

Bio-data

1. Name: Pradeep Kumar Singh
2. Date of Birth: 01.01.1963
3. Current Position and Address: Director
 CSIR-Central Institute of Mining and Fuel Research
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4. Educational Qualifications:

Sl. No.	Degree/Certificate	Year of Passing	University/Institute	Subjects
1.	Post Doctoral Research	2005	Lassonde Institute of Geosciences, University of Toronto, Toronto, Canada	Topic "Characterisation of rock and explosives parameters for optimal explosive energy utilisation in rock blasting"
2.	Doctor of Engineering	1998	Institute of Mining Engineering Technical University, Clausthal, Germany	Thesis title "A study on ground vibrations due to rock blasting"
3.	M. Sc. (Tech.)	1984	Banaras Hindu University, Varanasi	Exploration Geophysics
4.	B. Sc.	1981	Banaras Hindu University, Varanasi	Physics, Chemistry, Mathematics
5.	P. U. C.	1978	Banaras Hindu University, Varanasi	Hindi, English, Bengali, Physics, Chemistry, Maths
6.	High School	1977	U. P. Board, Allahabad	Hindi, English, Science, Mathematics, Sanskrit

5. Academic/Research Experience/Employment

Sl. No.	From	To	Name of Organisation	Position held
1.	December 8, 2015	Till date	CSIR-Central Institute of Mining and Fuel Research, Dhanbad	Director
2.	January 29, 2013	December 7, 2015	CSIR-Central Institute of Mining and Fuel Research, Dhanbad	Chief Scientist
3.	January 29, 2008	January 28, 2013	CSIR-Central Institute of Mining and Fuel Research, Dhanbad	Senior Principal Scientist
4.	January 29, 2004	January 28, 2008	Central Institute of Mining and Fuel Research, Dhanbad	Scientist EII
5.	January 29, 2000	January 28, 2004	Central Mining Research Institute, Dhanbad	Scientist EI
6.	January 29, 1995	January 28, 2000	Central Mining Research Institute, Dhanbad	Scientist C
7.	January 29, 1990	January 28, 1995	Central Mining Research Station, Dhanbad	Scientist B

6. **Area of Specialization** : Rock Mechanics and Mining Methods in general
and Rock Excavation Technologies in particular
: Coal characterisation and Clean Coal Technologies

7. **Honors/Awards Received:**

- i. CSIR Technology Award for Business Development and Technology Marketing-2019
- ii. CSIR Technology Awards 2019 for Physical Sciences including Engineering for the scientific work "Controlled Blasting Techniques developed for Safe Extraction of Minerals from Mines and Construction of Various Civil Infrastructure Projects".
- iii. Elected Fellow of the National Academy of Sciences, India (NASI), 2018.
- iv. CSIR Technology Award for Business Development and Technology Marketing-2018.
- v. The Certificate of Merit under CSIR Technology Awards 2018 for Physical Sciences including Engineering for Mine Transport Surveillance System.
- vi. Recipient of Highest ECF Generation Lab of CSIR during FY 2017-18 (INR 332.64 Crore equivalent to 34.54% of CSIR ECF).
- vii. CSIR Technology Award for Business Development and Technology Marketing-2017.
- viii. National Mineral Award, 2007.
- ix. Raman Research Award, 2005.
- x. CMRI award for earning highest external cash flow from S&T projects grant, 2005.
- xi. German Academic (DAAD) fellowship, 2003.
- xii. CMRI award for earning highest external cash flow for the Institute, 2001.
- xiii. CMRI award for highest number of publications, 2000.
- xiv. CSIR Golden Jubilee CMRI-Whitaker Award, 1997.
- xv. German Academic (DAAD) fellowship, 1995-1998.
- xvi. National Merit Scholarship, 1977-1981.

