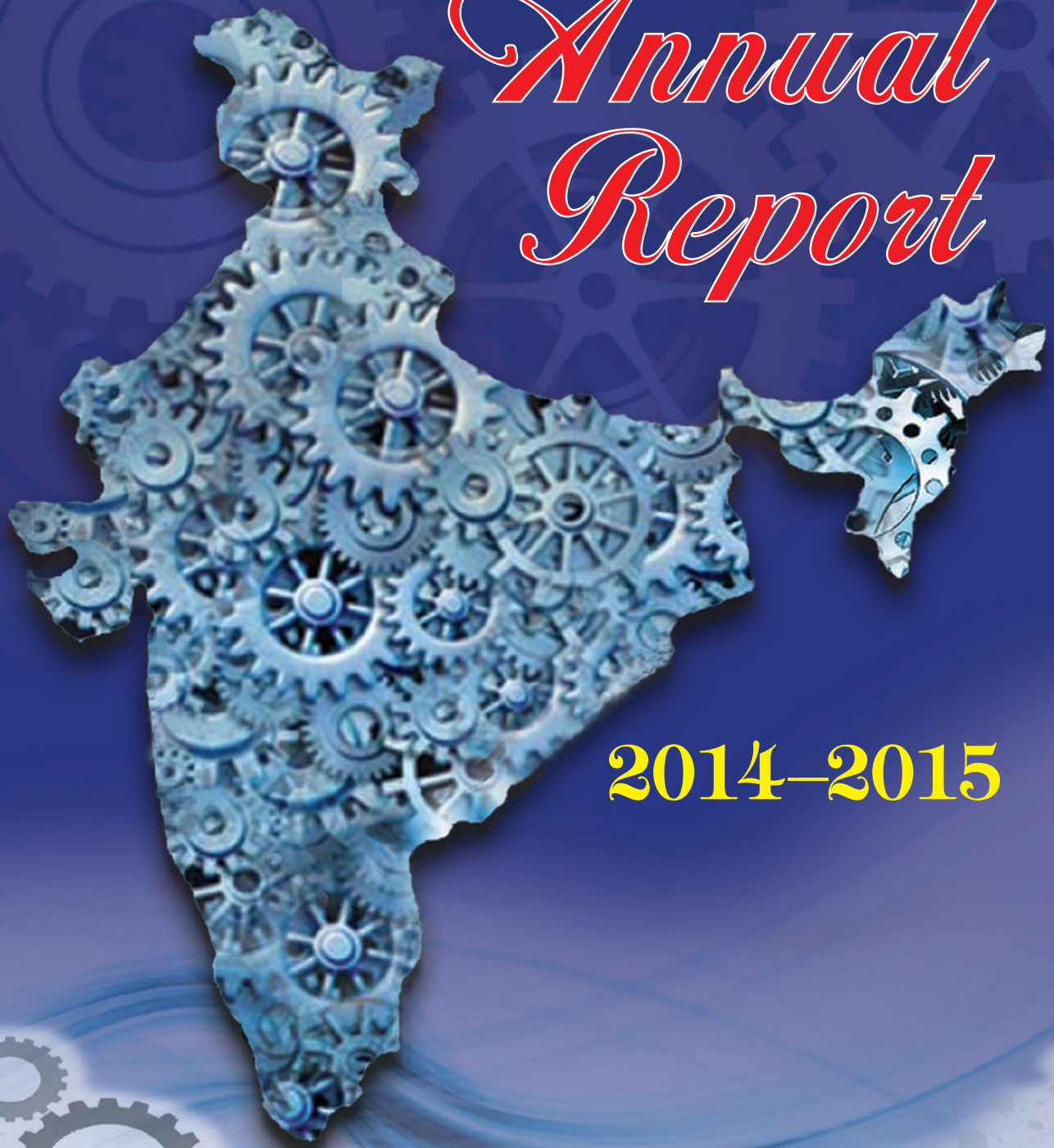
Annual Report



2014–2015

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Department of Scientific and Industrial Research
MINISTRY OF SCIENCE AND TECHNOLOGY

http://www.dsir.gov.in

Annual Report

2014–2015

Department of Scientific and Industrial Research
MINISTRY OF SCIENCE AND TECHNOLOGY

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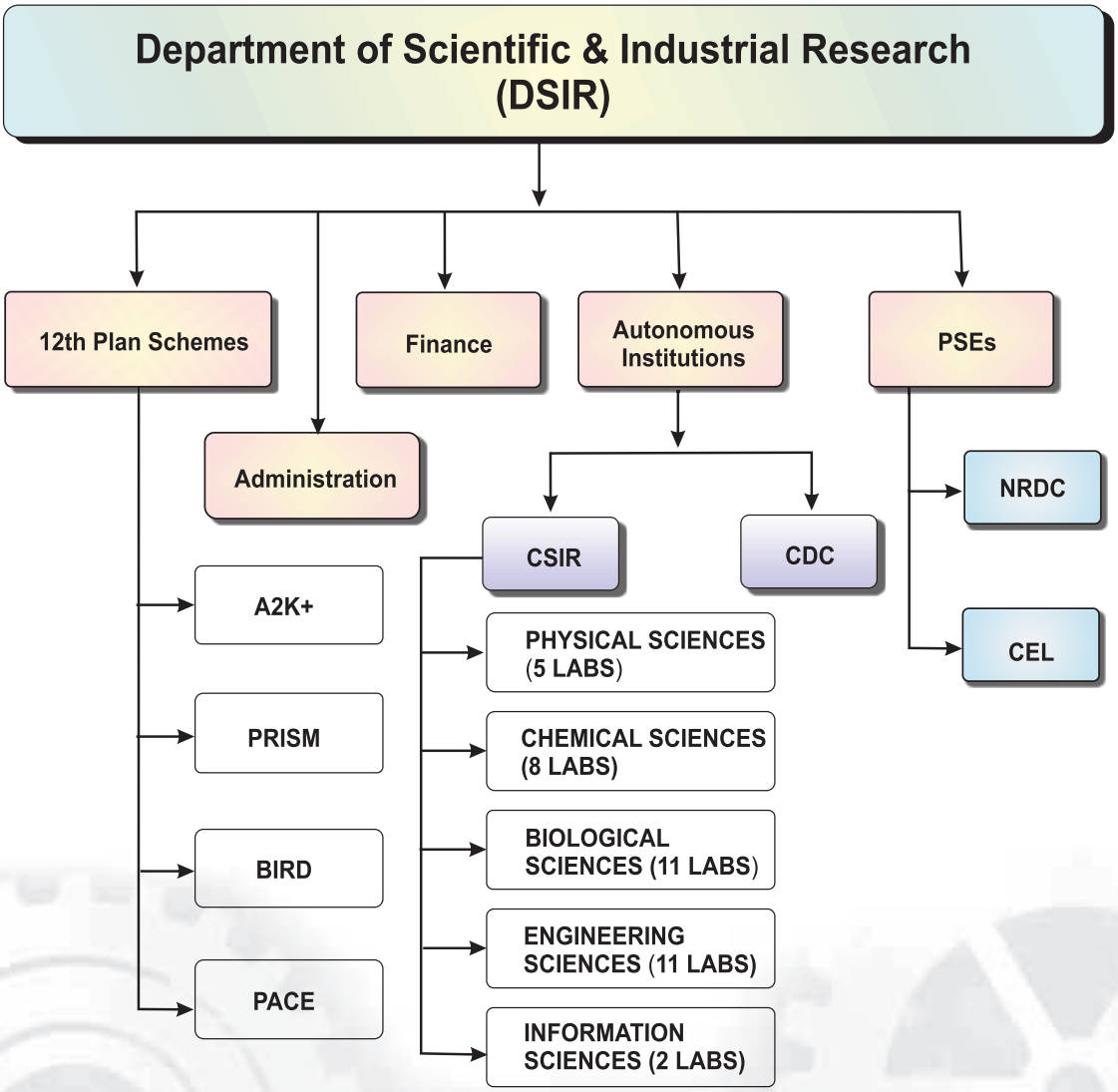
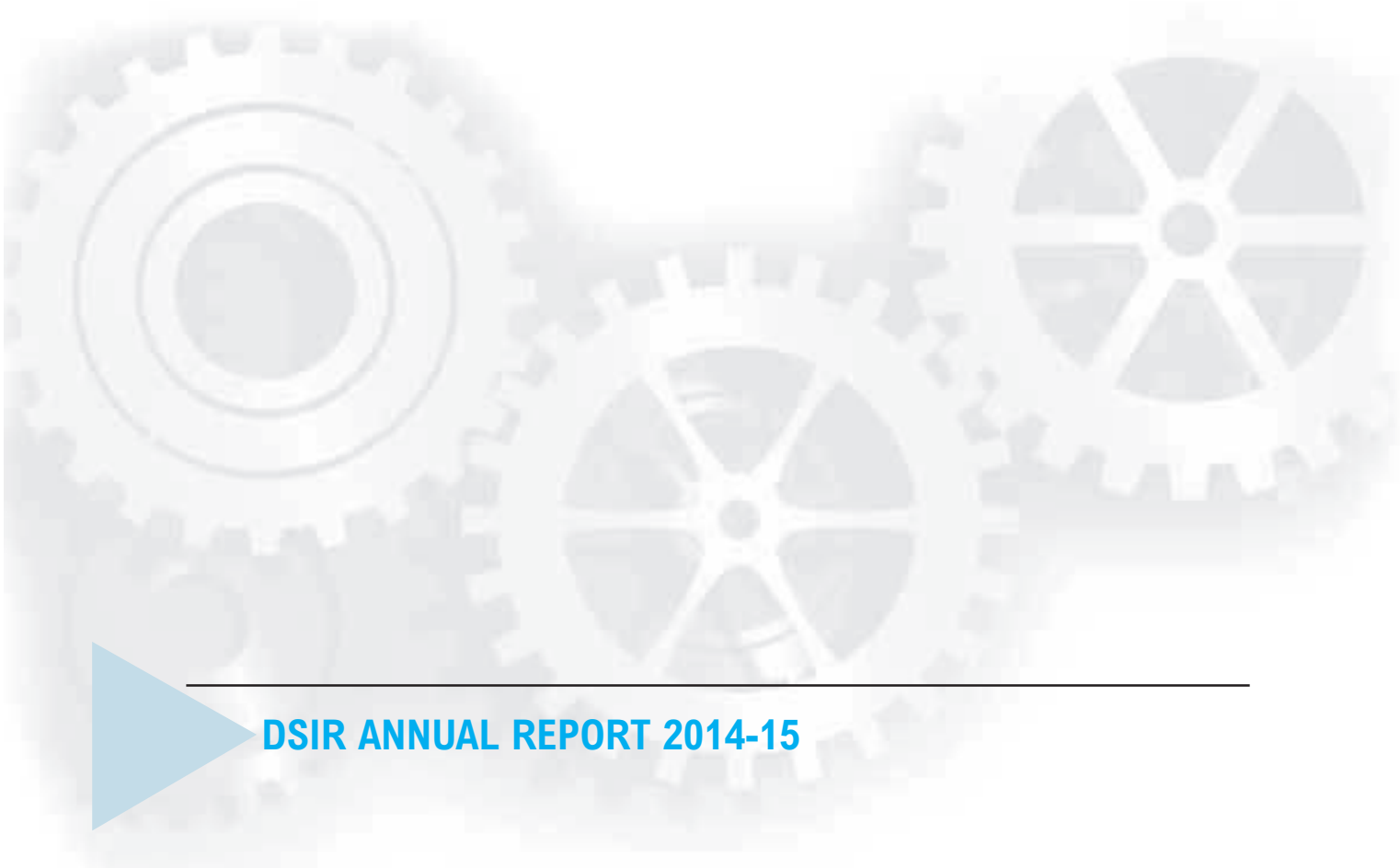
FUNCTIONAL STRUCTURE



A2K+	Access to Knowledge Development and Dissemination
PRISM	Promoting Innovation in Individuals, Start-ups and MSMEs
BIRD	Building Industrial Research and Development
PACE	Patent Acquisition and Collaborative Research and Technology Development
CSIR	Council of Scientific and Industrial Research
CDC	Consultancy Development Centre
PSEs	Public Sector Enterprises
NRDC	National Research Development Corporation
CEL	Central Electronic Limited

Highlights of Annual Report 2014-15



DSIR ANNUAL REPORT 2014-15

HIGHLIGHTS

- The department has also successfully completed 23 (twenty- three) on-going TePP projects supported during 11th five year plan. Some of the successfully completed projects are Belt system for body support, Bio-medical engine tool kits (BEAT), Mobile presence authentication system, A novel method for biometric recognition, Prototype development for low cost air borne surveillance system, Rapid detection and differentiation of torch infections by one-step PCR assay, Non-invasive Oral Cancer Detection System, Development of MAMMO ONCOMETER (A digital device to detect breast cancer based on cell membrane potentials) and so on.
- Around 68 technologies developed under the scheme TDDP have been commercialized The department has received a cumulative royalty of Rs.24.52 Crore on the projects supported during 1997-2013. In this financial year, 39 projects were monitored and 7 projects were completed.
- CRTHD programme which received SFC (Standing finance committee) approval in the previous financial year (2013-14), prepared the guidelines and advertised it on DSIR website. 16 proposal were received in the areas of Affordable Health, Electronics/Renewable Energy and Environmental Interventions.
- DSIR is the nodal department for granting recognition to in-house research and development centres of industry. Till December 2014, In-house R&D Centres recognized by DSIR remained nearly steady at 1762 as compared to December 2013. 80 companies incurred an annual expenditure of over Rs. 50 crores each, 399 companies incurred an annual expenditure in the range of Rs. 5 crore to Rs. 50 crores and 290 industries incurred an annual expenditure in the range of Rs. 2 crore to Rs. 5 crores.
- 28 new Scientific & Industrial Research Organisations (SIROs) were recognized by DSIR during 2014.
- A DSIR registered public funded research institutions (PFRI), universities, IITs, IISc and NITs, can avail customs duty and central excise duty exemptions under notifications 51/96-Customs and 10/97-Central Excise. During the period under report, 5 such institutions were newly registered with DSIR; and 33 institutions were granted renewal of registration.
- 80 new R&D centres were approved during the year 2014 as compared to 149 in the year 2013 for claiming weighted tax deduction u/s 35(2AB) of IT Act. The detailed R&D expenditure of the approved companies have also been examined by DSIR and 118 reports valued at Rs. 9359 crores have been forwarded to DGIT (E) in Form 3CL, as required under the IT Act.

- With the objective of Minimum Government and Maximum Governance the new portal has reduced the time and increases the transparency of operation within DSIR. The steps taken has been very successful, appreciated by many organizations and for this initiative the DSIR has received Skoch award for 'Minimum Government and Maximum Governance' in September 2014.
- CSIR, an autonomous organization is placed at 84th among 4851 institutions worldwide and is the only Indian organization among the top 100 global institutions (Scimago Institutions Ranking World Report 2014). Consisting of 38 national laboratories, 39 outreach centres, 3 Innovation Complexes and 5 units, CSIR holds the 17th rank in Asia and leads the country at the first position.
- CSIR has published 5086 research papers during 2013 with an average impact factor per paper as 2.86 in SCI journals of national and international repute contributing to 8.72% of Indian R&D literature. Its has also filed 342 patents abroad and 266 patents in India during 2013-14 and is maintaining a portfolio of 2767 patents abroad and 1746 patents in India as on 31.03.2013.
- CSIR scientists are well recognized and are awarded prestigious fellowships and conferred awards regularly. In the year 2014 Dr. R.A. Mashelkar, Former Secretary-DSIR and DG-CSIR received Padma Vibhushan, while another Former Secretary-DSIR and DG-CSIR, Dr. T. Ramasami received Padma Bhushan from the Hon'ble President of India. CSIR scientists Dr. S. Venkata Mohan (CSIR-IICT), Dr. Anurag Agrawal (CSIR-IGIB) and Dr. Souvik Maiti (CSIR-IGIB) received Shanti Swarup Bhatnagar Prize 2014, while Dr. Srivari Chandrashekar of CSIR-IICT received Infosys Foundation Award 2014.
- First indigenously built multi-disciplinary Research Vessel 'Sindhu Sadhana' was dedicated to Nation by Dr. Jitendra Singh, then Minister of State for Ministry of Science and Technology and Ministry of Earth Sciences (Independent charge) on 12th July, 2014. This research vessel boast 10 laboratories fitted with state-of-the-art equipment facilitating high precision data and sample acquisition.
- CSIR-NAL has made notable contributions to BrahMos Programme especially to the strategic sector. A drop test of stores from a SU-30MKI aircraft model in NAL's 1.5m low speed (M<0.3) wind tunnel using Froude scaling principles was carried out to study provided the ideal conditions for the stores release at actual flight Mach numbers. For this breakthrough technology development and associated outstanding contributions, CSIR-NAL has been conferred with "Best Laboratory Award 2014" by BrahMos. Dr. APJ Abdul Kalam, former President of India, presented the 'Best Laboratory Award 2014' to CSIR-NAL during the celebration of BrahMos Day in New Delhi on 12th June 2014.
- CSIR-NAL has played a crucial role in the acoustic qualification of subsystems for the indigenous cryogenic stage used in GSLV–D5 for the Department of Space and for ISRO's recent successful Mars Orbiter Mission (MOM) satellite.
- The Clot Specific Streptokinase (CSSK), a novel patented thrombolytic biopharmaceutical therapeutic protein drug licensed from CSIR-IMTECH, has received permission from the Drugs Controller General of India (DGCI) in February 2013 to conduct Phase-2 human clinical trial to test the efficacy of CSSK in the patients of heart attack, a condition known as Acute Myocardial Infarction.
- As a new leaf in the CSIR efforts to empower the Indian farmers, Krishi Shakti – a small range (11.2 hp) diesel engine tractor designed and developed by CSIR-CMERI was launched on

20th November, 2014 by Hon'ble Union Minister, Science and Technology and Earth Sciences and VP, CSIR, Dr. Harsh Vardhan.

- Central Electronics Limited (CEL) is a Public Sector Enterprise under DSIR, executed the prestigious export order of USD 302,000 for supply of Phase Control Modules (PCMs) to Poland. The Company has also enhanced manufacturing capacity of PCMs for AKASH Missiles.
- The Company has successfully commissioned a 5 MWp Module Manufacturing Plant at Maputo, Republic of Mozambique.
- The Company has exported various Solar Photo Voltaic Systems worth Rs. 2.87 Crores, setup two 500 KWp roof top Power Plant in Greater Noida and has taken up work for installation of a 1 MWp Power Plant using latest technology high efficiency cells during the year under review.
- The National Research Development Corporation (NRDC) another premier organisation, under DSIR generated a gross income of Rs. 766.20 lakhs.
- The Corporation signed Memorandums of Understanding/Agreements with 14 new organizations for assignment of technologies developed by them. During the year under review 68 new processes were assigned to the Corporation and 19 license agreements were signed.
- NRDC has established an Intellectual Property Facilitation Centre for MSME at Bengaluru with support of MoMSME to focus on protection and management of IP for the MSME. The Corporation during the financial year 2013-14 has also set up two NRDC – Innovation Facilitation Centres, One at All India Institute of Medical Sciences (AIIMS), New Delhi and another at Amity University Uttar Pradesh (AUUP), , Noida, premises.
- Result Framework document (RFD) for DSIR for 2013-14 are placed in departmental website. Composite score for the year 2013-14 was 71.64

I An Overview

1. *Introduction*
2. *DSIR Programmes*
3. *RTI Act 2005*
4. *Autonomous Institutions*
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6. *Result Framework Document*
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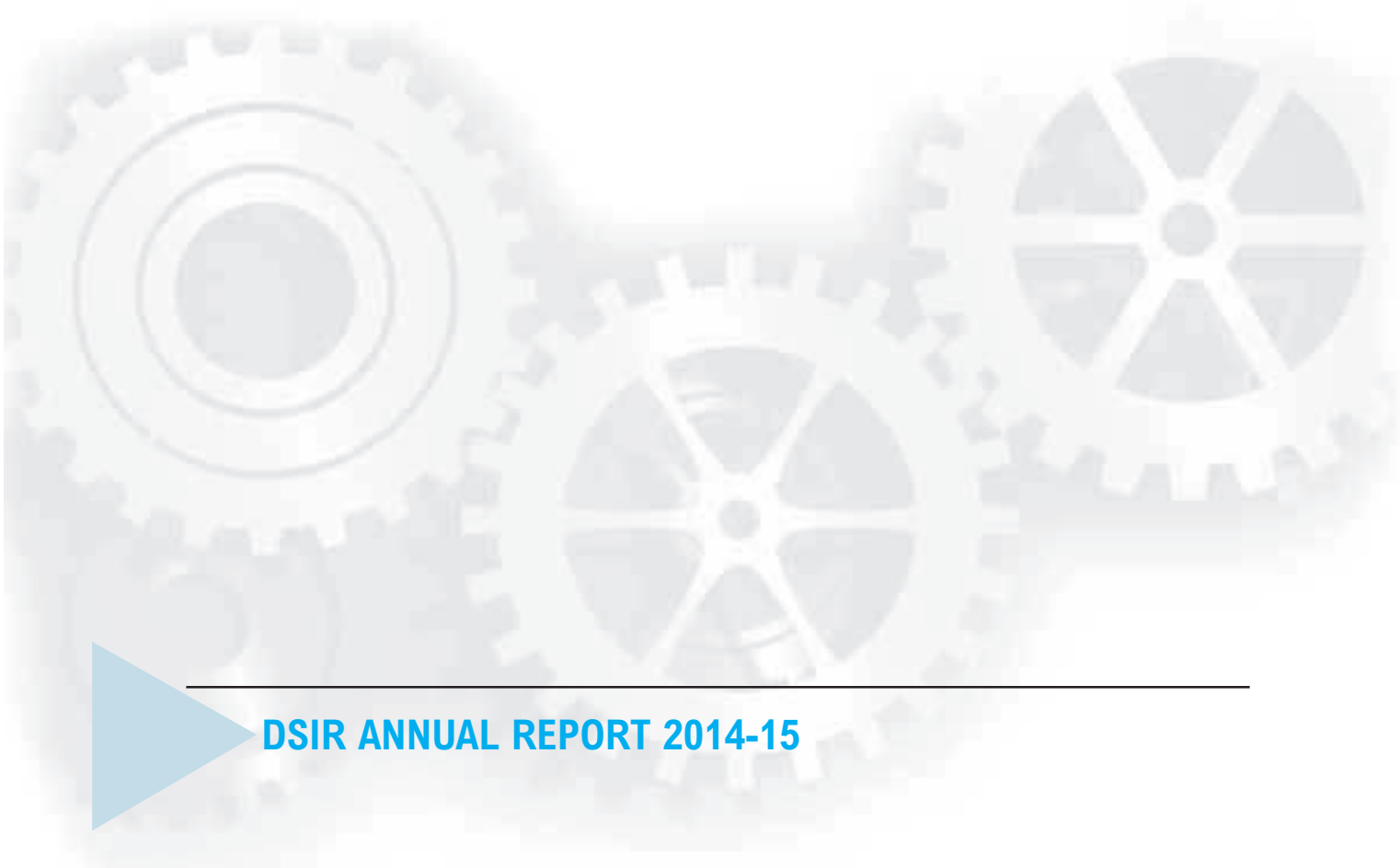


DSIR ANNUAL REPORT 2014-15

AN OVERVIEW

1. INTRODUCTION

The Department of Scientific and Industrial Research (DSIR), one of the departments of the Ministry of Science and Technology, was set up through a Presidential Notification, dated 4th January, 1985 (74/2/1/8 Cab.). The mandate of DSIR includes promotion of industrial research for indigenous technology promotion, development, utilization and transfer. Dr. Harsh Vardhan assumed as Union Minister for Ministry of Science & Technology on 10th November, 2014. Prior to that Dr. Jitendra Singh was holding the charge as Minister of State for Ministry of Science & Technology and Earth Sciences.

