S&T
Annual Report
वार्षिक प्रतिवेदन
2010 – 2011

Government of India
Ministry of Coal
New Delhi 110 001

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

प्राक्कथन

कोयला उद्योग के सम्पूर्ण विकास के लिये संगठित अनुसंधान 1975 में सरकार का योजनाबद्ध कार्यक्रम ''कोयला विज्ञान एवं प्रौद्योगिकी योजना'' के अपनाने के बाद ही प्रारम्भ हुआ। इसने कोयला गवेषण से लेकर खनन के पश्चात पर्यावर्णिक विषय तक में व्यापक रूप में अनुसंधान एवं विकास के क्रियाकलापों को 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 हैं, ये हैं :
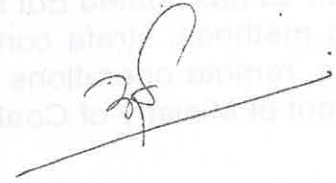
☛   उत्पादन, उत्पादकता एवं सुरक्षा

☛   कोयला परिष्करण एवं उपयोग

☛   पर्यावरण एवं पारिस्थितिकी

1975 से कोयला एवं लिग्नाइट उत्पादक कम्पनियों की सक्रिय सहभागिता के साथ कोयला एवं सम्बद्ध उद्योगों से सम्बन्धित राष्ट्रीय अनुसंधान एवं शैक्षणिक संस्थाओं द्वारा कोयला मंत्रालय के विज्ञान एवं प्रौद्योगिकी अनुदान के तहत् वर्तमान में अनुसंधान परियोजनाएँ क्रियान्वित की जा रही हैं। इसके परिणामस्वरूप अभी तक 198 करोड़ रुपये की अनुमानित लागत से 295 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 16 चालू परियोजनाएँ एवं 08 पूरी की जा चुकी परियोजनाओं की स्थिति को दर्शाया गया है।

हाल ही में भुवनेश्वर में सम्पन्न हुए 99वीं भारतीय विज्ञान कांग्रेस में भारत के प्रधानमंत्री माननीय डॉ. मनमोहन सिंह ने वैज्ञानिक अनुसंधान के लिए वर्तमान के सकल घरेलू उत्पाद के 0.9% खर्च को बढ़ाकर 2% करने एवं उद्योग जगत को और अधिक योगदान के लिए आह्वान किया।

सीएमपीडीआई ने खनन विधि, स्ट्राटा कंट्रोल एवं खान सुरक्षा, कोल बेड मिथेन, शेल गैस, भूमिगत खदान में रिमोट संचालन आदि, 15 चयनित विषयों के संदर्भ में कोयला मंत्रालय के विज्ञान एवं प्रौद्योगिकी अनुदान के लिए ई.ओ.आई. जारी किया 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:
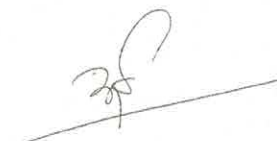
☞   Production, Productivity & Safety

☞   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, 295 projects have been completed since inception at an approximate cost of Rs. 198 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 16 on-going and 08 completed S&T projects during the year.

In the recently concluded 99th Indian Science Congress at Bhubaneshwar, Dr. Manmohan Singh, Honourable Prime Minister of India has called for a hike in expenditure in scientific research to at least 2% of funds from the current level of about 0.9% of the Gross Domestic Product (GDP) and enhanced contribution from the industry.

CMPDI has floated EoI for calling proposals on 15 selected topics related to mining methods, strata control and mine safety, Coal Bed Methane (CBM), Shale gas, remote operations in underground coal mines etc., for funding under S&T Grant of Ministry of Coal.

(A. K. Singh)
Chairman-Managing Director

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LIST OF COAL S&T PROJECTS COMPLETED DURING 2010-11

LIST OF ABBREVIATIONS

AMU	Annamalai University, Annamalai Nagar, Chennai
ATPL	Adcept Technologies Pvt. Ltd., Kolkata
AU	Anna University, Chennai
BCCL	Bharat Coking Coal Limited, Dhanbad
BHU	Banaras Hundu University, Varanasi
CCL	Central Coalfields Limited, Ranchi
CIMFR	Central Institute of Mining and Fuel Research (erstwhile CMRI & CFRI), Dhanbad
CMPDI	Central Mine Planning & Design Institute, Ranchi
DGMS	Director General of Mines Safety, Dhanbad
ECL	Eastern Coalfields Limited, Sanctoria
IIT	Indian Institute of Technology, Kharagpur
ISM	Indian School of Mines, Dhanbad
JBEPL	Jaya Bharat Equipment Pvt. Ltd., Hyderabad
JU	Jadavpur University, Kolkata
MCL	Mahanadi Coalfields Limited, Sambalpur
MEPCO	MEPCO Engineering College, Sivakasi
NCL	Northern Coalfields Limited, Singrauli
NEIST	North East Institute of Science and Technology, Assam
NIRM	National Institute of Rock Mechanics, Kolar
NLC	Neyveli Lignite Corporation Limited, Neyveli
RDCIS	Research and Development Centre for Iron & Steel, Ranchi
RVCE	R. V. College of Engineering, Bangalore
SCCL	Singareni Collieries Company Limited, Kothagudem
SECL	South Eastern Coalfields Limited, Bilaspur
SSRC	Standing Scientific Research Committee
TNAU	Tamil Nadu Agricultural University, Coimbatore
VCRC	Vector Control Research Centre, Puducherry
WCL	Western Coalfields Limited, Nagpur

Production, Productivity & Safety

S&T Annual Report

2010-11

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.	Revised date of completion	:	Sep 2011/Mar 2011/Oct 2010
5.	Implementing Agency	:	CIMFR, Dhanbad
6.	Project Leader/Co-ordinator	:	Dr. K.K.K. Singh, Scientist CIMFR, Dhanbad
			Dr. A. Sinha, Director, CIMFR, Dhanbad
7.	Total Approved Cost	:	Rs. 342.2692 Lakh

DESCRIPTION OF THE PROJECT

8. **Objectives :**

   (i)   Establishment of GPR signatures for different geological formations, cavities and waterlogged workings.

   (ii)   Delineation of galleries and pillars from the surface and from 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.

9. **Status as on 31.03.2011 :**

   • M/s Groundradar, Canada was selected for development of GPR System.

   In the first visit, M/s Groundradar, Canada had visited the selected locales of the study i.e. East Basuria Colliery of Kusunda Area, BCCL; Tetulmari Colliery of Sijua Area, BCCL; Shyampur B Colliery of Mugma Area, ECL and Barmundia Colliery of Salanpur Area, ECL in the third week of March, 2010 along with their developed prototype GPR System. In the second visit (During July 30-August 8, 2010), extensive tests at four underground coalmines (East Basuria & Tetulmari Collieries of BCCL and Shyampur B & Dabor Collieries of ECL was performed using prototype GPR system having antenna frequency of 40 MHz. The survey was done with non-intrinsic system. A detailed presentation was made by Mr. Jan Franke, Groundradar, Canada on 8th August 2010 at CIMFR, Dhanbad. It was opined that the results were encouraging and further development should be incorporated to reduce the weight of the system so that the system becomes portable. In the third visit, the presentation was made on 17th February 2011 by Mr. Jan Francke, M/s Groundradar, Canada on the field studies carried out with developed GPR System during 15 & 16th February 2011. Scientists from CIMFR, Dhanbad, Executives from CMPDI, Ranchi & Asansol, Professor from ISM, Dhanbad were present in the meeting. After detailed deliberations, the participants appreciated the outcomes of the study, particularly the effort made to develop a GPR which can identity the barrier

thickness of 60 m and more. Some technical points had been suggested to be incorporated to achieve the objectives of the S&T project by the Committee.

10. Slippage, if any : Yes, slippage by four months

In view of the remarks of the Technical committee meeting (Meeting on 17th February 2011) and subsequent request received from M/s Groundradar, Canada for extension of the project up to May 31, 2011, It is requested that the duration of the project should be extended up to Sep, 2011 to incorporate of the suggestions made by technical committee in the development of final version of GPR and subsequent submission of final report. Therefore, time extension for four months i.e. upto Sep, 2011 for successful execution of the project has been proposed and submitted to CMPDIL, Ranchi for approved of the concerned authority.

11. Action Plan for 2011-12 :

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	May 2007	Jan 2009
2.	Development of GPR System, Field investigation, Collection of data and experimentation with developed GPR	Feb 2009	April, 2011
3.	Compilation of data and their analyses and Report preparation	Mar 2010	Sep 2011

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	:	Mar 2008
3.	Scheduled date of completion	:	Nov 2011/Feb 2011
4.	Implementing Agency	:	IIT, Kharagpur
5.	Project Leader/Co-ordinator	:	Dr. Samir Kr. Pal, Deptt of Mining Engineering, IIT, Kharagpur
6.	Total Approved Cost	:	Rs. 402.66 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 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 31.03.2011 :

An ultrasonic system for fine tuning of depth sensing water level installed at Shyamsunderpur colliery, ECL. Rimming of borehole no. 10 was carried out for inserting ROV Camera into borehole. The project implementation got delayed due to delay in procurement of 4 Nos. of ROV camera from USA. Project has extended upto Nov 2011 in the 7th Technical subcommittee meeting of SSRC held on 04.01.2011.

9. Slippage, if any :

Delayed procurement of the ROV cameras.

10. Action Plan for 2011-12 :

Sl. No.	Activity	Date of start	Date of completion
1.	Validation and modification of empirical relationship obtained from laboratory model studies	Jun 2010	Aug 2011
2.	Studies on pressure signature variation and evaluation of pre-jamming indication parameter applicable for field conditions , if needed.	Jun 2010	Aug 2011
3.	Selecting location and drilling of the next feeder borehole. and other accessory boreholes	Nov 2010	Jun 2010
4.	Preparation steps feeding borehole and continuation in the same way till 30,000m³ of sand is filled into the underground voids	Sep 2010	Sep 2011
5.	Final analysis and conclusion of the project	Jun 2010	Nov 2011

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

DESCRIPTION OF THE PROJECT

7. Objectives :

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

8. Status as on 31.03.2011 :

- Trial Production of high strength roof bolt bars were taken up at Durgapur steel plant and IISCO Steel Plant, Burnpur. After trials successful production could be done for high strength (Yield strength >600 MPa) roof bolt bars in 16 mm and 20 mm sizes as per scope of the project.
- 16 mm and 20 mm roof bolt quality TMT were sent to Jhanjra. TMT bars of 22mm diameter was also supplied for trials.
- Fabrication of 16mm and 20mm Roof Bolts were done at M/s Amar Engineering, Howrah and fabricated bolts assembly were supplied to Jhanjra mine.

9. Slippage, if any : Nil

10. Action Plan for 2011-12 :

Sl. No.	Activity	Date of start	Date of completion
1.	Literature review	Jan 2010	Mar 2010
2.	Production of high strength rebars	Apr 2010	Dec 2010
3.	Analysis of result	Jul 2010	Mar 2011
4.	Application of developed roof bolts at site	Jan 2011	Sep 2011
5.	Recommendation and Submission of Final Report	Oct 2011	Dec 2011

1.	Name of the Project	:	Prototype development for methane alarm system using carbon nano fibres
2.	Date of Start	:	Jan 2010
3.	Scheduled date of completion	:	Dec 2011
4.	Implementing Agency	:	Jadavpur University, Kolkata
5.	Project Leader	:	Prof. A.K. Pal, Department of Instrumentation Science, Jadavpur University, Kolkata
6.	Total Approved Cost	:	Rs. 30.85 Lakh

DESCRIPTION OF THE PROJECT

7.   Objectives :

Optimization of the process technology for the synthesis and associated characterization of carbon nanofibers by adopting cost-effective and scalable electro deposition technique for methane gas sensor applications will be undertaken with special attention to the problems identified as: Deposition parameters pertaining to pH of the bath solution

- Si(100) surface treatment
- Graphite electrode surface modification
- Drift due to electronic components
- Contact problems
- Encapsulation of the sensor element
- Prototype sensors will be developed and performance of the prototypes will be monitored. Information on the performance vis-à-vis material properties related to the items indicated above will be looked into to derive meaningful information to improve the technological aspects for realizing marketable methane gas alarm system prototypes.
- These prototypes will be subjected long term stability and reproducibility test.
- Field tests in coal mines to ascertain the viability of the use of such sensors developed under this project.