8. **Professional Assignments:**

- i. Chairman, BIS Committee on Solid Mineral Fuels Sectional Committee (PCDC-07).
- ii. Member, International Committee of Rock Fragmentation by Blasting (FRAGBLAST), Headquarters in Spain.
- iii. Member, Standing Scientific Research Committee, Ministry of Coal, Govt. of India.
- iv. Member, Standing Scientific Advisory Group, Ministry of Coal, Govt. Of India.
- v. Member, Governing Body and General Body, National Institute of Rock Mechanics, Bengaluru, Karnataka.
- vi. Member, Research Advisory Council, NTPC-NETRA, Noida. (2016-2019).
- vii. Member and Domain Expert, Ministry of Human Resource Development, Govt. of India – Committee on Uchhatar Abhiskar Yojana (UAY) on Construction, Steel, Mining and Geotechnics (DEC-IV).
- viii. Executive Committee member of World Forum of Universities of Resources on Sustainability (WFURS), head quarter in Germany (Representing India in WFURS).
- ix. Member, International Society for Rock Mechanics.
- x. Member, Committee on Central Government Programming Board, GSI, Govt. of India.
- xi. Member, International Society of Explosives Engineers.
- xii. Member, Indian Geo-technical Society.
- xiii. Member Nominee (CSIR), Indian National Committee on World Mining Congress.
- xiv. Life Member, Mining Geological and Metallurgical Institute of India.
- xv. Member, Association of Exploration Geophysicists.
- xvi. Life Member, International Society of Rock Mechanics and Tunnel Technology.
- xvii. Life Member, Association of Indian Mining Engineering Journal Forum.

- xviii. Member, Board of Research Studies of Central University of Jharkhand, Ranchi (2016-19).
- xix. Member, Editorial Board of Journal of Rock Mechanics & Tunnelling Technology (JRMTT).
- xx. Member, Academic Council, Indian Institute of Technology (ISM), Dhanbad (2016-2019).
- xxi. Guest Professor, Faculty of Geosciences, Geoengineering and Mining, Technische Universität, Bergakademie, Freiberg, Germany.
- xxii. Member, Committee on Violation of Environmental Clearance in the country, Govt. of India, Ministry of Environment, Forest & Climate Change, New Delhi.
- xxiii. Member, Board of Governors, Rajiv Gandhi Institute of Petroleum Technology by Ministry of Petroleum & Natural Gas, Gol w.e.f. 20.02.2017 for period of three years.
- xxiv. Member, Governing Board of Skill Council for Mining Sector, National Skill Development Corporation, New Delhi.
- xxv. Member, Surface Coal Gasification, NITI Aayog, Government of India.
- xxvi. Member, Research Council of CSIR-IIP, Dehradun w.e.f August 2017 for 3 years.
- xxvii. Member, Research Council of CSIR-NIO, Dona Paula, Goa w.e.f August 2017 for 3 years.
- xxviii. Member, SERB Expert Committee for UAY scheme w.e.f. 19.02.2018 to 18.02.2021.
- xxix. Member, Expert Committee for inspection of Coal Fired Thermal Power Plants in the State of Jharkhand.

9. Research Publications details:

Papers in International Journals and Proceedings:	152
Papers in National Journals and Proceedings:	69
Industrial R & D and Sponsored/Consultancy projects:	574
S & T Projects (Advisor):	11
S & T Projects (Project Leader):	07
Booklets (Published):	04
Patents Filed	11

10. **Books Authored/Edited:** 10

11. **Ph. D. supervised:** 8 (Completed-2 & Continuing-6)

Books authored/edited:

1. A Study on Ground Vibrations due to Rock Blasting. Published by PAPIERFLIEGER, Clausthal, Germany, ISBN 3-89720-106-2, 1998.
2. Evaluation of Damages to Underground Coal Mines Caused by Surface Blasting vis-a-vis Establishment of Blast Vibration Threshold. Published by International Society of Explosives Engineers, Ohio, USA, 2002.
3. Rock Fragmentation by Blasting. Published by CRC press/ Balkema, UK. ISBN: 978-0-415-62143-4, 2012.
4. NexGen Technologies for Mining and Fuel Industries. Published by Allied Publishers Pvt. Ltd., New Delhi. ISBN: 978-93-85926-40-2, 2017.
5. Safety of Mining Equipments and Corrosion Control. Proceedings of the Workshop organized during April 16-17, 2018 at Kolkata, West Bengal.