The Allocation of Business for the Department is as follows:

- All matters concerning the Council of Scientific and Industrial Research (CSIR).
- All matters relating to National Research Development Corporation (NRDC).
- All matters relating to Central Electronics Limited (CEL).
- Registration and Recognition of R&D Units.
- Technical matters relating to UNCTAD and WIPO.
- National register for foreign collaborations.
- Matters relating to creation of a pool for temporary placement of Indian Scientists and Technologists.

The primary endeavour of DSIR is to promote R&D by the industries; support industrial units to develop state-of-the-art globally competitive technologies of high commercial potential; catalyze faster commercialization of laboratory-scale R&D; augment technology transfer capabilities; enhance the share of technology intensive exports in overall exports; strengthen industrial consultancy and establish a user-friendly information network to facilitate scientific and industrial research in the country. The DSIR has two public sector undertakings viz. National Research Development Corporation (NRDC) and Central Electronics Ltd (CEL) and two autonomous organizations viz. Council for Scientific and Industrial Research (CSIR) and Consultancy Development Centre (CDC). The Department also provides host facilities and assistance to Asian and Pacific Centre for Transfer of Technology (APCTT) as the focal point in the country.

2. DSIR PROGRAMMES

The Technology Promotion, Development and Utilization (TPDU) Scheme in 11th Five Year Plan was aimed at promoting technology development and industrial research in the country and encouraging its utilization by various sections of economy including industry, academic/research/scientific institutions and the society at large. The components of the TPDU programme were:

- Industrial R&D Promotion Programme (IRDPP)
- Technology Development and Demonstration Programme (TDDP)
- Technopreneur Promotion Programme (TePP)
- Technology Development Utilization Programme for Women (TDUPW)

During the 12th five year plan, the DSIR has initiated four schemes focusing on innovations, after the recommendation of the Steering Committee on Science and Technology, in-principle approval of the planning commission and approval of the Standing Finance Committee have been obtained. The four schemes are :

(i) Promoting Innovations in Individuals, Start-ups and MSMEs (PRISM) – This scheme focuses on supporting individual innovators, start-up companies, incubatee companies in public funded technology business incubators and MSMEs besides supporting the approved 11th Plan projects related to Technopreneur Promotion Programme (TePP) spilling over from the 11th five year plan.

(ii) Patent Acquisition and Collaborative Research & Technology Development (PACE) – This is a new scheme focusing on technology acquisition and its development and demonstration for commercialization.

(iii) Building Industrial Research & Development (BIRD) – This is a new scheme which focuses on creation of common research facilities for micro and small enterprises and subsumes components of the 11th Plan scheme, viz., Industrial R&D Promotion Programme, Information Technology and e - Governance (ITeG) and Asian and Pacific Centre for Transfer of Technology (APCTT).

(iv) Access to Knowledge for Technology Development and Dissemination (A2K+) – This is a new scheme focusing on facilitating access to scientific journals by in-house R&D units of industry and Scientific and Industrial research Organizations (SIROs). The scheme subsumes the 11th Plan component scheme on Technology Development and Utilization Programme for Women (TDUPW) and DSIR Building and Infrastructure. Besides, the scheme supports the approved 11th Plan projects related to Technology Development and Demonstration Programme (TDDP) spilling over from the 11th five year plan.

Present report includes only the committed liabilities of 11th Plan Technology Promotion, Development and Utilization (TPDU) Scheme.

2.1 Major Achievements

The major achievements of the various programmes of the Department during the period under report are as under:

2.1.1 Access to Knowledge for Technology Development and Dissemination (A2K+)

Access to Knowledge for Technology Development and Dissemination (A2K+) is a scheme targeted towards developing mechanisms to disseminate science, technology and innovation related information to industries, research and academic institutions, in-house R&D units of industry, Scientific & Industrial Research Organizations (SIROs), consultants, industry associations, techno-entrepreneurs, government departments and others.

Programmes supported are the following:

1. Supporting industrial technology related studies (A2K+ Studies)
2. Supporting the organization of national and international conferences, exhibitions etc. (A2K+ Events)
3. Support for Technology Development and Utlization Programme for Women (TDUPW), including projects spilling over from the 11th five year plan.
4. Continuing support to Technology Development and Demonstration Programme

projects, spilling over from the 11th five year plan (TDDP)

The main objective of the programme is to undertake industrial technology related studies on frontier areas of technology that impact the country. During the year, study areas of importance in different fields of technology were identified in collaboration with different government ministries and departments. The scheme was finalized and the details were advertised on the DSIR website. Proposals were invited from diverse subject areas and 50 proposals were received from various technical and industrial organisations across the country which are currently under process.

The Department has been organizing workshops, stakeholder meetings, interaction meets, training programmes and other events on industrial research and innovation issues in different regions of the country in collaboration with various agencies for sharing of perspectives, training and advocacy. During the year, 30 proposals were received from different regions of the country, which are currently under process.

Independent evaluation of past performance of Technology Development and Utilization Programme for Women (TDUPW) was carried out during the year. Six projects were completed during the year out of nineteen projects supported during the 11th Plan. Six projects are under progress.

Under Technology Development and Demonstration Programme (TDDP) in operation since 1992 the department has supported 254 R&D projects of Industrial units with a total project cost of Rs. 750.60 crores out of which DSIR support is Rs. 280.40 crores. These projects cover products and processes in various important industries such as metallurgy, electrical, electronics, instrumentation, mechanical engineering, earth moving and industrial machinery, chemicals and explosives, etc. Under the program 32% engineering; 27% electronics; 21% Chemical; 7% energy and waste utilization and 13% Health & Pharmas project have been supported. The TDDP supported projects covers 22 states with maximum number of projects supported to Andhra Pradesh 18% followed by Karnataka 15%, Maharashtra 13%, Delhi 10%, Tamil Nadu 10%.

Around 68 technologies developed under the scheme have been commercialized. The department has received about Rs.24.52 Crore royalty during 1997-2013. In this financial year 7 projects were completed out of the 39 ongoing projects.

2.1.2 Promoting Innovations in Individuals, Start-ups and MSMEs (PRISM)

PRISM (Promoting Innovations in Individuals, Start-ups and MSMEs) scheme aims at to support individual innovators which will enable to achieve the agenda of inclusive development – one of the thrust area of 12th five year plan (2012-2017). It would also provide support to autonomous institutions or organizations or to society registered under the Societies Registration Act, 1860 or Indian Trusts Act, 1882 or other statues leading to development of state-of-art new technology solutions aimed at helping MSME cluster units.

The proposals shall preferably be considered in the following focus sectors: Green technology, Clean energy, Industrially utilizable smart materials, Waste to Wealth, Affordable Healthcare, Water & Sewage Management and any other technology or knowledge intensive area.

The financial assistance under the programme may vary from Rs. 2.00 lakh to Rs. 50.00 lakh. The department has also successfully completed 23 (twenty- three) on-going TePP projects supported during 11th five year plan. Some of the successfully completed projects are Belt system for body support, Bio-medical engine tool kits (BEAT), Mobile presence authentication system, A novel method for biometric recognition, Prototype development for low cost air borne surveillance system, Rapid detection and differentiation of torch infections by one-step PCR assay, Non-invasive Oral Cancer Detection System, Development of MAMMO ONCOMETER (A digital device to detect breast

cancer based on cell membrane potentials) and so on.

The financial assistance was extended to around seventeen (17) individual innovators for their innovation centric project proposals. Some of these are:

i. Development of bio-degradable Sanitary Napkin for Women

ii. Transient 3D framework for seeding and expansion of cells towards delivery *in vivo* and therapeutics

iii. Power operated Garlic & Onion Bulb Cutter

iv. Plasma expressor semi-automatic Top & Bottom in the field of affordable healthcare

v. Improved Hydro Screw Turbine Generator

vi. Mechanical Hoe

vii. Pesticide mixer cum sprayer agricultural pump

viii. Low cost diagnostic & correlating device for design pf patient-specific shoe-bed (insole) especially for diabetes management

ix. Motorized car jack

x. Development of low cost sequence Embroidery Machine for productivity enhancement in Zari and Zardozi work

xi. Wireless informer

xii. A novel jacquard punched card reader for digitizing the woven designs

xiii. Development of autonomous driving system for Ground Vehicles

xiv. Development and commercial extraction of bio-product from biomass

xv. Oil and stain cleaner from Carambola (Star Fruit)

xvi. Cost effective portable chalk board eraser cleaner

xvii. Design, development & testing of novel hollow clay brick manufacturing machine & accessories

2.1.3 Common Research and Technology Development Hubs (CRTDHs)

Keeping in view the need for promoting new product development activities by industry, enhancing translational research and fostering industry-institute interaction leading to growth of innovative capabilities in the country, a programme aimed at creation of Common Research and Technology Development Hubs (CRTDHs) was conceived.

The CRTDHs would enable industries to have access to state-of-the-art equipment, research facilities and expertise available in R&D institutions to facilitate their undertaking new/improved product/process development and skill enhancement activities, and also help in converting research outputs into products. During the current year, the guidelines of the scheme were finalized and advertised on the DSIR website. 16 Proposals that were received in the areas of Affordable Health, Electronics/ Renewable Energy and Environmental Interventions were processed.

2.1.4 Industrial R&D Promotion Programme

DSIR is the nodal Department for granting recognition to in-house Research and Development centres of industry. As on 31st December, 2014, there were 1762 in-house R&D centres with DSIR recognition, of these 80 companies incurred an annual expenditure of over Rs. 50 crores each, 399 companies incurred an annual expenditure in the range of Rs. 5 crore to Rs. 50 crores and 290 industries incurred an annual expenditure in the range of Rs. 2 crore to Rs. 5 crores.

Under the e-governance initiative of DSIR, department has started online application submission facility for greater accessibility and transparency of the department programmes / schemes and for this initiative DSIR has been awarded the Skoch award for 'Minimum Government and Maximum

Governance' in September 2014.

During the period under report, 105 in-house R&D centres were accorded fresh recognition and recognition for 436 centres was renewed.

Scientific research foundations in the areas of medicine; agriculture; natural and applied sciences; and social sciences seek DSIR recognition and registration as Scientific and Industrial Research Organisations (SIROs) under the programme granting recognition to SIROs. The registered SIROs are eligible for availing customs duty exemption on imports and central excise duty exemption on indigenous purchase of essential scientific and technical instruments, apparatus, equipment (including computers), accessories, spare parts thereof and consumables, required for R&D activities. During the period under report, 28 SIROs have been accorded fresh recognition.

DSIR is the nodal Department for registration of public funded research institutions (PFRI), Universities, IITs, IISc and NITs, for availing customs duty exemption and central excise duty exemptions under notifications 51/96-Customs and 10/97-Central Excise. During the period under report, 5 such institutions were newly registered with DSIR and 33 institutions were granted renewal of registration.

Secretary, DSIR is designated as the Prescribed Authority under section 35(2AB) of Income-tax Act, 1961. Fresh approvals were accorded to 80 companies by the prescribed authority. Agreements of co-operation for R&D were also signed with these companies. The detailed R&D expenditure of the approved companies have also been examined by DSIR and 118 reports valued at Rs. 9359 crores have been forwarded to DGIT (E) in Form 3CL, as required under the IT Act.

2.1.5 Asian Pacific Centre for Transfer of Technology (APCTT)

The Department of Scientific and Industrial Research (DSIR), Ministry of Science and Technology (MOST), Government of India has been the national focal point of APCTT since its inception in 1977. Matters pertaining to the APCTT and UN-ESCAP are dealt with in cooperation with the Ministry of Commerce and Industry and the Ministry of External Affairs, Government of India. DSIR also plays an active role in APCTT's functioning, particularly relating to its programmes and policies. India being the host country, has been providing institutional support to APCTT.

Institutional support of US$ 200,000 in Indian Rupees was provided to APCTT for meeting local costs. In addition, funding for building repairs, renovation work, and municipal taxes was also provided. DSIR has also extended programme support towards the APCTT project entitled, "Promotion of National Innovation Systems (NIS) in Countries of the Asia-Pacific Region – Phase II".

The revised Statute of APCTT, adopted by the Commission at its Sixty-first session in May 2005, through its resolution 61/4, stipulates among other things, that the Centre shall have a Technical Committee consisting of experts from members and associate members of ESCAP and from inter-governmental and non-governmental organizations. Members of Technical Committee shall be appointed by the Head of APCTT in consultation with the Executive Secretary of ESCAP. The Technical Committee shall be responsible for advising on the formulation of the programme of work and on technical matters concerning the operations of APCTT. The 10th Technical Committee of APCTT held at Kunshan, China in November, 2014 was attended by departmental representative.

It is also stipulated that the Centre shall have a Governing Council consisting of a representative designated by the Government of India and no fewer than eight representatives nominated by other members and associate members of ESCAP elected by the Commission. The members and associate members elected by the Commission shall be elected

for a period of three years, but shall be eligible for re-election. The members of APCTT's Governing Council for the period 2014-2017 are Bangladesh, China, Fiji, India, Indonesia, Islamic Republic of Iran, Malaysia, Pakistan, Philippines, Republic of Korea, Samoa, Sri Lanka, Thailand and Viet Nam. The 10th Governing Council held at Colombo, Sri Lanka in November, 2014 was attended by the departmental representative.

2.1.6 Information Technology and e-Governance

IT-eG division implements e-Governance in the Department progressively that needs to be in conformance to the National eGovernance Action Plan. IT-eG Division operates on a separate IT Budget Head that came into effect in DSIR since FY 2004-05 for the implementation of an IT Action Plan.

The DSIR Website has been made compliant to the Guildelines for Indian Government of Websites (GIGW). The website has been regularly updated.

A project entitled 'Design, Development, Implementation of Enterprise Application and Maintenance Support Services for DSIR' is ongoing. The project has two RFPs, ie. RFP1 includes Enterprise Integration, Program Implementation and eService Delivery and RFP2 includes Office Automation Solution, Workflow Management, Record Management, and Data Warehousing. Most of the programmes / modules have been made functional under the ERP project and are being reviewed regularly. Hands-on-Training is being imparted to the DSIR employees for use various modules developed and gone live. Third party Security Audit of the said ERP project has been completed by the CERT-In empanalled consultant. DSIR got the Skoch Order-of-merit Award to DSIR for Newgen's eGov Suite during 37th Skoch Summit on September 19, 2014 at New Delhi.

An e-Book on DSIR Activities and Achievements (including CSIR, CDC, CEL and NRDC) is being prepared for hosting on the DSIR Website.

3. RTI ACT 2005

The Right to Information Act 2005, enacted on 15th June 2005, has been implemented successfully in the department. As per the provisions of the Act Nodal Officer, Appellate Authority, Transparency Officer, Central Public Information Officer and Central Assistant Public Information Officer are designated.

The proactive disclosures under Section 4 (1) (b) of the RTI Act 2005 enacted on June 15, 2005 are regularly updated and available on the DSIR Website at http://www.dsir.gov.in. DSIR has complied with the directives received from Central Information Commission.

DSIR has received 416 Applications during 2014 [01/01/2014 to 31/12/2014] and all the Applications were registered and disposed off on RTI Request & Appeal Management Information System, https://rtinonline.gov.in/RTIMIS. During 2014 [01/01/2014 to 31/12/2014], 14 applications were registered as first appeal and no application was registered as second appeal.

DSIR has been effectively using various IT applications like RTI Request & Appeal Management Information System at http://www.rtionline,gov.in/RTIMIS, RTI Annual Return Information System at http://rtiar.nic.in . The quarterly returns were uploaded on RTI Annual Return Information System at http://rtiar.nic.in .

The Division provided technical support by way of lectures on RTI Annual Return Informaton System, RTI Request & Appeal Management Information System and RTI-MIS Updated System during a Programme on Effective Implementation of RTI Act for Appellate Authorities and PIOs in CSIR System organized by Council of Scientific and Industrial Research at CSIR-Human Resource Development Centre, Ghaziabad on 30/05/2014.

DSIR participated in Residential Programme on Modern Office Management and RTI Act organized by National Productivity Council, New Delhi during 15-19/09/2014 at Port Blair.

4. AUTONOMOUS INSTITUTIONS

4.1 Council of Scientific and Industrial Research (CSIR)

4.1.1 Preamble

The Council of Scientific & Industrial Research, constituted in 1942 is an autonomous body which is known for its cutting edge R&D knowledgebase in diverse S&T areas, is a contemporary R, D & E organization. Having pan-India presence, CSIR has a dynamic network of 38 national laboratories, 39 outreach centres, 3 Innovation Complexes and 5 units. CSIR's R&D expertise and experience is embodied in about 4000 active scientists supported by about 7000 scientific and technical personnel.

CSIR covers a wide spectrum of science and technology – from radio and space physics, oceanography, earth sciences, geophysics, chemicals, drugs, genomics, biotechnology and nanotechnology to mining, aeronautics, instrumentation, environmental engineering and information technology. It provides significant technological intervention in many areas with regard to societal efforts which include environment, health, drinking water, food, housing, energy, leather, farm and non-farm sectors.

CSIR is the Nation's custodian for Measurement Standards of Mass, Distance, Time, Temperature, Current etc. CSIR has created and is the custodian of Traditional Knowledge Digital Library (TKDL) which is a powerful weapon against unethical commercial exploitation of Indian traditional knowledge. CSIR maintains Microbial Type Culture Collection (MTCC) and Gene Bank.

Pioneer of India's intellectual property movement, CSIR today is strengthening its patent portfolio to carve out global niches for the country in select technology domains.

CSIR has pursued cutting edge science and advanced knowledge frontiers. During 2013 CSIR published 5086 papers in SCI journals with average impact factor per paper as 2.86.

CSIR's role in S&T human resource development is noteworthy. It nurtures Research Scholars supporting them through fellowships namely Junior Research Fellowships (JRFs), Senior Research Fellowships (SRFs), Research Associates etc. It also provides Extra Mural Research Fundings to Publicly Funded institutions.

CSIR has operationalized desired mechanisms to boost entrepreneurship, which could lead to enhanced creation and commercialization of radical and disruptive innovations, underpinning the development of new economic sectors.

CSIR today is a globally benchmarked organization. According to the Scimago Institutions Ranking World Report 2014, CSIR is ranked at 84th among 4851 institutions worldwide and is the only Indian organization among the top 100 global institutions. CSIR holds the 17th rank in Asia and leads the country at the first position.

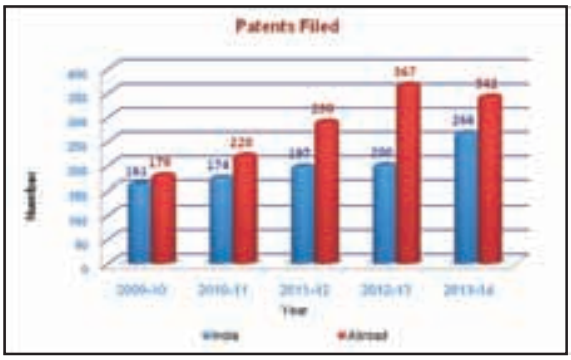
4.1.2 Scientific Excellence

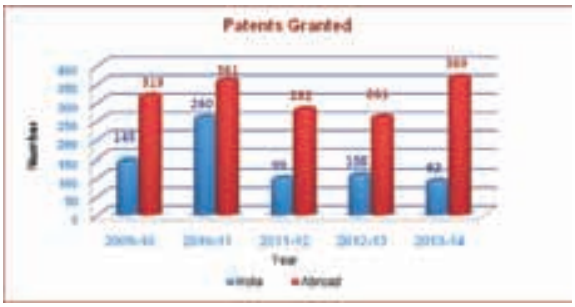
CSIR has published 5086 research papers during 2013 with an average impact factor per paper as 2.86 in SCI journals of national and international repute contributing to 8.72% of Indian R&D literature.

Several research papers were in high impact factor journals like Chemical Reviews' (IF 41.298) , 'Lancet' (IF 38.278), 'Nature' (IF 38.597), 'Science' (IF 31.20), 'Chemical Society Reviews' (IF 28.76) etc.

Value Generation through Intellectual Property

CSIR has filed 342 patents abroad and 266 patents in India during 2013-14. It is maintaining a portfolio of 2767 patents abroad and 1746 patents in India as





on 31.03.2013. The above graph provides data on patents filed and patents granted over the last five years.

Creating and Nurturing S&T Human Resource

CSIR has been systematically creating and nurturing highly qualified S&T manpower in the country. It is presently supporting more than 8000 Research fellows, 159 Senior Research Associates and more than 1000 research schemes to various universities.

CSIR Scientists in Frontier of Science

CSIR scientists are well recognized and are awarded prestigious fellowships and conferred awards regularly. A glimpse of these recognitions is given below:

Padma Vibhushan 2014: Dr. R.A. Mashelkar, Former Secretary, DSIR and Former DG, CSIR.

Padma Bhushan 2014: Dr. T. Ramasami, Former Secretary, DSIR and former DG, CSIR.

Shanti Swarup Bhatnagar Prize 2014: Dr. S. Venkata Mohan (CSIR-IICT), Dr. Anurag Agrawal (CSIR-IGIB) Dr. Souvik Maiti (CSIR-IGIB).

Infosys Foundation Award 2014: Dr. Srivari Chandrashekar (CSIR-IICT).

