

# PROGRESS REPORT

## 1991

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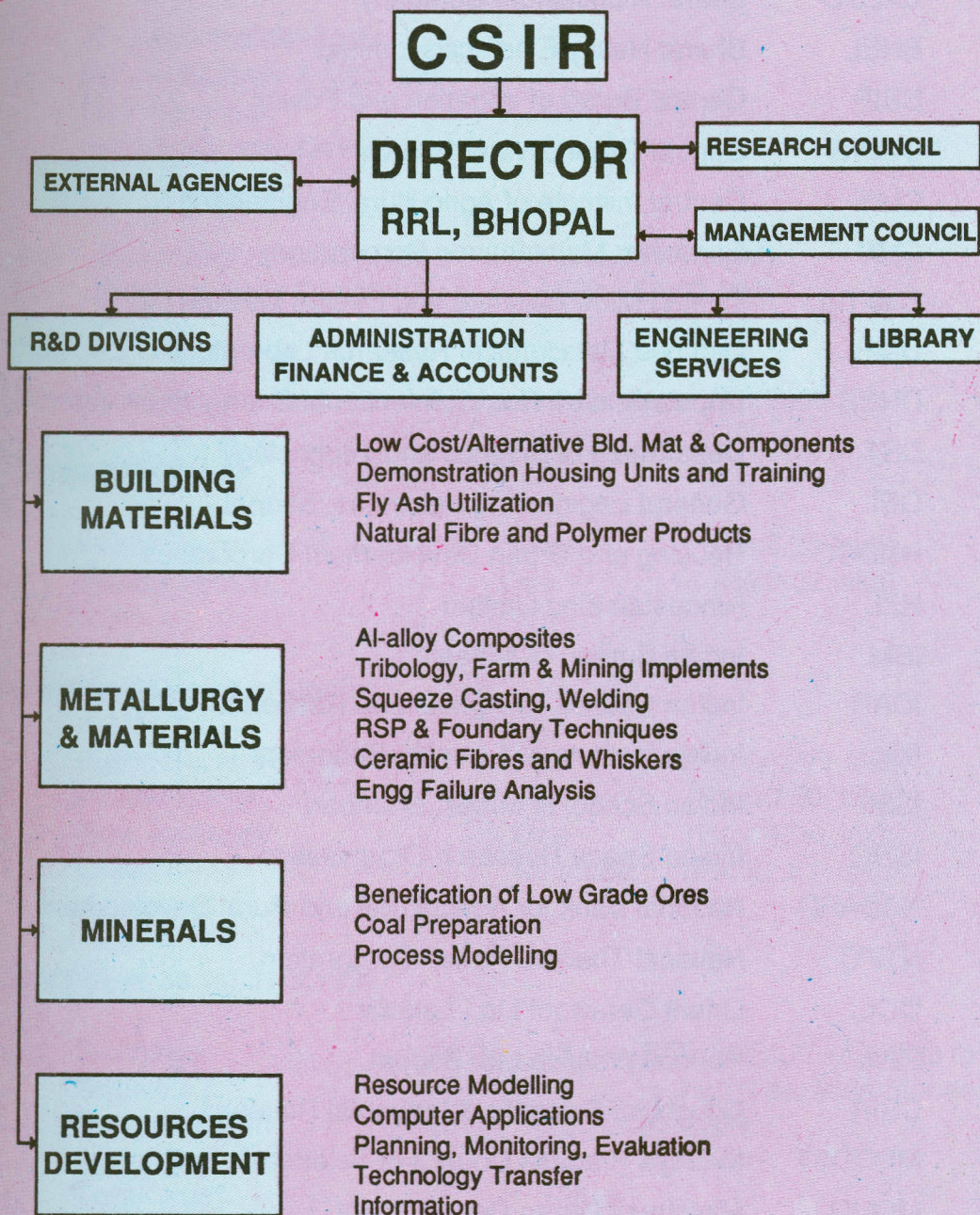


REGIONAL RESEARCH LABORATORY  
BHOPAL

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## ORGANIZATION CHART



## LIST OF ABBREVIATIONS USED

BALCO	Bharat Aluminium Company
BHEL	Bharat Heavy Electricals Limited
CBIP	Central Board of Irrigation and Power
CGWB	Central GroundWater Board
CIAE	Central Institute of Agricultural Engineering
CMC	Computer Maintenance Corporation
CMPDIL	Central Mine Planning and Design Institute Ltd.
DMRL	Defence Metallurgical Research Laboratory
DNES	Department of Non Conventional Energy Sources
DST	Department of Science and Technology
GEI	General Engineering Industries, Bhopal
HUDCO	Housing and Urban Development Corporation
HZL	Hindustan Zinc Limited
IBM	Indian Bureau of Mines
ICAR	Indian Council for Agricultural Research
IISc	Indian Institute of Science, Bangalore
ISM	Indian School of Mines, Dhanbad
ISRO	Indian Space Research Organisation
NABARD	National Bank for Agricultural and Rural Development
NTPC	National Thermal Power Corporation
OCL	Orient Cerawool Ltd. Lakhtar
PWL	Permal Wallage Ltd. Bhopal
CSIR	Council of Scientific & Industrial Research
MPCOST	Madhya Pradesh Council of Science & Technology
MOUD	Ministry of Urban Development

## RRL BHOPAL AT GLANCE

### R&D Divisions

- (i) Building Materials
- (ii) Metallurgy & Materials
- (iii) Minerals
- (iv) Resources Development

ECF* Committed since Jan.1990	-	<b>Rs.115.00 lakh</b>
ECF* Realised since Jan.1990	-	<b>Rs. 54.00 lakh</b>

### Number of Externally funded Assignments since Jan.1990

#### Consultancy

Public Sector, Govt. Agencies	Seven	(Rs.8.25 lakh)
Private Sector	One	(Rs.0.32 lakh)

#### Sponsored/Joint projects

Public Sector	Four	(Rs. 08.277 lakh)
Private Sector	Two	(Rs. 10.50 lakh)
Govt Agencies	One	(Rs. 04.98 lakh)
Grant-in-Aid	Nineteen	(Rs. 82.81 lakh)

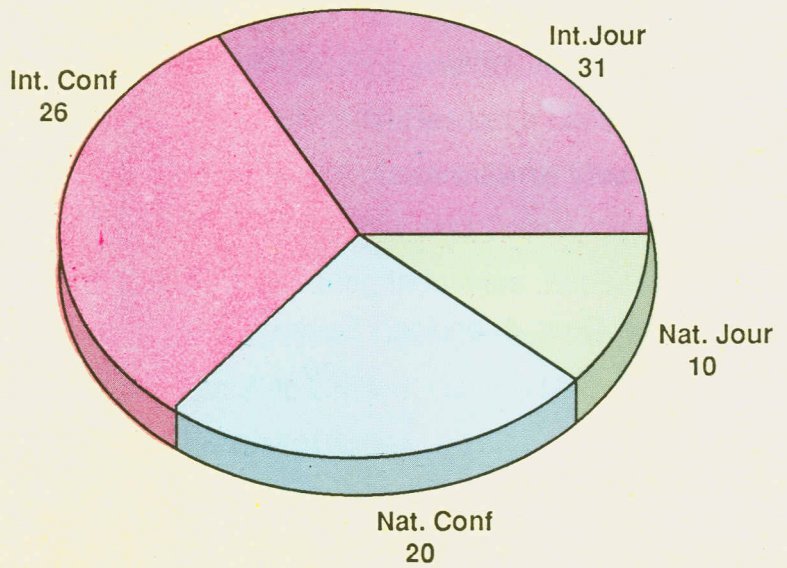
#### Manpower as on 31.3.1992

Scientists	Gr IV	43	Ratio of Gr.IV + Gr.III to the rest $\cong$ 1:1 as recommended by CSIR
Scientific & Technical Staff	Gr III	20	

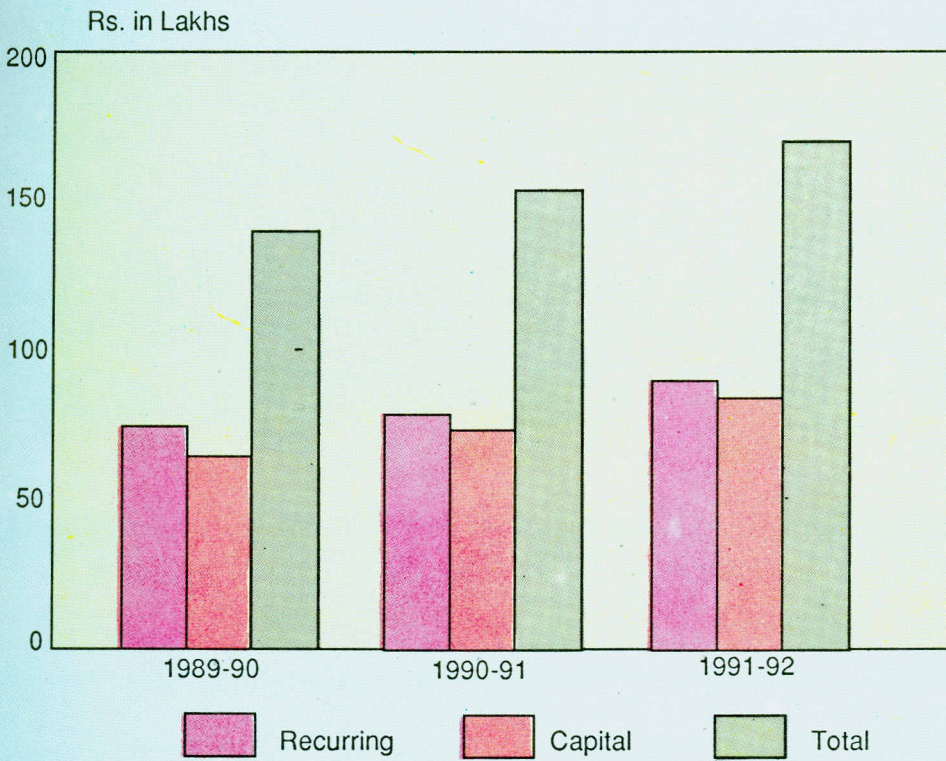
**Total staff** **125**

\*ECF - External Cash Flow

Publications by RRL Scientists 91-92



### Budget & Expenditure



## OUR LINKAGES

To ensure user involvement from inception to various stages of development, RRL undertakes contract research projects, consultancy and other technical services of Govt. Agencies, industry, public undertakings and institutions. Some of our active linkages are mentioned below:

### **Central Govt. Deptts. Agencies and Institutions**

Dept of Mines, Indian Bureau of Mines, DST, Ministry of Urban Development, HUDCO, ISRO, DMRL, ICAR, CIAE, CGWB, NABARD, IISc, ISM,

### **MP State**

MPCOST, MP State Mining Corpn., State Water Resources Deptt. Dist Administration in Tribal Regions.

### **Industrial Sector including PSE's, private and local industry**

BHEL, BALCO, CMPDIL, DMRL, NTPC, HZL, CMC, TISCO, M/s OCL Ltd., M/s PWL, Bhopal, M/s GEI, Bhopal

**DIRECTOR'S REPORT**

निदेशकीय



Prof. T.C.Rao

## DIRECTOR'S REPORT

### PREAMBLE

It is a great privilege to present this progress report of Regional Research Laboratory, Bhopal which covers a period from January, 1991 to March, 1992. During this period, the Laboratory has sustained a steady growth rate in terms of its R&D activities and infrastructure development which was essential to provide a guided momentum and consolidate the organisational strengths. This was particularly so after the post 1989-90 period, when most of the much needed support, guidance and directives were forthcoming with abundance and certainty. Thus a conscious effort was made to galvanise the Laboratory into a vibrant and responsive set up. It is heartening to report that these efforts have started yielding results and would have a long term bearing on the future of the Laboratory.

The hallmark of the Laboratory activities during the period is the successful credibility building phase as evidenced by a large number of externally funded assignments. Till recent years the external cash flow (ECF) had aggregated to about Rs.10.00 lakhs since the inception of the Laboratory. From January, 1990 the ECF (sanctioned and committed) has increased to over Rs.100.00 lakhs though the strength of scientists has hovered around forty.

### R&D HIGHLIGHTS

As mentioned earlier (Progress Report-1990), the Laboratory structured the R&D programmes under the following four Divisions:

- *Building Materials*
- *Metallurgy & Materials*
- *Minerals*
- *Resources Development*

A salient feature has been the shift towards user involvement through Memorandums of Understanding (MoUs). Three such MoUs were executed during the period.

While details of the R&D projects are covered elsewhere in this report some significant developments are highlighted in the subsequent sections.

### ● Building Materials

RRL carried out studies on alternate/low cost components like sisal cement roof sheets, hollow/solid cement concrete blocks, clay flyash bricks, stabilized mud blocks, mud polymer door panels etc. These materials developed by the Laboratory were used in the construction of **low cost demonstration houses** in and around Bhopal.

The **Clay - Flyash Brick manufacturing technology** reports were submitted to NTPC Rihand Nagar and NTPC Korba after laboratory trials of their respective site samples.

One of the main thrusts of activities in this area relates to :

- *Training in the area of Building Materials for Low Cost Housing,*
- *Improvement of rural economy in housing sector through R&D on locally available materials by using them as low cost building materials.*

RRL is playing a very active role in the area of training-cum-demonstration programmes for rural masses. At the same time training programmes were conducted for Graduate Engineers & Diploma Holders in Civil Engineering to promote RRL technologies at district level with joint collaboration of CBRI Roorkee and CSIR Poly-technology Transfer Centre Bhopal.

### ● Metallurgy and Materials

The Laboratory and Bharat Heavy Electricals Ltd., Bhopal, have strengthened their active collaboration and work was carried out on four assignments during the period. Improvement on welding of ETP Copper short circuit rings used in AC machines has resulted in the development of a unique welding process based on modified weld-joint design. This process, targeted to achieve zero defect welding, has **proved successful in the shop production.**

Studies on bonding characteristics of white metal pad to mild steel in thrust bearings were completed and **demonstration trials** are being undertaken in BHEL.

A Memorandum of Understanding was signed amongst RRL Bhopal, BHEL Bhopal and M/s Permal Wallase Ltd. Bhopal, for the development of new fibre glass reinforced plastic material for **gear cases of traction motors.**

The Laboratory successfully completed the work for M/s General Engineering Industries, Bhopal, an ancillary to BHEL, which has led to improved and **internationally competitive** 'G' finned heat exchanger tubes.