6. Recent Challenges in Mining Industry. Proceedings of the National Conference organized on April 28, 2018 at Dhanbad, Jharkhand.
7. Technological Advancement and Emerging Mining Methods. Proceedings of All India Seminar organized during August 24-25, 2018 at Dhanbad, Jharkhand.
8. Rock Blasting Techniques – Challenges and Opportunities. Proceedings of National Seminar organized during November 23-24, 2018 at Dhanbad, Jharkhand.
9. Energy and Environment - Challenges & Opportunities. Pulished by CRC Press/Balkema, Taylor & Francis Group, AK Leiden, Netherland. ISBN: 978-0-415-62143-4 (Hbk + CD-ROM), ISBN:978-0-203-86291-9 (eBook).
10. Evaluation of Shale Source Rocks and Reservoirs, Series: Petroleum Engineering, by Bodhisatwa Hazra, David A. Wood, Devleena Mani, Pradeep K Singh and Ashok K. Singh. Publisher: Springer, 1st ed. 2019 Edition (July 13, 2019). ISBN-10: 303013041X; ISBN-13: 978-3030130411.

Institutional publications brought out:

Scientific/Technical guidelines have been published based on the outcome of the S&T projects and has been distributed to all the mines and civil construction projects. The applicant has authored the guidelines on the following topics:

1. Evaluation of damages to underground coalmines caused by surface blasting vis-a-vis establishment of blast vibration threshold.
2. A study on effect of delay timing, total charge and direction of initiation on blast induced ground vibration.
3. Standardisation of blast vibration damage threshold for the residential structures in mining areas.
4. A study on effect of underground blasting on surface structures vis-à-vis Standardisation of blast vibration damage threshold.

National and international recognitions:

- The National Academy of Sciences, India (NASI) has elected Dr. P. K. Singh its Fellow in the year 2018.
- Received coveted National Mineral Award from the Ministry of Mines, Government of India for the year 2007 in the recognition of significant contribution in the field of Mining Technology.
- The Raman research fellowship was awarded to the applicant to carry out advance research at University of Toronto, Toronto, Canada in 2005.
- The Directorate General of Mines Safety (DGMS), the mine regulatory authority in India, has accepted the scientific study report authored by the applicant and has stipulated the guidelines to be adopted by the mines vide Circular No. DGMS (Tech) (S&T) Circular No. 06 of 2007 dated 28.05.2007 on “Damage of below ground structures due to blast induced vibration in nearby opencast mines”.
- World Forum of Universities of Resources on Sustainability (WFURS), head quarter in Germany, selected the applicant as a member of Executive Committee in August, 2012 to steer future activities to be undertaken by World Forum. The applicant is

representing India in WFURS by virtue of his notable contribution in the field of sustainable mining and has formulated the Constitution and Bylaws of WFURS.