INSA Fellows (w.e.f. 1.1.2014): Dr. Uday Bandyopadhyay (CSIR-IICB), Dr. Syamal Roy (CSIR-IICB), Dr. Rajesh. S. Gokhale (CSIR-IGIB), Dr. M. Lakshmi Kantam (CSIR-IICT), Dr. C.S. Nautiyal (CSIR-NBRI), Dr.Anuradha Dube (CSIR-CDRI).

4.1.3 Some noteworthy accomplishment

Infosys Prize 2014

Infosys Prize 2014 is awarded to Dr. Srivari Chandrashekar, Chief Scientist, CSIR- Indian Institute of Chemical Technology, Hyderabad in the area of Physical Sciences. Since its inception in 2009, this is the 5th prize to CSIR Scientists. It is testimony of the fact that internationally competitive highest scientific research is being carried out in CSIR and it has an outstanding young scientific leadership in position. The Infosys Prize has been instituted to enhance the prestige of scientific research in India and inspire young Indians to choose a vocation in scientific research. The prize is given annually to honour outstanding achievements of researchers and scientists across six categories namely, Engineering and Computer Sciences, Humanities, Life Sciences, Mathematical Sciences, Physical Sciences and Social Sciences.

First indigenously built Research Vessel 'Sindhu Sadhana' dedicated to Nation

Dr. Jitendra Singh, the then Vice President, Council of Scientific and Industrial Research and Honorable Minister of State for Ministry of Science and Technology and Ministry of Earth Sciences (Independent charge), PMO, Personnel Grievances and Pensions, Department of Atomic Energy, Department of Space dedicated first indigenously built multi-disciplinary research vessel to the Nation on 12th July, 2014.

The ship is 80 meters long and 17.6 m wide and can accommodate 57 personnel including 29 Scientists and 28 crew members. She is designed for a cruising speed of 13.5 knots and an endurance of 45 days. The research vessel has 10 laboratories which are fitted with state-of-the-art equipment facilitating high precision data and sample acquisition. The ship is equipped with a number of laboratories for on-line data collection and data processing from single beam and multi beam echo sounders, water column and sub-bottom profiler, gravimeter, magnetometer, acoustic doppler current profiler, conductivity-temperature-depth profiler, autonomous weather station, air quality monitors as well as sampling gears such as A-frame, Gamma frame, and deep sea winches with supporting cranes. The vessel is also equipped with dynamic positioning system that allows holding the vessel at a point for sampling including 24 meter long sediment cores. It also facilitates precise deployment of instrumented moorings, towing of Remotely Operated Vehicles (ROVs) and Autonomous Underwater Vehicles (AUVs).

Contributions BrahMos Programme

CSIR-NAL has made notable contributions especially to the strategic sector which has brought both honour and pride. A drop test of stores from a SU-30MKI aircraft model in NAL's 1.5m low speed (M<0.3) wind tunnel using Froude scaling principles has been carried out. The study provided the ideal conditions for the stores release at actual flight Mach numbers. including the deflection setting angles for the fore and aft fins. The software developed allowed tracking of the time-resolved displacement, velocity, acceleration and Euler angles. The Further, wind tunnel tests were also carried out on a scaled isolated store model in the 0.6m trisonic wind tunnel to obtain the aerodynamic loads. The same store model was attached to a scaled SU-30MKI aircraft model and aerodynamic loads on the complete configuration were determined in the 1.2 m wind tunnel. Tests were carried out in the Mach number range 0.55 to 1.2 at various angles of attack and sideslip to ascertain installation effects, store load in carriage position and in aircraft interference flow-field. For this breakthrough technology development and associated outstanding contributions, CSIR-NAL has been conferred with "Best Laboratory Award 2014" by BrahMos. Dr. APJ Abdul Kalam, former President of India, presented the 'Best Laboratory Award 2014' to CSIR-NAL during the celebration of BrahMos Day in New Delhi on 12th June 2014.

Contributions to Space Programmes

CSIR-NAL has played a crucial role in the acoustic qualification of subsystems for the indigenous cryogenic stage used in GSLV–D5 for the Department of Space. These tests helped in the first successful flight (January 5, 2014) of the GSLV Mark II using the indigenously developed cryogenic engine, the CE-7.5 by ISRO. The LH2 Vent and Relief line along with the vent valve and the Protection plate in the Inter-Tank Truss region were crucial subsystems of the indigenous cryo stage which underwent acoustic qualification at CSIR-NAL. Further, complete aerodynamic re-characterization of the LVM 3 vehicle with fully simulated wind tunnel model has been carried out at NTAF of CSIR-NAL. The major challenge was to design, manufacture and test models for force measurements, steady and unsteady pressure measurements in a very short time frame. Further, the acoustic qualification of ISRO's recent successful Mars Orbiter Mission (MOM) satellite has been carried out at the new ATF facility at ISITE (ISRO Bengaluru) designed, built and commissioned by CSIR-NAL. NAL's ATF scientists were closely associated with these acoustic qualification tests. CSIR is very proud to be associated with the successes of ISRO's GSLV-D5 and Mars Orbiter Mission programmes.

Contributions to Strategic area

CSIR-CEERI has developed five different versions of Low temperature co-fired ceramics (LTCC) micro-hotplates. These micro-hotplates have

achieved a temperature of 300°C with power consumption less than 1 watt and size 3.5x3.5 mm^2. These micro-hotplates have high temperature stability, mechanibilty strong interconnects and are reliable and ruggedized for harsh adverse environment. These are being used by Solid State Physics Laboratory (DRDO), Delhi, CSIR-CGCRI, and CSIR-CSIO for various sensor applications. Armament Research Board of Ministry of Defence, Government of India has issued an appreciation letter to CSIR-CEERI recently recognizing the contributions.

CSIR-Developed Clot Specific Streptokinase Enters into Phase-2 Human Clinical Trials

The Clot Specific Streptokinase (CSSK), a novel patented thrombolytic biopharmaceutical therapeutic protein drug licensed from CSIR-IMTECH, has received permission from the Drugs Controller General of India (DGCI) in February 2013 to conduct Phase-2 human clinical trial to test the efficacy of CSSK in the patients of heart attack, a condition known as Acute Myocardial Infarction. M/s Symmetrix Biotech Pvt. Ltd. has been carrying out the clinical development of CSSK, also known as SMRX-11.

Naturally occurring plant based anti-cancer compound-Activity-Target database

Plant derived molecules have been highly valued by biomedical researchers and pharmaceutical companies for developing drugs, as they are thought to be optimized during evolution. CSIR-IMTECH has collected and compiled a central resource Naturally Occurring Plant-based Anti-cancer Compound-Activity-Target database (NPACT, http://crdd.osdd.net/raghava/npact/) that gathers the information related to experimentally validated plant-derived natural compounds exhibiting anti-cancerous activity (in vitro and in vivo), to complement the other databases. It currently contains 1574 compound entries, and each record provides information on their structure, manually curated published data on in vitro and in vivo experiments along with reference for users referral, inhibitory values (IC(50)/ED(50)/EC(50)/GI(50)), properties (physical, elemental and topological), cancer types, cell lines, protein targets, commercial suppliers and drug likeness of compounds. NPACT can easily be browsed or queried using various options, and an online similarity tool has also been made available. Further, to facilitate retrieval of existing data, each record is hyperlinked to similar databases like Super Natural, Herbal Ingredients' Targets, Comparative Toxicogenomics Database, PubChem and NCI-60 GI(50) data.

Novel Uricase Enzyme

CSIR-IMTECH has discovered two novel mutant uricases having better enzymatic efficiency (2 to 3 times higher) compared to that of the wild type uricase enzyme. The main advantages of the present invention are higher activity and optimum pH close to the biological pH 7 which helps the enzyme to retain almost entire activity (close to 100%) when administered as drug. This enzyme can be used in clinical diagnosis kits to measure the serum uric acid levels and for their use as a potential drug. An Indian patent has been filed for these enzyme mutants.

New Chapter in Groundwater Hydrology from Heliborne Geophysical Investigations

CSIR-NGRI has carried out 13,800 line km of helicopter borne Time domain Electromagnetic (HeliTEM) and Magnetic (HeliMAG) surveys- the globally acclaimed state-of-the-art geophysical technique on an experimental basis in six hydrogeologically representative pilot areas in the states of Rajasthan, Bihar, Maharashtra, Kamataka and Tamil Nadu to delineate the principal aquifers at 1:50,000 scale. These studies helped to identify the principal aquifers in diverse hydro geological provinces of India, viz., in Gangetic alluvium, Tertiary-sediments underlying the Thar Desert, Deccan basalts and the Gondwana sediments, weathered and fractured granite gneisses and schists and the Coastal alluvium and Tertiary sediments.

The study also helped in identifying the subsurface structures controlling the groundwater conditions, the regional continuity of principal aquifers, the variations in lithological character of aquifers and the quality of water in terms of salinity.

Contributions to the Uttarakhand Flood Relief

CSIR-IIP, being closest to the Uttarakhand hills, was made the Nodal Laboratory to coordinate with the state-level Disaster Management team on behalf of CSIR Headquarters and its laboratories.

Following is a description of the help & support provided:

CSIR-CFTRI, Mysore provided *mathi* (60 cartons), *roti* (15 Cartons), tomato sauce (1 carton), *murmure* (300 bags), energy powder (200 bags), high-protein rusks (63 cartons), *Bissi Bele Bhaath* (South Indian *Khichadi* – 189 cartons), *imli poha* (56 cartons), ORS (153 cartons) and bread (4 cartons). CSIR-NCL, Pune, came forward with Water Filtration Unit (20 boxes) and hand pumps (20 boxes); CSIR-IMMT, Bhubaneshwar provided water filters (500 units); CSIR-CLRI, Chennai had footwear (2000 pairs) to offer and CSIR-NEERI, Nagpur donated NEERI-ZAR, a Water Filter Unit (100 units), while CSMCRI, Bhavnagar came forward with two big RO units at Rishikesh and Srinagar (Garhwal) to ensure supply of pure water, with a capacity of i.e upto 30000 lt/day

CSIR-IIP had offered: raincoats (1000 nos), tarpaulins (100 nos.), stainless steel utensil sets (200 nos), plastic tags (200 nos), candles (44 pkts of 968 pieces each) and match-boxes (63 pkts of 900 pieces each).

Krishi Shakti – a small range (11.2 hp) diesel engine tractor launched

As a new leaf in the CSIR efforts to empower the Indian farmers, Krishi Shakti – a small range (11.2 hp) diesel engine tractor designed and developed by CSIR-CMERI was launched on 20th November, 2014 by Hon'ble Minister, Science and Technology and Earth Sciences and VP, CSIR, Dr. Harsh Vardhan. He handed over five tractors to the farmers. The Krishi Shakti would benefit Indian farmers possessing small land holdings. Dr. Harsh Vardhan, while launching the Krishi Shakti said that "the development has bridged a long felt technology gap. There is an urgent need to develop state-of-the-art technology of agriculture implements. The implements need to be suiting Indian agro climates and should be energy efficient. These agriculture implements should remove farmer's drudgery". Dr. Harsh Vardhan appreciated CSIR efforts contributing for 'Make in India' mission of Hon'ble Prime Minister. The Krishi Shakti has received CMVR Certification as an Agricultural Wheeled Tractor after rigorous trials and testing. The Technology of Krishi Shakti was transferred to M/s Singha Components Pvt. Ltd., Howrah, West Bengal, who have started manufacturing. In India, about 85 percent households cultivate about 36 per cent of entire cultivable land. The average land holding of the small Indian farmer normally does not exceed even 1 hectare. It is therefore quite difficult for the average Indian farmer to afford mechanized farming utilizing standard tractors of 35 hp and above ratings, which in 2 turn tells upon the productivity and per unit yield. As a result, there has been tremendous demand for developing small, compact and easily maneuverable tractors of rating in the range of 10-12 hp, which are deemed fittest for small and fragmented land holdings. CSIR's Krishi Shakti, a small tractor, is an apt CSIR response to this necessity enabling farm mechanization in an affordable manner. Furthermore, this small tractor and its matching implements are based on available diesel engine and available tractor parts in the market. Krishi Shakti is the latest in the legacy of CSIR interventions in enabling mechanized agriculture.

4.2 Consultancy Development Centre (CDC)

During the period, CDC has undertaken various schemes, programs & projects in a "Programmatic

Cluster Driven Approach" in which all the activities are strategically re-grouped in various clusters which comprises of consultancy promotion, services, national program for competency development, technology delivery, transfer & commercialization, international collaboration, research & analysis, developing national knowledge repository standards & contribution to national projects, financial consulting and training & development.

During the year plan support of Rs. 360.00 lacs was received from DSIR for carrying out specific projects & activities. Besides plan support activities, CDC undertook various funded projects from various Ministries/Departments of the Government of India.

5. PUBLIC SECTOR ENTERPRISES

5.1 National Research Development Corporation (NRDC)

The National Research Development Corporation (NRDC) is a premier organisation, under Department of Scientific & Industrial Research (DSIR), Ministry of Science & Technology, engaged in the development, promotion and commercialisation of the R&D results / technologies emanating from Research Institutes/ Universities / Industries, etc. The Corporation provides comprehensive technology transfer services and acts as a catalyst for transforming innovative research into marketable industrial products. NRDC is a unique organisation because it is the only public enterprise wholly dedicated to transfer of technologies developed at R&D laboratories to industry. During the past six decades of its existence, the Corporation has developed strong links and network with various R&D organisations in the country as well as abroad for transfer of technologies. Its operations cover the entire spectrum of industrial technologies ranging from chemicals to metallurgy, mechanical engineering, electrical engineering, electronics, biotechnology and so on.

During the period, the Corporation continued to face leadership crisis and hardship and as a result could not maintain all round progress in its activities. The dedicated, hard and sincere work of the employees of the Corporation could not fetch enough revenue earnings to overcome the financial obligation. The Corporation's gross income was Rs. 766.20 lakhs, as compared to Rs 709.86 lakhs in the previous year.

The Corporation ended up with deficit before tax of Rs. 170.42 lakhs as compared to a deficit of Rs. 247.60 lakhs in the previous year.

5.2 Central Electronics Limited (CEL)

Central Electronics Limited (CEL) is a Public Sector Enterprise under the Department of Scientific and Industrial Research (DSIR), Ministry of Science & Technology, Government of India. It was established in 1974 with an objective to commercially exploit the indigenous technologies developed by National Laboratories and R & D Institutions in the country. CEL is one of the companies that utilized home grown technologies during all these years of its existence. The Company is primarily engaged in production of strategic components for defence applications of national importance, equipment for railway safety and solar photovoltaic modules and systems.

The Company has developed a number of products for the first time in the country through its own R & D efforts and in close association with the premier National & International Laboratories including Defense Laboratories. In recognition of all these efforts, CEL not only have the distinction of being a DSIR recognized R & D Company, but also has been honored a number of times with prestigious awards including "National Award for R & D by DSIR".

CEL holds a unique position among the family of Public Sector Enterprises in the country, with its emphasis on indigenous technology inducted both from its in-house developments and from the National Laboratories, for its production programme in diverse high-technology areas of national importance. CEL has facilitates networking with

leading research laboratories and leading institutions in India (IIT, IICT, NCL, NPL etc.) and abroad (UNSW, Georgia Institute of Technology, EPFL etc.). The company is already approved from the year 1994 as an R & D centre from the DSIR.

CEL has already established partnerships and linkages with various stake-holders and business associates in the areas of railways, telecom, police, power generation and distribution companies, service providers in the energy sector, public funded institutions and even rural communities through the state governments. The existing marketing channels are being consolidated and expanded harnessing the unique advantage CEL has in terms of its product base and Government backing.

The renewed mandate of CEL includes development and harnessing technology for (i) Solar Energy Systems and Solutions (ii) Strategic Electronic Components and systems required for Defense, Space, Atomic Energy. (iii) Signaling and Safety in Public Transport Systems (iv) Infrastructure, Eco-systems management and energy conservation and (v) Security and Surveillance in strategic establishments.

CEL has been the pioneer in the country in the different areas of manufacturing & proprietary manufacturer of the many strategic electronic components for use by defense organizations in the country.

6. RESULT FRAMEWORK DOCUMENT

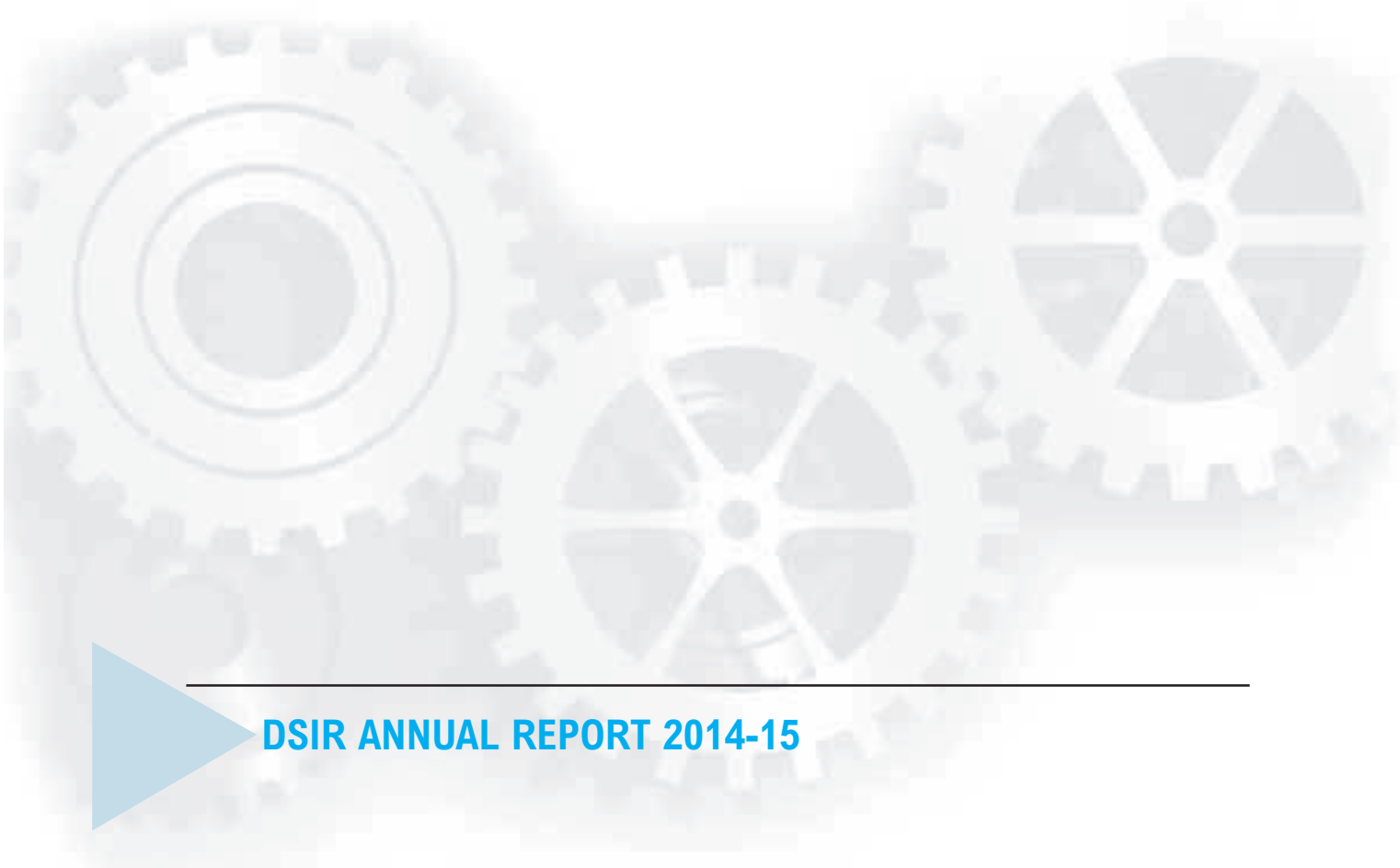
Government of India has approved the outline of a "Performance Monitoring and Evaluation System (PMES) for Government Departments" to measure the performance of the Government by preparing Results-Framework Documents (RFD) of all Ministries/Departments every year, which provides a summary of the most important results that a department/ Ministry expects to achieve during the financial year. Result Framework document (RFD) for Department of Scientific & Industrial research for 2013-14 are placed in Departmental website. Composite score for the year 2013-14 was 71.64

7. ISO 9001:2008

In reference to the mandatory indicator under RFD, lay down by the "Performance Management Division" of the Cabinet Secretariat; the department has started implementation process of ISO 9001:2008. Quality Manual & Procedure Manual has been approved and issued. Awareness training, Process specific training, Internal Auditors Training and Internal Audit has been completed. External Audit and other steps are under process for awarding of ISO 9001:2008.

II Access to Knowledge for Technology Development and Dissemination (A2K+)

1. *A2K+ - Studies*
2. *A2K+ Events*
3. *Technology Development and Utilization Programme for Women (TDUPW)*
4. *Technology Development and Demonstration Programme (TDDP)*



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Access to Knowledge for Technology Development and Dissemination (A2K+)

Access to Knowledge for Technology Development and Dissemination (A2K+) is a scheme targeted towards developing mechanisms to disseminate science, technology and innovation related information to industries, research and academic institutions, in-house R&D units of industry, Scientific & Industrial Research Organizations (SIROs), consultants, industry associations, techno-entrepreneurs, government departments and others.

Programmes supported are the following:

1. Supporting industrial technology related studies (A2K+ Studies)
2. Supporting the organization of national and international conferences, exhibitions etc. (A2K+ Events)
3. Support for Technology Development and Utlization Programme for Women, including projects spilling over from the 11th five year plan.
4. Continuing support to Technology Development and Demonstration Programme projects, spilling over from the 11th five year plan (TDDP)

1. A2K+ - Studies

The main objective of the programme is to undertake industrial technology related studies on frontier areas of technology that impact the country. These study-reports are aimed at providing a useful information and knowledge base to industry, industry associations, academia, research institutions, consultants, entrepreneurs, research students and policy makers for doing any further work in these areas.