Similarly, the Laboratory has entered into technical collaboration with M/s Orient Cerawool Ltd. (a licensee of M/s Premier Refractories & Chemicals, USA) for the development of semi-commercial process for manufacture of porous **ceramic fibre preforms**.

### ● Minerals

Encouraging results have been obtained on **Beneficiation of Siliceous Rock Phosphate** from Hirapur in M.P.  $P_2O_5$  content upto 30% (from as low as 10-12%) and  $SiO_2$  content reduction to less than 10% have been possible. Pilot plant trials are being planned with the association of Indian Bureau of Mines, Nagpur. Dept. of Mines and M.P. Council of Science & Technology are funding this project.

**TISCO, Jamshedpur** has sponsored a project on 'Modelling and performance of Vorsyl separator' for coal beneficiation.

The advisory consultancy assignment for Computer Maintenance Corporation, Calcutta, was completed.

### ● Resources Development

Resources Development Division of RRL is presently carrying out **Groundwater Modelling Studies on Tawa Command Area in Hoshangabad District**. Two field surveys were completed in the command area with a view to identify waterlogged areas and suggest suitable schemes for solving the waterlogging problems based on aquifer characteristics. This work is being carried out in association with M.P. State Water Resources Dept. and Central Ground Water Board. The Division is exploring avenues for interaction with some overseas Institutions in this area of activity.

## SOCIETAL MISSIONS

RRL has completed a series of programmes in tribal areas including training of artisans and on-site demonstration of **RRL's improved technology of bell metal castings**. Presently the Laboratory is carrying out work on improvement of **traditional blacksmithy techniques, in vogue in tribal areas**.

Support to metal based industries in tribal regions, extension activities in low cost housing and natural resources data management system at block level (with village as a unit) are the proposed activities which reflect the aspirations of RRL Bhopal in fulfilling its mandate to cater to **regional S&T needs**.

## INFRASTRUCTURE AND CAMPUS DEVELOPMENT

Efforts were made to strengthen the S&T base and augment the general infrastructure in order to sustain the initiatives for attracting newer projects, and to alleviate pressure on the available Laboratory space and services respectively.

Main additions to major R&D facilities included mineral processing equipment like Hydrocyclone test rig, Heavy medium cyclone test rig, Column flotation etc. Some sophisticated equipment like XRD, SEM, Tribology Labs. were updated. A unit for XRD analysis has been added to the existing XRD unit. A computerised hysteresis graph characterisation of magnetic materials has been installed.

Library and associated services were extended with emphasis on procurement of literature/reprints through computer based searches and email, thus effecting economy.

Some of the new works in progress and or nearing completion are

*Extension of Foundry Shed*

*Installation of a sub-station*

*Water supply and laying of underground LT power cable in the building complex and rewiring phase-II*

*Construction of 16 Scientists' Apartments and ancillary works Horticulture tree plantation.*

## OTHERS

During the year 1991-92, CSIR planned to conduct six Lead Conferences spread across the country. It is heartening to report one of the most significant events during the year was the **CSIR Golden Jubilee Lead Conference on 'Science & Society'** held in December 1991 at RRL, Bhopal. This in fact was a recognition by CSIR of the important role that the Laboratory has to play in the region. The Conference was a unique event in the State of Madhya Pradesh and eminent Scientists, technologists, planners and academicians participated and deliberated on the theme of the Seminar. Held under the joint auspices of M.P. Council of Science & Technology, the Conference truly bore manifestations of the linkages amongst research Laboratories, Govt. Depts./ agencies, voluntary organisations etc.

During this conference discussions were held by Dr. S.K. Joshi, Director of CSIR, with the Hon'ble Chief Minister M.P., Shri Sunderlal Patwa to identify action plan for application of S&T solutions to problems of tribal/backward region of the state, particularly Bastar District. DGSIR has identified RRL to coordinate these activities with other CSIR Laboratories. Dr. B.D. Tilak, Former Director, NCL, Pune has kindly consented to prepare an action plan.

A close cooperation and support from the M.P. State Govt. has been a salient feature of the year. It is gratifying to report that His Excellency the Governor of M.P. Shri Kunwar Mehmood Ali Khan, Hon'ble Chief Minister of M.P. Shri Sunderlal Patwa, Hon'ble Minister of State for Science & Technology Shri B.M. Agrawal, Secretaries and Senior Officers of M.P. State Govt. visited RRL, Bhopal.

RRL hosted three important seminars during this period viz., '**Workshop on Recent Advances in Water Resources Management**', '**National Convention of Electrochemists**', and '**R&D Needs of Metallurgical Industries in M.P.**' In addition, a large number of invited lectures and internal seminars were conducted. Research publications in prestigious journals and conferences, patent applications, testing and analytical services and trainings have helped to sustain a professional outlook of the Laboratory.

A very distinguished Research Council, Chaired by Dr. P. Rama Rao, Secretary, DST, provided guidance and directions. The activities of CSIR Technology Advisory Board (TAB) Materials Sciences & Technology are now being coordinated at RRL, Bhopal.

The support from Dr. S.K. Joshi, DGSIR, and CSIR Headquarters, the Research Council and the M.P. State Govt. agencies is gratefully acknowledged. A very encouraging feature has been a close interaction with M.P. State Depts. and agencies. This has been mainly possible due to continued support by Dr. D.N. Misra, Director General, M.P. Council of Science & Technology. Seed support to many S&T programmes of relevance to regional development was extended by the Council.

The scientists and staff of the Laboratory combined vigour and dedication in achieving high professional standards, progress and growth of the Laboratory.



Prof. T.C.Rao  
Director, RRL, Bhopal

## निदेशकीय

### भूमिका

जनवरी, 1991 से मार्च, 1992 की अवधि की प्रगति रिपोर्ट प्रस्तुत करना अत्यधिक का विषय है। इस अवधि में प्रयोगशाला ने अनुसंधान एवं विकास गतिविधियों तथा आधारभूत के विकास के संदर्भ में एक नियत विकास-दर कायम रखी है, जो कि एक नियंत्रित गति प्राप्त संस्थागत क्षमता के दृढ़ीकरण के लिए अत्यावश्यक था। ऐसा विशेष रूप से 1989-90 के बाद में था, जबकि अधिकांश वांछित सहयोग, सुझाव एवं दिशानिर्देश प्रयाप्त मात्रा में प्राप्त हो सके। वजह से प्रयोगशाला को एक जीवंत तथा उत्तरदायी संस्था के रूप में विकसित करने का सकेन्द्रित किया गया। यह प्रसन्नता का विषय है कि इन प्रयासों के परिणाम प्राप्त होने शुरू हो गये हैं, जो कि भविष्य पर स्थायी प्रभाव छोड़ेंगे।

इस अवधि में प्रयोगशाला की गतिविधियों का उल्लेखनीय चरण एक विश्वसनीयता की स्थापना है, जिसका प्रमाण बाहरी संस्थाओं द्वारा बड़ी संख्या में प्रायोजित परियोजनाओं में मिल सकता है। प्रयोगशाला के प्रारंभ से अभी हाल ही के वर्षों तक बाहरी धन प्रवाह कुल मिलाकर 10.00 लाख रु. था। जनवरी, 1990 के बाद बाहरी धन प्रवाह बढ़कर 100.00 लाख अधिक हो गया, जबकि वैज्ञानिकों की संख्या चालीस के आसपास थी।

### अनुसंधान एवं विकास गतिविधियाँ

जैसा कि पहले भी उल्लेख किया जा चुका है (प्रगति-रिपोर्ट, 1990), अनुसंधान एवं क्षेत्र में प्रयोगशाला चार विभागों के अंतर्गत कार्यरत है :—

- भवन-निर्माण - सामग्री
- धातुविज्ञान एवं सामग्री
- खनिज
- संसाधन-विकास

मेमोरेण्डा ऑफ अंडरस्टैंडिंग के माध्यम से उपभोक्ताओं से सम्पर्क के प्रति झुकाव एक महत्वपूर्ण है। इस अवधि में इस प्रकार के तीन अनुबंध कार्यान्वित किए गए।

अनुसंधान एवं विकास परियोजनाओं का विस्तृत विवरण इस रिपोर्ट में आगे उपलब्ध होगा। कुछ महत्वपूर्ण गतिविधियों को यहाँ रेखांकित किया जा रहा है।

### ● भवन - निर्माण - सामग्री

क्षेत्रीय अनुसंधान प्रयोगशाला ने सिसल-सीमेन्ट छत की चादरों, खोखले/ठोस सीमेन्ट कॉन्क्रीट ब्लॉकों, मिट्टी-फ्लाय एश की ईंटों, मजबूत गारे के ब्लॉकों, रेड मड-पॉलीमर दरवाजे के पैनेलों इत्यादि स्थानापन्न/कम लागत की भवन-निर्माण-सामग्री पर अनुसंधान कार्य किया है। प्रयोगशाला द्वारा विकसित यह सामग्री क्षे.अ.प्र., भोपाल में एवं आस-पास निर्मित कम लागत के प्रदर्शन भवनों के निर्माण में प्रयुक्त की गयी है।

मिट्टी-फ्लाय एश की ईंटों के निर्माण की प्रौद्योगिकी की रिपोर्ट एन.टी.पी.सी रीहन्द नगर एवं एन.टी.पी.सी कोरबा को उनके संबंधित साइट सैम्पल के प्रयोगशाला परीक्षण के उपरांत सौंप दी गयी है। इस क्षेत्र में महत्वपूर्ण गतिविधियाँ हैं :

- कम लागत के भवन-निर्माण के क्षेत्र में प्रशिक्षण।
- स्थायी रूप से उपलब्ध सामग्री पर अनुसंधान कर उसे कम लागत की भवन-निर्माण-सामग्री के रूप में विकसित करके भवन-निर्माण के क्षेत्र में ग्रामीण आर्थिकी का विकास।

क्षे. अ. प्र. की ग्रामीण जनता के लिए प्रशिक्षण-सह-प्रदर्शन कार्यक्रम की दिशा में महत्वपूर्ण भूमिका है। साथ ही केन्द्रीय भवन अनुसंधान संस्थान, रुड़की तथा बहुप्रौद्योगिकी हस्तांतरण केन्द्र, भोपाल की सहायता से प्रयोगशाला ने जिला स्तर पर क्षे. अ. प्र. द्वारा विकसित प्रौद्योगिकी के प्रचार-प्रसार हेतु अभियंताओं तथा सिविल इंजीनियरिंग के डिप्लोमाधारियों के लिए प्रशिक्षण कार्यक्रम भी आयोजित किए।

### ● धातुविज्ञान एवं सामग्री

भारत हेवी इलेक्ट्रिकल्स लिमिटेड एवं प्रयोगशाला के बीच सक्रिय सहयोग रहा और दोनों ने आपसी सहयोग से इस वर्ष चार परियोजनाओं पर कार्य किया। ए.सी. मशीनों में प्रयुक्त की जाने वाली ई.टी.पी. कॉपर शॉर्ट सर्किट रिंग्स की वेल्डिंग में विकास से विकसित वेल्ड जॉइंट डिजाइन पर आधारित नवीन वेल्डिंग प्रक्रिया विकसित हुई है। यह नई विधि, जिसे बिना किसी कमी के पूरा करने के लिए प्रयुक्त किया गया था, बिक्री हेतु उत्पादन में सफल हुई है।

ग्रस्ट बियरिंग्स में माइल्ड स्टील एवं व्हाइट मेटल पैड के बीच बाँडिंग के गुणों का अध्ययन पूरा हो गया है और बी. एच. ई. एल. द्वारा प्रदर्शन ट्रायल लिए गए हैं।

क्षे. अ. प्र., भोपाल, वी. एच. ई. एल., भोपाल एवं मेसर्स परमाली वैलेस लिमिटेड, ट्रेक्शन मोटर के गियर केस हेतु नई फाइबर ग्लास रीइनफोर्स्ड प्लास्टिक सामग्री के विकास मेमोरेण्डम ऑफ अंडरस्टैंडिंग भी हस्ताक्षरित किया गया।

प्रयोगशाला ने मेसर्स वी. एच. ई. एल., की सहायक संस्था मेसर्स जनरल इंजीनियरिंग भोपाल का कार्य भी सफलतापूर्वक पूरा किया है, जिसके परिणामस्वरूप अंतर्राष्ट्रीय मुकाबले हीट एक्सचेंजर ट्यूब का विकास किया गया।

इसी प्रकार प्रयोगशाला छिद्रयुक्त सिरामिक फाइबर प्रिफॉर्म के निर्माण की अर्धव्यापक के विकास हेतु मेसर्स ओरिएन्ट सेरवूल लिमिटेड (मेसर्स प्रीमियर रिफ्रेक्टरीज एण्ड केमिकल्स की लाइसेंसधारी) के साथ सहयोग कर रही है।

### ● खनिज

मध्यप्रदेश के हीरापुर से प्राप्त सिलिकायुक्त रॉक फॉस्फेट के सज्जीकरण पर उत्साह प्राप्त हुए हैं। इसमें  $P_2O_5$  की मात्रा 30% तक (10-12% की कम मात्रा से) एवं  $SiO_2$  की मात्रा से भी कम प्राप्त करना संभव हुआ। इस संबंध में इंडियन ब्यूरो ऑफ माइन्स, नागपुर के सहयोग से प्रूफ परीक्षण नियोजित किए जा रहे हैं। खनिज विभाग एवं म. प्र. विज्ञान एवं प्रौद्योगिकी विभाग परियोजना को प्रयोजित कर रहे हैं।

टिस्को, जमशेदपुर ने कोयला सज्जीकरण के लिए "बोरसाइल सेपरेटर की मॉडलिंग एवं परियोजना प्रायोजित की है।

