finalised and main layout of the oven & plant is completed.
- (ii) All the detailed engineering drawing required for complete plant has been completed and refractory specification finalised.
- (iii) Received CSIR approval for the turn-key Job, NIT published, work order placed, site handed over to the vendors.
- (iv) Construction of the chimney, control room and like oven battery completed.
- (v) Construction of flue tunnel and combustion chamber are going on.
- (vi) Dismantling and reconstruction of by-product section, material handling section are in progress.
- (vii) Erection of waste heat boiler, control panel completed.
- (viii) Renovation of Pusher cum stamp charging car is in progress.

11. Slippage, if any :

Project got delayed due to

- (i) Delay in finalisation of detailed Engineering drawing
- (ii) The vendors unable to hand over the proposed plant within time frame due to non-availability of refractory materials.

12. Action Plan for 2008 – 09

The following major activities will be done during 2008-09

- (i) Construction & Commission of new plant
- (ii) Trial run, testing and analysis.
- (iii) Final Completion Report writing.

- |    |                              |   |  |
|----|------------------------------|---|--|
| 1. | <b>Name of the Project</b>   | : | <b>Agglomeration formation in reducing condition in pressurised fluidised bed gasification (PFBG) with low rank high ash Coals.</b>              |
| 2. | Date of start                | : | Nov 2003   |
| 3. | Scheduled date of completion | : | Oct 2006   |
| 4. | Revised date of completion   | : | March 2009/March 2008  |
| 5. | Implementing Agency          | : | CIMFR, Dhanbad   |
| 6. | Sub-implementing Agencies    | : | i. Centre for Energy Technology, Osmania University, Hyderabad<br>ii. Central Mine Planning and Design Institute Ltd.                            |
| 7. | Project Leader/Co-ordinator  | : | Sri P. D. Chavan, CIMFR<br>Sri S. Dutta, CIMFR<br>Sri K. Basu, Project Manager<br>Centre for Energy Technology,<br>Osmania University, Hyderabad |
| 8. | Total Approved Cost          | : | Rs. 338.58 Lakh<br>CIMFR – Rs. 283.48 Lakh<br>CET, Osmania Uni - Rs. 42.71 Lakh<br>CMPDI – Rs. 12.39 Lakh  |

**DESCRIPTION OF THE PROJECT**

**9. Objective**

- \* Validation of Reactivity of various coals under reducing conditions
- \* Mechanism of agglomerate and clinker formation, under pressure and in reducing atmosphere due to coal properties and reactor design, and
- \* Mechanism of elutriation with different ash content (different coals)

**10. Status as on 31.03.2008**

- (i) Execution of PFBG plant fabrication work at vendor's site is in progress
- (ii) Site Preparation is in progress
- (iii) Coal procurement is in progress



11. **Slippage if any :**

The project has got substantial delay due to :

- (i) NIT preparation of the (previously approved) was delayed as the design and specifications are unique in nature.
- (ii) Processing of NIT got held up due to some changes in the CSIR guidelines for awarding civil work for installation of pilot plant at CIMFR on turnkey basis.
- (iii) The previous Project Leader was transferred. Considerable time took in formation of new Project Team.
- (iv) Reduction of dia of PFBG (from 200 mm reactor dia to 100 mm reactor dia) due to financial constraints and its approval.
- (v) Retendering of revised NIT took considerable time for procurement PFBG.

12. **Action Plan for 2008 – 09**

Sl. No.	Activity	Date of start	Date of completion
1.	Procurement of revised PFBG unit (Dia 100mm)	Dec 2006	Continue
2.	Mathematical Modeling	Aug 2007	Continue
3.	Characterisation of tools	Dec 2006	Continue

1. **Name of the Project** : **Direct Sourcing of coal for value added chemicals**
2. **Date of start** : Nov 2004
3. **Scheduled date of completion** : Oct 2007
4. **Revised date of completion** : Apr 2008
5. **Implementing Agency** : CIMFR, Dhanbad and IICT, Hyderabad
6. **Project Leader/Co-ordinator** : Dr. G. Ghosh, Scientist, CIMFR  
Dr. S. K. Srivastava, Scientist, CIMFR
7. **Total Approved Cost** : Rs. 70.30 Lakh  
For CFRI - Rs. 32.30 Lakh  
For IICT - Rs. 38.00 Lakh

### DESCRIPTION OF THE PROJECT

#### 8. Objectives

Sourcing coal (directly) for value added chemical, which involves selective catalytic degradation/fragmentation, characterization and ascertain the precursors for value-added chemicals and investigate practicable methods of upgradation of coal derived products for value - added chemical.

#### 9. Status as on 31.03.2008

- (i) In addition to Samla coal of ECL, Tirap coal of Assam (NE region) has been collected, Sub-sampled and prepared to -212 micron size sample.
- (ii) Development of appropriate method for isolation, identification & quantification of various coal derivatives have been done using GPC column and its software was installed successfully for characterization of coal derivatives on the basis of their molecular weight.
- (iii) 20 gms of raw coal under different batches were de mineralized in an indigenously designed reactor under mechanical stirring at 150°C in presence of optimum amount of alkali. Ash level of Samla coal was reduced to <3% from 14% while that of Tirap coal to 0.9% from 6.1%. The main objective of chemical demineralization of coal was to get a clean raw material and generate more surface area for effective oxidative degradation of coal.
- (iv) An effort was taken to see the possibility of converting the nitro group in the ONC into NH<sub>2</sub> (AMINO) group which have been of immense importance in producing organic conductors, temperature sensors and other strategic materials through polymerization. Conventional method failed but, by applying sodium dithionite ammonia method nitro group was successfully converted into amino group, which was confirmed through FTIR spectroscopic analysis.

10. **Findings of the study are :**

- (i) Low rank bituminous coals are mostly utilized for power generations but as a precious deposit, it is desirable to utilize a part of this abundant resource as a source of high value product. Low rank coals have a large amount of oxygen functional groups such as COOH, -OH, >OH, >CO etc. These oxygen functionalities make the coal low in their fuel value. These coals of high moisture content are attractive to produce value added, chemical due to their reactivity towards oxidation reactions. The objective of the project has been fully achieved. Oxidation using nitric acid has vindicated its usefulness in covering coal to useful product in substantial quantity. This study is directed towards the non fuel use of coal. So coal producer would supply coal to chemical industry to produce value added new material directly from coal without burning a gram of the valuable natural deposit.

11. **Slippage, if any :**

12. **Action Plan for 2008 – 09 :**

Preparation of final completion report and its submission.

**DESCRIPTION OF THE PROJECT**

Sl. No.	Objective	Status as on 31.03.2008
i)	Isolation of various coal derivatives for identification & quantification of various coal derivatives on the basis of their molecular weight.	In addition to 8 units of EOL, Trip coal of Assam (NE region) has been collected. Out sampled and prepared to ~12 micron size sample.
ii)	Development of apparatus method for isolation, identification & quantification of various coal derivatives have been done using GPC column and its software was installed successfully for characterization of coal derivatives on the basis of their molecular weight.	Status as on 31.03.2008
iii)	20 gms of raw coal under different batches were mineralized in an indigenously designed reactor under mechanical stirring at 150°C in presence of optimum amount of alkali. Ash level of 8 units coal was reduced to <3% from 14% while that of Trip coal is 0.2% from 6%. The main objective of chemical demineralization of coal was to get a clean raw material and generate more surface area for effective oxidative degradation of coal.	In addition to 8 units of EOL, Trip coal of Assam (NE region) has been collected. Out sampled and prepared to ~12 micron size sample.
iv)	An effort was taken to see the possibility of converting the nitro group in the ONO and NH (AMINO) group which have been reported in producing organic conductors, temperature sensors and other strategic materials through polymerization. Conventional method failed but by applying sodium dithionite ammonium method nitro group was successfully converted into amino group, which was confirmed through FTIR spectroscopic analysis.	In addition to 8 units of EOL, Trip coal of Assam (NE region) has been collected. Out sampled and prepared to ~12 micron size sample.

1. **Name of the Project** : **Production or [60], [70] fullerenes, Hetro fullerenes and cabron nanotubes from coal**
2. **Date of start** : **May 2007**
3. **Scheduled date of completion** : **Apr 2010**
4. **Implementing Agency** : **CIMFR, Dhanbad**
5. **Sub-Implementing agency** : **BHU, Varanasi**
6. **Project Leader/Co-ordinator** : **Shri Ashisk Kumar Ghose, CIMFR/ Prof. O.N. Srivastava, BHU**
7. **Total Approved Cost** : **Rs. 175.80 Lakh**  
For CIMFR - Rs. 145.92 Lakh  
For BHU- Rs. 29.88 Lakh

### **DESCRIPTION OF THE PROJECT**

#### **8. Objectives**

The objective of the project in to produce soot enriched in [60], [70] Fullerenes, Hetrofullerenes and Nanotubes involving indigenous designed reactor system.