8.   Status as on 31.03.2011 :

The existing electro deposition apparatus was modified to coat CNF on 5 cm x 5 cm area New ZnO and Ti targets arrived. New set of ZnO / nano-Ti bilayered films were deposited to prevent photo and TCR effects. The field trails of modified sensors have yet to be conducted.

9.   Slippage, if any :

Previous ZnO target got exhausted and new ZnO and Ti targets arrived. We lost three months time and the work resumed after the arrival of the new targets.

10. Action Plan for 2011-12 :

Sl. No.	Activity	Date of start	Date of completion
1.	Mounting of the modified sensor chips initiated	Jan 2011	Aug 2011
2.	Modification of electronic circuit completed	Jan 2011	Aug 2011
3.	Problems arising out of photo-effect and high TCR are being looked into	Jun 2010	Solved the problem by March 2011
4.	ZnO/nano-Ti layer eliminated all the photo and TCR problems	Jun 2010	Sep 2010
5.	New ZnO and Ti targets arrived. Deposition of ZnO/nano-Ti started	Apr 2011	Sep 2011
6.	Sensor chips will be produced in batches and protypes will be sent for field test	Jul 2011	Oct 2011
7.	Preparation of Report	Oct 2011	Dec 2011

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

DESCRIPTION OF THE PROJECT

7.   Objectives :

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

The complete communication System will be based on :

1.   Through-the-earth (TTE) one way messaging system with all communication infrastructure on the surface, including the antenna.

2.   Tracking system with location readers deployed in the underground.

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

8.   Status as on 31.03.2011 :

Procurement of equipment has been completed. Approval for field trial at Central Saunda Mines received from DGMS, Dhanbad. Site visits were made by officers from Mining Electronics Deptt, CMPDI along with Adcept officials for installation & commissioning of plant and equipment required for proposed.field trial.

9.   Slippage, if any : Nil

10. Action Plan for 2011-12 :

Sl. No.	Activity	Date of start	Date of completion
1.	Design, supply, delivery, installation and commissioning of all equipment as stipulated in Phase I for Through-The-Earth Messaging System at Central Saunda CCL Mines	Sep 2010	Jan 2011
2.	Trial run of the above Through-The-Earth Messaging System as per DGMS stipulated norms	Jan 2011	Jun 2011
3.	Receipt of formal approval from DGMS Dhanbad for Through The Earth Messaging System	Jan 2011	Oct 2011
4.	Supply and delivery of all the equipment as stipulated in Phase II for Tracking and Two-way communication system	Aug 2011	Sep 2011
5.	Re-installation of Through-The-Earth Messaging System at Bhurkunda seam at CCL	Sep 2011	Feb 2012
6.	Field trial of Tracking and Two-way communication system (Phase I & II)	Feb 2012	To be continued

1. **Name of the Project** : Development of Self Advancing (mobile) Goaf Edge Supports (SAGES) or Depillaring Operations in Underground Coal Mines

2. Date of Start : Sep 2010

3. Scheduled date of completion : Dec 2012

4. Implementing Agency : Dept of Mining Engineering, ISM

5. Sub-Implementing Agency : M/s Jay Bharat Equipment Pvt. Ltd.

6. Project Leader : Prof. (Dr.) Upendra K. Singh, Dept. of Mining Engineering, ISM, Dhanbad

   Co-investigators :
   a. Shri NVN Reddy, Director, M/s Jay Bharat Equipment Pvt. Ltd.
   b. Dr. Dheeraj Kumar, Dept. of Mining Engineering, ISM, Dhanbad

7. Total Approved Cost : Rs. 197.75 Lakh

   For JBEPL – 135.65

   For ISM – 62.10

DESCRIPTION OF THE PROJECT

8. **Objectives :**

   Design and develop Self Advancing Goaf Edge Support (SAGES) of Medium Duty :

   2x200t Load Capacity for depillaring operations in underground coal mines.

9. **Status as on 31.03.2011 :**

   1. Stress analysis for structural design and material to be used for fabrication of the SAGES using Finite Element Modeling (FEM) is done (Fig. 1 and Fig. 2).
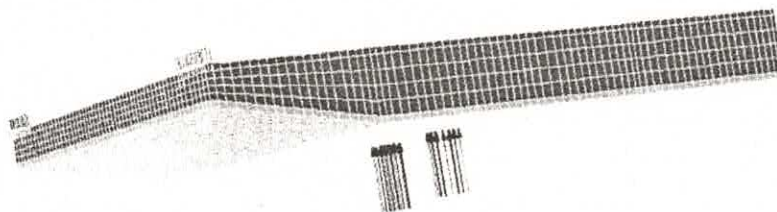
Figure 1 : Finite Element mesh of canopy of the SAGES.
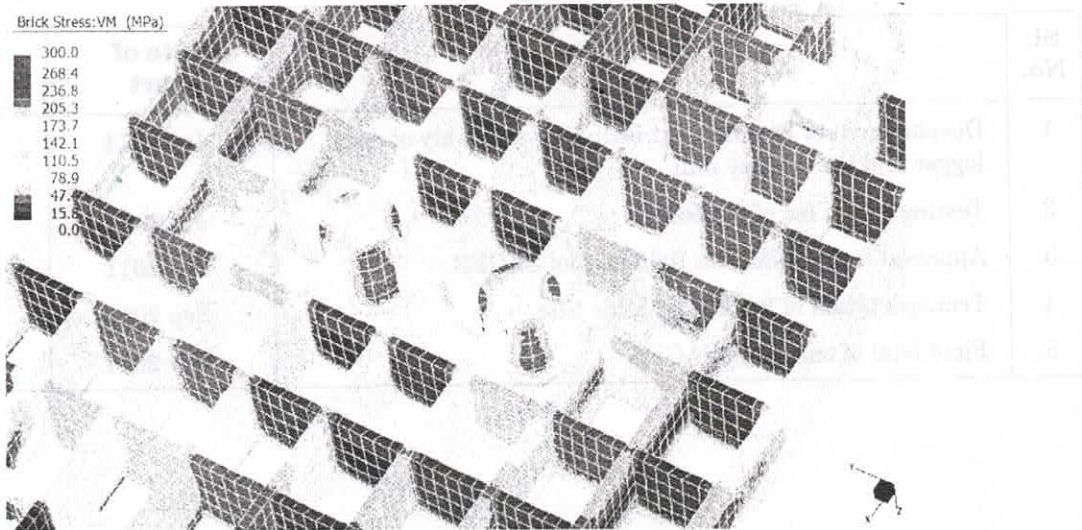
Figure 2 : 240 t load Von Mises Stresses in stiffeners in 3-point bending and torsion tests viewed from the bottom side. Top and bottom plates hidden to show stiffeners.

2. An Memorandum of Agreement (MOA) between ISM, Dhanbad (project implementing agency) and M/s Jay Bharat Equipment Pvt. Ltd., Hyderabad (sub-implementing agency) is made for smooth execution of project for manufacturing of SAGES and releasing fund to M/s Jaya Bharat Equipment Pvt. Ltd., Hyderabad as sanctioned by Ministry of Coal vide its letter no. 34012/2010-CRC-1 dated 12th August 2010.

3. JBEPL has completed fabrication of one set of the SAGES based on the outcome of FEM analysis of the modeled structure (Fig.3).
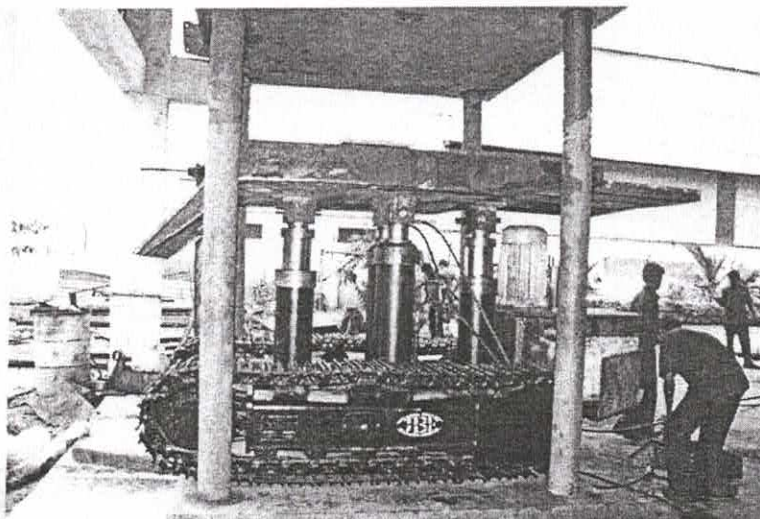
Figure 3 : Fabricated SAGES under trial in test rig at M/s JBPEL, Hyderabad.

10. Slippage, if any : Nil.

11. Action Plan for 2011-12 : As per approved project schedule.

Sl. No.	Activity	Date of start	Date of completion
1.	Development of Display unit including assembly of data logger and the display unit	Jan 2011	Sep 2011
2.	Testing of one set of support	Jul 2011	Aug 2011
3.	Approval from DGMS for field trial of SAGES	Sep 2011	Oct 2011
4.	Transportation of SAGES at Mine Site	Sep 2011	Sep 2011
5.	Field trial of one set of SAGES	Nov 2011	Mar 2012

1.	Name of the Project	:	**Development and optimization of coal bed recovery process for CO_2 sequestration**
2.	Date of Start	:	Jan 2010
3.	Scheduled date of completion	:	Dec 2011
4.	Implementing Agency	:	ISM, Dhanbad
5.	Project Leader	:	Dr. Keka Ojha, Department of Petroleum Engineering ISM, Dhanbad
6.	Total Approved Cost	:	Rs. 22.30 lakh

DESCRIPTION OF THE PROJECT

7.   Objectives :

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

The major objectives of the investigations are:

- Collection of CBM samples from nearby CBM fields and their characterization.

- To study the adsorption-desorption isotherm of methane and CO_2 with varying compositions at different pressure and temperature conditions. Desorption behavior of methane is the representation of primary recovery of CBM. Investigations will be carried out at dry as well as moist conditions as many Indian CBM reservoirs have high moisture content and required much study for efficient and economic recovery of methane from those.

- Experimentation on recovery of CBM by CO_2 injection with variable pressure, temperature, gas composition and flow rate conditions.

- Modeling and simulation of the system to optimize the CBM recovery

8.   Status as on 31.03.2011 :

Sample Collection & Characterization:

Coal samples were collected from Kulti Block of Raniganj coalfield, West Bengal, India.

Porosity and permeability of the coal samples were determined. Amount of ash content, moisture consent, and volatile matter were evaluated from proximate analysis of the samples. The average properties of coal samples have been summarized in Table 1. The reservoir condition is also mentioned in the table.

Parameter	Sample 1	Sample 2
Depth of reservoir, m	972.33-972.83	973.43-973.90
Reservoir Temperature, ^0F	132.52	138.74
Reservoir Pressure, psi	1391.15	1394.1
Z factor of gas at reservoir condition	0.905	0.905
Porosity, %	2.67	2.84
Permeability, mD	1.43	1.83
Ash Content, wt %	8.3	7.6
Moisture content, wt %	2.0	1.0
Volatile matter, wt %	20.7	19.8
Fixed carbon content,.wt %	69.0	70.7
Coal density, gm/cc	1.4172	1.4579

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Total gas content by a coal sample is the sum of volume of lost gas, desorbed gas and residual gas measured. For determination of gas content of the coal desorption experiments were carried out for the different samples. The results are shown in Table 2. The adsorption isotherms for the samples were also determined and the results of one sample are presented in the Figure 1.