कम्प्यूटर मेन्टेनेन्स कारपोरेशन, कलकत्ता का भी एक परामर्श कार्य पूरा किया गया।

### ● संसाधन - विकास

क्षे.अ.प्र. का संसाधन-विकास विभाग वर्तमान में होशंगाबाद जिले के तवा कमांड एरिया में मॉडलिंग अध्ययन पर कार्यरत है। कमांड एरिया में पानी के जमाव के क्षेत्रों की पहचान तथा पर आधारित पानी के जमाव की समस्याओं को सुलझाने हेतु उपयुक्त योजनाएं सुझाने के लिए सर्वे किए गए। यह कार्य जल-संसाधन विभाग, मध्यप्रदेश शासन तथा केन्द्रीय भूजल बोर्ड के सहयोग से किया जा रहा है। यह विभाग इस कार्यक्षेत्र में किसी विदेशी संस्था से संपर्क की संभावनाएं देख रहा है।

## समाजोन्मुख कार्य

इस वर्ष क्षे.अ.प्र. ने आदिवासी इलाकों में कई कार्यक्रम, जैसे क्षे. अ. प्र. की बेल मेटल कास्टिंग की विकसित प्रौद्योगिकी का इसी स्थान पर प्रदर्शन एवं कलाकारों को प्रशिक्षण सम्पन्न किए। वर्तमान में प्रयोगशाला आदिवासी क्षेत्रों में प्रचलित लोहारी की परंपरागत तकनीक के विकास पर कार्यरत है।

आदिवासी इलाकों में धातु-आधारित उद्योगों को सहयोग, कम लागत के भवन-निर्माण के प्रसार एवं प्राकृतिक संसाधनों के आँकड़ों की ब्लॉक स्तर पर (ग्राम एक इकाई के रूप में) प्रबंधन व्यवस्था इत्यादि प्रस्तावित गतिविधियों में क्षेत्रीय अनुसंधान एवं विकास आवश्यकताओं की आपूर्ति की क्षे. अ. प्र. की आकांक्षा स्पष्ट देखी जा सकती है।

## आधारभूत सुविधाएं एवं परिसर विकास

नई परियोजनाओं को आकर्षित करने एवं उपलब्ध प्रयोगशाला कार्य स्थान तथा सुविधाओं पर पड़ने वाले दबाव को कम करने हेतु विज्ञान एवं प्रौद्योगिकी तथा सामान्य आधारभूत ढाँचे को मजबूत करने के प्रयास किए गए।

अनुसंधान एवं विकास सुविधाओं की वृद्धि में खनिज परिष्करण उपकरण जैसे- हायड्रोसायक्लोन टेस्ट रिग, हैवी मीडियम सायक्लोन टेस्ट रिग, कॉलम फ्लोटेशन इत्यादि शामिल हैं। कुछ परिष्कृत उपकरणों जैसे- एक्स आर डी, स्कैनिंग इलेक्ट्रॉन माइक्रोस्कोप, ट्राइबॉलॉजी प्रयोगशाला इत्यादि का आधुनिकीकरण किया गया। एक्स आर डी में टेक्सचर विश्लेषण के लिए एक अतिरिक्त इकाई का समावेश किया गया।

चुम्बकीय सामग्री के गुण-निर्धारण के लिए एक कम्प्यूटरीकृत हिस्टरसिसग्राफ की स्थापना की गयी।

पुस्तकालय एवं अन्य सहयोगी सुविधाओं को रीप्रिंट्स/साहित्य की कम्प्यूटर के माध्यम से प्राप्ति तथा इलेक्ट्रॉनिक मेल के प्रयोग पर बल देने की दृष्टि से विकसित किया गया।

कुछ नए प्रगतिरत एवं सम्पूर्ण होने के करीब पहुँचे कार्य इस प्रकार हैं:

फाउन्ड्री शेड का विस्तार

सब-स्टेशन की स्थापना

जल-प्रदाय एवं भवनों में भूमिगत एल टी पावर केबल डालना एवं रीवायरिंग चरण II

16 साइन्टिस्ट्स अपार्टमेंट्स का निर्माण एवं सहायक कार्य

बागवानी एवं वृक्षारोपण

## अन्य

वर्ष 1991-92 में वैज्ञानिक एवं औद्योगिक अनुसंधान परिषद् ने पूरे देश भर में 6 प्रमुख आयोजित करने का निर्णय लिया। यह उल्लेख अत्यंत उल्लास का विषय है कि दिसम्बर, 1991 में सम्पन्न “विज्ञान एवं समाज” विषयक सी. एस. आई. आर. स्वर्ण-जयंती-समारोह की प्रमुख वर्ष के सर्वाधिक महत्वपूर्ण अवसरों में से एक थी। वास्तव में यह क्षेत्र के विकास में प्रयोगशाला की भूमिका को सी. एस. आई. आर. द्वारा दी गयी मान्यता थी। यह संगोष्ठी मध्यप्रदेश राज्य में एक आयोजन थी और इसमें महत्वपूर्ण वैज्ञानिकों, प्रौद्योगिकीविदों, नियोजकों एवं शिक्षाविदों ने विमुख्य विषय पर विचार-विमर्श किया। सी. एस. आई. आर. तथा म. प्र. विज्ञान एवं प्रौद्योगिकी के संयुक्त तत्वाधान में आयोजित इस संगोष्ठी में वास्तव में अनुसंधान प्रयोगशालाओं, शासकीय एजेंसियों, स्वयंसेवी संस्थाओं के बीच विज्ञान एवं प्रौद्योगिकी सम्पर्क का विचार निहित था।

इस संगोष्ठी के दौरान परिषद् के महानिदेशक डॉ.एस.के. जोशी ने राज्य के आदिवासी इलाके, विशेषकर बस्तर जिले की समस्याओं के समाधान हेतु विज्ञान एवं प्रौद्योगिकी के प्रयोजन एक्शन प्लान तैयार करने के संदर्भ में प्रदेश के मुख्यमंत्री माननीय श्री सुन्दरलाल पटवा से चर्चा के महानिदेशक डॉ.एस.के. जोशी ने क्षे. अ. प्र. भोपाल को अन्य सी. एस. आई. आर. प्रयोगशाला सहयोग से इस कार्य को कार्यान्वित करने का दायित्व सौंपा। राष्ट्रीय रासायनिक प्रयोगशाला, पुणे निदेशक डॉ.बी. डी. तिलक ने एक्शन प्लान तैयार करने की स्वीकृति दी है।

मध्यप्रदेश शासन का सक्रिय सहयोग इस वर्ष का उल्लेखनीय बिन्दु है। यह अत्यधिक विषय है कि इस वर्ष मध्यप्रदेश के महामहिम राज्यपाल श्री कुँवर महमूद अली खान, मध्यप्रदेश मुख्यमंत्री श्री सुंदरलाल पटवा, मध्यप्रदेश के विज्ञान एवं प्रौद्योगिकी राज्यमंत्री श्री बृजमोहन मध्यप्रदेश शासन के अनेक सचिव एवं वरिष्ठ अधिकारी प्रयोगशाला आ चुके हैं।

इस अवधि में क्षे. अ. प्र. ने - “जल-संसाधन प्रबंधन में नये विकास पर कार्यशाला रासायनशत्रियों का राष्ट्रीय अधिवेशन” एवं “मध्यप्रदेश स्थित धातुवैज्ञानिक उद्योगों की विकास आवश्यकताएं” विषयों पर तीन महत्वपूर्ण गोष्ठियाँ आयोजित कीं। इसके अतिरिक्त में आमंत्रित व्याख्यान एवं आंतरिक गोष्ठियाँ आयोजित की गयीं। विभिन्न प्रतिष्ठित शोध-पत्रिका पत्रों के प्रकाशन, गोष्ठियों, पेटेंट आवेदन, परीक्षण एवं विश्लेषण सेवाएं तथा प्रशिक्षण प्रयोगशाला के व्यावसायिक दृष्टिकोण को बनाए रखने में सहायता की है।

डॉ.पी.रामाराव, सचिव, विज्ञान एवं प्रौद्योगिकी विभाग की अध्यक्षता में स्थापित अल्प अनुसंधान परिषद् ने प्रयोगशाला को दिशानिर्देश दिया। सी. एस. आई. आर. प्रौद्योगिकी परामर्श विज्ञान एवं प्रौद्योगिकी के क्रियाकलाप का समन्वयन अब क्षे. अ. प्र., भोपाल से ही किया

हम डॉ.एस.के. जोशी, महानिदेशक, वैज्ञानिक एवं औद्योगिक अनुसंधान परिषद, सी. एस. आई. आर. मुख्यालय, अनुसंधान परिषद् एवं मध्यप्रदेश शासन की एजेसियों के अत्यंत आभारी हैं। मध्यप्रदेश शासन के विभागों एवं एजेसियों से गहन सम्पर्क हमारे लिए अत्यंत उत्साहवर्धन का विषय रहा है। यह सम्पर्क मुख्य रूप से मध्यप्रदेश विज्ञान एवं प्रौद्योगिकी परिषद् के महानिदेशक डॉ.डी.एन. मिश्र के सतत सहयोग से ही संभव हो सका। क्षेत्रीय विकास के संदर्भ में आयोजित किए जाने वाले कई विज्ञान एवं प्रौद्योगिकी कार्यक्रमों में म.प्र. विज्ञान एवं प्रौद्योगिकी परिषद् ने आधारभूत सहयोग उपलब्ध कराया।

प्रयोगशाला के वैज्ञानिकों एवं अन्य कर्मचारियों ने उच्च व्यावसायिक मानदंडों को प्राप्त करने, प्रगति एवं प्रयोगशाला के विकास के लिए उत्साह एवं समर्पण की भावना से एकजुट होकर कार्य किया है।

टी. सी. राव

प्रो. टी.सी. राव

निदेशक

क्षेत्रीय अनुसंधान प्रयोगशाला

भोपाल



*CSIR Golden Jubilee Lead Conference on Science and Society*



*Session of RC Meeting in Progress*

# BUILDING MATERIALS

THE CITY OF  
SAN FRANCISCO  
DEPARTMENT OF  
PUBLIC WORKS  
CONSTRUCTION  
DIVISION

## PROJECT DETAILS

# BUILDING MATERIALS DIVISION

This Division carried out work on five assignments of a total external funding of Rs.16 Lakhs. Also two in-house projects namely, "Development of red mud polymer composite material for building components" and "Characterisation of sisal fibres under different conditions" were underway for which proposals were sent to Ministry of Urban Development and MPCOST respectively.

The Division interacted with MOUD, HUDCO, NTPC, MPCOST, MP State agencies, and CBRI, Roorkee for ongoing and proposed projects.

**Title** : *Pilot Plant Studies of Sisal Cement Roofing Sheet*  
**Sponsor** : *Ministry of Urban Development*  
**Objective** : *Substitution of health hazardous asbestos fibre by natural fibre (Sisal Fibre) for corrugated roofing elements*

## **Status**

A large number of sisal cement corrugated roofing sheets of various sizes ranging from 1 m to 2.5 m in length and 1 m in width were made and used as roofing element in various low cost houses constructed by RRL under MOUD project and 35 point action plan programme of CSIR.

Comparative studies of sisal fibre cement sheet and asbestos cement sheet were also carried out by measuring their water absorption, breaking load, weathering, water impermeability, acid resistance, frost cracking, deflection, impact strength.

Ratio of cement and sand, to fibre content, water cement ratio, length of chopped fibre, casting pressure, curing time, alkali resistant polymeric coatings and their effect on flexural strength has been studied to arrive at appropriate mix proportion. Typical flexural strength recorded on sheets produced on a 100T hydraulic press are shown on the following Table-1.

**TABLE-1 : Flexural Strength of Sisal Cement Roofing Sheets**

S.No.	Loading Kg/cm <sup>2</sup>	Flexural Strength in Kg/cm <sup>2</sup>	
		7 Days	14 Days
1	2.00	2.90	3.00
2	2.25	2.90	3.06
3	2.50	2.93	3.08
4	2.75	2.98	3.15

**Title** : *Low Cost Cementitious Binder from Red Mud*  
**Sponsor** : *Ministry of Urban Development*  
**Objective** : *Development of economically viable technologies for the m of low cost cementitious binders for construction work*

**Status**

Various samples were prepared and fired at temperatures 700°, 800° and 900°. Samples are being evaluated for their physico-chemico-mechanical properties. Equipment installed include ball mill, testing equipment and kiln for calcining the raw material making pozzolona ash.

**Title** : *Laboratory Trials for the Manufacture of Clay Ash Bricks with NTPC Pond Ash and Flyash*  
**Sponsor** : *National Thermal Power Corporation*  
**Objective** : *Study of characteristics of raw materials and lab scale trials for the manufacture of clay ash bricks*

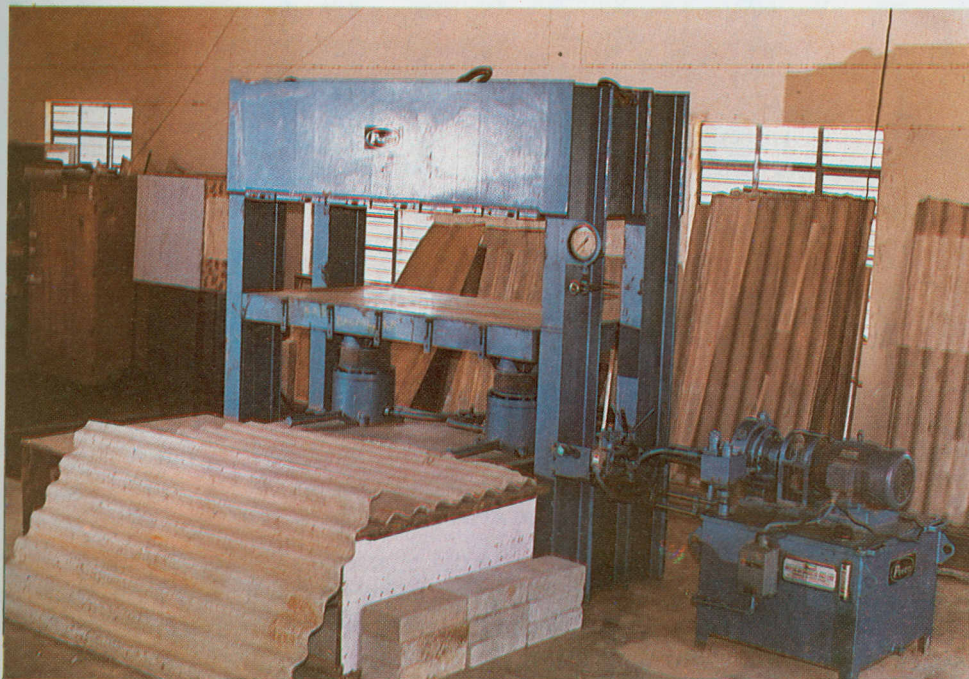
**Status**

NTPC has funded two assignments for utilisation of NTPC pond ash and flyash at Korba and Rihand Nagar for the manufacture of clay ash bricks.