- The International Committee of Rock Fragmentation by Blasting, head quarter in Spain, representing major countries of the world in the field of explosives and blasting technologies elected the applicant in November 2012 to serve as a Executive Committee member of the International Committee for development of explosives science and blasting technologies in the recognition of his noteworthy contribution in the field of rock fragmentation and blasting.
- Delivered invited talk as International Luncheon speaker at 38th International Society of Explosives Engineers (ISEE) conference at Nashville, USA on 13.02.2012. This honour was given to any Indian for the first time in the history of ISEE, USA.
- Another example of recognition with International researchers is the decision by the International Committee of FRAGBLAST on 16th September, 2009 in Granada, Spain to hold the next International Symposium on Rock Fragmentation by Blasting (Fragblast 10) in India. The bid to host Fragblast 10 in India was presented by the applicant in Granada and successfully organised the 10th International Symposium on Rock Fragmentation by Blasting (Fragblast 10) as Convenor and Organising Secretary at Vigyan Bhawan, New Delhi during November 24-29, 2012. This is the most prestigious global event in the field of Mining Engineering. It was held for the first time in India. The success of the symposium was acknowledged by the International Committee, participants from 40 countries, the then Hon'ble Minister of S&T; Hon'ble Minister of Coal; Secretary, Ministry of Coal; DG, CSIR and other dignitaries who attended the symposium and participants.
- Authored the concepts of effective explosive weight per delay; blast vibration damage threshold; optimal delay interval between two detonations, which have been globally accepted and implemented.
- Delivered key note talks at International and National conferences and also chaired technical sessions in the conferences.
- International Journal for Rock Mechanics and Mining Sciences, an Elsevier Publication, honoured the applicant as Outstanding Reviewer for 2014.
- Served as examiner of Ph.D. and M. Tech. dissertations submitted for award of respective degrees from different universities.
- Working as Expert member of Executive Board of Defence Research & Development Organisation (DRDO), Ministry of Defence, Government of India for review and implementation of the projects of strategic national importance.

Deputation abroad:

Deputed by CSIR/CIMFR to the following countries for scientific pursuits:

Australia, Austria, Brazil, Canada, Chile, China, France, Germany, Japan, Netherlands, Norway, Poland, Portugal, Russia, South Africa, Spain, Sweden, Tanzania and USA.

Most of the foreign visits were sponsored by the host organisations such as German Academic Exchange Services (DAAD), Germany; China Society of Engineering Blasting, China; World Forum of Universities of Resources on Sustainability, Germany; International Society of Explosives Engineers, USA; European Federation of Explosives Engineers,

Portugal. Applicant is representing India in the World Forum of Universities of Resources on Sustainability; International Committee of FRAGBLAST.

Reviewer of the referred Journals:

1. International Journal of Rock Mechanics and Mining Sciences, Elsevier Publications
2. International Journal of Environmental Earth Sciences, Springer Publications
3. International Journal of Vibration and Control, SAGE Publication
4. International Journal of Soil Dynamics and Earthquake Engineering, Elsevier Publications
5. International Journal of Tunnelling and Underground Space Technology, Elsevier Publications
6. International Journal of Geophysics
7. Transaction of the Institution of Mining and Metallurgy, Section A, Mining Technology
8. International Journal of Explosives Engineering
9. International Journal of Fragmentation and Blasting
10. Earthquake Engineering & Engineering Vibration
11. Journal of Applied Geophysics
12. International Journal of Surface Mining Reclamation & Environment
13. Rock Mechanics and Rock Engineering, Springer Publications
14. Journal of Rock Mechanics and Geotechnical Engineering, Elsevier Publications
15. Journal of Mining World Express (MWE), Science and Engineering Publishing Company

Supervisor of Ph. D. candidates:

1. Dr. M. P. Roy earned his Ph.D. degree from Indian School of Mines, Dhanbad on "Study to investigate the effect of delay time, total charge and effective charge per delay on blast induced ground vibration".
2. Mr. Ranjit K Paswan earned his Ph.D. degree from Indian Institute of Technology (Indian School of Mines), Dhanbad on "Geotechnical Characterisation of Strata for Pre-split Blasting to Control Pit-wall Damage in Open-pit mine".
3. Md. Sarim is continuing his Ph.D. thesis at AcSIR on "Geological and technical aspects of underground excavation in geologically complex area by blasting".
4. Mr. Vivek Kumar Himanshu is continuing his Ph.D. work on "Determination of Rock-Explosive Interactions under Dynamic Loading for Indian Geo-mining Condition". The thesis will be submitted at Indian Institute of Technology (Indian School of Mines), Dhanbad.
5. Mr. Sanjay Mishra is continuing his Ph.D work on "A Study to evaluate the effect of various Geo-mining parameters on Blast Design and its effect on the performance of High Capacity Excavators in Mega Opencast Projects." The thesis will be submitted at Indian Institute of Technology (Indian School of Mines), Dhanbad.
6. Mr. Gouranga Senapati is continuing his Ph.D work on "Study on impact of Rock Fragmentation size on performance of Excavators in Opencast Coal Mines." The thesis will be submitted at Indian Institute of Technology (Indian School of Mines), Dhanbad.
7. Mr. Chitranjan Prasad Singh is continuing his Ph.D work on "Influence of various Geo-mining parameters on Blast Induced Ground Vibrations and Blast performance in Opencast Mines." The thesis will be submitted at Indian Institute of Technology (Indian School of Mines), Dhanbad.