#### **9. Status as on 31.03.2008**

- I. Bulk coal samples from Putki, Munidih, Satgram, Bastacola (zero seam). Tata digwndih (XI seam) & Bhowrah (XVII seam) collieries have been collected and stored under distilled water.
- II. Tata digwadih coal has been carbonized after reduction to 3mm size. The coke thus obtained was further crushed to 72 BS and from the coke powder rods of dimension 3cm length and 0.5 cm diameter were successfully fabricated.
- III. As pilot study several arching experiment were done with the rods on the reactor system at the lab of BHU, Varanasi, of which same rods responded towards production of soot.
- IV. Soot deposited in the walls of the reactor and the electrodes were collected and preserved for analysis of Transmission Electron microsope.

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

#### **11. Detailed Action Plan for 2008 – 09**

- I. Installation & standardization of equipment.
- II. Preparation of coal/coke rods.
- III. Exploratory deposition of soot with existing facilities in BHU
- IV. Carrying out experiments in the fullerenes reactor system.
- V. Product analysis and characterisation
- VI. Selection of suitable 'host' compound for separation of fullerenes.

1. **Name of the Project** : Pulse detonation combustion of coal for energy application.
2. **Date of start** : March 2008
3. **Scheduled date of completion** : Feb 2010
4. **Implementing Agency** : IISc, Bangalore
5. **Project Leader** : Prof. T.S. sheshadri, IISc Bangalore
6. **Total Approved Cost** : Rs. 22.80 Lakh

### **DESCRIPTION OF THE PROJECT**

#### **8. Objectives**

- \* To setup facility for pulse detonation combustion of coal with technology and research goal.
- \* To achieve constant volume combustion of coal and thus attain higher energy efficiency.
- \* To study of detonation structure in coal air mixtures and coal detonation chemical kinetics at higher temperature & Pressure and diffusion process.

#### **9. Status as on 31.03.2008**

Newly started project, progressing on per schedule.

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

#### **11. Detailed Action Plan for 2008 – 09**

- I. Design of coal air pulse detonation facility
- II. Fabrication
- III. Operation and testing
- IV. Measurement of energy efficiency for water heating and other heat intensive application.

*Environment & Ecology*

**S&T Annual Report**

**2007-08**

1. **Name of the Project** : **Development of emission factors for various mining machineries & operations in opencast coalmines**
2. **Date of start** : **May 2002**
3. **Scheduled date of completion** : **Apr 2005**
4. **Revised Date of Completion** : **Mar 2008/Mar 2007**
5. **Implementing Agency** : **Sri J.K. Goel, GM (Env.), CMPDI**
6. **Project Co-ordinator** : **Dr. M.N. Mukherje, Chemist (M-1), Mr. P.C. Jha, Dy SE (Env.)**
7. **Total Approved Cost** : **Rs. 78.01 Lakh**

### DESCRIPTION OF THE PROJECT

#### 8. Objectives

- \* Assessment of dust emission rate/factor of opencast coal mining operations.
- \* To validate the dispersion levels from these emissions in an OC coal mine.

#### 9. Status as on 31.03.2008

- \* The field work for development of emission factors at KDH Project of Cantral Coalfields Limited has been completed, Rajrappa OCP of CCL has been selected for validation of data developed at KDH Project. The data required for validation studies were generated at and gathered from Rajrappa OCP, CCL. The emission factors for following activities have been developed using upwind-down wind methology :
  - (i) Drilling in Coal Benches
  - (ii) Drilling in OB benches, loading of overburden, unloading of overburden, loading of coal & CHP (Coal sizing)
- \* The emission factor for haul road transportation has been developed with the help of specially designed 'Profilor' which was installed in the field.

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

#### 11. Action Plan for 2008 – 09

The emission factors data is being validated with the help of fugitive dust model of U.S. Environment Protection agency.

Final Report Preparation is going on.

1. **Name of the Project** : **Environmental impact of subsidence movements caused due to caving on ground water and forest cover in Godavari valley coalfields**
2. **Date of start** : Oct 2003
3. **Scheduled date of completion** : Sep 2006
4. **Revised date of completion** : Sep 2007
5. **Implementing Agency** : CIMFR, Dhanbad
6. **Sub-implementing Agency** : Singareni Collieries Company Limited, Kothagudem
7. **Project Leader/Co-ordinator** : Dr. K.B. Singh & Dr. R.S. Singh, Scientists, CMRI
8. **Total Approved Cost** : Rs. 72.03 Lakh  
S&T Grant - Rs. 60.83 Lakh  
Cont. SCCL - Rs. 11.20 Lakh

**DESCRIPTION OF THE PROJECT**

**9. Objectives**

Environmental impact of subsidence movements due to caving on :

- \* Vertical and lateral fluctuation of ground water
- \* Forest cover

**10. Status as on 31.03.2008**

- \* Subsidence investigation were conducted over N-31 panel at 5B Incline in Kothagudem area and Y-12 panel at MK-4 incline in Mandmarri area, SCCL.
- \* To know the impact of ground movements on environment with time, two old panels dipillared about five years back were also selected at each mine.
- \* The measured data of subsidence and width of cracks were collected from the concerned colliery where as slope & strain were predicated for them.
- \* Seasonal water levels were measured in the constructed peizometric wells. Pumping test was done twice at each mine before and after depillaring on N-31 & Y-12 panels to known the aquifer parameters Seasonal soil testing was done for all the above sites to know the impact of submsidence movements. Phytosociological study including abundance, density and frequency of plants were done at each sites seasonally.



11. Findings of the above studing as follows :

- (i) The maximem subeidence, compressive and tencile strains and slope over all the four sites (two old and two new) were 1565mm/m, 24.32mm/m, 23.74 mm/m & 56.76mm respectively.
- (ii) The variation in width of surface cracks were 5cm to 100cm.
- (iii) All the peizometric wells lying above and over surrounding barrier pillars are of the panels were dry & could not be recovered even after 13 months after completion of extraction in the panels.
- (iv) Transmissivity and hydraulic conductivity of the aquifer were almost unaffected due to mining at 5B Incline whereas hey became doubled at MK-4 Incline due to creation of secondary permeability following subsidence induced cracks due to working in four multi seam panels at a time.
- (v) Subsidence movements have increased organic Carbon, total Nitrogen, toal Phosphorous and fine root bio-mass in subsided sites with respect to undisturbed sites.
- (vi) Subsidence movement have no impact on phyto sociological characters of forest cover over all the subsided sites having upto 100cm wide cracks and 23.74 mm/m tensile strains although, a few plants got falling within cracked zone of ground movements.

12. Slippage, if any :

The project in running behind revised date of completion due to delay in drilling of boreholes in the selected mines at SCCL.

1. **Name of the Project** : **Fly ash characterization for mine void reclamation**
2. **Date of start** : **Nov 2003**
3. **Scheduled date of completion** : **Oct 2006**
4. **Revised date of completion** : **Jan 2010/Oct 2008**
5. **Implementing Agency** : **CMPDI Ltd.**
6. **Project Co-ordinator** : **GM (Env.), CMPDI Ltd. Ranchi**
7. **Total Approved Cost** : **Rs. 287.684 Lakh**

### **DESCRIPTION OF THE PROJECT**

#### **8. Objectives**

- \* To identify and characterize samples of power grade coal from mines from major coalfields in India producing power grade coal and supplying coal to identified TPS.
- \* To characterize the PFA produced from coal from indentified mines and establish relationships between trace elements present in coal and its PFA.
- \* To carry out standard leaching tests on ash samples and characterize the leachate produced with respect 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 of, including development of townships on such land.
- \* Foreign grade coal to be tested w.r.t. the above three issues, to compare its eco-friendliness vis-s-vis Indian coal.
- \* To analyze slope stability of the dump formed by backfilling fly ash (PFA) and dump material in two scenarios
  - \* Fly ash (PFA) and overburden material are mixed during the backfilling
  - \* Fly ash (PFA) and overburden material are dumped in layers.

#### **9. Status as on 31.03.2008**

- \* Literature survey has been completed
- \* Major equipment like ICP, TCLP, Auto Furnace & Mercury Analyzer are under procurement process.
- \* Samples have been collected from Korba STPS, Amarkantak STPS, Singrauli STPS, Ib STPS, Talcher STPS and also from different mines of SECL, NCL and MCL. Samples from CCL and

BCCL and their respective thermal power plants are yet to be collected and this is expected to be completed shortly. Limited enquiry for physical analysis of fly ash for slope stability has raised. Due to single quotation (IIT Roorkee) this out sourcing job is again to be re-tendered. Chemical & leachate analysis of coal and fly ash samples will be carried out after arrival of equipment.

**10. Slippage, if any :**

- \* Project got delayed due to procurement of different equipments.
- \* Single quotation received for ICP and TCLP so retendering has been done.
- \* Physical analysis of fly ash for slope stability job will be carried out by outsourcing. This outsourcing job is again to retendered due to single quotation received from IIT, Roorkee.

**11. Action Plan for 2008 – 09**

- Procurement of equipment will continue.
- Samples collection from CCL and BCCL and their respective thermal power plants will be done.
- Physical analysis of fly ash samples would be done by outsourcing.
- Interpretation of the ratio shall be carried out after sample analysis along with slope stability through modeling.