In consultations with NTPC representatives sites for brick plants were identified. Soil and ash samples were analysed for chemical composition, X-ray studies, spectroscopy DTA, Particle size and Plasticity limits. Reports have been submitted for further trials at the respective sites.



*Typical Low-Cost Demonstration Housing Unit*



*Sisal Cement Roofing Sheets Produced on 100T Hydraulic Press*

- Title** : *Development of Red Mud Polymer Composites Material for Building Components*
- Nature** : *Inhouse*
- Objective** : *Development of building material components from natural and red mud reinforced polymer composite*

**Status**

To develop the red mud sisal fibre reinforced building materials composite, interfacial phenomena i.e. bond characteristics between sisal fibre and polymer matrix were investigated and polymeric coatings were developed to improve the interfacial bond.

Some results on bond strength, chemical resistance, weathering, thermal stability and flexural strength are shown in Table-2.

**TABLE-2 : Properties of RMP Composites**

S. No.	Materials	Density	Water absorption	Impact strength	A W I c
		gm/cc	%	j/mm <sup>2</sup>	
1.	Polyester (PE)	1.17-1.19	0.34	0.35	7
2.	PE + Red mud (RM)	1.40-1.43	0.46	0.21	5
3.	PE + RM + fibre chopped (FC)	1.59-1.62	1.00	0.41	6
4.	PE + RM + fibre woven (FW)	1.60-1.63	1.20	0.31	5
5.	PE + FC	1.18-1.20	1.53	0.24	5
6.	PE + FW	1.19-1.21	3.70	-	5
7.	PVC	1.40	1.40	-	8
8.	Wood	0.50-0.60	20-25	-	-

- Title** : *Characterisation of Sisal Fibres under different conditions*
- Nature** : *Inhouse*

**Status**

Experimental results obtained so far on the characterization of sisal fibres indicated that sisal fibres should be classified on the basis of the age of the plant. The values of standard deviation of strength data opens the field to use sisal fibre composites with higher degree of reliability.

Improvement in the mechanical strength of sisal fibres at 80°C was observed. Microstructures of the fibres, fractured at 800°C showed the brittle failure of fibre.

# METALLURGY & MATERIALS DIVISION

This Division was engaged on fourteen assignments of a total external funding of about Rs.34 lakhs. In addition two in-house projects namely, "Development of Zinc-Bromine Batteries" and "Quality upgradation for better performance of critical parts of agricultural machinery" were underway for which proposals were sent to DNES and ICAR respectively.

The Division is presently corresponding with overseas agencies, major organisations/industries like BHEL, HZL, TELCO, CMPDIL and local industries for exploring avenues of interaction in terms of major projects, research support, technical services and such other assignments.

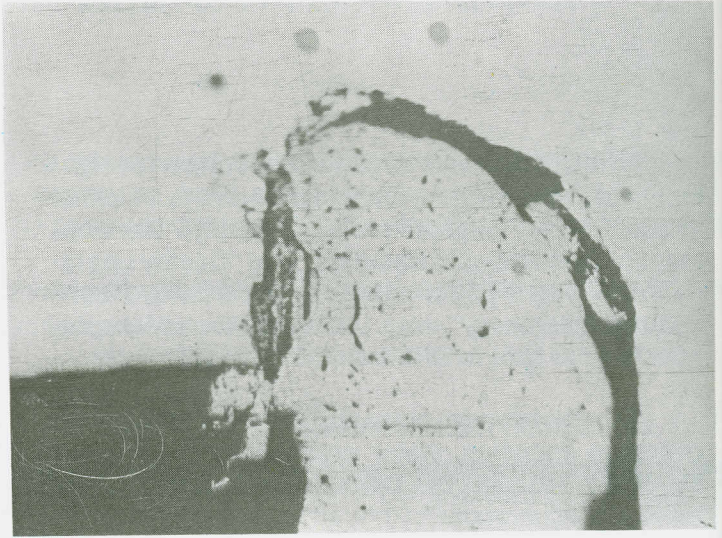
**Title** : *Improving the Quality of 'G' Finned Heat Exchanger Tubes*  
**Sponsor** : *M/s General Engineering Industries, Govindpura, Bhopal*  
**Objective** : *To develop an in-house company standard for the "G" finned heat exchanger tube that would result in improving the quality*

## **Status**

M/s General Engineering Industries (GEI), Bhopal, a manufacturer of 'G' finned heat exchanger tubes entered into a Memorandum of Understanding with the Laboratory, for evaluating the bonding of 'G' fin with the heat exchanger tube through metallographic studies and mechanical properties.

The groove geometry and the dimensions of the groove of the 'G' finned tubes i.e., groove width and groove depth were measured and defects/irregularities such as voids at the interface of fins and the tube were also examined. Bond strength (pull-out load) between fin and tube was evaluated using a modified process suggested by RRL Bhopal (Fig.1 a,b).

This assignment has been successfully completed. As a result M/s GEI can suitably modify the existing technology and improve the quality of 'G' finned heat exchanger tubes to international standards.



*Fig 1 (a) : Voids at the interface between fin and tube*



*Fig 1 (b) : Improved "G" finned tube showing good bonding at interface between fin and tube*

**Title** : *Process Improvement of Welding Annealed Copper Used as Squirrel Cage End Rings for AC Machines*  
**Sponsor** : *Bharat Heavy Electricals Ltd., Bhopal*  
**Objective** : *Improvement in the welding process to reduce rejection to the minimum*

**Status**

Major project work was completed and shopfloor trials using the suggested modifications were carried out (Figs.2 a,b,c). The report is prepared in a format as desired by BHEL. A paper titled *Quality and Productivity Improvement of ETP Copper Welding - An Experimental Study* has been published in BHEL Journal.

**Title** : *Bonding Characteristics of White Metal Pad to Mild Steel in Thrust Bearing*  
**Sponsor** : *Bharat Heavy Electricals Ltd., Bhopal*  
**Objective** : *To study into the causes of debonding of white metal pad to mild steel in thrust bearing especially with ageing and suggest ways and means to alleviate the problem of debonding*

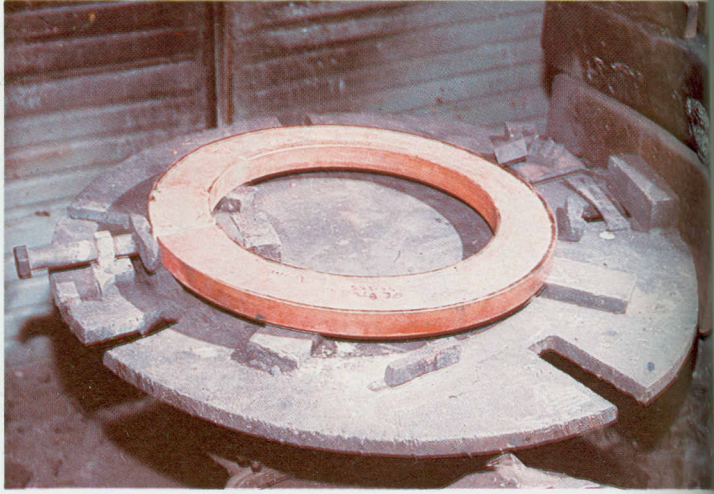
**Status**

Extensive work on tinning and babbiting were carried out on steel samples supplied by BHEL. Processing parameters for tinning and babbiting were established for obtaining good bonding of babbitted steel samples. A number of components in sizes 70 mm x 20 mm x 12 mm and 200 mm x 150 mm x 50 mm were tinned by adopting the new process advised by the Laboratory.

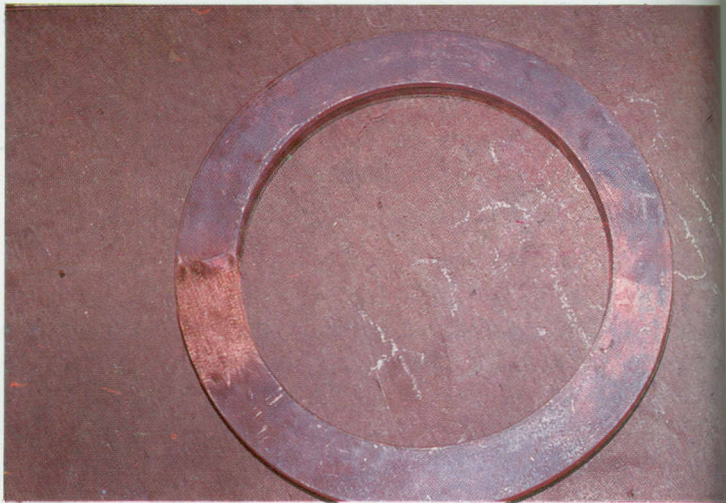
After tinning, babbiting was carried out by casting in a bottom filling/pouring mould designed and fabricated at RRL, Bhopal. Defect free good bonding at the interface of the lining material and steel pad was obtained.

The project has been successfully completed at the laboratory scale. Demonstration of this process at BHEL works is being undertaken.

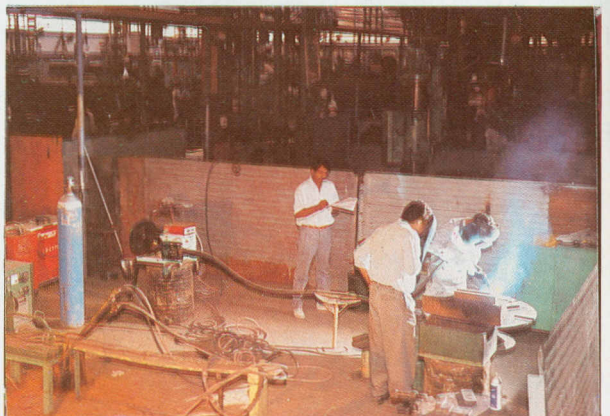
**Title** : *Development of Suitable FRP Material for the Gearcase of Traction Motor and to Make Prototype Gearcases*  
**Sponsor** : *Bharat Heavy Electricals Ltd., Bhopal*  
**Objective** : *To develop/identify FRP material suitable for making prototype gear case for traction motors used by Indian Railways*



*Fig 2 (a) : SC ring just prior to welding*



*Fig 2 (b) : Welded SC ring ready for NDT*



*Fig 2 (c) : Shopfloor trials at BHEL*

**Status**

As mentioned earlier an MoU was entered amongst BHEL, M/s Permali Wallace Ltd, Bhopal and RRL Bhopal. A technical report on development of FRP material was prepared and submitted to BHEL for approval. This report was approved by BHEL, Bhopal. Design of FRP gear case parts was done with the help of BHEL. Drawings of FRP gear case have been handed over to M/s Permali Wallace Ltd. as per MoU.

Next phase of fabrication of gear cases at the works of M/s Permali Wallace Ltd. as per the MoU is being undertaken.

**Title** : *Development of Half Clamp Component by Squeeze Casting Process*  
**Sponsor** : *Bharat Heavy Electricals Ltd., Bhopal*  
**Objective** : *To establish the process of squeeze casting for manufacture of half-clamp initially and to demonstrate the efficacy and advantage of the squeeze casting process over the present practice of permanent mould gravity die casting for manufacture of non-ferrous castings*

**Status**

Steps have been taken to procure of dies required for the experiments. Die designers were called and the drawings were finalised.

After receiving the squeeze casting dies trials are expected to commence for fabrication of the component.

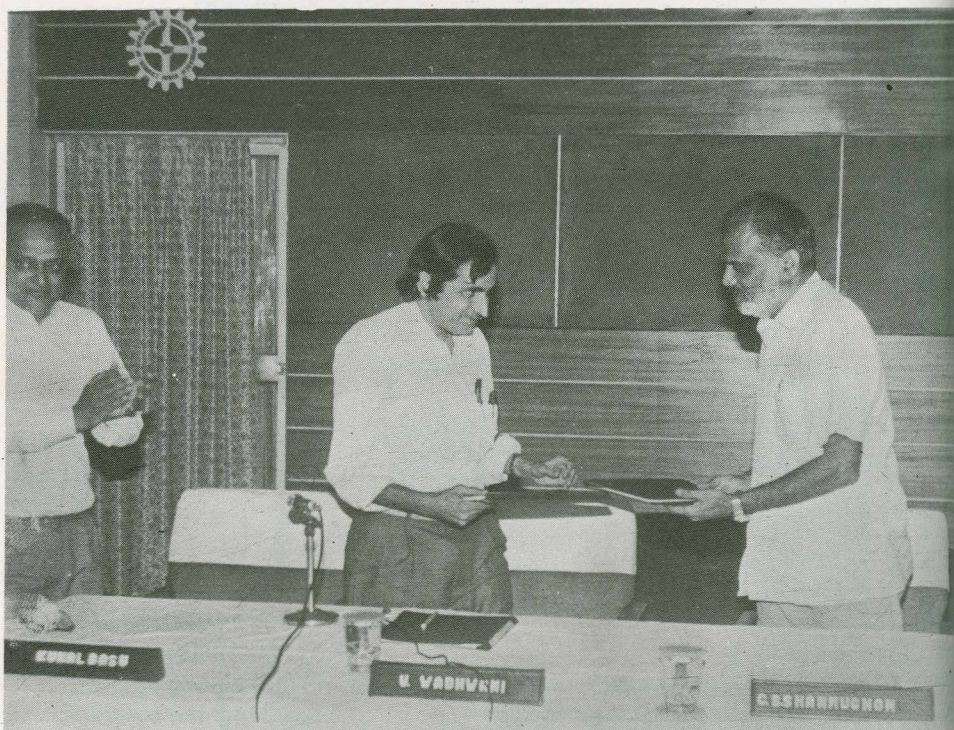
**Title** : *Tensile Properties of Aluminium Alloys at Elevated Temperatures (ISS:617,1975; BSS:LM13)*  
**Sponsor** : *BALCO, Korba*  
**Objectives** : *(i) to evaluate tensile properties of aluminium alloys at different temperatures upto 473 K and  
(ii) to optimise the heat treatment cycles for proved tensile properties at elevated temperatures*

**Status**

Three sets of Al-Si (LM13) alloy, designated as Heat I, II and III were received from BALCO, Korba with various concentration of Ni (0.8 - 1.3%). Aim of the project was to find out the effects of temperature (upto 200C) on the tensile strength of alloys and also to optimise heat treatment cycle for improved mechanical properties. Results showed that the samples made out of Heat. II were found to show superior properties than those of Heat I and



*MoU was signed amongst RRL, BHEL and M/s Permal Wallace Ltd. B for the project on FRP Gea-rcases*



*MoU with M/s Oriental Cerawool Ltd. Lakhtar*

Heat III samples. Heat treatment of Al-Si alloy altered the morphology of eutectic silicon from faceted in cast alloy to near-spherical in heat treated condition. Tensile strength and elongation were found to increase due to heat treatment. Fractograph of as cast alloy revealed well faceted particle appearance resembled to eutectic silicon, while, the fractograph of heat treated alloy revealed smooth silky areas and semi-dimple pattern reflecting the fracture mode to be shifting towards ductile (Figs.3 a,b).