Achievements:

During the year, study areas of importance in different fields of technology were identified in collaboration with different government ministries and departments. The scheme was finalized and the details were advertised on the DSIR website. Proposals were invited in the following subject areas:

1. Electronics Systems Design and Manufacture in select sectors
2. Framework of Industry-University linkages
3. Sports sciences
4. Development of Salt Industry
5. Safe storage of food grains
6. New technologies for disease management of livestock and livestock products
7. Development of Conditional Access Systems, Set-top Boxes and DRM digital radio receivers
8. Advanced Signalling and Train Control systems for safe and efficient operations
9. Cold Chain Development
10. Rice milling and Processing of millets and onions
11. Safety Systems for Vehicles

12. Development of aeronautical products
13. Technology Status of the Steel sector
14. Design and life assessment of materials for high temperature and high pressure conditions of power plants
15. Process improvements in power plants
16. Power transmission
17. Combined Heat Power based Systems
18. Construction of cost effective disaster resilient houses equipped with sustainable energy solutions
19. Smart, sustainable city with modular, flexible open systems approach
20. Capital goods sector
21. Watershed management
22. Water
23. Network technology and other emerging technologies
24. India as a hub for Cloud Technology

Around 50 proposals were received from various technical and industrial organisations across the country and are under process.

2. A2K+ Events

The Deprtment has been organizing workshops, stakeholder meetings, interaction meets, training programmes and other events on industrial research and innovation issues in different regions of the country in collaboration with various agencies for sharing of perspectives, training and advocacy.

The main objective is to provide a platform for exchange of views, useful insight and learning for the benefit of industry, academic, consultancy and research organizations, and others. Such events would be supported on a selective basis in consultation with various stakeholders, industry associations, other ministries and departments, and other relevant sources. These events would be aimed at increasing awareness, capacity building and stakeholder engagement on industrial research and innovation issues, resulting in strengthening of technology development and competitiveness.

Achievements:

During the year, around 30 proposals were received from different agencies to organize workshops, stakeholder meetings, interaction meets, training programmes and other events on industrial research and innovation issues in different regions of the country, and are under process.

3. Technology Development and Utilization Programme for Women (TDUPW)

The program is aimed to meet specific needs of women and to enhance their contribution towards technology capability building. The objectives of the programme are:

- Promoting the adoption of new technologies by women.
- Awareness creation and training of women on technology related issues with regard to women.
- Promoting Technology up gradation (through technologies developed by scientific establishments) of micro, small and medium enterprises run by women Self Help Groups(SHGs)/entrepreneurs .
- Showcasing of appropriate technologies developed by scientific establishments and organizing demonstration programmes for the benefit of women.
- Design and development of products, processes (by utilizing waste) beneficial to women.
- Diffusion of technologies developed by scientific establishments for reduction of drudgery and empowerment of women.

A brief write up on the projects completed during the year is as follows:

1. Development of women entrepreneurs in advanced pottery technologies in Vilavancodetaluk of Kanyakumari district

The main objectives of the proposal received from Centre for Social Development, Ammandivilai, Kanyakumari were to upgrade the skill of the women in pottery production technologies in scientific procurement, testing and processing of raw materials to suit the production activities, to introduce affordable and efficient mechanical devises for quantity and quality products fabrication and elimination of production drudgery, to introduce new designs in the products development and producing diversified value added products, to create effective marketing channels and outlets and to train the beneficiaries as entrepreneurs in collective / individual production system and run the units with sustainability.

For the implementation of this project seven potters concentration, namely Kollemcodu, Kappicadu, Kaithagam, Malaicode, Kaliyal, Athencodu and Arumanai villages of Vilavancodutaluk were selected. Skill up gradation programmes were conducted in all the seven villages. The duration of each training programme was 6 months. In each village one training programme was organized with 15 beneficiaries in a batch. The course content for training the women potters covered better techniques of pot making by using locally available raw materials and covered details of theory and practical classes. Importance was given to practical classes to upgrade their knowledge and skill level.

2. Technology Adoption and Utilization Programme for Women in Coconut fibre Sector

The main objectives of the proposal received from Kerala Rural Development Agency (KRDA), Karunagappally, Kollam Dt, Kerala were to promote the adoption of new mechanical-ratt Technology in Coconut fibre craft production among 60 women in coastal belt of Karunagappally in Kerala and to promote the adoption of coloring Technology among 300 women craftsmen in Coconut fiber Craft in Kerala and to build up capacity and awareness of the craftsmen engaging in the Coir craft activity. 60 beneficiaries were trained in mechanical-ratt for production of coir rope. The Technology behind the mechanical Ratt was innovated and developed by the Coir Board, Govt. of India. The beneficiaries selected were trained in two training units set up at Kuttivattam and Maruthoorkulangara. In each center 15 trainees in a batch of 4 were trained under master trainers. 300 women were trained in Dye making. The Trainees were given training in Vegetable dye making, its combinations and its applications in natural fibers. This technology of vegetable dyeing in natural fibers was developed by the Regional Design and Technical Development Centre (RDTDC), Government of India, Bangalore. As a part of the capacity building training programme the trainees were given training on Micro enterprise, credit management, banking and group strengthening activities. Among the 60 trained women in *Coir Ratt Technology,* 54 have started producing coir rope by themselves as individual enterprises.

3. Technology propagation and development of micro enterprise by SHG women

The objectives of the proposal by Kalasalingam University, Tamilnadu were to provide training to the women Self Help Group (SHG) members and propagate the suitable technology for imparting them income generating skills, to locate and identify the beneficiaries and to offer training in income generation activities based on resource analysis and demand in the study area, to produce and develop the content to impart necessary technical skills on identified income generating activities, to create awareness among SHG women on technology related issues, to demonstrate and train selected women SHG members on technology based enterprises and to facilitate linkage with financial institutions to undertake livelihood activities.

The project involved training to unemployed women, preferably from lower income group, in agro processing, sericulture and food processing. Mainly rural unemployed women, of the society were selected for the training programmes. Training was imparted to members of SHGs in Virudhunagar District of Tamilnadu. 33 women from various Self Help Groups (SHGs) were trained in various functional areas of sericulture. During the programme, field visits were arranged in the industrial places like Udumalaipet, Vanniyampatti, Tenkasi, and Kuttralam.The training involved various aspects of silk production like, seed production, reeling, re-reeling, twisting, doubling, weaving and processing. The participants were also imparted training on germ plasm bank, plant introduction and acclimatization, selection, hybridization, polyploid and mutation breeding, breeding for disease and drought resistance etc. The women participants were also trained on vermi compost and mushroom culture. 15 women members each (from various SHGs') in Batch I and II were trained. Training was imparted to the participants in the field of mushroom culture, vermin compost and natural farming. 32 women participants from various SHGs were trained in the field of food processing and marketing of products. Throughout the training, trainees were given hands on training on preparation of food products like squash, pickles, dry products, essence, juices etc.

4. Composting coir pith for sustainable livelihood and eco-restoration in Satyabadi block of Puri District in coastal Orissa

The proposal of "ANUPAMA", District-Puri, Odisha was supported to help women set up microenterprises based on coir pith compost technology in rural areas of Satyabadi by technics like organic farming. 100 women beneficiaries from 10 self-help group of Satyabati block and 11 project team members have been trained under this project.

5. To educate and train rural women of western Uttar Pradesh in the cultivation and processing of medicinal plants for the preparation of nutraceuticals/ functional foods and health care products

The proposal of Amity Institute of Herbal Research and Studies, Amity University, NOIDA was supported to educate and train women of the weaker section of the society in the identification, cultivation of locally available medicinal and aromatic plants for preparation of nutraceuticals/ functional foods and health care products for personal use and gainful employment.

Under the program eleven villages, namely, Matki, Ghunna, Telipura, Salempur, Pikki, Mehrwani, Mirjapur, Maheshwari, Ghanna, Boandaki and Puaraka were selected in District Saharanpur of Western Uttar Pradesh. About 1071 beneficiaries/ families participated in the training for cultivation and processing technology of different medicinal plants. The beneficiaries were educated, trained and encouraged in the cultivation and processing of the medicinal plants, namely, Curcuma longa (Haldi), Aloe vera (Ghrit Kumari), Andrographispaniculata (Kalmegh), Withania somnifera (Ashwagandha), Acorus calamus (Vacha), Rauwolfia serpentina (Sarpgandh), Ocimum sanctum (Holy basil), Lajwanti, Asparagus racemosus, Bacopa monneri, Centella asiatica and Moringa oleifera. The project has been completed.

6. Promotion of composite fresh water aquaculture in Gop Block in Puridistrict, Orissa – A step towards livelihood security

The proposal of Welcome (Welfare & Community Enrichment), Gop, Dist, Puri, Orissa was supported to popularize the advanced technology of composite fish culture, in which more than one type of compatible fishes are cultured simultaneously for higher return and to utilize perennial fresh water pond/tank retaining water depth above one metre efficiently for fish culture purpose. Under the project, 10 awareness programmes and training on "composite fresh water aquaculture" were conducted. About 100 beneficiaries from 10 Self Help Groups benefited from the project.

7. Socioeconomic empowerment of rural women by training them with agro based biotechnological intervention

The proposal from The Standard Fireworks Rajaratnam College for Women, Sivakasi, Tamil Nadu was supported for skill development on recycling agro based wastes and to promote entrepreneurship by training the rural women on mushroom cultivation and vermi composting of mushroom spent substrate. 120 women have been trained under the project.

A write up of ongoing projects is as follows:-

1. Economic Empowerment of SC & ST women on processing of Moringaoleifera leaves and its products as an income generating activity

The proposal from Home Science College and Research Institute, Tamilnadu Agricultural University, Madurai was supported for application of new technologies for developing and standardizing new innovative traditional value added products using Moringa leaves retaining its nutritional benefits and medicinal value. So far, 30 women entrepreneurs have started their own enterprises and are successfully running them.

2. Generating Secured Income for Farm Women through Dissemination of Hybrid Castor Production Technology.

The proposal from Tapioca and Castor Research Station, Tamil Nadu Agricultural University, Yethapur, Salem, Tamil Nadu was supported for creating awareness on hybrid castor production technology and impart training on hybrid castor production, to generate secured farm income for farm women through adoption of hybrid castor production and to enhance their socio-economic status. The project is being implemented in Salem and Namakkal districts of Tamil Nadu. Six blocks have been selected from the above two districts. Total 18 villages have been selected and the project is being executed in these villages.About 180 acres of land is being dealt under the project. Nine groups having 10 members in each group (total 90 beneficiaries) have been benefitted under the project.

3. Technological empowerment and sustainable livelihood security of tribal women through agricultural farm productivity and employment generation activities in Kalrayan hills of Tamil Nadu

The project from Tapioca and Castor Research Station, Tamil Nadu Agricultural University, Yethapur, Salem, Dist., Tamil Nadu was supported for awareness creation on bee keeping among tribal women beneficiaries.

4. Self Employment by the women community of the rural areas of West Jorhat (SC populated) through organic vegetable gardening as well as production of popular food viz. mushroom cultivation

The project undertaken by North East Institute of Science and Technology, Jorhat, Assam trained 1750 women of different communities by providing both in-campus and on the spot training on mushroom cultivation.

4. Technology Development and Demonstration Programme (TDDP)

The Department has been providing partial financial support to research, development, design and engineering (RDDE) projects proposed by industry in the following areas:

(a) Development of a new or improved product resulting in prototype development and ending with demonstration in commercial environment.

(b) Development of a new or improved process resulting in establishment of process know-how, development of process equipment and demonstration of yield, efficacy etc on a pilot plant.

(c) Absorption and up-gradation of imported technology.

(d) Priority technology development projects of PSUs in consultation with and co-financing from economic ministries. Under this, consortium projects for development of technologies of common interests for group of industries or associations to be undertaken by industrial units, national laboratories, user industries in important focused areas such as Electronics and Communications, Railways, Drugs, Chemicals and Fertilizers etc.

(e) Development and demonstration of technologies for common use by industry clusters.

(f) Development and demonstration of technologies for government's flagship and mission mode projects.

The partial financial support by DSIR in the above areas primarily covers prototype development and pilot plant work, testing and evaluation of products from such R&D, user trials, etc. Bulk of the cost of the project is met from the proposer industry's resources.

The Department, under this programme has so far supported about 254 R&D projects of Industrial units with a total project cost of Rs. 750.60 crores out of which DSIR support is Rs. 280.40 crores. These projects cover products and processes in various important industries such as metallurgy, electrical, electronics, instrumentation, mechanical engineering, earth moving and industrial machinery, chemicals and explosives, etc. Under the program (32%) engineering; (27%) electronics; (21%) Chemical, (7%) energy and waste utilization and (13%) Health & Pharma projects have been supported. The TDDP supported projects covers 22 states with maximum number of projects supported to Andhra Pradesh (18%) followed by Karnataka (15%), Maharashtra (13%), Delhi (10%) and Tamil Nadu (10%).

Around 68 technologies developed under the scheme have been commercialized (Annexure 2). Cumulative royalty of Rs.24.52 Crore has been received during 1997-2013.

In this financial year, 39 projects were monitored and 7 projects were completed.

Status of ongoing TDDP Projects Supported During the Eleventh Plan

1. Development of Indigenous Radiotherapy Simulator (RTS) for Radiation Treatment of Cancer by M/s Elim Meditech Pvt. Ltd., Kanyakumari, Tamil Nadu.

M/s Elim Meditech Pvt. Ltd. has taken up a project to degsin, develop and demonstrate Indigenous Radiotherapy Simulator through the experience of refurmishing an exesiting imported simulator. The new design has many new software facilities in imaging, image processing and communication system. In mechanic design it is sleak and light weight and the electronic circurtry is of latest technology with image guided motor controls, wireless remote controls etc. This design is ready for manufacture and the existing refurmished system is ready for installation in a cancer hospital for regular clinical work after getting new certification. The project is under progress.

2. Development and Demonstration of process for manufacture of Hydrogel at Pilot Plant Scale by M/s Earth International Pvt. Ltd., New Delhi

Hydrogels also known as Super Absorbent Polymers (SAP) are substances that have a unique water absorption capacity. This property can be a boon for agriculture since absorbed water along with nutrition and other desirable substances can continuously provide all requirements of the plants. Hyrdrogel is a cross-linked polymer, which when put in water, traps the water and forms swollen networked structures, forming a gel like substance. The hydrogels developed in Indian Agriculture Research Institute (IARI), in its dry form are capable

of absorbing 400-500 times its weight of water, can withstand up to 50°C temperature, have repetitive gelling character, biodegradable with a shelf life of 2 years. These hydrogels besides meeting water demands of the plant improves germination and minimizes soil erosion. These hydrogels in combination with drip irrigation can transform the barren land to a productive one.

The performance trials and test runs on various crops in different climates are in progress. The company is scaling up the lab process up to pilot scale (initially in a batch of 5 kg with the maximum of 25 kg) and developing field trials data for commercialization of the lab scale technology on use of Hydrogels. The project is nearing completion.

3. Development of Small size pistons for Two Stroke Engines by high pressure die casting process by Abilities India Pistons & Rings Ltd., Delhi

The company has taken up a project for development of small size pistons for IC engines used in specialized applications like Chain saws, Brush cutters, Hedge trimmers' etc. very popular world over. The development of pistons with High Pressure Die Cast (HPDC) process was taken up to achieve the desired high degree of fuel efficieny with the development of light weight and thin walled pistons with intricate shaps. The components produced with HPDC process are "Near Final Shape" with out any additional machining and render the engine more efficient in terms of improved fuel economy and reduced emissions.

Under the project the company proposes to develop small size Pistons (size 44mm for 50cc Engines and size 37.08mm for 33cc engines) with high silicon content for two stroke engines. The project is nearing completion.

4. Manufacture of Magnesium & Calcium Metal Powder by M/s Ardee Business Services Pvt. Ltd.

The objective of the project is manufacture of Magnesium and Calcium Metal Powder through modified Pidegeon process using electric energy by induction heating principle. The process developed incorporates automation and closure control of process parameter for reliability and high energy efficiency. The project is completed.

5. Development of Coal dry beneficiation system -X-Ray based Sorting system for Indian Coals of size range 13-50mm (ArdeeSort) by Ardee Hi-Tech Pvt Ltd, Vishakhapatnam

The project is for development of field scale X-ray based sorting system to provide complete solution for coal dry beneficiation for particle size, in the range of 13-50 mm. This technology will yield similar results as compared to the existing technologies without using water. The system electronics, removal technology, logic of separation are novel. Prototype developed & field trials are under progress. The project is nearing completion.

6. NLT 40% L-Dopa from Mucuna Prurious Seeds by BACFO Pharmaceuticals (I) Ltd., New Delhi

The objective of this project is to develop a process for Commercial Manufacture of Standardized Extract NLT 40 % L- Dopa from *Mucuna pruriens* (Kaunch) seeds. *Mucuna pruriens* (Kaunch) seeds have L-Dopa with hundreds of compounds, of different chemical groups. The potential ingredients from the seeds have been separated by the company with pH selective extraction, as combination of synergistic ingredients, with L-Dopa is highly useful in treatment of Parkinson's disease. Laboratory Experiments of 1.0 Kg. batch size have been successfully completed to produce free flowing yellow brown powder having NLT 40 % L-Dopa with 61 gm yield. The process has been developed for 500 Kg . batch size pilot plant. The project is completed.

7. Indigenous Development of FTIR Spectrophotometer by M/s ELICO Limited, Hyderabad

The project envisages development of FTIR in the Price band less than 5 Lakhs Rupees to make it

affordable to academic & research institutions. The targeted FTIR Instrument would come with configurable optics, application specific accessories, in-built PC Processing capabilities, and advanced Human / Machine Interfaces like Touch Screen, USB Mass Driver storage, USB Printing, and TCP/IP for networking. The project is under progress.

8. Development of Endoxifen as a new efficacious and safe therapeutic agent for the treatment of breast cancer by M/s. Intas Pharmaceuticals Ltd, Ahmedabad.

The main objective of the project is the Development of a delayed release and scaleable Endoxifen, an active metobolite of the marketed drugs Tamoxifen, for the treatment of breast cancer. Endoxifen has 30-100 times more affinity with target Estrogen receptor than Tamoxifen. In breast tissues, Endoxifen acts as an Estrogen receptor antagonist so that transcription of Estrogen receptive gene is inhibited. The Project is under progress.

9. Development of Non-infringing processes for API's in pilot scale by M/s. Ogene Systems (I) Pvt. Ltd., Hyderabad.

Development of 17 Active Pharmaceutical Ingredients (APIs) (viz Telmisartan, Zolmitriptan, Levetiracetam, Irbesartan, Lacidipine, Valsartan, Olmesartan Medoxomil, Manidipine Hydrochloride, Fosamprenavir, Montelukast, Linezolid, Nifedipine, Felodipine, Florfenicol, Bifonazole, Tamsulosin Candesartan) by non-infringing processes from gms scale to Kgs scale in the pilot plant. The Project is under progress.

10. Process Up-scaling & Clinical Evaluation-PBL 1427 – A Novel Long Acting DPP IV Inhibitor for the Treatment of Type 2 Diabetes by M/s Panacea Biotec Ltd., New Delhi

The antidiabitic compound developed by the company PBL1427 has exhibited potent, reversible competitive inhibition in human DPP IV enzyme activity with an IC50 of 12 nm. It has > 15000 fold selectivity for DPP IV over DPP8 / 9. PBL 1427 binds more strongly to the DPP IV enzyme as compared to Sitagliptin and Vildagliptin. PBL 1427 showed a good *in vivo* efficacy in lean mice and rats in terms of improvement in oral glucose tolerance test suggesting a better glycemic control. PBL 1427 is a novel long acting DPP IV inhibitor with an attractive profile that meets the need for promoting safer drugs to treat Type 2 Diabeties in growing patient population. The project is under progress.

11. Development and commercialization of Aliskiren and its Intermediates by M/s. Penn Bio-Chemicals (India) Pvt Ltd.

The overall objective of this proposal is to produce Aliskiren and its intermediates. The Aliskiren compound is complex molecule with four stereo centers in the structure. For the sake of convenience, the company is targeting to synthesize three fragments and market all these three synthons. Design and synthesis of novel approach for the three fragments (AK1, AK2 and AK3), is carried out in the in-house R&D centre and scale up using pilot scale. The long term goal is to develop the most efficient operating conditions for large scale synthesis of the Aliskiren and its intermediates to market the finished product in the India as well as in the world markets. The project is under progress.

12. Optimization and Pilot Plant trials towards commercialization of Standardized Colocynthin extract from the medicinal plant "Citrullus Colocynthis by M/s. SAMI Labs Ltd., Bangalore.

The main objective of the project is to optimize the extraction process of Colosynthin – an anti-arthritic product, at several scale-up levels and also to identifiy quality raw materials sources from different parts of India. The company has developed 50% and 95% Colocynthin grades that may be useful in the development of anti-psoriatic and anti-cancer formulations. The project is nearing completion.

13. Conversion of steel/iron forged/cast under chassis auto-components e.g. steering knuckles & suspension links to lighter weight aluminium equivalents by deploying advanced LPDC process by M/s. Synergies Castings Limited, Visakhapatnam.

The project is aimed at conversion of steel forged / cast under chassis auto-components to lighter weight Aluminum equivalents by deploying advanced LPDC process. Components identified for conversion are 'Suspension Links', 'Steering Knuckles' from cast / forged steel / iron components for production with LPDC Aluminum equivalents. The Project is nearing completion.

14. Purification of Gas Gangrene Clostridium Toxins & Development of Monovalent and Polyvalent Antitoxins by M/s. VINS Bioproducts Ltd., Hyderabad.

The objective of this project is production of gas gangrene causing toxins from three different *Clostridium* strains namely *C. perfringens*, *C. septicum* and *C. novyi*, purification of toxins from the culture media by chromatography based methods, development of strategic immunization schedule for obtaining high titre antitoxin from equines, standardization and purification from equine plasma and testing the efficacy of the purified antitoxin by animal assays and user trials. The project is under progress.

15. Bench and Pilot Scale Process Development for UV Reflective Security Inks & Pigments (UVRIP) by M/s Aron Universal Ltd., Bangalore.

The main objective of the project is to develop and commercialize novel UV-reflective security inks and pigments with improved performance characteristics in terms of glow intensity under UV exposure, solvent reistance, reduced particle size and acid/ alkali resistance; technology. The project is under progress.

16. Rapid Diagnosis of Malaria by Multiplex Fast-PCR Assay by M/s. Chromous Biotech Pvt. Ltd., Bangalore

The proposal envisages design and development of primers for specific amplifications and identification *Plasmodium* species by PCR for the diagnosis of Malaria. After the development of primers, the specificity and sensitivity of the primers were tested using genomic DNA of standard strains of *Plasmodium falciparum*. Multiplex – fast PCR (using specific primers) is validated using clinical samples of Malaria. The project is completed.