8. Mr. Surendra Prasad Singh is continuing his Ph.D work on “Development of innovative blasting technique at hot strata condition for safe and efficient extraction of coal from developed pillars in opencast mines” at Indian Institute of Technology (Indian School of Mines), Dhanbad.

S&T projects as Project Leader:

1. Blast design and fragmentation control – Key to productivity, funded by Coal S&T grant of Ministry of Coal, Govt. of India. December 2016, (Completed).
2. Characterisation of rock and explosives parameters for optimal explosives energy utilisation in rock blasting. Funded by Ministry of Coal, Government of India. March, 2010, (Completed).
3. Effect of production blasts, ground water and geo-technical properties on pit-wall and dump stability in open-pit coal mines. Funded by Ministry of Coal, Government of India. February, 2007, (Completed).
4. A study on effect of underground blasting on surface structures vis-à-vis standardisation of blast vibration damage threshold. Funded by Ministry of Coal, Government of India. September, 2006. (Completed)
5. Standardisation of blast vibration damage threshold for the safety of residential structures in mining areas. Funded by Ministry of Coal, Government of India. August, 2006, (Completed).
6. Study on the effect of delay timing, total charge and direction of initiation on blast induced ground vibration. Funded by Ministry of Mines & Mineral, Department of Coal, Government of India. May, 2004, (Completed).
7. Evaluation of damages to underground coal mines caused by surface blasting vis-a-via Establishment of blast vibration threshold. Funded by Ministry of Mines & Mineral, Department of Coal, Government of India. August, 2000, (Completed).

S&T Projects as Project Advisor:

1. Improved fugitive methane emission factors for coal mining and handling activities in India Including abandoned mines. Funded by MOEFCC, Government of India, Ongoing (2018-19).
2. Design guidelines for underground coal extraction beneath massive competent Strata: A case study validation. Funded by Coal India Limited, Ongoing (2018-19).
3. Design and stability of pillars/arrays of pillars for different mining method in coal mine workings. Funded by Ministry of Coal, Government of India, Ongoing (2017-18).
4. Development of digital mine using internet of things. Funded by Ministry of Electronics & Information Technology, Government of India, Ongoing (2017-18).
5. Bio-Methanation of coal mill and coal washery rejects. Funded by Dept. of Science & Technology, Ministry of Science and Technology, Government of India, Ongoing (2017-18).
6. Development of a selection methodology for road header and tunnel boring machine in different geological conditions for rapid tunnelling. Funded by Ministry of Power, Government of India, Ongoing (2016-17).

7. Development of Tracking System for Controlling Illegal Mining and Coal Transportation in North East Region of India. Funded by Ministry of Electronics & Information Technology, Government of India, 2017, (Completed).
8. Development of Feasibility Assessment Model for Adaptation of Underground Coal Gasification Technology in North East Region of India. Sponsored by Department of Electronics & Information Technology (DeitY), Ministry of Electronics & Information Technology, Government of India, 2016, (Completed).
9. To Find Methodology of Safe Liquidation of thick seam of Raniganj Coalfields: Design, Development & Showcasing Demonstrative Trial at Khottadih Colliery. Sponsored by R&D Board, Coal India Limited, June 2016 (Completed).
10. Highwall Mining Design and Development of Norms for Indian Conditions. Funded by SERB, Department of Science and Technology, Government of India New Delhi, completed in February, 2018.
11. Study of Toxic Fumes and Development of Carbon Nanotubes based sensing device, Ministry of Mine, Government of India, Completed in June, 2018.