**Title** : *Effect of Inclusion Content on the Mechanical Properties and Deep Drawability of Al-alloys*  
**Sponsor** : *BALCO, Korba*

#### **Status**

Deep drawing is a metal working process in which a flat sheet of material is formed into three dimensional products. This project involved characterisation of various parameters which affect deep drawability of Al-alloy sheets of various thickness. Al alloys, ISS:19000 and ISS:64430 were used in the present investigation. Anisotropic (normal and planar) parameters, inclusion content, size of inclusions, roughness parameters etc were evaluated (Fig.4). The height of the ear was measured by Erichsen cup test.

**Title** : *Development of a Process to Make High Integrity Castings of Aluminium alloy - SiC Particle Composites*  
**Sponsor** : *DMRL, Hyderabad*  
**Objective** : *To develop high integrity castings of Al alloy SiC particle composites using solidification processing techniques*

#### **Status**

A combination of vortex method as well as squeeze casting techniques was adopted to synthesize the castings. Satisfactory metallography and mechanical properties of the composites so prepared, were observed.

Table-3 shows the mechanical properties of the base alloy as well as the composite. The influence of pressurized solidification on the properties can be noted.

**Table -3 Mechanical Properties of Base Alloy and Composite**

	UTS MPa	EI	Hardness BHN
2124 + 1 Mg	175	4.6	95
2124 + Mg + 10%SiC			
Gravity Cast	100	2.0	110
Squeeze Cast	180	3.0	133

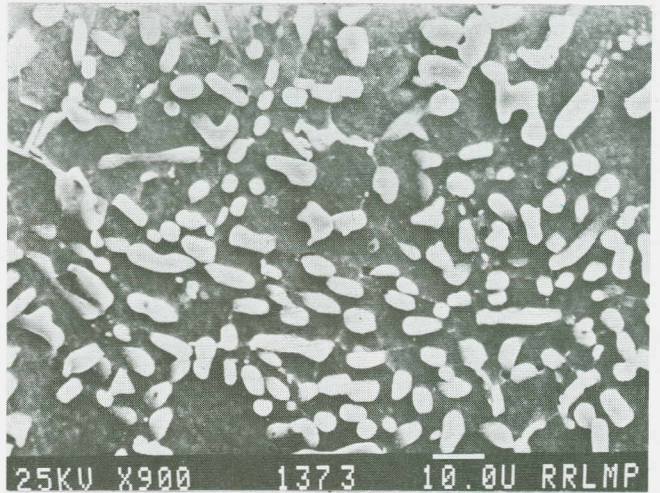


Fig 3 (a) : Near spherical silicon in heat treated Al-Si (LM13) alloy

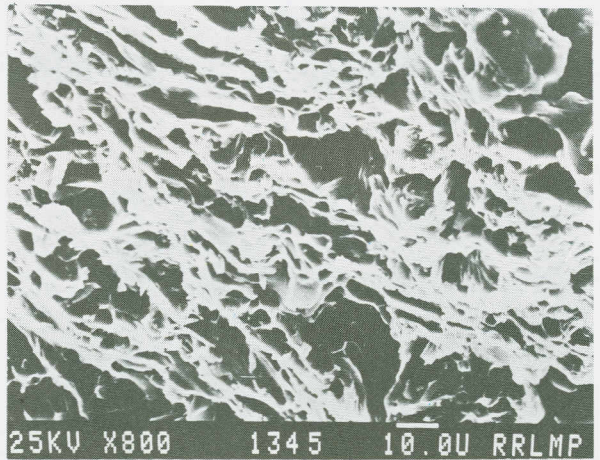


Fig 3 (b) : High temperature (200C) tensile fracture surface of heat treated Al-Si (LM13) alloy

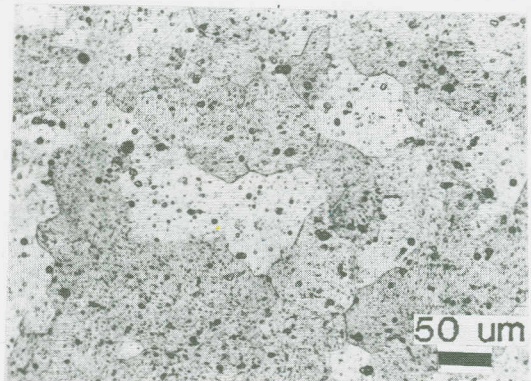


Fig 4 : Micrograph showing distribution of inclusion in Al-alloy (ISS:19000), sample thickness 1.54mm

**Title** : *Utilisation of Bluedust of Bailadila as a Starting Material to Produce Hard Ferrites*  
**Sponsor** : *MPCOST, Bhopal*  
**Objective** : *Assess the feasibility of using bluedust for obtaining excellent magnetic properties*

#### **Status**

A new composition of hard ferrites with the addition of a constituent that promotes liquid phase sintering was prepared. The composition referred to as G.BSF was prepared in a 500 gm lot by mixing the constituents in appropriate proportions, and dry milling was carried out for 10 hours in a steel ball mill. Compacts of diameter 31.68 mm out of the mixture were prepared and calcined at 1050C for two hours in an oxidising atmosphere. The calcined product was again wet milled, mixed and finally made to compacts of diameter 12.70 mm applying load of the order of 7 tonnes in a hydraulic press. The compacts were sintered at temperatures between 1200 to 1250C for different durations maintaining identical heating and cooling cycles throughout the experiment.

Table-4 shows the density and shrinkage properties of the sintered compacts which were examined in both optical and scanning electron microscopes after polishing. Conventional methods of ceramic polishing was undertaken in all the cases.

Preparation of oriented ferrites is in progress by pressing the calcined products in the presence of a magnetic field. For this die and punch assembly are being fabricated.

Mean while one of the manufacturers of hard ferrites M/s Morris, Pune has agreed to prepare some commercial hard ferrite components from the calcined product made by RRL. Two compositions BSF and G.BSF were prepared in 3Kg batches. These materials will be sintered at Pune and evaluated for their magnetic properties.

**Table-4 : Density and Shrinkage properties of G.BSF ferrites**

Sintering Par. Temp./time(m)	Volume Shrinkage %	Density Change %
1200/30	15.48	16.98
1200/60	16.84	19.79
1220//30	16.90	14.06
1220/60	14.72	16.44
1220/120	18.68	21.72
1250/30	20.28	17.34
1250/60	20.39	23.54
1250/120	22.03	26.06

- Title** : *Development of Aluminium Metal Matrix Composite Materials for space Applications*
- Sponsor** : *ISRO*
- Objectives** : *(a) Development of large scale process technology for 2024 Al alloys SiC whisker composite by squeeze infiltration route for enhancement of yield strength and Youngs modulus over the target properties 30% in excess of base metal with the use of combination of work hardening and heat treatment.*  
*(b) To study the possibility of making 2.0 mm thick 2024 Al-SiC sheet by rolling of squeeze infiltrated composites.*

**Status**

Work on development and characterisation of Al-ceramic fibre composite by infiltration process is underway. Alumina- ceramic fibre for the present exploratory later this will be repeated for SiC Whiskers.

A 150 T hydraulic press has been used for experiments and AMMCs of various shapes have been successfully produced (Fig.5). Characterisation of the AMMCs produced has also been undertaken to investigate the process complexities.



*Fig 5 : AMMC with ceramic fibre reinforcement*

Also AA 2024 aluminium alloy and porous preforms made from aluminium silicate fibres have been used as matrix and reinforcing element respectively.

- Title** : *Quality Upgradation of Black Smithy Technology for Rural and Tribal Areas of Madhya Pradesh*
- Sponsor** : *MPCOST, Bhopal*
- Objectives** : *(i) To upgrade the process technology of the rural and tribal Blacksmiths  
(ii) To improve the agricultural tool life by suggesting and demonstrating a simple, scientific way of tool making and heat treatment in order to meet the demands of the farmers*

**Status**

Visits at various places in Damoh and Bastar were undertaken to identify in consultation with MPCOST, Bhopal to understand the process technology and problems associated with this craft. Sample collection for investigation has been completed. Demonstration of improved technique of heat treatment of tool making at the identified sites is being undertaken.

- Title** : *Improvement in Wear Life of Some Farm Implements*
- Sponsor** : *MPCOST, Bhopal*

**Status**

Soil engaging farm implements such as tiller blades, reaper blades etc. fabricated from plain carbon steels fail quite frequently in the field. It has been observed that wear related failures of the components due to the abrasive action of the soil particles are largely responsible for their frequent replacement.

An attempt has been made by RRL to identify the reasons behind the failure of such components and to improve the life span of the same. A range of mechanical properties and microstructure of various grades of steels for fabricating the implements were developed by subjecting them to various heat treatment cycles. Abrasive wear studies of the steels and the components indicated that an appropriate combination of mechanical properties and microstructure is required for a steel to possess good abrasion resistance leading to longer life of the implements. The study is expected to be useful to local manufacturers vis-a-vis users.

- Title** : *Development of Zinc-Bromine Battery*  
**Nature** : *Inhouse*  
**Objective** : *To develop zinc-bromine secondary battery for utility and transportation. In the first phase, 1.0 kWh prototype module will be developed and tested. In the second phase, bigger batteries suitable for wind energy storage and transport ( 25 kWh ) will be developed.*

**Status**

Acetylene black-polymer and indigeneous graphite-polymer composite electrodes have been prepared with varying polymer content and tested for their performance. Deposited zinc is found to be sufficiently adherent to the surface. The conductivity of the electrodes is, however, lower than that of the electrodes prepared from Specpure graphite powder of Johnson Matthey make. The complexing medium for bromine is under study. Simultaneously, it is proposed to prepare carbon felt- graphite-polymer composite electrodes and study its performance as bromine electrode.

# MINERALS DIVISION

Minerals Division was engaged on four assignments and external funding of Rs.37.00 lakhs is committed from the concerned agencies. The Division interacted with Dept. of Mines, Indian Bureau of Mines, GSI, M.P. State Mining Corporation, TISCO, HZL, and CMPDIL, Ranchi.

In addition, three proposals for support under US held rupee funds are at various stages of approvals and envisage interaction with Dept. of Metallurgy, Michigan Technological University, Dept. of Materials & Met. Engg., University of Utah, Henry Krumb School of Mines, Columbia University.

**Title** : *Beneficiation Studies on Low-grade Tin Ore of Madhya Pradesh*  
**Sponsor** : *MPCOST, Bhopal*

## **Status**

The all India recoverable reserves of tin are placed at about 29 MT, most of which are in Bastar district. Tin occurs mainly in two forms - primary and secondary (Colluvial and Alluvial) deposits.

The work carried out so far includes characterisation of pegmatitic sample and the preliminary beneficiation studies on Mozley Mineral Separator. Experiments with pegmatitic ore were carried out on Mozley Mineral Separator using the v-profile tray by varying the levels of tray inclination, water flow-rate and oscillation speed. Similar experiments have been carried out with soil type sample.

The size and size-wise mineral percentages show the presence of more cassiterite in finest size and gangue in coarser size fractions.

Physical observation of the experiment and the weight distribution of the beneficiation tests have shown that in Mozley Mineral Separator tray inclination has more effect on the removal of the gangue minerals followed by oscillation speed and water flow-rates.

**Title** : Beneficiation and Industrial Utilization of Fertilizer Minerals  
**Sponsor** : Dept. of Mines, Govt. of India  
**Objectives** : (i) To develop an economically viable process for beneficiating low grade rock phosphates occurring in MP with a view to wide material base for fertiliser industry

(ii) To find suitability of glauconitic sandstones of MP for potash enrichment of the soils either directly or after recovering potassium in soluble form and develop an economically viable process for its commercial exploitation

## ROCK PHOSPHATE

### Status

#### Dolomitic rock phosphate

The low grade (5.4%  $P_2O_5$ ) dolomite rock phosphate was collected from the help of M.P. State Mining Corporation.

Detailed characterization studies were carried out for chemical analysis, mineral distribution, DTA and XRD.

For beneficiation of the above low grade dolomitic rock phosphate some flotation tests were carried out. The conventional flowsheet for phosphate beneficiating by bulk flotation with sodium silicate and sodium oleate, cleaning and reverse flotation followed. But in this route the grade was not improved significantly (only 7%  $P_2O_5$ ).

A few experiments were also carried out using two-stage conditioning minus 200 mesh sample (Table-5).

The result is quite encouraging because for fertilizer industry more than 10%  $P_2O_5$  is acceptable. Further reduction in MgO in the concentrate may be possible by changing test conditions. The grade of  $P_2O_5$  in the concentrate may be improved by adding depressant like  $H_3PO_4$  or ACCO PHOS-950 during reconditioning of the pulp. The concentrate may further be improved by floating silica with a suitable aminic

**Table-5 Chemical composition of concentrate**

Constituent	wt. %
$P_2O_5$	8.31
MgO	2.0
$SiO_2$	34.82
$R_2O_3$	8.69
CaO	27.0
L.O.I.	18.68
Others	0.5

## Calcareous Rock Phosphate

The grade and recovery of  $P_2O_5$  in the bulk concentrate were 16.0% and 85.0% respectively. In order to further improve the grade as well as recovery of the concentrate, statistical design of experiments were carried out in the present investigation for bulk flotation step of the final test. The grade of this concentrate is just below the acceptable grade which is required for making phosphatic fertilizer.

