

S&T
Annual Report
वार्षिक प्रतिवेदन
2016-17



Government of India
Ministry of Coal
New Delhi 110 001

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

प्राक्कथन

1970 के शुरुआत में कोयला क्षेत्र के राष्ट्रीयकरण के पश्चात, 1975 में "कोयला विज्ञान एवं प्रौद्योगिकी योजना" सरकारी वित्तीय व्यवस्था के तहत व्यवस्थित रूप से अनुसंधान शुरु हुआ। इसे विशेष रूप से भारतीय परिस्थितियों के लिए उपयुक्त प्रौद्योगिकी के विकास को सुविधाजनक बनाने के उद्देश्य से अनुसंधान एवं विकास तथा समन्वित कार्य हेतु शुरु किया गया 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 का संचालन स्थायी वैज्ञानिक अनुसंधान समिति (एस एस आर सी) नामक एक शीर्ष वैज्ञानिक निकाय द्वारा किया जाता है। एस एस आर सी को कोयला अनुसंधान के निम्नलिखित महत्वपूर्ण क्षेत्रों से संबंधित उप समिति द्वारा सहायता प्रदान की जाती है, ये हैं :

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

1975 से कोयला एवं लिग्नाइट उत्पादक कम्पनियों की सक्रिय सहभागिता के साथ कोयला एवं सम्बद्ध उद्योगों से संबंधित राष्ट्रीय अनुसंधान एवं शैक्षणिक संस्थाओं द्वारा कोयला मंत्रालय के विज्ञान एवं प्रौद्योगिकी अनुदान के तहत वर्तमान में अनुसंधान परियोजनाएँ क्रियान्वित की जा रही हैं। इसके परिणामस्वरूप 31.03.2017 तक 275 करोड़ रुपये की अनुमानित लागत से 319 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 12 चालू परियोजनाएँ एवं 06 पूरी की जा चुकी परियोजनाओं की स्थिति को दर्शाया गया है।

इस पुस्तिका को प्रकाशित करने का उद्देश्य न केवल किए जा रहे अनुसंधान एवं विकास से संबंधित सूचना का प्रचार करना है, बल्कि भविष्य में गहन अनुसंधान के लिए प्रोत्साहन देना भी है। भविष्य में संस्करण को समृद्ध बनाने के लिये प्रस्तुति एवं विषयवस्तु के प्रकाशन में सुधार लाने हेतु आपके महत्वपूर्ण सुझावों का स्वागत है।

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

स्थान : राँची



(शेखर सरन)

अध्यक्ष-प्रबंध निदेशक

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2.	Techno-economic Evaluation and performance behavior of Self Advancing (mobile) Goaf Edge Supports (SAGES) (Phase - II)	MT - 166	ISM, Dhanbad & M/s. JBEPL, Hyderabad	3 - 5
3.	Investigation pertaining to geotechnical & hydrogeological aspects to stabilize the non - cohesive granular soil/sand in the opencast mines adjacent to the major perennial river	MT - 167	RI - IV, CMPDI, Nagpur, Indian Institute of Technology (IIT), Mumbai and WCL, Nagpur	6 - 7
4.	Shale gas potentially evaluation of Damodar Basin of India	CE - 30	NGRI, Hyderabad, CIMFR, Dhanbad & CMPDI, Ranchi	8 - 11
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8.	Sustainable livelihood activities on reclaimed open cast coal mines : a technology enabled integrated approach in Indian coal sector	EE - 44	TERI/TERI University, New Delhi, CMPDI, Ranchi and BCCL	21 - 23

LIST OF COAL S&T PROJECT COMPLETED DURING 2016 - 17

Sl. No.	Name of Project	Code No.	Impl. Agency(s)	Page No.
1.	Optimization of various parameters of lab scale coal winnowing system (phase - II)	CP - 48	CIMFR, Nagpur and CMPDI, Ranchi	37 - 39
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6.	Development of Indigenous catalyst through pilot scale studies of Coal-To-Liquid (CTL) conversion technology	CU - 57	CIMFR, Dhanbad & CMPDI, Ranchi	58 - 62

Production, Productivity & Safety

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1. **Name of the Project** : **Assessment of horizontal stress fields in deeper horizons and development of roof hazards maps of coal resources in SCCL**
2. **Date of Start** : 24th March 2015
3. **Scheduled date of Completion** : 23rd March 2018
4. **Implementing Agency(s)** : (i) SCCL, Kothagudem
(ii) NIRM, Bangalore
5. **Project Leaders** : (i) Dr. D.N. Sharma, GM (Exploration), SCCL
(ii) Dr. D. S. Subrahmanyam, Scientist & Head, NIRM, Bangalore
6. **Total Approved Cost** : Rs. 358.40 lakh
 - **For NIRM** : Rs. 340.05 lakh
 - **For SCCL** : Rs. 18.35 lakh
7. **Total Disbursement** : Rs. 150.00 lakh
 - **NIRM** : Rs. 150.00 lakh

DESCRIPTION OF THE PROJECT

8. Objectives :

To assess the horizontal stress field in deeper horizon in the mines of Godavari coalfield, vis-à-vis roof hazard map, and devise suitable support systems for the coal mining blocks of SCCL.

- After establishing the Stress field and preparation of suitable Support design in SCCL, guidelines will be prepared so that these investigations will be useful for the other coalfields of India for the support design
- Hydraulic fracturing technique will be used to measure the state of in-situ stress underground through a borehole. The test provides, in general the magnitudes and directions of the principal horizontal stresses. Roof hazard zonation will be carried out to identify potential weak zones in the mines. Integrating the two, a suitable methodology will be developed for devising the support systems or for change in direction of the workings for safer and productive mine workings.

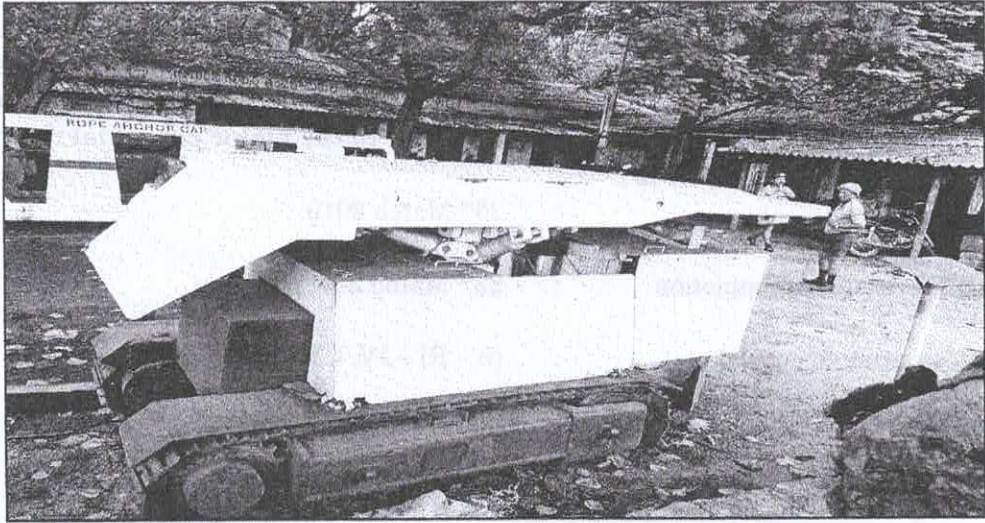
1. **Name of the Project** : Techno-economic evaluation and performance behavior of Self-Advancing (mobile) Goaf Edge Supports (SAGES) - [Phase-II]
2. **Date of Start** : 15th December 2015
3. **Scheduled date of Completion** : 14th December 2017
4. **Implementing Agency** : IIT - ISM, Dhanbad
5. **Project Leaders** : (i) Prof. (Dr.) U. K. Singh, IIT - ISM, Dhanbad
(ii) Shri N. V. N. Reddy, Director, M/s JBEPL, Hyderabad

6.	Total Approved Cost	:	Rs. 73.27 lakh
	● For IIT - ISM	:	Rs. 33.04 lakh
	● For JBEPL	:	Rs. 40.23 lakh
7.	Total Disbursement	:	Rs. 40.00 lakh
	● IIT - ISM	:	Rs. 18.00 lakh
	● JEBPL	:	Rs. 22.00 lakh

DESCRIPTION OF THE PROJECT

8. Objectives :

- Modifications and refurbishment of 6 nos. of SAGESs
- Study of performance behavior of modified SAGESs in an underground coalmine and its influence on ground behavior



SAGES after final Modification at RK 7 SCCL

DESCRIPTION OF THE PROJECT

Objectives

- To study the hydrogeological conditions existing in the area of the project.
- To design a suitable slope stabilization scheme using low cost synthetic materials and geogynthetic clay layers for retaining the loose granular soil.
- To estimate the water seepage rate from the roadway and help in the design of a suitable drainage system.

9. Status as on 31.03.2017 :

Literature survey, hydrological investigation and geotechnical field investigation has been completed. Procurement of equipment are in progress.