1. **Name of the Project** : **Development of suitable biological wastewater treatment technology through constructed wetlands for treatment of acid mine drainage from coal projects.**
2. **Date of start** : **Aug 2004**
3. **Scheduled date of completion** : **Jul 2007**
4. **Revised date of completion** : **June 2009**
5. **Implementing Agency** : **CMPDI Ltd., Ranchi**
6. **Sub-implementing Agency** : **Western Coalfields, Nagpur**
7. **Project Leader** : **GM (Env.), CMPDI Ltd. Ranchi**
8. **Total Approved Cost** : **Rs. 78.62 Lakh**

### **DESCRIPTION OF THE PROJECT**

#### **9. Objectives**

- \* Design of Anoxic lime stone drain.
- \* Identification of plant species capable of bio-degrading the acid mine drainage.
- \* Design of organic substratum of wetland to support plant species.
- \* Assessment of treatment efficiency and operating parameters for treatment of the acid mine drainage by the plant species through bio-degradation.
- \* Development of a simple and cost-effective bio-treatment system to treat the acid mine drainage from the coal mines, so that it could be made potable.

#### **10. Status as on 31.03.2008**

- \* Literature survey is continue.
- \* Land is tentatively identified with WCL, Authority.
- \* Two round of sample collection and characterisation has been completed. Analysis of mine water samples by outside laboratory has been completed.
- \* The plant species Typha has been identified for this purpose.
- \* The design of wetland system has been completed.

11. **Slippage, if any**

- (i) Project got delayed due to change of site by WCL.  
The project now will be executed at Maori U/G Mine and Sasti Incline of WCL.
- (ii) Initial delay in specialized analysis of mine water samples by outside agency got delayed due to non-availability of suitable agencies resulted in delay of the subsequent activities of the project.

12. **Action Plan for 2008 – 09**

The following activities are proposed to be carried out in 2008-09 :

- (i) Preparation of NIT and tender documents for turnkey execution of the project.
- (ii) Construction of the treatment system.
- (iii) Monitoring of the treatment process.
- (iv) Modification, if any, in the treatment process.
- (v) Monitoring of the treatment process.
- (vi) Preparation of Report & Submission.

1. **Name of the Project** : **Environmental Cleanup and remediation of coal mining overburden sites of TIRAP collieries, Assam**
2. **Date of start** : **Nov 2005**
3. **Scheduled date of completion** : **Oct 2008**
4. **Implementing Agency** : **North East Institute of Science & Technology  
Jorhat, Assam**
5. **Project Leader/Co-Ordinator** : **Dr. H. P. Deka Boruah, Scientist, RRL, Jorhat**
6. **Total Approved Cost** : **Rs. 18.90 Lakh**

### **DESCRIPTION OF THE PROJECT**

#### **7. Objectives**

- \* In situ assessment of the environmental degradation due to opencast coal mining.
- \* Monitoring of Soil degradation due to acid mine drainage (AMD), by siltation or by dumping of over burden materials.
- \* Assessment of the microbial population size in and around coal mining areas and possible remedial measures to restore the microbial community.
- \* Assessment of phytotoxicity of coal mining pollutants and assessment of accumulation pattern of different trace and heavy metal content, detoxification of coal mine pollutants phytotoxicity both by chemical and biological means.
- \* Development of agro-forestry, assessment of growth pattern of the plants and biochemical and physiological characterization of the plants grown in coal mine pollutants ravaged areas.
- \* Management of organic matter and development of green cover.

#### **8. Status as on 31.03.2008**

- \* Tirap Colliery OB dump site overlooking to NH37 selected for in-situ remediation study of the Project. It was observed that total microbial population size enumerated in coal mine OB and of the OB enzymatic activity were below the threshold limit.
- \* Plant samples that are able to grow on mine OB were screened under control conditions.
- \* Evaluation of enzymatic activity (dehydrogenase, urease, phosphate) of OB experimental site is continued Field preparation for in-situ remediation of the experimental sites at tirap OB dumping site and other related activities of the project is progressing as per schedule.

- \* Rate of germination, morphological changes of root, physiological & bio-chemical characters of the plant DHAINSHA has studied in control condition.
- \* Activity of enzyme (catalase, peroxidase and nitrate reductase) was assessed and found 7 to 8 fold less. Biomass for the plant grown in mine OB were 7 to 10 times less compared to un-mined soil. Evaluation of enzymatic activity of OB experimental site is continue.
- \* Mine OB transformation in soil promotion and soil DNA of the experimental bed determined and weathering of mine OB was faster in remediate site. Simultaneously a higher level of DNA was recorded in remediate site.

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

10. **Detailed Action Plan for 2007 – 08**

Sl. No.	Activity	Date of start	Date of completion
1.	Monitoring of soil quality, i.e., recording of pH, soil particle size distribution, assessment of different ion content and soil enzymatic activity. This will also include, affect of seasonal variation on soil.	Mar 2006	Will continue
2.	Screening of different quick growing herbaceous edible, non-edible plants and also both legume and non-legume crops.	Mar 2006	Will continue
3.	Management of organic matter by external application of both synthetic agrochemicals and organic manure followed by multiple cropping, their growth pattern, biochemical and Physiological changes.	Sep 2007	Continue
4.	Development of green cover by planting timber yeilding and other economically important plant.	Dec 2007	Continue

1. **Name of the Project** : **Investigation into low cost liner for disposal of coal ash in abandoned opencast mine.**
2. **Date of start** : Oct 2006
3. **Scheduled date of completion** : Sep 2009
4. **Implementing Agency** : CIMFR, Dhanbad
5. **Project Leader/Project Co-Ordinator** : Dr. (Mrs.) Bably Prasad, CIMFR (CMRI)
6. **Total Approved Cost** : Rs. 39.00 Lakh

**DESCRIPTION OF THE PROJECT**

**7. Objectives**

- (i) To develop an economically viable method of preparation of zeolite material from coal fly ash that can be used as liner for coal ash disposal in abandoned open cast.
- (ii) To evaluate the efficiency to prevent leaching of conaminants to ground water.

**8. Status as on 31.03.2008**

- \* Sampling of fly ash from Talcher, Korba, Kahalgaon, Singrauli, Ramagendem, Chandrapur Super thermal plant and Tenughat thermal power plant has been completed. Purchase of equipment is in progress.
- \* KRD & SEM analysis of prepared Fly Ash Zeolite (FAZ) and Fly Ash (FA) are under progress.
- \* Anmonium exchange capacity of different fly ash zeolite has been completed.
- \* Preparation of laboratory Bench scale fly ash filled in VAT with fly ash zeolite as liner has been prepared and caperiment has been started.
- \* Leaching studies of fly ash filled VAT on weakly basis and analysis of different contaniments in the leachate water collected from the bottom of VATs is going on. The Project is progressing as per schedule.

**9. Detailed Action Plan for 2008 – 09**

These following activities will be taken up during 2007-08 :

- \* Procurement of equipment - expected to be completed by Oct. 2008
- \* Laboratory Bench scale experiments.
- \* Data analysis and evaluation of liner efficiency.



1. **Name of the Project** : **Study on blasting dust management system in an opencast coal mines.**
2. **Date of start** : **Oct 2006**
3. **Scheduled date of completion** : **Sep 2009**
4. **Implementing Agency** : **NIRM, MCL & NCL**
5. **Project Leader/Project Co-Ordinator** : **Mr. Surendra Roy, NIRM**  
**Dr. G. R. Adhikari, NIRM**
6. **Total Approved Cost** : **Rs. 48.33 Lakh**

### **DESCRIPTION OF THE PROJECT**

#### **7. Objectives**

- \* To study the meteorological conditions at the mine sites.
- \* To assess the ambient air quality at the study site due to blasting.
- \* To study the influence of rock density and blast design parameter on dust emission.
- \* To develop emission factor for the quantification of dust emission due to blasting.
- \* To develop predictive estimation equation for the dust concentration at particular location.
- \* To find out central measures for the dust generation due to blasting.

#### **8. Status as on 31.03.2008**

Collected drill cuttings of coal samples have been analysed for moisture content, texture and specific gravity. These parameters have great impact on generation of dust.

#### **9. Slippage, if any**

The project is progressing as per schedule.

#### **10. Detailed Action Plan for 2007 – 08**

These following activities will be done during 2007-08 :

- (i) Sampling and analysis of air quality due to blasting.
- (ii) Micro meteorological data collection.
- (iii) Study the influence of rock density and blast design parameters on dust generation.

1. **Name of the Project** : **Development and use of fly ash based pesticides**
2. **Date of start** : **May 2007**
3. **Scheduled date of completion** : **Apr 2011**
4. **Implementing Agency** : **Annamalai Univ. (AMU), VCRC, Pondichery & NLC**
5. **Project Leader/Project Co-Ordinator** : **Shri V. Manoharan, Chief Manager (Sci/CARD/NLC/  
Dr.P. Narayanasamy, Prof. Head, Deptt of Entomology (AMU)/  
Dr. P Jambulingam, Scientist FVC RC, Pondichery.**
6. **Total Approved Cost** : **Rs. 295.43 Lakh**  
S&T Grant : Rs. 265.867 Lakh  
For NLC : Rs. 131.737 Lakh  
For AMU : Rs. 82.62 Lakh  
For VCRC : Rs. 51.53 Lakh  
Cont NLC : Rs. 29.543 Lakh

### DESCRIPTION OF THE PROJECT

#### 7. Objectives

- \* To standardize methods to develop fly ash based pesticides.
- \* To formulate fly ash " 100% dust insecticides".
- \* To develop "herbal fly ash insecticides".
- \* To develop "Microbial fly ash insecticides".
- \* To develop and test bio-logical fly ash pesticides against mosquitoes.
- \* To test the fly ash based pesticides against pest problems in rice, groundnut, sugarcane, vegetables, cotton & pulses and in store godowns.
- \* To assess pesticides, residues in plant products, produce soil and water samples.

