राष्ट्रीय सीमेंट एवं भवन सामग्री परिषद्

National Council for Cement and Building Materials

December-2019

NCCBM NEWS LETTER

NCCBM

Endeavours & Works for Sustainability of Cement & Construction Industry

Message from Editorial Team

Editorial Director
Dr B N Mohapatra

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Mr S K Agarwal

Mr Kapil Kureja

Mr Saurabh Bhatnagar

Mr Suresh Shaw

Mr K P K Reddy

Dr (Ms) Varsh Liju

Ms Richa Mazumdar

Mr Lalit Yadav

It is indeed a great honor to release the Seminar edition for NCB News 2019. In this issue, we will recount the various projects and activities in which NCB is actively involved since the last one year. This edition also tells about the Organizational structure, the six engines providing power to the entire R&I machinery as well as the service groups complimenting the Centres. NCB's areas of work spans over the entire spectrum of cement manufacturing and usage – starting with geological exploration of raw materials through the processes, the machinery, the manufacturing aspects, energy and environmental considerations to the final utilization of materials in actual construction, condition monitoring & rehabilitation of buildings and structures.

For more than five decades now, NCB has continued its efforts to sustain the tempo and quality of technical inputs and further strengthen the interface it has forged with the users of its services. The government and industry have extended their unending support and encouragement to NCB's efforts to enable it to gear up for meeting bigger challenges in future and to provide industrial support services of global standards to the Indian cement and construction industries.
NCB has been working on newer technologies and materials for performance enhancement, cost reduction and durable constructions. The Indian cement and building materials industries are fortunate in having the active support and services of NCB with its excellent infrastructure and invaluable intellectual capital. With continued patronage from the government and society at large, the cement industry along with NCB shall continue to strive to meet the legitimate aspirations of its constituencies and fulfill its responsibilities to the nation.

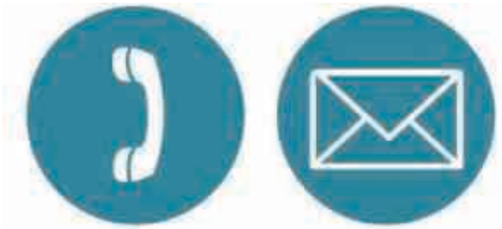
NCB International Seminars on Cement, Concrete and Building Materials provide a comprehensive update on cement and construction technologies including related plant and machinery, projecting international endeavors and experiences in these areas with the underlying objective of sustainable development. We are quite optimistic that the vast expertise available at the 16th edition of the seminar from India as well as from abroad would be most appropriately used for finding out pragmatic solutions for the benefit of cement and construction industries.

A big thanks to the Technical team for making this edition of newsletter possible by contributing and giving valuable insights in their respective fields of endeavor.

Last but not least, the Editorial team would like to thank Director General- NCB, Dr. B N Mohapatra, for his everlasting guidance and support throughout the creation of this edition.

It is an appeal to all readers to forward suggestions, critics to improve the quality of the NCB newsletter at crincb@gmail.com

CONTACT DETAILS



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Sh S Sridharan PS-Director General	0129-2242525 0129-4192236	

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Centre for Mining, Environment, Plant Engineering and Operation (CME)	Sh Ashutosh Saxena Joint Director	0129-4192242 0129-2244883	cme2b@ncbindia.com ncbcme@gmail.com
Centre for Construction Development and Research (CDR)	Sh V V Arora Joint Director	0129-4192240 0129-2246173	cdrb@ncbindia.com
Centre for Quality Management, Standards and Calibration Services (CQC)	Sh P N Ojha General Manager	0129-4192239	cqcb@ncbindia.com ncb.cqc@gmail.com
Centre for Industrial Information Services (CIS)	Sh A V S Manian General Manager	0129-4192279	cisb@ncbindia.com
Centre for Continuing Education Services (CCE)	Dr D K Panda General Manager	0129-4192339	cceb@ncbindia.com ncbcce@gmail.com

VISIONARIES OF NCB's JOURNEY

DIRECTOR GENERAL

NATIONAL COUNCIL FOR CEMENT AND BUILDING MATERIALS

Dr H C Visvesvaraya (Chairman & DG)	**01-04-1966**	**–**	**01-11-1989**
Dr A K Mullick	**02-11-1989**	**–**	**18-02-1994**
Dr S P Ghosh	**19-02-1994**	**–**	**30-06-1998**
Dr C Rajkumar (Actg.)	**01-07-1998**	**–**	**26-04-2000**
Shri D B N Rao	**27-04-2000**	**–**	**30-11-2001**
Shri Shiban Raina (Actg.)	**01-12-2001**	**–**	**31-10-2005**
Dr K Mohan (Actg.)	**01-11- 2005**	**–**	**16-05-2007**
Shri M Vasudeva (Actg.)	**17-05-2007**	**–**	**30-04-2010**
Shri Ashwani Pahuja	**01-05-2010**	**–**	**30-04-2017**
Dr Shri Harsh (Actg.)	**01-05-2017**	**–**	**30-06-2017**
Shri Ashutosh Saxena (Actg.)	**01-07-2017**	**–**	**02-12-2018**
Dr B N Mohapatra	**03-12-2018**		

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From the desk of Director General

I take great pride in presenting NCB NEWS 2019 Edition to you. NCB, like rest of our society, country and the world is on the cusp of a transformation. With the basic needs of a majority of world's population addressed, the thrust now is on clean and green future, responsible consumption of resources and long term sustainability.

The Indian cement industry, a pivotal sector contributing significantly towards the economy of the country through employment generation and government exchequer, understands that it has to contribute in a bigger way for the world to achieve net zero carbon dioxide emissions by mid-century. It has set upon a mighty endeavor for devising sustainable and commercially viable solutions to address problems of energy conservation, global warming and climate change, depleting air and water resources. It has also started pulling the right levers due to which, today, it is rated as one of the best performing industries across various sectors in terms of energy consumption, GHG emissions, quality systems, environmental and ecological sustainability and corporate social responsibility.

However, this pursuit of excellence is long and having the company of a "*trusted friend*" in such pursuit is always a blessing. The foundation of NCB was laid more than five decades ago with the vision of its founding fathers of providing that "*trusted friend*" who can stand by the industry in times of adversity and new challenges. Saying that NCB has made significant contribution in multi-faceted dimensions during all these years towards achieving some key milestones towards betterment of the industry, would be a gross understatement. Being the pivotal institution and knowledge bank for the sector, NCB, is committed to conduct frontline research activities in cement and concrete for benefit of the industry and society at large.

This newsletter gives a brief glimpse of R&D projects in which I along with my team of highly qualified and vastly experienced scientists and engineers are working. It also tells about the multi-disciplinary domains of cement and concrete in which we are offering our expert services. At NCB, to think critically and find solutions to unexpected challenges is business as usual. We believe that the greatest rewards for our efforts will not come instantaneously but from sustained efforts and through hard work.

NCB is built on the pillars of knowledge, infrastructure, energy and drive of its people. This Newsletter is all about capturing the dynamic quality that permeates in every laboratory, training hall and building within all NCB units, present in all four corners of the country.

I wish to thank former Director Generals of NCB for laying a strong foundation for us to build upon. Whilst passing the baton to me, they have filled me with tremendous sense of pride and responsibility. I also wish to thank my colleagues for their dedicated support, whole hearted cooperation and commitment to uphold the high standards of professionalism. I am grateful to the Board of Governors and its Committees, Department for Promotion of Industry & Internal Trade, Ministry of Commerce and Industry, Government of India for their support, guidance and encouragement. I also thank industry in general for reposing faith in NCB's services and their continued patronage without which no achievements would have been possible.

I hope that every page of this newsletter will introduce you to the true inner workings of NCB, the engines that keep us running strong. At many places in the newsletter, you will see faces, smiles, curious and determined eyes, passionate hearts, and boundary-pushing minds. In short, our people.

Dr. B N Mohapatra

Director General

Message from Chairman

The cement industry today, rated as one of the best performing industries across various sectors is pivotal in realizing the dreams of a "New India" by supporting infrastructure development, real estate and many flagship schemes of the Indian Government like Housing for All, Swachch Bharat Abhiyan, Make in India, 100 Smart cities, World-class Cement Concrete Highways, Dedicated Freight Corridors, Ultra Mega Power Projects to name a few. During this quest, the industry is destined to achieve many more significant milestones and achievements, thanks largely to the technical intellect and sheer willpower of the personnel serving this industry.

Research and Innovation play a pivotal role for any industry to remain competitive and keep pace with the demand and growth of the society and the country at large. NCB, a premier Research, Development and Innovation institution of its kind in Asia, is available in our country that is equipped with multi-disciplinary expertise coupled with state of the art testing and evaluation facilities.

It is a matter of great satisfaction to note that NCB's current Research and Innovations projects are well aligned to national priorities besides addressing current R & I requirements of cement, building materials and construction industries. It is worth noting that institution has chalked out ambitious and visionary R&I plan for 2021 and beyond. The research outcomes from these projects will provide Indian cement, building materials and construction industry a technologically sound platform to further reduce CO_2 emissions, energy consumption leading to resource & environment conservation, higher thermal substitution rates, longer service lives of concrete structures and cost optimization taking due care of national and international commitments besides contributing to our Hon'ble Prime minister's dream of "Swachch Bharat".

NCB's flagship event, 16th NCB International Seminar on Cement, Concrete and Building Materials, is being organized from December 03rd – 06th, 2019 at New Delhi. I've been informed that the Seminar has already received an overwhelming response. With large number of innovative technical papers, the sessions are expected to be much more lively and informative. The concurrent technical exhibition is also attracting more participation. This event provides a rare learning and networking opportunity and I appeal you all to take maximum advantage of the event.

I wish the Seminar a grand success!

Mahendra Singhi
Chairman

MESSAGES FROM FORMER DIRECTOR GENERALS

DR H C VISVESVARAYA
Ex-Director, ISI, New Delhi
Ex-Chairman, National Board of Accreditation
Ex-Vice Chancellor, University of Roorkee
Chairman & DG, NCB, New Delhi (Retd)
Past President, Institution of Engineers (India)
Recipient of Padmashree in 1991

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M a l l e s w a r a m
BANGALORE 560 003

e-mail:<hcv1008@gmail.com> ***Tel: 080 - 2334 5988***

D.Sc. (Honoris Causa) in 2012

17 November 2019

MESSAGE

The cement and construction industries in India have greatly benefited from the yeomen service NCB has been rendering for over half a century; the periodic international seminars organized by NCB have greatly contributed to the rapid progress of these industries and to fulfilling the needs of the consumers and the efforts of the government. The recent activities of NCB have indeed added great value in this progress; I am glad these recent activities are also being highlighted in the forthcoming 16th NCB International Seminar in December 2019 in New Delhi.

May the Seminar be a grand success! My Best Wishes to all the participants.

H.C. VISVESVARAYA

Dr A K Mullick
Former Director General
National Council for Cement and Building Materials

18 November 2019

MESSAGE

I am delighted to know that the NCB Newsletter highlighting the recent activities carried out by NCB is being brought out during the 16th NCB International Seminar on Cement, Concrete and Building Materials scheduled to be held during 03-06 December 2019 at Manekshaw Center, New Delhi.

This efforts of NCB in fulfilling the needs of the cement and construction industries is highly appreciable. NCB's contribution to the progress and development of the Cement and Construction industries have been both explicit and implicit. More than anything else, to have a sound technological base to support the activities of the industries is a tremendous boost, which NCB has always provided. I hope that the outcome of the Seminar will definitely benefit the cement and construction industries.

I wish for a grand success for the Seminar.

Dr. A.K. Mullick

Dr C Rajkumar
Former Director General (Actg.)
National Council for Cement and Building Materials

20 November 2019

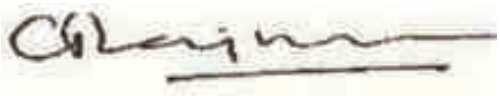
MESSAGE

I am delighted to know that the NCB Newsletter highlighting the recent activities carried out by NCB is being brought out during the16th NCB International Seminar on Cement, Concrete and Building Materials, scheduled to be held during 03-06 December 2019 at Manekshaw Centre, New Delhi.

The efforts of NCB in fulfilling the needs of the cement and construction industries are significant and highly appreciated policy makers, technologists and experts.

I sincerely wish that the outcome of this Seminar will lead to next level of technological developments in different facets of the cement and construction industries.

My best wishes for a successful 16th NCB Seminar.



C. Rajkumar

D.B.N.RAO, B.E.(Mech), M.Tech., PGD Cement Tech,

Former Chairman, Civil Engg. Divisional Council for Cement and Concrete, Bureau of Indian Standards (BIS), (Ministry of Consumer Affairs, New Delhi)

Former Director General of National Council for Cement and Building Materials (NCBM), New Delhi, (Ministry of Commerce & Industries)

Former Director General of Building Materials Technology and Promotion Council (BMTPC), New Delhi, (Ministry of Urban Employment and Poverty Alleviation)

18th November 2019

MESSAGE

I am delighted to know that the NCB Newsletter highlighting the recent activities carried out by NCB is being brought out during the 16th NCB International Seminar on Cement, Concrete and Building Materials scheduled to be held during 03-06 December 2019 at Manekshaw Centre, New Delhi.

The efforts of NCB, which is a beacon to the Cement & Construction Industry, in fulfilling the technological advancements of these Industries deserves to be highly commendable. I hope that the outcome of the Seminar will definitely be beneficial to Construction industry as a whole.

I hope that NCB, in its quest to share its rich expertise not only for the development & growth of the Industry, but will also enable the Industry to surpass the world standards in every sphere of its activities.

I wish the 16th NCB International Seminar a grand success

D.B.N. Rao

Dr K Mohan
Former Director General (Actg.)
National Council for Cement and Building Materials

18 November 2019

MESSAGE

It has been my great honour and privilege to be associated with a prominent institute National Council for Cement and Building Materials (NCB) and lead a team of extremely talented, highly dedicated, committed and absolutely first rate scientists and engineers. NCB has been rendering its high quality technical services to the cement, construction and building materials industries through its research and development programmes, testing and calibration services, manpower training and consultancy services etc. NCB has played a prominent role in the growth and development of country's cement sector over the last five decades.

It has made significant contribution to the benefit of industry. It has achieved many milestones and provided innovative technological solutions to the industry. The research and development activities of NCB, their transfer and implementation in partnership with cement, construction and building materials industries have been well appreciated. It gives me immense pleasure to mention that the pioneering research and development work carried out by scientists and engineers of NCB have been internationally recognized and highly appreciated as evidenced by numerous publications in prestigious international journals and patents granted and they deserve kudos.

I wish and hope that with the concerted efforts of scientists and engineers including other technical and non-technical staff NCB will maintain its status as the leading research organization and also the preferred technology development partner in the cement and construction sector.

NCB has been organizing successfully International Seminar on Cement and Building Materials since 1987 and it is rated as one of the biggest event in this part of the world. I wish the forthcoming 16th NCB International Seminar on Cement, Concrete and Building Materials to be held during 03 – 06 December, 2019 in New Delhi a huge success.

K. Mohan

DR. K. MOHAN

M. Vasudeva
Former Director General (Actg.)
National Council for Cement and Building Materials

18 November 2019

MESSAGE

I am glad to know that, coinciding with the 16th NCB International Seminar on Cement, Concrete and Building Materials scheduled to be held during 03-06 December 2019 at Manekshaw Centre, New Delhi, NCB is bringing out the Newsletter highlighting its recent activities.

The services of NCB over the past five decades, focused on the technical needs of the cement and construction industries, have indeed provided invaluable support to these industries. I am sure the Seminar, another effort of NCB in that direction, will immensely benefit the cement and construction industries.

I wish the Seminar a resounding success.

M. Vasudeva

M. VASUDEVA

Ashwani Pahuja
Former Director General
National Council for Cement and Building Materials

19 November 2019

MESSAGE

I am delighted to know that the NCB Newsletter highlighting the recent activities carried out by NCB is being brought out during the 16th NCB International Seminar on Cement, Concrete and Building Materials scheduled to be held during 03-06 December 2019 at Manekshaw Centre, New Delhi.

The efforts of NCB in fulfilling the needs of the cement and construction industries is highly appreciable. I hope that the outcome of the Seminar will definitely benefit the cement and construction industries.

I wish for a grand success for the Seminar.

Ashwani Pahuja

National Council for Cement and Building Materials
(A Premier R&D Organization under the Administrative Control of Ministry of Commerce & Industry, Govt. of India)

OUR VISION

Be a preferred technology partner to cement and construction sectors in the sustainable development of a better infrastructure and housing.

OUR MISSION

Research and Development of innovative technologies, their transfer and implementation in partnership with cement and construction industries.

- To enhance quality, productivity and cost-effectiveness
- To improve the management of materials, energy and environmental resources
- To develop competency and productivity in human resources

To develop technologies for durable infrastructure and affordable housing

INTRODUCING NCB

National Council for Cement and Building Materials (NCB), then Cement Research Institute of India (CRI) was founded on 24th December 1962 with the objective to promote research and scientific work connected with cement and building materials trade and industry.

Today, NCB is the premier body under the administrative control of Ministry of Commerce and Industry, Govt. of India, for technology development, transfer, continuing education and industrial services for cement and construction industries. NCB serves as the nodal agency for providing necessary support to the Government for formulation of its policy and planning activities related to growth and development of cement industry. It is devoted to protect the interests of consumers of cement and concrete in the country. NCB's stakeholders are Government, Industry and Society, who perceive NCB's role as discharging national responsibility, providing adequate technology support and improving the quality of life respectively.

Geographically, NCB has its research center and main laboratories located at Ballabgarh (near New Delhi); another well-established regional center at Hyderabad, unit at Ahmedabad (Gujarat) and at Bhubaneswar (Odisha). The units of NCB-Ballabgarh, Hyderabad and Ahmedabad are ISO 9001:2015 certified.