10. Slippage, if any : Delay in tendering process to select the implementing agency due to poor response in the tender.

11. Action Plan for 2017 -18 :

Sl. No.	Activity	Date of Start	Date of Completion
1	Numerical modelling	May 2017	Jun. 2017
2	Selection of implementing Agency	Continuing	Jun. 2017
3	Detailed design and drawing preparation	Jul. 2017	Aug. 2017
4	Execution of retention scheme	Sep. 2017	Dec. 2017
5	Monitoring retention scheme	Jul. 2017	Feb. 2018

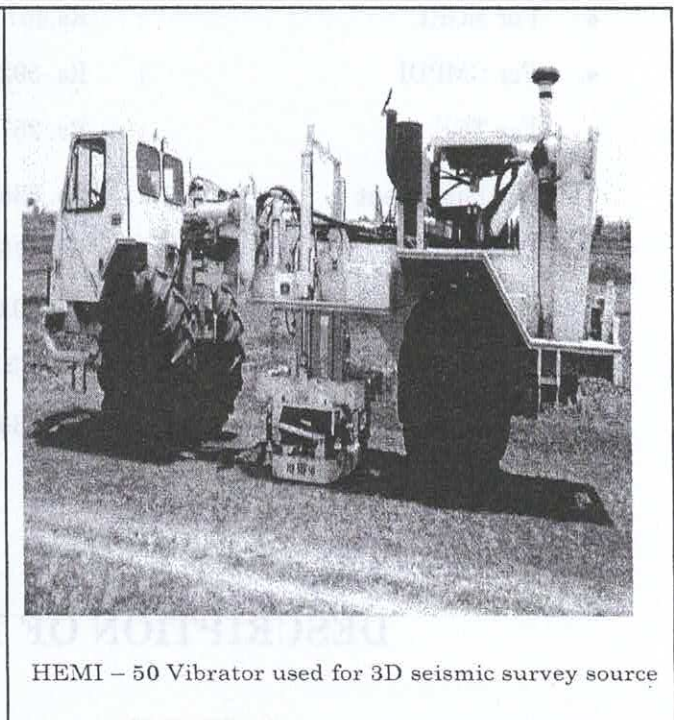
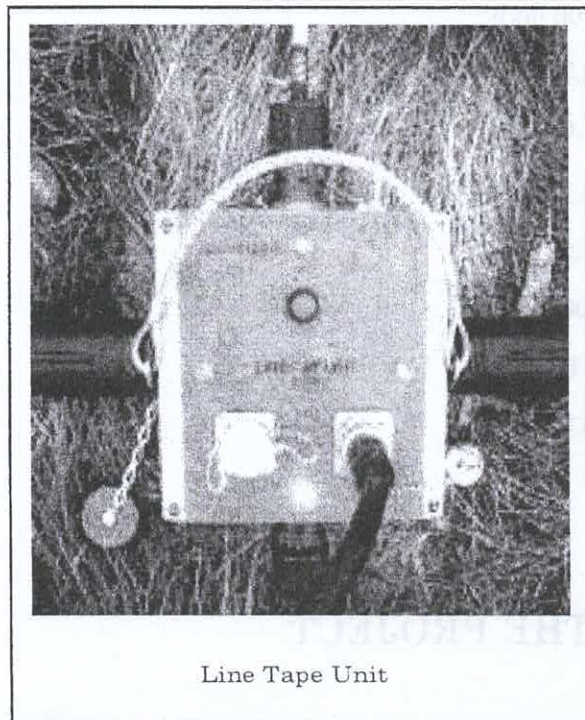
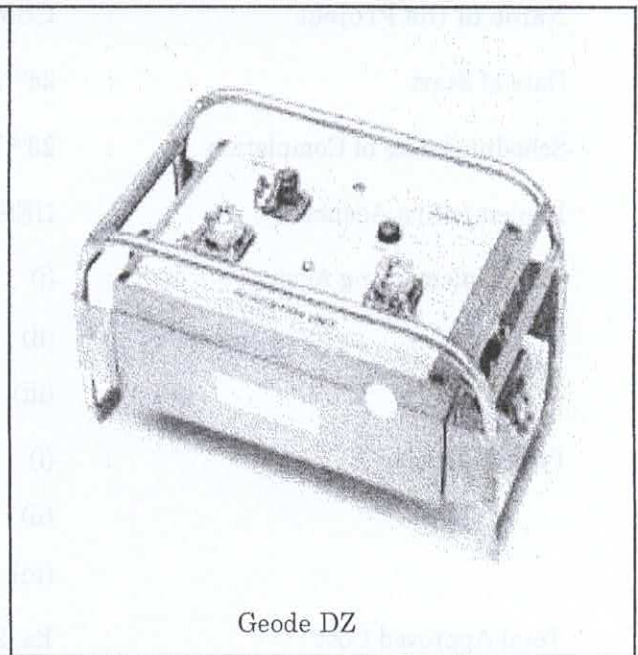
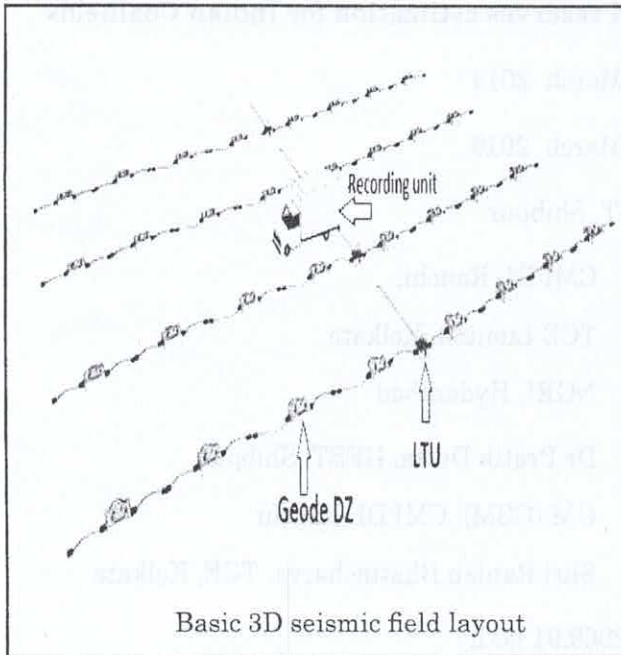
- In the first phase, study will be carried out for shales associated with Damodar basin.
- Near surface group of NGRI will be taking up 2D/3D (9-Component) seismic surveys and other geophysical methods to delineate Shale Beds and associated structural features in Damodar basin. Based on geophysical study, area will be selected for the borehole drilling.
- In first phase it is plan to study two to five bore hole from Damodar basin. Number of shale samples from each bore hole will depend on the thickness of the shale. Core library will be maintained at NGRI and the core will be available for any academic interest.
- Collected shale samples will be analyzed for total organic content and their characterization, maturity of organic matter through TOC, pyrolysis test and isotopic measurements at NGRI geochemical lab.
- To measure petro physical properties (density, porosity, shear and compressional wave velocities) of sedimentary rocks from the deep boreholes and supplement the measurements in the geophysical modeling of the gas bearing shale beds.

9. Status as on 31.03.2017 :

- All the equipment have been procured under this project.
- Rangamati B Block at Raniganj coalfields and Radha Nagar Piparatand Western Jharia Coalfields have been selected as suitable site for conducting 3D seismic survey.
- Petrographic analysis, adsorption isotherm test, proximate analysis etc. have been carried out at CIMFR, Dhanbad and NGRI, Hyderabad from the collected samples.
- 3D seismic survey has been completed in an area of 2.4 Sq. Km in Rangamati B block near Durgapur carried out by NGRI, Hyderabad.

10. Slippage, if any : Due to delay in 3D seismic survey by NGRI, Hyderabad.

12. Photographs of Equipment / Experimental Set-up at Site



- To determine various in situ coal properties for coal characterization within the study area.
- To find out the in-situ gas content and establish adsorption isotherms for estimation of gas saturation.
- To calculate CBM reserve estimate by volumetric method followed by uncertainty analysis by probabilistic method.
- To calibrate the information generated through the steps above by conducting flowing material balance and production decline curve analysis.

9. Status as on 31.03.2017 :

Patratu Block of South Karanpura coalfields has been selected for the proposed study. About 90% job of 2D seismic survey was completed at South Karanpura Coalfields. 3D seismic survey will be started shortly.

10. Slippage, if any :

Due to delay in 3D seismic survey to be carried out by NGRI, Hyderabad.

11. Action Plan for 2017 -18 :

Sl. No.	Activity	Date of Start	Date of Completion
1	2D seismic data acquisition and interpretation	Continuing	Sep. 2017
2	3D Seismic field data acquisition	Oct. 2017	Jun. 2018
3	3D seismic data analysis and processing	Mar. 2018	Sep. 2018
4	Interpretation of the data, selection of locations for boreholes and submission of draft report on 3D seismic studies.	Apr. 2018	Sep. 2018
5	Final report preparation and submission	Sep. 2018	Mar. 2019

1. **Name of the Project** : **Capacity building for extraction of CMM resource within CIL command areas**
2. **Date of Start** : **23rd March 2016**
3. **Scheduled date of Completion** : **22nd March 2019**
4. **Implementing Agency** : **CBM Cell, CMPDI, Ranchi & CSIRO, Australia**
5. **Project Leader** : (i) **Mr. Rajiw Lochan, CM (CBM), CMPDI, Ranchi**
(ii) **Dr. Hua Guo, CSIRO, Australia**
6. **Total Approved Cost** : **Rs. 2392.79 lakh**
 - **For CMPDI** : **Rs. 1492.72 lakh**
 - **For CSIRO** : **Rs. 900.07 lakh**
7. **Total Disbursement** : **NIL**

DESCRIPTION OF THE PROJECT

8. Objectives :

- To develop efficient and cost-effective methane capture technologies at a pre-selected field or mine site under Indian resource and mining conditions.
- To develop advanced gas testing laboratory services and capabilities within CMPDI which may be replicated in at respective regional institutes of CMPDI associated with CIL subsidiaries.