#### 8. Status as on 31.03.2008

Revival of bacterial strains obtained from the microbial culture collection has been done & laboratory scale production of two bacterial strains is over. Selection of particle size of the fly ash appropriate to the target mosquito species has been completed & accordingly the fly ash is being prepared. Collection of peropagules for mass production of pesticides plants to produce herbal pesticides is in progress. Preparation of formulation is in progress. A detailed survey of the mosquito breeding in 19 locations of Neyveli, Tamilnadu has been undertaken and the mosquito species prevalent in these habitats were recorded for planning field testing of formulation, once the laboratory test are completed. Data on insecticides use in the field site (Nayveli Township) have been collected for planning, comparative evaluations with fly ash based formulation. Construction of pesticide lab, poly green house are in progress. Procurement of equipments for pesticides production is in progress.

#### 9. Slippage, if any : Nil

10. Detailed Action Plan for 2008 – 09

Sl. No.	Activity	Date of start	Date of completion
<b>A. NLC PART</b>			
1.	Preliminary survey of field in and around Neyveli - collection of soil, water & food chain samples and testing. Collection of data on pest incidence etc.	Continued from first year	March 09
2.	Multiplication of biopesticides strains in fermentor, and analyzing soil, plant and animal samples for presence of heavy metals and enzymes etc. after harvest of each crop	Cotinued from first year	March 09
3.	Co-ordinating in the conduct of Lab. & field experiments involving fly ash based pesticides in field crops & mosquitoes.	Continued from first Year	March 09
<b>B. Annamalai Univ. (AMU) PART</b>			
1.	Development of various flyash dust and fly ash based bio-pesticides at lab and their characteristion	Continued from first Year	March 09
2.	Production and evaluation of various fly ash pesticides against the bests of rice, ground nuts, vegetables, cotton and pulses etc.	Apr. 2008	March 09
<b>C. VCRC, Pandichery PART</b>			
1.	Development and formation of mosquitocidal toxins from bacteria using fly ash as a carrier.	Continued from first year	March 2009
2.	Laboratory evaluation of fermentation of mosquitocidal toxins from bacteria for activity against immature stages of bacteria.	Sep. 2008	March 2009
3.	Conducting toxicological studies on this mosquitocidal toxins from bacteria as well as the formulation prepared from them for verifying their safety to mammals and non-target organism.	Apr. 2008	March 09

1. Name of the Project	:	Survey and ecological conservation of NLC environment through bio-remediation with tree species.
2. Date of start	:	May 2007
3. Scheduled date of completion	:	Apr 2010
4. Implementing Agency	:	NLC & Tamil Nadu Agriculture University (TNAU)
5. Project Leader/Project Co-Ordinator	:	Shri K.C. Radhakrishnan, DGM, CARD, NLC Dr.S. Santhanam, DGM, CARD, NLC Shri V. Manoharan, CM, CARD, NLC
6. Total Approved Cost	:	Rs.77.01 Lakh For NLC : Rs. 25.30 Lakh For TNAU: Rs. 51.71 Lakh

### DESCRIPTION OF THE PROJECT

7. **Objectives**
- (i) To survey the ecological diversity of NLC as influenced by air born contaminants viz CO<sub>2</sub>, SO<sub>2</sub> NO<sub>x</sub>
    - (a) Survey of the vegetation pattern of NLC
    - (b) Identification of bio-indicators.
    - (c) CO<sub>2</sub> distribution through infra red imagery.
  - (ii) To study the Photo-remidiation efficiency of the existing green belt of NLC to air born contaminants viz CO<sub>2</sub>, NO<sub>2</sub> and SO<sub>2</sub> and soil born contaminants.
    - (a) Absorption efficiency of vegetation for in pollutants.
    - (b) Aporption efficiency for CO<sub>2</sub> by afforested tree species.
  - (iii) To evaluate tree species and fruit saplings to tolerance to air and soil born contaminants for sustaining for clean environment in and around NLC.
  - (iv) To study short-term and long-term effects of air and soil born pollutants on tree species and fruit crops.
8. **Status as on 31.03.2008**
- \* Thirty locations have been fixed in four directional sectors with eight locations in each sectors. One location far from Industrial area has been fixed as a reference location. Four tree species have been identified at each location for regular sampling.
  - \* First set of plant, soil and water samples have been collected from all sampling locations and their analysis has been carried out.
  - \* Purchase order has been placed for procurement of 2 nos of CO<sub>2</sub> analyzer & accessories.
  - \* A tender has been issued for work contract for sample collection, preparation and analysis of heavy metals on plant, water & soil sample collection.
9. **Slippage, if any** : Delayed in completing samples analysis due to SRF/JRF leaving the project.

10. Action Plan for 2008 – 09

These following activities are proposed to be carried out in 2008-09 :

- \* Collection and analysis of plant, soil and water samples will be continued.
- \* Monitoring of carbon dioxide covering the entire study area on a weekly basis as soon as CO<sub>2</sub> analyzer is received and commissioned.
- \* Finalization of work contract for carrying out analysis of heavy metals.
- \* Simulation work on air pollution in open top chamber to be taken up at TNAU.
- \* The vegetation mapping work through IR Imagery to be carried out with the assistance of M/s SACON, Hyderabad.
- \* Glass house experiments to evaluate tree species & fruits saplings for air, water and soil born contaminants (photo-remediation efficiency)
- \* Evaluation of trees and fruits saplings existing in NLC for photo-remediation efficiency to air pollutants.

1. **Name of the Project** : **Low cost input technology for re-vegetaion of coal mine spoils in order to protect the environment.**
2. **Date of start** : May 2007
3. **Scheduled date of completion** : Apr 2010
4. **Implementing Agency** : TM Bhagalpur Univ., MCL & NCL
5. **Project Leader/Project Co-Ordinator** : Prof (Dr.) A.K. Roy  
University Department of Botony TM Bhagalpur Univ.  
Bhagalpur.
6. **Total Approved Cost** : Rs. 19.88 Lakh

### **DESCRIPTION OF THE PROJECT**

#### **7. Objectives**

- \* Eco-diversity of micro-flora on different aged OB dumps relation to developing native or artificially raised vegetation.
- \* To screen out common efficient micro-flora used as bio-tools for the establishment of plant species on OB dumped.
- \* Development of eco-friendly micro-bial package for the restoration of vegetation on OB dump or mine spoils at regional & national level to sustain the effect of variable biotic & abiotic factors.

#### **8. Status as on 31.03.2008**

The experimental OBD sites selection has been completed at NCL & MCL. Identification & documentation of native flora has been completed. Out of three, two instruments, have been installed in the laboratory and the third (Trinocular Research Micro Scope Model C<sub>41</sub>) will be installed very soon. Collection of rhizosphere and non rhizosphere soil of native plants have been made for the screening of biological profile in terms of fungi, Bacteria Vesicular Arbuscular Mycorrhizae (VAM) at Samleshwari OCP, MCL and Jayant OCP, NCL. Dilution Plant technique was adopted and pure culture of different fungal species, was isolated and subjected to identification. Preparation of data of bacterial profile is in progress. The progress of the project in as per sehedule of work elements.

#### **10. Detailed Action Plan for 2008 – 09**

These following activities will be done during 2008-09

- (i) Development of bio-inoculant package.
- (ii) Selection of plants for re-vegetaion.
- (iii) Polybag experiment under green house condition.

***S&T Completed Projects during 2007-08***

**S&T Annual Report**

**2007-08**





1. **Name of the project** : **Development of support guidelines for depillaring panels in Indian Coal Mines.**
2. **Implementing Agency** : CIMFR, Dhanbad
3. **Project Leader / Co-ordinator** : Dr. A Kushwaha, Scientist, CIMFR  
Dr. S K Singh, Scientist, CIMFR
4. **Date of Start** : Oct. 2001
5. **Date of completion** : Dec. 2006
6. **Total approved cost** : Rs. 21.78 lakh

**DESCRIPTION OF THE PROJECT**

**7. Objective**

- \* Identification of the main factors contributing to support load during depillaring
- \* Evolution of guidelines for estimation of support requirements at and around the face during depillaring.
- \* Application of the support guidelines for better productivity and their validation in three trial panels in Indian coal mines.