NCB's areas of work span over the entire spectrum of cement manufacturing and usage – starting with geological exploration of raw materials through the processes, the machinery, the manufacturing aspects, energy and environmental considerations to the final utilization of materials in actual construction, condition monitoring & rehabilitation of buildings and structures. NCB provides ISO 17025 accredited testing and calibration services, ISO 17043 accredited Proficiency Testing (PT) services and ISO 17020 accredited inspection services. It also develops and supplies Certified Reference Materials (CRMs) to cement and construction sector. For human resource development, NCB provides training services in cement, concrete and building materials field through short term and long term courses. PG diploma course in cement technology is accredited by AICTE. NCB has organized 15 editions of international seminars on cement, concrete and building materials to provide a platform where the experts from the industry, research institutes, regulatory bodies, academia etc. share their knowledge and experiences for the good of the industry as well as society.

NCB's Tree with Six Branches of Research Centers

- **CRT**–Cement Research & Independent Testing
- **CQC**–Quality Management, Standards & Calibration
- **CME**–Mining, Environment, Plant Engg. & Operation
- **CDR**–Construction Development & Research
- **CCE**–Continuing Education
- **CIS**–Industrial Information

NCB has following four service groups to support the technical activities of above six research centers.

Finance and Account Services (FAS)

FAS is responsible for managing all day- to-day financial activities

Human Resource and Administrative Services (HRS)

HRS-GEN provides the transportation infrastructure and HRS-PER looks in to human resources activities such as recruitment, promotion, appraisal etc.

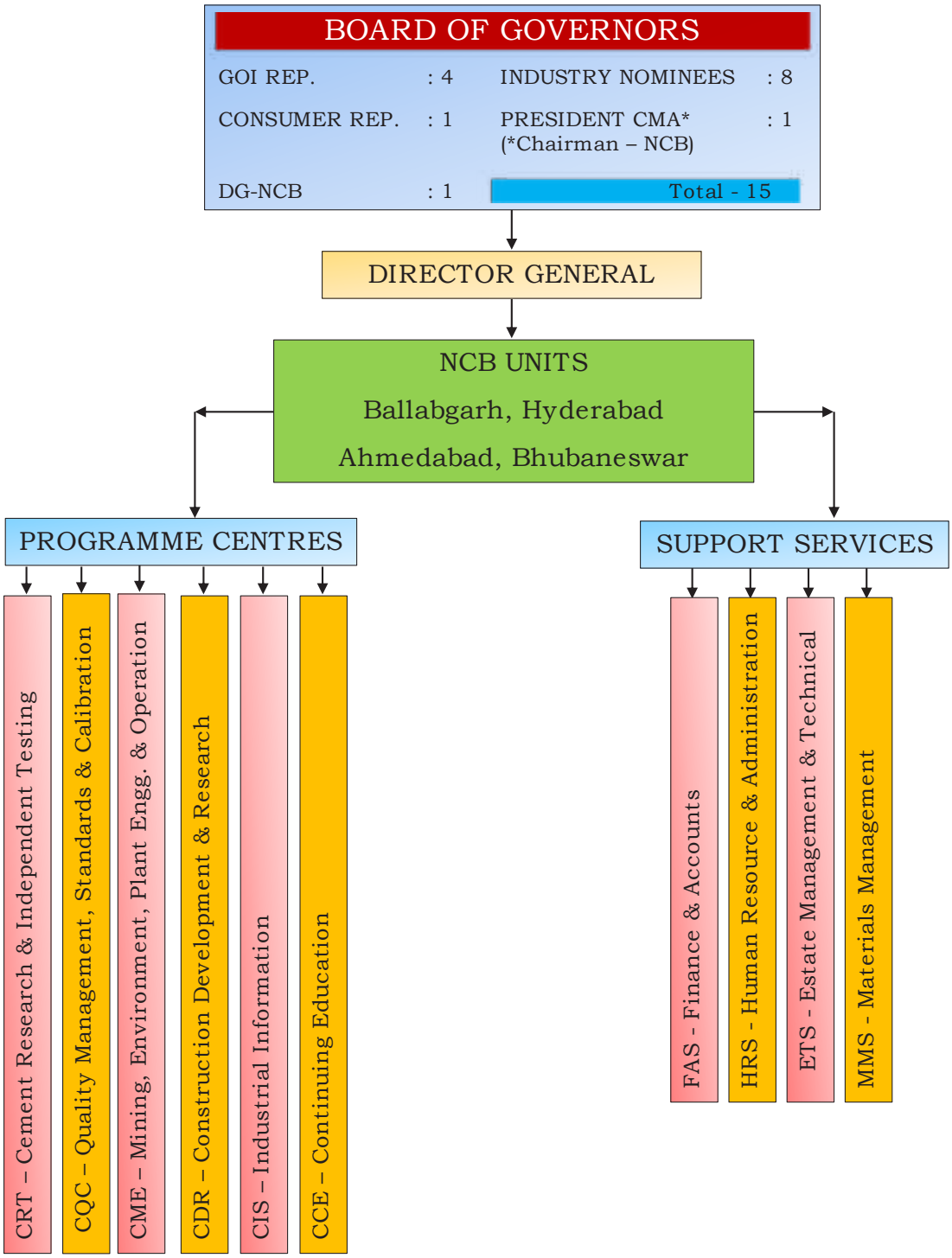
Estate Management and Technical Services (ETS)

ETS is responsible for maintaining the infrastructure including resources such as workspace, utilities, equipment and communication technology infrastructure.

Materials Management Services (MMS)

MMS is responsible for procurement of materials including raw material as well as equipment as per the requirements of different departments of organization.

NCB ORGANIZATION STRUCTURE



NCB'S COMMITMENT TO INTERNATIONAL QUALITY STANDARDS

NCB in its commitment to achieve excellence has adopted world class practices and implemented international standards for Quality Management System. NCB's quality management system is certified as per ISO 9001:2015. NCB provides Testing, Calibration, Proficiency Testing and Third Party Inspection Activities which are accredited as per International Standards.

Accreditations and certifications

Director General's Profile

- M.Sc. (Chemistry), PhD in Cement Mineral Chemistry
- Over 33 years of cross-functional experience in Research and Development areas, some of which include Mineral and Material Characterization, Waste Elimination and Utilization, New Product Development, Utilization of Alternate Fuel & Raw Materials, Research on Cement Technology, Quality Control & Quality Assurance, Total Quality Management, Concrete Technology, Project Management, Leadership & Team Management, Technology Selection, Raw Material Handling, Environment Management System & Control and Client Relationship Management
- Worked with Dalmia Institute of Scientific and Industrial Research, Odisha ,OCL India Ltd (Dalmia Group), Vikram Cement Works, a unit of UltraTech Cement Ltd (Aditya Birla Group) and Ambuja Cement Ltd (conglomerates of Lafarge Holcim Group)
- Author of a Book **"Application of X-Ray Diffractometry in Cement Quality Control System"**
- **92 nos.** Publication / Presentation in National/ International Journals, Conferences & Seminars
- Member of various technical committee of BIS & Member of Research Advisory Committee of DISIR & AKS University
- Chairman of Cement sectoral committee of BEE
- Successfully completed International assignments in Germany, Malaysia, Japan, Oman etc.
- Achieved various reputed awards as a team leader like Rajiv Gandhi award **for Quality-2010** (Best of All), Rajiv Gandhi award for **Environment-2011,** CII Best **Environment Award-2012,** CII Best **Energy Award-2012, Indian Manufacturing** Excellent Award-2012, **"14th National Award for Excellence in Energy Management 2013"** by CII, Hyderabad, **"Best Environmental Excellence in Plant Operation 2012 -13**"by NCCBM, New Delhi "**IMC Ramakrishna Bajaj National Quality Award** 2011-12, 2012-13 and 2013-14" by Indian Merchant Chamber.
- He has chaired several important Technical Sessions on Supplementary Cementitious Materials (SCMs) in conferences of repute like 15th ICCC -2019. He is frequently invited as a keynote speaker and distinguished panelist in discussions on various topics like Co-processing of waste, cement sustainability and Cement Business and Industry.
- He is also guiding 4 NCB officials pursuing Ph.D in their research work

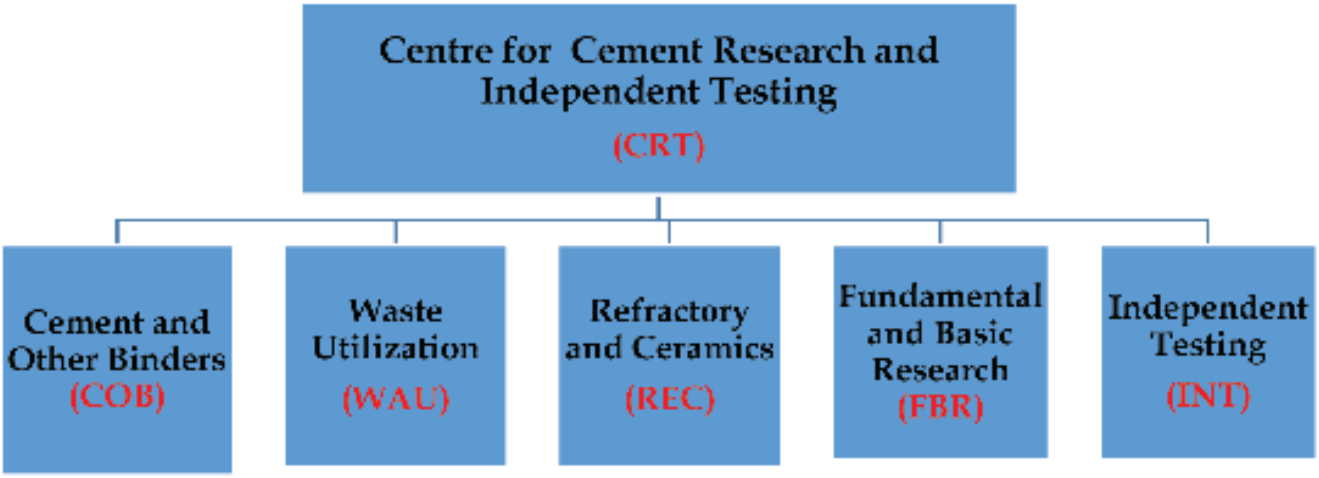
NCB's RESEARCH CENTERS

Centre for Cement Research and Independent Testing (CRT)

Dr S K Chaturvedi
Joint Director &
Head of Centre

- B.Tech (Ceramic Engg.), PhD,
- Over 32 years of experience in the Field of Cement and Building Materials, nano cement/ceramics, reactivity of raw materials
- The center executes its activities in the areas of utilization of low & marginal grade limestone, evaluation of raw materials & fuel, optimization of raw mix design, lump formation, use of mineralizers, use of industrial wastes and by-products in clinker making, low lime & energy cement, development of building products, refractory management, diagnostic studies related to premature refractory failure, kiln shell corrosion etc.

The Centre provides its services through the following Programmes:



CRT's Scientists, Engineers and Offered Services

 Dr D YADAV General Manager	• M.Sc. (Chemistry), Ph.D, MBA • 35 years' research experience in the areas of raw mix design, waste utilization, independent testing laboratory, polymer science • 47 research papers published in journals and conferences • 6 patents to credit	**SERVICES OFFERED BY COB** • Establishing Limestone Consumption Factor (LCF) for cement plants • Utilization of marginal/low grade limestone in the manufacture of cement • Characterization and evaluation of raw materials and fuels • Optimization of raw mix design for improved quality of clinker • Development of low lime and energy saving cements • Investigations on lump formation in cement silo/bags and remedial measures • Effect of minor constituents on clinker/cement quality • Studies on use of mineralizers in clinkerization **SERVICES OFFERED BY WAU** • Utilization of industrial wastes and by-products in the manufacture of cement. Enhancing the fly ash content in PPC by adopting activation of fly ash through different routes. • Use of low grade materials and mine rejects in development of synthetic slag • Utilization of industrial by-products such as lead-zinc slag, copper slag, LD slag etc from metallurgical industries, spent pot lining (SPL) waste from alumina industry, jarosite from zinc industry, barium sludge from chemical industry as raw material/ mineralizer/mineral additive in the manufacture of OPC.
 Dr A K DIKSHIT General Manager	• M.Sc. (Chemistry), Ph.D • 6 patents and 61 paper to credit • Experience in the field of nanomaterials; sol gel; glass and ceramic materials; newer cements; waste utilization in cement industry; construction chemicals in cement and concrete; cement hydration; microstructure; certified reference materials; quality management system; statistical quality control; quality assurance and customer protection etc.	
 G J NAIDU Group Manager	• M.Sc. (Chemistry), PGDEM • 24 Years' experience in the area of cement raw mix design for different type of cements, testing and evaluation activities of cements, cement raw materials, fuels etc., utilization of industrial wastes such as fly ash, bottom ash, lime sludge, GBF slag in development of OPC based blended cements	

 S K AGARWAL Manager	• M.Sc. (Physics), M.Phil • 32 years' experience in cement technology, use of alternate raw materials and SCMs, development of building products • About 45 research papers published in journals like Cement and Concrete Research, Advances in Cement Research, ICR etc and communicated in national & international conferences • 8 patents to credit • Reviewer of international journal "Advances in Cement Research" • Activity incharge-Patents	• Use of "jarosite" as partial substitute of conventional mineral gypsum in controlling cement setting. • Developmental studies on plaster coating, tiles, bricks, blocks etc using industrial wastes such as marble slurry, fly ash, red mud etc. **SERVICES OFFERED BY REC** • Diagnostic studies/ investigations related to premature refractory failures in cement rotary kilns • Damage assessment during shipment of refractories • Quality evaluation of fresh refractories lot at cement/ refractory plant, kiln shell corrosion, loosening of brick rings in cement rotary kiln during operation, coating and build ups formation/ring formation • Refractory management studies and optimization of refractory lining performance • Development and technology transfer of refractory products • High temperature investigations • Technical suitability of industrial wastes in refractory and ceramic industries • Development of kiln furniture and pottery wares by using industrial by-products • Comprehensive thermal investigations of refractories using state-of-art equipment's such as thermal spalling, thermal analyzer, PCE, RUL, PLC etc.
 Dr PINKY PANDEY Manager	• M.Sc. (Chemistry), Ph.D • 12 years' experience in the area cement chemistry, testing of cement, allied materials and fuel • About 28 research papers published in journals/ Seminars/Conferences	
 T MOHAN RAO Manager	• M.Sc. (Chemistry) • 33 years' experience in the field of cement research, instrumental techniques	
 SURESH VANGURI Deputy Manager	• M.Sc. (Physics), M.Tech (Solid State Technology) • 9 years' experience in the area of material, characterization, raw mix design, cement hydration, waste utilization	

	• 15 research papers published and presented in national and international conferences	**SERVICES OFFERED BY FBR** • Exploratory studies related to the material science • Application of nano technology for enhancing cement performance • Development of novel cement systems and additives, such as geopolymer, composite cement, Portland limestone cement etc **SERVICES OFFERED BY INT** Independent Testing Laboratories undertake complete physical, chemical, mineralogical and micro-structural analyses of various types of raw materials, cement, clinker, pozzolana, aggregate, concrete, admixtures, water, refractory, bricks, coal, lignite etc as per National and International standards. NCB testing laboratories achieved a hallmark when NABL accredited them in the year 1997 and since then, the quality of testing services is maintained through NABL accreditation. The laboratories are BIS recognized, ISO certified and equipped with Laboratory Information Management System (LIMS) facilitating smooth and efficient operations with state-of-art instrumental facilities to carry out the tests. The number of samples tested during the financial year 2018-19 were more than 11000
 Dr VARSHA LIJU Deputy Manager	• M.Sc. (Chemistry), Ph.D and Post-Doctoral from Trinity college, Dublin, Ireland • 8 years' of experience in the area of geopolymeric cement, cement nanotechnology, composite cement, raw mix designing • 1 patent to credit • 20 paper in international journals and seminars • Experience in handling advanced instrumental techniques like TG/DTA, heating microscope etc	
 Dr SURESH PALLA Deputy Manager	• M.Sc. (Chemistry), Ph.D • 5 years' experience in the areas of material science and cement chemistry • Experience in operation of advanced instrumental techniques; XRD, XRF, SEM, Isothermal calorimeter • 35 published paper in International/National journals, seminar etc.	
 GIASUDDIN AHAMED Deputy Manager	• B.Tech (Ceramic Tech.), M.Tech (Ceramic Engg.) • 5 years' experience in refractory materials, materials characterization, raw mix design, raw mix design, coating and build ups • Experience in refractory testing facilities like PCE, RUL, thermal spalling etc.	

Salient R&D and Sponsored Projects

Centre for Cement Research and Independent Testing is devoted for development of low lime and low energy cements for environmental sustainability to mitigate carbon footprints from atmosphere during cement production and also towards the conservation of natural resources by exploring alternate raw materials and unconventional Supplementary Cementitious Materials (SCMs) in development of blended cements with low clinker to cement ratio. Some of the salient studies are:

Development of Belite Calcium Sulfoaluminate Clinker (BCSA)

The production of conventional clinker consumes substantial amount of cement grade limestone and energy along with release of CO_2 in atmosphere. In view of above, a study has been taken up for development of BCSA clinker using low grade limestone, additives and industrial by-products, sintered at comparatively lower temperature with major clinker phases; C_2S, $C_4A_3\$$, CA and $C_{12}A_7$.

High MgO Clinker for PPC & PSC

In order to promote utilization of low grade of limestone bearing high MgO, in manufacture of blended cements; PPC and PSC, a study was focussed on evaluation of the performance of PPC and PSC blends, prepared using high MgO clinker. The results obtained so far were quite encouraging which will pave the way for utilization of high MgO bearing low grade limestone.