9. Status as on 31.03.2017 :

After getting sanction letter of the project and before proceeding further, CSIRO, Australia was insisting for a 'Collaborative Understanding' document to be signed between CMPDI & CSIRO with

Coal Beneficiation

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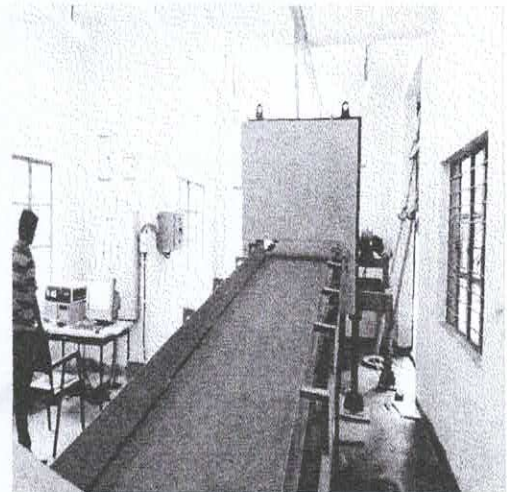
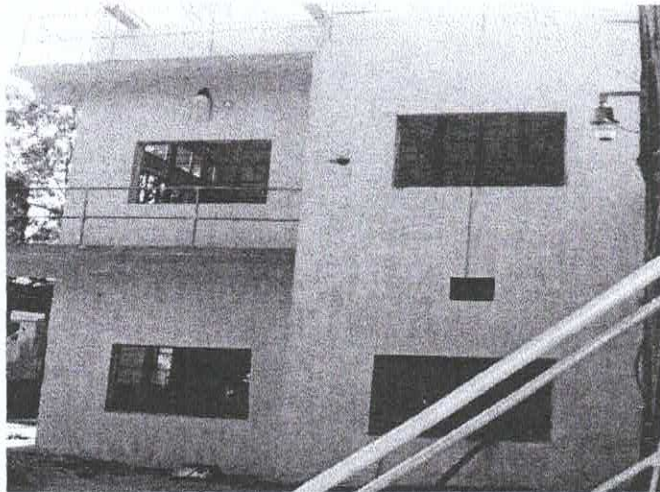
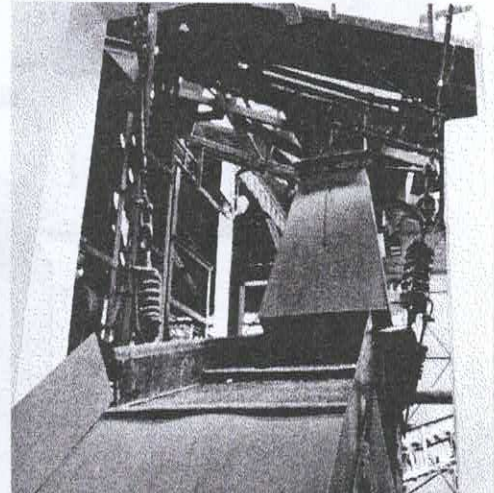
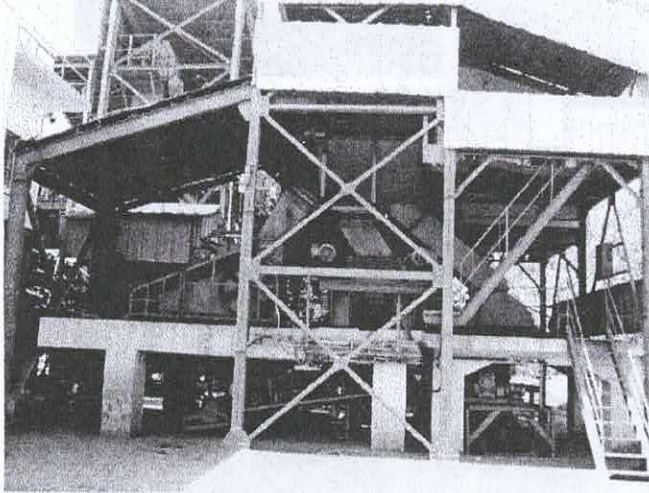
1. Name of the Project : Development of an on-line Coal Washability Analyser
2. Date of Start : 24th March 2014
3. Scheduled date of Completion : 23rd March 2017
4. Implementing Agency : CIMFR, Dhanbad
5. Sub-Implementing agency : M/s Ardee Hitech Pvt. Ltd., Visakhapatnam
6. Project leader /Co-ordinator : (i) Mr. K.M.P. Singh, CIMFR, Dhanbad
(ii) Mr. T. Gouri Charan, CIMFR, Dhanbad
(iii) Dr. S. A. Khayyom, M/s Ardee Hi-tech Pvt. Ltd., Vishakhapatnam
7. Total Approved Cost : Rs. 849.00 lakh
 - For CIMFR : Rs. 505.80 lakh
 - For Ardee Hitech : Rs. 343.20 lakh
8. Total Disbursement : Rs. 765.00 lakh
 - CIMFR : Rs. 480.00 lakh
 - Ardee – Hitech : Rs. 285.00 lakh

DESCRIPTION OF THE PROJECT

8. Objectives :

The objective is to develop an X-ray –based, on-line coal washability analyzer and demonstrate the capabilities of the analyzer by comparing efficiency data from traditional float- sink tests with efficiency data form traditional float-sink tests with efficiency data generated by the washability analyzer.it is proposed

To develop a laboratory scale model initially to establish the concept and derive the required establish the concept and derive the required parameters and to develop suitable software. The second phase the system may be upgraded for online operations.



Two Storey Building and the On-line Coal Washability Analyser

Environment & Ecology

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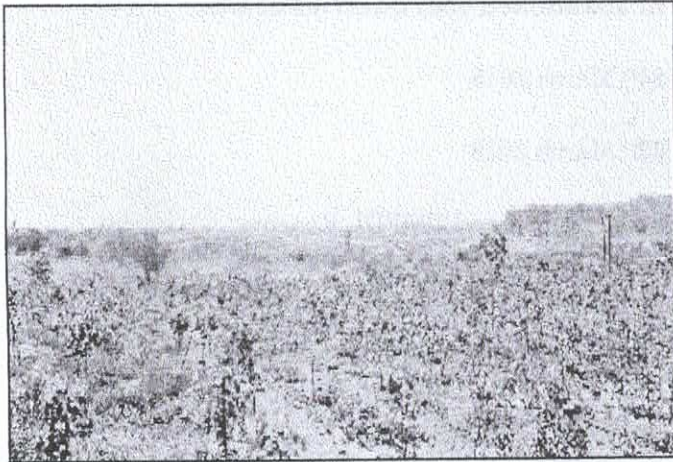
1. **Name of the Project** : **Sustainable livelihood activities on reclaimed open cast coal mines: a technology enabled integrated approach in Indian coal sector**
2. **Date of Start** : **24th March 2015**
3. **Scheduled date of Completion** : **23rd March 2018**
4. **Implementing Agency** : **TERI / TERI University, New Delhi**
5. **Project Leader /Co-ordinator** : (i) **Professor Arabinda Mishra, TERI University, New Delhi**
(ii) **General Manager (Env), CMPDI, Ranchi**
6. **Total Approved Cost** : **Rs. 371.69 lakh**
 - **For TERI** : **Rs. 290.69 lakh**
 - **For CMPDI** : **Rs. 81.00 lakh**
7. **Total Disbursement** : **Rs. 178.45 lakh**
 - **TERI** : **Rs. 160.00 lakh**
 - **CMPDI** : **Rs. 18.45 lakh**

DESCRIPTION OF THE PROJECT

8. Objectives :

- To assess, through the application of a systematic multi-criteria evaluation framework, the suitability potential of post-mining land use for ecologically beneficial and socio-economically productive outcomes.
- To develop permanent green cover on overburden dumps/backfilled mined land area using mycorrhiza and various plant species of economic importance.
- To develop entrepreneurship and vocational skills among members of local Self Help Groups (SHGs) for community (with a focus on women and other weaker sections of the society) empowerment through access to new economic opportunities.

12. Photographs of Training & Experimental Site



*Forest restoration in progress at Muraidih Project,
Barora Area, BCCL*



Training on Mushroom farming



Training on Cattle farming



Training on Fisheries

9. Status as on 31.03.2017 :

Sangam OCP and Saunda AK of CCL have been selected for the study. Procurement of the equipment are under progress. Samples from the Sangam quarry were collected and analysis is under progress.

Samples from the Sangam quarry were collected and analysis in continuing. It have been found that Total Dissolved Solids (TDS) in Sangam OCP is high in comparison to other quarry voids of the area. The aquatic plants Azole. Sylvania and Spirodella alonge and in groups hass shown some promises in reducing the TDS.

Dissolved Oxygen (DO) reduces drastically after a depth of 20 ft. in quarry void. An aquatic plant called Hydrilla has been planted on the periphery of the water bodies to boost up the DO concentration in the water.

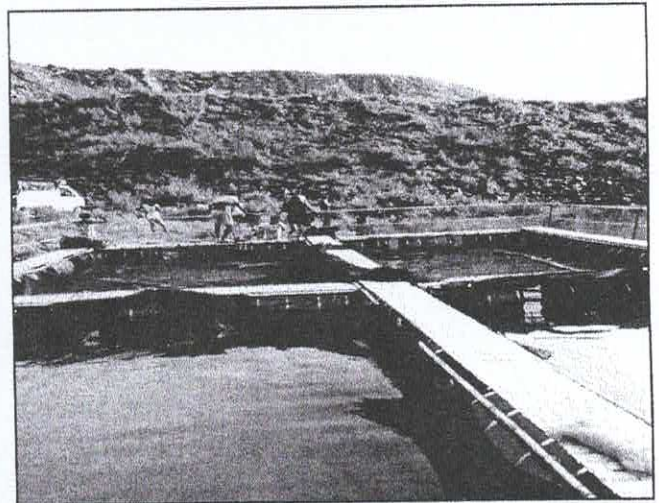
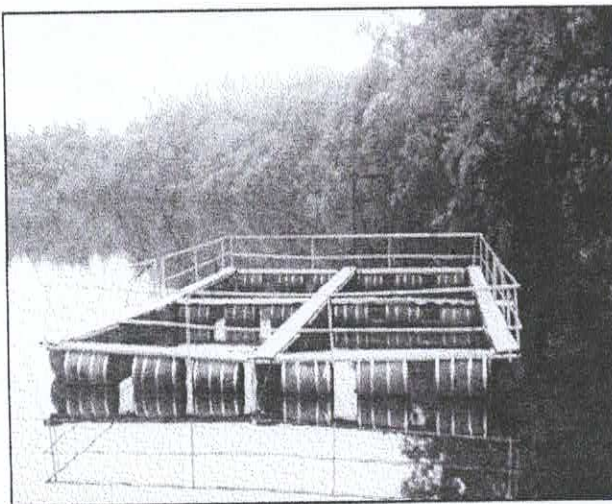
10. Slippage, if any: Not Applicable