**8. Work Done**

Eighteen underground coal mines were selected for the study, where RMR and other geo-mining parameters of the immediate roof rock strata were determined. These parameters were used to Run 3-D Numerical Models of their running panels to estimate the required support density at the slice junction, within slice, in split gallery and at the goaf edge under three different in situ stress condition. During Modelling four set of split and slice width (3m to 6m) along with three set of roof rock mass rating were taken to estimate the required support load density at different places of the face. Total 612 3-D models were run to generate sufficient number of data set for developing the best possible empirical equations for those places of the face. To supplement the modelling results, four coal mines were selected for the field instrumentation where Instrumented rock bolts were used to determine the axial load, bending moment etc developed along the bolts along with stress meter observations for ribs stability. Three case studies were presented with the application of developed equations where required support load density has been estimated at different places of the face and compared with applied support system in these mines. It was found that the results obtained from developed equations are well matching with mine support system. Based on detailed study conducted during running of the Project a readily & yardstick suitable guidelines had been proposed to use it at the faces of depillaring panels in Indian coal mines.

**9. Findings**

The developed equations are as follows:

$$\text{For slice junction, } SLD_{jn} = \frac{\gamma \times H^{0.50} \times K^{0.64} \times W^{1.17}}{R^{0.90}}$$

$$\text{Within slice. } SLD_{sl} = \frac{\gamma \times H^{0.67} \times K^{0.84} \times W^{1.74}}{R^{1.42}}$$

$$\text{In the split gallery, } SLD_{sp} = \frac{\gamma \times H^{0.52} \times K^{0.59} \times W^{1.12}}{R^{1.02}}$$

$$\text{For goaf edge, } SLD_{ge} = \frac{\gamma \times H^{0.54} \times K^{0.49} \times W^{0.89}}{R^{0.79}}$$

- Where
- $\gamma$  = Weighted average density of the immediate roof rock strata (t/m<sup>3</sup>)
  - H = Depth of cover (m)
  - K = Ratio of horizontal to vertical in –situ stress.
  - W = Width of split or slice (m)
  - R = Weighted average RMR of the immediate roof rock

$SLD_{in}$ ,  $SLD_{st}$ ,  $SDL_{sp}$  &  $SDL_{ge}$  are the required support density in t/m<sup>2</sup> at the slice Junction, within slice, in the split gallery and at the goaf edge respectively.

1. **Name of the project** : **Effect of production blast, ground water and geo-technical properties on pit wall and dump stability in open pit coal mines.**
2. **Implementing Agency** : CIMFR, Dhanbad
3. **Project Leader / Co-ordinator** : Dr. P K Singh, Scientist, CIMFR
4. **Date of Start** : Sep. 2002
5. **Date of completion** : Feb. 2007
6. **Total approved cost** : Rs. 36.24 lakh

### DESCRIPTION OF THE PROJECT

#### 7. Objective

- \* To study the effects of blast vibrations on pit-wall and dump stability.
- \* To evaluate the effects of ground water and geo-technical properties on pit wall and dump stability.
- \* To establish the nature and extent of damages caused to the pit wall and dump from production blasts.

#### 8. Work Done

Blast induced vibrations were recorded at various locations at waste dump of the Jayant Project and at pit-wall of the Jhingurdah Project, NCL with the existing blast design practiced in the mines as well as with modified blast design to achieve the objectives of this S&T project. A Geo-technical study was carried out at both the mines to determine the optimum internal dump and pit wall height and its overall angle. The stability analysis was done with the help of GALENA Software based by limit equilibrium method.

#### 9. Findings

The following recommendations are made to ensure safe & efficient dragline blast to ensure greater safety in the mine.

- It is recommended that during dragline blasting the heavy machine should be placed at least 15m away from the operating pit-walls in the close proximity to dragline blast.
- The dragline blasts should be detonated in such a pattern that most of the explosive energy is utilized in rock fragmentation.
- The delay intervals between the rows for dragline blasting should be 10-28.6 ms of effective burden and for shovel benches the optimum delay internal should be 8-17.6 ms of effective burden for improving fragmentation and reducing vibration.
- The existing practice of 8 ms delay internal for charge separation of two detonations is not adequate. The 8ms delay criterion is not holding good at low frequency site because the wave lengths are simply too long to constructively cancel out the waves. The minimum delay internal of 17 ms between the holes in row should be adopted.
- Dominant peak frequencies and Fast Fourier Transform (FFT) analysis of frequencies of vibration confirmed that the low frequency vibrations were recorded in the dump.

- The emulsion explosive should not be loaded from height in the blast holes. It lead to breaking of bonds of emulsion and will be crystallized with time. It is a very serious concern in the sleeping holes. Emulsion droplets are by nature unstable, so down the hole loading should be done.
- Decking length should not be more than 17 times of the diameter of the blast hole and should not be less than 10 times of the diameter of the blast holes to avoid sympathetic detonation.

**The following recommendation are made to ensure stability of the internal dumps:**

- The dump should be surveyed to produce up to date & accurate dump Geometry.
- The top soil should be dumped separately. Such materials should not be placed at the base of the dump.
- The spoil undercutting should be avoided for any requirement of waste material in mine to fill up the low-lying area after making any road near the toe . The undercuts are "cancerous" for stability. These cuttings create unstable slopes.
- The water accumulation in the de-coaled floor of the mine should be checked/ minimized by ensuring natural gravitational drainage of water towards the main sump. It will prevent the dumping in water to increase the dump slope stability condition.
- The interface layer i.e. debris of coal dust fragmented rock, soil mixed with water should be cleared as far as possible from the de-coaled floor before dumping by draglines. The analyses shows that the presence of the wet interface material decreases the safety factor.
- The dump floor, which form the base of internal dump may be ripped or blasted to a depth of 1 to 2m in a scattered way, if possible, before dragline dumping to improve the factional resistance at the bore of the dump. Small scale blasting will also facilitate the passage of water through the mine floor down to the competent rock strata, thus preventing accumulation of water at the base of dump.
- Cut dumping by shovel dumper should be avoided so that height of dragline dumping is kept to be minimum.
- To obviate accumulation of large amount of water behind the coal rib, it should be punctured at some places after advance of the face. Analyses shows that in absence of rib the dump material stands at the angle of repose and the dump stability improves.
- The valley in the dragline dump should be leveled by dozing to avoid formulation of rain water ponds between the heaps of the draglines dump.
- The shovel dumper dumping should not be on or near the currently created draglines dump to avoid the dead loading of the partially consolidated dragline dump. Ideal dumping by shovel dumper should be at least two cuts away.
- The final resultant dump slope after re-handling should not exceeds the angle of repose for the dump material.
- The local self sustaining plant species should be grown on the upper surface of final dumps as well as on dump slopes.

- 1. Name of the project : **A study on effect of underground blasting on surface structures vis-à-vis standardization of blast vibration damage threshold.**
- 2. Implementing Agency : CIMFR, Dhanbad
- 3. Project Leader / Co-ordinator : Dr. P. K. Singh, Scientist EII, CIMFR  
Dr.P. Pal Roy, Scientist F, CIMFR
- 4. Date of Start : Oct. 2003
- 5. Date of completion : Sep. 2006
- 6. Total approved cost : Rs. 30.388 lakh

**DESCRIPTION OF THE PROJECT**

**7. Objective**

- \* To determine the natural frequency of the houses and level of vibration generated by underground blasting.
- \* To determine the sub-surface strata conditions between underground working and surface structures using ground penetrating Radar (GPR) and resistivity imaging techniques.
- \* To determines the amplification/reduction characteristics of vibration in the houses and to establish a relationship between vibration & strain .
- \* To quantify the damages to the residential houses and recommendation vibration damage threshold.

**8. Work Done**

Under this programme of study, Kalidaspur and Narsamunda mines of Eastern Coalfields Limited (ECL), Pinoura underground mine of SECL and orient mine No. 3 and Hinger Rampur colliery of MCL were selected as experimental sites. The impact of 129 blasts conducted at the aforesaid mines were monitored on or near the structures above the underground workings. Vibrations were monitored on the surface at the vertically above point of the underground blasting face, a few location away from the vertically above points and in and around the houses/ structures. Total 391 blasts vibrations data were recorded on the surface above underground workings. The Ground Penetrating Radar (GPR) was used for identifying and locating surface features, such as cavities, conduits, fractures and buried caves if any between the underground blasting face and the surface structures. Resistivity multi-electrodes were used in exploration of underground in homogeneities such as cavities, fractures, caves etc. The blast vibrations magnitude in the structures and their resulting responses at each experimental sites were determined.

The structural response due to blasting was just opposite to that of opencast blasting. Since all the incoming vibration produced in underground were of higher frequency than the natural frequency of the houses. There was no resonance and hence no amplifications of vibration in the structures.

Three types of test structures viz (a) Mud house with Raniganj tiles (b) Brick and Mud with cement plaster and Raniganj tiles and (c) Double storey room RCC structures, similar to these found in mining areas, were constructed at two experimental sites. Two houses were also adopted for study purpose. The impact of blasts conducted aforesaid were monitored at the structures and 1871 blast vibration datas were recorded on or near the structures.