Composite Cements

Based on NCB's study, Bureau of Indian Standard (BIS) has formulated IS code IS: 16415-2015 (Composite Cement-Specification), permitting the use of fly ash (15-35%) and GBF slag (20-50%) simultaneously in the manufacture of composite cement by inter-grinding of all constituent's method. Further, a study is going on for the preparation of composite cements using separate grinding and blending of all components and also on limestone-fly ash based cement system to broadened raw materials base in manufacture of composite cements.

Portland Limestone Cement (PLC)

European standard EN-197-1 permits the use of 35%, max limestone ($CaCO_3 \geq 75\%$) in the manufacture of Portland limestone cement. At present, this type of cements is not being standardized in India. NCB has taken up the studies to investigate the feasibility of using different grades limestone in development of Portland Limestone Cement and to formulate new Indian standard for its commercialization.

Multi-component Cement System

Due to the fast depletion of proven supplementary cementitious materials such as fly ash and GBF slag, a feasibility study is underway on calcined clay based cement systems such as limestone-calcined clay cement, marble dust-calcined clay cement, calcined clay-fly ash cement, fly ash-GBF slag-limestone cement etc.

Enhancing use of Fly ash in PPC

Bureau of Indian Standards permits the use of up to 35%, max fly ash confirming to Indian standard IS:3812-2013 in the manufacture of PPC (IS-1489(1)-2015). To enhance the utilization level of fly ash from current level of 35% to 40%, a study is going on maximise the use of fly ash in PPC by adopting different activation routes.

Improving the Reactivity of Fly ash and their Effect on Cement and Concrete Performance

Investigation was carried out to improve the reactivity of fly ash by mechanical and chemical activation as well as their combination and showed their potential to increase their consumption level in cement.

Steel Slag (LD-slag) as Raw Material in Clinker Making

The utilization of alternative raw materials containing calcium, which are either de-carbonated or contain calcium as non-carbonate minerals, provides a technically sound alternative for reducing carbon footprint in atmosphere and reduces energy required for de-carbonation of such raw materials. Steel slag (LD-slag), a waste generated during the process of refining of molten iron to steel and as a source of lime, could be a potential material in the production of Portland clinker.

Wollastonite as Raw Material in Clinker Making

Calcination reaction is the main contributor of CO_2 emission in atmosphere and use of non-carbonate bearing raw material is a promising approach to minimize the impact of carbon footprint. The present study highlights the feasibility of using wollastonite, a natural occurring mineral ($CaSiO_3$) as a source of lime by replacing equal amount of conventional limestone in clinker production.

Development of Synthetic Slag using Low Grade Limestone

In India, large amount of low grade limestone, dolomitic limestone etc are lying unutilized, and not found to be suitable in cement manufacture and GBF slag is mainly available in the eastern part of the country. Therefore, it is imperative to develop synthetic slag using low grade limestone and other additives to provide availability of GBF slag in manufacture of composite cement. The study showed potential of developing synthetic slag having properties similar to conventional GBF slag.

Establishing Limestone Consumption Factor

NCB has carried out LCF studies for cement plants for rationalization of limestone consumption in production of cement, estimating royalty payable to state for the limestone mined from their respective captive mines besides internal material audit of the concerned cement plants.

Visit to Orient Cement, Karnataka

Visit to ACC, Madukkarai, TN

Assessment of Quality Control Laboratories of Cement Plant

Laboratory assessment studies, which include the visit to the laboratories, assessment of infrastructure and equipment, calibration of equipment, skill level assessment, providing necessary training and assisted the plant laboratories in getting the NABL accreditation, was carried out

Laboratory Assessment at Plants in Nepal and India

CRT's Achievements

- Formulation of Indian standard IS:16415-2015 for composite cement
- Inclusion of copper slag, lead-zinc slag, steel slag and E-Eat as performance improver in OPC through Indian standard IS:269-2015
- Establishing Limestone Consumption Factor for more than 220 cement plants
- Optimization of raw mix designing utilizing of low grade limestone and other additives/ corrective materials for more than 50 cement plants

- Meeting delivery schedules and targeted quality of delivered cement through minimizing/ eliminating lump formation in silos/bags for 8 cement plants
- Developed high performance refractory products; (i) Alumina- Zircon Refractory (AZR) bricks for transition zone (ii) Magnesia Spinelide Refractory bricks for burning zone (iii) High Strength Insulating bricks for pre-heating areas (iv) Coating Repellent casting for build ups prone areas.
- Trouble shooting services for 20 cement plants with benefits of (i) kiln uptime increase by 12% (ii) fuel consumption reduction by 2-3% (iii) lining performance synchronization for one year (iv) trouble free kiln operation
- Testing of more than 11,000 no's of samples in INT for FY 2018-19
- 36 No's of patents granted and 07' No's of patents filed.

Showcase of CRT's Scientific Equipment

Scanning Electron Microscope with EDAX

Sputter Coater for SEM

X-ray Diffractometer

Particle Size Analyser

Optical Microscope

X-ray Fluorescence Spectrometer

Heating Microscope

Raising Hearth Furnace

Thermal Spalling Testing

RUL Testing Equipment

PCE Testing Equipment

Bomb Calorimeter

CHNS Analyzer

UV- Visible Spectrophotometer

Inductively Coupled Plasma Spectrometer

pH ion Meter

Air Permeability Apparatus

Flame Photometer

Muffle Furnace

Humidity Cabinet

Compression Testing Machine

Abrasion Testing Equipment

Vibrating Machine

Compression Testing Machine

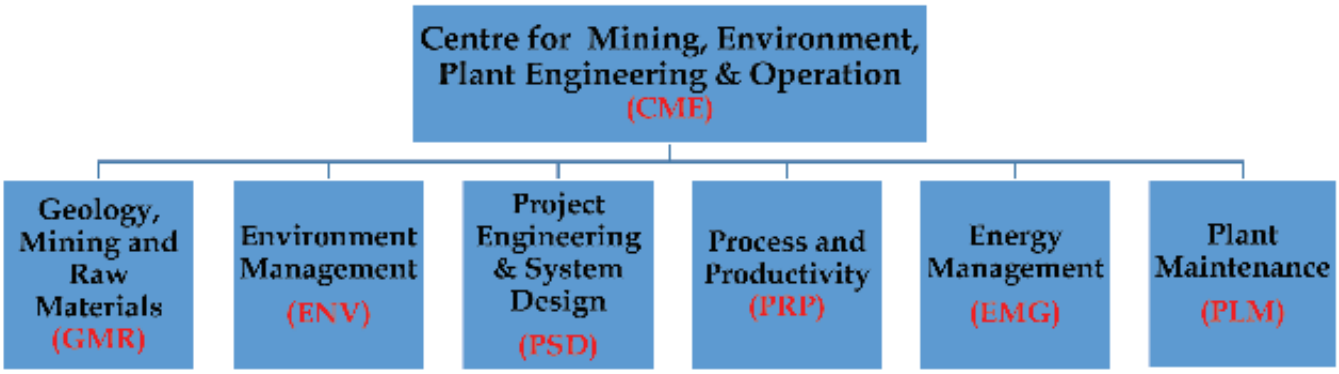
Hard Groove Index

Centre for Mining, Environment, Plant Engineering & Operation (CME)

Ashutosh Saxena
Joint Director &
Head of Centre

- BE (Electrical)
- 34 years of experience in Energy Audits of Cement Plants and Power Plants, Heat balance, Waste Heat Recovery & Feasibility studies
- The center provides entire range of services from identification of the site to commissioning of the cement plant including Geology and Mining, Project Engineering & System Design, Process Optimization, Energy & Environment audits and Plant Maintenance

The Centre provides its services through the following Programmes:



CME's Scientists, Engineers and Offered Services

 Dr D K PANDA General Manager & Programme Leader - GMR	• M.Sc. (Applied Geology), Ph.D (Geology) • Over 32 years of experience in the field of geological exploration, site investigation, Computer-Aided Deposit Evaluation of limestone deposits, upgradation of low/ marginal grade limestone etc. for cements plants	**SERVICES OFFERED BY GMR** • Identification, Technical Appraisal & Feasibility study of Potential Limestone Deposit for New Projects • Planning, Supervision and Monitoring of Exploration activities • Computer Aided Deposit Evaluation and Mine Planning, Production Scheduling and Blending using advanced softwares

 A K DUBEY General Manager - GMR	• B.Tech (Mining) from IIT (ISM) Dhanbad, 1st class manager certificate of competency & MBA (Operation Research) • Over 37 years of experience in the field of supervision of all mining activities, mine planning including equipment and manpower planning etc.	• Long term Mine Production Sensitivity Analysis based on Grade Constraints and Production target using advanced softwares • Technical Health Audit of Open Cast Limestone mines • Lab Scale Beneficiation Studies of Low/Marginal Grade Limestone
 RICHA MAZUMDER Deputy Manager - GMR	• M.Sc. (Tech) Applied Geology from IIT (ISM) Dhanbad • Over 10 years of experience in the field of geological exploration, site investigation, Computer-Aided Deposit Evaluation of limestone deposits, upgradation of low/ marginal grade limestone etc.	
 K V KALYANI JD & UIC-NCB:H	• B-Tech (Chemical Engg.) • Unit In-charge of NCB-Hyderabad Unit • Over 34 years of rich experience in the field of Process Optimization & Productivity, CFD, Energy Audit, Plant operation, and Simulation of Cement Plant Operation & Training activities in NCB-H	**SERVICES OFFERED BY PRP** • Rational Utilization of Alternative Fuels & Improvement in Fuel Combustion Efficiency • Techno-economic feasibility studies for utilization of alternative fuels. • Techno-economic feasibility studies for cement plant capacity upgradation. • Use of Hazardous Combustible Wastes Characterization including ○ Quantification of Heavy Metals ○ Impact on Combustion, Kiln Operation, Product Quality and Environment ○ Factors Governing Size and Extent of Utilization ○ System for Feeding & Firing in the Kiln System
 ANUPAM General Manager & Programme Leader - PRP	• B. Tech (Chemical & Bio Engineering) from N.I.T. Jalandhar • Over 21 years of experience in various segments of Cement Industry such as Plant operation, Plant design & Engineering / Re-engineering, Diagnostic studies & Optimization projects, Due-	

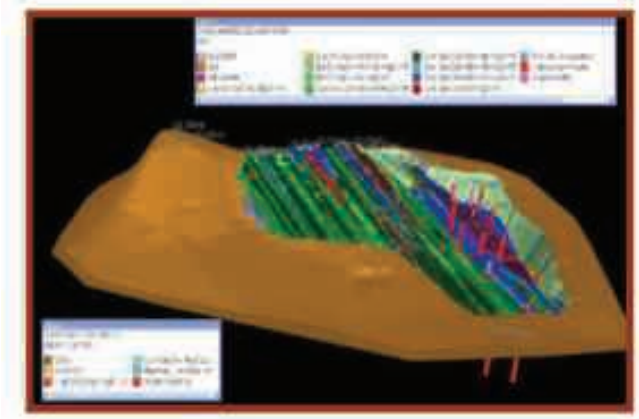
	Diligence & Feasibility Studies, Energy & Technical Audit, Conceptualization of Energy recovery from Waste, and Business Development	○ Techno-economic Viability • Long-term Productivity Enhancement Studies • Diagnostic Studies: High PH Exit Gas Temperature, Kiln Shell Corrosion, Unstable Combustion/Burning of Fuel, Coating Formation/Build-up in Kiln System, Lump Formation in Cement Silos • Process Optimization Studies on Mills, Separators and Kilns **Computational Fluid Dynamic Software** • Analysis of the Complex Flow Structures (Typical of cyclone, burner and calciner). • Assessment of the suitability of alternative fuels in Calciners. • CFD software in NCB is having various turbulence models like standard k-epsilon, spalart-allmaras, SST, k-omega, RSM model etc.
 ANIL POPURI Group Manager – PRP	• B. Tech (Chemical) from Osmania university, Certified Energy Auditor • Over 15 years of experience in the field of Plant Operation, Consultancy & Process Design and Retrofit Engineering of Cement plants.	
 KPK REDDY Deputy Manager - PRP	• B-Tech (Chemical Engg.) • Over 11 years of rich experience in the field of Process Optimization & Productivity, Energy Audit, Simulation of Cement Plant Operation	
 M V R RAO Deputy Manager - PRP	• B.Tech (Chemical), M-Tech (Energy & Environment-IIT Delhi), Certified Energy Auditor • Over 10 years of rich experience in the field of Process engineering, Plant operation, Energy management and Environment management.	
 RAYEES AHMED Deputy Manager - PRP	• B.E (Chemical Engineering), M-Tech (Chemical Engineering) • Over 12 years of rich experience in the field of Cement Process, Energy audit studies, Training activities	

 KAPIL KUKREJA Manager & Programme Leader - PSD	• B.E (Mechanical), M-Tech (Energy & Environment-IIT Delhi), PhD (Mechanical -Perusing from BITS-Pilani) • Over 15 years of rich experience in the field of System Design, Project Engineering & Management.	**SERVICES OFFERED BY PSD** ■ **Project Formulation** • Project conceptualization • Techno-Economic Feasibility Studies • Detailed Project report ■ **Project Engineering** • Basic Engineering • Procurement Assistance • Detailed Engineering • Project Planning and Monitoring ■ **Project Implementation** • Project Management and Control. • Inspection & Quality Assurance • Field Supervision • Commissioning & Plant Stabilizations ■ **Plant Operation & Assessment** • Plant Operation & Maintenance • Plant operation optimization • Capacity Balancing • Plant Modification and Upgradation • Plant Performance Audit • Plant Asset Evaluation
 SAURABH BHATNAGAR Deputy Manager - PSD	• B.Tech (Mechanical), M-Tech in Energy & Environment-IIT Delhi (Pursuing) • Over 11 years of rich experience in the field of System Design, Project Engineering & Management.	
 ANKUR MITTAL Manager & Programme Leader- EMG	• B.E (Chemical), M-Tech (Pursuing) (Energy Systems-IIT Delhi), BEE Certified Energy Auditor • Over 14 years of rich experience in the field of Cement plant operation, technical services, energy audits, technical faculty.	**SERVICES OFFERED BY EMG** • Energy Audit Studies in Cement Plants, Utilities Audit. • Energy Monitoring and Motivation for Competitive Improvement: National Awards for Energy Efficiency in Indian Cement Industry since 1986-87

 PRATEEK SHARMA Deputy Manager - EMG	• B.E (Chemical), M-Tech (Energy Systems-IIT Delhi), BEE Certified Energy Auditor • Over 10 years of enriched experience in the field of Process Optimization, Energy Audits and Waste heat recovery studies.	• Technological and R&D Support for Energy & Operational Efficiency, Fuel Substitution etc. • Heat Balance Studies • Gas Balance Studies Techno-economic Feasibility Studies for Cogeneration of Power through Waste Heat Recovery in Cement Plants. **Energy Awareness Activities** • Training Programmes, Workshops, Seminars etc. • Publications • Technology Digests & Newsletters
 VADDY VENKATESH Deputy Manager	• B.E., (Electrical & Electronics Engineering), M-Tech (Energy Engineering) • Over 9 years of rich experience in the field of Energy audits in more than 70 cement plants & power plants, Electrical and Mechanical Third party Quality assurance & Training activities in NCB-H	
 M SELVARAJAN General Manager & Programme Leader - ENV	• M.Sc in Geology from Presidency College, Madras University; PGDESD & PGDIM from IGNOU • Having 36 years of experience in the field of EIA/EMP, Environment Monitoring and Life Cycle Assessment	**SERVICES OFFERED BY ENV** • Control of Particulate and Gaseous Emissions • Environment Monitoring (Point Source & Ambient Air) • Life Cycle Assessment (LCA) studies • Carbon & Water Footprint Assessment • Pollution Load Assessment • Performance Evaluation of Air Pollution Control Equipment (APCE) • Environment Audit
 ANAND BOHRA Deputy Manager - ENV	• M.Tech in Environment Management from IIT Delhi and B.E. (Hons) from M.B.M. Engineering College, Jodhpur • Having 9 years of experience in the field of Life Cycle Assessment, Reduction in NOx and SO_2 in cement	

	plants and Environment Management	• Noise & Ground Vibration studies • Water & Waste water Analysis • Solid and Hazardous Waste • EIA and EMP studies
 KRP NATH Deputy Manager - ENV	• B.Tech (Chemical), M-Tech (Pursuing) in Environment Engg from JNTU • Over 10 years of experience in the field of Life Cycle Assessment, Reduction in NOx and SO_2 in cement plants and Environment Management	

Showcase of CME's Activities



3-D Ore Body Model of LS Grade Distribution within Conceptualized Pit

Gas Balancing and Baseline Study For CFD

Geological Exploration Work at Congo

NCB Team for Brow filed Expansion Project

NCB Team Visited at M/s J K Lakshmi Cement Ltd. Jhajjar for Energy Audit

Techno-Economic Feasibility Study of Secondary SO2 Control Systems

Showcase of CME's Engineering Softwares & Equipment

Engineering Softwares

Multi Mine Scheduler
&
RM Scheduler

CFD Software

Equipment

Stack Monitoruing Kit

Flue Gas Analyser

Contonous Emission Monitoring System

Respirable Dust Sampler

Chemiluminescence NOx Analyzer

Indoor Air (VOC) analyser

SO_2 Fluorescent Analyser

CME's Achievements

Successfully completed +500 projects covering the followings:

- **+ 90 nos.** Process optimization/Productivity enhancement etc. in cement plants.