A final phosphate concentrate assaying a composite grade of 27.0%  $P_2O_5$  and composite  $P_2O_5$  recovery of 74.7% has been produced using froth flotation technique in Denver type flotation machine.

It is noteworthy that a phosphate concentrate having the grade of  $P_2O_5$  ranging from 28 to 36% is required for making Single Super Phosphate and Triple Super Phosphate.

## GLAUCONITE

### *Status*

A report on processes developed for recovering potash values from glauconitic sandstone of Majhgawan, Satna District, M.P., was prepared.

This report describes the results obtained from the characterisation of glauconitic sandstone sample with the help of different instrumental techniques and details of five processes including the raw materials used, description of the methods followed, selected experimental conditions giving specific values of the process parameters, advantages of the processes and inferences drawn on this work.

Selected few solutions obtained from the direct acid leaching and the leach liquors of pyrometallurgy cum leaching processes were screened for elements other than potassium particularly for phosphorous, aluminium, iron and sodium.

The solutions obtained from direct acid leaching of glauconitic sandstone, step extraction and direct extraction of glauconitic sandstone with calcareous rock phosphate were subjected to ICP and DCP spectrometers for estimation of the phosphorous and aluminium contents. Phosphorous showed up in pretty high concentrations varying from 500 to 20000 ppm while aluminium exhibited lower concentrations varying from 100 to 250 ppm. Iron content varied from 200-260 ppm and that of sodium from 9-12 ppm.

The leach liquors of 'Calcium Chloride Process' were found to contain very low concentrations (1 ppm) of iron and aluminium while sodium was in the range of 12 to 13 ppm only.

The leach liquors of 'Double Salt Process' analysed for iron and sodium contents were found to have very low concentrations (1 ppm) of iron but sodium concentrations ranged between 600-900 ppm.

The figures obtained in these results form the basis of the requirements of the solutions and leach liquors to isolate or reduce the content of a particular ash as to render these useful for straight application in the fields.

**Title** : *Modelling and Performance Studies on Vorsyl Separator*  
**Sponsor** : *TISCO*

### **Status**

The size and size-wise ash analysis of the coal received from TISCO was carried out. Since the laboratory studies are to be carried out with coal of size  $-2.0 + 0.5$  mm, a small fraction of the coal was subjected to size reduction to get a final product of  $-2.0 + 0.5$  mm. A small representative sample of this coal, was subjected to sink- float analysis. In this analysis, sodium chloride solutions of different specific gravities from 1.30 to 1.80 in the steps of 0.05 were used. The different specific gravity fractions are being analysed for their ash content. The results obtained will be used for washability studies of the coal.

A test rig for the vorsyl separator/heavy medium cyclone is being procured for this project. However, the first set of preliminary experiments is being carried out with a vorsyl separator which has been brought from Indian School of Mines on loan. The three variables which will be studied are vortex finder, vortextractor nozzle diameter and heavy medium specific gravity.

# RESOURCES DEVELOPMENT DIVISION

This Division has a two fold charter which includes carrying out R&D projects under broad category of Natural Resources Data Management with reference to M.P. and S&T support system to the Laboratory including PME, liason, information and R&D management.

Presently two DST supported projects on Modelling of groundwater systems are underway envisaging funding of Rs.10.316 lakhs. A proposal on Groundwater Database Management System for various basins of M.P. is submitted to MPCOST.

In consonance with its mandate to help develop natural resources data management systems, an intent proposal has been approved in principle for Bastar region by the DST. The need for this was underlined by the Chief Minister, M.P. and is prepared on the advice by DGSIR in coordination with MPCOST.

Prof. K.R. Rushton, Dept. of Civil Engg., University of Birmingham, UK visited RRL Bhopal during 22-24 March, 1992. During his stay he also visited some sites in the Tawa canal command area along with Tawa project Authorities.

In addition the Division is interacting with IIT, Kanpur, IIT, Bombay, CBIP, CGWB and M.P. State agencies related to groundwater resources.

- Title** : Groundwater Resources Management Through Modelling in the Tawa Canal Command Area, Hoshangabad Dist,MP
- Sponsor** : Deptt. of Science & Technology, Govt. of India
- Objectives** : I. Impact of canal seepage on local groundwater regime
- (a) Identification of water-logged areas and their trend
  - (b) Analysis of variation in water table elevations in its relation to inputs, outputs and geology

- (c) Identification of suitable schemes for solving the water logging problem based on aquifer characteristics
- (d) Quality variations with relation to water-logging

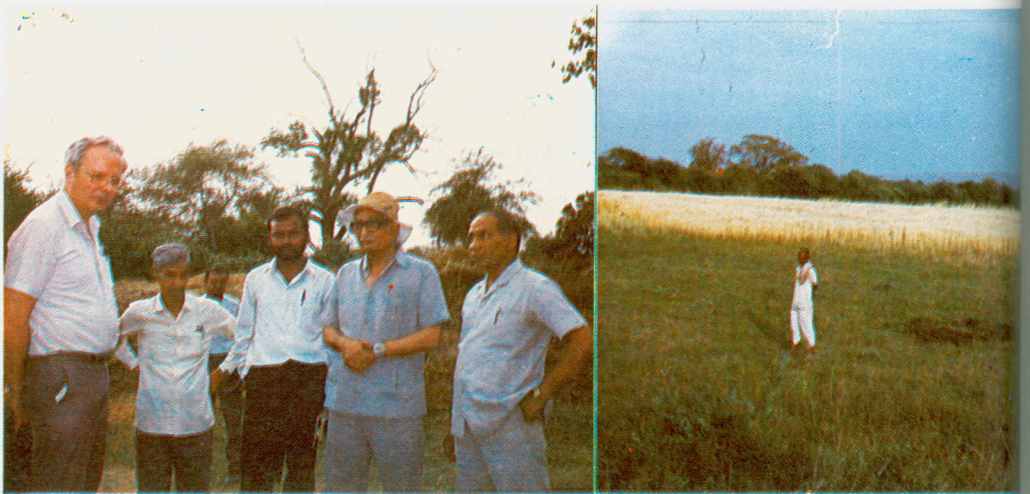
II. Simulation model to predict water table elevation for ten year variable inputs

### **Status**

Water table data for the pre-monsoon and post-Monsoon seasons were collected from the field. Various other data collected include historical water table data, hydrometeorological data, canal network and discharges data, lithology etc.

Based on the pre and post-monsoon water table data the extent of the water-logged areas were delineated. Groundwater Mass Balance Studies are being carried out according to CGWB norms/procedure to estimate the various recharge and discharge components in the first stage. Alternative strategies for solving water-logging problem are formulated such as control over actual canal discharges, utilisation of groundwater for irrigation, development of additional drainage, artificial discharge through additional pumping, creation of fish ponds in low lying areas, plantation of trees on the wedges and changes in cropping pattern.

The water samples collected during the premonsoon and postmonsoon periods are being analysed qualitatively. The analysis indicated increase in the total dissolved solids and sulphate deterioration in some pockets.



*Prof. Rushton's Visit to Water-Logged Site in Tawa Command Area, Hoshang*

## **GENERAL INFORMATION**

### **CSIR GOLDEN JUBILEE CELEBRATIONS :**

#### **FOUNDATION DAY**

CSIR Foundation Day was celebrated at Regional Research Laboratory, Bhopal on Sept 26, 1991. Shri Ranjit Vithaldas, Managing Director, Permal Wallace Limited, Bhopal, delivered the Foundation Day lecture. He mentioned that, with the changed Industrial Policy, there is urgent need for the Industrialists and CSIR Scientists to work in close collaboration. This would be required to achieve the main objectives of "Excellence, Efficiency and Export" in our Industries.

Dr. Kunal Basu, Deputy Director, introduced the activities of CSIR in general and RRL Bhopal in particular.

Cash awards and certificates were presented on this occasion to outstanding SC/ST students of Xth Class.

In the afternoon, the Laboratory observed Open Day and a large number of students from various schools, colleges and prominent persons of Bhopal visited the Laboratory.

#### **CSIR GOLDEN JUBILEE LEAD CONFERENCE ON "SCIENCE & SOCIETY" HELD ON 21-22 DECEMBER, 1991.**

This was one of the six lead conferences being held during the CSIR Golden Jubilee year. The specific objective of the Lead Conference on Science & Society was to share experiences amongst researchers, field functionaries and policy makers on direct benefits of science and technology in solving the problems of common man, particularly in rural areas. The CSIR, the Govt. departments and voluntary organisations all are engaged in one way or other to accomplish this task. Therefore, it was thought appropriate that during Golden Jubilee Celebration all such agencies are brought together.



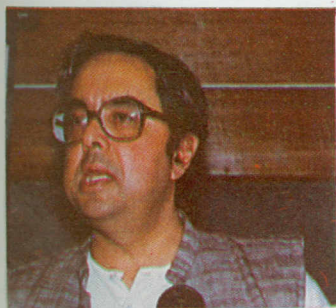
*Shri Vithaldas, Managing Director, PWL, Bhopal Delivering Foundation Day*

His Excellency, the Governor, M.P., Shri Kunwar Mehmood Ali Khan, inaugurated the seminar. Shri Sunderlal Patwa, Chief Minister, M.P. presided. Shri B.M. Agarwal, Minister for Science & Technology, M.P., Dr. S.K. Joshi, Director General, CSIR graced the occasion. Prof. M.G.K. Menon, Member, Rajya Sabha and former Vice President, CSIR delivered the keynote address.

Speaking on the occasion the Governor opined that Science & Technology has opened new avenues for harnessing natural resources for development. He said that the country and the State of M.P. has been bestowed with abundant natural resources. If these are harnessed scientifically, these would help in making the country prosperous. He called for expansion of health, education and communication services.

Shri B.M. Agarwal, M.P. Minister for Science & Technology, in his address said it was befitting that such a major CSIR conference was being held in Madhya Pradesh as a large potential for S & T inputs to societal development exists.

Prof. M.G.K. Menon in his keynote address said that the imbalance in the country can be removed only if the science was assimilated into the life of the people. He stressed the need for primary education to all to keep pace with the progress in other developed countries.



*Eminent Speakers at the CSIR Lead Conference*



*Delegates of Lead Conference with the Hon'ble Governor - M.P. at Raj Bhawan*



*Hon'ble Minister Water Resources, M.P. Shri Shitala Sahai inaugurates Water Resources Day Celebrations*



*Exhibition on the occasion of Water Resources Day Celebrations*

In his presidential address Shri Sunderlal Patwa, Chief Minister, Madhya Pradesh said that appropriate thrust should be given to the development of technologies for rural areas, and an effective technology system for these areas be evolved in order to swiftly end economic and social backwardness of the people.

The conference had technical sessions and panel discussion on the following :

- *Science, Technology & Basic Needs*
- *Technology for Rural Employment*
- *Innovative Educational Approaches*
- *Science, Technology and Decentralised Planning*

Eminent scientists, technologists, planners and academicians participated and deliberated on the theme of the seminar. They included Dr. M.P. Dhir, Director, Engg. Coordination, CSIR, Dr. B.D. Tilak, Former Director, NCL, Pune, Shri M.P. Parmeshwaran of KSSP, Kerala, Dr. S.S. Kalbag, Centre for Science Education Research, Pune, Dr. Ashok Khosla, Centre for Development Alternatives, Delhi, Dr. R.K. Iyengar, ADG, CSIR, Dr.(Mrs.) Manju Sharma, Planning Commission, Dr. D.N. Misra, Director General, MPCOST, Dr. Ashok Jain, Director, NISTADS, Delhi, Dr. M.S. Sodha, Vice Chancellor, DAV, Indore.

A large number of delegates from all over the country attended this conference held under the joint auspices of CSIR and MPCOST.

The delegates called on the Governor at Raj Bhawan at a get-together. A dinner was hosted by The Chief Minister of M.P. in honour of the delegates.

## **WATER RESOURCES DAY CELEBRATIONS**

Shri Shitala Sahai, Minister, Water Resources, M.P. inaugurated the "Water Resources Day Celebrations" on May 14, 1991. The theme of these celebrations was "Water Conservation."

Speaking on the occasion, he stressed the need for a scientific approach in harnessing the surface and ground water resources of the region. He expressed confidence that with rigorous efforts of scientists and engineers in designing of optimum methods of water conservation, prospecting and supply, a new era of meaningful development will dawn in the State of Madhya Pradesh. He complimented the M.P. Council of Science & Technology and RRL Bhopal and all the participating agencies for coming together to discuss issues in the "Workshop on Recent Advances in Water Resources Management."

Dr. D.N. Misra, Director General, MP Council of Science & Technology, outlined the objectives of Water Resources Day celebrations and the Workshop. Shri M.S. Billore, Secretary, Water Resources (M.P.) delivered the key note address.

Prof. T.C. Rao, Director, RRL welcomed the dignitaries and guests and that the RRL Bhopal shall endeavour to provide a nodal role in S&T activities to natural resources of M.P.

Shri Sahai also inaugurated an exhibition in which interesting exhibits from Ground Water Board, Central Water Commission, WALMI, M.P. Council of Science & Technology (Remote Sensing Centre), Water Resources Deptt. (M.P.), Ground Water Survey (M.P.) and RRL Bhopal were on display.

### **Workshop on Recent Advances in Water Resources Management**

The one day workshop sponsored by MP Council of Science & Technology with the Water Resources Day Celebrations. Spread over a session each on Ground Water Exploration and Conservation; and Water Resources Management, there were several technical papers for presentation in the Workshop. Over fifty delegates representing a wide spectrum of Central and State agencies working in this field participated.

### **NATIONAL CONVENTION OF ELECTROCHEMISTS**

The convention was held at RRL Bhopal on Sept.18-19, 91. Organised by the Society for Advancement of Electrochemical Science and Technology (SAEST), it was cosponsored by MPCOST, RRL Bhopal and CECRI, Karaikudi. His Excellency the Governor, Kunwar Mehmood Ali Khan, inaugurated the convention. Shri B.M. Agrawal the Minister for Science & Technology was present on the occasion. Prof. S.K. Rangarajan, Director, CECRI, Karaikudi, delivered the keynote address.