## 9. Findings

- (i) There are number of causes other than blasting to create cracks in the houses. A few of them may be due to universal existence of Natural, cultural stresses, thermal cycles, humidity changes, material curing and shrinking affecting houses and developing cracks. The non-blasting sources also produce significant vibration levels such as movement of heavy vehicles, trains etc. Environmental changes and human activities produces strains equivalent to 12-15 mm/s and even higher in some cases.
- (ii) The study clearly demonstrates that there is no chance of damage to surface structure due to blasting being carried out at 50m and beyond in underground workings. The fear of damage of the structures of the villagers is only an apprehension and not the real causes.
- (iii) Recommended Peak Particle Velocity (PPV) in mm/s at the foundation level of building/structures in mining areas are:

Type of structure	Dominant Peak Frequency, Hz		
	<15 Hz	15-30 Hz	< 30 Hz
<b>(A) Buildings/Structures not belong to the owner</b>			
1. Domestic house/ structure (Kuchcha, Brick-Mud, Brick Cement)	12	20	25
2. Industrial Buildings	10	30	40
3. Objects of historical importance & sensitive structure	05	07	10
<b>(B) Building belong to owner with limited spans of life</b>			
1. Domestic houses/structures	18	30	40
2. Industrial buildings	30	40	50

- (iv) Since underground blasting are carried out in a day as well as in night so the disturbance and annoyance caused to the villagers by blasting in sleeping houses, generally, lead to complaints for damage in their houses. This problem is surmounted only through the presentation of the facts that the fear of damage to the houses/structures due to underground blasting is only apprehension not the real causes.

1. **Name of the Project** : **Model studies on the efficiency of gravity blind back Filling method and evaluation of a pre- jamming In indication parameters.**
2. **Implementing Agency** : Indian Institute of Technology, Kharagpur
3. **Project Leader / Co-ordinator** : Dr. S.K.Pal, Associate Professor, Department of Mining Engineering, IIT Kharagpur  
Prof. S.K.Mukhopadhyay, Department of Mining Engineering, IIT Kharagpur.
4. **Date of Start** : Apr. 2005
5. **Date of completion** : Mar. 2007
6. **Total approved cost** : Rs. 14.766 lakh

### DESCRIPTION OF THE PROJECT

#### 7. Objective

- \* Experimental studies on simple hydraulic back filling method by gravity and measuring its efficiency in terms of high rate filling and large area coverage from a single boreholes.
- \* Estimation of the shape of the filled out area in terms of relative spreads in strike and dip direction.
- \* Optimization of flow rate and slurry concentration to achieve efficient by way of minimizing the flow pressure loss per unit length.
- \* Studying the relation between channel shape, size with flow velocity and deduce a theoretical relationship between flow velocity, channel size and flow pressure loss using fluid dynamics technique.
- \* Generating a multiple regression model to obtain empirical relationship connecting important parameters, so as to project the model data to the actual condition.

#### 8. Work Done

Theoretical relationship between slurry flow velocity, channel size and slurry flow pressure loss was developed from the fundamental concepts of fluid dynamics. Multi regression model were fitted to obtain on empirical relationship that can predict the expected filled up area for any given slurry flow rate and sand concentration. Another empirical relationship was developed between the flow pressure loss per unit length with slurry flow rate and concentration values. Studies on pressure signature curves have opened up a new area of research where the physical channel charging situations and pre-jamming conditions could be indicated from the nature of variations in pressure-time curve. The effects of injection velocity and inclination of the model on the filled up area also carried out.

#### 9. Findings

On the basis of the experimental results obtained the following conclusion are drawn:

- The gravity blind backfilling method as practiced in all experiments was found to be efficient i.e. it was able to fill-up a large area of the model from a single inlet point when the sand concentration were in the range of 6% and 9% and the slurry flow rate were kept 20, 25 and 30 litre/min.
- For unhindered fillings the shape of the filled out area is diamond shaped with equal spread along the strike direction (Ls) and slightly spread in the rise direction (Lu). Lu is found to be close to

linearly related with  $L_s$  for  $7.5^\circ$  model inclination, but this relation becomes non-linear for  $3.5^\circ$  model inclinations.

- Filling with 30 L/m<sup>2</sup> of flow rate at 9% sand counteraction will lead to most efficient filling.
- The area filled up can also be estimated from an empirical relationship with the variables such as, slurry flow rate and sand concentration. Another relationship among flow velocity, Mean Hydraulic radius of the channel flow pressure and other parameters related to channel geometry was also developed from the basic concepts of fluid mechanics.
- Two distinct phases in pressure signature was observed. These phases are turned as (a) the healthy a normal phase, where pressure fluctuations are low and (b) The unhealthy or pre-jamming phase where the pressure fluctuations are severe in nature.
- Several trials was done to identify the unhealthy or pre-jamming phase where partial success could be achieved to identify pre-jamming conditions.
- The analysis of variance of the residual pressure time curve in a fixed window size of 200 data produced a modified signature, which has sharp peaks of high amplitude during the final phase of filling. The cut off levels in the modified signature were obtained for different sand concentrations. When the variance in the modified signature exceeds the corresponding cut-off level, the arrival of final phase can be predicted.

## DESCRIPTION OF THE PROJECT

### Objective

Experimental studies on simple hydraulic back filling method by gravity and measuring its efficiency in terms of high rate filling and large area coverage from a single borehole. Estimation of the shape of the filled out area in terms of relative spreads in strike and dip direction. Optimization of flow rate and slurry concentration to achieve efficient by way of minimizing the flow pressure loss per unit length. Studying the relation between channel shape, size with flow velocity and deduce a theoretical relationship between flow velocity, channel size and flow pressure loss using fluid dynamics principles. Generating a multiple regression model to obtain empirical relationship connecting important parameters, so as to predict the model data to the actual condition.

### Work Done

Theoretical relationship between study low velocity, channel size and slurry flow pressure loss was developed from the fundamental concepts of fluid dynamics. Multiple regression models were fitted to obtain an empirical relationship that can predict the expected filled up area for any given slurry flow rate and sand concentration. Another empirical relationship was developed between the flow pressure loss per unit length with slurry flow rate and concentration values. Studies on pressure signature curves have opened up a new area of research where the physical channel changing situations and pre-jamming conditions could be indicated from the nature of variations in pressure-time curve. The effects of reaction velocity and inclination of the model on the filled up area was carried out.

### Findings

On the basis of the experimental results obtained the following conclusion are drawn:  
● The gravity filled backfilling method as practiced in all experiments was found to be efficient in terms of filling up a large area of the model from a single borehole with low sand concentration. The slurry flow rate was kept 30, 25 and 20 liter/min. and the slurry flow rate were kept 5%, 7.5% and 10% respectively.  
● For distributed filling the shape of the filled out area is diamond shaped with equal spread along the strike direction ( $L_s$ ) and dip direction ( $L_d$ ). It is found to be close to



1. Name of the project : Development of a process for the production of activated carbon from Neyveli Lignite.
2. Implementing Agency : NLC, Neyvelli /RRL(T)
3. Project Leader / Co-ordinator : Dr. G.D.Surender, Deputy Director, RRL, Trivandrum  
Director, R.R.L Trivandrum
4. Date of Start : Nov. 2003
5. Date of completion : Mar. 2007
6. Total approved cost : Rs. 98.60 lakh  
For NLC- Rs 22.70 lakh  
For RRL( T) - Rs 75.90 lakh

### DESCRIPTION OF THE PROJECT

#### 7. Objective

- \* To develop a process for the conversion of Neyveli Lignite to powdered activated carbon involving reactive solids.
- \* To optimize the process parameters for the conversion of Neyveli Lignite to activated carbon.
- \* To obtain process engineering data to design and scale up to commercial plant levels.
- \* To characterize and evaluate the product as per national and international standards.
- \* To confirm techno-economic feasibility for commercial scale manufacture.

#### 8. Work Done

The plant was operated uninterruptedly for more than 100 hr. on 3 shift basis. The feed, pre-mixed was loaded to the feed hoppers intermittently. The Kiln product was collected and subjected to magnetic separation using a permanent magnetic separator in order to separate the magnetic & non-magnetic portions. The non-magnetic fractions, ie. main produced activated carbon, is analysed for methylene blue number, iodine number & surface area. Periodic sample of the kiln output is drawn twice in a shift of 8 hours.

#### 9. Conclusion & Recommendation

- The laboratory studies proved that using a oxygen supplier solid mineral, it is possible to have controlled activation of Neyveli Lignite resulting in the preparation of activated carbon with better Methylene blue number, Iodine number & surface area in comparison with IS specification for commercial grades.
- A mathematical model theoretically validated this concept.
- By setting up a pilot plant and carrying out trail runs and production runs, it is proved that commercial production of activated carbon is possible from Neyveli Lignite.

1. Name of the project : Development of cost effective high performance highways using fly ash composites.
2. Implementing Agency : Neyveli Lignite Corporation Limited, Neyveli
3. Project Leader / Co-ordinator : Dr. S. Santhanam, Chief CARD NLC  
Shri V.S. Sankaran, D.G.M.,NLC
4. Date of Start : May, 1999
5. Date of completion : Dec. 2006
6. Total approved cost : Rs. 38.10 lakh  
For NLC- Rs 22.10 lakh  
For Anna Univ – Rs 16.00 lakh

### DESCRIPTION OF THE PROJECT

#### 7. Objective

The main objectives of the Project are to develop a cost effective high performance road as per the following procedure:

- \* To prepare a suitable mix using fly ash, soil and additives for the sub base (bottom layer) of the road.
- \* To prepare a suitable mix using fly ash, cement and aggregates for the top wearing layer of the road.
- \* To prepare a light weight porous skirting blocks and aggregates with a suitable mix using fly ash, lime and additives for the drains of the road.