11. Action Plan for 2017 – 18 :

Sl. No.	Activity	Date of Start	Date of Completion
1	Study the effect of dolomite/Lime on heavy metals bioaccumulation in fish (in open water bodies)	May 2017	Feb. 2018
2	Study of heavy metals in fish reared in cage (Bioaccumulation as per age and weight of fish)	Jun. 2017	Feb.2018
3	Aeration using the cost effective method i.e. Solar pump	Sep. 2017	Feb. 2018
4	Study of heavy metals in fish reared in cage fed on supplementary feeding	Jun. 2017	Feb. 2018
5	Report Preparation	Feb. 2018	Mar. 2018



Azolla Grow at Sangam OCP, Saunda Colliery, CCL



Cage culture in abandoned mine of Sangam OCP, Saunda Colliery, CCL

1. **Name of the Project** : Construction structure on backfilled opencast coal mines : An attempt to suggest viable methodologies
2. **Date of Start** : 15th December 2015
3. **Scheduled date of Completion** : 14th December 2018
4. **Implementing Agency** : IIT – ISM, Dhanbad & CMPDI, Ranchi
5. **Project Leader** : (i) Prof. Sekhar Chandra Dutta, IIT – ISM, Dhanbad
(ii) General Manager (Civil), CMPDI (HQ), Ranchi

6.	Total Approved Cost	:	Rs. 338.32 lakh
	● For IIT – ISM	:	Rs.304.12 lakh
	● For CMPDI	:	Rs.34.20 lakh
7.	Total Disbursement	:	Rs. 150.00 lakh
	● IIT – ISM	:	Rs. 150.00 lakh

DESCRIPTION OF THE PROJECT

8. Objectives :

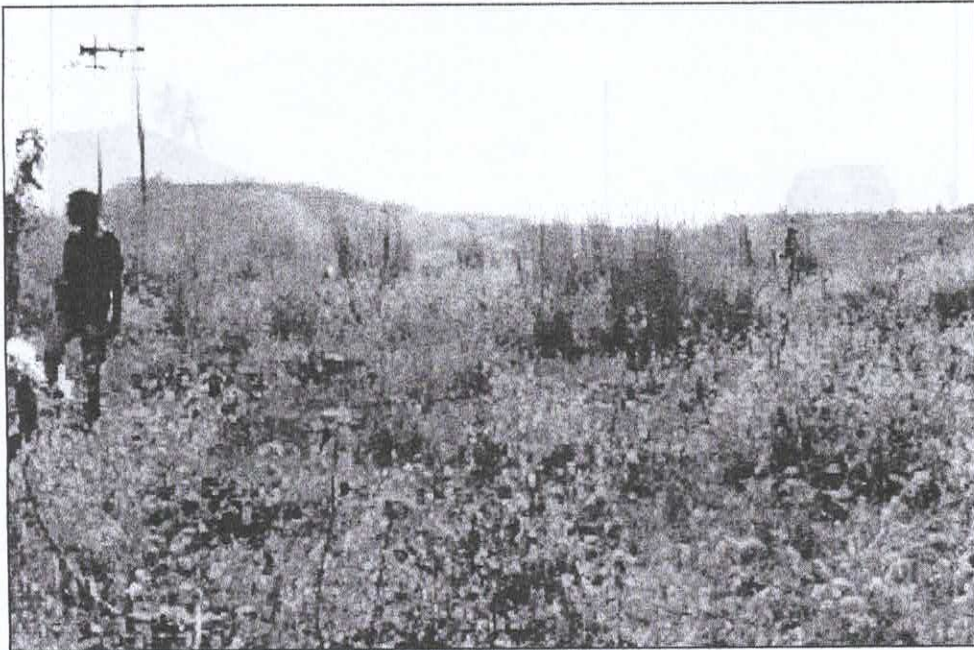
To study the feasibility of constructing habitations and other infrastructural facilities on back filled opencast mines.

To frame a guidelines such that the structures with adequate foundation can be constructed on backfilled opencast mines all over India.

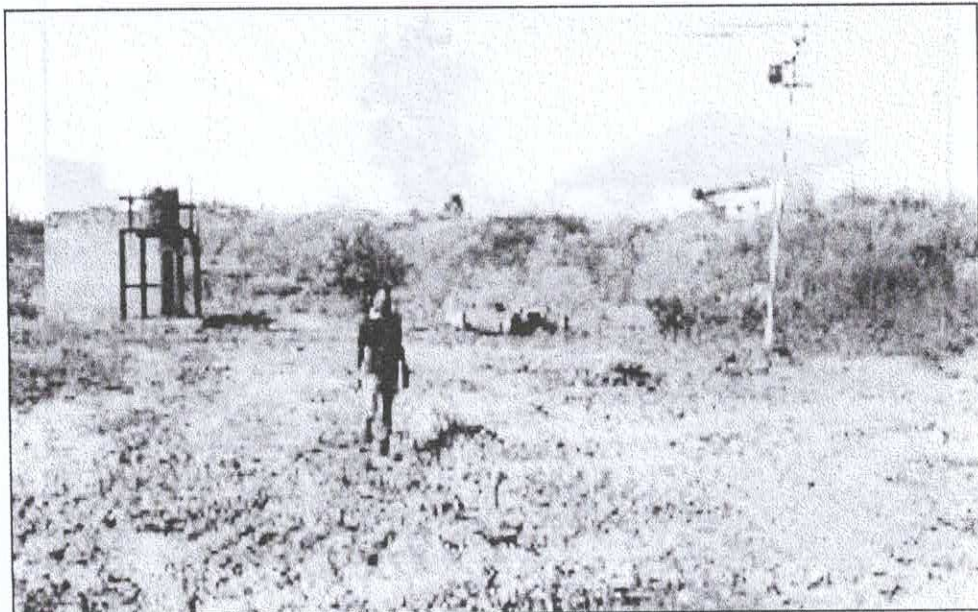
9. Status as on 31.03.2017 :

- Jagannath and Bharatpur OCP have been selected for the study.
- Disturbed soil samples collected from selected locales and analysis is in progress

12. Photographs of Experimental Site and Location



Jagannath Colliery, MCL (Location 1 Near View Point)



*Jagannath Colliery, MCL (Location 2 Near Mines Time Office
(downside of view point))*

1. **Name of the Project** : **On-line coal dust suppression system for opencast mines**
2. **Date of Start** : **23rd March 2016**
3. **Scheduled date of Completion** : **22nd September 2018**
4. **Implementing Agency** : **CDAC, Thiruvananthapuram & CMPDI, Ranchi**
5. **Project Leader** : (i) **Dr. S. Rominus Valsalam, CDAC, Thiruvananthapuram**
(ii) **General Manager (ME), CMPDI (HQ), Ranchi**
6. **Total Approved Cost** : **Rs. 421.04 lakh**
 - **For CDAC** : **Rs.361.04 lakh**
 - **For CMPDI** : **Rs.60.00 lakh**

7. **Total Disbursement** : **Rs. 80.91 lakh**
 - **CDAC** : **Rs. 75.00 lakh**
 - **CMPDI** : **Rs. 5.91 lakh**

DESCRIPTION OF THE PROJECT

8. Objectives :

- To identify air pollutants present in opencast coal mines and provide centralized online monitoring of inventory of the pollutants (PM₁₀, PM₂₅, SO₂, NO₂ and CO).
- To develop an automatic dust suppression system for the dust generated during transportation activities in opencast coal mines for regulating the amount of particulate matter PM₁₀ and PM₂₅ present in the air based on NAAQS standard by sprinkling of adequate quantity of water.

1.	Name of the Project	:	Possible implication of bioavailable iron in coal mine dust on coal workers' lung disease
2.	Date of Start	:	23 rd March 2016
3.	Scheduled date of Completion	:	22 nd September 2018
4.	Implementing Agency	:	NIMH, Nagpur
5.	Sub implementing Agency	:	(i) PIET, Nagpur (ii) CIIMS, Nagpur (iii) WCL, Nagpur
6.	Project Leader(s)	:	(i) Dr. Shubhangi Pingle, NIMH, Nagpur (ii) Dr. Sanvidhan G Suke, PIET, Nagpur (iii) Dr. Rajpal S. Kashyap, CIIMS, Nagpur
7.	Total Approved Cost	:	Rs. 96.50 lakh
	● For NIMH	:	Rs.57.28 lakh
	● For PIET	:	Rs. 20.33 lakh
	● For CIIMS	:	Rs.18.93 lakh
8.	Total Disbursement	:	Rs. 54.00 lakh
	● NIMH	:	Rs. 35.00 lakh
	● PIET	:	Rs. 10.00 lakh
	● CIIMS	:	Rs. 9.00 lakh

DESCRIPTION OF THE PROJECT

8. Objectives :

- To study detailed profiling and characterization of bioavailable iron in the coal samples and in respirable coal dust particles of various coal mining regions of central India.
- To develop in vitro model using human lung cell line and in vivo model using animal for pneumoconiosis disease by exposing different dose time interval of bioavailable iron coal dust or respirable coal dust particle.
- To study toxicity profile of respirable coal dust and bioavailable iron present in coal dust by measuring oxidative stress, cytotoxicity, genotoxicity and immunotoxicity parameters by using developed in vitro and in vivo models.