- **+ 200 nos.** Energy Audit studies in cement plants.
- **+ 50 nos** EIA/EMP studies, Pollution Load Studies for Plants and Mines, LCA Study for Cement Plants etc.
- **+ 20 nos.** Technical/Maintenance/Utility audits
- **+ 35 nos.** Monitoring and supervision of geological survey, exploration including drilling, computer aided deposit evaluation and mine planning
- **+ 100 nos.** TEFR study and Detailed Project Report
- **+ 10 nos.** AFR Process Impact Assessment and System Design Project

CME's Efforts for Environmental Sustainability of Cement Industry

- **+ 10 nos.** Projects Completed related to Waste utilization as Alternative Fuels in cement plant.
- Recently completed a R&D Project on assessment of the environment impacts associated with ammonia usage for NOx reduction in Indian Cement Plants
- Recently completed a R&D on "Water Footprint Assessment of Cement Plants"
- Various studies carried out for assessment of SO2 generation in cement plants in India
- Projects like CCU, Calcination of Phospho Gypsum, Multi type AF handling chute, Pilot Cement plant at NCB etc are in pipeline in view of future requirement & challenges of Cement industry.

Accolades Received from Clients

Appreciation Letter Received from the Government of RoC in April 2019 for PMC Project

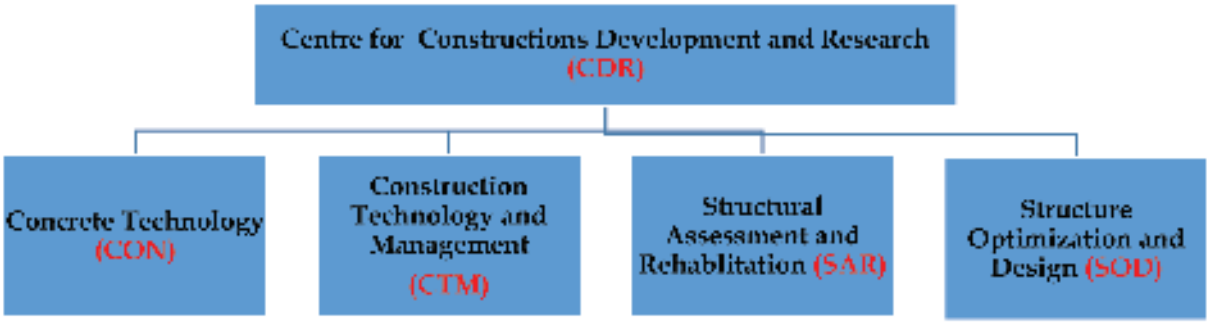
Appreciation Letter Received from the Oman Cement in April 2019 for AF Project

Centre for Construction Development and Research (CDR)

V V Arora
Joint Director &
Head of Centre

- BE (Civil), M-Tech
- 38 years of experience in Cement and Concrete Technology, Structural Design & NDT
- Centre for Construction Development & Research (CDR) is at the fore front in the service of concrete and construction industry. Strategic Goal of the CDR is to contribute in developing durable and sustainable civil infrastructure for the nation. CDR anticipates and meets the critical requirements and technology needs and solve contemporary and emerging engineering problems of the concrete and construction industries through state-of-the-art interdisciplinary research and consultancy services

The Centre provides its services through the following Programmes:



CDR's Scientists, Engineers and Offered Services

 P N OJHA General Manager & Programme Leader - CON-I	❖ M.Tech (Building Science & Construction Management, IIT Delhi), MBA (FMS, D.U.), ❖ 27 Yrs. Exp. in Concrete Technology, Structural Engineering, Construction Technology, Assessment of Structures	**Concrete Technology** **Evaluation of Concrete Making Materials** • Cement and cementitious Materials such as OPC, PPC, PSC, Fly ash, GGBS, Silica-fume, Ultrafine GGBS, Ultrafine Fly ash, LD Slag etc. • Aggregates - Complete physical and chemical analysis, Petrography, Soundness and Alkali-aggregate reactivity of Natural aggregates, crushed

 AMIT TRIVEDI General Manager, Programme Leader – CTM II & PSI-MPI	❖ M.Tech (Construction Technology & Management), ❖ 22 Yrs. Exp. in Concrete Technology, Execution of Civil Works, NDT, Contract Management, Project Planning & Management, Assessment of Structures	fine aggregate, recycled aggregate and manufactured aggregate like electric arc furnace slag aggregate etc. • Chemical Admixture: Effectiveness and compatibility studies of Super-plasticizers, accelerators, VMA, Anti washout admixture, Anti shrinkage compounds, water proofing chemicals etc. • Complete Evaluation of Corrosion inhibitors as per different Indian and international standards like JIS Z1535, ASTM G1, ASTM G3, AASHTO T259 etc. • Mixing and curing water & Curing compounds **Special Concrete, Advance Concrete Composite & Standard Concrete Mix Designs** • Ordinary concrete, standard concrete and High Strength Concrete using OPC, PPC, PSC, OPC + fly ash, OPC + Fly ash + silica fume etc. • Development of Special Concrete such as High Performance Concrete, Pervious concrete, Plastic concrete High Volume Fly Ash Concrete, Self-Compacting Concrete, Pavement Quality Concrete, Dry Lean Concrete, Roller Compacted Concrete, under water concrete, Fiber Reinforced Concrete, Controlled Low Strength Material (CLSM) etc. • Shotcrete & Non Shrink Grout **Mechanical Properties and Durability Studies of Concrete** • Accelerated Carbonation test and measurement of carbonation induced reinforcement corrosion • Creep testing and coefficient of thermal expansion of concrete. • Stress strain behavior of concrete and determination of Poisson's ratio for concrete • Water permeability test for concrete. • Chloride induced reinforcement corrosion
 ARUN SOOD Dy. Manager	❖ B.Sc. ❖ 37 Yrs. Exp. in Concrete Technology	
 SURESH KUMAR Manager and Progamme Leader-CON-II	❖ B.Tech (Civil) ❖ 33 Yrs. Exp. in Concrete Technology	
 MANISH KUMAR MANDRE Manager	❖ M.Tech ((Construction Technology & Management)) ❖ 12 Yrs. Exp. in Concrete Technology	

 J NARSINGA RAO Dy. Manager- NCB-H	❖ B.Sc ❖ 32 Yrs. Exp. in Concrete Technology, Quality Control and Quality Assurance in construction	through test like chloride immersion test, impressed current voltage test. • Abrasion resistance of concrete as per revolving disk method and under water resistance test • Performance of concrete against Sulphate attack • Alkali–Aggregate Reaction and other aggressive environment to cause deterioration of concrete **Studies Undertaken** • Development & design of high Abrasion resistance concrete in Laboratory & Quality assurance services at site for its production and placement for Maneri Dam Site, Uttarkashi & Ichari Dam site, Uttarakhand. • Use of fly ash, bottom ash and recycled aggregate in concrete • Evaluation of Low Density Aggregates (LDA) and Structural Lightweight Concrete using LDA. • Study on the use of copper slag as a replacement to river sand in different grades of concrete. • Study on Use of ferrochrome slag as a fine aggregate (water cooled) and coarse aggregate (air cooled) in concrete. • Development of high abrasive strength materials for spillway and glacis. • Studies for Preparation of Specifications and Guidelines for use of Coal based Bottom Ash as Replacement of Fine Aggregate in Concrete. • Evaluation of concrete making materials like cement, water, mineral/chemical admixtures & aggregates for alkali-aggregate reactivity and other properties for hydroelectric & thermal power plants (more than 50 projects per annum). Concrete mix proportions for various grades of concrete for different projects across the country (more than 250 mix designs per annum).

 B PANDU RANGA RAO General Manager and Programme Leader - CTM-I	❖ M.Tech (Structural Engg.), PD in Environmental Engg. ❖ 25 Yrs. Exp. in Execution of Civil, Water and Waste Water Treatment, Structural Designing, Quality Control & Quality Assurance in Construction of Buildings Roads, Bridges, Tunnels, Utility Projects etc.	**Construction Technology and Management** **Services Offered** • NCB - Inspection Body is carrying out Third Party Quality Assurance/Audit (TPQA) of new construction projects in construction scope sector for Buildings, Roads, Bridges & Tunnels, Construction of Utility projects, Other civil Engineering Projects, Special construction activities etc. • Inspection body got accredited by National Accreditation Board for Certification Bodies (NABCB) in accordance with ISO/IEC 17020:2012 accreditation standards under Type 'A' status, during the year 2018. • Inspection body implemented digitization of inspection activities through android mobile app/web based app. to monitor the activities on real time basis, data archival etc. • Design of mixes and Evaluation of engineering properties for fly ash based building products such as fly ash bricks, paver blocks, kerb stones, aerated concrete block, geopolymer concrete etc. • Precast Concrete Technology **Projects Undertaken** • Third Party Quality Assurance/Audit for more than 2200 projects across the country in construction scope sector for CPWD, PWD, Municipal Corporations of Delhi, DDA, ITPO, IICC, AIIMS, LUVAS, PGCIL, etc. **Major Projects** • Buildings - Housing projects in CPWD & DDA, AIIMS • Roads – Various road projects in MCD
 AMIT N GANDHI Group Manager-NCB-A	❖ B.Tech (Civil) ❖ 28 Yrs. Exp. in Concrete, Construction, Quality Control & Quality Assurance, Assessment of Structures	
 B SRINIVASA RAO Group Manager-NCB-H	❖ M.Tech (Structures) ❖ 22 Yrs. Exp. in Structural Engineering, Construction Technology, Assessment of Concrete Structures	
 D PAVAN KUMAR Manager-NCB-Bhubneswar	❖ M.Tech (Transportation Engg.), 17 Yrs. Exp. in Quality Control & Quality Assurance of Civil Works	

 ARUP GHATAK Dy. Manager	❖ B.Tech. (Civil) ❖ 8 Yrs. Exp. in Construction Technology, Quality Mgt., Structural Assessment & Rehabilitation	• Bridges – ROB Sultanpuri, Vikaspuri and Barapullah flyovers • Tunnels – Transit development at Pragati Maidan, PWD • Utility Projects – Transmission lines foundations, PGCIL • Special Construction Activities – Convention Centre's, IICC and ITPO Technical Audit and Quality Assurance including testing of materials, repairs, retrofitting, capability building etc. for major reconstruction projects of earthquake affected areas for Gujarat State Disaster Management Authority (GSDMA), construction of 7000 classrooms by PWD, New Delhi, irrigation projects in Karnataka state etc.
 AMIT SAGAR Dy. Manager	❖ B.E (Civil) 11 Yrs. Exp. in Construction Technology, Quality Management	
 AJAY KUMAR Dy. Manager	❖ B.E (Civil) ❖ 8 Yrs. Exp. in Construction Technology, Quality Management	
 DIPESH J TAILOR Dy. Manager-NCB-A	❖ Diploma & B.E (Civil) ❖ 15 Yrs. Exp. in Concrete & Soil Mechanics, Quality Control & Quality Assurance of Construction work	

 SUNIL KUMAR SOREN Dy. Manager-NCB-Bhubneswar	❖ B. Tech (Hons.) Civil Engg, 9 Yrs. Exp. in Construction Technology, Quality Management	
 TVG REDDY General Manager & PL-SAR	❖ M.Tech (Structural Engg.), 18 Yrs. Exp. in struct. Assessment & Rehabilitation & Execution of Civil Works	**Structural Assessment and Rehabilitation** **Services Offered** • In-situ quality assessment, durability investigation and residual life assessment of concrete structures • NDT, Pile integrity testing and Impact echo testing • Distress investigations of buildings, bridges, dams, power plants, chimney, silo etc. deteriorated due to aggressive environment or fire damaged structure • Consultancy for repairs/rehabilitation & retrofitting • Study of Micro-structure of Concrete using SEM, OM, XRD, TG-DTA-DSC • Bridge diagnostic testing using state-of-the-art equipment **Studies Undertaken** • In-situ testing of concrete structures for assessment of quality and distress evaluation of concrete structures of various types across the country (more than 35 projects per annum). • Condition assessment of civil structures including field and laboratory studies using state-of-the-art equipment covering
 B SRINIVASA RAO Group Manager-NCB-H	❖ M.Tech (Structures) 22 Yrs. Exp. in Structural Engineering, Construction Technology, Assessment of Concrete Structures	
 SANJAY MUNDRA Group Manager	❖ M.Tech (Structures), ❖ 18 Yrs. Exp. in Structural Assessment & Rehabilitation & Concrete Technology	

 ADARSH KUMAR N S Dy. Manager-NCB-H	❖ M.Tech (Soil Dynamics), ❖ 10 Yrs. Exp. in Structural Assessment, Rehabilitation, Quality Control & Quality Assurance	recommendations for repair and remedial for restoration and rehabilitation of the aging structures to ensure the structural integrity, restoration of strength and health of RCC structures like Turbine Generator Foundation, Boiler Mill Foundation, FD & ID Foundations, Chimney Shell, Silos etc. • Study on field and laboratory investigations of concrete dam. • Evaluation of cementitious repair products conforming to EN 1504-2005 for NHPC. • Performance evaluation for Steel Fibre Reinforced Shotcrete (SFRS) Lining of the underground Desilting Chambers of a hydro power project • Condition Assessment Study using Non Destructive & Partial destructive Evaluation Technique including repair methodology and schedule of items for repair & restoration work of Minor Bridges/culverts & Major Bridges at NTPC Rihand • Assessment of fire damaged building at AIIMS, Delhi
 RIZWAN ANWAR Dy. Manager	❖ B.Tech. (Civil) ❖ 9 Yrs. Exp. in Structural Assessment & Rehabilitation	
 Y N DANIEL Dy. Manager	❖ M.Tech (Construction Technology & Management) ❖ 7 Yrs. Exp. in Concrete Technology, Structural Assessment & Rehabilitation	
 BRIJESH SINGH Manager and PSI-STN	❖ M.Tech (Structural Dynamics), ❖ 10 Yrs. Exp. in Structural Engineering, Construction Technology, Assessment of Concrete Structures	**Structural Optimization and Design** **Services Offered** • Evaluation of Structural adequacy and Seismic load carrying capacity of structures • Proof Checking of Structural Design • Service Life Design for concrete structures • Load testing and assessment of load-carrying capacity of structural elements • Detailed investigation on mechanical, thermal, chemical & mineralogical properties of aged concrete dams

 PUNEET KAURA Dy. Manager	❖ B.Tech (Civil) ❖ 7 Yrs. Exp. in Concrete Technology, Durability Studies on Concrete	**Studies Undertaken** • Performance and durability studies on Prestressed Concrete made with PPC • Effect of Supplementary Cementitious Materials (single and Multi blends) on the service life design of concrete structures • Development of Design Parameters for High Strength Concrete • Effectiveness of different repair systems for the repair, restoration and strengthening of corrosion damage structures • Performance evaluation of fibre reinforced concrete for performance improvement of concrete structures • Load testing of Prestressed I girder for expressway Project • Field and laboratory investigations of aged concrete dams for Finite Element Analysis and deciding repair/rehabilitation strategy

Construction Technology and Management

India International Convention & Expo Centre, Dwarka-New Delhi

Barapullah Flyover-PWD, New Delhi

Conventional Centre in Pragati Maidan – ITPO, New Delhi

Museum at Noida- CPWD

Quarters at Jasola- DDA, Delhi

IDCO Complex, Mahispat

Structural Assessment and Rehabilitation

UPV test of Concrete Structure for Quality Assessment

Pile Integrity Test of Prestressed Concrete Bridge

Condition Assessment of RCC Bridges

Core extraction from RCC foundation

Half-cell Potential Measurement of Corrosion Damaged Structure

Carbonation depth being measured on freshly extracted core at site

Structural Optimization and Design

Accelerated Chloride Induced Corrosion Studies

Carbonation Induced Corrosion Studies

Test for Determining Creep Coefficient (In Compression)

Flexural test setup for high grade

Concrete Fibre reinforced Beams (In Flexure)

Testing of notched beam in progress for the study of fracture behaviour of High Strength Concrete

Concrete Technology

Workability Measurement of Roller Compacted Concrete

V-Funnel & L-Box Test for SCC

Abrasion Resistance test

Abrasion Value Test for Aggregate

Carbonation chamber

Aggregate testing facilities (Bhubaneswar)

NDT Laboratory

Nondestructive Testing and Distress Investigation Lab with state of the art equipment such as digital Rebound Hammer, UPV tester, Corrosion Analyzer, Endoscopy, Pile Integrity Tester, Ground Penetrating Radar, Impact Echo Tester etc.

Specialized Additions to Laboratory Facilities (Mechanical and Physical Investigations Laboratory)

BET Apparatus for determining fineness of ultra-fine powder materials such as silica fume, metakaolin, ultrafine fly ash, ultrafine slag etc. has been procured and installed

Strain Controlled Flexural Testing Machine-300kN for determination of flexural toughness of fiber reinforced concrete & crack mouth opening gauge for measurement and control of crack width

Mercury Intrusion Porosimeter is used to study the pore size distribution and porosity determination of aggregate, concrete and mortar

Confined Compressive strength of Concrete and Rock Specimens

Tensile Testing of Steel Fibers

Water Permeability Testing on concrete samples

Testing for Stress Strain curve in progress for High Strength Concrete

Marsh Cone Test for ultra-fine cement to study the flow ability of cement

Rapid Chloride Penetrability Test for concrete samples to study the degree of penetrability of chloride ions

Laboratory Facilities (Mechanical and Physical) Bhubaneswar

Important R & D Assignments

- **Development of Ultra High Performance Concrete (UHPC) – Including use of Nano Technology for UHPC**
  The objective of this project is to prepare guideline for developing the UHPC in India based on various international codal procedures, accepted research theories and experimental research.

- **Studies for Preparation of Specifications and Guidelines for use of Coal based Bottom Ash as Replacement of Fine Aggregate in Concrete for M/s NTPC Netra.**
  Bottom Ash is the major by-product of the coal based power generation process. This study is a follow up work of the previous study conducted by NCB on use of bottom ash as replacement of fine aggregate in cement concrete. This study aims at the formulation of specifications of bottom ash and guidelines for designing concrete mixes using bottom ash as replacement of fine aggregate.