National Project Coordinator of sponsored project:

1. Scientific study of Quality Monitoring of coal for efficient power generation. Funded by Coal producing companies and Power utilities. Ongoing since 2016-2017.

Collaborative projects with international institutions:

1. A collaborative project for reclamation of Rampura Agucha Open-pit Mine is under process. A MoU has been signed with TU Bergakademie, Freiberg and GmbH, Germany for mine reclamation of Hindustan Zinc Limited.
2. Worked with Professor R. Paul Young and Professor Bibhu Mohanty, Lassonde Institute of Geosciences, University of Toronto, Toronto, Canada on "Characterisation of rock and explosives parameters for optimal explosive energy utilisation". A joint project proposal with Professor Bibhu Mohanty on "Explosive energy partitioning vis-a-vis rock fragmentation" has been prepared and funding is anticipated from INCO, Canada.
3. Established first Calibration Centre for calibration of blasting monitoring Seismographs in South East Asia at CIMFR, Dhanbad in technical Collaboration with M/s InstanTel Inc. Canada in 2001. Till date 524 seismographs of different organisations have been calibrated at CIMFR, Dhanbad.
4. Worked with Professor C. Niemann-Delius, Director, Institute of Mining Engineering III, Aachen University of Technology, Aachen, Germany on "Annoyance, structure response and damage produced by blast-emitted noise and their control measures" under DAAD re-invitation program.

Patents Filed:

1. A Device for Wheel Controlled Odourless and Waterless Discharge system in Trains. S.K. Kashyap, P.K. Singh. (NF No. 0095NF2017, 10.04.2017, filed on 07.03.2018)

2. Vision Improvement Device for Harsh Atmosphere caused by Temperature Attenuation (VIDHATA). S.K. Chaulya, G. Banerjee, P.K. Singh, G.M. Prasad, Virendra Kumar, Debashis Chatterjee, Raj Kumar, Kunal Saurav. (NF No. 0174NF2017, 24.08.2017, filed on 07.03.2018)
3. Pressurized Fluidized Bed Gasification Pilot Scale Test Facility with the provision of external heating to test the high ash coals, biomass, rejects and their blends. P.D. Chavan, S. Datta, S. Saha, G. Sahu, P. Dutta, P.K. Singh. (NF0177NF2017, 08.09.2017, filed on 13.04.2018)
4. An Intelligent dust suppression system for mining applications. S.K. Chaulya, T.B. Singh, G. Banerjee, P.K. Singh, Naresh Kumar, Virendra Kumar, J.K. Singh, T.N. Ghosh, Ranjeet Mandal, Debashis Chatterjee. (NF No. 9186NF2017, 12.10.2017, filed on 13.04.2018)
5. A novel portable device for providing hydration in remote areas. (Pallabi Das, S.K. Kashyap, G.C. Mondal, K.K.K. Singh, P.K. Singh. (NF No. 0201NF2017, 25.10.2017, filed on 13.04.2018)
6. Biometric-based Exploder. S.K. Chaulya, S.K. Roy, Pijush P. Roy, P.K. Singh, G. Banerjee, J.K. Singh, Naresh Kumar, Virendra Kumar, Debashis Chatterjee, T.N. Ghosh. (NF No. 0216NF2017, 24.11.2017, filed on 24.05.2018)
7. Biometric-based Theft Control Device for Two Wheelers. S.K. Chaulya, G. Banerjee, P.K. Singh, Naresh Kumar, Virendra Kumar, Debashis Chatterjee, T.N. Ghosh. (NF No. 001NF2018, 24.01.2018, filed on 24.05.2018)
8. A chemical inhibitor composition for controlling and combating high intensity fire in surface coal mines. R.V.K. Singh, N.K. Mohalik, R.K. Mishra, D.D. Tripathi, Ajay Khalkho, Jitendra Pandey, P.K. Singh, Rajesh Hiralal Sabdra. (NF No. 00NF2018, 27.03.2018, filed on 24.05.2018)
9. Intrinsically Safe Digital Fuel Meter. Jitendra Kumar Singh, S. K. Chaulya, Gautam Banerjee, P. K. Singh, G. M. Prasad, Abhishek Chowdhury, Naresh Kumar, Virendra Kumar (NF No. 0151NF2018, Application No. 201811047607 Filed on 17.12.2018)
10. Blocks and sand manufacturing process using mine wastes. S. K. Chaulya, Raj Shekhar Singh, Sailendra Sumar Singh, K.K.K. Singh, Gautam Banerjee, P. K. Singh, Ranjit Kumar Singh, Debashis Chatterjee, Kunal Saurabh, Virendra Kumar (NF No. 0089NF2018, Application No. 201811040429, Filed on 26.10.2018).
11. Automatic Headlamp Dimming Device. S. K. Chaulya, Gautam Banerjee, P. K. Singh, G. M. Prasad, Debashis Chatterjee, Naresh Kumar, Virendra Kumar, Jitendra Kumar Singh, Kunal Saurabh (NF No. 0083NF2018, Application No. 201811040427, Filed on 26.10.2018).