17. Development and Commercialization on Low Temperature Polymer Exchange Membrane Fuel Cell and Stack by Elpro Energy Dimensions Pvt. Ltd., Bangalore

The objective of the project is Development of Polymer Exchange Membrane fuel cell stacks for stationary applications. The development of fuel cells is very critical in view of the energy and environmental considerations. The work on low temperature and high temperature fuel cells for stationery applications is being carried out at IIT Mumbai and upon successful development the company shall manufacture the same commercially. The fuel cells developed at proof of concept level at IIT Mumbai delivered the power of 0.2 watts per cm^2 with air as an oxidant. However, further development work needs to be carried out, initially at IIT and subsequently upto pilot scale at the company before commercialization. The Project is under progress.

18. Project "Development & Commercialization of Seating Mechanism (Recliner, Track & Lifter)" - Ms. Hema Engineering Industries Limited, Gurgaon

The objective of the proposal is to develop compact Seat Mechanisms for automobiles involving recliner, track and lifter. In the existing mechanism the release of the slider is done by togal bar. In the proposed lifter the seat cushion can be raised by 1.5 mm in each stroke. The mechanisms would be inline with the specifications and cost targets of the benchmarked front row seats of passenger car segments B and C respectively.The mechanisms

would meet all the regulatory and safety requirements for seating systems. The project is under progress.

19. Three Dimensional Mixer by M/s. Hexagon Product Development Pvt. Ltd., Vadodara

The objective of this project proposal is design and development of 3-Dimensional mixer of 500 litres capacity for efficient mixing of powder and liquid materials for pharmaceuticals, paints, construction and finishing industry. The company has already developed a prototype of 75 litre capacity and plans to develop mixers up to 500 litres capacity. The project is nearing completion.

20. Smarter Material Handling Automated Guided Vehicles (AGVs) by M/s. Hi-Tech Robotic Systemz Ltd., Gurgaon

The objective of the project is to develop an AGV Pallet Truck, which combines an autonomous navigation system with a pallet handling system with a new generation of AGV controller, a new power pack and guidance system. The two-fold goal of this project is to develop an indigenous vehicle as a substitute for imported vehicles and develop a new generation controller. The project is nearing completion.

21. Development of novel Biopesticides from Antagonistic Microbes *Bacillus subtilis* and *Trichoderma viride* using Dextrose as a carrier by M/s. Nirmal Seeds Pvt. Ltd. Jalgaon

The project envisages development of novel bio-pesticides from antagonistic microbes *Bacillus subtilis* and *Trichoderma viride* using Dextrose as a Carrier. The company has formulated these bio-pesticides in the lab and plans to scale up production. *Trichoderma viride* is a green coloured, fast growing beneficial fungal species. It has multiple uses in crop protection, as a bio control and decomposing agent. The Project is completed.

22. Development & commercialization of Rapid cast Technology for manufacturing of stainless/steel castings of weight 5000 Kgs single piece by M/s. PTC Industries Limited, Lucknow.

The project aims at development of Rapid Cast Technology for highly complex stainless/steel castings weighing up to 5,000 Kgs single piece. The project is under progress.

23. Development and Validation of a novel Computer Aided Drug Design (CADD) technology for drug discovery by M/s. Rational Labs Pvt Limited, Hyderabad.

The objective of the project is to develop an integrated CADD technology for drug discovery, validation for Relative Solvation Free Energies of Small Molecules and Validation for a Diverse Set of Small Molecules and Drug Targets. The project is nearing completion.

24. Manufacture of Corey's Lactone and Prostanoids: Iloprost, Lubiprostone and Travoprost by M/s Sai Advantium Pharma Ltd., Hyderabad.

The main objective of the project is to synthesize Corey' lactone, a key intermediate required for the syntheses of several prostanoids; to synthesize Iloprost, Lubiprostone and Travoprost from Corey's lactone'; to match purity of Corey's lactone with samples supplied by Cayman (US); to develop analytical methods for synthesized prostanoids. The Project is under progress.

25. Motor and control for hybrid car on transmission shaft by M/s. S K Dynamic Pvt. Ltd., Roorkee

The objective of the project is to develop, fabricate, test and commercialize motor and control for hybrid car that can be mounted on the transmission shaft. The Project is under progress.

26. Development and Demonstration of Innovative Technology for the automation

of Firework Manufacturing by M/s Sri Kaliswari Fireworks Private Ltd., Sivakasi, Tamil Nadu.

The objective of the project is to develop machinery for automation in cracker manufacture in order to achieve elimination of human touch of toxic chemicals, improving the occupational hazards, improving the productivity and elimination of environmental pollution. The project is nearing completion.

27. Design and Development of Biological Toilet System by M/s. Stone India Ltd., Kolkata

The objective of the project is to eliminate open defecation fully and to prevent human wastes from being dumped on the ground through biological digestion using bio media, further purify resultant water & recycle for flushing, discharged on the ground or used for agriculture satisfying environmental limits. The concept of bio digester tank has been jointly developed by Stone India Limited along with its technical collaborators in India and overseas. The project is completed.

28. New Process Development for Special Elastomer Compound by M/s. Som Shiva (Impex) Limited, Ahmedabad

The objective of the project is regenerating Polymer which has gone through certain heat cycles there by imparting specific end-use properties. Low melting temperatures of Elastomer and high melting temperatures of Polymers are used for compounding the Polymer Matrix in order to make it a viable commercial proposition. The project is under progress.

29. Development of LTE Macro eNodeB Base stations by M/s TEJAS Networks LTD., Bangalore.

The objective of the proposal is to design, develop and manufacture indigenous eNodeB Base stations based on Long Term Evolution (LTE) emerging as the single most dominant wireless standard for fourth generation wireless access. The project is nearing completion.

30. Project "Upscaling and commercial production of the lactic acid bacteria starter culture for yogurd curd production" - M/s. Tropilite Foods Pvt Ltd, Gwalior

The objectives of the project are identification, isolation, standardization and upscaling of lactic acid bacteria for curd and yogurt production; standardization of commercial chemical media for mass production of lactic acid bacteria; standardization of upstream and downstream process for the production of freeze dry lactic acid bacteria starter culture. The company during the project has set up a pilot plant facility including pilot scale fermenters, centrifuge and lyophilizer. The project is nearing completion.

31. Development & demonstration of technology to manufacture a new dosage form namely Oral Thin Films by M/s. ZIM Laboratories Ltd., Nagpur.

The project involves developing of machine for manufacture oral thin film containing Medicament. The process of manufacture of such product comprises of formulation of solution/dispersion/ emulsion required for solvent casting and its characterization. The project is nearing completion.

32. E-waste Recycling & Precious Metal Recovery by Eco Recycling Ltd., Mumbai

E-waste is a growing concern and will continue to rise with the socio-economic developments. This

'waste' is resource rich and also very hazardous. The present proposal will provide complete solution to address all the relevant concerns and will help in recovering the precious metals from Printed Circuit Boards. The project is nearing completion.

33. Development of a novel, Cost effective liquid and stable Adsorbed Rabies Vaccine based on Vero Cell Platform by M/s. Pochiraju Industries Limited, Hyderabad.

The main objective of the project is to develop a safe and effective rabies vaccine technology superior

to the existing ones which does not need ultra Centrifuge. The Vaccine formulation will be liquid stable and storable at 4°C with a shelf life of 2-3 years and a process that is highly reproducible and with complete removal of host cell DNA contamination. The Project is under progress.

34. Fuel Cell Bus development Programme by Tata Motors Ltd, Mumbai.

FUEL CELL BUS

Hydrogen is emerging as a leading contender for the energy carrier options of future. The project is aimed at design, development and demonstration of Fuel Cell Bus which will be fuel by Hydrogen. The Project is under progress.

35. Design and development of ultra high pressure (6000 bar) pump by M/s. Water Jet Germany Pvt. Ltd, Tamil Nadu.

The project involves design and development of a pump which can build up pressures beyond 6000 bar for increasing cutting speeds, thereby improving

productivity of the water jet cutting machine. The Project is under progress.

36. Smart Closed Loop Energy Management Solution by M/s. Genus Power Infrastructures Ltd, Jaipur.

The main objective of the project is to reduce transmission, distribution and commercial losses in LT distribution system through smart closed Loop Energy management system. This solution leverages the potential of Power management with IT and Telecommunication technologies to help realize the hitherto unrecoverable revenues; to monitor and control losses in an LT distribution network. It encompasses Automatic and Remote meter reading for a group of 1ph and 3ph LT/HT consumers mapped to a distribution transformer which in turn is mapped to a feeder; to provide closed loop metering rendering the abnormalities immediately on the GPS map, enabling specific and concentrated

counter-measures; to establish a management server to monitor and control the billed and unbilled electricity consumption etc. The Project is completed.

37. Solid Handling Fluid transfer Pumps by M/s. Oriental Engineering Works Pvt. Ltd., Yamuna Nagar.

The objective of the project is to design and develop the prototypes of solid handling fluid transfer pumps and associated accessories as per the need of customers and test these pumps in house as well as in field for different application e.g. Viscous Liquids, Site Drainage, Raw/Process Water, Storm/Flood Water, Emergency Pumping, Sewage, Sludge, Slurry and Bentonite. The Project is under progress.

38. TDDP project, "Development of Spiral Cobalt Radiotherapy Machine" by M/s Panacea Medical Technology Pvt. Ltd., Bangalore

The aim of the project is development of Spiral Cobalt Radiotherapy Machine for treatment of

cancer. The deliverable output of this project is fully functional prototypes for Rotational Gamma Beam machine to achieve conformal therapy. The proposed machine will be able to offer the 3D conformal therapy using cobalt 60. The overall cost of treatment delivery with such a configuration will be lowest, while offering the 3D conformal treatment. Isotope based tele-therapy machine work with maximum advantage when the distance from source to tumor is lower. This machine offers a very low distance of 60 cm. This is a major breakthrough in tele-therapy and it will be first of its kind in the world. This machine will be precise, accurate, rugged and reliable for conformal therapy at a fraction of the cost of competing technologies in developing countries. It is operated by a built in

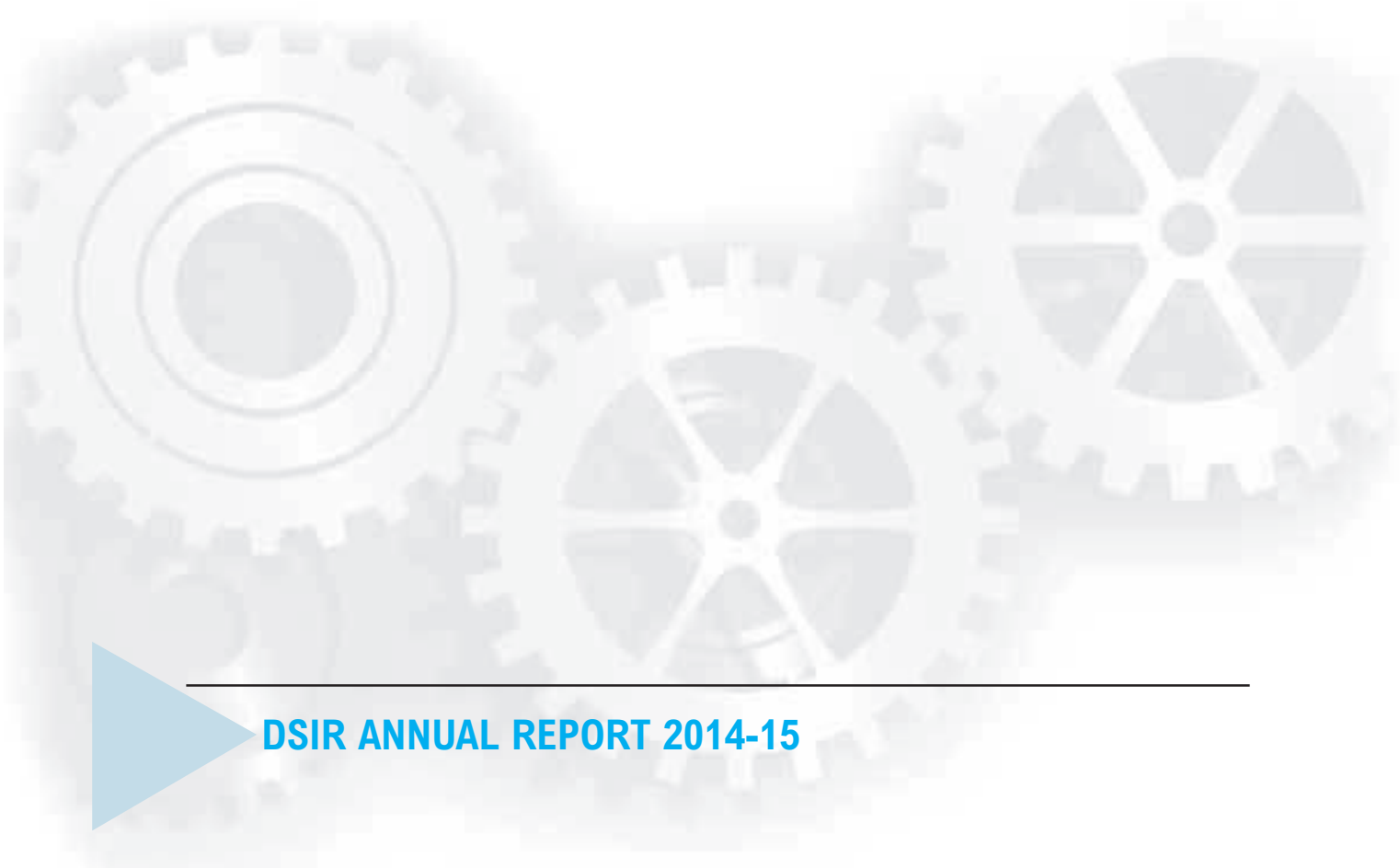
battery with low power consumption, suitable for rural India. The project is completed.

39. Development of Chiral APIs by M/s Sharon Bio-Medicine Ltd. Mumbai.

The main objective of the project is to develop fermentation and downstream processes for Chiral Immobilized Enzymes for Target Molecules/Target Transformations by screening of libraries for specific biocatalysts Isolation and production of identified variants; improvement of selected enzymes (biocatalysts); continued search and operation of new libraries; developing Fermentation capabilities in order to provide Enzymes for various Transformations; optimizing fermentation, down-stream process to prepare the target molecule/s

including use of immobilized enzymes and also using Walden inversions via enzymatic-switch routes. The Project is under progress.

III Promoting Innovations in Individuals, Start-ups and MSMEs (PRISM)



DSIR ANNUAL REPORT 2014-15

Promoting Innovations in Individuals, Start-ups and MSMEs (PRISM)

1 PREAMBLE

Department of Scientific and Industrial Research (DSIR) has launched a new programme viz. Promoting Innovations in Individuals, Start-ups and MSMEs(PRISM) during 12th five year plan. The programme aims at to support individual innovators having original ideas to convert them into working models, prototypes etc. It also aims at supporting autonomous institutions or organizations or registered society for developing state-of-art new technology solutions aimed at helping MSME units in industrial clusters. The department has supported seventeen (17) new projects during 2014-15 (up to December 15, 2014) [Annexure 1]. As a part of its commitment to complete on-going spill-over projects supported under erstwhile TePP, the department has successfully completed twenty- three (23) projects during the period. The details of the completed projects supported under erstwhile TePP are given in Annexure. Further, details of some of the completed TePP projects are given below:

Eco-friendly Leisure Boat

A 5 - seater solar powered Eco-friendly Leisure Catamaran Boat having average speed of 3 to 4 knots was developed and tested under the guidance of Ocean Engineering Department, IIT Chennai. The technology has been developed by the innovator Shri Gautam Mdhavan Nair, Chennai with the help of TePP/DSIR.

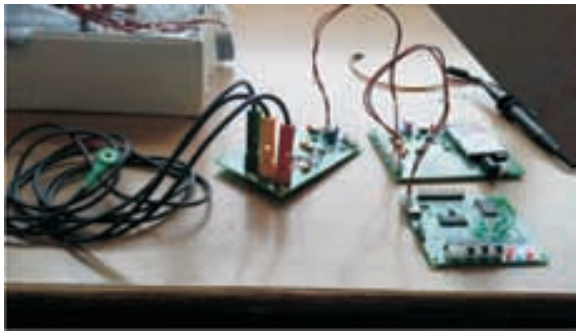
Belt System for Body Support (Jaipur Belt)

A Jaipur Belt (Belt System for Body Support) has been developed by Shri Ganesh Ram Jangir, Jaipur to assist people who suffers from Slip-Disk,

Spondylytis and other age related disorder. The technology has been developed by innovator Shri Ganesh Ram Jangir, Jaipur. The device has been tested at Dr. P. K. Sethi Rehabilitation Centre, Jaipur. The device has been developed with financial assistance under TePP/PRISM of DSIR.

Bio-medical Engineering Tool Kits (BEAT)

BEAT is an educational advanced platform comprising of plug and play toolkit to enable Biomedical Engineering students to design and learn different diagnostic devices/medical instruments without wasting their time in a safe and effective



manner. BEAT allows its users to design their own systems in a quick manner by providing all necessary plug-ins thereby reducing up to 90% of the development time and 80% of the cost for developing monitoring devices. The technology has been developed by the innovator Shri Abhinav, New Delhi with financial assistance under TePP/PRISM of DSIR.

2. OTHER ACTIVITIES

2.1 To expand the reach of PRISM among common masses, fifteen (15) TePP Outreach cum Cluster Innovation Centre (TOCIC) have been set up by DSIR. These are located at CSIR-Central Scientific Instruments Organization(CSIO), Chandigarh; CSIR-Central Mechanical Engineering Research Institute(CMERI), Durgapur; Acharya Nagarjuna University, Guntur ; CSIR-NEIST, Jorhat ; SIDBI Innovation and Incubation Centre, IIT Kanpur; Indian Institute of Technology Kharagpur, Kharagpur; CSIR- Central Glass Ceramic Research Institute (CGCRI), Kolkata; CSIR-Institute of Himalyan Bio-resources, Palampur; Indian Institute of Technology Roorkee, Roorkee; University of Kashmir, Srinagar (J&K); Sri Padmavati Mahila Visvavidyalam, Tirupati; College of Technology & Engineering (CTAE), Udaipur ; Indian Institute of Technology Varanasi and Technopark, Thiruvananthapuram; University of Madras, Chennai (T.N).

2.2 A number of other activities organised/ participated by PRISM/TePP during the year to sensitize academia, disseminate information on TePP to the larger mass of the populace network partners and impact generation among common masses:

i. Sensitization Programme on PRISM , Durgapur (July 5, 2014)

ii. PRISM Workshop cum Symposium at IIT Kharagpur (July 7, 2014)

iii. 10th Government Achievements & Schemes Expo 2014, Pragati Maidan, New Delhi (25-27 July, 2014)

iv. Innovation Clinic for MSME Clusters , Kolkata (August 13, 2014)

(Lighting, Zari, Fan & Surgical Tools)

v. PRISM Workshop & Awareness, Kolkata (August 19, 2014)

vi. Outreach Camp for Students & Faculty, Barasat, North 24 Pargana (West Bengal) (August 20, 2014)

vii. Outreach Camp for entrepreneur at Metal Cluster, Howrah (August 25, 2014)

viii. PRISM Awareness Camps, Guntur, August 26, 2014

ix. Students Sensitization Programme, BB College , Asansol (September 4, 2014)

x. Workshop on Innovation & Entrepreneurship, Tirupati (September 10, 2014)

xi. PRISM Sensitization Programme for Students, NIT Mizoram (September 11, 2014)

xii. Innovators Awareness Camp at CSIR-CDAR, Aizol (Mizoram) (September 12, 2014)

xiii. PRISM Awareness Camp at IIT Varanasi (September 12-13, 2014)

xiv. Vibrant India 2014 & 9th Meri Dilli Utsav at New Delhi (October 17-19, 2014)

2.3 A review meeting was also organised at College of Technology and Engineering, Udaipur during October 8-9, 2014 to review the progress of various TePP Outreach cum Cluster Innovation Centre (TOCICs).

2.4 Third Party evaluation of erstwhile Technopreneur Promotion Programme(TePP) Scheme operated during 11th five year plan has successfully been completed by Indian Institute of Public Administration (IIPA), New Delhi during the month of September, 2014. IIPA, New Delhi has recommended the continuation of TePP Scheme and has opined that with the present thrust "Make in India", the programme will be very useful.

2.5 A TePP innovator - Dr. Suresh Kumar Nair, CEO, Innobreeze bagged Top Gold award in Medical for Medical Devices Category for his innovation "Non Invasive Oral Cancer Detection System (BreezeScan). BreezeScan has also won the DST-Lockheed India Innovation Growth Program award. The device uses light rays for different wavelengths passing through human tissue via an optical fibre probe to help locate pre-cancerous and cancerous cells non-invasively. When cancer cells get formed, there are bio-chemicals, morphological and vascular changes in tissues and the fibre-optic light reflected carries that information. " It is like a torch – the optical fibre tip of the probe glows and the received light that has passed through the tissue contains all the information needed to detect carcinoma.

IV Building Industrial Research & Development And Common Research Facilities (BIRD-Crf)

1. *Creation of Common Research and Technology Development Hubs (CRTDH)*
2. *Industrial R & D Promotion Programme*
3. *Asian Pacific Centre for Transfer of Technology (APCTT)*
4. *Information Technology and e-Governance*

Building Industrial Research and Development and common research facilities (BIRD-Crf)

A. Common Research and Technology Development Hubs (CRTDHs)

Keeping in view the need for promoting new product development activities by industry, enhancing translational research and fostering industry-institute interaction leading to growth of innovative capabilities in the country, a programme aimed at creation of Common Research and Technology Development Hubs (CRTDHs) has been conceived.

One of the key determinants of competitiveness is innovation capabilities, which refers to capabilities both in developing new scientific and technological inventions, and also in carrying out incremental changes, systemic changes and changes in the manner of doing business. Besides developing new technologies, it is vitally important for research institutes and companies to translate these technologies, ideas and inventions into marketable products and services. However, this has not always been possible due to many reasons such as lack of requisite resources, or not having access to sophisticated infrastructure. It is also appreciated that the innovation capacity of the Indian industry depends not only on large enterprises having access to financial and other resources, but crucially on Micro Small and Medium Enterprises targeting radical innovation and new product development. Micro and Small enterprises (MSEs) particularly, even though steered by talented individuals, often find it difficult to invest in R&D and technology development due to lack of access to suitable equipment, skill-sets, instruments, and other such resources.

AIMS AND OBJECTIVE

The programme is aimed at creation of DSIR-CRTDHs to encourage research and technology development activities by industry and to concurrently accelerate translational research activities by R&D institutions. Partial financial support would be provided to eligible institutions as grant-in aid to establish DSIR-CRTDHs to conduct industrial R&D and innovation activities.