- **Investigation on Application of Carbon Nanotubes for Improving Performance of Cement Concrete and Concrete Based Precast Building Products for M/s Indian Oil Corporation, Faridabad.**
  NCB has taken up an R&D project on investigation on application of Carbon Nanotubes for improving the performance and properties of cement concrete and concrete based precast building products.

- **Durability Study on PSC Made using Composite Slag (Mix of BF Slag and LD Slag) for M/s Tata Steel.**

  This study is an experimental work in which BF slag will be replaced by LD slag at 8% and 15% to make composite slag.

  Various PSCs'will be prepared using different proportions of composite slag. Those PSCs' will be studied for several physical and chemical properties of cement. Along with that, they will be used in concrete mixes to study several fresh, hardened and durability properties of concrete samples.

- **Concrete Mix Design for Special Applications**

- **Self-compacting Concrete**

  Concrete mix design for special applications such as Self-Compacting Concrete (SCC), High Performance Concrete with and without steel fiber has been designed.

- **Abrasion Resistant Concrete with and without Steel Fiber**

  NCB has designed mix of high performance concrete of Grade M 75 with steel fiber with the available site aggregates (Non-wearing Surface Aggregate) for NTPC, Joshimath. Impact resistance and abrasion resistance of concrete has been evaluated by underwater method and revolving disk method. Quality control at Maneri dam projects of UJVNL to repair spillway with M90 Grade concrete has been carried out by NCB

- **Evaluation of Corrosion Inhibitors**

  Centre has developed the facility for evaluation of corrosion inhibitors through modified accelerated corrosion test as per JIS Z 1535, rebar weight loss by immersion method as per ASTM G-1, polarization test as per ASTM G-3 and corrosion rate measurement as per ASTM G109 & AASTHO T259. The Centre has evaluated 5 samples of different brands of corrosion inhibitors that are being used in construction industry.

- **Field and Laboratory Studies on Distress Investigations of Dams**

  NCB has taken up projects on laboratory and field studies on various important dams across the length and breadth of the country.

- **Development & usage of Geopolymer Concrete**

  NCB has taken up project on development of geopolymer concrete for its application in pavements and other precast concrete constructions. Field trials were carried out using developed products by NCB and draft guidelines preparations for usage have been prepared.

- **Design of Low-Traffic Volume Concrete Roads using C&D Waste**

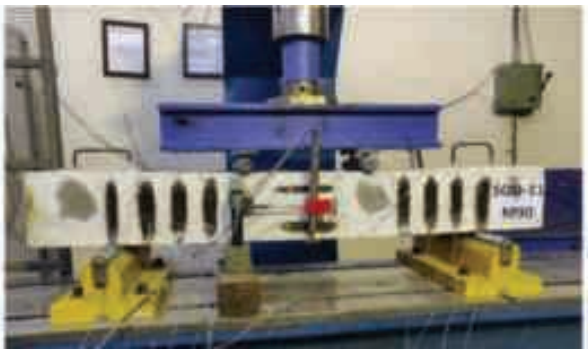
  Keeping in view the sustainability, a paradigm shift has been observed in research with more inclination towards use of waste based materials as aggregates and SCM as supplement to cement in construction. In this project a sustainable approach to construction of low volume concrete roads using C&D aggregates as full replacement of natural aggregates in base and pavement layer has been adopted.

Casting of Pavement in Progress

Load Testing and Monitoring of Stresses

- **Effect of Supplementary Cementitious Materials (SCMs) (Single and Multi blends) on Service Life of Concrete Structures-including Studies to Durability/ Service Life.**
  The project investigates the application of SCMs (single and multi) in high proportion as a part replacement of Ordinary Portland Cement and its impact on service life. The output of the project will be industry oriented design guideline that assures greater acceptability of these cementing materials across engineering fraternity.

- **Experimental Study on Shear & Compression Design of High Strength Concrete Including Effect of Fiber on Enhanced Ductility & Fire Resistance**
  This research is intended to develop design parameters for high strength concrete so that designers can use high strength concrete in design of structures with confidence.



Testing of Reinforced High Strength

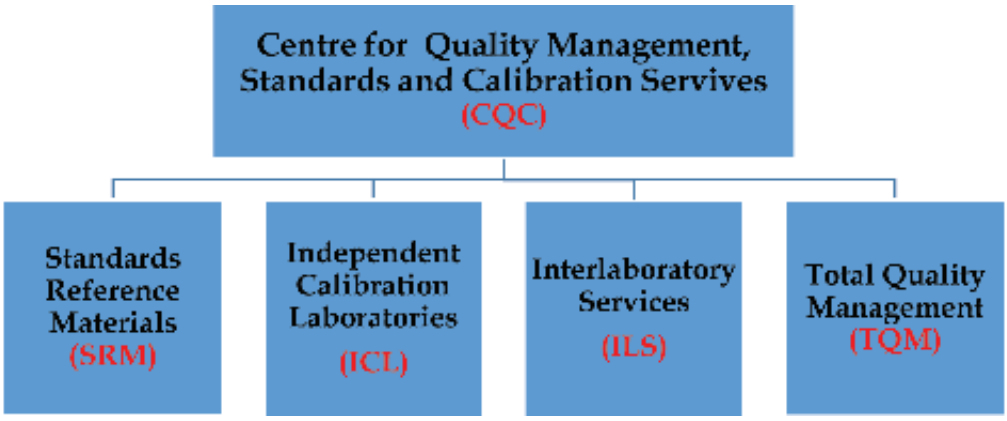
Concrete Beams in Shear

Centre for Quality Management, Standards and Calibration Services (CQC)

P N Ojha
General Manager &
Head of Centre

- B.Tech (Civil), M.Tech (Building Science & Construction Management, IIT Delhi), MBA (FMS, D.U.),
- 27 years of experience in Cement and Concrete Technology, Structural Design & QMS
- The activities of the Centre for Quality Management, Standards and Calibration Services were organised under four programmes: Total Quality Management, Interlaboratory Services, Standard Reference Materials and Calibration Services. These activities address all aspects of quality management and provide the entire range of Standardization and Calibration services to cement industry, R&D institutions, Concrete and allied building materials laboratories in India and abroad.

The Centre provides its services through the following Programmes:



S K SHAW
Manager &
Programme Leader
- SRM

- B-Tech (Chemical Engg.)
- Over 10 years of rich experience in the field of Process Optimization & Productivity, Energy Audit, Cement Plant Operation and Development of CRMs & PT

SERVICES OFFERED by SRM

- Development and supply of certified reference materials (CRMs) like OPC, PPC, PSC, Fly ash, CCP, WPC, Sand, Gypsum, limestone, clay, raw meal, clinker, fly ash and granulated slag, coal and hydrated lime etc.
- Development of plant specific limestone/raw meal/clinker/ cement

		standards for calibration of x-ray analyzer for cement plants.
 P SRIKANTH Dy Manager & Programme Leader - CLS	• B. Tech (Electronic and Instrumentation Engineering), MBA (TQM) • Over 10 years of experience in the field of Calibration and Total Quality Management, Energy Audit and Electronic Signaling Systems	**SERVICES OFFERED by CLS** • Calibration services are offered for various equipment like CTM, weighing balances, weights, pressure indicating devices, temperature indicating devices, Blaine cell, volumetric glassware, sieves, proving rings, Vernier caliper, steel scale etc.
 V NAGA KUMAR Dy Manager & Programme Leader – ILS	• B-Tech (Chemical Engg.) • Over 10 years of rich experience in the field of Process Optimization & Productivity, Energy Audit, Cement Plant Operation and Development of CRMs & PT	**SERVICES OFFERED by ILS** • Proficiency testing for cement and construction material testing laboratories • Organizing corporate group specific proficiency testing schemes
 A AGNIHOTRI Asst. Manager & In-charge - TQM	• M.Sc (Chemistry) • Over 23 years of rich experience in the field of Development of CRMs, PT & TQM	**SERVICES OFFERED by TQM** • Laboratory assessment and proficiency improvement services • Setting up laboratories and laboratory upgradation • Assistance in ISO/IEC 17025:2017 accreditation • Total quality management • National quality Award scheme for cement industry • Benchmarking for improvement in products and processes and continual improvement.

Showcase of CQC's Activities/Event

Signing of the MOU between CSIR-NPL and NCB for BND Certifications on the occasion of World Metrology Day on 21st May 2018. CSIR-NPL and NCB Team Members are Present on the Dais

Release of NCB BNDs by Honorable Minister Dr Harsh Vardhan at CSIR-NPL on 16th August, 2018

Dr B N Mohapatra, Director General and other NCB Officials during the Release of BND Certificates on 1st January 2019

A Group Photograph of NCB Officials with Dr D K Aswal (Director, CSIR-NPL) after the Release of BNDs on 16th August, 2018

Dr B N Mohapatra, Director General-NCB Welcoming Sh O P Agrawal and Sh D Bhattacharya on Training Programme of ISO 9001:2015 on 14th October 2019

Training Programme on Internal Audit for ISO 9001:2015 on 14th – 15th October 2019 in NCB

Showcase of CQC's Equipment Facilities

Equipment

Liquid Temperature Baths

Tachometer Calibrator

Temperature Calibration Facilities

Standard Weights Calibration

Profile Projector

RH Calibration System

A view of CRMs and BND

CQC's Achievements

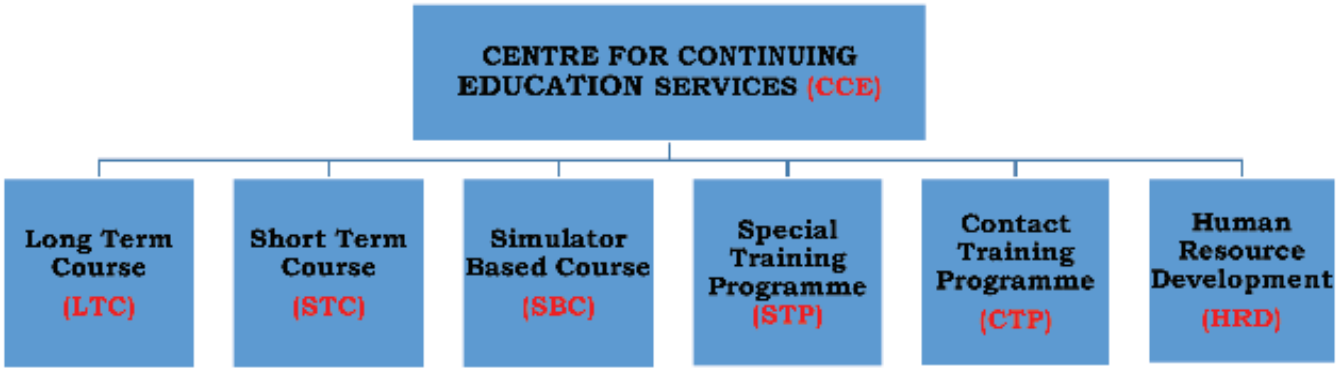
- + 79 nos. of CRMs have been developed along with 10 nos. Bhartiya Nirdeshak Dravyas (BNDs), the Indian Certified Reference Materials (CRMs). BNDs derive their traceability to SI units from CSIR-National Physical Laboratory (NPL), India, the custodian of national standards in India. The availability SI traceable BNDs will give a boost to "Make in India" programme and harmonize the quality infrastructure of the country.
- A total of 9196 vials of different CRMs and 1483 sets of standard lime were supplied to 730 customers from cement plants, testing laboratories and R&D institutions during 2018-19.
- The calibration laboratories continued to implement Quality Management System as per ISO 17025:2005 requirements.
- + 1700 equipment/apparatus including proving rings, compression testing machines, vibrating machines, dial gauges, Blaine cells, pressure gauges, sieves, thermometers, environmental chambers, ovens, furnaces, balances, rebound hammers etc. were calibrated during 2018-19.
- In 2013, Interlaboratory Services (ILS) programme received first NABL accreditation for Proficiency Testing (PT) provider as per ISO/IEC 17043: 2010 in the country, and successfully completed several PT schemes thereafter.
- + 80 nos. of Proficiency Testing (PT) have been completed covering of cement; fly ash; aggregate; mortar/concrete; tile (ceramic); burnt clay building brick; steel bar in mechanical field and limestone; clinker; cement; fly ash; concrete admixture; water for concrete; coal/coke/pet coke in chemical field.
- Re-certification audit of quality management system based on ISO 9001:2015 was completed.
- Training imparted to NCB officials on internal audit on ISO 9001:2015
- + 50 nos. of sponsored projects of different areas like Laboratory Assessment and Proficiency Improvement services for testing laboratories, Quality Monitoring Service for input, process and output control and Quality Assurance in cement plants, Assistance in NABL accreditation of laboratories, Assessment of the Quality Assurance System in cement plants and Application of TQM tools and techniques for Quality Improvement etc.

Centre for Continuing Education Services (CCE)

Dr. D K PANDA
General Manager &
Head of Centre

- M.Sc. (Applied Geology), Ph.D (Geology)
- 32 years of experience in various R&D and Sponsored Projects in Raw Materials, geological exploration, Computer-Aided Deposit Evaluation of Limestone
- The Centre for Continuing Education Services of NCB has been organizing various industry oriented training and skill development programmes in cement, concrete, construction and building material sectors.

The Centre provides its services through the following Programmes:



 K V KALYANI JD & UIC-NCB:H	• B-Tech (Chemical Engg.) • Unit In-charge of NCB-Hyderabad Unit • Over 34 years of rich experience in the field of Process Optimization & Productivity, CFD, Energy Audit, Plant operation, and Simulation of Cement Plant Operation & Training activities in NCB-H	The Centre with its experienced faculty comprising of engineers and scientists and faculty from industry, and modern infrastructural facilities like Lecture Halls, Auditorium, Computer Centre, Hostel, Canteen etc., is imparting training to technical professionals of all levels in various organizations (Cement, Concrete, Construction and Building Industries) in India and abroad at its **Ballabgarh** and **Hyderabad** Units.

 KPK REDDY Deputy Manager	• B.Tech (Chemical Engg.) • Over 11 years of rich experience in the field of Process Optimization & Productivity, CFD, Energy Audit, Plant operation, and Simulation of Cement Plant Operation • Certified Energy Auditor	The various Training Programmes includes: - P G Diploma in Cement Technology (approved by AICTE), - Short Term courses in Cement & Concrete Technology, - Simulator Based Training for Cement Industry Professionals, - Contact and Special Group Training Programmes for particular organization. - Customized Special Group Training Programmes giving emphasis on specific topic related to cement and concrete sectors. The training programmes also covers laboratory demonstrations and site visits wherever necessary. NCB encourages students from various Engineering College for their visit to NCB laboratories.
 M V R RAO Deputy Manager & Course Coordinator for PGD in Cement Technology	• B.Tech (Chemical), M-Tech (Energy & Environment-IIT Delhi), Certified Energy Auditor • Over 10 years of rich experience in the field of Process engineering, Plant operation, CFD, Energy management and Environment management.	
 RAYEES AHMED Deputy Manager	• B.E (Chemical Engineering), M-Tech (Chemical Engineering) • Over 12 years of rich experience in the field of Cement Process, CFD, Energy audit studies, Training activities	
 VADDY VENKATESH Deputy Manager	• B.E., (Electrical & Electronics Engineering), M-Tech (Energy Engineering) • Over 9 years of rich experience in the field of Energy audits in more than 70 cement plants & power plants, Electrical and Mechanical Third party Quality assurance & Training activities in NCB-H	

Showcase of CCE's Activities

DG-NCB Inaugurating Special Group Training Programme on Quality Control and Quality Assurance in Concrete Construction for IMTI Govt. of TN at NCB-B

DG-NCB Interactive Session on Application of XRD in Cement Industry at NCB-H

Inaugural Session of a Training Programme on Advanced Pyro-processing Techniques For Improved Productivity And Clinker Quality at NCB-B

Discussion during a Training Programme on Sampling and Testing of Cement as per BIS standards at NCB-B

An Interactive Session on Cement Marketing Training Programme

CCE's Facilities

Lecture Hall-1 at NCB-B

Lecture Hall-2 at NCB-B

Lecture Hall-3 at NCB-B

Simulator Lab at NCB-B

Training Block at NCB-H

Training Hall at NCB-H

Simulator Lab at NCB-H

Trainee hostel at NCB-B

Trainee Hostel at NCB-H

CCE's Milestone

NCB's conducts **"One Year PG Diploma in Cement Technology"** course approved by All India Council for Technical Education (AICTE), Govt. of India. The highlights of this programme are as followings:

- *The curriculum of this course includes* ***Theoretical classes, Laboratory training, Simulator based training, and Cement Plant training****.*
- ***Faculties are Scientist and Engineers*** *having vast experience of cement industry.*
- ***Limited 18 seats to be*** *filled by Written test and Personal Interaction*
- More focus on practical training through site visit, case studies, simulation software, lectures by industry experts.
- *Students those have completed* ***MSc in Chemistry/BE or B-Tech in Chemical Engineering*** *with First Class may apply*
- *Some recruiters for PG Diploma students are JK Cement Ltd., Nuvoco, Dalmia Bharat Cement, Sanghi Cement, Shree Cement, UltraTech Cement, J K Lakshmi, Star Cement, Larafge, Prism Johnson Ltd.*

Faculties are Scientist and Engineers having vast experience of cement industry.