Table 2: The estimated gas content of the samples :

Sample	Wt of the sample, gm	Total lost gas, cc, at STP Q1	Desorbed gas, cc, at STP Q2	Residual gas, cc, at STP Q3	Total gas, cc, at Q	Gas content cc/gm at STP
1	1064	777.58	3268.15	186.55	4232.28	3.98
2	1100	973.87	3465.98	217.32	4657.17	4.23
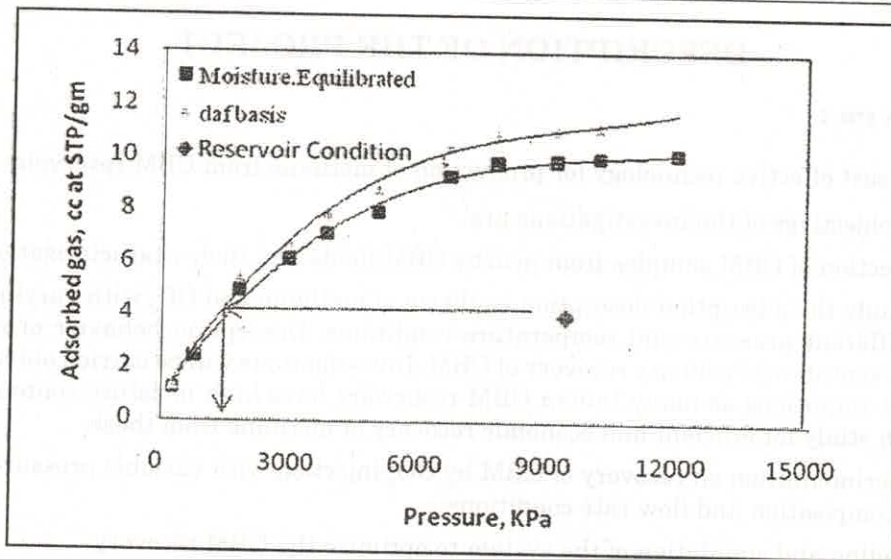
Figure 1 : Methane Adsorption Isotherm curve and Desorption Isotherm of sample RC 01.

Future prediction: Fekete CBM software is used to predict the future gas and water production rate. The field data are used for future prediction using Fekete CBM software. The result will be history matching once production data of the field be available.
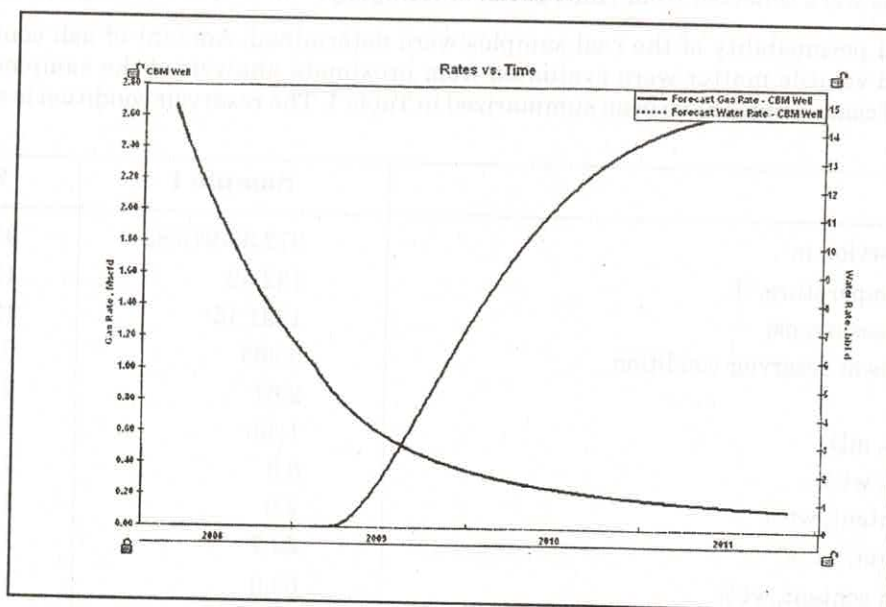
Figure 2 : Predicted Gas and water producton rate with time.

A number of samples were collected from Singareni Collieries Co. Ltd. Andhra Pradesh

Table 1 : Proximate Analysis of the Samples

Well Name	Depth Intervals	M (%)	Ash (%)	VM (%)	Fixed Carbon (%)
Well No. 1	426.95 m - 428.95 m	3.76	26	32.50	37.74
	429.43 m - 432.00 m	3.01	24.94	32.75	39.30
	498.23 m - 498.35 m	3.04	26.59	26.30	44.07
	499.61 m - 499.86 m	3.38	22.82	31.62	42.18
	501.72 m - 504.00 m	3.12	17.03	30.46	49.39
	540.17 m - 541.77 m	3.35	22.65	23.30	50.70
Well No. 2	368.59 m - 369.19 m	2.95	23.0	28.96	45.10
	370.60 m - 372.40 m	2.46	45.99	25.45	26.01
	434.67 m - 436.57 m	3.43	25.17	33.61	37.79
	438.03 m - 439.57 m	3.72	15.39	27.68	53.21
	442.72 m - 444.02 m	3.15	10.52	40.26	46.07
	455.08 m - 458.12 m	3.82	11.15	31.11	53.92

Table 2 : Elemental Analysis of the Samples

Well Name	Depth Intervals	C	H	N	S	O	H/C	O/C
Well No. 1	426.95 m - 428.95 m	54.66	4.09	1.76	0.68	9.05	0.07	0.16
	429.43 m - 432.00 m	57.49	4.12	1.63	0.66	8.15	0.07	0.14
	498.23 m - 498.35 m	57.47	3.79	1.69	0.59	6.83	0.06	0.11
	499.61 m - 499.86 m	59.42	4.22	1.73	0.55	7.88	0.07	0.13
	501.72 m - 504.00 m	66.17	4.34	1.57	0.57	7.20	0.06	0.10
	540.17 m - 541.77 m	61.89	3.77	1.59	0.43	12.17	0.06	0.19
Well No. 2	368.59 m - 369.19 m	44.38	3.94	1.79	0.54	8.72	0.08	0.19
	370.60 m - 372.40 m	38.44	2.91	1.48	0.49	8.23	0.07	0.21
	434.67 m - 436.57 m	56.36	4.12	1.67	0.51	8.74	0.07	0.15
	438.03 m - 439.57 m	67.68	4.31	1.71	0.55	6.64	0.06	0.09
	442.72 m - 444.02 m	70.24	5.07	1.66	0.63	8.73	0.07	0.12
	455.08 m - 458.12 m	71.01	4.58	1.69	0.60	7.15	0.06	0.10

9. Slippage, if any :

Delay in procurement of the Instruments due to lag purchase process.

10. Action Plan for 2011-12 :

Sl. No.	Activity	Date of start	Date of completion
1.	Sample collection and characterisation	Jul 2010	Nov 2010
2.	CO_2 injection and recovery of the CBM	Jul 2010	Jun 2011
3.	Data analysis, Model development and Simulation and Optimisation study	Jan 2011	Sep 2011
4.	Preparation of Report	Oct 2011	Dec 2011

Coal Beneficiation & Utilisation

S&T Annual Report

2010-11

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

DESCRIPTION OF THE PROJECT

7. **Objectives :**

- Study of depolymerization of Neyveli lignite using phenol and catalysts such as p-toluenesulphnic acid, sulphated zinconia and MCM-41 supported HPA.

- Characterization of the products of depolymerization.

- Liquefaction of the depolymerized product by alkylation using olefins as the alkylating agents.

- Analysis of the products by GC/MS.

- Optimization of the reaction parameters for high conversion and better liquefaction.

8. **Status as on 31.03.2011 :**

1. Depolymerisation of Neyveli Lignite is carried out with heteropoly acid catalysts (HPA).

2. Increase in pyridine extractability of depolymerised lignite indicates the cleavage of coal structure.

3. Depolymerisation conditions are optimized for bulk quantity of lignite.

4. Depolymerisation of Neyveli lignite is carried out using other catalysts like clay supported heteropolyacids and sulphated zirconia. But there is no significant increase in pyrdine extractability.

5. Depolymerised products are characterized by techniques like IR and TGA.

6. Chemicals for the alkylation reaction are purchased.

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

10. Action Plan for 2011-12 :

Sl. No.	Activity	Date of start	Date of completion
1.	Alkylate the depolymerised lignite using alkylating agents.	Apr 2011	Jun 2011
2.	Optimize the conditions of alkylation reaction.	Jul 2011	Nov 2011
3.	Characterize the alkylated products.	Oct 2011	Dec 2011
4.	Consolidation of reports.	Jan 2012	Mar 2012

Environment & Ecology

S&T Annual Report

2010-11

1.	Name of the Project	:	**Biological production of clean fuels from Coal**
2.	Date of start	:	Feb 2009
3.	Scheduled date of completion	:	Jan 2012
4.	Implementing Agency	:	RV College of Engineering, Bangalore
5.	Project Leader/Co-ordinator	:	Prof. (Dr.) Pushpa Agrawal RV College of Engineering, Bangalore
6.	Total Approved Cost	:	Rs. 45.36 Lakh

DESCRIPTION OF THE PROJECT

7.   Objectives :

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

8.   Status as on 31.03.2011 :

Cellulose content of lignite was converted to reducing sugars to the extent of 90% which is fermented to alcohol. The non-fermentable aromatic residue is being converted to methane gases which can be used as gaseous fuel. The remaining residue, the humec acid can be used as fertilizer. The process is being scaled up for large scale production.

9.   Slippage, if any : Nil

10.   Action Plan for 2011-12 :

Sl. No.	Activity	Date of start	Date of completion
1.	Estimation of byproduct	Jan 2011	May 2011
2.	Cost effective production of the fuels using the existing and modified organisms.	May 2011	Jul 2011
3.	Estimation of the efficiency of the clean fuels that are environmental friendly.		
4.	Estimation and characterization of Humic acid	Jul 2011	Sep 2011
5.	Formulation of biofertilizer and field trials.	Sep 2011	Oct 2011

1.	Name of the Project	:	Development of indigenous catalyst through Pilot Scale Studies of Coal-To-Liquid (CTL) conversion technology.
2.	Date of start	:	Jan 2010
3.	Scheduled date of completion	:	Dec 2012
4.	Implementing Agency	:	CIMFR, Dhanbad
5.	Sun-implementing Agency	:	CT Deptt., CMPDI, Ranchi
6.	a. Project Leader	:	Dr. Sudip Maity, Scientist, CIMFR, Dhanbad
	b. Project Co-ordinator	:	Dr. Amalendu Sinha, Director, CIMFR, Dhanbad
7.	Total Approved Cost	:	Rs. 805.40 Lakh
			For CIMFR : Rs. 688.50 Lakh
			For CMPDI : Rs. 116.90 Lakh

DESCRIPTION OF THE PROJECT

8. Objectives :

(i) developing suitable catalysts and to study the coal-to-liquid conversion technology in Pilot Scale in an integrated plant consisting of low cost air blown gasifier and a multi-tubular fixed bed reactor (Catalyst Capacity: 10.0 L).

(ii) testing high ash Indian coals in the gasifier.

(iii) generating basic design & process parameters for further scale-up to commercialization.

(iv) characterizing the products (liquid and gaseous) and its up-gradation/processing for commercial use.

9. Status as on 31.03.2011 :

Global tender floated for procurement of coal-to-oil pilot plant. Three parties have responded. Technical evaluation of bids was done by duly constituted technical sub-committee. A continuous experimental run of 120 h in the existing reactor was conducted on iron-cobalt mixed metal catalysts and appreciable success for liquid production is achieved. Experiment was conducted on synthetic gas mixture simulating the coal gasification product. Gas and liquid analyses are in progress to quantify the yield and selectivity of the catalyst.