Societal/ Industrial pursuit of Dr. Pradeep Kumar Singh

1. **Regulatory Agency Guidelines.** Dr. Singh has developed a blast damage index for underground openings involving nearby open-cast blasting operations. Accepting the recommendations of this study, Directorate General of Mines Safety, the mine regulatory authority in India, has issued a mandatory guideline for implementation at all mines. On the implementation this circular, a number of underground mines and open-pit mines are able to extract the minerals in safe manner simultaneously.
2. **Quality Coal for Power Generation:** CSIR-CIMFR has entered into MoUs with Coal Producing Companies and Power Utilities for quality analysis of coal for thermal

power plants on PAN India basis. Dr. Singh is the National Coordinator of this national Mission project. Coal samples of about 600 million metric tons, being consumed per annum by power utilities, are being analyzed for quality assurance. The efforts have minimized the disagreements on quality issues between coal producers and power utilities. NTPC has acknowledged this initiative which helped in reduction of specific coal consumption and reduction of cost of electricity generation which is being passed on to the consumers. This endeavour has helped the country in sustainable and affordable energy supply and security.

3. **Methanol Economy Mission Program:** Govt. of India has initiated Methanol Economy Mission Program under the aegis of NITI Aayog to ring-fence India from oil and natural gas price volatility. In this direction, Dr P K Singh has taken up multifaceted program to setup a Coal-to-Methanol pilot plant. CIMFR has already developed a pilot scale Air-blown Pressurized Fluidized Bed Gasification (PFBG) facility and in the process of up-scaling the Oxy-blown PFBG of 1.5 TPD coal feed rate capacity suitable for Coal-to-Methanol pilot plant. Further, it is in process of developing syngas ultra-cleaning facility and syngas to methanol facility which will be integrated with 1.5 TPD PFBG facility.
4. **Coal to Liquid:** Under the guidance of Dr. Singh, a nationally important project on conversion of coal to liquid fuel was successfully completed. In this project, one cobalt catalyst for conversion was developed and tested in an integrated Coal to Liquid Pilot Plant commissioned in the Institute. The concerted efforts of Dr Singh have led to the development and distribution of Certified Reference Material (CRM) to industries and laboratories for quality assurance and calibration of chemical analyses of bituminous coal. Dr. Singh is now guiding a team of scientists working on Oxy Fuel Combustion of Pulverized Coal, Co – Combustion of Coal and Biomass in FBC and Mercury emissions monitoring from point sources in coal fired plants.
5. **Reclamation of Mine Water to drinking water:** Dr. Singh has coordinated in developing a technology entitled “Mine water reclamation technology for providing safe drinking water in mining areas”. It has already been commissioned in one of the colliery sites of Coal India Limited (CIL) and fulfilling the needs of the locality with scarce potable water. Dr. Singh is now concentrating to set up similar facilities in other parts of the country at 25 mine sites to ease the problem of people living in and around the mine sites.
6. **Navi Mumbai International Airport:** Navi Mumbai International Airport, a Greenfield project, is being built at Ulwe Kopar-Panvel in Maharashtra, India. It is being developed as the second international airport for the Mumbai Metropolitan Region. Under the leadership of Dr. Singh, CSIR-CIMFR is involved in land development work that comprises of flattening of Ulwe hill which is 92 m in height, by drilling and blasting method. The project will open up the state's vast hinterland rich in agriculture, floriculture, hi-tech high value industries to the world market. Thus, the airport will act as a focal point for the emergence of transshipment centre in the South Asian region.