NCB conducts **Short Term** courses in **cement technology** every year and few of the

Director General Dr B N Mohapatra felicitating the passed out students of PG Diploma in Cement Technology 2018-19 batch

recently organized short term programmes are: Instrumental Methods of Analysis in Cement Plant, Estimation of Free Silica in Limestone & Kiln Feed, Technologies for reducing PM NO_x, SO_x and CO_2 in Cement Industry, Advanced Pyroprocessing Techniques for Improved Productivity and Clinker Quality, Use of Fly ash and Blended Cements for Durable Concrete, Optimization of Grinding Systems, Sampling and Testing of Cement as per BIS Standards, Kiln feed Optimization to Improve Cement Quality, Safety Practices in Cement Industry, Application of XRD in Cement Industry, Alternate Cementitious Materials etc.

Similarly, NCB conducts **Short Term** training programmes on **Concrete technology**. Recently organised training programmes are: Seismic Evaluation and Retrofitting of Reinforced Concrete Buildings, Cracks and Leakages in Concrete Structures: Causes, Prevention and Repair, Consumer Complaint and Handling Technique in Cement Marketing, Quality Control and Quality Assurance in Concrete Construction, Concrete Construction, Project Management and Quality Assurance and Quality Control, Concrete Mix Design and Acceptance Criteria of Concrete, Corrosion in Reinforced Concrete Structures and Remedial Measures, Production of Durable Concrete, Non Destructive Testing and Evaluation of Concrete etc.

In the **year 2019-20** so far NCB has already conducted **Special Group Training Programmes**, some of them are:

- Quality Control and Quality Assurance in Concrete Construction for Irrigation Projects for the Engineers of **Irrigation Management Training Institute (IMTI), Water Resources Department, PWD, Govt. of Tamil Nadu.**
- Special Group Residential Training Programme on Cement Manufacturing Technology for Cement Professionals of **M/s Dalmia Cement (Bharat) Ltd**.
- Optimization of Raw Mix to Improve Cement Quality for the Officials of **KCP Ltd**.
- Quality Control and Quality Assurance in Concrete Construction for the Engineers of **HPCL, Mumbai**
- Special Group On-site Training Programme on Quality Control in Construction and Durability Assessment in Concrete Structures for the Engineers of **Power Grid Corp. Ltd**.
- Quality Control & Quality Assurance in Concrete Structures" for the Engineers of **M/s Bharat Petroleum Corporation Ltd. Mumbai**

Centre for Industrial Information Services (CIS)

A V S Manian
General Manager &
Head of Centre

- M.Tech (Industrial & Management Engg.)
- Over 30 exp. in Plant Maintenance, Organising Seminars/Workshops/ Events, IT & Library Management
- Centre for Industrial Information Services (CIS) serves industry's needs through six programmes, namely: Industrial Information and Data Bank, Integrated IT Solutions, Publications, Seminars and Conferences, International and National Linkages and Image Building. CIS collects and disseminates information to cement, building materials and construction industries. Besides other facilities, the Centre includes a modern library and a computer centre.

Industrial Information and Data Bank

NCB Library at Ballabgarh Unit serves as the national information centre for cement, building materials and construction industries. ***The holdings of the Library have grown to 46,710 documents***. The library has a bibliographic data base consisting of about 42,914 entries derived from the journals received. NCB scientists as well as cement plants and other user industries utilize it for interactive searches. A library automation system called 'LIBSYS' has been installed. The system is user-friendly and compatible to network communication.

NCB Ballabgarh Library

Publication

Information on technologies and services of NCB is disseminated through NCB Publications regularly. Efforts to widely popularize and promote NCB activities, technology and consultancy services amongst the cement and related building materials industries were continued. The following publications were brought out during the year are as follows:

- NCB Annual Report 2017-18 in English and Hindi versions separately
- Compendium – "The Cement Industry - India 2018"
- Bulletin - 1 of 16th NCB International Seminar on Cement, Concrete and Building Materials, 03-06 December 2019, New Delhi

Seminars and Conferences

NCB has been organizing national and international seminars and exhibitions from time to time. The 9th International Congress on the Chemistry of Cement held in November 1992 was organized by NCB, for the first time in this part of the world. Besides several international events organized by NCB, the biennial series of NCB International Seminar on Cement and Building Materials has since come of age and the cement, building materials and construction industries look forward to participation in the same with interest.

International and National Linkages

NCB has been actively interacting and liaising with a number of international bodies and exchanging knowledge and experience particularly in the area of cement and building materials.

MEMBERSHIP	
Indian	**Overseas**
• Construction Industry Development Council (CIDC), New Delhi	• The American Concrete Institute (ACI), USA
• Indian Roads Congress (IRC), New Delhi	• Precast/ Pre-stressed Concrete Institute (PCI), USA
• Indian Mining & Engineering Jl, Bhubaneswar	
• Materials Research Society of India, Bengaluru	

Image Building

Image Building (IMB) programme carries out dissemination/propagation of important institutional initiatives and achievements to the masses in general, and industry in particular through print and electronic media and advertisements in press, trade journals, periodicals, souvenirs, etc. The in-house Quarterly publication "NCB Newsletter" is also used as an information carrier of NCB activities to the industry.

Integrated IT Solutions

The Website, www.ncbindia.com was uploaded with promotional information about NCB's activities was done from time-to-time. The following services were continued:

- Indexing Services from Library, through Intranet site and www.ncbindia.com site.
- Announcements on 16th NCB International Seminar, Training Courses and quality related schemes.
- Employment opportunities & RTI related documents.
- Maintenance of hardware and software for whole of the institute including LIMS and LIBSYS.

Bulk e-mailing services was continued for promotional information.

Some Glimpses of 15th NCB International Seminar, December 2017

NCB Day Celebration 2018

RECENT NOTABLE WORKS

Compendium on "The Cement Industry – India 2018"

National Council for Cement and Building Materials (NCCBM) compiled compendium on "The Cement Industry – India 2018" in association with Department for Promotion of Industry and Internal Trade (DPIIT). The compendium contains key information about technology development, challenges & opportunities for Indian cement industry along with an exhaustive directory of cement plants in India, which would be beneficial to cement industry, policy planners, OEMs, academicians etc.

Release of Compendium by Hon'ble Minister of Commerce Shri Suresh Prabhu at Rajiv Gandhi Bhawan, New Delhi on 5th February 2019

The compendium was released by Hon'ble Minister of Commerce Shri Suresh Prabhu at Rajiv Gandhi Bhawan, New Delhi on 5th February 2019. Shri Mahendra Singhi (Chairman, BOG and President CMA), Shri Anil Agrawal (Joint Secretary, DPIIT) along with DG-NCB were also present during the release. The event was attended by senior officials from Ministry of Commerce and Industry (MoC&I), NCB officials, cement industry and representatives of cement manufacturers association. Shri Suresh Prabhu during the release emphasized that the cement industry plays a vital role in the growth and economic development of India and industry has focused on improving energy efficiency in plant operations. He urged NCCBM to think of recycling of material used in production of cement.

Launch of Indian Certified Reference Materials/Bhartiya Nirdeshak Dravayas (BNDs) Developed by NCB in the area of Building Materials

Reference Materials (RM) play pivotal role in maintaining the quality infrastructure of any economy through testing and calibration with precise measurements traceable to SI units. The Govt. of India (GoI) has supported NPLI to strengthen its Bhartiya Nirdeshak Dravya-BND® program under Make in India initiative by developing BNDs in the area of AYUSH, Materials, Nanotechnology, Medicine, Food & Agriculture and Biologics. The availability SI traceable BNDs will give a boost to "Make in India" programme and harmonize the quality infrastructure of the country.

An MOU between CSIR-NPL and National Council for Cement and Building Materials NCB for BND Certifications was signed on the occasion of World Metrology Day on 21st May 2018 in CSIR-NPL. First batch of 6 NCB BNDs was released by Honorable Minister Dr Harsh Vardhan at a glittering function on 16th August 2018 in CSIR-NPL auditorium in New Delhi, in the presence of Dr D K Aswal (Director-NPL), Sh Ashutosh Saxena then DG (Actg.)-NCB, Dr S K Breja (Centre Head, CQC) and NCB team. The second batch of NCB BNDs was released on NCB day on 01st January, 2019 by DG-NCB and Head of Centres. NCB is the first organization in the country, outside (CSIR-NPL), to get BND marking for its reference materials.

Signing of the MOU between CSIR-NPL and NCB for BND Certifications on the occasion of World Metrology Day on 21st May 2018

Release of First Batch of NCB BNDs by Honourable Minister Dr Harsh Vardhan at CSIR-NPL on 16th August, 2018

Release of Second Batch of NCB BNDs by DG-NCB and Head of Centres on the Occasion of NCB Day celebrated on 01st January, 2019

Technology Resource Centre (TRC)

A Technology Resource Centre was inaugurated by Chairman-NCB at NCB-Ballabgarh. The centre showcases various technologies/products developed and patented by NCB for commercialization. The centre also highlights the utilization of various industrial waste materials which has been permitted by BIS in cement manufacture after extensive research done by NCB.

Technology Resource Centre (TRC) at NCB-Ballabgarh

राष्ट्रीय व्यवहार में हिन्दी को काम में लाना देश की उन्नति के लिए आवश्यक है।

माननीय संसदीय राजभाषा समिति की बैठक

08 दिसंबर 2018 को माननीय संसदीय राजभाषा समिति की बैठक का आयोजन अशोका होटल, नई दिल्ली मे किया गया। बैठक में महानिदेशक डॉ बी एन महापात्र, संयुक्त निदेशक श्री आशुतोष सक्सेना, श्री विनोद कुमार (अध्यक्ष), श्रीमती मिथलेश शर्मा (हिन्दी अधिकारी) तथा मोहम्मद इकबाल (सदस्य) ने भाग लिया। संसदीय राजभाषा समिति ने हिन्दी के प्रचार प्रसार के लिए संस्थान प्रमुखो को राजभाषा नीति को संस्थान में पूर्णतः लागू करने का आग्रह किया।

राजभाषा अधिनियम पर कार्यशाला

राष्ट्रीय सीमेंट एवं भवन सामग्री परिषद् (एन सी बी) की बल्लभगढ़ इकाई में एन. सी. बी. राजभाषा कार्यान्वन समिति द्वारा राजभाषा अधिनियम पर कार्यशाला का आयोजन किया गया। इस कार्यशाला का मकसद प्रचार एवं प्रसार में हिन्दी के प्रभावी उपयोग को बढ़ाना था।

डॉ बी एन महापात्र, महानिदेशक, एन. सी. बी. द्वारा राजभाषा अधिनियम कार्यशाला का उद्घाटन

इस कार्यशाला का उद्घाटन डॉ बी एन महापात्र, माननीय महानिदेशक, एन. सी. बी. के द्वारा 14 जनवरी 2019 को किया गया। डॉ. बी. एन. महापात्र, ने कार्यशाला के प्रतिभागियो को संबोधित करते हुए हिन्दी के प्रचार प्रसार के लिए अधिकतम कार्य हिन्दी में करने पर बल दिया और संस्थान में लक्ष्य प्राप्ति के लिए सभी को साथ मिल कर कार्य करने का भी आह्वान किया। इस अवसर पर समिति के अध्यक्ष श्री विनोद कुमार ने अधिनियम पर चर्चा की एवं श्री आशुतोष सक्सेना (संयुक्त निदेशक, मानव संसाधन विभाग) कार्यशाला की सफलता पर प्रसन्नता व्यक्त की एवं समिति का आभार जताया।

Glimpses of NCB Activities

INTERACTION WITH ACADEMIA

Worldwide, industry and academia share a mutually beneficial relationship. The academia and industry interaction help cope with the high pace of changes these days with the help of new competencies and skills. Academia has a rich blend of creativity and competency whereas the industry is having the potential to execute and commercialize these. This combination substantially leads to meaningful innovation, research and a change which will ultimately benefit the society.

NCB, has also taken steps and ventured in this industry and academia interaction by collaborating with BITS Pilani. Under this collaboration, students are being involved in live R&D and Sponsored projects who in turn add value to the ongoing projects in the organization.

Project Review Meeting of BITS Students with DG-NCB

Further, NCB has signed a MoU with Manav Rachna University on 2nd September 2019. Manav Rachna University (MRU) is a State Private University (established by Haryana State Legislature Act No. 26 of 2014 & under section 2(f) of UGC Act 1956), MoU covers submission of collaborative research projects, students' trainings, FDPs, availability of instrumentation facilities, laboratory & library facilities and other aspects of capacity building in order to bridge the industry- academia gap.

The MoU was Signed by Dr B N Mohapatra, Director General, NCB and Prof (Dr) I K Bhat, Vice Chancellor, MRU

MRU First Year MSc Students Visited NCB Laboratory

Highlights of NCB-Academia Interaction

- More than 40 students have completed their Short term/long term Internship at NCB where they were involved in Live Sponsored & R&D Projects.
- 4 NCB officials are pursuing their PhD studies under the guidance of DG NCB
- BITS Pilani & NCB have undergone a new collaboration where BITS Pilani extended PhD under Aspirant scheme for NCB scientists and engineers. Under this PhD programme, NCB scientists and engineers may have their supervisor from NCB and Co-supervisor from BITS-Pilani and Research & Development work related to PhD will be carried out at NCB. After completion of research work (Approval of thesis) PhD degree would be awarded by BITS-Pilani.

Trainee Encourage for Giving Speech on Environment Day 2019

DG-NCB Visits National Institute of Technology, Warangal (NITW) on 1st Mar'19 & Interacted with Director (Actg.) & Sr. Faculty of NITW

DG-NCB Delivers a Guest Lecture on "Total Quality Management" to the Students of Kakatiya Institute of Technology & Science (KITS), Warangal, Telangana

INTERACTION WITH INDUSTRY

Oman Cement Company (SAOG) and NCB signed a MoU to co-operate in setting-up of OCC's Research and Development (R&D) center in Muscat to carry-out R&D activities in the field of cement and building materials.

Higher Authorities of OCC and NCB signing the MOU at NCB-B

NCB technical team visited Oman Cement Company (OCC), Muscat - Sultanate of Oman, leading cement producer in Oman and one of the global pioneer in Oil Well Cement manufacturing. OCC has signed a Memorandum of Understanding with National Council for Cement and Building Materials (NCB) with core objectives of reducing cost of production as well setting up state of the art R&D centre in Oman with collaboration of NCB India.

DG-NCB during a Technical interaction with OCC Official

Executives of NCB alongwith OCC officials at OCC-Oman

With a purpose of sustainable coalition with industry and raw material suppliers, a 3-member NCB team led by DG-NCB, Dr B N Mohapatra, organized an interaction session at Regional Training Centre (RTC), Nimbahera with cement plants located in Chittorgarh cluster. Industry showed an over-whelming response with more than 30 participations including dignitaries like Shri S K Rathore, President, J.K. Cement,

Shri S M Joshi, President, Wonder Cement, Shri Ashok Khuntwal, President, Vikram Cement, Shri Dinesh Kumar, Vice President, Birla Cement.

DG-NCB Interacting with Cement Industry of Chittorgarh Cluster

NCB team led by Dr B N Mohapatra, DG-NCB visited cement plants in Satna region, Madhya Pradesh. During visit NCB visited, Prism Johnson cement, Satna Cement Works (M P Birla, Birla Corporation) and KJS Cement, Maihar, Satna. Technical experts from cement industries shared their experiences and concerns and asked NCB to carry out R&D work on utilization of dolomitic limestone in clinker manufacturing and another challenging issues cement factories are currently facing.

DG-NCB Interacting with Cement Industry of Satna-Maihar Cluster

Ms K V Kalyani, UIC-NCB-Hyderabad and team visited cement plant clusters to assess the plant requirements and appraise the plant personnel about the current services being offered by NCB.

NCB-H Team Interacting with Cement Industry of Nalgonda Cluster

A prestigious International assignment was awarded to National Council for Cement and Building Materials by M/s Gulf Nations for Construction Material Company, Kuwait (Trade name: Baitak Cement). The assignment included the inspection and certification of equipment supplied by a European OEM and Evaluation of plant operational performance. A team of 3 experts from NCB visited Kuwait and successfully completed the assignment, to the customer's satisfaction.

NCB Team with the Executives of Baitak Cement

NCB Team Taking Measurement at Site

Dr B N Mohapatra, DG-NCB visited NCB Hyderabad Unit on 27th February 2019, interacted with the officials regarding activities being carried out, visited the laboratory and discussed about opportunities for enhancing services and for capacity building.

INTERACTION WITH GOVERNMENT INSTITUTES/ORGANIZATIONS

NCB team interacted with Dr Vipin Thapliyal, Director, Central Pulp and paper Research Institute, Saharanpur on the potential uses of waste generated by pulp and paper industry in cement and allied industries.

NCB Team Interaction with CPPRI Executive, Saharanpur

Dr B N Mohapatra, DG-NCB meeting with Shri Lalit Das, IPS, MD, OPHWC (Odisha Police Housing Corporation). CMD inquired about various facilities of building materials especially pertaining to green buildings, AAC blocks, paver blocks, arresting the leakages of plumbing installations post construction, water harvesting and solid waste disposal.

NCB Team Interacting with CMD of Odisha Police Housing Corporation

NCB team met with Shri Anil Kumar Tripaty, CE (World Bank Projects) Dept. of Roads. CE suggested NCB to submit an offer for providing services of (i) inspection of bridges covering all elements of bridges including small, minor and major bridges under SAR and (ii) inspection of road works like profile correction courses, testing construction of road materials (post construction).

NCB Team Interacting with CE (World Bank Projects) Dept. of Roads

DG-NCB met with Shri Suresh Chandra Mohapatra, IAS, Addl. Chief Secretary, Dept. of Forest & Environment, Odisha. Shri Suresh Chandra Mohapatra suggested NCB to interact with various State Govt. Organizations like Works Deptt., Water Resources Deptt., R&B, Rural Development, Police Housing Corp, Major Infrastructure Development clients like Shipping, National Highways etc. within the state and provide services to such clients in the state.