The DSIR-CRTDHs would enable industries have access to state-of-the-art equipment, research facilities and expertise available in R&D institutions to facilitate their undertaking new/improved product/process development and skill enhancement activities, and also help in converting research outputs into products.

Achievements:

During the current year, the guidelines of the scheme were finalized and advertised on the DSIR website. 16 Proposals that had been received in the areas of Affordable Health, Electronics/Renewable Energy and Environmental Interventions were processed.

In the first phase, DSIR-CRTDHs in Affordable Health and Environmental interventions sectors are being established as follows:

i. **Centre for Cellular and Molecular Biology (CCMB), Hyderabad**

The focus of DSIR-CRTDH at CCMB would be in the field of health care products and modern biology covering *inter alia* Diagnostics, Bio-pharma and Medical devices. In particular, the products and technologies that would be targeted would relate to development of DNA based diagnostic kits for screening of eye infections, Acute Encephalitis, Septicemia, antibiotic resistance, and others.

ii. **Institute of Himalayan Bioresource Technology (IHBT), Palampur**

The DSIR-CRTDH at IHBT would take advantage of the institute's expertise in development of value added products such as thermos-stable enzymes, zero-calorie sugar substitutes etc. The hub would catalyze development of bio-pharmaceutical ingredients such as black carrot anthocyanin, beetroot betaine, mango peel carotenoids etc. by industries located in its vicinity.

iii. **National Institute for Interdisciplinary Science and Technology (NIIST), Thiruvananthapuram**

The objective of the DSIR-CRTDH at NIIST would be towards development of products and technologies in respect of environmental issues. Industries would benefit from the institute's expertise and experience in technologies related to odour control, anaerobic treatment, nitrification treatment, water quality analysis and others.

B. Industrial R & D Promotion Programme

1. OBJECTIVES

The broad objectives of the Industrial Research and Development Promotion Programme are to:

- Bring in-house R&D into sharper focus;
- Strengthen R&D infrastructure in industry and Scientific and Industrial Research Organisations (SIROs);
- Promote R&D initiatives of the industry and SIROs;
- Ensure that the contributions made by the in-house R&D centres and SIROs dovetail adequately in the overall context of technological and industrial development.

2. AREAS OF COVERAGE

The specific areas covered under the component scheme are:

- In-house R&D in Industry,
- Scientific and Industrial Research Organisations (SIROs), and
- Fiscal Incentives for Scientific Research

Activities and achievements in each of above areas are presented below:

3. IN-HOUSE R&D IN INDUSTRY

3.1 Recognition of In-house R&D Units

A strong S&T infrastructure has been created in the country. This covers a chain of national laboratories, specialised R&D centres, various academic institutions and training centres, which continuously provide expertise, technically trained manpower and technological support to the industry. Various policy measures have been introduced from time to time, to meet the changing industrial and technological requirements of the industry. The Government has been giving special attention to promotion and support to industrial research in industry. Several tax incentives have also been provided which encourage and make it financially attractive for industrial units to establish their own in-house R&D units.

A scheme for granting recognition to in-house R&D units in industry is operated by the DSIR. A number of incentives and support measures are made available to in-house R&D units. Ministry of Finance has issued notification amending the basic notifications under customs and central excise. As per the amendments, all DSIR recognized in-house R&D units other than hospitals can avail customs and central excise duty exemption on their procurements for research purposes.

The in-house R&D units qualifying for recognition are expected to be engaged in research and development activities related to the line of business of the firm, such as, development of new technologies, design and engineering, process/ product/design improvements, developing new methods of analysis and testing; research for increased efficiency in use of resources such as capital equipment, materials and energy; pollution control, effluent treatment and recycling of waste products.

The R&D activities are expected to be separate from routine activities of the firm, such as production and quality control. The in-house R&D units should have staff exclusively engaged in R&D and headed by a full-time R&D manager who would have direct access to the chief executive or to the board of directors depending upon the size of the unit. The in-house R&D units are also expected to maintain separate identifiable infrastructure and R&D accounts.

Number of in-house R&D units recognised by DSIR increased steadily from about 100 in 1973 to about 275 by 1975, to over 700 by 1980, around 925 by 1985, over 1100 in 1990 over 1200 in 1995 and thereafter is hovering between 1200 to 1250; 1361 in March 2010; 1618 in December 2011, 1767 in December 2012, 1797 in December 2013, 1820 in March, 2014 and 1762 in December 2014. Of these nearly 1650 are in the private sector and the remaining units are in public/joint sector. The last updated 'Directory of Recognised in-house R&D Units' was brought out on December, 2013. This Directory lists 1797 recognised in-house R&D units, giving registration number, name and mailing address of the company, location of the in-house R&D unit(s) and validity of DSIR recognition. From January, 2012 the scheme has become totally online.

The application system has been made completely online for recognition and registration of in-house R&D units (RDI), Scientific & Industrial Research Organisations (SIRO) and Public Funded Research Institutions (PFRI). With the objective of Minimum Government and Maximum Governance the new portal has reduced the time and increases the transparency of operation within the DSIR. The steps taken by DSIR have been very successful and have been appreciated by many organizations. For this initiative the DSIR has received Skoch award for 'Minimum Government and Maximum Governance' in September 2014.

Under the e-governance initiative of DSIR, department has started online application submission facility for greater accessibility and transparency of the departmental programmes / schemes. For the purpose of recognition of in house R&D units, submission of online application facility started in the year 2012 through the department website (http://www.dsir.gov.in). Details about the schemes are available on department website.The applications received are scrutinised for their completeness in the DSIR and are then circulated for comments to various other departments/agencies such as concerned administrative ministries, MSME, CSIR, ICAR, ICMR, CCRAS, DBT, DC & PC, DoT, DRDO, DIT, DoP and NRDC. The units seeking recognition are invited for presentation in DSIR and visited, if need be, by expert teams comprising of representatives of DSIR, as well as outside agencies, like, administrative ministries, CSIR, NRDC, DBT, ICAR, ICMR, DRDO, DIT, DOT, IITs and local educational and Research Institutions before they are taken up for consideration to verify their separation from the commercial activities like production and quality control and services. In order

to obtain first hand information on R&D activities of the applicant firms, discussions with the chiefs of the R&D unit and executives of the firm are also held in DSIR in many cases. During the discussions outside experts are invited and their comments are sought. The applications along with comments from outside agencies, visit reports, and the Department's own evaluation are considered by an Inter-Departmental Screening Committee constituted by the Secretary, DSIR. The Committee meets every month to consider the applications and makes recommendations to the Secretary, DSIR based on its evaluation of the R&D infrastructure and R&D activities of the applicant firms.

R&D recognition by DSIR is considered as the basic requirement to avail fiscal incentives focused towards R&D and separation of R&D activities from commercial production/service activities of the company is considered important.

During the period under report, the Screening Committee met 12 times. Of the 326 applications received for recognition, the screening committee considered 309 applications. 105 R&D units were granted fresh recognition based on their satisfactory R&D Infrastructure, Qualified Manpower and Programmes; 204 applications were rejected and 17 applications are under process at the end of 31st December, 2014. A statement giving month-wise receipt, disposal and pendency of applications for recognition of in-house R&D units is given at Annexure 3.

During the period under report, more than 225 discussions/meetings were held with heads/ representatives of in-house R&D units. Also, expert teams visited a number of in-house R&D units.

3.2 Renewal of Recognition

Recognition to R&D units is granted for a period ranging from 2 to 5 years. The R&D units are advised to apply for renewal of recognition well in advance (3 months prior to the date of expiry of the recognition). The department has for the first time made arrangements for online submission of applications for renewal of recognition beyond 31.03.2013. The applications are examined in DSIR taking into account the inputs received from other agencies for taking suitable decision on their renewal. As of 1st April 2014, 540 in-house R&D units were due for renewal of recognition out of which 460 applications were received. Based on the evaluation of the performance of the R&D units, renewal of recognition was granted to 436 R&D units. Recognition granted to 104 companies could not be renewed because of the reason that either their application is not received or the R&D performance was not up to the mark. A statement showing month-wise receipt, disposal and pendency of the cases of renewal of recognition of the R&D units is given in Annexure 4.

3.3 R&D Expenditure

The expenditure incurred by in-house R&D units in industry has steadily increased. During 1980-81 it was of the order of Rs. 300 crores. In 1985-86, it was of the order of Rs. 500 crores. It is estimated that the present R&D expenditure of the 1762 recognised in house R&D units is of the order of about Rs.25,000 crores per annum. The share of public and joint sector is about 20 per cent and that of private sector about 80 per cent. Of these 1762 recognized in-house R&D units 80 spent over Rs. 5000 lakhs each on R&D while 399 spent between Rs. 500 lakhs to Rs. 5000 lakhs each per annum on R&D and 290 spent between Rs. 200 lakhs to Rs. 500 lakhs each per annum on R&D The list of these R&D units is given in Annexure 5, 6 and 7 respectively.

3.4 R&D Infrastructure

The in-house R&D centres have created impressive infrastructural facilities for R&D including sophisticated testing facilities, laboratory equipment and pilot plant facilities. Analytical facilities such as HPLCs, HPTLC, FTIR, GCMS, Polymerase Chain Reaction(PCR) equipment, Hydrogenator, Stability Chamber, Aflotoxin analyzer, X-ray

defractometer, Salt Spray test chamber, Vickers hardness tester, IR/UV-VIS spectrophotometers, NMR spectrometers, electron microscopes, particle size analyzers, portable particle counting systems; vibration test equipment, calorimeter, ultra filtration equipment, sonicator, spectro fluorimeter, protein purification set up, digital viscometer, high temperature test and evaluation facilities, CAD-CAM facilities, rapid prototype building machines, greenhouse and tissue culture laboratory facilities are available with many in-house R&D units.

3.5 R&D Manpower

There has been a steady increase in R&D manpower employed by the in-house R&D units. By 1975-76, about 12,000 R&D personnel were employed by recognised in- house units and by 1981-82, the figure was over 30,000. The present estimated manpower for the 1762 in-house R&D units is over 1,55,000.

3.6 Achievements of In-house R&D Units

Some of the R&D achievements reported by the recognised in-house R&D units are listed below:

Agricultural Sciences :

- Development of Cotton variety namely Shankar-178,Guar variety Shankar-1 and mustard variety Dron
- Development of Hybrid Maize Texico - 309 2. Hybrid Tomato Texico – 201
- Development of high yielding disease resistant malting barley variety suitable for North India.
- Development of high yielding lodging and disease resistant barley variety for North India.
- Development of Bhendi variety - PUSPA, Chilli variety - ANKITA.Chilli Hybrid - ANJU, Bhendi Hybrid - PUSHPA,
- Development of Green coffee bean, caffeine, vinpocetine
- Development of High Oleic Sunflower hybrid Olisun 3794, high oleic contain High Oil by GOI. PAC 339 medium maturing sunflower hybrid.
- Development of medium maturity maize hybrids PAC 745, PAC 751 and PAC 753 .
- Development of Mustard ADV 444 Brown mustard hybrid with medium maturity for north India.
- Development of ADV 409 yellow mustard hybrid for eastern India.

Biological Sciences:

- Development of cryo-preservation of cord tissue and subsequent culture of clinical grade MSC from frozen tissue, production of Clinical Grade Umbilical Cord Tissue Wharton's Jelly derived Mesenchymal Stem cells.
- Development of DLS-Silver Dressing (SILVEL), DLS-Negative pressure wound therapy (VELNEXT), DLS-Hydrogel (SOFTGEL), DLS-Hemostat and DLS-Multifunctional wound bed
- Development of Vitamin D3 (Cholecalciferol) 200IU Drops.
- Development of Disposable Laparoscopy Trocar.
- Development of Ultra Light Weight Hernia Mesh with Unique Knit for TEP/TAPP Repair and Safety Syringe
- Development of Lipid Based formulations for the Treatment of Anal fissure
- Development of Liposomal Pharmaceutical formulation for enhanced drug delivery of anticancer drug
- Development of process for synthesis of APIs like Acomprosate Calcium, Sevelamer Carbonate, Iopomidol, Butyl Nicotinate,

Ethyl Nicotinate, Benzene Sulfonalide, Diclofenac Epolamine, Telmisartan, Enrofloxacin, Bisphenolc and Loratadine

- Development of devices like IF-Stim (Nerve & Muscle Stimulator), Nucalm (Cranial Electrical Stimulator), CES (Cranial Electrical Stimulator), Fast-Prep(Centrifuge), Max-90(Electro-Chemistry Analyser), PDA G2(Photo Density Analyser) AP-439 Audio/ Ultrasound Audio(Talking Devicse for Visually Challenged), J-Stim-2(Joint Stimulator), Brain Dryvr(Sound Therapy for Mentally Challenged), ST-2,ST-4,SSD-0,SSD-1,SSD-2, My Care(Multi-wave Stimulators), Alphalase(Laser Therapy for Hair Density & Growth) and FM 10/C G2(Cranial Electrical stimulator).
- Development of oncological Products like Pegylated Liposomal Doxorubicin, Tablets: Abiraterone Acetate, Erlotinib, Everolimus and Fulvestrant.
- Development of antibacterials injection: Liposomal Amphotericin, Clarithromycin Injection Hormones B and Lyophilized Powder for Injection are Caspofungin Acetate, Daptomycin Lyophilized and Colistimethate Sodium ,
- Development of veterinary injections like Enrofloxacin, Ivermectin Clorsulon Injection, Thelzon (Buparvaquone IM inj, Zolidone (Piroxycam IM/SQ inj), Synulogs-C (Amoxicillin & Clavulanic Acid IM/SQ inj), Enrofloxacin Tablets, and Milbemycin + Praziquantel Tablets (for Cats)
- Development of tablets like Artemether and Lumefantrine 40mg/240mg, Balofloxacin Tablets 100mg, Cilostazole Tablets 50mg & 100mg , Diclofenac Sodium Sustained Release Tablets 100mg, Etorocoxib Tablets 60mg/90mg/120mg , Etorocoxib and Paracetamol Tablets 50mg/500mg, Dextrose, Calcium Carbonate and Vitamin C OR D Tablets , Esomeprazole and Levosulphride Capsule 40mg/75mg

Chemical Sciences:

- Development of Impregnated Activated carbon Products suitable to various ppm level; Pd impregnated activated carbon catalyst; GAC for radioactive element adsorption, Hazardous gases like chlorine, H_2S & Formaldehyde gas adsorption
- Development of Industrial Polymers such as Thermo Plastic Elastomers (TPES), Unfilled Polyamide 6 and Custom Compounds.
- Development of process of recovery of Polyamide 6 from mixed ground rubber and fiber and process to convert the polyamide in pallets/granules.
- Development of products like 8-Legged 13500 MT Jacket for offshore platform; Integrated Gas Dehydration & Gas Sweetening Modules for offshore process platform.
- Development of Granulation of Phospho Gypsum Plant
- Development of Polyurethane , Fine Film , High Solvent Resistance , Low Bake Non-Tarnish Metallic , Zinc Rich Primer , Polyester Matt , Engine Epoxy, Low Bake Polyester , Low Bake Epoxy Polyester , Low Bake Cum Thin Film Epoxy Polyester , High Performance Polyester for Architectural applications
- Development of Dental grade Dicalcium Phosphate, Sodium Perborate, Sodium Percarbonate, Guaiacol from Catechol, Biowins and Mono, Di, Tri Sodium & Potassium Phosphates
- Development of chemicals like (z)-4-(4-(Piperidine-1-ylmethyl)pyridine-2-

yloxy)but-2-en-1-ol, 2-(Furan-2-ylmethylthio)acetamide, 1-(4-azido-5-trityloxymethyl-tetrahydro-furane-2-yl)-5-methyl-1H-pyrimidine-2,4-dione and the APIs like Memantine Hydrochloride, Desloratadine, Betahistine Dihydrochloride, Levodropropizine and Zaltoprofen.

Engineering Industries:

- Development of Flanges, Lever, Sleeve, Shaft, Lift, Lharm, Spacer Rear, Gear HD, Rocker, Power Lift Internal, Body Fuel Pump, Cam Shaft Gear, Pivot, Retainer Head, SML - Hub Rear Axle Casing, Arm Knuckle Up, Knuckle Steering (Air Break)

- Development of Twin Column Bandsaw Machines with LMG Rails & Bearings: a) Automatic PLC controlled High Productions Horizontal Twin Column LMG type Bandsaw Machine; b) Fully Automatic PLC controlled Horizontal Double Column LMGNC type Bandsaw Machine; c) Double Column LMG Pro type Automatic Bandsaw Machine

- Development of Carbide Circular Sawing Machine- a) Manually Operated High Speed Circular Sawing Machine; b) High Speed Numerical Controlled Circular Sawing Machines with Auto Loader; c) High Speed Numerically Controlled AC Servo driven Carbide Circular Sawing Machines; d) High Speed Numerical Controlled Circular Sawing Machines

- Development of Burr Free Cold Saw & Friction saw Fly Cut off (Dual shuttle type) ITL- FCS-CNF-120, Burr Free Cold saw with dual saw head fly cut off (for large pipes)

- Development of Exhaust Gas Recirculation Tube , V Clamp , Diffuser ,Exhaust Gas Recirculation Tube, Oil Drain Tube, Flex For various two wheelers & four wheelers customers.

- Development of Carousel for cylindrical and panel filter, Servo Rotary Pleater, End Cap Embedding Machine, Gasket glueing machine, Media folding & automatic spacer insertion machine, The Servo Motor Driven Blade Pleater and Clipping Machine - 350/42

- Development of Alloy Steel fasteners for Landing Gear Applications, Super Alloy fasteners for Aero Engine Application and Tool Steel Fastener for Space Application.

- Development of 362mm Push type clutch set for New Generation Vehicles, 330mm Push type clutch set, Split Torque clutch for Tractors, Dual Clutch for Tractors and clutch with swan neck clip.

- Development of HDPE formulation for Blow Moulding Application, UV resistant Masterbatches for Agriculture Applications.

- Development of Back Pressure/Extraction Back Pressure Steam Turbines., Geothermal & Solar Thermal Turbines, Topping / Bottoming Turbines. , Energy Recovery Turbines, Steam Turbine of 2500 KW straight condensing with top exhaust to reduce the civil construction cost

- Development of Various types of Carrier Differential , Bearing Cap RH , Case Transmission , Rear Wheel Hub , Exhaust Manifold, Various types of Carrier Differential ,Brake Bracket chamber-RH , Brake Bracket chamber-LH , Wheel Hub Cast , Various types of Carrier ,Differential ,Carrier-TANDUM , Carrier Bearing Cap , Case body , Case Cap , Wheel Hub , Axle Housing , Front Engine, Challenger HLC, Sub Assembly HLC.

- Development of Single Load-Current Feedback CT, Relay Outputs, 4, 8, 12 or 16 Output Channels; Capacitor-Duty Thyristor Switch(es) (TSCI/TSCC); Single-Phase Lighting Controller, LC-01, Energy Saver for Fluorescent Lamps; Three-Phase Lighting Controller; Remote Load Management System (RLMS) Controller, Detuned Inductor (Reactor) for PF Improvement Capacitors and Hand-Held-Unit (HHU) - APFC Data Communicator / Mobilizer.
- Development of Needle Roller Bearings for slide ways (NB1019.98.8), flange four bolt cast-iron housed unit (YCM 45), Stud type cam follower, Double row ball bearing with wider inner ring (BBD163248P2RS), Cage guided needle roller bearing (RNAK53982), cylindrical roller bearing (NUP2210VE) and Cage guided needle roller bearing (NBI172920)
- Development of Paper Machinery like Pressurized Head Box, Hydraulic Head Box, Wire Part, Top Former, COMBI Bi NIP Press, TRI NIP Press, Dryer Section, Size Press, Mill Duty Winders, Two Drum Winder, Salvage Winders, Sheet Cutters.
- Development of Voice Communication and Control System (VCCS), Iron System for Indian Airforce.
- Development of Tipper Segment 2523 TP (6x4) with bell crank suspension, 3118 TP (6x4), 2518 TP (6x4)Cowl version, 1618 TP (4x2) Cowl version B) and Haulage Segment like 3118 HL (8x2 Haulage), 2516 HLL (Long vehicle), 3116 HL ABS (Tanker application) and 3116 HLL (Long vehicle).

Information and communication Technology (ICT):

- Development of Relays- Numerical / Microprocessor based Current Relays - Numerical communicable Over Current & Earth Fault relays with IEC61850 or MODBUS communication, Electro-mechanical Based Auxiliary and High Speed Tripping Relays, Self Powered Relays.
- Development of Semaphore Indicators, Hooters ,Annunciators, Terminal Blocks, Panel Meter, Smartcon - DT
- Development of Advanced EDFA : Low-noise and bit rate independent EDFA (Erbium Doped Fiber Amplifier) .
- Development of FDT features with an internal rotating spool on which the fiber can be stored and retrieved based on the installation requirements.
- Algorithms to estimate pressure and cross-sectional area of a coronary artery using electromagnetic field analysis and MEMS based sensors.
- Development of Avionics equipment in Navigation, Communication and Control for Aerospace Applications and Digital Moving Map for substantial import substitution
- Development of virtual Account Manager - Consisting of big data visualization, actionable visual elements, Actionable and Response Driven Campaign Manager, Three Dimensional profiler - Delineation Engine, 360 Degree Driven Next Best Action Framework and Next Best Action Delivery Engine
- Development of ETIM Application software, Public Online Reservation System (PORS),RFID Pass System, Integrated Urban Local Body - Municipal Management System and Land Transport Office (LTO).
- Development of Algorithms for Modulation and demodulation Software

Defined Radio applications and High speed DSP libraries for use in radar signal processing, Hyperspeed Fast Fourier Transform (FFT) engines to process digitized data at 1.33 Gsps,

3.7 Imports Made by In-house R&D Units

The recognised in-house R&D units have imported a variety of equipment, raw materials and samples for their R&D activities. These include: HPTLC, FTIR, GCMS, Polymerase Chain Reaction(PCR) equipment, Hydrogenator, Stability Chamber, Aflotoxin analyzer, X-ray defractometer, Salt Spray test chamber, Vickers hardness tester, Microplate reader, Medical photography equipment, Nitrogen generator, Abrasion loss testing machine, viscosity testing machine, Load cell, Universal testing machine, 30 ton capacity pully block , Ginning machine,Spares for Rota vapor chiller and extraction system, Polymer microscope, Oscillation granulator, Automatic potentiometric titrator, DSC (PerkinElmer), etc

3.8 Other Benefits Availed by the Recognised R&D Units

The Department provides assistance to recognised in-house R&D units in a number of ways, such as cases of industrial R&D units requiring allotment of special controlled materials for R&D, permission to export of specialised products reserved for small scale industries by medium scale industries for test marketing in other countries and disposal of imported R&D equipment/instruments and pilot plant produce are examined for making suitable recommendations to concerned agencies.