10. Slippage, if any :

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

11. Action Plan for 2011-12 :

Sl. No.	Activity	Date of start	Date of completion
1.	Design, procurement , installation and commissioning of integrated CTL pilot plant	Jan 2010	Continuing
2.	Preparation and characterization of catalysts	Mar 2010	Dec 2011
3.	Test run of sample catalysts in existing 100 ml fixed bed reactor	Jul 2010	Jun 2011
4.	Continuous experiment runs in pilot plat	Jan 2011	June 2012
5.	Engine testing of liquid hydrocarbon products	Jan 2012	Dec 2012

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

DESCRIPTION OF THE PROJECT

7. Objectives :

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

8. Status as on 31.03.2011 :

- Some hard copies of toposheets have been converted into the soft copy and digital copies of coalfields of Jharkhand produced through digitization.

- Georeferencing and attributing of maps and toposheets of different coalfields are being done.

- Training of Project Assistants on different analytical techniques going on.

- Purchase procedures for reflectance unit (MSP 200) photometer and spectro-radiometer could not be finalized and it has been retendered.

- Delay in field work for collecting spectral radiance values from coalfields due to non-procurement of spectro-radiometer and other instruments.

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

10. Action Plan for 2011-12 :

Sl. No.	Activity	Date of start	Date of completion
1.	Field work for mapping, collection of spectro-radiometric data and sample	Jul 2010	Jun 2012
2.	Sample preparation for different analysis/test	Jan 2010	Jun 2012
3.	Analysis/testing of prepared samples	Jan 2011	Jun 2012

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	:	Jun 2011/Jul 2010/Jan 2010/Oct 2008
5.	Implementing Agency	:	CMPDI, Ranchi.
6.	Project Co-ordinator	:	GM (Env.), CMPDI, 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 identified 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-a-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 31.03.2011 :

Stage – 1 : Literature Survey

Literature survey has been carried for the approved Project by interacting with various reputed institutes and surfing the INTERNET. The indent for procurement of equipment of was prepared

after interaction and literature survey.

Stage – 2 : Procurement, Installation and Commissioning of Equipment

The Procurement of following equipment has been proposed in the project:

Sl.No.	Instrument	Remarks
1.	Inductively Coupled Plasma	Supply Order placed on M/s Thermo Fischer Scientific, UK, Instrument installed in March'11. Instrument to be demonstrated for its application.
2.	Microwave digestor	Supply order placed in Dec.'06. Instrument installed on November '07.
3.	TCLP/Tox Alert	Supply order placed in July '10. Instrument installed in Dec. '10.
4.	Spares for instrument	—
5.	High Purification Lab Water System	Supply order placed in June '10. Instrument installed in Dec. '10.
6.	Micro-processor based photometer	Instrument has been supplied and installed in September 2007.
7.	Auto Digital Furnace	Instrument has been supplied and installed in January 2009.
8.	Mercury Analyser	Instrument has been supplied & installed in May 2007
9.	Personal Computer-Pentium 4 with printer	Computer & Printer has been supplied and installed.
10.	Magnetic Stirrer with temperature controller	Not considered necessary in view of leachates prepared through TCLP i.e. instrument at Sl. No. 4
11.	Peristaltic pump	
12.	Jet Pump	
13.	Air-conditioner	Procured and installed in July 2007.
14.	Software for slope stability & hydro-geological study	Under process of procurement.

Stage – 3 : Sampling

The samples have been collected from Korba STPS, Amarkantak STPS, Singrauli STPS, Ib TPS, Talcher TPS and from mines of SECL, NCL & MCL. The samples from CCL and BCCL and their respective thermal power plants were also collected and sampling is completed.

Stage – 4 : Laboratory Testing and Analysis

Slope stability analysis study has been outsourced to BIT Mesra along with physical characterization of coal and fly ash samples an the chemical analysis has been outsourced to ISM, Dhanbad. Both the results have been received and are under finalizaition.

TCLP, Ultrapure Water System and ICP instruments have also been received and have been installed. ICP is yet to be demonstrated. The analysis by TCLP is in progress. Validation of the analysis results shall be done in May'11 after demonstration of ICP in April'11.

Stage – 5 : Interpretation of the results

Shall be carried out after sample analysis and revalidation of analysis results along with slope stability analysis through software modeling in May 2011.

10. Slippage, if any :

Delay in procurement of equipment.

11. Action Plan for 2011-12 :

Sl. No.	Activity	Date of start	Date of completion
1.	Procurement of the Equipment, Installation & Commissioning	Nov. 2004	Apr 2011
2.	Sample Collection	Dec 2005	Apr 20'09
3.	Analysis of Samples	Feb 2009	Jul 20'09 (Physical)
4.	Interpretation of results	Aug 2009	Oct 2009 (Physical)
		Revalidation	May 2011
5.	Report Preparation	Sep 2008 After analysis of the samples & revalidation	Jun 2011

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1.	Name of the Project	:	Development of methodology for Estimation of Greenhouse Gas (GHG) Emissions in mine fire areas and their mitigation through terrestrial sequestration.
2.	Date of start	:	Feb 2009
3.	Scheduled date of completion	:	Jan 2012
4.	Implementing Agency	:	CIMFR, Dhanbad
5.	Sub-Implementing Agency	:	Department of Botany, BHU, Varanasi
6.	Project Leader	:	Dr. Siddarth Singh, Scientist
7.	Project Co-ordinators	:	Dr. A. K. Singh, Scientist, CIMFR, Dhanbad Dr. B. K. Tewary, Scientist, CIMFR, Dhanbad
8.	Total Approved Cost	:	Rs. 341.77 lakh For CIMFR : Rs. 341.77 lakh For CMPDI : Rs. 12.72 lakh

DESCRIPTION OF THE PROJECT

9. Objectives :

(i) To estimate Greenhouse Gases (CO_2, CH_4 & N_2O) emission from coal mine fire areas, inventorization and its temporal and spatial dispersion at ground level.

(ii) To estimate in real time the load of combustion aerosol (black carbon, sulphates and nitrate) emissions from mine fire area.

(iii) To quantify the existing greenhouse gases sinks using space born data and estimate its carbon sequestration potential.

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

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

10. Status as on 31.03.2011 :

CIMFR PART :

Development of monitoring Protocol : Detail literature survey has been done to develop the monitoring protocol for collection and measurement of gas samples at both the sites. Considering the approved methodology it has been planned to go for upwind and downwind sampling and subsequent analysis on Gas Chromatograph in the laboratory.

Recruitment of project staff: For the recruitment of project staff advertisement has beeen made in the Employment News and other news papers in February 2009. More than two hundred application forms were received among which five candidates were selected and engaged.

Procurement of Instruments : Extensive literature survey has been done to collect information regarding the best available technology to be implemented in the project. Detailed information has

been collected from the personal communication to the manufacturers and users of instruments in India and abroad. Visits have been made to few advance research labs to see the working of latest analytical and measurement techniques. Indents for procurement of approved instruments were finalized obeying the CSIR Purchase Rule and submitted to the purchase department.

Present status of the procurement is as follows:

- Most of the indents are in the order stage.
- So far two approved Software, Athalometer and Aerosol Spectrometer has been installed.
- Shipment of Gas Chromatograph has been released in May 2011 as informed to CIMFR.

Recruitment of consultants for the preparation of CDM Proposal (Carbon Credit) : Extensive survey has been done to prepare a panel of consultants of very high reputation and success record. Enquiry has been issued and job has been awarded to the Pricewaterhouse Cooper (PWC). The work has been started.

Base line data generation for CDM Project/Carbon Credit : One of the very important perquisites for approval of CDM Proposal is the availability of baseline data for various environmental components to compare for the increment in the carbon storage.

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

- Total mass (Percentage) of soil in each sieve size fraction : >2 mm, >1 mm, >0.5 mm, >0.25 mm, >0.125 mm, >0.075 mm, >0.062 mm and <0.062 mm was found as 16.49%, 16.28%, 21.16%, 15.19%, 15.47%, 6.25%, 3.36%, and 5.03% respectively in Salanpur & Mugma areas of Raniganj Coalfield.
- Majority of soil samples were classified as Sandy Loam.
- The average bulk density of soil was recorded as 1.26 gm/cm3.

Soil organic carbon status of the study area in Jharia and Raniganj coalfields have been estimated and compared for manual and instrumental methodologies. The Organic Carbon status in top soil (upper 15 cm) ranges from 0.5 to 2.2%, In majority of soil samples there is a possibility to improve the soil OC status.

Installation of equipment Aerosol Spectrometer and Aethalometer in the in the laboratory and in coalfield.

Aerosol Spectrometer

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

Size range in μm	0.22 to 0.3	0.3 to 0.5	05. to 10	1.0 to 2.5
Comc. in μg/m²	301571.2	85874.27	3859.3	434.97

Data obtained from the Aerosol Spectrometer monitoring supports following interpretation:

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

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

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

Data collection for entire coalfield is in progress.

Aethalmeter

Aethalmeter takes the measurement of Black carbon by optical attenuation method. Two equipments of such type have been taken in this study. One is portable (AE-42) and another is rack mounted controlled site (CIMFR) as per the guidelines of manufacturer. The portable one has been taken to the field and installed at various places in Jharia Coalfield.

Controlled Site

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

No. Data Sets	Minimum Value (ng/m^3)	Maximum Value (ng/m^3)
23534	2196.01	11529.39

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

Two prominent peaks have been observed during this period.

The first peak is in the morning.

The second peak is in the evening.

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

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

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

Mining Site (Jharia Coalfield)

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

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

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

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

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

Sites	Minimum (ng/m^3)	Maximum (ng/m^3)
Ena Collieary	4049.51	15638.60
Coalfield roads	7475.08	16871.5

BHU PART :

Visit of the study area: Monthly visit of the study area was done for air monitoring and soil sampling.

Literature survey : Literature survey is continuing related to the research work on project theme.

Installation of Instrument : LI-820 CO_2 analyzer, and LI-1400 data logger have been installed.

Sampling and analysis of GHG's : Green house gases such as CO_2, CH_4 & N_2O from mine fire are and around were collected and analyzed using Gas Liquid Chromatography.

Air quality monitoring : Air qualty monitoring was done for SO_2, NO_2, O_3 SPM and dust deposition.

Soil sampling : Analysis of soil samples for total organic carbon, available and exchangeable nutrients and heavy metals and microbial biomass C and N have been done.

Plant analysis : Samples of common plants were collected for the analysis of dust capturing capacity, photosynthetic pigments, primary and secondary metabolites, antioxidants and oxidative stress.

Calculation of Air Pollution Tolerance Index : Based on changes in total chlorophyll content, ascorbic acid content, leaf extract pH and relative water content in different foliage, Air pollution tolerance index was calculated for different plant species.

11. **Slippage, if any :** Project got delay due to procurement of equipment.