DG-NCB Meeting with Addl. Chief Secretary, Dept. of Forest & Environment, Odisha

DG-NCB met with Shri Kalyan Charan Mohanty, CGM (SLNA). CGM formally invited NCB senior officials to participate in the upcoming industrial meeting to be held in Bhubaneswar, so that they can use the platform and to interact with various industries.

DG-NCB Meeting with Shri Kalyan Charan Mohanty, CGM (SLNA)

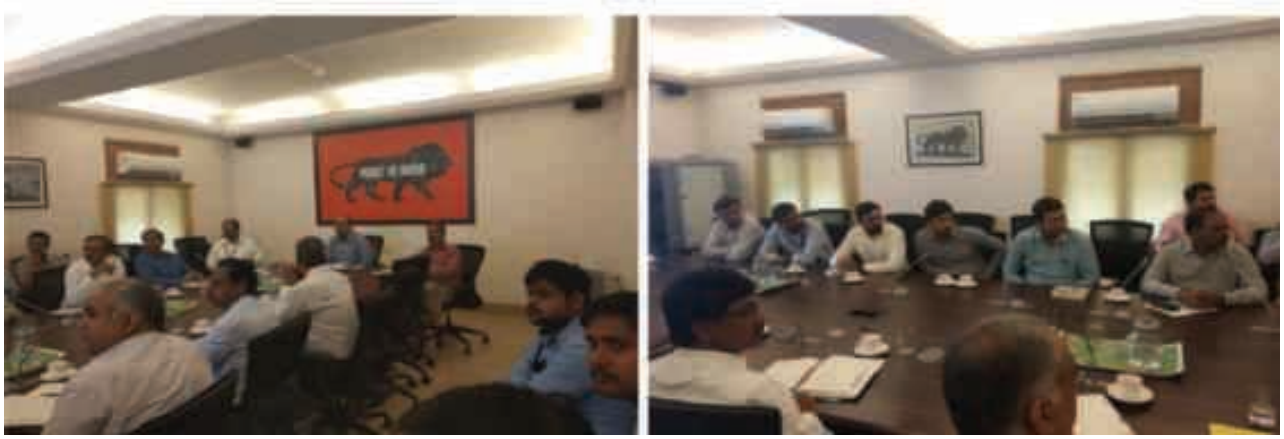
DG-NCB briefed Sh Sanjay Singh, IAS, CMD, IDCO about the TPQA services of various IDCO project during the last $3^{1/2}$ years provided to IDCO as per the MoU. Sh Singh expressed his satisfaction to the services offered by NCB.

NCB Briefed about the TPQA Services of IDCO Project to the CMD, IDCO

DG-NCB met with Shri Mainak Sarkar, Capacity Building Expert (WR). Shri Mainak Sarkar showed interest in the NCB's CCE Training Programmes for the Skill Development Training needs of his Deptt.

DG-NCB Meeting with Shri Mainak Sarkar, Capacity Building Expert (WR)

A presentation on the various R&D projects of National Importance undertaken by NCB was held in DPIIT, Delhi on 09th May, 2019. Sh. Anil Agrawal, Joint Secretary-DPIIT reviewed the progress and findings of various R & D projects along with DG-NCB, Head of Centres, Scientists and Engineers of NCB. The Head of Centres of NCB also presented the various activities of their respective centres.



Joint Secretary-DPIIT reviewing R&D Projects at Udyog Bhawan, New Delhi

A team of experts from Swiss Cooperation Office, Embassy of Switzerland in India comprising of Shri Anand Shukla, Senior Thematic Advisor Energy, Mr Bernard Mathieu, HOP3 Consulting (Belgium) and Mr Atul Khosla called on Dr B N Mohapatra, Director General NCB on 06 August 2019. The team led by Director General held wide ranging discussions on prospects of Limestone Calcined Clay Cement (LC3) in India.

An interactive meeting was held amongst the teams of National Council for Cement and Building Materials, led by Dr S K Chaturvedi (HOC-CRT) and Sh A Saxena (HOC-CME), Jawaharlal Nehru Aluminium Research Development and Design Centre, led by Dr Anupam Agnihotri, Director, representatives from European Union (EU-REI) and Sh Ulhas Parlikar, Global Consultant to explore the feasibility of implementing collaborative research between NCB and JNARDDC in imparting pozzolanic characteristics to bauxite residue on 18th October 2019. Dr Rachana Arora, initially highlighting EU-REI efforts in building efficiency policy framework along with NITI Aayog. Dr A. Agnihotri briefed about JNARDDC activities and technologies for disposal of red mud. Sh Anupam briefed about NCB organisational structure and Sh S K Agarwal, gave a presentation on NCB's work in the area of waste utilization.

NCB's CONTRIBUTION TOWARDS RESEARCH & INNOVATION

PAPERS PRESENTED IN WORKSHOPS, SEMINARS, CONFERENCES AND JOURNALS

The following papers were contributed / presented by NCB experts to / in different National and International Seminars, Workshops etc.:

3rd INTERNATIONAL CONFERENCE ON CALCINED CLAYS FOR SUSTAINABLE DEVELOPMENT, 15-17 OCTOBER 2019, NEW DELHI

"Investigations on Limestone Calcined Clay Cement System", S K Agarwal, S Palla, S K Chaturvedi, B N Mohapatra (NCB), S Bishnoi (IIT-D), S Maity (TARA) (2019),

15TH INTERNATIONAL CONGRESS ON THE CHEMISTRY OF CEMENT, 16-20 September 2019, PRAGUE, CZECH REPUBLIC

1. *"Improving the Reactivity and Quality of Clinker through Enhanced Combustion Kinetics in Kiln Main Burner", B N Mohapatra, Atul Chaturvedi, Ramsing Chauhan, K Subbulakshmanan, Reshu Chauhan, Rishi Joshi, Sukuru Ramarao*
2. *"Service Life Design of RC Structures Prone to Carbonation Using Accelerated Test Methods" by Puneet Kaura, Vikram Arora, B N Mohapatra*
3. *"Study on Alkali Aggregate Reaction and Sulphide Attack on Aged Concrete Large Dams" by V.V. Arora & Brijesh Singh*

NCB team led by DG-NCB, Dr B N Mohapatra attended 15th International Congress on the Chemistry of Cement during 16-20th September 2019 at Prague, Czech Republic along with Shri Brijesh Singh, Manager-NCB and Shri Puneet Kaura, Deputy Manager-NCB. During the five-day conference, Dr B N Mohapatra, Director General-NCB and a Member of the Scientific Committee,15th ICCC -2019 Chaired the Technical Session on Supplementary Cementitious Materials (SCMs). Dr B N Mohapatra, Director General-NCB, presented a technical paper on **"Improving the Reactivity and Quality of Clinker through Enhanced Combustion Kinetics in Kiln Main Burner"**. NCB team also presented four technical posters; (i) Superiority of composite cement over binary blended cement (ii) Effect of chemical and mineralogical parameters of cement on concrete workability (iii) Study on alkali aggregate reaction and sulphide attack on aged concrete large dams (iv) Service life design of RC structures prone to carbonation using accelerated test methods.

Technical experts and eminent professors from academic institutes, cement and construction industries shared their experiences and current areas of research in the field of cement and construction sector. To meet the requirements of sustainable future, low carbon binders, hybrid binders, digital concrete, improvement in climate performance of cement based binders, geopolymer concrete etc. in the field of cement and construction industry, DG NCB shared with all international experts that NCB has already taken up various activities in line with the issues of cement and construction industries.

Dr B N Mohapatra, Mr Brijesh Singh and Mr Puneet Kaura with Dr Angel Palomo, Eduardo Torroja Institute for Construction Science, Spain

Dr B N Mohapatra with Martin Schnieder, VDZ, Germany and Dr Sada Sahoo, Solidia Technologies, USA

Dr B N Mohapatra and Mr Brijesh Singh with Dr Lukas Perka, Chairman Organizing Committee, 15th ICCC-2019, Prague

Dr B N Mohapatra and Mr Brijesh Singh with Dr A K Chatterjee, India and Dr Sada Sahoo, Solidia Technologies, USA

Dr B N Mohapatra with Jan Gemrich, Chairman Scientific Committee, 15th ICCC-2019, Prague and Dr Subrato Chowdhury, India

3rd INDO-GERMAN CONFERENCE ON SUSTAINABILITY IN ENGINEERING: ENHANCING FUTURE SKILLS AND ENTREPRENEURSHIP SEPTEMBER 2019, BITS PILANI

1. *Indian Cement Industry: A Key Player in the Circular Economy of India by Kapil Kukreja, Prateek Sharma, B.N Mohapatra, Ashutosh Saxena*
2. *Oxygen Enrichment Technology-An Innovation for improved solid fuel combustion and sustainable environment by Ankur Mittal, B.N Mohapatra, Ashutosh Saxena*

ENCO 2019 (AN INTERNATIONAL SEMINAR ORGANIZED BY CIMFR-CSIR), 19-21 FEB 2019, NEW DELHI

Oxygen enrichment technology- an innovation in coal combustion in cement rotary kilns by Sh Ankur Mittal, Sh Ashutosh Saxena

INTERNATIONAL DAM SAFETY CONFERENCE – 2019 BHUBANESWAR, ODISHA, 13-14 FEBRUARY 2019

Detailed Investigation of Large Concrete Dams in India for Finite Element Analysis and Repair Strategy by V V Arora and Brijesh Singh (NCB) and Pramod Narayan (CWC)

INTERNATIONAL SEMINAR ON CONSTRUCTION AND REHABILITATION OF RIGID PAVEMENT – CURRENT PRACTICE AND WAY FORWARD, 18-19 JANUARY 2019, NEW DELHI

A Sustainable Approach to Construction of Low Volume Concrete Roads using C&D Aggregates and Supplementary Cementitious Materials by Vaibhav Chawla, Amit Trivedi & V V Arora

"PROMOTING AWARENESS & USAGE OF IRON AND STEEL SLAG: USHERING A NEW ERA", NEW DELHI 2019

Use of Iron and Steel Slag in Cement and Concrete, Dr B N Mohapatra

3rd R N RAIKAR MEMORIAL INTERNATIONAL CONFERENCE & G E T T U - KODUR INTERNATIONAL SYMPOSIUM ON ADVANCES IN SCIENCE & TECHNOLOGY OF CONCRETE, 14-15 DECEMBER 2018, MUMBAI

Study on Flexural Behaviour of High Strength Concrete using Granite Aggregate by V V Arora, Brijesh Singh & Vikas Patel

CORCON 2018 ON CORROSION SCIENCE AND ENGINEERING, 30 SEPT. - 03 OCT. 2018, JAIPUR

Performance of Evaluation of Corrosions Inhibitors and their Corrosion Inhibiting Efficiency for RCC Structures by P N Ojha, Puneet Kaura, Piyush Mittal and V V Arora

8th INTERNATIONAL CONFERENCE ON SUSTAINABLE WASTE MANAGEMENT, 22-24 NOVEMBER 2018, VIJAYWADA

Experimental Studies on Bottom Ash Fine Aggregate in Concrete by V V Arora & P N Ojha

WORKSHOP ON LATEST INVESTIGATIONS, REPAIR AND REHABILITATION TECHNOLOGIES FOR DAMS, 4-5 OCTOBER 2018, NEW DELHI

1. *Importance of Detailed Investigations of Large Concrete Dams in India for Accurate Analysis and Repair Strategy* by V V Arora and Brijesh Singh (NCB) and Pramod Narayan (CWC)
2. *Laboratory Evaluation and Field Execution of Concrete Repair for Concrete Dams in Himalayan Regions* by P N Ojha, Suresh Kumar, P S Rawat and V V Arora

Promoting Awareness & Usage of Iron & Steel: Ushering a New Era

One- day conference on "Promoting Awareness & Usage of Iron and Steel Slag: Ushering a New Era" was organized at FICCI Federation House, Tansen Marg, New Delhi on **27th August 2019**. Dr B N Mohapatra, Director General delivered a talk on 'Iron & Steel Slag Utilization in Cement and Concrete'.

Conserve Green & Sustainable Resources

Dr B N Mohapatra, DG-NCB participated in the CMA conference "CONSERVE GREEN & SUSTAINABLE RESOURCES" held in New Delhi from **30th September-1st October 2019** and was panelist in the session on "Technology and Innovations for Sustainability". During the session, DG NCB presented the current status of thermal substitution in Indian cement industry and future potential of waste availability. He also highlighted the challenges faced by cement plants and modifications required for increasing Alternate Fuel utilization. He showcased NCB's contribution towards utilizing alternate raw materials, reducing clinker factor by increasing usage of supplementary cementitious materials and development of new clinker. DG highlighted status of cement industry's efforts and NCB R&D activities to "Make the Indian Cement Plants World Class in Green".

Dr B N Mohapatra, DG-NCB was invited for a panel discussion on Sustainability in Cement sector: Challenges and Perspective – Present and Future. The Session chaired by Mr Sumit Banerjee, Chairman, Editorial Advisory Board, Indian Cement Review and the other panelists were Mr K N Rao, Co-Chairman, Green Cementech 2019 & Director-Energy and Environment, ACC Ltd, Mr Sandeep Srivastava, Sr. Vice President-Corp. Sustainability & Environment, Ambuja Cement Ltd. Mr Ashwani Pahuja, Chief Sustainability Officer, Dalmia Cement (Bharat) Ltd. & Mr Sivaram Krishnamoorthy, Operations Officer, International Finance Corporation. As part of panel discussions, various initiatives taken by the cement plants to reduce emissions and develop cement plants sustainable manner were highlighted. DG-NCB discussed R&D activities that are in-line with commitment towards sustainable development of cement industry.

3rd International Conference on Calcined Clays for Sustainable Development

NCB scientist Sh S K Agarwal presented a research paper entitled "Investigations on Limestone Calcined Clay Cement System", 3rd International Conference on Calcined Clays for Sustainable Development, at India Habitat Centre, 15-17 October 2019, New Delhi.

CORCON 2019 ON CORROSION SCIENCE AND ENGINEERING, 23 SEPT. - 26 SEPT. 2019, MUMBAI

Laboratory and Field Investigation of Long Term Performance of Bi-polar Corrosion Inhibitor by P N Ojha, Puneet Kaura, Piyush Mittal and V V Arora

ENCO 2019 (INTERNATIONAL SEMINAR), 19-21 FEB. 2019, ORGANISED BY CIMFR-CSIR, NEW DELHI

Oxygen Enrichment Technology – An Innovation in Coal Combustion in Cement Rotary Kilns by Ankur Mittal, Ashutosh Saxena

PAPERS PUBLISHED DURING 2018-19

The following papers were contributed by NCB scientists to outside technical journals:

1. S K Agarwal, S K Chaturvedi and Ashutosh Saxena, "*Effect of Mineral Addition on the Mechanical Properties of Portland Slag Cement*". **International Cement Review, December 2018, p.37-45.**

2. S K Agarwal, S Vanguri, S K Chaturvedi, B N Mohapatra (NCB), Anil Kumar, Subhdra Sen, A S Reddy, Ashok Kumar (Tata Steel Limited), "*Investigations on mechanical properties of GBFS-steel slag based Portland slag cement*", **(Accepted for publication in Zement Kalk Gips (ZKG).**

3. Brijesh Singh, V V Arora, Vikas Patel & Nitin Chowdhary "*Non-Destructive Testing of Bored Piles using the Low Strain Pile Integrity Method*". **Indian Concrete Journal.**

4. V V Arora & Brijesh Singh, "*Field and Laboratory Investigation on Ageing Effect in Concrete Arch Dam-Indian Case Study".* **Dam Engineering Journal, UK.**

5. Vikas Patel, Brijesh Singh, B P R Rao & V V Arora: *Challenges in quality Assurance in Construction Industry-A Case for Delhi.* **CE&CR Magazine.**

6. V V Arora, Brijesh Singh & Vikas Patel: *Study on Flexural Behaviour of Reinforced High Strength Concrete Beams.* **Indian Concrete Journal.**

7. Brijesh Singh, V V Arora & Vikas Patel: *Study on Stress Strain Characteristics of High Strength Concrete.* **Indian Concrete Journal.**

8. Vikas Patel, Brijesh Singh, B P R Rao and V V Arora: *Quality Assurance in Construction Industry.* **Concrete Update, E-Bulletin, CE&CR.**

9. T V G Reddy & Ankit Sharma: *Condition Assessment and Repair of RCC Structures - Case Studies.* **Advanced Research in Civil and Environmental Engineering.**

10. B N Mohapatra, *Pravesh Kumar Sharma* (Ambuja Cements Ltd.), V Liju, S K Chaturvedi (NCB), (2019), *"Portland Composite Cement: An Sustainable Product in Indian Scenario"* **Proceedings** of **The 34th International Conference on Solid Waste Technology and Management Annapolis, MD, USA.**

11. R S Gupta, S Vanguri, V Liju, S K Chaturvedi (2019), *"Investigations on preparation of geo based cementitious material at normal temperature, curing by alkali activation of blends of fly ash and GBFS",* **Cement International.**

12. V V Arora, Brijesh Singh and Vikas Patel, *"Durability and corrosion studies in prestressed concrete made with blended cement",* **Asian Concrete Federation Journal, Vol. 5, No. 1, July 2019.**

13. V V Arora, Pramod Narayan, Brijesh Singh & Bikram K Patra *"Detailed Investigations and Finite Element Analysis of IDUKKI Dam in India*" **International Commission on Large Dams / Commission, Ottawa. Canada June 9-14, 2019.**

REPRESENTATION OF NCB OFFICIALS IN VARIOUS TECHNICAL COMMITTEES

NCB is actively involved with a large number of overseas and Indian organizations in formulating and revising standards and policies through membership or otherwise. The Director General and other officials continued to serve on a number of committees constituted by the Government of India, the Bureau of Indian Standards and other organizations as follows:

Dr B N Mohapatra, Director General

a. Member of Civil Engineering Division Council (CEDC), Bureau of Indian Standards, New Delhi.

b. Member, Panel for Building Materials (CED 46:P3), Bureau of Indian Standards, New Delhi.

c. Member of BIS Cement & Concrete sectional committee CED 2, Cement pozzolana and Cement Additives sub-committee CED 2:1 and Concrete Sub-committee CED 2:2

d. Member of BIS Technical Committee (P4)

e. Member of technical Committee for development of Low Calcined Clay Cement (LC3) with of IIT- Mumbai, Delhi & Chennai & TARA

f. Member of Research Advisory Committee at DISIR (Dalmia Institute of Scientific and Industrial Research, Rajgangpur, Orissa

g. Member of scientific committee of 15th International Congress on the Chemistry of Cement (ICCC) held at Prague at 2019.

h. Member in their Technical Committee for the development of Standards for RMC. (Formed by CII – Confederation of Indian Industry)

Sh Ashutosh Saxena, Joint Director

a. Member, Working Group on Technical Sector of Standard Promotion and Consumer Affairs Deptt. (SP & CAD), Bureau of Indian Standards, New Delhi.