1. **Name of the Project** : **Optimization of various parameters of lab scale coal winnowing system (phase-II)**
2. **Date of Start** : **December 2015**
3. **Scheduled date of Completion** : **September 2016**
4. **Implementing Agency** : **CIMFR, Nagpur Unit, Nagpur**
5. **Sub-implementing Agency** : **CMPDI, Ranchi**
6. **Project leader /Co-ordinator** : (i) **Sri D.K Sakhare, Sr. Scientist, CIMFR Unit-II, Nagpur**
(ii) **General Manager (CMP), CMPDI, Ranchi**
7. **Total Approved Cost** : **Rs. 18.55 lakh**
 - **For CIMFR, Nagpur** : **Rs. 12.55 lakh**
 - **For CMPDI, Ranchi** : **Rs. 6.00 lakh**
8. **Total Expenditure** : **Rs. 7.18 lakh**

DESCRIPTION OF THE PROJECT

9. Objectives :

- Optimization of various parameters of lab scale 'Coal winnowing system' for consistency in product yield and ash of various coals from different coalfields.
- Determination of ash, moisture and GCV of product & rejects of each samples and segregation of the coal samples and rejects, based on the Gross Calorific Value (GCV) and segregation of the coal and rejects, based on the GCV.

10. Work Done :

- ❖ Winnowing experiments have been conducted on with 100-50 mm, 100-75 mm and 75-50 mm size fraction coal samples of New Shasti siding (NSS) & Hindustan Lalpeth (HLSG) sidings

Development of safe, robust and reliable operations technology for underground coal mines

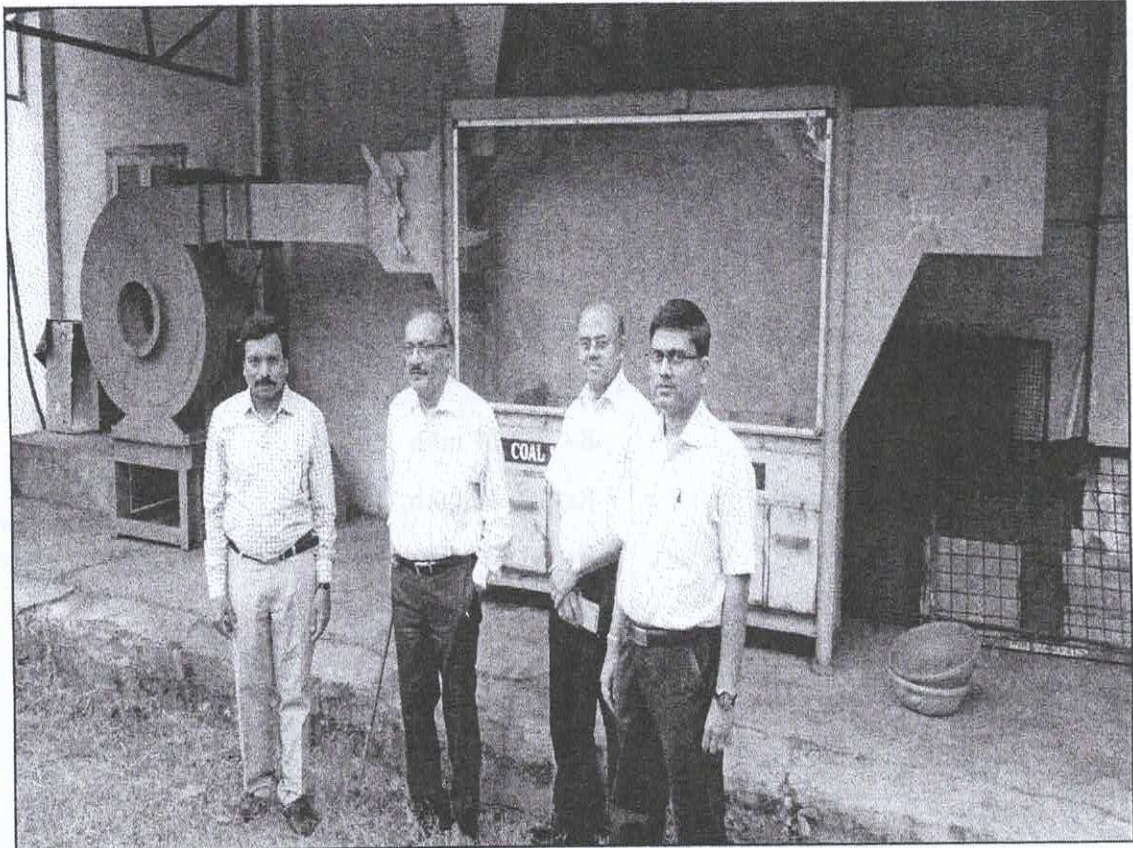
Name of the Project

September 2012

Date of Report

August 2017

Submitted Date of Finalization



CMPDI team visited winnowing experiment site in CIMFR, Nagpur

DESCRIPTION OF THE PROJECT

Objectives:

- Development of Winnowing technology for monitoring in real-time conditions
- Development of Winnowing Robot Technology for safe, robust, environment friendly and monitoring of underground (coal) mines with integrated remote based approach for controlling system operations

10. Work Done :

- ❖ Design and developed wireless technology for monitoring of roof/strata conditions
- ❖ Development of wireless data communication system using wireless sensor networking (WSN)/radio frequency identification (RFID) devices/motes/visible assets.
- ❖ Integration of geotechnical sensors with developed wireless data communication system.
- ❖ Development of algorithm for dynamic sensor networking and application software for monitoring and storing the sensor data to a computer/server.
- ❖ Laboratory trial and fine tuning.
- ❖ Experimental trial of the system
- ❖ Analysis of mine specific field data
- ❖ Development of computer models for design, characterization etc.
- ❖ Development of algorithms and software for navigation, command and control
- ❖ Developing the testing procedure and plan
- ❖ Fabrication/Integration of Prototype at CMERI.
- ❖ Testing, validation under simulated mine condition and preparation for field trials.
- ❖ Khottadih mine of ECL has been identified for field trials of Experimental Model for testing & data collection.
- ❖ Exploration, mapping and roof displacement and strata conditions monitoring of the operational mine galleries and goaf areas.
- ❖ Selection & experiment with suitable sensors and algorithm for measurement of environmental data and generating 3-D mapping of the underground Environment.
- ❖ Wireless transmission of information to the surface control room and visualization of mine environment through augmented reality to plan an intervention with maximum effectiveness and minimum risk.

11. Findings :

The developed robot is capable of monitoring environmental parameters viz. percentage of CO₂, CH₄, O₂, and also humidity & temperature. The real time graphical-user-interphase (GUI) based navigational camera is capable of displaying the status of robot and 3D representation of operational environment in the underground mines from sensor data. Long range communication with the robot through multiple wireless routers was also established. Field trail of Tele-robot developed under the project was conducted at Khottadih mine of ECL.

1. **Name of the Project** : **Enhancing life of de-watering pipes in coal/ lignite mines by prevention of erosion - corrosion with Nano - crystalline surface engineering treatments**
2. **Date of Start** : **September 2012**
3. **Scheduled date of Completion** : **August 2016**
4. **Implementing Agency** : **NLC India Limited (NLCIL), Neyveli**
5. **Sub-implementing Agency** : **National Institute of Technology (NITT), Tiruchirappalli**
6. **Project Leaders** : (i) **Sri M. P. Ambalavanan, NLCIL, Neyveli**
(ii) **Dr. S. P. Kumaresh Babu, NITT, Tamilnadu**
7. **Total Approved Cost** : **Rs. 299.97 lakh**
 - **For NLCIL** : **Rs. 78.68 lakh**
 - **For NITT** : **Rs. 221.29 lakh**
8. **Total Expenditure** : **Rs. 230.04 lakh**
 - **NLCIL** : **Rs. 46.41 lakh**
 - **NITT** : **Rs. 183.63 lakh**

DESCRIPTION OF THE PROJECT

9. Objectives :

NLCIL

- To establish the basic causes for the erosion-corrosion of pipelines in mines.
- To assess corrosive environment and the corrosion process mechanisms.
- To develop appropriate erosion-corrosion models for different environment and their correlation.

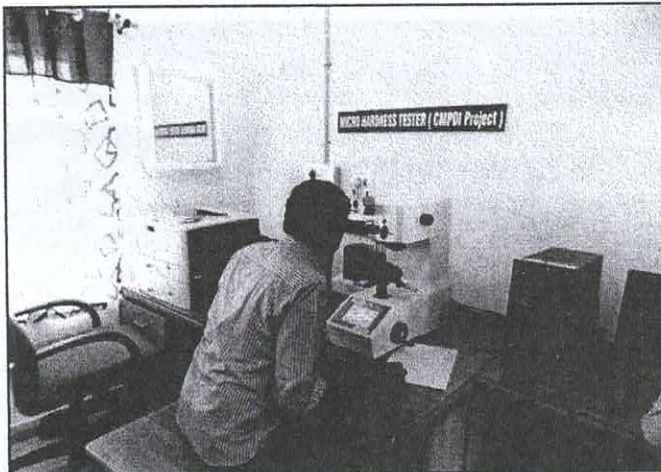
- All the coating were analyzed for erosion and corrosion behavior. Based on the performance and cost effectiveness, the polyuria coating is suggested for field trails in Mines. Poly Urea coating have been done in three phases and the coated pipes are being deployed and serving in Mines-II and Mine-IA. The evaluated results of thickness of coating in the pipelines ranges from 250-350 μm for phase-I & II and 1000 μm for phase III coating. It is found that the thickness is intact and is highly satisfactory. Also it is found to be cheapest coating among the other types of equivalent coatings.