12. **Action Plan for 2011-12:**

CIMFR PART :

Sl. No.	Activity	Date of start	Date of completion
1.	Literature review, Collection of Maps and other releavnt documents from BCCL and ECL	Apr 2011	Aug 2011
2.	Recruitment of project staff	Completed	Completed
3.	Preliminary visits to mines for selection sampling sites for emission monitoring due to mine fire.	Completed	Completed
4.	Selection of monitoring sites for horizontal GHG dispersion studies at ground level. Selection of sites for installation of Automatic Weather Stations at both the sites.	Completed	Completed
5.	Chalking out the Specifications for instruments which involve literature survey and interaction with users and manufacturers.	Completed	Complted
6.	Submission of indents and Procurement of Instruments and installation in the laboratory and field.	Completed	Completed
7.	Collaboration with a Govt. agency to carry out the sink quantification and NDVI estimation of the mine fire sites of Jharia and Raniganj coalfield. Procurement of Remote Sensing data Land Use characterization and output in the GIS environment.	Apr 2011	Dec 2011
8.	Initiate the Selection of the Project Developer to develop Project Idea Note (PIN) and Project Concept Note (PCN) and prepare Project Design Document (PDD) for the submission at UNFCCC.	Jan 2011	Oct 2011

Sl. No.	Activity	Date of start	Date of completion
9.	Meeting of the Implementing Agencies to prospect the protocol of work to be done.	Jun 2011	Jun 2011
10.	Meeting of the Implementing Agencies to review the progress achieved.	Dec 2011	Dec 2011
11.	Quarterly Report submission	Jun 2011 Oct 2011 Jan 2012	Jul 2011 Oct 2011 Jan 2012

BHU PART :

Sl. No.	Activity	Date of start	Date of completion
1.	Literature review	Apr 2011	Mar 2012
2.	Field investigation, collection of data, and experimentation and laboratory study and preparation of carbon credit project	Apr 2011	Dec 2011
3.	Data compilation and synthesis	Dec 2011	Feb 012

1.	Name of the Project	:	Carbon sequestration in revegetated coal mine wastelands.
2.	Date of start	:	Feb 2009
3.	Scheduled date of completion	:	Jan 2012
4.	Implementing Agency	:	CIMFR, Dhanbad
5.	Project Leader	:	Dr. Raj Shekhar Singh, Scientist, CIMFR, Dhanbad
6.	Project Co-Ordinator	:	Dr. B. K. Tewary
7.	Total Approved Cost	:	Rs. 64.76 Lakh

DESCRIPTION OF THE PROJECT

8.   Objectives :

- To quantify the carbon storage in soils of different aged revegetated mine spoils.

- To estimate the carbon storage by different plant species in revegetated mine spoils along an age gradient.

- To explore the amount of soil biomass carbon in diferent aged mine spoils.

- Estimation of carbon in different component of plants of revegetated mine spoils.

- To estimate the carbon storage and flux potential of the revegetated mine spoils.

9.   Status as on 31.03.2011 :

Literature Survey : A considerable amount of literature has been referred and collected.

Selection of sites : Selection of different aged (0-20 years) revegetated coal mine sites at ECL (Mugma) and NCL Singrauli (Nigahi, Jhingurda and Jayant) coalfields area.

Physico-chemical studies : Physico-chemical characteristics, viz. pH, moisture and organic carbon have shown that in Mugma, Nigahi, Jayant and Jhingurds sites pH values ranged from 7.2 to 7.5, 3.9 to 6.8, 5.4 to 6.7 and 4.0 to 4.4, respectively and soil moisture content was found in the range from 3.78 to 3.95, 2.35 to 6.84, 4.49 to 17.78 and 8-12%, respectively.

Soil organic carbon : Soil organic carbon upto 20 cm depth of soil was found in the range of 0.10 to 0.6, 0.22 to 0.92, 0.19 to 0.8 and 0.67 to 0.71%, respectively in different age revegeated mine spoild in Mugma, Nigahi, Jayant and Jhingurda sites, respectively. There was an increase of 79% in organic carbon content in revegetated mine spoils over a period of form 0 to 20 years considering the Nigahi and Jayant sites where revegetation is 20 years old.

Plant Species Composition : Mugma Mine area of ECL has been revegetated with *Delergia sisoo* (Shishum), *Leucena leucocephala* (Subabool), *Acacia sp.* (Babool), *Peltoferum enormi* (Peltoforam), *Albizia procera* (Siris), *Pongamia pinnata* (Karanj), *Azadirachta indica* (Neem), *Gmelina arborea* (Gamhar), *Emblica officinalis* (Aonala), Eucalyptus, *Delonex regia* (Gulmohar), Bamboo spp. Along with other casual plant species.

In Nigahi project site of NCL revegetation has been done from 1996 to 2010 the plant species *Eucalyptus, Dalbergia sissoo* (Shishum), *Azadirachta indica* (Neem), *Pongamia pinnata* (Karanj), *Prosopis juliflora, Terminalia chebula* (Bahera), *Terminalia bellerica* (Harre), *Emblica officinalis* (Aonla), *Schizygium jambolana* (Jamun), and the grass spp. Like *Stylohemata* spp., Dinanath grass, Sawai grass, etc.

The Jayant Project areas of NCL, where plantations have been done from 1991 to 2010, consist of Azadirachata indica (Neem), Delbergia sisoo (Shishum), Leucena leucocephala (Subabool), Shorea robusta (Sal), Pongamia pinnata (Karanj), Pithocelobium duice (Jangli Jalebi), Cassia samea, Emblica officinalis (Amla), Gmelina arborea (Gamhar), Delonix regia (Gulmohar), Madhuca indica (Mahua), Ficus religiosa (Peepal), Ficus bengalensis (Bargad), Bauhinia racemosa (Kachnar), Acacia catechu (Khair) along with Bamboo species.

In Jhingurda Project plantation over the OB dumps was done in 1998 with plant species Gmelina arborea (Gamhar), Bauhinia variegate (Kachnar), Azadirachta indica (Neem), Pongamia piñata (Karanj), Emblica officinalis (Amla), Zizyphus sp., Butea monosperma and bamboo sp.

Plant biomass : Plant growth performance was measured through height and girth in different age revegetated mine sites. The plant biomass comprised of above ground biomass (AGB) and below ground biomass (BGB). The plant biomass indicates the carbon sequestration potential of species planted on revegetated mine spoils. The half of the plant weight is constituted by the carbon. So, the half of the dry weight will indicate the carbon sequestration potential of the plants.

Above ground biomass (AGB) study performed with leaf litter of forest, revegetated mine spoils of Mugma (ECL), Nigahi and Jayant (NCL) sites has shown the range of AGB in to be 5510575 gm2, 19-20203 gm2, 25-66-275 gm2 and 32-52-336 gm2, respectively, Belowgrond biomass (BGB) study has shown the range in forest and revegetated mine spoil sites from 710-794 gm2, 42-338 gm2 and 54-386 gm2, respectively.

Microbial biomass C : Microbial biomass carbon in Forest, Mugma (ECL), Nigahi, Jayant (NCL) and Jhingurda revegetated mine sited has been found in the range of 512-630, 35-249,45-222, 52-426 and 64-512 ug/g, respectively.

Estimation and quantification of carbon sequestration in different plant species and above ground plant biomass and below ground biomass of revegetated mine spoils will be done after estimation of total carbon through auto CHN analyzer.

10. Slippage, if any : Nil

11. Detailed Action Plan for 2011-12

Sl. No.	Activity	Date of start	Date of completion
1.	Monitoring of plant growth (height & growth)	Continuing	Aug 2011
2.	Collection of plant root and soil samples	Continuing	Aug 2011
3.	Chemical analysis of plant, soil and carbon storage and flux studies	Sep 2010	Aug 2011
4.	Synthesis of data and statistical analysis	Aug 2011	Jan 2012

1. **Name of the Project**   :   **Treatment of acid mine water generated in Indian coal mines using low cost material.**

2. Date of start   :   Jan 2010

3. Scheduled date of completion   :   Dec 2012

4. Implementing Agency   :   CIMFR, Dhanbad

5. Project Leader/Co-Ordinator   :   Dr. (Mrs) B. Prasad /Dr. B K Tewary, Scientist, CIMFR, Dhanbad

6. Total Approved Cost   :   Rs. 44.17 Lakh

DESCRIPTION OF THE PROJECT

7. **Objectives :**

    ● Characterization of acid mine water of few Indian coal mines (underground and opencast)

    ● Conversion of fly ash in to zeolitic mineral to be used for treatment of acid mine water.

    ● Treatment of acid mine water by fly ash zeolites.

    ● Evaluation of effectiveness and cost for treatment of acid mine water by fly ash zeolite.

8. **Status as on 31.03.2011 :**

    ● Purchase of Equipment is in progress.

    ● Literature survey has been carried out.

    ● Collection of AMD from Gorbi mines of NCL has been done and characterization of AMD has been carried out. Characterisation of AMD with respect to anions and cations has been done using Atomic Absorption Spectrophotometer

    ● AMD samples and Fly ash has been collected from Neyveli Lignite Mines and characterization of mine water of Neyveli has been carried out similar to Gorbi mine water sample analysis.

    ● Preparation of fly ash zeolite from Talcher, Chandrapur and Neyveli fly ash has been done using hydrothermal technique.

    ● Characterisation of FAZ with respect to XRD, XRF and SEM analysis is under progress.

    ● Treatment of Gorbi mine water and Neyveli Lignite mine water is being carried out using fly ash and fly ash zeolite in batch experiment. The treatment is under progress.

10. **Slippage, if any :** Procurement of instrument is still in progress.

11. **Detailed Action Plan for 2011-12 :**

Sl. No.	Activity	Date of start	Date of completion
1.	Purchase of Instrument (Ion Chromatograph)	Jan 2010	Dec 2011
2.	Sample collection and Laboratory Bench scale experiment	Jul 2010	Jun 2012
3.	Data analysis & evaluation of FAZ efficiency for AMD treatment	Jul 2012	Sep 2012
4.	Compilation of result and report writing	Oct 2012	Dec 2012

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

DESCRIPTION OF THE PROJECT

7.   Objectives :

- To quantify the particulate matter (SPM, PM2.5 and PM10) and toxic gas emissions from coal mining and utilization industries.

- Chemical characterization and mass size distribution of particulate matter (PM 2.5 and PM 10) from coal based industries.

- Evolving relationship between the coal quality parameters emissions.

- Identification of the factors that contribute towards emission of particulates (SPM, PM2.5 and PM10) and toxic gases depending upon the type of mining methodologies and utilization techniques.

- Emission inventory for coal based industries.

- Modeling and suggestive measures to regulate the emission from coal from coal mining and utilization industries like coke ovens, mining etc.

8.   Status as on 31.03.2011 :

Procurement of SPM, PM 2.5 and PM10 sampler have been completed. Gas analyzer equipment procurement is in progress. Sample collection and analysis is in progress. Analysis o particulate matter (SPM, PM2.5 and PM10) and gases (SO2, NO2, NH# and SO42-) of collected samples has been done. Chemical characterization (PAH, Metal, ions) of particulate samples is in progress.

9.   Slippage, if any : Nil

10.   Detailed Action Plan for 2011-12 :

Sl. No.	Activity	Date of start	Date of completion
1.	Sample Collection analysis	Continuing	Mar 2012
2.	Emission of estimate for emission inventory	Dec 2010	Oct 2011
3.	Data Compilation, analysis interpretation	Continuing	Dec 2012

S&T Completed Projects during 2010-11

S&T Annual Report

2010-11

1.	Name of the Project	:	**Investigation of cavability of overlying strata and development of guidelines for estimation of support capacity for longwall faces.**
2.	Implementing Agency	:	CIMFR, Dhanbad NIRM, Kolar. ISM, Dhanbad
3.	Sub-implementing Agency	:	CMPDI, Ranchi, SECL, SCCL, ECL & BCCL
4.	Project Leader/co-ordinator	:	1. Shri Gautam Banerjee, Scientist, CIMFR, Dhanbad 2. Dr. V. Venkateswaran, Scientist, NIRM, Kolar 3. Prof. U. K. Singh, Deptt. of Mining Engg., ISM, Dhanbad 1. Mr. A. K. Ghosh, CIMFR, Dhanbad 2. Dr. V. Venkateswaran, Scientist, NIRM, Kolar 3. Prof. S. N. Mukherjee, ISM, Dhanbad
5.	Date of Start	:	Nov 2005
6.	Date of Completion	:	Sep 2010
7.	Total Approved Cost	:	Rs. 461.3674 Lakh For CIMFR – 200.142 For NIRM – 187.91 For ISM – 63.3154 For CMPDI – 10.00

DESCRIPTION OF THE PROJECT

8.   Objectives :

- To develop a suitable method for the assessment of cavability of overlying roof rocks.
- To categorise the coal measure rock, rock beds based on its caving behaviour.
- To develop guidelines for estimation estimation of support capacity.
- To suggest guidelines and requirement of hard roof management techniques for difficult to cave roof conditions.
- Standardizatoin of support condition monitoring bechniques to be implemented for the longwall faces and gate roads.