Dr S K Chaturvedi, Joint Director

a. Member, Cement and Concrete Sectional Committee (CED 2), Bureau of Indian Standards, New Delhi.

b. Member, Panel for work relating to ISO/TC71 and ISO/TC74 (CED2/P1), Bureau of Indian Standards, New Delhi.

c. Member, Cement, Pozzolana and Cement Additives Subcommittee (CED 2:1), Bureau of Indian Standards, New Delhi.

d. Member, Panel for Revision of Cement Standards (CED 2:1/P1), Bureau of Indian Standards, New Delhi.

e. Refractories Sectional Committee (MTD 15), Bureau of Indian Standards, New Delhi.

Sh V V Arora, Joint Director

a. Chairman, Cement Matrix Products Sectional Committee, Bureau of Indian Standards, New Delhi.

b. Member, Civil Engg. Divisional Council (CEDC), Bureau of Indian Standards, New Delhi.

c. Member, Cement and Concrete Sectional Committee (CED 2), Bureau of Indian Standards, New Delhi.

d. Member, Panel for work relating to ISO/TC71 and ISO/TC74 (CED2/P1), Bureau of Indian Standards, New Delhi.

e. Member, Panel for Revision of Handbooks (CED 2/P2), Bureau of Indian Standards, New Delhi.

f. Member, Panel for Aggregates from other than Natural Sources (CED 2/P3), Bureau of Indian Standards, New Delhi.

g. Member, Panel for Revision of Cement Standards (CED 2:1/P1), Bureau of Indian Standards, New Delhi.

h. Member, Concrete Sub Committee (CED 2:2), Bureau of Indian Standards, New Delhi.

i. Member, Panel for Revision of IS 3370 (Part I & Part II) (CED 2:2/P1), Bureau of Indian Standards, New Delhi.

j. Member, Panel for Revision of IS: 456 and IS: 1343 (CED 2:2/P5), Bureau of Indian Standards, New Delhi.

k. Convenor, Panel for Revision of IS 457 (CED 2:2/P6), Bureau of Indian Standards, New Delhi.

l. Member, Panel for Revision of Indian Standards on Test Methods for Concrete (CED 2:2/P7), Bureau of Indian Standards, New Delhi.

m. Member, Structural Safety Sectional Committee (CED 37), Bureau of Indian Standards, New Delhi.

n. Member, Earthquake Engineering Sectional Committee (CED 39), Bureau of Indian Standards, New Delhi.

o. Member, National Building Code Sectional Committee (CED 46), Bureau of Indian Standards, New Delhi.

p. Member, Panel for Fire protection (CED 46:P2), Bureau of Indian Standards, New Delhi.

q. Member, Panel for Building Materials (CED 46:P3), Bureau of Indian Standards, New Delhi.

r. Member, Panel for Load, Forces and Effects (CED 46:P4), Bureau of Indian Standards, New Delhi.

s. Member, Panel for Soil and Foundation/Panel for Plain Reinforced & Prestressed Concrete (CED 46:P5), Bureau of Indian Standards, New Delhi.

t. Member, Panel for Masonry (CED 46:P7), Bureau of Indian Standards, New Delhi.

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e) Member, Panel for Revision of IS: 456 and IS: 1343 (CED 2:2/P5), Bureau of Indian Standards, New Delhi.

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c) Member, Panel for Administration, Development Control Rules and General Buildings (CED 46:P1), Bureau of Indian Standards, New Delhi.

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b) Member, Panel for Revision of IS 2386 (CED 2:2/P10), Bureau of Indian Standards, New Delhi.

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NCB PATENTS GRANTED DURING 2010-2019

Sl. No	Application No.	Title	Name of Inventors
1.	248230	A Ceramic Composition for Preparing Scientific Pottery ware and Process of Preparation thereof (Date of Grant: 28-06-2011)	Shri S Raina Dr K Mohan Dr K M Sharma Dr M M Ali Sh S K Chaturvedi Dr D Yadav Sh S K Agarwal
2	251637	A decorative plaster coating (Date of Grant: 27-03-2012)	Sh S Raina Dr K Mohan Dr K M Sharma Dr M M Ali Sh S K Chaturvedi Sh S K Agarwal
3	288839	Decorative tiles utilizing marble dust and a process for preparation thereof (Date of Grant: 27-10-2017)	Sh S Raina Dr K Mohan Dr K M Sharma Dr M M Ali Sh S K Chaturvedi Sh S K Agarwal
4	289766	Cement and flyash based aesthetic building bricks tiles utilizing marble dust and a process for preparation thereof (Date of Grant: 21-11-2017)	Sh S Raina Dr K Mohan Dr K M Sharma Dr M M Ali Sh S K Chaturvedi Sh S K Agarwal
5	294833	A process of preparation of ordinary Portland cement (Date of Grant: 23-03-2018)	Sh M Vasudeva Dr M M Ali Dr D Yadav Dr J M Shatma NALCO Officials
6	295058	A process for preparation of synthetic slag from low grade limestone and dolomite (Date of Grant: 27-03-2018)	Sh A Pahuja Dr M M Ali Sh P S Sharma Sh S K Chaturvedi Sh S K Agarwal Dr V P Chatterjee Dr D. Yadav Sh Tashi Tshering Sh Udai Kaflay

Sl. No	Application No.	Title	Name of Inventors
7	314591	Rationalizing formulations and curing conditions for improving properties of hardened Geopolymeric Cement (Date of Grant: 25-06-2019)	Sh Ashwani Pahuja Dr M M Ali Dr R S Gupta Dr S Vanguri Dr V Liju

NCB Patents Filed During 2010-2019

Sl. No	Application No.	Title	Name of Inventors
1	2598/DEL/2014	Marble dust as mineral additive in the manufacture of ordinary Portland cement	Sh A Pahuja Dr M M Ali Sh P S Sharma Sh S K Agarwal Sh Ashish Goyal
2	2599/DEL/2014	Mineralizing effect of "barium sludge- an industrial byproduct" in the manufacture of ordinary Portland cement	Sh A Pahuja Dr M M Ali Dr V P Chatterjee Sh S K Chaturvedi Sh S K Agarwal
3	1195/DEL/2015	Investigations on the use of limestone mine reject on the properties of OPC clinker and resultant cement	Sh Ashwani Pahuja Dr M M Ali Dr V P Chatterjee Sh S K Chaturvedi Sh S K Agarwal
4	1194/DEL/2015	Process for the Preparation of sulphoaluminate - belite cement utilizing high magnesia / dolomitic limestone	Sh Ashwani Pahuja Dr M M Ali Sh P S Sharma Dr V P Chatterjee
5	1196/DEL/2015	Nanosilica blended ordinary Portland cement compositions with improved performance characteristics and a process thereof	Sh Ashwani Pahuja Dr M M Ali Dr S Harsh Sh Suresh Vanguri Dr Varsha Liju
6	1964/DEL/2015	Method for rapid estimation of Na_2O and K_2O in different types of cement and raw materials	Sh Ashwani Pahuja Dr M M Ali Sh S K Chaturvedi Sh S C Sharma

Sl. No	Application No.	Title	Name of Inventors
7	201611029136	Fast process for determining expected 28-day compressive strength of concrete made with Portland Pozzolana Cement (PPC)	Sh V V Arora Sh Suresh Kumar Sh Manish Kumar Mandre
8	201711000524	A process for preparing tiles	Sh Ashwani Pahuja Dr S K Chaturvedi Dr S Harsh Dr R S Gupta Sh S Vanguri Dr V Liju Dr MNK Prasad Bolisetty
9	201811047884	Geopolymer concrete paving block and a preparation thereof	Sh V V Arora Sh Amit Trivedi Sh Lalit yadav

NCB's SCIENTISTS & ENGINEERS-REVIEWER OF NATIONAL/INTERNATIONAL JOURNALS

S K AGARWAL
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MSc, MPhil

- British International Journal "Advances in Cement Research"

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M.Tech (Structural Dynamics)

- American Concrete Institute Materials Journal, America
- Construction and Building Materials Journal, Elsevier
- Journal on Case Studies on Non Destructive Evaluation, Elsevier
- Journal of Building Materials and Structures, Algerian Scientific Platform
- Journal of Materials in Civil Engineering, American Society of Civil Engineering
- Journal of Advances in Concrete Construction, South Korea
- Canadian Journal of Civil Engineering, Canada
- KSCE, Journal of Civil Engineering

Advisory Board Member of Journal of Research on Engineering Structures & Materials, Turkey

SELECT CLIENT LIST

OVERSEAS CLIENTS

SINTEF Building and Infrastructure, Norway	Mangdechhu Hydroelectric Project Authority, Bhutan	East African Portland Cement Co., Kenya	Shandong Binani Rongan Cement Co. Ltd., China
Raysut Cement Co., Oman	Penden Cement Authority Ltd., Gomtu, Bhutan	Mafikeng Cement (Pty.) Ltd., South Africa	Libyan Cement Company, Benghazi, Libya
Kuwait Cement Co., Kuwait	Gulf Cement Company, Qatar	Heidelberg Cement Ltd., Bangladesh	Mombasa Cement, Kenya
Muhammadiyah University-Jakarta, Indonesia	Cement Company of Northern Nigeria PLC. Sokoto	FAB Cement (Pty.) Ltd. South Africa	German Technical Cooperation (GTZ)
Emergency Irrigation Rehabilitation Project, Ministry of Energy & Water (MEW), Afghanistan	United Nations Industrial Development Organisation (UNIDO), Austria	Bestway Cement Ltd., Pakistan	The Second North-East Irrigated Agriculture Project (NEIAP II), Sri Lanka
Ghorahi Cement Industries Pvt. Ltd. Nepal	Oman Cement Company, Oman	Kuwait Cement Company, Kuwait	CMS Cement Industry, Malasiya
The Government of Republic of Congo			

INDIAN CLIENTS

A. P. Government, Hyderabad, Telangana	The India Cements Ltd.	Lafarge India Pvt. Ltd.	Jaiprakash Associates Ltd. (Cement Division)
Reliance Energy Ltd. (Formerly BSES)	Nagaland Mineral Development Corp. Ltd.	Jammu & Kashmir Cements Ltd.	OCL India Ltd.
Sanghi Industries Ltd.	Saurashtra Cement Ltd.	Saraswati Power & Industries (P) Ltd.	Penna Cement Industries Ltd.

Ministry of Environment & Forests	My Home Industries	Murli Industries Ltd.	Mawmluh-Cherra Cements Ltd
Mangalam Cement Ltd.	Manikgarh Cement	Lakshmi Cement	Kesoram Cement
PGCIL	Sri Vishnu Cement Ltd.	Kalyanpur Cements Ltd.	JK Cement Works
National Remote Sensing Centre	Odisha Industrial Infrastructure Development Corporation	Indian Railways	NPCIL
Visvesvarya National Institute of Technology	Vardhman Special Steels Ltd.	UJVN Ltd.	U P Rajya Vidyut Utpadan Nigam Ltd.
THDC India Ltd.	Tata Steel Ltd.	TATA Power Delhi Distribution Ltd.	Sport Authority Gujarat
SJVN Ltd.	National Informatics Centre, Hyderabad	Simplex Infrastructure Pvt. Ltd.	Sardar Sarovar Narmada Nigam Ltd, Gujrat
J K Laskhmi Cement Ltd.	Reserve Bank of India	Reliance Infrastructure Ltd.	Reliance Energy Ltd.
Ratnagiri Gas & Power Company Ltd.	Rajasthan Rajya Vidyut Utpadan Nigam Ltd.	Public Works Department, Govt. of Meghalaya	Public Works Department, Govt. of Delhi
Power Grid Corporation India Ltd.	Omnibus Industrial Development Corporation, Daman	NBCC Ltd.	Neyveli Uttar Pradesh Power Ltd.
National Small Scale Industries Corporation, New Delhi	All India Institute of Medical Sciences, New Delhi	ACC Ltd., Mumbai	Agricultural Produce Marketing Committee, Gujarat
Airport Authority of India	JSW Cement Ltd.	Jindal Power Ltd.	Indian Oil Corporation Ltd.

Indian Institute of Public Administration, New Delhi	Indian Agricultural Statistical Research Institute, New Delhi	India Trade Promotion Organization, New Delhi	India International Convention & Exhibition (IICC) at Dwarka, New Delhi
Himachal Pradesh Power Corporation Ltd.	Haryana Urban Development Authority	GERI, Gujarat	Garrison Engineer (AF), Air Force
Gannon Dunkerley and Company Ltd.	GAIL (India) Ltd.	Delhi Urban Shelter Improvement Board	Fosroc Chemicals (India) Pvt. Ltd.
Delhi Tourism & Transport Development Corporation Ltd.	Delhi Metro Corporation Ltd.	Delhi Development Authority	Central Water Commission
Cement Corporation India Ltd.	BSES Rajdhani Power Ltd.	BASF India Ltd.	JSW Ltd.
Bureau of Indian Standards	National Highways Authority of India	Kolkata Port Trust	Municipal Corporations of Delhi
Kandla Port Trust	Larsen & Toubro Ltd.	Lala Lajpat Rai University of Veterinary & Animals Science	UP Rajya Vidyut Utpadan Nigam Ltd.
Sterlite Industries (India) Ltd., Tuticorin	Kolkata Municipal Corporation	Central Pulp and Paper Research Institute, Saharanpur	Central Pollution Control Board, New Delhi
Reliance Industries Ltd.	State Directorates of Mines and Geology	Rajasthan State Minerals Development Corporation, Jaipur	Rajasthan State Pollution Control Board, Jaipur
National Environmental Engineering Research Institute, Nagpur	National Aluminum Company Ltd., Bhubaneswar	National Mineral Development Corporation, Hyderabad	Dhrangdhra Chemical Works, Dhrangdhra

Chennai Port Trust	Hindustan Zinc Ltd., Udaipur	IIT Delhi	Gammon India
Shree Digvijay Cement Company Ltd.	Shriram Cement Works	Shree Cement Ltd.	Tata Sponge Iron Ltd.
Vasavadatta Cements	Ministry of Water Resources, Govt of Karnataka	Uttaranchal Health System Dev Project	UP Health System Dev Project
Delhi Transco Ltd.	Bharat Aluminium Ltd. Korba	Water Resources Department, Govt of Maharashtra	Kochi Refineries Ltd
Ambuja Cements Ltd.	Wadi Cement Works	Tikaria Cement Works	Sindri Cement Works
Madukkarai Cement Works	National Thermal Power Corporation (NTPC Ltd.), NETRA	National Hydroelectric Power Corporation (NHPC Ltd.)	Birla Corporation Ltd.
Bharat Aluminium Ltd. Korba	Cairn Energy	Bihar Sponge Iron Ltd.	Binani Cement Ltd.
Vikram Cement	Rajashree Cement	Grasim Cement (Chhattisgarh) Grasim Industries Ltd.	Aditya Cement
Central Pollution Control Board	Century Cement	Bureau of Energy Efficiency	AAI
Andhra Cements Ltd.	Maharashtra Agricultural Marketing Board	Andaman PWD	MIDC
NHPEC	Central Water Commission	Indorama Cement Ltd.	New Delhi Municipal Council
Central Public Works Department	National Test House	Gujarat Sidhee Cement Ltd.	National Dairy Development Board
Border Roads Organization	NABARD	Dalmia Cement (Bharat) Ltd.	Bharat Sanchar Nigam Ltd.
Chettinad Cement Corporation Ltd.	Municipal Corporation Greater Mumbai	Bharat Heavy Electricals Ltd	Tamil Nadu Cement Corpn Ltd.

CCI Ltd.	Bhabha Atomic Research Centre	Bhakra Beas Management Board	Military Engineer Services
Minor Irrigation & I & CAD Dept. Govt. of AP)	BALCO MECON Ltd.	Mazagaon Dock Ltd.	AP Police Housing Corporation
Delhi Development Authority	Department of Water Resources, Govt. of Orissa	Orient Cement	UNITECH Prefab Ltd.
Hindalco Industries Ltd.	State Bank of India	Mysore Cements Ltd.	HPGC
SAIL	Gujarat Maritime Board	Maihar Cement	RITES Ltd.
Gujarat Industries Power Co Ltd.	Madras Cements Ltd	Reserve Bank of India	HPCL
Gammon India Ltd.	Reliance Industries Ltd	GAIL (India) Ltd.	Khyber Industries ltd
Regional Research Laboratory	Food Corporation of India	Kalyanpur Cement Ltd.	Zuari Cement Ltd
Punjab National Bank	Engineer's India Ltd.	CSIR-CRRI	Tata Projects Ltd.
NCL Industries Ltd.	AKS University	Kalburgi Cements	WAPCOS Ltd.
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