4. SCIENTIFIC AND INDUSTRIAL RESEARCH ORGANISATIONS (SIRO's)

4.1 Recognition of Scientific and Industrial Research Organisations (SIROs)

The DSIR had launched a scheme of granting recognition to SIROs in 1988. SIROs recognised by DSIR are eligible for Customs Duty Exemption and Central Excise Duty Waiver in terms of notification Nos. 51/96-Customs dated 23.7.1996 and 10/97-Central Excise dated 1.3.1997 respectively.

In order to simplify the processing of application and augment the transparency, DSIR has commissioned online filing of application for both fresh and renewal of recognition . Many of existing SIROs have applied online for recognition/renewal of recognition. So far about 600 SIROS have already applied on line.

The DSIR has brought out Guidelines for Recognition of SIROs, which give procedural details and application proforma for seeking recognition under the SIRO Scheme. Functional SIROs having broad based governing council, research advisory committee, research personnel, infrastructural facilities for research, well defined, time bound research programmes and clearly stated objectives of undertaking scientific research, are considered eligible for recognition by DSIR. The investments of surplus funds not needed for immediate research should be in accordance with the Income-tax Act, 1961.

Applications for seeking recognition under the SIRO scheme are considered in DSIR by an Inter-departmental Screening Committee with members from Council of Scientific and Industrial Research (CSIR), Indian Council of Medical Research (ICMR), Indian Council of Agricultural Research (ICAR), Indian Council of Social Sciences Research (ICSSR) and University Grants Commission (UGC). The recommendations of the Screening Committee are put up for approval of Secretary, DSIR. The recognition is effective from the date of approval of Secretary. Retrospective approval is not granted.

During the period under report the Screening Committee met 08 times and recommended 28 cases for recognition as SIROs. These include cases in the natural and applied sciences, agricultural, medical sciences and social sciences. List of these SIROs is furnished at Annexure - 8.

Recognition granted to SIROs is for duration ranging from 1 to 3 years. The SIROs are advised to apply for renewal of recognition well in advance (3 months prior to the date of expiry of recognition). Such applications received for renewal of recognition are examined by Research Review Groups by involving representatives from ICAR, ICMR, CSIR and ICSSR depending on the area. Based on the evaluation made by the Research Review Groups, renewal of recognition is granted to SIROs.

At present, there are 626 SIROs duly recognised by DSIR; of these, 250 are in the area of natural and applied sciences, 251 are in the area of medical sciences, 39 are in the area of agricultural sciences and 86 are in the area of social sciences.

The SIROs have employed qualified scientists and researchers and have also established good infrastructural facilities for research. They have developed new processes, procedures, techniques and technologies and also filed several patents. They have also organised seminars/ symposiums/ workshops and published research papers / reports / books.

5. FISCAL INCENTIVES FOR SCIENTIFIC RESEARCH

Government has evolved, from time to time, fiscal incentives and support measures to encourage R&D in industry and increased utilisation of locally available R&D options for industrial development. New incentives to encourage investments in R&D by industry are announced in the Union Budget.

Fiscal incentives and support measures presently available include:

- Income-tax relief on R&D expenditure (capital & revenue);
- Weighted tax deduction U/s 35(2AA) of IT Act 1961 for sponsored research programs in approved national laboratories, universities and IITs;
- Weighted tax deduction u/s 35(2AB) of IT Act, 1961 on in-house R&D expenditure for any company engaged in the business of biotechnology or in any business of manufacture or production of any article or thing not being an article or thing specified in the list of the eleventh schedule of IT Act, having R&D facility approved by Secretary, DSIR.
- Customs duty exemption on capital equipment, spares, accessories and consumables imported for R&D by approved institutions/SIROs;
- Customs duty exemption on specified goods (comprising of analytical and specialty equipment) for use in pharmaceutical and biotechnology sector;
- Central Excise duty waiver on items purchased from the domestic market by approved institutions/ SIROs for R&D;
- Ten year tax holiday for commercial R&D companies approved upto 31.03.2007
- Central Excise duty waiver for 3 years on goods produced based on indigenously developed technologies and duly patented in any two of the countries out of India, European Union (one country), USA and Japan;
- Accelerated depreciation allowance on plant and machinery set-up based on indigenous technology;
- Customs duty exemption on imports for R&D projects supported by Government.

Information on some of these fiscal incentives implemented by DSIR is given in the following paragraph.

5.1 Depreciation Allowance on Plant and Machinery Setup Based on Indigenous Technology

Secretary, DSIR, is the Prescribed Authority to certify expenditures where higher rate of

depreciation can be allowed for the plant and machinery installed for the manufacturing of products using indigenous know-how as per the provisions of rule 5(2) of IT Rules. Certificates are issued for eligible expenditure after a detailed examination in the department. During the period under report, no certificate was issued.

5.2 Central Excise Duty Waiver for three years on patented products

Government of India, Department of Revenue, vide Notification No. 13/99-CE dated 28th February 1999 as amended by Notification No. 22/99 had exempted, all goods falling under the Schedule of the Central Excise, Tariff Act, 1985 (5 of 1986), from the whole of the duty of excise leviable thereon under the Central Excises (Goods of Special Importance) Act, 1957 (58 to 1957), subject to the following conditions:-

(a) such goods are manufactured by a wholly Indian owned company;

(b) such goods are designed and developed by such Indian company;

(c) the goods so designed and developed are patented by such Indian company in India and in any other or more of the countries of the European Union and in United States of America or Japan or in both;

(d) that the manufacturer before the commencement of commercial production, produces a certificate from an officer not below the rank of the Additional Secretary to the Government of India in the Department of Scientific and Industrial Research (DSIR) to the effect that the said goods are designed and developed by a wholly Indian owned company and patented in any two countries from amongst India, USA, Japan and any one of the European Union to the jurisdictional Commissioner of Central Excise, and

(e) the procedure as prescribed by the jurisdictional Commissioner of Central Excise, is followed.

In order to operationalise the scheme department has evolved guidelines and application form for screening and issuance of certificate. These guidelines and application form is available on DSIR website.

Department had received 2 applications during the year, which are under process as per the established procedures. List of these applicant companies and the technologies is furnished at Annexure - 9.

5.3 Reference on expenditure on scientific research under Section 35 (3) of Income Tax Act, 1961.

Section 35(3) of Income-tax Act, 1961 provides that if a question arises as to whether and, if so, to what extent any activity constitutes or constituted or any asset is or was being used for scientific research, the Central Board of Direct Taxes would refer the question to the Prescribed Authority. Director General Income-tax (Exemptions) in concurrence with Secretary, DSIR is the Prescribed Authority for deciding such cases.

5. 4 Approval of Commercial R&D Companies

In order to promote research and development activities in the commercial research and development companies, the Finance Act, 2000 provided for a ten-year tax holiday from income-tax under section 80-IB(8A) of the Income-tax Act, 1961, to approved companies, whose main objective is undertaking scientific and industrial research, Secretary, DSIR is the Prescribed Authority vide Gazette notification no. S.O. 85(E) dated 31 January, 2001, issued by Department of Revenue, Ministry of Finance for granting approval under section 80-IB(8A) of the IT Act. The notification was valid upto 31st March, 2007 and this scheme was not extended further by the Government.

The approval to commercial R&D companies is given initially for a period of 3 years, which can be extended up to 10 years based on evaluation of its performance. The tax exemption is available to a company, which is accorded approval by the Prescribed Authority at any time after the 31st day of March 2000 but before the 1st day of April 2007.

Out of 45 companies approved till 31st March 2007, thirteen companies are availing benefit under the section at present. The list of 13 companies is given at Annexure-10.

5.5 Customs Duty Exemption to Recognised SIROs

All SIROs recognised by DSIR other than hospitals are eligible for Customs Duty Exemption on the import of scientific equipment, instruments, spares, accessories as well as consumables for research and development activities and programmes.

The department was issuing the essentiality certificates to SIROs for obtaining the customs duty exemptions. As per the notification No. 24 /2007 dated 1st March, 2007 the Director or Head of the institute/organization is empowered to sign the essentiality certificate.

5.6 Central Excise Duty Exemption to Recognised SIROs

All SIROs recognised by DSIR other than hospitals are eligible for Excise Duty Exemption on purchase of scientific and technical instruments, apparatus, equipment (including computers); accessories and spare parts thereof and consumables; computer software, Compact Disc - Read Only Memory (CD-ROM), recorded magnetic tapes, micro films, microfiches; and prototypes for research and development activities and programmes.

This provision was introduced by Ministry of Finance (Department of Revenue) vide notification No. 10/97-Central Excise dated 1st March, 1997. The department was issuing the essentiality certificates to SIROs for obtaining the central excise duty exemptions. As per the notification No.10/ 2007 dated 1st March, 2007 the Director or Head of the institute/organization is empowered to sign the essentiality certificate.

5.7 Customs and central excise duty exemption to Recognised in-house R&D units

Ministry of Finance has issued notification no. 24/ 2007 – Customs dated 01/03/2007 and 16/2007 – Central Excise dated 01/03/2007 amending the basic notifications under customs and excise. As per the above amendments all DSIR recognized in-house R&D units other than hospitals can avail customs and central excise duty exemption on their procurements for research purposes. All the eligible in-house R&D units recognized by DSIR have been issued the certificates of registration.

5.8 Registration of Public Funded Research Institutions, Universities etc.

Public funded research institutions, universities, IITs, IISc., Bangalore; Regional Engineering Colleges (other than a hospital) are eligible for availing customs duty exemption on import of equipment, spares and accessories and consumables for research purposes through a simple registration with the DSIR. The heads of the public funded research institutions / organisations duly registered with DSIR can certify the R&D goods for duty free import as per the notification No. 51/96-Customs dated 23 July 1996. As per the Government notification No. 10/97-Central Excise dated 1.3.1997, the above Public Funded Research Institutions registered with DSIR are also eligible for Central Excise Duty Waiver on purchase of indigenously manufactured items for scientific research purposes.

Coinciding with the presentation of Union Budget for the year 2004, Ministry of Finance amended the notification No. 51/96-customs vide notification No. 28/2003-Customs dt. 1.3.2003. As per the amendment, departments & laboratories of central government and state governments (other than a

hospital) are not required to register with DSIR for availing the customs duty exemption. They can clear the consignments by producing a certificate from the Head of the institution certifying that the said goods are required for research purposes only. Another significant change in the notification is that Regional Cancer Centres have been included in the list of institutions eligible for DSIR registration for importing goods for research purposes at a concessional rate of customs duty.

Under the e-governance initiative of DSIR, department has started online application submission facility for greater accessibility and transparency of the department programmes/schemes. For the purpose of registration / renewal of registration of Public Funded Research Institutions (PFRIs) and others, submission of online application facility started in the year 2012 through the department website (www.dsir.gov.in). Details about the schemes are available on department website. So far about 150 institutions have applied online. The complete applications are considered by an Inter-departmental Screening Committee constituted by the department for considering the requests from various institutions. Presently the committee is chaired by a former Secretary of DSIR,

The Screening Committee met once during the period under report and considered 15 applications received from various public funded research institutions. During the period under report, 5 registration certificates were issued to such public funded research institutions for availing customs duty exemption on import of scientific equipment, spares and accessories, consumable items and Central Excise Duty exemption on indigenous purchases for Scientific Research Purposes. There are about 660 PFRIs registered by DSIR.

The registration to public funded research and other institutions mentioned in the notification is granted for maximum period of five years / ten years (for all institutions of national importance, CSIR, ICAR & ICMR labs, IITs, NITs, etc.). The registered institutions are advised to apply for renewal of registration well in advance of the date of expiry of the registration.

During the period under report, 47 institutions were due for renewal of registration. The department received 33 renewal applications. These were processed on individual files and approval of Competent Authority was obtained and 33 renewal certificates were issued.

5.9 Approval of In-house R&D Centres under Section 35(2AB) of I.T. Act 1961

In order to encourage R&D initiatives of industry, the finance bill 1997 introduced a sub section (2AB) in section 35 of the IT Act, 1961. The provision introduced initially was for select sectors of industry i.e. drugs, pharmaceuticals, electronic equipment, computers, telecommunication equipment, chemicals and provided weighted deduction of 125 per cent on expenditure on in-house research and development facility as approved by the prescribed authority i.e. Secretary, DSIR. Subsequently, a number of other sectors were added to the list of eligible sectors. From the year 2009 the benefits have been extended to all sectors of industry with a select list of non-priority items. Rate of weighted tax deduction was raised from 125 per cent to 150 per cent subsequent to the year ending March, 2000. The rate of weighted tax deduction was further enhanced to 200% from 1st April 2010. Initially the provision was introduced up to 31st March, 2000. The provision was extended from time to time initially till 31st March, 2005 and then upto 31st March, 2007, further up to 31st March 2012. In the Union Budget 2012, the provision has been extended up to 31st March 2017.

During the period under report, 87 new applications were received for approval under the provision. New approvals were accorded to 80 companies in Income Tax prescribed Form 3CM. Further, the detailed R&D expenditure of the approved companies were also examined and 118 reports valued at Rs. 9359 crores forwarded to DGIT (E) in Form 3CL as prescribed in IT Act. A list of companies approved

under Section 35(2AB) of IT Act, during the year 2014 is furnished in Annexure-11.

C: Asian Pacific Centre for Transfer of Technology (APCTT).

1. PREAMBLE

The Department of Scientific and Industrial Research (DSIR), Ministry of Science and Technology (MOST), Government of India has been the national focal point of APCTT since its inception in 1977. Matters pertaining to the APCTT and UN-ESCAP are dealt with in cooperation with the Ministry of Commerce and Industry and the Ministry of External Affairs, Government of India. DSIR also plays an active role in APCTT's functioning, particularly relating to its programmes and policies. India being the host country has been providing institutional support to APCTT.

Institutional support of US$ 200,000 in Indian Rupees (to meet local costs) for the period (2013-2014) is expected to be paid to APCTT in addition to funding for building repairs, renovation work, and municipal taxes. DSIR has also extended programme support towards the APCTT project entitled, "Promotion of National Innovation Systems (NIS) in Countries of the Asia-Pacific Region – Phase II".

The revised Statute of APCTT, adopted by the Commission at its Sixty-first session in May 2005, through its resolution 61/4, stipulates among other things, that the Centre shall have a Technical Committee consisting of experts from members and associate members of ESCAP and from inter-governmental and non-governmental organizations. Members of Technical Committee shall be appointed by the Head of APCTT in consultation with the Executive Secretary of ESCAP. The Technical Committee shall be responsible for advising on the formulation of the programme of work and on technical matters concerning the operations of APCTT. The 10th Technical Committee of APCTT held at Kunshan, China in November, 2014 was attended by departmental representative.

It is also stipulated that the Centre shall have a Governing Council consisting of a representative designated by the Government of India and no fewer than eight representatives nominated by other members and associate members of ESCAP elected by the Commission. The members and associate members elected by the Commission shall be elected for a period of three years, but shall be eligible for re-election. The members of APCTT's Governing Council for the period 2014-2017 are Bangladesh, China, Fiji, India, Indonesia, Islamic Republic of Iran, Malaysia, Pakistan, Philippines, Republic of Korea, Samoa, Sri Lanka, Thailand and Viet Nam. The 10th Governing Council held at Colombo, Sri Lanka in November, 2014 was attended by the departmental representative.

2. ACTIVITIES OF APCTT

Science, Technology and Innovation (STI); Technology Transfer; and Technology Intelligence were identified as three focus programme areas in the five year Strategic Plan (2013-2017). Under these programme areas, the activities focused on: promotion of national innovation systems; technology transfer support services for SMEs; the promotion of critical emerging technologies such as renewable energy technologies, biotechnology and nanotechnology; and the provision of information, networking and the sharing of experiences relating to the management of technology, and enhancing technology intelligence through the provision of technology information services. During the reporting period, 2013-2014, the Centre has undertaken the following activities:

1. APCTT organized more than 33 capacity building activities with participants from 13 countries namely Bangladesh, Bhutan, China, India, Indonesia, Islamic Republic of Iran, Lao PDR, Malaysia, Nepal, Pakistan, Philippines, Thailand and Sri Lanka APCTT's activities were jointly organized in cooperation with more than 22 partner institutions

that included government ministries, national institutions and international agencies.

2. During the reporting period, APCTT carried out several activities under the second phase of the project on strengthening of national innovation systems (NIS) in the Asia Pacific Region (2010-2013), funded by the Department of Scientific and Industrial Research (DSIR), of the Ministry of Science and Technology, Government of India. Under this project, APCTT in collaboration with the Science and Technology Policy Institute (STEPI) of the Government of Korea jointly implemented activities with strong participation of LDC partners in order to help them to develop customized STI initiatives.

(a) Through two national workshops organised by APCTT in Indonesia and Lao PDR held back to back during 12-16 May 2014, national policymakers and stakeholders of sustainable energy deliberated on the draft national sustainable energy strategies to strengthen technology enabling environment and innovation systems in their respective countries.

(b) Bangladesh senior policy makers enhanced their understanding of and the need to strengthen a national agricultural technology innovation systems: APCTT promoted the concept of technology innovation and elaborated the conceptual framework of the national innovation system and various dimensions and relevance of technology innovation in the agricultural sector at a national workshop on "Bangladesh Agricultural Technology Innovation System: Opportunities and Challenges in Dhaka". This workshop was organized under the South-Asia component of the SATNET project implemented by the Centre.

(c) Asia-Pacific NIS On-line Resource Centre http://nis.apctt.org : The on-line knowledge platform, aimed at STI stakeholders, to share policy approaches and experiences of countries on a range of issues in strengthening the national innovation systems was updated with the outputs and outcomes of all the activities under the STI/NIS programme area of work of the Centre as of October 2014. Users could view and download presentations made by the national and international experts and reports of the regional and national workshops, meetings and NIS fora.

(d) ESCAP Consultative Meeting with Chinese Inventors and Technology Stakeholders on Technology Facilitation for Sustainable Development: In this meeting organized in conjunction with the 10th Technical Committee (TC) Meeting of APCTT, the Centre facilitated dialogue and discussions with key representatives of the China Association of Invention (CAI), the Ministry of Science and Technology (MOST), China, and relevant technology stakeholders. The meeting was attended by senior officials of CAI and its branches throughout the country, numbering about 20-30 representatives; National/International participants of IEIK 2014; Senior officials of MOST, China; Officials of Trade and Investment Division (TID) and Asian and Pacific Centre for Transfer of Technology (APCTT) of ESCAP; and Member State representatives to APCTT's TC Meeting. In this meeting, ESCAP officials shared with Chinese stakeholders ESCAP's vision and mission on addressing critical issues for technology facilitation in the post-2015 sustainable development agenda as well as exchange ideas on developing national/regional STI and technology transfer strategies for technology facilitation in the context of post-2015 agenda.

(e) Senior Policymakers debated upon STI approaches to sustainable development. In conjunction with APCTT's annual Governing Council meeting held in Colombo, Sri Lanka on 27 November 2014 and the ESCAP-TID Asia Pacific Trade and Investment Week, APCTT organised a one-day meeting with the senior policy makers from the S&T ministries and specialized institutions of the Asia-Pacific countries on an overarching theme of relevance to its work programme. The meeting was attended by senior officials from Bangladesh, China, India, Indonesia, Islamic Republic of Iran, Malaysia, Pakistan, Philippines, Republic of Korea, Sri Lanka, and Thailand to brainstorm on the STI based approaches to achieve the post-2015 sustainable development goals. The objective of the meeting was to appraise the SDGs and the means of implementation that are relevant to the work programme of the Centre and deliberate on the current STI based approaches of the Asia-Pacific countries to brainstorm on the way forward.

3. APCTT and Science and Technology Policy Institute (STEPI) of the Republic of Korea, through combining their on-going programme activities have been assisting Nepal and Lao PDR in analyzing their current STI framework conditions and developing strategies to strengthen their NIS enabling environment and promote technology based entrepreneurship. This joint initiative of the two institutions concluded with the organization of the following activity. APCTT plans to continue to assist LDCs in strengthening their STI capability in specific areas during the coming years through development of new projects.

(a) *Lao PDR policy makers brainstormed on STI strategic planning:* APCTT, in partnership with STEPI and the Department of Technology and Innovation (DTI), Ministry of Science and Technology (MOST) of Lao PDR, organized '*Brainstorming Workshop on STI Strategic Action Planning, Case Study: Master Plan on Technology and Innovation Development up to 2020 for Lao PDR, 26-27 May 2014, Vientiane, Lao PDR.*' The workshop aimed at deliberating on the study results of STI diagnosis and strategy development for Lao PDR which was carried out by APCTT and STEPI and assisting Lao PDR in developing a Master Plan on technology and innovation development up to 2020. The workshop was attended by about 40 participants from different ministries, departments, national institutions and academia of Lao PDR.

4. APCTT and the Environment and Development (EDD) Division of UN-ESCAP concluded the implementation of the United Nations funded project on affordable and accessible sustainable energy through South-South cooperation. APCTT activities were focused to assist Indonesia and Lao PDR in developing their national strategies to strengthen their enabling environment and technology innovation ecosystem for affordable sustainable energy. The APCTT component of the project began with the development of a national assessment framework to collect and organize relevant information about the national scenario of sustainable energy, technology enabling environment and innovation ecosystem, business enabling environment and ecosystem, business models for sustainable energy technology (SET) delivery, socio-economic factors, South-South Cooperation and case studies. The draft framework was introduced to and discussed with the national stakeholders at the national workshops held in Indonesia and Lao PDR. The reviewed framework was used by national consultants to collect and provide relevant information and technical inputs for preparing the national strategy papers. Based on the findings of the assessment and learnings from experiences of other countries, draft national strategy reports of Indonesia and Lao People's Democratic Republic were developed. These draft

reports were later discussed, deliberated, reviewed and finalized at the national consultative workshops held in both countries.

Activities

(a) *Sustainable energy experts, policy makers and business stakeholders discuss and finalise the national assessment framework on Accessible and Affordable Sustainable Energy from 19-20 March 2014, Jakarta, Indonesia*. Organized in cooperation with Indonesian Institute of Sciences (LIPI) and attended by government and private sector agencies. The objective of the workshop was to present and discuss the national assessment framework on enabling environment and technology innovation eco-system and sharing of experiences from other developing countries on enabling environment and technology innovation ecosystem for promoting sustainable energy products and services.