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

9.   Work Done :

Two approaches, namely, Parting Plan (PP) APPROACH AND ROOF SEPARATION INDEX (RSI) approach have been used for identifying caving layers. In the PP approach the logical parameters, Po, is considered for identifying weak beds which will act as parting plane. The parameter is TRUE for weak bed and FALSE for competent bed. In RSI approach, extreme value of -25 for weak beds and 0 for competent beds were assigned. The strength properties and modulus values were weighted according to the thickness. The results of both the approaches were almost similar.

The equivalent main fall span corresponding to the critical face length of longwall panel has been

found to be standard parameters for categorization of overlying roof rocks. Based on the equivalent main fall spam, the overlying roof rocks were classified as :

Category of Roof	Caving Nature	Equivalent Main Fall Span
I	Edasily Cavable	< 35 m
II	Modenatell cavable	35 - 55 m
III	Cavable with difficulty	55 - 75 m
IV	Cavable with substantially difficulty	75 m - 100 m
V	Cavable with extreme difficulty	> 100 m

Standard Methodology for assessment of cavability of Roof Rock

Two different numerical modiling approaches have been used to develop the models for assessment of cavability. Approach 1 has been developed on FLAC 3D platform in plain strain condition while approach 2 has been developed in FLAC 2D platform which also assumes a plain strain condition.

The first approach numerical model which was developed in FLAC 3D has been used to validate in 7 (Seven) longwall panels and has also been used to predict caving behaviour of longwall panels and observed that this model had predicted the mainfall and periodic fall span reasonably well.

The second modeling approach has been evaluated for different field conditions. This model was also used to predict caving behaviour for different long wall panels. These modeling approached were used conducting a parametric study of critical factors like, cover depth, thickness and strength of layers in-situ horizontal stress, extraction height etc. Bridge the gap of understanding and incorporating the results coming out which a better and more representative approach.

10. Findings :

Two different numerical modeling approaches have been used to develop the guidelines for estimation of support capacity of a longwall faces. The results of the models have been validated from field data collected from past operated longwall faces and have been used to estimate optimum support capacity required for operating these faces. The two approaches are similar and use the face convergence slope as the parameter for determining the optimum support resistance required for longwall panel. Approach 1 uses a cantilever model simulating the periodic fall conditions. The convergence limit has been taken as 60 mm/m of face advance from a large number of studies it has been observed that in massive and hard roof especially in category IV & V, the convergence slope cannot be restricted to 60 mm/m. In such condition hard roof management techniques for induced caving will be required.

The 2nd modeling approach was used to investigate its applicability in assessing the setting load requirement for optimal performance of a given capacity support. On the numerical modeling results of extracted panels and their field experiences. A peak face convergence gradient of 75mm/m of face advance has been stipulated as the sustainable value i.e. the maximum permissible value to fulfill this condition.

Numerical modeling technique was used to study the sequence and nature of caving of overlying rocks of a few previously worked out and presently running longwall panels. The results of the models have been validated from field data collected from past operated longwall faces. The proposed models give a very promising result to assess the progressive caving behaviour of strata, viz, the nature of caving, span of first local fall, main fall and periodic caving. Some of the most important strata behaviour parameters like load on the support, face convergence, front abutment stress and vertical strain in coal at the face are also predicted. The technique was also applied to estimate optimum support capacity required for operating the longwall faces.

1.	Name of the Project	:	**High resolution seismic monitoring for early detection and slope failures in opencast mines.**
2.	Implementing Agency	:	A U, Chennai
3.	Sub-Implementing Agency	:	SCCL, Kothagudem
4.	Project Leader/Co-ordinator	:	Prof. (Dr.) L. Ajay Kumar, Deptt of Mining Engineering, College of Engineering, Anna University, Chennai. General Manager (R&D), SCCL, Kothagudem
5.	Date of Start	:	Mar 2008
6.	Date of Completion	:	Feb 2011
7.	Total Approved Cost	:	Rs. 124.30 Lakh
			S&T Grant – Rs. 99.44 Lakh
			Cont SCCL – Rs. 24.86 Lakh

DESCRIPTION OF THE PROJECT

8.   Objective :

The objective of slope stability analysis is to provide safe and economic design of the slopes, steeper the pit slopelesser the waste rock excavation and the economic benefits are gained in addition to this the objective of the present 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 failures and high walls.
- Planning of mine operations against pit failures.

9. Work Done :s

In this project high resolution seismic monitoring was tried to assess the pit slope stability with the view for early detection of failure, appreciate failure mechanism and enhance the knowledge for prediction of failures. The study in high wall and overburden dump involved a well designed monitoring program by installing an optimum microseismic sensor array. The microseismic sensor were installed in boreholes andgrounted firmly with the strata under study. These sensors were networked and configured with seismic recorder or data logger (Paladin). Acquisition of the microseismic data and processing was done on a real time basis at three places namely Manuguru opencast mine office, Kothagudem corporate office and Anna University, Chennai.

The microseismic monitoring system is capable of acquiring and processing a large amount of microseismic data in a real time and provides seismic source parameters which include event location, energy index, seismic moment, apparent stress, event magnitude, apparent volume and spectral

parameters of waveform. The micro seismic data stored in the database is easy to access for generating reports and for the data presentation in 3D visualization mode. The contours of various source parameters for selected times along with results of statistically analysed data provide information to understand the strata behaviour for each microsecond in real time.

The results have enabled to identify failure initiation along with three dimensional modeling. Understand slope failure mechanisms and early detection of failures. The client server software helps simultaneous monitoring of data in a real time mode at any place with the Ethernet facility available, In the present study data was simultaneously monitored at SCCL project office (Manugure), SCCL Head Office (Kothagudem) and Anna University (Chennai) which made every official to see the stability of highwall slope of Manugure Opencast III SCCL mine, even locating seismic source was possible from these places.

Based on the observations, it can be said seismic monitoring technique can be used to assess the stability of highwall and dump slopes. These studies would facilitae identifying weak fracturing zones and assess the status of slopes. These studies would facilitate identifying weak fracturing zones and assess the status of slopes. The daily report of microseismic monitoring system, could be included in mine scheduling to increase safety and productivity of opencast mines. The waveform of seismic data can be used to analyse/optimize the blasting operation performance of mines.

10. Findings :

In order to understand the behaviour of strata vis-à-vis assiss the slope condition, the Micro seismic technique has been experimented in 70m deep highwall and 90m high OB dump of Manguru OCP of SCCL at Manguru Mandal in Khammam district, Andhra Pradesh.

The results have enabled to identify failure initiations along with three dimensional modeling, to understand slope failure mechanism and early detection of failures. The client server software helps simultaneous monitoring of data in a real time mode at any place with the Ethernet facility.

The threshold value for the PPV was marked as 25 mm/sec in highwall and 10mm/sec at the OB dump for Manguru OC. The threshold value for the moment magnitude (MO) marked as 0.3 in high wall and 0.2 in OB dump for Manguru OCP SCCL. In the OB dump analysis, around 50 events were recorded. Majority of analysed events were within the threshold limit.

Based on the observations, the stability of the slope at highwall and OB dump were assessed and found to be stable with the present operating conditions and methods being practiced.

Seismic monitoring technique can be used to assess the stability of highwall and Anup slopes. These studies would facilitate in identifying weak fracturing zones and assess the status of the slopes. These studies would facilitate in identifying weak fracturing zones and assess the status of the slopes. The waveform of seismic data can be used to analysed/optimize the blasting operation performance of mines.

The technology advancement makes seismic monitoring system more user friendly as seismic warning alarms can be received by mine authorities PC/Cell phone

In order to understand the behave high resolution micro seismic monitoring in opencast mines resulted in high sensitivity that has precisely identified failure initiation location, and yielded information on failure process and mechanisms. A well designed monitoring program will help to differentiate between normal elastic movements, inconsequential dilation and incipient pit wall failure. Early detection of wall failure allows mine operators to plan and implement appropriate actions with sufficient notice such that the effect of the failure on mine safety and productivity is minimal.

1.	Name of the Project	:	**Stabiity of parting between coal pillar workings in level contiguous seams during depillaring.**
2.	Implementing Agency	:	CIMFR, Dhanbad
3.	Project Leader/ Co-ordinator	:	Dr. Raghavendra Singh, Scientist, CIMFR, Dhanbad
4.	Date of Start	;	Oct 2004
5.	Date of Completion	:	June 2010
6.	Total Approved Cost	:	Rs. 50.54 Lakh

DESCRIPTION OF THE PROJECT

7.   Objectives :

i.   to develop guidelines for assessing parting stability taking into consideration in situ stresses, roadways width, depth of cover, parting thickness, eccentricity, RMR

ii.   the guidelines so developed as per (i) may be validated at selected sites of depillaring situations. At all the sites, in situ stresses, magnitudes & directions will be essentially measured.

iii.   to do numerical modeling to assess in the context to case-studies and other collected data with an aim to derive a ration formulation for parting stability for depillaring situations:

8. Work Done :

To fulfill the objective of this project, investigations were carried out based on field data collected from 6 coal mines which have been chosen for numercal modeling. For numerical modeling of contiguous seam, a virtual coal seam having same thickness and geo-mechanical properties, was created hypothetically below the existing seam at a varying parting thickness of 3.6 and 9m, keeping the other mining parameters same. After going through the data and details from different mines, extensive numerical modelings were conducted in addition to the in-situ stress measurement at Shyamsunderpur colliery, ECL. The validation of developed formulae and guidelines was done after analyzing data of strata control monitoring during contiguous depillaring at Ray-Bachra colliery, CCL and Nowrozabad East colliery, SECL.

For numerical modeling, parametric changes in the following factors were made for all the 6 mines.

(i)   horizontal to vertical in situ stress ratio, K

(ii)   width of split/slice, W

(iii)   rock mass rating, RMR

(iv)   parting thickness, T

(v)   three different positions of depillaring face in upper and lower workings

This gave rise to 540 models with as many output data sets. Regressions were then done to give separate equations for calculation of minimum safety factor,

SF_{min} for three different depillaring face positions in contiguous working. In addition, in upper workings, the rock load height has also been calculated directly by changing different parameters

and after regression a separate equation for rock load height and support load density for the slice junction was evolved.

8. Findings :

The suitable guideline for defining parting stability has been proposed to use at the depillaring faces in contiguous working in Indian coal mines under the following mining conditions. The developed guidelines can be used for all type of the contiguous depillaring caving. These guidelines should be used for depillaring in level contiguous seams only.

●   The developed guidelines can be used for all type of the contiguous depillaring caving faces.

●   These guidelines should be used for depillaring in level contiguous seams only.

The developed guidelines can be used for all types of the contiguous depillaring with caving.

1.	Name of the Project	:	**Production or [60], [70] fullernes, Hetro fullernes and cabron nanotubes from coal**
2.	Implementing Agency	:	CIMFR, Dhanbad
3.	Sub-Implementing Agency	:	BHU, Varanasi
4.	Project Leader/Co-ordinator	:	Shri Ashish Kumar Ghosh, CIMFR, Dhanbad
4.	Date of Start	:	May 2007
5.	Date of Completion	:	Feb 2011
6.	Total Approved Cost	:	Rs. 175.80 Lakh

For CIMFR — Rs. 145.92 Lakh

For BHU — Rs. 29.88 Lakh

DESCRIPTION OF THE PROJECT

7. **Objectives :**

To produce soot enriched in (60) & (70) fullerenes, hetero fullerenes and other novel nonmaterials involving indigenously designed reactor system. For this step, arc discharge method will be adopted. The next step will be development of easier method for the isolation and purification of fullerenes from the soot thus obtained. This last step will require utilization of host guest chemistry with some of the host molecules.