#### 8. Work Done

The dry ash from Thermal Power Stations-1 of NLC had been collected and sent to Anna University, Chennai for their physical & chemical characteristic analysis. Tests on soil samples where the proposed experimental road is to be laid has been done both at NLC & at Anna University. Having considered the test reports, it is recommended to use township block - 7 road to lay model pavement and to assume performance of model pavement.

Fly ash-lime-sand-soil combination was tried to achieve a CBR value of 15%. Trials were made with different combinations of the fly ash. Depending upon the existing soil condition a minimum CBR 10% under soaked condition was tried to achieve. Trials were also made with addition of Gypsum for stabilization of soils. Addition of cement found to improve the performance of stabilized sub-base.

#### 9. Conclusion & Recommendation

The experimental fly ash road has furnished the base data for permanent design and further improvements. The fly ash could widely used in formation of roads. The physical and chemical tests, abrasion test, XRD tests and electron Microscope test have given excellent fly ash hydration, gel formation in concrete that recommends use of fly ash for road works. The industry would benefited by having a rigid pavement with replacing the costlier cement materials with fly ash high performance concrete in forming rigid pavements & also getting enhanced durability.

- |    |                               |   |  |
|----|-------------------------------|---|--|
| 1. | <b>Name of the project</b>    | : | <b>Studies on the use of bottom – slag in crop production NLC</b>  |
| 2. | Implementing Agency           | : | Neyveli Lignite Corporation, Neyveli   |
| 3. | Project Leader / Co-ordinator | : | Dr.S.Santhanam, NLC<br>Dr.A.Vadival, TNAU  |
| 4. | Date of Start                 | : | Nov. 2004  |
| 5. | Date of completion            | : | Oct. 2007  |
| 6. | Total approved cost           | : | Rs. 92.3244 lakh<br>S&T Grant- Rs 81.36 lakh<br>For NLC- Rs 31.35 lakh<br>For TNAU-Rs 51.9744 lakh<br>Cont NLC- Rs 9.00 lakh |

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**DESCRIPTION OF THE PROJECT**

**7. Objectives**

- \* To characterize bottom-slag, a by-product from the thermal plant of NLC.
- \* To study the effect of bottom-slag on the physical-chemical properties of soils.
- \* To isolate microorganism for bio-dissolution of sulfur from bottom-slag.
- \* To isolate microorganism for bio-dissolution of iron from bottom-slag
- \* To isolate microorganism for biodissolution of phosphorous from rock phosphate incorporated in slag by sulfur oxidizing bacteria.
- \* Developing suitable microbial technology for making bottom-slag as suitable nutrient for crop plant.
- \* To evaluate bottom-slag as a source of Sulphur to crops in Sulphur deficient soils
- \* To study the nutrient (Phosphorus) mobilizing behaviour of bottom-slag in calcareous soils.
- \* To evaluate bottom-slag as a source of Iron to sugarcane in calcareous Fe deficient soils
- \* To find out the suitability of bottom-slag for reclamation of calcareous sodic soils in Rice-Pulse cropping system.

**8. Work Done**

To develop a suitable pot mixture using Ni red spoils bottom slag, fly ash and rock phosphate a study was conducted by using tree crops, vegetables, oil seed crops and green manures as test crops.

Incubation experiment was carried out using soils collected from different places that represent the soil types. Soil samples of red calcareous and black calcareous types were used for conducting pot experiments using sunflower & groundnut as test crops to study the effect of bottom slag application on P dynamics in calcareous soil.

Field experiments were conducted to find out the P solubilizing power of bottom slag in block calcareous soil using sunflower and another field experiment was conducted with groundnut on red clamorous soil to evaluate the efficiency of different levels of bottom slag.

Field experiments were conducted to study the effect of bottom slag as Fe source in calcareous Fe deficient soil using sugarcane variety as a test crops.

To assess the long term effect of bottom slag as an amendment for reclamation of calcareous sodic soil an incubation experiment has conducted using calcareous sodic soil collected from Trichy district of Tamilnadu.

Two field experiments were conducted to study the effectiveness of bottom slag as an amendment for the reclamation of calcareous sodic soil using rice varieties.

## 9. Findings & Recommendations

- Decreases the pH of calcareous soil due to its acidic nature.
- Improve phosphorous availability in calcareous soil by enhancing the phosphorus solubilization from in- soluble calcium phosphate.
- Enhance the Fe availability in Fe deficient calcareous soil thereby increase the crop yield.
- Bottom slag is a very good amendment for sodic soil reclamation. It can be used as an alternate source of Gypsum.
- Application of 100% NPK + 6.4 T/ha bottom slage + phosphobacteria can be recommended for sunflower & groundnut crops grown in calcareous soils.
- Application of 100% NPK +6.4 T/ha bottom slag + Phosphobacteria can be recommended for sugarcane crop. Grown in Fe deficient soil
- Application of 100% NPK + 16 T/ha bottom slag can be recommended for reclamation of calcareous sodic soil.

- 1. **Name of the project** : **Studies on the impact atmospheric biotic/abiotic particulates on the environment of jharia coalfield and their abatement strategies**
- 2. **Implementing Agency** : CIMFR, Dhanbad
- 3. **Project Leader / Co-ordinator** : Dr.S.K.Bharti / Dr. L.C.Ram
- 4. **Date of Start** : Nov. 2003
- 5. **Date of completion** : Oct. 2007
- 6. **Total approved cost** : Rs. 33.90 lakh

**DESCRIPTION OF THE PROJECT**

**7. Objectives**

- \* Assessment of the qualitative and quantitative prevalence of particulates (pollen grains fungi, dust mites & other biota) and abiotic (coal dust, free silica, gases, etc.) in extramural and intramural environments from different areas in and around Jharia coalfields and coal based industries (coal mining coal washeries, coke over plants, fertilizer and TPPs)
- \* Possible correlation of abiotic and bio-particulates with incidence of respiratory ailments of the susceptible human population in the region and specially the workers those who are working in mining industry and other coal based industries.
- \* To assess the allergenic potentiality of abiotic and biotic particulates in both a reference and selected coal based industrial area and its correlation with occupational hazards and atmospheric pollution.
- \* To assess the impact of metrological parameters on the aerobiological parameters on the aerobiological particulates and establish a correlation between biotic particulates and prevailing a biotic compounds and seasonability.
- \* To evolve the suitable abatement strategies for reducing the damage, if any, to environment and human health and preparation of pollen and fungal spore calendar for Jharia coal fields (Mathematical model in the form of pollen and fungal calendar will be prepared which will give the status of airborne pollen and fungal spores per month for the whole year in accordance with meteorological parameters).

**8. Work Done**

Assessment of qualitative and quantitative prevalence of bio-particulates and a-biotic particulates in the environments in and around Jharia coalfields and coal based industries was carried out. The periodical variations in the concentration of biotic components (like detriment pollen fungi, spore , algal etc) and abiotic components (SPM, RSPM etc.) were identified in and around Jharia coalfields.

Health survey during using medical questionnaire of 20,000 populations was made for possible correlation of abiotic & bio particulates with incidence of allergic disorders of the susceptible human population in the region, particularly these who are living in the close vicinity of mining industry.

The major environmental allergens of biological origin are pollen grains, fungi spores, algae and house dust mine.

Data regarding aerobiological investigation for bio particles in and around coalfields/ coal based industries have been carried out under this project for first time in India.

Aerobiological investigation in and around Jharia Coalfields shows a good spectrum of airborne bio particulates. After extremes aerobiological investigation, pollination, pollen, fungi, algae and house dust mite calendar are prepared which will certainly provide the status of such pollutants and help in proper diagnosis and treatment of the population suffering in the region from allergic ailments, and will help in evolving the suitable abatement strategies for reducing the damage, if any, to environment and human health thus achieving the desired objectives of the project.

## 9. Findings & Recommendations

- Aerobiological surveys conducted in and around Jharia Coalfields have shown that the concentration and composition of atmospheric bioparticulates experience great variations in the regions.
- During pollination studies 286 flowering plants species were identified from the region belonging to 99 different angiospermic families dominated by shrubby and herbaceous species. From the identified flora 45 plant species are reported allergic in Nature.
- Aerobiological studies revealed 74 types of air born components from the air over Jharia Coalfields. 13 types of airborne algal components were trapped from the air over Jharia Coalfields and revealed the presence of algae forms in almost all the months of the survey. 11 types of house dust mites were identified from the house dust samples of Jharia Coalfields and revealed that presence of house dust mites forms in almost all the months of the survey. This revealed that there is a marked difference in composition and concentration of air borne bio-particulates, which may be due to the variations in climatic, vegetative and geographical factors. Some of these airborne bio-particulates like pollen grains, fungal spores, algae, etc. which were identified allergens and after coming in contact with human beings can produce allergic manifestation. The aerobiological investigation over Jharia Coalfields constitutes pioneering work in this field which has helped to assess and quantify the components of air spores, which would, as hoped, serve as a base for future workers in the field of aerobiology, thus serving the practical utility or the objective set.