11. Findings :

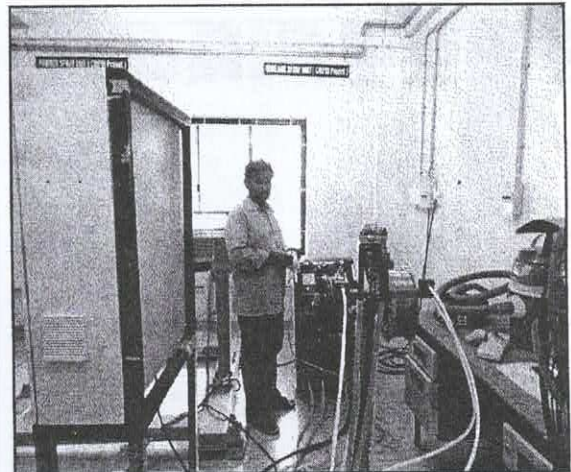
- Under this project, six types of metallic coating and three types of non-metallic (poly-urea coating) were developed for coating on the Fe410 grade substrate for erosion and corrosion resistance. All combination of poly-urea coatings were found to have extremely good corrosion resistance in all environment as well as possess good erosion resistance.
- On comparing the cost-economics of both metallic and non-metallic coatings for mining application, it was found that the poly-urea coatings were very cheap and economical and the life of the coated pipelines will be approximately 6-10 years. The poly-urea coated pipes were put into service in different mines and periodic evaluation of these pipelines was conducted by NITT and CARD officials. The coating was intact and the performance of the coating was found to be very satisfactory. The coating thickness was uniform throughout the pipeline and no deterioration in the coating was noticed.

Note: The project completion report will be placed in the next meeting of Technical sub-committee of SSRC for acceptance.

12. Photographs of Equipment procured / Field Trails at Experimental Site



Micro Hardness Tester



Wire Arc Spray Unit

1. **Name of the Project** : **Blast design and fragmentation control – key to productivity**
2. **Date of Start** : **January 2013**
3. **Scheduled date of Completion** : **December 2016**
4. **Implementing Agency** : **CIMFR, Dhanbad**
5. **Project Leaders/ Co-ordinators** : (i) **Dr. P K. Singh, Director, CIMFR, Dhanbad**
(ii) **Shri M. P. Roy, Senior Scientist, CIMFR, Dhanbad**
6. **Total Approved Cost** : **Rs. 303.86 Lakh**
7. **Total Expenditure** : **Rs. 277.43 lakh**

DESCRIPTION OF THE PROJECT

8. Objectives :

- The objective of the project is develop procedures and criteria for selection of explosives, initiators and appropriate blast designs and finally integrated blast design guidelines for improving productivity in the opencast mines.

9. Work Done :

- Field investigations were carried out at Kusmunda project of SECL, Samleshwari project of MCL, Nigahi Project of NCL and Sonepur Bazari Project of ECL. Altogether, 192 experimental blasts were conducted at hard and medium hard OB benches being operated by Draglines and shovels. Out of 192 blasts, 128 blasts were conducted at Samleshwari project, 37 blast were conducted at Kusmunda project, 21 blast were conducted at Sonepur Bazari project and 6 blasts were performed at Nigahi Project during this financial year.

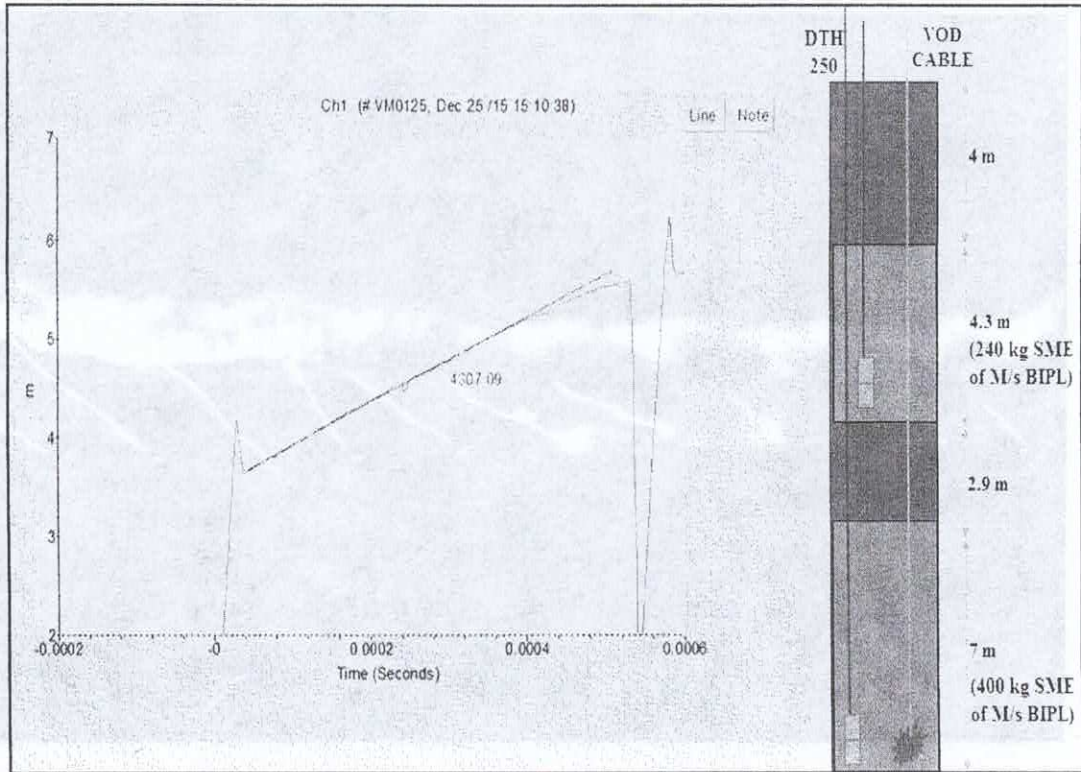


Fig.2: Recorded signature of VOD of SME explosives of M.s BIPL recorded on 25.12.2015 at Samleshwari Project.

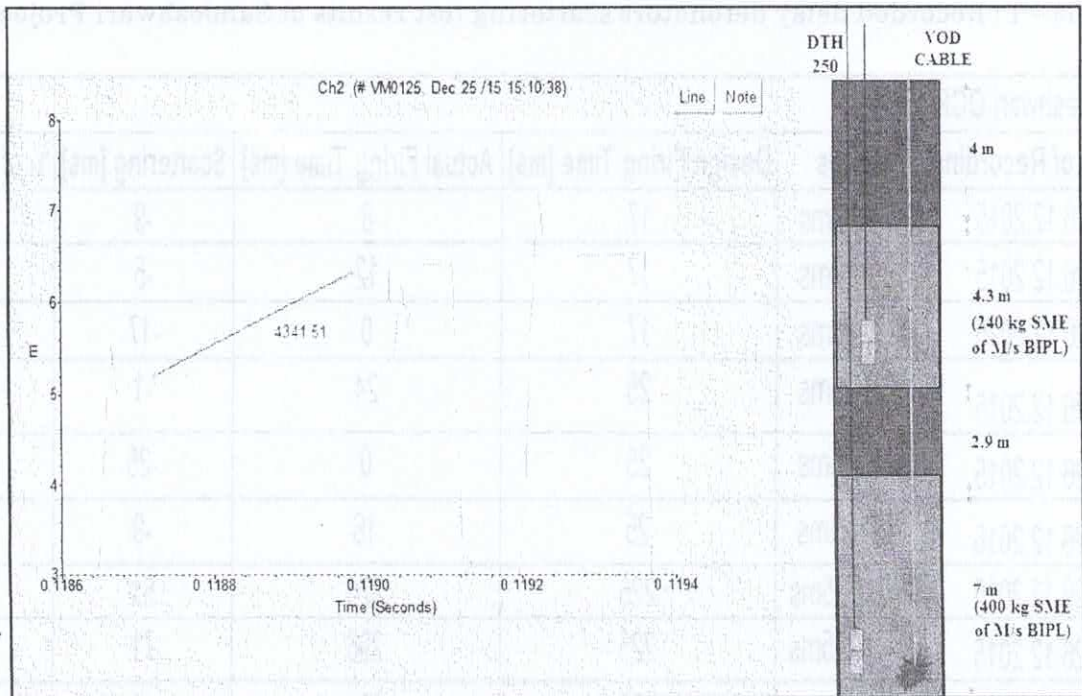


Fig.3: Recorded signature of VOD of SME explosives of M.s BIPL recorded on 25.12.2015 at Samleshwari Project.

- The overburden at Kustumunda project at all the benches are being operated by shovel-dumper combination. The average explosives in a blast holes varied from 151 kg to 539 kg having hole depth of 10 m to 20 m. The burden \times spacing were of 5.8 m \times 6.2 m, 6 m \times 6.5 m, 6.2 m \times 6.8 m, 6.8 m \times 7 m, 7 m \times 7.5 m, 7.2-7.3 m \times 7.5-7.8 m. The quality test of boosters, explosives and blasting accessories (particularly MS connectors, detonating fuse and cord relays) were carried out before conducting trial blasts. The delay detonators scattering tests were performed at Kustumunda project for MS connectors, cord relays and Down-the-hole (DTH) used at shovel bench blasting and are presented in Table 2 which shows the excessive scattering in the MS connectors of 17ms, cord relays of 50ms and DTH-450ms. The recorded signature of VOD of Solardet cast booster-100g (8094 m/s) on 23.04.2015 and is presented in Figure 5. Figure 6 depicts the VOD trace of detonating fuse of M/s AEC recorded at Kustumunda project. The in-the-hole VOD of SME explosives of M/s IOCL-IBP recorded at 702 drill bench of Kustumunda project on 04.05.2015 was 4452 m/s (bottom deck) and 4647 m/s (top deck) and is presented in Figure 7.