8. **Work Done :**

Fullerence and CNT syntheses is a relatively new and emerging area of research with major developments continuing till date.

In this project by sourcing Indian coals successful synthesis (60), (70) Fullerenes, Heterofullerenes and CNTs have been done both by coke and coal derived electrodes with and without use of catalysts. From the project work it is evident, prima facie that high sulphur coals can be used for production of Fullerences and CNTs and high sulphur content is not a serious detriment in this regard. Considering that most Indian coals are of drift origin and therefore having high ash content doubts have been reisd whether such coals will be suitable for synthesis of such sophisticated materials. It is strongly established that high as coal beneficiation by conventional physical processing e.g. gravity separation is amply suitable for such purposes which opens up bright future prospects for use of Indian coals for further research.

10. **Findings :**

- Successful synthesis of (60)-(70) Fullenenes, Hetrofullerenes and Carbon nano tubes (CNTs) have been done direct sourcing of Indian coals.

- Synthesis of CNTs were achieved by both coke derived electrodes and coal derived electrodes where as the synthesis of fullerenes were achieved only by coke derived electrodes.

- Multiwalled Carbon Nanotubes (MWCNTs) have been synthesized using coal and coke based electrodes in place of graphite electrodes without employing any catalyst. The average diameter of MWCNT was found to be 8-20nm while the average length was 5-10 um. ·

- Single walled carbon nanotubes (SWCNTs) were Synthesized using coal and coke based rod and Ni – Y as catalyst. The average diameter and length of SWCNTs have been found to be 1.05 nm and 0.8pm respectively.

- Fullerenes and CNTs can be isolated utilizing host guest chemistry in easier way as it is less cumbersome and less time consuming than the chromatographic procedure. Compounds such as chloranils, crown ethers, calixarenes and Resorcinanenes can be used for Trapping of fullerches and CNT from the Mixture.

- From the project work it is evident, prima facie that high sulpher coals can be used for production of Fullerenes and CNTs and high sulpher content is not a scrious deteriment in this regard. Outcomes from this study has strongly established that high ash coal after beneficiation by conventional physical processing i.e. gravity seponation is amply suitable for such purposes which opens up bright future prospects for use o Indian coals for further research.

Successful synthesis of (60) (70) fullerenes, Heterofullerenes and CNTs have been done by direct sourcing of Indian coals. Synthesis of CNTs were achieved both by coke derived electrodes and coal derived electrodes whereas the synthesis of fullerenes were achieved only by coke derived electrodes and coal derived electrodes. Probable pathway of Fullerenes or CNT formation from Indian coal has been suggested.

1.	Name of the Project	:	**Re-design and fabrication of biomass gasification plant coal fuel utilization**
2.	Implementing Agency	:	RVCE, Bangalore
3.	Project Leader/Co-ordinator	:	Dr. M. Krishna, Director, Research and Development Deptt of Mech. Engg., RVCE, Bangalore
			Dr. H. N. Narasimha Murthy, Director, P G Studies Deptt. of Mech. Engg., RVCE, Bangalore
			Dr. S. C. Sharma, Principal, RVCE, Bangalore
4.	Date of Start	:	Feb 2007
5.	Date of Completion	:	Jul 2010
6.	Total Approved Cost	:	Rs.40.06 Lakh

DESCRIPTION OF THE PROJECT

7.   Objectives :

- To design and develop co-gasification (Dual Fuel) technology by using existing biomass gasification unit.

- To optimize carbon / biomass ratio for efficient power generation.

- To develop an efficient gas cleaning technology.

- To increase power generation capacity (power out put/size of the system).

8.   Work Done :

(i)   Preliminary studies on the existing sytem for different coal / biomass.

(ii)   Varying feedstock parameters to obtain more efficient producer gas.

(iii)   Varying as engine parameters for maximum power .

(iv)   Redesign of biomass gasifier for dual mode operations.

(vi)   Study the operation of coal / biomass dual fuel mode gasification unit.

(vii)   Study of commercial viability of coal dual gasifier unit.

9.   Findings :

The research work presented a methodology for fuel collection, fuel characteristics of the co – firing, its relation to ration fed, and the change in fuel characteristics and volatile oxides due to composting. The bench scale experiments with 125 KW facility revealed better combustion for coal:

1.   Eucalyptus: lignite (92:08) blends better than for Eucalyptus biofuel alone

2.   Sawdust: lignite (90:10) blends better than for sawdust biofuel alone

With larger-scale (P=pilot plant) experiments conducted at the 120 KW but sawdust: lignite biend resulted in almost twice the ash output compared to Eucalyptus ash deposits on heat exchanger tubes that. The increased fouling behavior with blend is probably due to the higher ash loading and ash composition of sawdust.

For the base case conditions assumed in the study, the Cost of Electricity (COE) for a co-firing biogasifier (8% lignite & 92% eucalyptus – Rs 3.65/unit and 10% lignite & 90% sawdust blends – Rs. 2.88/unit) much lesser than the market values and pure biogasifier.

Cellulose content of lignite was converted to reducing sugars to the extent of 90% which is fermented to alcohol. The non-fermentable aromatic residue is being converted to methane gases which can be used as gaseous fuel. The remaining residue, the humic acid can be used as fertilizer. The process is being scaled up for large scale production.

It has been concluded that 8-15% lignite with 92-85% word face enhances the overall calorific value of the minegas. The composition of the combustible gases namely CO_2, CH_4 and H_2 is more for 8% of lignite mix with wood fuel. It is observed that the calorific value of minegas is 5.077 MJ/M^3. The results show that operating of the plant with 92% eucalyptus and 8% lignite blends (Rs. 3.65/unit) is more attractive than 100% eucalyptus (Rs. 4.25/unit). However, 90% sawdust + 10% lignite pallets (Rs. 2.88/unit) is found to be more attractive.

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.	Implementing Agency	:	CMPDI, Ranchi
3.	Project Leader/Co-ordinator	:	General Manager (Env.), CMPDI (HQ), Ranchi
4.	Date of start	:	Aug 2004
5.	Date of Completion	:	Dec 2010
6.	Total Approved Cost	:	Rs. 78.62 Lakh

DESCRIPTION OF THE PROJECT

7.   Objectives :

- Design of anoxic lime stone drain.

- Identification of plant species capable of bio-degrading the acid mine drainage

- Design of organic sub-stratum of wetland to support plant species

- Assessment of treatment efficiency and operating parameters for treatment of 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.

8.   Work Done :

- Literature survey was carried at various libraries e.g. Indian Botanical Research Institute, Lucknow, Indian School of Mines, Dhanbad, surfing on various internet sites and a number of national and international experts were consulted. Based on the outcome of this consultation, Typha latifolia plant was selected to treat the acid mine drainage through anaerobic constructed wetlands.

- Quantification of the Acid Mine Drainage (AMD) was done based on the field data. The representative mine water samples were collected and analyzed at outside laboratory to determine the quality of acid mine drainage.

- The site for locating the wetlands was finalized in consultation with project authorities.

- The design of the constructed wetlands was carried out based on the quality of the AMD, quality of AMD, acidity load, the available design methodology and treatment efficiency. Two nos. of treatment circuits were planned.

- Depending upon the AMD characteristics, anaerobic wetlands consisting of Typha latifolia plant was planted into deep, permeable sediments comprised of soil, straw/manure underlain with limestone was tried. In these wetlands,treatment involves major interactions within the substrate. Typha (Bulrushes) are much more tolerant to AMD as they do not accumulate metals to toxic levels.

- The most important metal removing mechanism in wetland is bacterial sulphate reduction in the anaerobic environment of the organic substrate. Certain bacteria e.g. Desulfovibro and Desulfotomaculum, can utilize the organic substrate as a carbon source and sulfate a an electron acceptor for growth. In the bacterial conversion of sulfate to hydrogen sulfide, bicarbonate alkalinity is produced and pH levels are thus increased.

- Based on the evaluation result of the constructed wetlands, it is now established that wetlands consisting of pant Typha latifolia significantly increase the pH level of the acid mine drainage form coal projects. The increase in pH level has been observed from 2.23 to 5.52. This level is expected to go up further in due course of time.

- In order o achieve further increase in pH level in future, a combination of two or more wetlands can be provided in series. This process is very simple one and does not require skilled operation.

9. Findings :

Based on the evaluation result of the constructed wetlands, it is now established that wetlands consisting of plant Typha latifolia significantly increases the pH level of the acid mine drainage from coal projects. The increase in pH level has been observed form 2.23 to 5.52. This level is expected to go up further in due course of time. With the above, a simple and cost-effective bio-treatment system to treat the acid mine drainage from the coal mines is developed.

1.	Name of the Project	:	**Study on blasting dust management system in an opencast coal mines.**
2.	Implementing Agency	:	NIRM, Kolar
3.	Sub-Implementing Agency	:	SCCL, Kothagudem
3.	Project Leader/Co-ordinator	:	Mr. Surendra Roy, Scientist, NIRM, Kolar
		,	Dr. G. R. Adhikari, Scientist, NIRM, Kolar
4.	Date of start	:	Oct 2006
5.	Date of Completion	:	Dec 2010
6.	Total Approved Cost	:	Rs. 48.33 Lakh

DESCRIPTION OF THE PROJECT

7. Objectives :

- To study the meteorological condition at the mine site.
- To assess the ambient air quality at the study site due to blasting.
- To study the influence of rock density and blast design parameters 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 a particular location.
- To find out control measures for the dust generation due to blasting.

8. Work Done :

Blasting, which is one of the major operation at surface mines, is associated with environment hazards such as ground vibration, air overpressure, flyrock and dust. Among these, the dust generated due to blasting causes air pollution in and around the mining areas. The charged zone around the charged section of the blasthole in the main origin of dust generation due to blasting.

During the study, it was observed that, thermal plumes (free) occurred during the day time whereas spiky, flat, stratified and multiple layers formed during the night time. Rising layers were observed during transition Phase on the morning some time after sunrise. Dot echo structures were found during rainfall.

The predominant wind direction as indicated by windrose diagrams for different seasons can be used to minimize the impacts of blasting dust by planting fast growing tree perpendicular to blasting dust plume towards habitations. Varying degree of simple correlations if meteorological parameters with mixing height was established, the highest being with solar radiation. Multiple regression analysis of data indicated the combined influence of meterological parameters on mixing height, it also established that solar radiation has dominant influence. The development of statistical model can be used at the mine site to compute mixing height Dispersion factor was high during 10:00-15:00 for all the seasons but for effective control of blasting dust, blast at the mine can be scheduled during 12:00-13:00 in post-monsoon and during 13:00-14-00 in other two seasons. Result of the study will also be useful for control of dust due to other mining activities.

Based on the preliminary observations of several blast, the accumulation period of dust for the mine site was found to be 20minutes, which was used as the monitoring period for all the blast. Correlations and scatterplot matrices indicated correlation between pair of predictors for the inference of multicollinearity, suitability for the use o no-intercept models and influence of independent variables on PM 10 and TSP. From the correlations, it stepwise regression procedures, stemming column, explosive quantity, moisture content and distance were selected as the most influencing parameters for PM10 and parameters like dasthole diameter, explosive quantity, moisture content and distance for TSP were used for development of statistical and neural network models, Assessment of model performance indicated that neural network can predict particulate matter better than multiple regression.

9.   Findings :

Under this project emission factors for dust concentrations were developed in gram per cubic meter of rock excavated. The developed emission factors were used to estimate dust emissions from adjacent mines due to similarity in mining and meteorological conditions. The statistic of emission factors for coal and overburden for all the seasons indicates that average emission factor for M10 (Particulate matter smaller than 10 microns in diameter) and TSP (total suspended particulate matter from 0.1 to about 100 µm in diameter) in coal blasts is higher than that for overburden blasts.