1. **Name of the project** : **Development of process/technique for utilization of less matured non coking coal for making hard coke by utilizing stamp charging.**
2. **Implementing Agency** : CIMFR, Dhanbad & CMPDI
3. **Project Leader/Coordinator** : Mr. G. K. Bayen / Dr. S. K. Hazra, Scientist, CFRI
4. **Date of Start** : Oct, 2003
5. **Date of completion** : June 2007
6. **Total approved cost** : Rs. 98.88 lakh  
For CIMFR - Rs 92.80 lakh  
For CMPDI - Rs 6.08 lakh

### DESCRIPTION OF THE PROJECT

#### 7. Objectives

The objective of the project is to find out the possible utilization of less matured high volatile coking coal for making hard coke for industrial applications. It is proposed to utilize the Maximum possible non-coking coal with suitable matched coal and/or coal fines from washery to produce coke which may have several industrial/metallurgical uses. Thus, Large of amount of unutilized high volatile non coking coal may find its application in industries with value addition and will create a market for it. In addition to the utilization of largely available non-coking coal a sufficient quality of good coal will also be saved.

#### 8. Work Done

It was proposed to carry out the studies in two phases.

**In Phase-I**, the study was carried out up to lab/bench scale level.

**In Phase-II**, pilot scale study was carried out both in electrically heated coke oven and pilot non-recovery coke oven.

Adequate quantity of materials were collected at different sites using mechanical auger and combined to get representative sample. For general analyses higher fractions were pulverized and mixed remaining fractions and finally obtained - 72 mesh (212 $\mu$ ) samples as per standard procedures.

The samples of washery fines (slurry) and coal were characterized with respect to Proximate Analysis, Swelling Index (IS - 1353:1993), Roga Index, LTGK Coke Type (IS - 1353:1993) and Petrographic Analysis (IS:9127) etc. The coke samples were tested for Minimum Indices (IS - 1354:1922) CRI/CSR, Bulk Density (IS - 7190:1974), Porosity (IS - 1354:1992), Proximate Analysis.

Lab scale coke making tests were carried out in laboratory scale electrically heated furnace having provision for reading temperature of cake mass and exit points for tar and gaseous products during carbonization. The prepared blend(s) was packed and then inserted into the oven whose temperature was raised from ambient to 100°C @ 5°C upto 600°C and then @ 10°C from 600-1000°C. The soaking time at the final temperature was 30 min after which the furnace was shut down, coke pushed into a tray and quenched with water. The coke thus produced was taken out and sub-stamped for different tests to

get knowledge about its quality. Based on laboratory and bench scale studies, the stamping machine for pilot plant was developed and various blends were tested in pilot run test series in both Carbolite electrical test coke oven as well as in the non-recovery coke oven battery for producing coke from blends. Depending upon the blended properties coke of different properties was obtained. It is indicated that even with inferior coals with suitable blend and suitable technology steel grade/metallurgical grade coke can be produced.

**9. Research Findings**

The laboratory and pilot scale studies reveal that there is a good potentiality of utilizing sustainable amount of inferior type coal in the blend with Judiciously chosen washery fines (slurry) to produce coke with stamping technology and it may find its application in industries for production of steel/Metallurgical coke also.

S. No.	Date of Start	Date of completion	Total approved cost
1.	Oct. 2003	June 2007	Rs. 98.88 lakh
2.			For CIMFR - Rs. 92.80 lakh
3.			For CMPDI - Rs. 6.08 lakh

**DESCRIPTION OF THE PROJECT**

**Objectives**

The objective of the project is to find out the possible utilization of less matured high volatile coking coal for making hard coke for industrial applications. It is proposed to utilize the Maximum possible non-coking coal with suitable particle size and/or coal fines from washery to produce coke which may have several industrial/metallurgical uses. Thus, large amount of unutilized high volatile non-coking coal may find its application in industries with value addition and will create a market for it. In addition to the utilization of largely available non-coking coal a sufficient quality of good coal will also be saved.

**Work Done**

It was proposed to carry out the studies in two phases.

In Phase-I, the study was carried out up to laboratory scale level.

In Phase-II, pilot scale study was carried out both in electrically heated coke oven and pilot non-recovery coke oven.

Adequate quantity of materials were collected at different sizes using mechanical auger and combined to get representative sample. For general analyses higher fractions were pulverized and mixed retaining fractions and finely opened - 75 mesh (212µ) samples as per standard procedures.

The samples of washery fines (slurry) and coal were characterized with respect to Proximate Analysis (Swelling Index IS - 1353.1953), Roga Index, TTK Coke Type-15 - 1353.1093 and Petrographic Analysis (IS: 9127) etc. The coke samples were tested for Minimum Indices (IS - 1354.1822), CHRICR, Bulk Density (IS - 7190.1874), Porosity (IS - 1354.1802), Proximate Analysis.

Lab scale coke making tests were carried out in laboratory scale electrically heated furnace having provision for reading temperature of coke mass and exit points for tar and gaseous products during carbonization. The prepared blends were packed and then inserted into the oven whose temperature was raised from ambient to 700°C @ 5°C upto 600°C and then to 700°C from 600-700°C. The soaking time at final temperature was 30 min after which the furnace was shut down, coke pushed into a tray and quenched with water. The coke thus produced was taken out and used for different tests to



1. Name of the project : Optimization of pillars parameter for development and final extraction of highly inclined seams of SCCL mines.
2. Implementing Agency : NIRM & SCCL
3. Project Leader : Dr. V. Venkateswarlu, Scientist, NIRM
4. Date of Start : Dec 1999
5. Date of completion : Dec 2007
6. Total approved cost : Rs. 24.96 lakh  
S&T Grant- Rs 19.96 lakh  
SCCL contribution- Rs 5.00 lakh

### DESCRIPTION OF THE PROJECT

#### 7. Objectives

- \* Identification of critical pillars parameters based on the model studies and a comparison with empirical method.
- \* Development of a panel based on the designed pillar and panel dimensions and to study the strata behaviour using instrumentation during development operations to calibrate and optimize the model.
- \* The same model would be used to investigate the behaviour for extraction stage also.

#### 8. Work Done

To achieve the objectives of the project studies were split into three phases :

**Phase-1** of the studies pertained to design of the safe pillar and gallery dimensions using numerical modeling, and preparation of the feasibility report.

**Phase-2** : Studies included development of panel as per the design, and strata monitoring.

**Phase-3** : Studies involved the final extraction of pillars by the mine management, and strata monitoring.

Kakatiya Khani No. 5 (KTK-5) incline in Bhoopalapalli area, SCCL was identified for this project, where seams dipping more than 1 in 2.5 (21.8°). The specific experimental panel was decided based on mutual discussion between NIRM & SCCL Mine Management. Core drilling was carried out by Mine Management to determine the physico-mechanical properties of the rock, which were carried out by NIRM. NIRM carried out tests for determination of in-situ strength of coal at KTK-5.

These dimensional numerical modeling were carried out to estimate the safety of pillars under different rectangular configuration. After discussion with the mine authorities about the feasibility of appropriate geometry of the developed pillars, the pillar dimensions for the experimental panel were finalized and support system was also worked out. Mine Management applied to DGMS for permission to develop the panel as per the scientific design. After getting permission from DGMS in March 2005, development of the experimental panel was started as per the recommendation of the pillar dimensions and the suggested support system. Strata behavior monitoring was carried out during the formation of 55 rectangular pillars

and the galleries. After completing the development of the experimental panels and based on the analysis of the strata monitoring data, suggestion made by NIRM for depillaring in the panel.

The mine Management applied to DGMS for seeking permission to commence extraction of coal from the fully formed rectangular pillars. After getting DGMS permission, depillaring operation started in Nov 2006. The strata behavior was systematically monitored through out the period of extraction. The extraction of all the rectangular pillars in the panel continued till Aug 2007, and after which panel was finally sealed off.

The rectangular pillars were successfully extracted based on continuous monitoring of strata behavior during the depillaring operations. Physical observation of the roof and sides in the panel indicated that the general ground conditions were satisfactory and there was no significant disturbance or deterioration of the support or pillars anywhere. The results of the entire studies carried out in the experimental panel were in very good agreement with the design values.

## 9. Research Findings

- Based on the success of this investigations, it is recommended to develop more panels under similar condition driving level and dip-rise galleries, to form rectangular pillars of size 26m(level) x 10m(in dip direction). The workable height should not be equal to seam thickness. The roof in the galleries & junction should be supported by two rows of full column grouted bolts.
- Rectangular pillars can be extracted by conventional slicing & caving method. The slice, junction and the goaf edge should be supported by steel props and cogs, in addition to the roof bolting.
- Induced blasting of the roof in the goaf is advised in case of hard roofs that are difficult to come.
- Systematic instrumentation should be carried out and strata behavior and support performance should be regularly monitored during development & extraction.
- Fast extraction of the slices is essential for the success of the experimented trial with proposed system of support.
- This method is advisable in steeply dipping coal seams, where manual loading of coal, with all its concomitant problems, is practiced.

## 10. Need for further study

The study under the present project was carried out in virgin condition at a shallow depth. The strata behavior could be different, if seam exists above or below the panel. The stress situation could also be different while working at a greater depth. Therefore, investigations should be carried out afresh whenever, such condition are encountered.