*Hon'ble Kunwar Mehmood Ali Khan, Governor, M.P. Inaugurating the National Convention of Electrochemists*

Four poster sessions on "Batteries and Metal Finishing"; "Solid State Electrochemistry and Fundamental and Electroanalytical Chemistry"; "Electrochemicals"; and "Corrosion" were held based on the contributed papers. A microsposium on "Electrochemistry and Non-conventional Energy Systems" was inaugurated by Shri R.K. Sharma, Secretary, Dept. of Non-conventional Energy Sources, Govt. of India. Prof. D. Balasubrahmanian, CCMB, Hyderabad received the Doss medal and delivered the Prof. Doss Memorial Lecture 1991" on "Hydrotopes".

## SEMINAR ON "R&D NEEDS OF METALLURGICAL INDUSTRIES IN MADHYA PRADESH"

RRL, Bhopal, M.P. Council of Science & Technology, Bhopal and the Indian Institute of Metals, Bhopal Chapter jointly organised the above seminar on Jan 6, 92 with an objective to bring together to a common forum industrialists, metallurgists, material scientists and engineers.

The seminar was inaugurated by Sri Brij Mohan Agarwal Minister of Science and Technology, M.P. Prof. T.C. Rao, Director, RRL Bhopal and Chairman of the Indian Institute of Metals Bhopal Chapter presented RRL's research involvement with various public and private sector industries in India. Dr. G.P. Tiwari, Project Director MPCOST gave an account of the efforts made by the Council in promoting industrial growth in the State. Sri S.K. Bose, Scientist and Secretary, IIM Bhopal Chapter presented the role of the Indian Institute of Metals in promoting metallurgical awareness in engineering industries. In the technical sessions the participating industries evinced keen interest on various topics such as in process optimization, quality assurance and reliability with reference to materials produced by them.



*Shri B.M. Agarwal, Minister of Science & Technology, MP inaugurating RDNMI-92.*

## CHILDREN MEET SCIENTISTS

'Children Meet Scientists' programmes were held on the occasion of National Science Day in February 91 and 92. Sponsored by NCERT main features of the programme were science quiz and extempore speech competition for students of Class X. A large number of students from different schools in Bhopal participated. Besides popular lectures by RRL scientists, screening of Science films 'Blooming Science' students were shown various laboratory facilities. Prizes were given for the best performers.



*School students in the laboratory on National Science Day' 92*

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39. S. Das, T.S.V.C. Rao, S.P. Mukherjee and A.H. Yegneswaran, **Effects of Microstructure on the Abrasion Resistance of 0.98% Carbon Steel**. 29th NMD and 45th ATM of Indian Institute of Metals, held at Ranchi, 1991.
40. S. Das, **Microstructure of Cast Al-Si alloy in the presence of dispersed particles**, 29th NMD and 45th ATM of Indian Institute of Metals, held at Ranchi, 1991.
41. Mohini Saxena, O.P. Modi, B.K. Prasad and A.H. Yegneswaran, **Corrosion behaviour of Cast Al-Alloy based particulate composites** Third National Convention of Electrochemists, RRL Bhopal, Sep, 1991.
42. B.K. Prasad, O.P. Modi, S. Das, A.K. Jha and A.H. Yegneswaran, **Zinc-Aluminium alloy - a Potential bearing material**, National seminar on Revolution in the Image of Zn alloys, 29-30, Aug, 1991, Bombay.
43. A.K. Jha, S. V. Prasad and G. S. Upadhyay, **Sintered Aluminium Alloy Ceramic Composites**, presented at INDO Soviet Workshop and Exhibition on Power Met. and Ceramics, INSOVEX- 91, Hyderabad.
44. Navin Chandra, B. Kujur, Jayanta Konar, Manoj Ban, **"Electrochemical Studies on the Corrosion of Cast Iron in Aqueous Solutions"**, National Convention of Electrochemists, RRL Bhopal 18-19 Sept. 1991.
45. Jayanta Konar **"Simplified Approach for Estimation of Silica in Silicate Minerals"**, M.P. Young Scientists' Congress, 28th Feb. to 1st March, 1992, Indore.
46. D. D. Mishra and L. Sanjeeva Rao, **"Computer simulation of beach sand beneficiation plants : A microcomputer program using the set up file concept"**. 3rd International symposium on Beneficiation and Agglomeration, January 1991, Bhubaneswar.

## LECTURES BY OUTSIDE EXPERTS AT RRL

1. **"An Overview of Bearing Materials"** Shri Brahm Prakash, IIT D
2. **"X-ray Energy System of Stressed Materials"** Shri A. Ghosh, Agric. Co., Calcutta.
3. **"Ferrous Alloys Design & Development"** Prof. A.K. Patwardi Roorkee, Roorkee.
4. **"Fabrication of Ceramic Matrix Composites"** Dr. V. Jayaram, lore.
5. **"Thermal Spraying of Metal Matrix Composites"** Dr. Rajesh T Stoney Brook, USA.
6. **"Recent Trends in Mineral Processing"** Dr. T. Pradip, TRDC, P
7. **"Sustainable Development"** Prof. V.K. Gaur, Secretary, Dept. o velopment, Delhi.
8. **"High Resolution XRD"** Dr. Krishan Lal, Acting Director, NPL, M
9. **"Model Agreements for Contract Research"** Dr. A.K. Guha, Sci CSIR, New Delhi.
10. **"Safety Measures and Management"** Shri R.P. Sinha, DGM, S neering, BHEL, Bhopal.
11. **"Extraction of potassic fertilizers"** Dr. B.K. Mahapatra, RRL, B
12. **"Use of solid reductants in Iron making in view of energy a mental considerations"** Prof. R.C. Gupta, BHU, Varanasi.
13. Dr. A.K. Rastogi, IIT, Bombay delivered a series of four lecture topics related to **"Water Resources Management."**
14. **"Current Advancement in Magnetic Materials"** Prof. Rajkama Vishwavidyalya, Indore,
15. **"Chemistry of Sea Water"** Dr. N. Das, DST, New Delhi
16. **"Some Thoughts on Perception"** Prof. H.S. Ray, Director, Region Laboratory, Bhubaneswar.
17. **"Computational Techniques Applied to Modelling"** Dr. Paras Scientific Officer, Centre for Atmospheric Sciences, IIT, Delhi.

18. (i) **The Potential Use of Direct Current Resistivity Methods as a Surveillance Tool for Shallow Geologic Problem,**
- (ii) **Ground Penetrating Radar Techniques from High-Resolution Mapping of Soil and Rock Stratigraphy**  
Mr. Satyendra Narayan, Department o Earth Sciences, University of Waterloo, Canada
19. **"Oxide-Metal Matrix Composites"** Dr. Amitava Banerjee, RRL, Bhubaneswar,

### INVITED LECTURES BY RRL STAFF

**Prof. T.C. Rao** - Delivered lectures at Refresher course for mineral engineers held at Puri conducted by Indian Institute of Mineral Engineers.

**Dr. RK Rawlley** - Ceramics as Corrosion Resistant Material, BHEL (4.9.1991).

**Mr. Murari Prasad** - (1) Principles of Heat Transfer, and (2) Effect of Humidity on Heat Transfer from Boiler, Metallurgical Interface of Boiler Operation organised by Neyveli Lignite Corporation at Neyveli from 7.10.91 to 11.10.91

**Mr. R.S. Solanki** - (1) Various types of joining processes used for fabricantions, (2) Weldability investigations of difficult to weld metals and alloys, (3) Successfull welding of steels used for elevated temperature applications, (4) How to minimise the residual stress and distortion by using appropriate welding techniques, (5) Quality control and inspection of the weld joints, and (6) Repair and maintenance welding for power plant industries, "In-plant Course on Metallurgical Interface of Boiler Operation" Neyveli Lignite Corporation, Neyveli from 7th to 11th October, 1991.

**Mr. S.P. Narayan** - "HSLA Steel as a soft magnetic steel" at Tinsplate company of India Ltd., Jamshedpur in Sep 1991.

**Dr.(Miss) Mohini Saxena** - "Yoga Science" at RRL Bhopal in NCERT, Children Meet Scientists, February 1991.

**Dr.(Miss) Mohini Saxena** "Yoga Science" in Personality Development Camp, organised by Vivekananda Centre, Kanyakumari, Bhopal branch at Bairagarh, Bhopal in May 1991.

## INTERNAL SEMINARS

- Shri. S.K. Bose, **SEM Studies**
- Dr. Kunal Basu, **Development of Composite Materials**
- Shri. R.S. Solanki, **Welding of Nodular Cast Iron**
- Dr. A.H. Yegneswaran, **Tribological Study of Zn-Al Alloy**
- Dr. Navin Chand, **Glass Reinforced Redmud Polymer Com**
- Shri. B.K. Saxena, **Quality Upgradation of Metal Based Industrie**
- Shri P.D.Ekbote, **Technology Forecasting for Planning**
- Dr. Navin Chandra, **Zinc-Bromine Battery**
- Dr. C..B.Raju, **Nitriqation of Fly ash: A study of the Products**
- Shri L.C.Mohan, **Alloy Cast Iron**
- Dr. A.K.Jha, **Erosion and Corrosion of Al-alloy Based Compos**

**APPENDIX - 7****PATENTS NEWS**

- Two Indian patents on **Redmud PVC polymer Composite Material and An Improved Ceramic Membrane Water Filter** filed by RRL have been granted.
- **A process for the manufacture of Aluminium - graphite particulate composite using uncoated graphite particles for automobile and engineering applications**, Invented by P.K. Rohatgi, T.K. Dan, S.C. Arya, S.V. Prasad, S. Das, B.K. Prasad and A.K. Jha awarded an Australian Patent (Patent No. 610516).
- **An Improved Process for Extraction of potassium from Glauconitic Sandstone for Fertilizer Application** : R.K. Rawlley (filed).
- **New Process of making a PK composition for Fertilizer Application from Glauconitic Sandstone** : R.K. Rawlley and S.S. Amritphale (filed).
- **Use of Low Grade Rockphosphate for Producing a PK Composition from Glauconitic Sandstone for Fertilizer Application** : R.K. Rawlley and S.S. Amritphale (filed).
- **A Reagent for Producing a Composition for Fertilizer Application Utilization Glauconitic Sandstone** : R.K. Rawlley and S.S. Amritphale (filed).
- **Utilization of Glauconitic Sandstone for Potash Recovery by Using Common Salt** : S.S. Amritphale, R.K. Rawlley and B. Kujur (filed).
- **A Process for Extraction of Potash useful for Fertilizer Application from Feldspar** : R.K. Rawlley, S.S. Amritphale (filed).
- **A Process for recovering Potash values useful for Fertilizer Application from Glauconitic Sandstone by using double salt method** : R.K. Rawlley, S.S. Amritphale (filed).
- **Development of Light hard and tough ferrous alloy of high carbon, low silicon and high aluminium content** : L.C. Mohan, V.S. Muneshwar, A.H. Yegneswaran and K. Venkat (filed).
- **A new process for production of silicon metal from alumino- silicate minerals** : J. James, C.B. Raju and K. Srinivas (filed).
- **Design of FRP housing of traction motor gearcase** : Navin Chand, S.A.R. Hashmi, B.P. Singh, S.K. Shukla and B.P. Agrawal(filed).

- **Preparation of a new light, hard and tough ferrous alloy of high carbon, silicon, high aluminium contents :** Mr.L.C. Mohan Patent Application No. 243/DEL/91 dt 18.9.91.
- **A process for Recovering Potash and a P.K. Composition for Fertiliser from Glaucanitic Sandstone.** Patent Application No. 244/DEL/91 R.K. Rawlley
- **A process for the preparation of a Binutrient Composition Useful in Agriculture by Utilising Glaucanitic Sandstone and Rock Phosphate.** Application No. 245/DEL/91. R.K. Rawlley and S.S. Amrithphale.
- **A process for Recovering Potash Values from Glaucanitic Sandstone using Common Salt.** Patent No. 247/DEL/91 S.S. Amrithphale, R.K. Rawlley and B.Kujur
- **A Novel Process for Making Potassic Fertiliser from Glaucanitic Sandstone using a Double Salt.** Patent Application No. 566/DEL/91 R.K. Rawlley and S.S. Amrithphale
- **A process for the production of spheroidised high strength low alloy (HSLA) steels for soft magnetic applications -** S.P. Narayan, V. P. Rao and O.N. Mohanty (2 nos.)- 1108 & 1109/DEL/89

**APPENDIX - 8****MEMBERSHIPS AND RECOGNITION OF SCIENTISTS****Prof. T.C. Rao, Director, RRL**

- Vice-President, Indian Institute of Mineral Engineers
- Fellow, Institution of Engineers (India)
- Mining, Geological and Metallurgical Institute of India
- Elected as Council Member, 45th Annual General Meeting, Indian Institute of Metals, Calcutta.
- Chairman, Sub-committee on Coal Preparation, Standing Scientific Research Committee, Deptt. of Coal, Govt. of India.
- Standing Scientific Research Committee Deptt. of Coal, Govt. of India.
- Convenor, CSIR Technical Advisory Board, Materials Science and Technology.
- Advisory Board, Indian Bureau of Mines (appointed by Ministry of Steel and Mines, Govt. of India).
- Committee on "Development of Oil-Agglomeration Technique", Ministry of Energy.
- Committee on "Utilisation and Disposal of Fly Ash", Planning Commission, Govt. of India.
- Expert Group appointed by Planning Commission, Govt. of India, to advise on "Development of Technology in Coal Sector."
- Expert Committee on Nandan Coal Washery Project - appointed by Ministry of Energy, Deptt. of Coal, Govt. of India.
- Member, Technical Working Group to examine the problems connected with the beneficiation of coking coal, Deptt. of Coal, Ministry of Steel, Mines & Coal, Govt. of India.
- Monitoring Committee, On Line Ash Monitoring System being developed by ECL.
- Nominated as the CSIR nominee, MPCOST.