In Dudhichua project, NCL, the average emission factor for coal was 0.38 g/m³ for PM10 and 2.08 g/m³ for TSP. For overburden, the emission factor was observed to be 0.18 g/m³ and 1.17 g/m³ for PM10 & TSP respectively.

All the Mines of NCL are located adjacent to each other and mining and meteorological conditions are identical, emission factors developed for Dudhichua Project can also be applied for all the adjacent mines.

The emission factors for Bharatpur opencast project for post Monsoon and Winter seasons were compared with these for Dudhichua Project, shows that emission factors are site-specific, unless geo-mining and meteorological conditions are identical.

From R&D studies at Dudhichua project, the average emission factor for coal was 0.38 g/m³ for PM10 and 2.08 g/m³ for TSP. Foe overburden, the average emission factor was observed to be 0.18 g/m³ and 1.17 g/m³ for PM10 and TSP respectively. These values can be used to estimate the emission quantities generated due to blasting. Seasonal variation in emission factors indicated that the emission factor was the lowest in monsoon due to higher moisture content in this season.

1.	Name of the Project	:	**Development and use of fly ash based pesticides – EE/36**
2.	Implementing Agency	:	NLC, Neyveli
3.	Sub-implementing Agency	:	Annamalai Univ. (AMU), Coimnatore & VCRC, Puducherry
4.	Project Leader/ Co-Ordinator	:	Dr. S. Santhanam, Chief CARD/NLC
			Shri V. Manoharan, Chief Manager (Science), NLC
			Dr. P. Narayanasamy Professor of Entomology, Annamalai University
5.	Date of start	:	May 2007
6.	Date of Completion	:	Mar 2011
7.	Total Approved Cost	:	Rs. 304.92 Lakh S&T Grant – Rs. 275.377 Lakh For NLC – Rs. 131.737 Lakh For AMU – Rs. 89.82 Lakh For VCRC – Rs. 53.82 Lakh Contr. of NLC – 29.543 Lakh

DESCRIPTION OF THE PROJECT

8. Objectives :

(i) To standardize methods to develop fly ash based pesticides

(ii) To formulate fly ash 100% dust insecticides

(iii) To develop "herbal fly ash" insecticides

(iv) To develop and test biological fly ash pesticides against mosquitoes

(v) To develop and test biological fly ash pesticides against mosquitoes

(vi) To test all the fly ash based pesticides against various pests problems in rice groundnut, sugarcane, vegetables, cotton and pulses and in store godowns.

(vii) To assess pesticides residues in plant products products produce, soil and water samples.

(viii) To create more awareness in the use of fly ash in agriculture, public health areas

9. Work Done :

Annamallai University, Coimbatore

- Construction of concrete shed for installing fly ash processing machineries by the work section of Annamalai University as well as greenhouse-cum insectary by M/s Pioneer Taurpalins (firm already experienced in construction of greenhouse at CARD, NLC) respectively with fly

bricks especially in front of the faculty building adjacent to new block was rearing completion subject to formal approval by the university authiorities.

- For premilinary research trails at Annamalai University Experimental Farm a ton Lignite fly as (LFA) was obtained from CARD, NLC

- Meanwhile, a ball mill of lower capacity installed at the Department of Technology Faculty of Engineering an Technology, Faculty of Engineering and Technology, Annamalai University sa made use of grind the LFA and fractionated to our daily requirements.

- To investigate the physical characterization of the micronized fly ash dusts, binocular stereo zoom Nikon Olympus E400 cmpount microscope available at the Department of Entomology, Faculty of Agriculture, Annamalai University was made use of first point.

VCRC, Puducherry

- Development and formulation of mosquitocidal toxins from bacteria using flyash as a carrier.

- Laboratory evaluation and formulation of mosquitocidal toxins form bacteria for activity against immature stages of bacteria.

- Conducting toxicological studies on the mosquitocidal toxins (Technical material) from bacteria a well as the formulation prepared from them for verifying their safety to mammals and non-target organisms.

- Field evaluation of the formulations of the moxquitocidal toxins.

NLC, Neyveli

- Priminary survey of field in and around Neyveli, soil, water, food chain samples, collection of ground water Collection of data on pest incidence, pesticide used at Afforestation tonip etc. collection of sample and testing.

- Multiplication of biopesticide strains in frementor, characterization of fly ash and supplying for the study, Analysing fly ash samples for heavy metals, other chemicals etc., Analysing soil, plant and animal samples for presence of heavy metals and enzymes, etc., after harvest of each crop.

- Coordinating in the conduct of lab. And field experiments involving flyash based pesticides in field crops and mosquitoes.

- Co ordinating with Health/TA/Mines/AU/VCRC for study pest/ mosquito control.

10. Findings :

The lignite fly ash based bio pesticides formulations developed in this project have been found to be highly effective against the immature stages of mosquitoes, which serve as vectors for malaria, filariasis, dengue, Japanese encephalitis, chikungunya etc. Hence they can be used for the control of these disease vectors and ultimately control of the diseases transmitted by them.
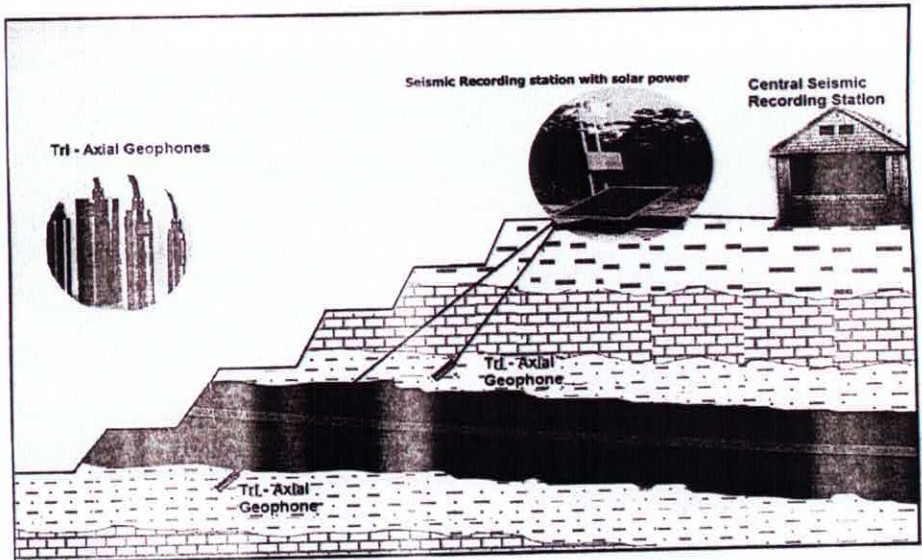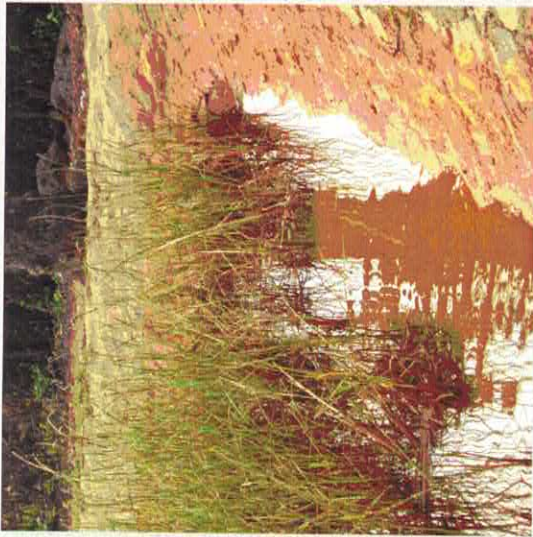
Monitoring of a slope face using geophones – MT/155
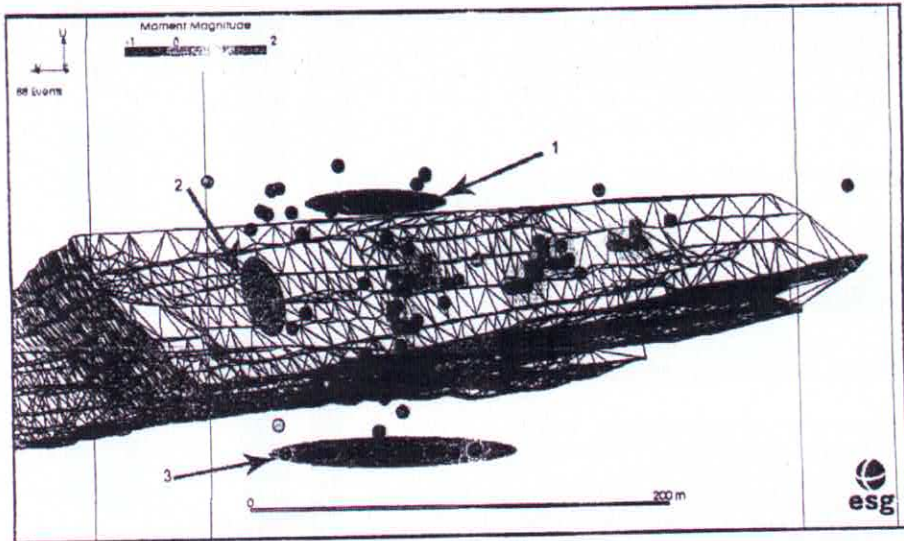
Showing the recording the events from the vertical view. – MT/155
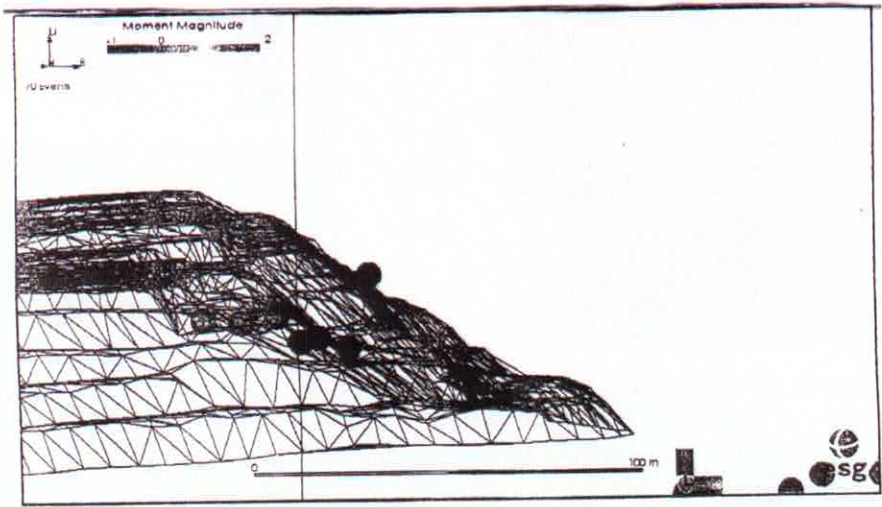
Showing events at OB dump recorded during monitoring period. – MT/155

Roots of
Typha Latifolia

Constructed Wetland at
Kanhan Area, WCL

Limestone
Drain

Acid Mine
Drainage → Equalization
Basin → Anaerobic
Wetland → Aerobic
Wetland → Treated
Mine Water

Suggested Flowsheet for AMD
treatment throughconstructed Wetland

Production of Bio-pesticide using seed fermentor at CARD-CARD/NLC & VCRC. – EE/36

Visit to Mosquito Breeding lab – VCRC, Puducherry–VCRC, AU & CARD, NLC. – EE/36

Over all view of bhendi field trial.
– EE/36

Application of flyash pesticides in bhendi crop.
– EE/36

Over all view of Sugarcane field trial. – EE/36

Over all view of Rice field trial.. – EE/36

Mealy bug affected plant before treatment of
FA based pesticide. – EE/36

Mealy bug affected plant after treatment of FA
based pesticides. – EE/36