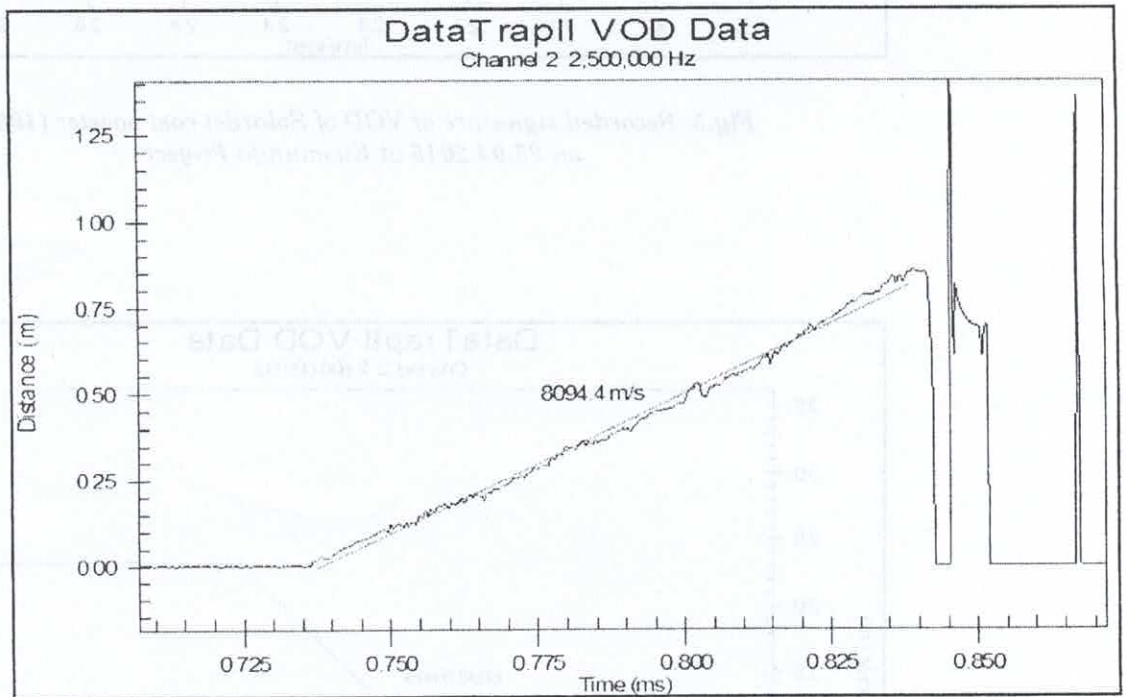


Fig.5: Recorded signature of VOD of Solardet cast booster (100g) on 23.04.2015 at Kustumunda Project

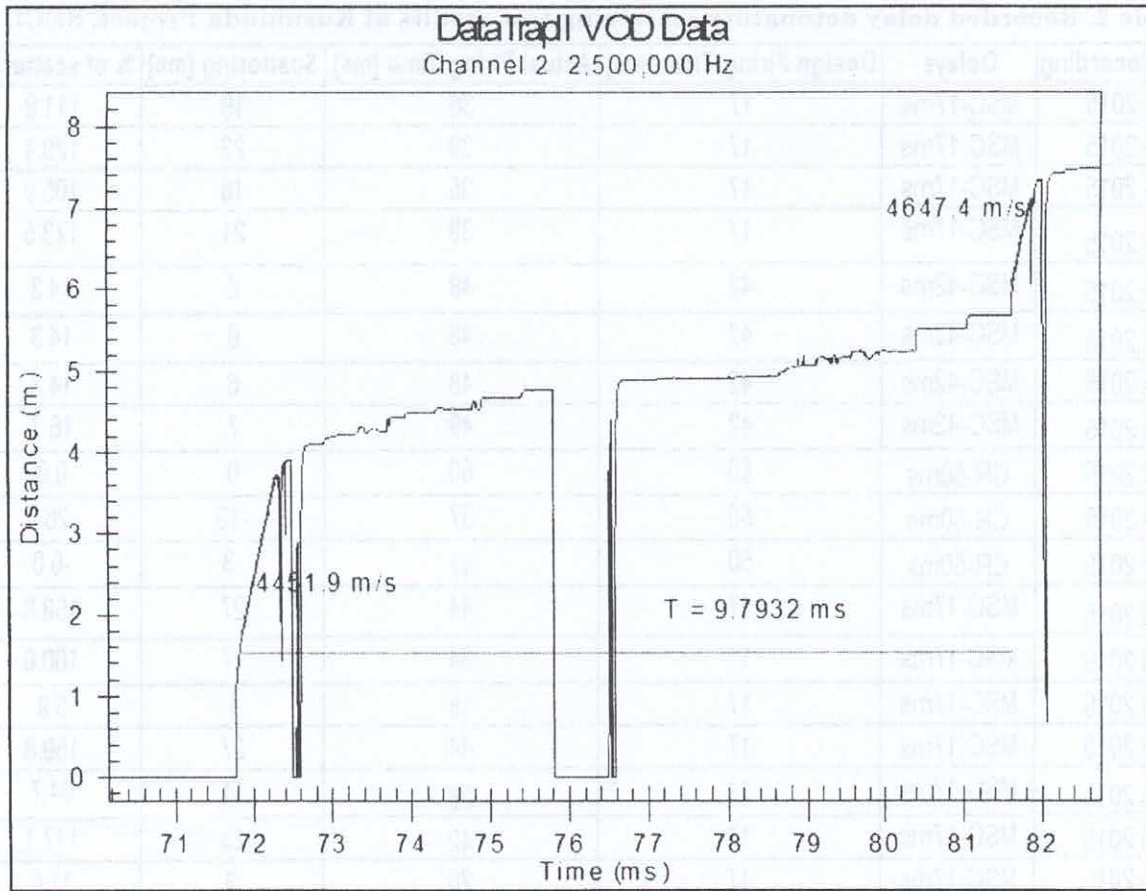


Fig.7: Recorded signature of VOD of SME explosives of M/s IOCL-IBP recorded on 04.05.2015 at Kasmunda Project.

- During the trial blasts at Sonpur Bazari Project average explosives in a blast hole varied from 65-500 kg for hole depth ranging between 7 m and 20 m. Total explosives weight in a blast round varied from 1,800 kg to 19,950 kg. The burden and spacing of the shovel benches were of 5 m × 6.0 m and 5.5 m × 6.5 m. The in-the-hole VOD of SME explosives of M/s IOCL-IBP recorded at Bhima O.B. bench of Sonepur bazari project on 26.08.2015 was 5228.0 m/s and is presented in Figure 8.

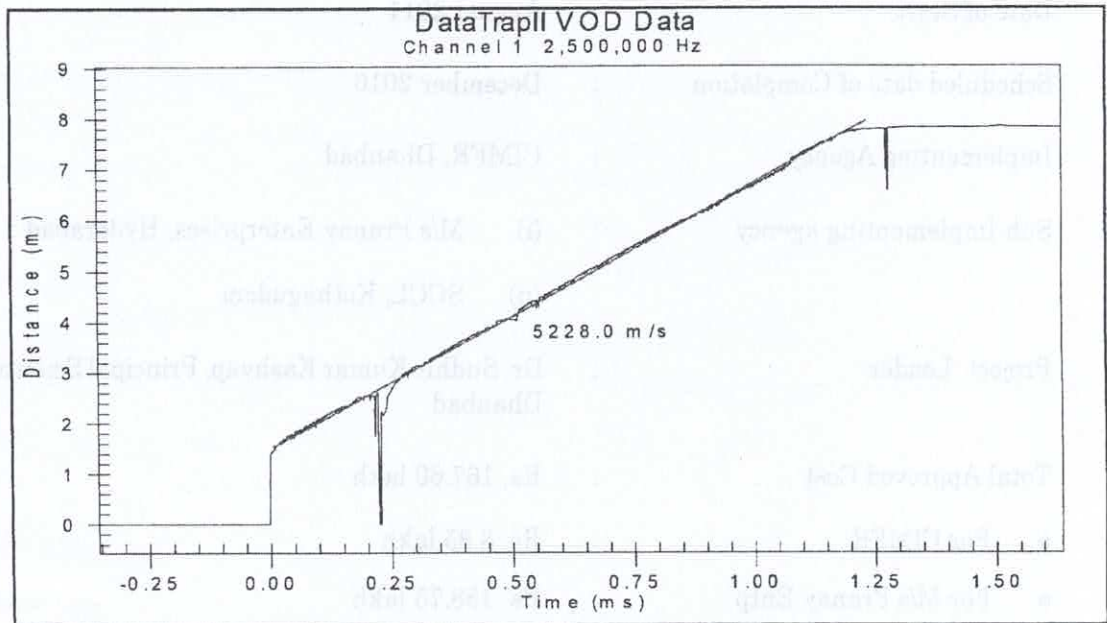


Fig.8: Recorded signature of VOD of SME explosives of M/s IOCL-IBP recorded on 26.08.2015 at Sonepur Bazari Project, ECL.

10. Findings :

- Blast design parameters have significant influence on rock fragmentation by blasting. The experimental trials with variation in burden and spacing with constant charge factor reveal that the mean fragment size decreases with decreasing burden and spacing.
- Experimental trial with constant burden and spacing and variable charge factor imply that there is decrease in mean fragment size with increasing charge factor.
- The scattering in delay detonators affects the firing sequence of the blast holes and subsequently the explosive weight per delay has been got changed. These changes are mainly due to the malfunctioning of the detonators and had influence the desired fragmentation level with increased level of blast variation. Thus, there is significant impact of delay timing and firing sequence on rock fragmentation which influence the blast performance.
- It is observed that stiffness ratio plays an important role in terms of blast fragmentation output and the best optimum value come around 3. Change in the burden or spacing has significant effect on rock fragmentation. In case of high stiffness value, it is easy to displace and deform rock especially at the center of the bench but in other hand, there can be problem relating to blast hole deviation. Thus, for better results the stiffness ratio should be more than 2.

Note: The project completion report will be placed in the next meeting of Technical sub-committee of SSRC for acceptance.