7. **Road Construction in hilly terrain:** Dr. Singh has initiated a new project with Boarder Road Organization (BRO) for developing site specific controlled blasting techniques for construction of road and stabilization of slope in hilly areas. Presently, six such sites are under investigation. MOU has been signed with BRO to be their knowledge partner for construction of the upcoming roads in hilly terrain.
8. **Quality assessment of Iron ore for steel making:** CSIR-CIMFR has signed a MoU with NMDC, Donimalai under the initiation of Dr. Singh for quality monitoring of iron

ore for affordable and sustainable steel production in the country. Steel plays a vital role in the modern world and is one of the most important materials for building and infrastructure; steel is the enabler of a wide range of manufacturing activities. It also creates opportunities for innovative solutions in other sectors and is indispensable in research and development projects around the world. Per capita steel consumption is said to be a measure of societal growth of a country. The activity will help in reduction of iron ore import, which will contribute in production of steel at an affordable cost to common people of country for their day to day use.

9. **Tunnel and Hydro Projects:** Significant contributions has been made under the guidance of Dr. Singh in blast designs for excavations of machine hall, head race and tail race tunnels, approach tunnels and diversion tunnels at Sardar Sarovar hydel project, Indira Sagar hydel project, Karcham-Wangtoo hydel project, Parbati hydel project, Chamera hydel project, Teesta hydel project, Chuzachen hydel project, Nathpa-Jhakari hydel project, Rampur hydel project, Sawra-Kuddu hydel project, Songtong-Karcham hydel project, Dul-Hasti hydel project, Baglihar hydel project, Tala (Bhutan) hydel project, Salma Dam (Afghanistan), Tehri project, Vishnu Prayag hydel project, Kol Dam hydel project and Hydel project of NEEPCO. This is enabling the country to exploit the water for electricity generation for the masses in the region.
10. **Construction of Konkan Railway:** Under the initiative of Dr. Singh, flattening of unstable high-rise rock slopes along 741 km railway route of Konkan railways, using controlled blasting techniques and design of rock excavation for open cutting and tunnelling for laying second railway track adjacent to existing track between Roha (near Mumbai) and Thokur (near Mangalore) has been initiated. This will help to make the lifeline of the region smooth and safe.
11. **Technology for treatment of acid mine water for its reuse and safe disposal:** Under the initiative of Dr. Singh, studies for providing drinking water to the inhabitant of Meghalaya by acid mine water purification. This enables and enhances the health conditions of the inhabitants of the State of Meghalaya in particular and North Eastern Region of India in general.
12. **Development of ANFO Explosives:** Under the guidance of Dr. Singh, a MoU has been signed with STL for the development of water resistant ANFO (WNFO), mixing of rejected crude oil in combination with fuel oil (ANFRO) and addition of aluminium powder with ANFO (ALANFO) for increasing energy level of explosives. These varieties of ANFO will replace the costly explosives available in the market and overall reduce the mining cost.