- Member of RSOP - Thermal working group on life estimation and Refurbishment of thermal power station CBIP, New Delhi along with Dr. A. H. Yegneswaran
- Vice-Chairman, Scientific Advisory Committee, M.P. State Government
- Ex-officio Member of Board of Director, Housing Development Institute, Bhopal
- President, Bhopal Chapter, Materials Research Society of India.
- Chairman, Advisory Council Regional Science Centre, Bhopal, National Council of Science Museums.
- Regional Editor, "Minerals Engineering", by Pergamon Press, Great Britain
- Member, Editorial Board of the Journal "Coal Preparation" published by Gordon and Breach, New York.
- Member of the Symposium Steering Committee of International Symposium on Beneficiation and Agglomeration of Mines.
- Assessor of the paper in Institute Transactions, Mining, Geological & Metallurgical Inst. of India, Calcutta.
- Nominated as Assessor of the papers in Mineral Beneficiation/coal Utilization for publication in the Institute's Transactions for the years 1991-92 & 1992-93 by the Mining, Geological & Metallurgical Institute of India, Calcutta.
- Given a certificate of Best Paper Award on his paper Grinding Aids for Energy Conservation : A Case Study On Grindability of Iron Ore, Indian Chemical Engineering Congress'1991.

### **A.C. Khazanchi**

- Award for best papers in Third NCB International Seminar on Cement and Building Materials co-authored with Mohini Saxena, R.K. Morchharia and Chauhan
- A.C.G.I. (London)
- National Building Code
- Fellow Institute of Standards Engineers (FISE)
- 4th Conference of Asian Pacific Congress on Strength Evaluation APC held in Beijing, China 1991
- Member, Regional Technical Committee, HUDCO

**Dr. Kunal Basu**

- Received certificate of Chartered Engineer from Institution of Engineers (India),
- Nominated Member M.C., NEERI, Nagpur.

**Dr. Kunal Basu and Dr. A.H. Yegneswaran**

- Members on MTD 28:2, Bureau of Indian Standards, New Delhi.
- Awarded Binani Trust Silver Medal-1990, at the Annual Foundry Convention-Feb 1991, Calcutta, along with **R.S Solanki, V.S. Muneshwer, A.K. Singh.**

**Dr. R.N. Yadava**

- Nominated peer on panel for Mathematical Modelling for S&T Studies, NIS-TADS, New Delhi.
- Supervisor for Ph.D Degree of Barkatullah University, Bhopal in Mathematics, Civil Engg. and Applied Mathematics.
- Supervisor and visiting professor in the Deptt. of Future studies for planning of DAVV Indore.

**Dr. A.H. Yegneswaran**

- Hon Sec., IIF Bhopal Chapter upto May 1991.
- Hon. Treasurer of IIM Bhopal Chapter.
- Member of Official Language Committee, RRL Bhopal.

**Dr. (Ms) Mohini Saxena**

- Elected National Secretary for India of International Society of Electrochemistry (associated organisation of IUPACE, Switzerland).
- Editorial Advisory Board, Int. J.of Physical Sciences.

Invited as Chief Judge in District level science model competition organised by Rashtriya Yuvak Parishad, National Council of Youth, Bhopal.

**Shri R.S. Solanki**

- Invited to participate as author in Text Book "Structural Steel Works Fabrication and Erection" by TTTI, Bhopal.

**Dr. S. Das**

- Awarded a cash prize for the best entry in the category Electron Microscopy in the Metallographic Contest during the 45th Annual Technical Meeting of the Indian Institute of Metals held at Ranchi (17.11.1991).
- Jt. Hon. Secretary of IIM Bhopal Chapter.

**Shri L.C. Mohan**

- Hon. Secretary, Inst. of Indian Foundrymen, Bhopal Chapter.

**Shri. S.P. Narayan**

- Elected as a Central Executive Committee member of Institute of Standards Engineers, New Delhi for 1991-92.
- Co-opted as Executive Committee member of Institute of Standards Engineers, Bhopal Chapter for year 1991-92.

**Ms. R. Dasgupta**

- Awarded the Master of Science (M.S.) degree in the Science and Technology Branch from the Birla Institute of Technology Science (BITS), Pilani.

**Dr. (Mrs.) Arati Roy**

- Supervisor for Ph.D Degree of Barkatullah University, Bhopal in Applied Mathematics.
- Invited as Judge in District level science model competition organised by Rashtriya Yuvak Parishad, National Council of Youth, Bhopal.

**APPENDIX - 9****WORKSHOPS/CONFERENCES/MEETINGS ATTENDED**

- Dr. Kunal Basu and Shri P.D. Ekbote attended **workshop on Quick Access Information System**, IICT, Hyderabad, 22.7.1991.
- Shri S.K. Bose, Shri B.K. Saxena, Shri S.P. Mukherjee, Dr. (Ms) Mohini Saxena, Dr. Navin Chand, Dr. A.K. Jha, Dr. S. Das, Shri O.P. Modi, Dr. A.K. Gupta attended **International Conference on Aluminium, INCAL-91**, Bangalore, 31st July-2nd Aug. 1991.
- Shri A.C. Khazanchi, Dr. R.N. Yadava, Shri P.D. Ekbote attended **CSIR Golden Jubilee Lead Conference on "Management of Change"**, New Delhi, 27.9.1991.
- Dr. Kunal Basu, **Workshop on Standardization for Advanced Materials : Strategic Issues**, Bureau of Indian Standards, New Delhi (11-12.11.1991).
- Mr. S. P. Narayan, **International Conference on Electrical Steels (ICES-91)** Sept. 19-20, Rourkela, India.
- Mr. S.P. Narayan, Dr. A.H. Yegneshwaran, Shri O.P. Modi and Shri B.K. Prasad, **Third National Convention of electrochemists** - Sept. 17-18, Bhopal (India).
- Mr. B. Tirupati, **National Seminar on use of computers in hydrology & water resources**, org. by CWC at IIT, Delhi, 16-18 Dec.'91.
- Dr. Navin Chand and Dr.(Ms) Mohini Saxena, **National Conference on Substitute for Wood in Building**, CBRI, Roorkee, Dec. 12-13, 1991.
- Ms. R. Dasgupta attended the **3rd Annual General Meeting cum Seminar of the Materials Research Society of India (MRSI)**, held at Bangalore, 9-11 Feb. 1992.
- Dr. S. Das attended **29th NMD and 45th ATM of 11 M Ranchi** Nov. 14-17, 1991.
- Dr. A.K. Jha and Dr. C.B. Raju attended **INDO Soviet Workshop-cum-Exhibition on Powder Metallurgy and Ceramics (INSOVEX-91)**, Hyderabad.
- Dr. A.H. Tegneshwaran, Mr. B.K. Saxena and Dr. A.K. Gupta attended the **Natural Seminar cum workshop on Short seaming and its applications**, MACT, Bhopal Dec. 13-14, 1991.

**APPENDIX - 11****STAFF NEWS****Appointments**

Shri S. Chandrashas (formerly Sr. Stenographer in CCMB, Hyderabad) Section Officer (F&A), 24.7.1991

Shri A.K. Jain, Junior Research Fellow, 29.7.1991

Shri G.S. Pande Junior Research Fellow, 7.8.1991

Dr. (Mrs) Sulbha Amlathe, Research Associate, 12.8.1991

Shri Ram Kishore, Driver, 20.8.1991

Shri Suman Kumar, Fellow, 25.9.1991

Shri S.K. Chaudhuri, Senior Personal Assistant, 1.11.191 (On promotion and transfer from IICB, Calcutta).

Shri Rs Ahirwar, Scientist B, 3.2.92

Shri SV Srimanth, Scientist B, 28.1.92

**Assessments**

Shri S.P. Mukherjee, Gr. IV (3), 1.4.1988

Dr. A.H. Yegneswaran, Gr. IV (3), 1.4.1988

Shri G.G. Nair, Gr. III(6), 1.4.1988 (Superannuated on 30.3.1990)

Dr. C.B. Raju, Gr. IV(3), 16.8.1989

Dr. Navin Chand, Gr. IV(3), 24.8.1989

Dr. S.S. Amritphale, Gr. IV(2), 1.2.1990

Shri K. Venkateshwarlu, Gr. III (2), 2.5.1990

**APPENDIX - 12****MEMBER OF STAFF****Prof. T.C. Rao**

Director

**BUILDING MATERIALS**

Mr. A.C. Khazanchi	Scientist F
Dr. (Ms) M. Saxena	Scientist B
Mr. R.K. Morchalle	Scientist B
Mrs. Alka Meshram	Scientist B
Mr. J. Prabakar	Scientist B
Mr. Shrimanth	Scientist B
Mr. R.S. Ahirwar	Scientist B
Mr. P. Asokan	Scientist B
Mr. Ajay Kulshresth	JTA/Gr.III (1)
Mr. R.K. Chouhan	JTA/Gr.III (1)
Mr. S.R. Karade	JTA/Gr.III (1)
Mr. V. Antony	Technician/Gr.II (1)
Mr. S.K. Botham	Helper/Gr.I (1)
Smt. Sathi Vijayan	Sr. Stenographer

**METALLURGY & MATERIALS**

Dr. Kunal Basu	Scientist F
Mr. S.K. Bose	Scientist E II
Mr. B.K. Saxena	Scientist E II
Dr. Navin Chandra	Scientist E I
Dr. A.H. Yegneshwaran	Scientist E I
Dr. Navin Chand	Scientist E I
Mr. S.P. Narayan	Scientist C
Mr. R.S. Solanki	Scientist C
Dr. A.K. Jha	Scientist C
Dr. S. Das	Scientist C
Mr. O.P. Modi	Scientist C
Mr. L.C. Mohan	Scientist C
Dr. A.K. Gupta	Scientist B
Mr. B.K. Prasad	Scientist B
Mr. V.S. Muneshwar	Scientist B
Mr. A.K. Singh	Scientist B
Ms. Rupa Dasgupta	Scientist B
Mr. S.A.R. Hashmi	Scientist B
Mr. D. Mondal	Scientist B

Mr. M.K. Ban	JSA/Gr. III (1)
Mr. T.S.V. Chakradhara Rao	JTA/Gr. III (1)
Mr. K. Venkateswarlu	STA/Gr. III (2)
Mr. P.K. Rangari	JTA/Gr. III (1)
Mr. P.N. Patil	Lab Asstt.'Gr.II (1)
Mr. D.K. Singh	Technician/Gr. II (1)
Mrs. Deepa Chaudhary	Programme Asstt.
Mr. Indraj Yadav	Jr. Security Guard
Mr. G.B. Gurung	Jr. Security Guard

### MINERALS

Dr. C.B. Raju	Scientist E1
Dr. J.P. Barnwal	Scientist C
Mr. B. Govindarajan	Scientist C
Dr. S.S. Amritphale	Scientist C
Dr. R.K. Rawley	Scientist B
Mr. Murari Prasad	Scientist B
Mr. L. Sanjeeva Rao	Scientist B
Mr. S.P. Pathak	Scientist B
Mr. A.K. Majumdar	Scientist B
Mr. B. Kujur	SSA/Gr. III (2)
Mr. P. Banerjee	SSA/Gr. III (2)
Mr. J. Konar	JTA/Gr. III (2)
Mr. P.C. Meshram	SLA/Gr. III (2)
Mr. B.L. Pradhan	Helper/Gr.I (1)

### RESOURCES DEVELOPMENT

Dr. R.N. Yadava	Scientist E 1
Mr. P.D. Ekbote	Scientist C
Dr. M.V.R.L. Murthy	Scientist C
Dr. (Mrs) Arti Roy	Scientist B
Mr. Rishi Kumar	Librarian/Gr. III (1)
Mr. Abhay Kumar	Roneo Operator/Gr.II (1)
Mr. Samdarshi Pali	Cataloguer/Gr. II (1)
Ms. Minimol. R	Sr. Stenographer
Mr. Devilal Rathore	Jr. Security Guard

### DIRECTOR'S SECTION

Mr. T.P. Prasannan	Sr. Stenographer
Ms. Manisha Dubey	Hindi Translator
Mr. Viswanathan. N	Sr. Stenographer
Mr. Roopanand Pradhan	Jr. Security Guard

**ENGINEERING SERVICES****Civil**

Mr. R. Dubey	AEE (Civil)/Gr. III (4)
Mr. N. Saha	Draughtsman/Gr.III (2)
Mr. Madan Lal Gujar	Plumber/Gr. II (1)

**Electrical**

Mr. Manik Chandra	STA/Gr. III (2)
Mr. M.K. Jain	JE(Elect)Gr. III (1)
Mr. S.K. Suryavanshi	Electrician/Gr.II (1)
Mr. Vijay Golait	Messenger

**WORKSHOP**

Mr. J.P. Pandey	Foreman/Gr. III (1)
Mr. Ujjwal Mukut	SLA/Gr. II (2)
Mr. Ramesh Kosthi	SLA/Gr. II (2)
Mr. A.K. Asati	Technician/Gr. II (1)
Mr. R.K. Gurjar	Lab. Assistant/Gr. II (1)
Mr. L.N. Sahu	Helper/Gr. I (1)

**ADMINISTRATION**

Mr. C.S. Shanmughom	Controller of Admn.
Mrs. Shyamala Soman	Sr. Stenographer
Mr. K.P. Tripathi	Jr. Security Guard
Mr. B.N. Dikshit	Section Officer
Mr. P.K. Srivastava	Assistant
Mr. S.K. Chaudhary	SPA
Mr. Jaipal Kujur	LDC
Mr. Satish Kumar	Helper/Gr. I (1)
Mr. B.S. Rajput	Section Officer
Mr. R.N. Ram	Assistant
Mr. B.C. Pal	Assistant
Ms. Asha Trivedi	LDC
Mr. N.K. Pethari	LDC
Mr. Arun Saxena	Guest House Keeper
Mr. Anil Gond	Messenger
Mr. G.D. Sootha	Cook-cum-Bearer
Mr. Md. Rafiq	Driver/Gr. II (1)
Mr. Ramcharan Malvi	Driver/Gr. II (1)
Mr. Govind Singh Yadav	Driver/Gr. II (1)
Mr. Ram Kishore	Driver/Gr. II (1)
Mr. L.N. Sahu	Helper/Gr.I (1)

**STORES & PURCHASE**

Mr. Sikandar Sultan	Dy. SPO
Mr. V.G.S. Rao	Dy. SPO
Mr. Girish Chand	UDC
Mr. Harihar Singh	Jr. Security Guard
Mr. D.M. Chilbule	Stores & Purchase Asstt.
Mr. R.N. Sharma	Stores Attendant

**FINANCE & ACCOUNTS**

Mr. B.D. Jha	FAO
Mr. S. Chandrahas	Section Officer (F&A)
Mr. P.K. Satyanesan	UDC
Mr. C.V. Balasubramanian	LDC
Mr. N.S. Jadav	Messenger

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