9. Work Done :

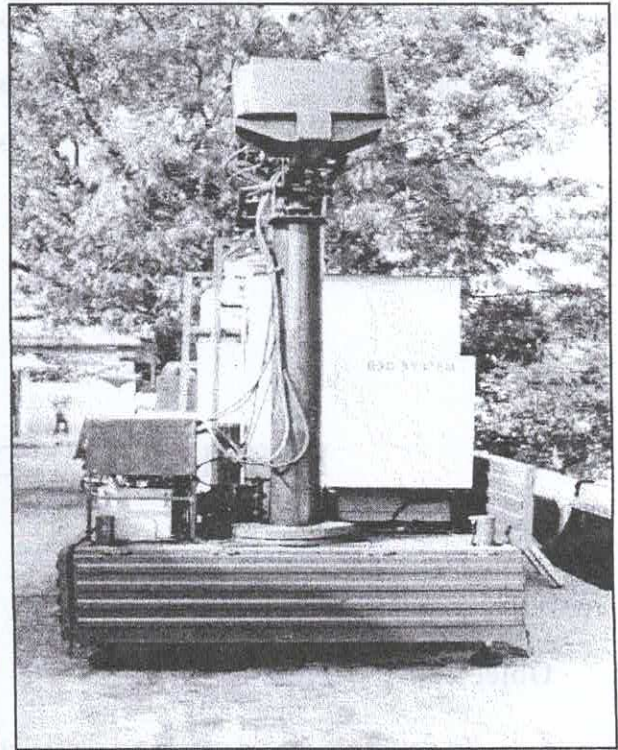
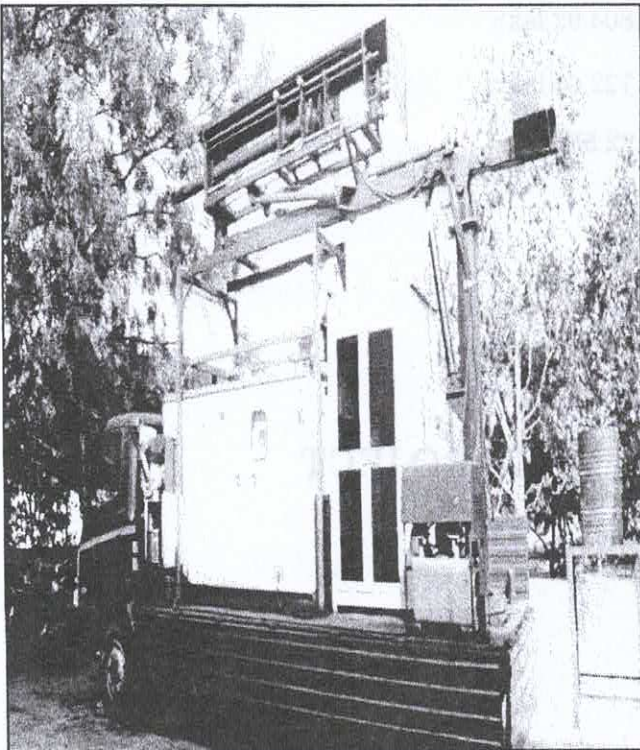
- In Phase – I of the project, the feasibility of nuclear technique method has been established with dual gamma-ray transmission for analysis of coal for ash and moisture contents. In Phase – II, Truck mounted mobile coal sampler has been developed which is capable of analyze the instant coal ash & moisture at site from railway wagon/truck. Field trail has been carried out in the mines of SCCL with newly developed truck mounted coal sampler machine and the results are satisfactory.

10. Findings :

- Under the project, the feasibility of nuclear technique method has been established with dual gamma-ray transmission for analysis of coal for ash and moisture contents.
- The Truck Mounted Mobile Coal Sampler with instant ash & moisture analyser has been developed for collecting coal sample from open railway Wagon/Truck. The coal collected from the loaded Wagon/Truck will provide a true random representative sample (up to 6 feet depth) which would be analysed instantly for determination of Ash & Moisture content in the sample to get GCV value.

Note : The project completion report will be placed in the next meeting of Technical sub-committee of SSRC for acceptance.

11. Photographs of Indigenously Developed Mobile Coal Sampler



Indigenously developed truck mounted mobile coal sampler with instant ash & moisture analyzer

- Testing high ash Indian coals in the gasifier
- Generating basic design & process parameters for further scale-up to commercialization.

10. Work Done :

- Based on data bank of Indian coal available at the Institute & other sources, best suited coal for gasification were selected and collected.
- Coal gasification has been done by air blown fixed bed gasifier.
- Testing of high ash Indian coals in the gasifier set up
- Gas clean-up has been done both by physical and chemical cleaning techniques namely cyclone, bag filters, alkali wash and cryogenic cleaning.
- Feed gas has been compressed by a multistage syngas compressor to the desired reaction pressure.
- H₂ enrichment has been made by shift converter with catalyst developed.
- Continuous experimental runs has been conducted and yield pattern were evaluated.
- Gaseous and liquid hydrocarbon products has been characterized.
- Quality evaluation of the liquid hydrocarbon products has been made.

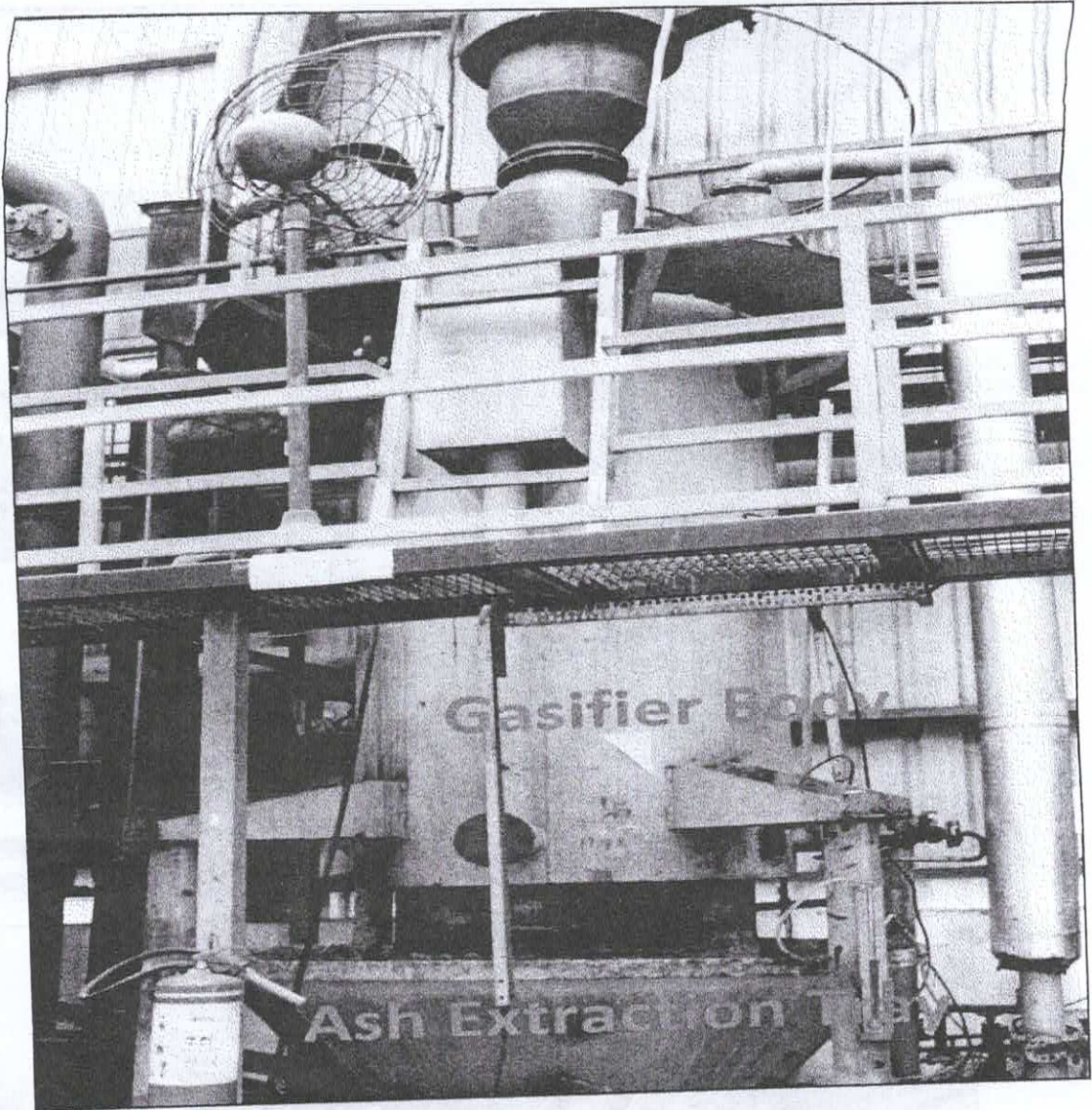
11. Findings :

Design, development, installation and commissioning of a fully integrated Coal-to-Liquid Pilot Plant consisting of coal gasification, gas cleaning, shift reaction, CO₂ scrubbing, liquefaction and liquid collection have been completed at the CIMFR, Digwadih Campus, Dhanbad.

The coal from Dabor OCP, Salanpur Area, ECL with ash content of around 33% has been used for syngas production in a fixed bed updraft air blown gasifier (Coal Feed rate Capacity: 50 – 100 kg/h). Four on-stream experimental runs (continuous) of total 857 hours have been conducted and three experimental runs have produced hydrocarbon liquid. Two Cobalt-based catalyst have successfully been tested in the CTL pilot plant for liquefaction reaction and one of them is a potential catalyst for further scale up studies which has produced 47.0 litres of CTL crude per tonne of coal. The CTL crude is diesel equivalent with the calorific value of 10900 kcal/kg.

Note : As advised by Secretary (Coal), MoC, an independent evaluation of the experimental data of CTL project by third party has been carried out at CIMFR, Digwadih Campus, Dhanbad.

CIMFR selected M/s Project & Development India Ltd. (PDIL), Noida as a third party to evaluate CTL results. Trail run of the CTL plant process was carried out at CIMFR, Digwadih campus,



Fixed Bed Updraft Gasifier