(b) *Senior policy makers develop National Strategy to Increase Affordability of Sustainable Energy Options through consultative workshop from 12-13 May 2014, Jakarta, Indonesia*. The workshop was organised in collaboration with Indonesian Institute of Sciences and with the objective of increasing the affordability and accessibility to sustainable energy products and services as well as energy saving building materials, through enhanced South-South cooperation in Asia and the Pacific for sustainable development. The draft national strategy report of Indonesia was discussed during the workshop which was based on the findings of the assessment and learning from experiences of other countries through the assessment framework. During the workshop several recommendations were suggested, one among them were like creating a committee on renewable energy chaired and coordinated by the National Energy Council to improve coordination among various government ministries and departments.

(c) *Senior Policy makers of Lao PDR were appraised with the sustainable energy policy approaches and institutional mechanisms of India, Thailand and Nepal*. APCTT in cooperation with and assistance by the national focal points in Thailand and Nepal, along with the project international consultant arranged a series of meetings with policy makers, regulators, sustainable energy businesses and non-governmental organizations as well as field visits in these countries from 21-28 February 2014. The senior policy makers from key ministries of the Government of Lao PDR were appraised with the (a) role of and need for competitive market and private sectors in delivering sustainable energy products and services; (b) various ways through which how government can create market demand for the renewable energy products and services by providing tailor made financial support and incentives to end users as well as energy service providers; (c) the need to regulate the energy market for the best interest of end-users as well as the energy service providers; and (d) role of NGOs which could interface between delivering the policy objectives of providing affordable and accessible sustainable energy to off-grid communities with private and government entities. The discussions held during the study tour has shown potential south-south cooperation opportunities between Lao PDR and the countries visited, especially in deploying biomass gasification, biogas energy and micro-hydro technologies.

(d) *Sustainable energy experts, policy makers discuss and finalise the national assessment framework on Accessible and Affordable Sustainable Energy from 11-12 February 2014, Vientiane, Lao PDR*. It was organized in cooperation with Department of Technology and Innovation (DTI), Ministry of Science and Technology (MOST), Vientiane, Lao People's Democratic Republic and attended by 32 participants, including policy makers and

experts from ministries and departments of the Government of Lao People's Democratic Republic. During the workshop the national assessment framework was discussed on enabling environment and technology innovation eco-system.

(e) *Senior policy makers develop National Strategy to Increase Affordability of Sustainable Energy Options through a consultative workshop from 15-16 May 2014, Vientiane, Lao PDR*. It was organized in cooperation with Department of Technology and Innovation (DTI), Ministry of Science and Technology (MOST), Vientiane, Lao People's Democratic Republic and attended by 39 international experts. The key findings of the assessment of national sustainable energy-enabling environment and technology innovation ecosystem of Lao People's Democratic Republic were discussed during the workshop.

(f) *Knowledge shared among the stakeholders of Indonesia, Lao PDR, Pacific Island countries and the Philippines on the Sustainable Energy Options*. UN-ESCAP organized the knowledge dissemination workshop in Bangkok, Thailand from 24-26 June 2014 participated by the stakeholders – project partners, policymakers from target countries and national experts - of all the three components of the project – Technology and Innovation Ecosystem (APCTT component), Pacific Regional Data Repository (PRDR) and Affordable and Resource Efficient Housing Concepts. The workshop facilitated discussions and peer exchange that enhanced comprehensive understanding and linkages among the three components of the project, assessed potential outcome of the project and possible impacts and identified potential areas of cooperation and actions for implementing the strategy papers.

5. With the availability of regular budget funds from the United Nations, in 2011 APCTT initiated a project titled, 'Promotion of a regional network among R&D institutions in the Asia-Pacific to strengthen their research and development (R&D) management capacity in new and emerging areas of technology.' This programme of work focused on strengthening capacity of researchers and research managers of member countries in the nanotechnology sector. A major objective was to create a regional network of R&D institutions working in the area of nanotechnology-based value-added product development. It was envisaged that, through this network, best practices could be shared and R&D management capacity could be built to promote collaboration in the area of nanotechnology-based value added product development to enhance the competitiveness of enterprises. Under the project, APCTT assisted member countries in strengthening R&D management capacity of relevant stakeholders through several activities during the reporting period:

***(a) R&D management capacity of nanotechnology stakeholders strengthened in Malaysia, Islamic Republic of Iran and the Philippines*:**

i. Malaysia: APCTT helped strengthen R&D management capacity of Malaysian nanotechnology stakeholders through delivering 'Nano Malaysia 2013 - Convention and Expo and National Workshop on Strengthening R&D Management Capacity of Researchers and Research Managers in the Area of Nanotechnology' in Malacca, Malaysia, during 10-13 December 2013.

ii. Islamic Republic of Iran: APCTT assisted in strengthening R&D management capacity of nanotechnology stakeholders of the Islamic Republic of Iran through servicing and delivering the 'Workshop on Strengthening R&D Management Capacity of Researchers and Research Managers in the Area of Nanotechnology', 25-26

February 2014, Tehran, Islamic Republic of Iran.

iii. Philippines: Various government and private sector agencies of the Philippines strengthened their understanding on critical aspects of nanotechnology R&D management through the 'Stakeholder Workshop on Critical Aspects of Nanotechnology R&D Management', 24-25 July 2014, Manila, the Philippines.

(b) Regional expert group meeting on nanotechnology facilitated:

In collaboration with the Technology Application and Promotion Institute, Department of Science and Technology, APCTT organized and facilitated an *Expert Group Meeting on Testing, Standardization and Certification of Nanomaterial and Nanoproducts, 23 July 2014, Manila, Philippines*. Twelve experts from nine member states (e.g. India, Indonesia, Islamic Republic of Iran, Malaysia, Pakistan, Philippines, Republic of Korea, Sri Lanka and Thailand) attended the EGM and shared country experiences and good practices in relation to testing and certification of nanomaterials and nanoproducts.

(c) Regional open innovation forum on nanotechnology and sustainable agriculture facilitated:

APCTT in cooperation with in cooperation with the National nanotechnology Directorate (NND), Ministry of Science Technology and Innovation (MOSTI), Malaysia organised the 'Regional Open Innovation Forum on Promoting Nanotechnology and Agriculture for Sustainable Development', 27-28 October 2014, Shah Alam, Malaysia. 11 Regional experts (from India, Indonesia, Japan, Malaysia, Philippines, Singapore, Sri Lanka and Thailand) and nearly 100 participants deliberated on how Open Innovation approach and practices could be used to deal with critical sustainable development issues through sharing of experiences and best practices, and promoting cross-country collaborations in technology development, commercialization and deployment especially in the nanotechnology and sustainable agriculture sectors.

(d) Assisted Malaysia to develop nano safety roadmap

In partnership with the National nanotechnology Directorate (NND), Ministry of Science Technology and Innovation (MOSTI), Malaysia, APCTT jointly organized a "National Workshop on Nano Safety and Regulatory Aspects of nanotechnology, *in Shah Alam, Malaysia on 29-30 October 2014*.

6. APCTT-ESCAP has been engaged in strengthening the technology transfer capacity of key stakeholders in member countries through a wide range of activities including, but not limited to, organizing Training of Trainers (ToT) programmes on planning and managing technology transfer projects; provision of technology transfer support services for SMEs and entrepreneurs through online as well as offline mechanisms; organizing business-to-business meetings in specific sectors in partnership with key nodal agencies in member countries; technology information services through information portals and technology publications; establishment of specialized technology transfer networks in specific sectors for enhancing cross-border technology-based business and/or research cooperation among member countries. Emphasis is currently being placed on supporting South-South Cooperation in new and emerging areas such as 'renewable energy' and 'nanotechnology's. APCTT is currently in the process of exploring a long-term solution for continuously upgrading the search engine and resolving technical issues related to hosting the search engine in a compatible and cost-effective hosting platform.

7. In addition to the web-based technology transfer services offered through www.technology 4sme.net, APCTT also provides support to SMEs through its networks of focal points and technology transfer intermediaries. When approached, APCTT offers search services to technology providers and

seekers especially by partnering with its focal points and technology transfer intermediary networks. Some specific examples of APCTT interventions to promote technology transfer partnerships include the following:

(a) Facilitated contacts between an Indian smallholder farmer association and a research institution based in Philippines for technology transfer related to coconut water microfiltration technology;

(b) Assisted a not-for-profit organization in Nepal in exploring cross-border partnerships for establishing community-based agro-enterprises;

(c) Assisted a Vietnamese SME to establish contact with an Indian consultancy firm to facilitate technology transfer related to Calcium Hypochlorite;

(d) Supported a Malaysian company in exploring cross-border partnerships for technology transfer related to Nanotechnology based manufacturing process for producing lubricant oils;

(e) Assisted an Indian consultancy firm in exploring technology-based business partnerships for a wide range of technologies with applications in energy and environment;

8. APCTT implemented a project during 2010-2012 entitled, 'Establishing an Institutional Cooperation Mechanism to Promote Renewable Energy' to support the ESCAP Commission resolution 64/3 of 30 April 2008 on promoting renewables for energy security and sustainable development in Asia and the Pacific. This project's objective is to support the development of an institutional cooperation mechanism focused on strengthening capacity of member countries to adopt multiple approaches to promote the utilization of renewable energy resources to meet their energy needs and foster sustainable development.

9. APCTT established a Cooperation mechanism named as Renewable Energy Cooperation-Network for the Asia Pacific (RECAP) to strengthen the capacity of participating member countries to implement projects related to renewable energy technologies through training, cooperation and promotion of partnerships amongst R&D institutions, universities, industries and other stakeholders in the region. The current membership of RECAP mechanism include 15 member states in the Asia Pacific region namely, Bangladesh, China, Fiji Islands, India, Indonesia, Islamic Republic of Iran, Malaysia, Mongolia, Nepal, Pakistan, Philippines, Republic of Korea, Sri Lanka, Thailand, Viet Nam. A Renewable Energy Technology Bank (RET-Bank) was also established as an on-line repository of information on tested and proven renewable energy technologies in the following renewable energy sectors: solar, biomass, wind, hydro power. As on date, the RET-Bank has about 60 renewable energy technologies with pro-poor applications ready for commercial transfer. Several country reports, guidebooks and resource assessment manuals related to renewable energy were developed by APCTT in four key renewable energy sectors namely, solar, biomass, wind and micro-hydro power were developed, for the benefit of renewable energy practitioners in the RECAP member countries with the involvement of renowned experts in the field. These knowledge products are disseminated through RECAP website (recap.apctt.org) for wider dissemination for the benefit of relevant stakeholders in the Asia-Pacific region.

10. As part of its efforts to facilitate regional cooperation among countries in the Asia Pacific region for promoting the use of renewable energy, APCTT organised an Expert Group Meeting (EGM) on 'Renewable Energy Resource Assessment for Countries in the Asia-Pacific Region' from 25-26 September 2014 in Bangkok in partnership with International Renewable Energy Agency (IRENA) and Ministry of Science and Technology, Royal Thai Government. The EGM provided a platform for brainstorming with international renewable energy

experts as well as key stakeholders on strategies for strengthening the existing capacities of member countries for identifying and assessing the potential renewable energy resources and to initiate efforts to fully realize the social, economic and environmental benefits associated with these resources. APCTT and IRENA brought together experts from internationally renowned renewable energy related organizations as well as representatives from RECAP member countries and other ESCAP members to participate in this EGM and prepared a roadmap for future initiatives to be undertaken for strengthening member country capacities to plan and undertake renewable energy resource assessments.

11. The Centre has also been co-implementing a EU funded project entitled, 'Network for Knowledge Transfer on Sustainable Agricultural Technologies and Improved Market Linkages in South and Southeast Asia (SATNET Asia)' in partnership with Centre for Alleviation of Poverty through Sustainable Agriculture (CAPSA)-ESCAP. During the reporting period, following activities were carried out under this project:

a) *National Training Programme on Cost-Benefit Analysis (CBA) of Agricultural Technologies' from 25-27 November 2013, Thimphu, Bhutan*: It was the first National Training Programme implemented by APCTT for the benefit of agricultural researchers and extensions workers in Bhutan in partnership with the Council for Renewable Natural Resources Research of Bhutan (CoRRB) of the Ministry of Agriculture and Forests in Bhutan.

b) *Stress-tolerant technologies: Using livelihood and productivity enhancing approaches for small holder farmers from 5-7 December 2013, Patna, India:* This workshop held in partnership with Catholic Relief Services (CRS), an international non-governmental organization focused on strengthening the capacity of relevant stakeholders on best practices related draught-tolerant and flood-tolerant varieties of cereal crops and their pre-harvest and post-harvest handling procedures.

c) *National Training Programme on Bio-Intensive Pest Management of Economically Important Agriculture Crops from 24-25 February 2014* and *National Training on Mass Scale Production of Biocontrol Agents and Establishing a Biocontrol Laboratory from 26-28 February 2014, Thimphu, Bhutan:* APCTT organised these two training programmes_in partnership with National Plant Protection Centre (NPPC) of the Ministry of Agriculture and Forest (MoAF) in Bhutan for helping Bhutan to achieve the targets set under Bhutan's Organic Agriculture Roadmap.

d) *National Training programme on Cost-Benefit Analysis of Agricultural Technologies from 3-4 March 2014, Kathmandu, Nepal:* This training programme_organized in collaboration with Nepal Agricultural Research Council (NARC) of the Ministry of Agriculture in Kathmandu from 3-4 March 2014 focused on imparting training to researchers, extension workers and government officials involved in planning and implementing technology transfer projects in agriculture sector in Nepal.

e) *National Training Programme on Biological Control of Agricultural Pests and Diseases from 5-7 March 2014, Kathmandu, Nepal:* This training programme organized in partnership with National Agricultural Research Council, Nepal focused on providing hands on training on biological control techniques and strategies for control of pests and diseases of agricultural crops in Nepal.

f) *National Training programme on Cost-Benefit Analysis of Agricultural Technologies*

from 17-18 March 2014, Islamabad, Pakistan: This training programme was organized in partnership with the Pakistan Agricultural Research Council (PARC) of the Ministry of National Food Security and Research (Pakistan) from 17-18 March 2014 in Islamabad, Pakistan.

g) *National Training Programme on Biological Control of Agricultural Pests and Diseases from 19-21 March 2014, Islamabad, Pakistan:* This training programme was organized in partnership with the Pakistan Agricultural Research Council (PARC) focused on integrated pest management practices and in particular, biological control approaches targeting control of insect pests and diseases of agricultural crops.

h) *National Training Programme on Best Practices in Integrated Nutrient Management and Organic Farming (Jeevatu Technology) from 23-25 April 2014, Kathmandu, Nepal:* This training programme organized in partnership with Nepalese Farming Institute (NFI) focused on knowledge sharing related to how integrated nutrient management and application of organic fertilizer named Jeevatu™ that comprise of naturally existing microorganisms is effective in helping agricultural productivity.

i) *National Training Programme on Food safety and Quality Assurance for Agricultural Trade Facilitation from 1-2 June 2014 in Dhaka, Bangladesh:* This training programme organized in partnership with Bangladesh Agricultural Research Council (BARC) of Ministry of Agriculture, Bangladesh focused on strengthening the capacity of SMEs in the food processing sector, as well as key value chain actors in Bangladesh on various procedures to ensure the food safety as well as quality of food products.

j) *National Training Programme on Biological Control of Agricultural Pests and Diseases from 3-5 June 2014, Dhaka, Bangladesh:* This training programme organized in partnership with Bangladesh Agricultural Research Council (BARC) focused on technologies and best practices related to eradication of agricultural pests and diseases that have a significant impact on the livelihoods of farmers and to the national economy as a whole in Bangladesh.

k) *National Training Programme on Post-harvest Technologies for Increasing Shelf Life of Agricultural Products from 18-21 June 2014, Pondicherry, India*: This training programme was organized in partnership with the Department of Food Science and Technology, Pondicherry University. The main focus of this training was to address the issues of post-harvest agricultural loss in India and to ensure the livelihoods of the smallholder farmers and small scale food-processing firms in the country.

l) *National Training Programme on Strengthening Market Linkages and Enhancing Trade Facilitation for Value Chain Actors in Small-Scale Food and Agro-Processing Sectors from 29-31 July 2014, Anand, India:* This training programme organised in partnership with Institute of Rural Management Anand (IRMA) in Anand, Gujarat was to broaden the understanding of the participants on various market linkage and trade facilitation mechanisms available for stakeholders in agro-food processing sector in India.

m) *National Programme on Bangladesh Agricultural Technology Innovation System - Opportunities and Challenges from September 2-3, 2014, Dhaka, Bangladesh:* This training programme organized in partnership with Bangladesh Agricultural

Research Council (BARC) focused on enhancing the understanding of the current agricultural technology innovation system in Bangladesh among the key actors of the innovation system (government policy makers, R&D institutions, academia and industries) and to provide specific recommendations for strengthening the agricultural innovation system in Bangladesh.

n) *South Asia Regional Training Programme on Postharvest Management and Market Linking for Vegetables and Fruits in South Asia from 26-28 November 2014, Hyderabad, India*: Postharvest losses negatively impact on the economic benefit derived from crop production. Reducing postharvest losses has far-reaching benefits. It improves incomes of farmers and marketers, makes diversification into high-value crop production less risky and more attractive, promotes value added activities and postharvest enterprises thereby creating rural employment and income generation opportunities, enhances productivity and competitiveness of vegetable industries, increases opportunities for export, and sustains economic growth.

12. To support the technology transfer efforts of SMEs in developing countries and more particularly, in least developed countries (LDCs), it is essential to strengthen their capacity to successfully handle the technology transfer process and develop skills ranging from business case preparation, technology sourcing, technology assessment, technology selection, technology pricing, drafting of license agreements, negotiation, contract finalization, implementation and impact assessment. Considering the large number of SMEs in the region, APCTT is currently embarking on a programme to develop trained personnel who can help SMEs to plan and implement technology transfer projects in a holistic manner. One approach to build up a critical mass of such experts in member countries is to develop trainers who can, in turn, develop others so that, through a multiplier effect, several trained personnel will become available to assist SMEs in planning and implementing technology transfer projects. Towards this objective, APCTT is planning to conduct 'training of trainers' programmes and, through the master trainers, empower member countries to independently continue TT capacity building efforts for SMEs in the Asia Pacific region. As part of this initiative, APCTT has developed a Training Manual on 'Planning and Implementing Technology Transfer Projects' which can be used to train trainers in member countries. The master trainers can then conduct further SME training programmes in their respective countries. The manual will also be disseminated through APCTT's website to enable wider dissemination and translation into local languages.

13. APCTT in partnership with Federation of Indian Export Organizations (FIEO) organized a workshop entitled, 'Workshop on Skills Development for Networking and Technology Transfer for Manufacturing Sector' on 13 January 2014 in New Delhi, India. The overall objective of this workshop was to strengthen the understanding of the participants of the workshop on the skills needed for and the importance of knowledge networking and technology transfer relevant for manufacturing sector. The workshop attracted 15 participants representing various SMEs from different regions of India. Some of the topics covered in this workshop were knowledge networks and open innovation, policy support mechanisms and instruments in selected countries for foreign technology acquisition, preparing a detailed business cooperation agreement, online resources and networks developed by APCTT for enhancing business cooperation and so on. APCTT also received a request from World Association for Small and Medium Enterprises (WASME) to organize a skill building programme on technology transfer for SMEs during an international energy related expo to be organized in Greater Noida, Uttar Pradesh, India during 2015.

14. APCTT also co-organized a Technology Transfer workshop in partnership with Human Life Advancement Foundation (HLAF), Malaysia on 9 June 2014. This workshop attracted the active participation of several participants including research scientists, technology intermediaries and representatives from SMEs in Malaysia. APCTT delivered hands on training on its online technology transfer platforms as well as presented case studies of successful as well as failed technology transfer projects. This workshop was well received by the participants and the local partner organization in Malaysia, HLAF made a request to APCTT to organize more capacity building programmes on this key topic in other developing countries as well, in partnership with HLAF. APCTT is currently considering this request and exploring the possibilities of establishing an institutional partnership with HLAF to jointly implement capacity building programmes for stakeholders in countries in the Asia Pacific region.

15. One of the key objectives of APCTT is to provide technology intelligence to help member states, their policymakers, institutions, academia, technology transfer intermediaries and SMEs to address the challenges of today's dynamic business and technological setting. Towards this endeavor, APCTT continued to publish e-periodicals, including the flagship *Asia-Pacific Tech Monitor* and *Value Added Technology Information Service (VATIS) Update* series on Biotechnology, Food Processing, Non-conventional energy, Ozone Layer protection and Waste management.

(a) *Asia-Pacific Tech Monitor*: The *Asia-Pacific Tech Monitor* features articles on technology trends and developments, technology policies, technology market, innovation management, technology transfer and new products and processes.

(b) *VATIS Updates*: Under the technology intelligence programme, APCTT published about 20 online issues (www.techmonitor.net) of *VATIS Updates* on five technology sectors.

16. As part of technology intelligence activities, APCTT carried out a combination of normative and analytical studies of regional relevance to identify trends highlight good policies and practices, and foster regional cooperation. During the reporting period, the following results were achieved under the normative and analytical work:

(a) National Assessment Framework on Enabling Environment, Technology Innovation Ecosystem for Making Sustainable Energy Options Affordable and Accessible (For Indonesia and Lao People's Democratic Republic).

(b) Report of the National Assessment of Sustainable Energy in Indonesia

(c) Indonesia National Sustainable Energy Strategy.

(d) Report of the National Assessment of Sustainable Energy in Lao People's Democratic Republic.

(e) Lao People's Democratic Republic National Sustainable Energy Strategy.

(f) Policy Brief on Regional Technology Transfer for Enhancing Food Security in the Asia Pacific Region.

17. APCTT continues to work towards strengthening cooperation with the least developed countries, landlocked developing countries and Pacific island developing countries:

(a) Through the capacity building programmes organized under SATNET Asia programme of work, APCTT trained over 300 participants from Countries with Special Needs such as Afghanistan, Bangladesh, Bhutan and Nepal.

(b) APCTT facilitated the participation of two participants from Afghanistan and Cambodia in the Expert Group Meeting (EGM) on

Renewable Energy Resource Assessment for Countries in the Asia-Pacific Region organised during 25-26 September 2014 in Bangkok in partnership with International Renewable Energy Agency (IRENA) and Ministry of Science and Technology, Royal Thai Government.

(c) APCTT established the first-ever local manufacturing facility for bio control agents at the National Plant Protection Centre (NPPC), Bhutan to assist the Bhutanese government to achieve the goals set under its Organic Agriculture Roadmap.

18. APCTT participated and made substantive contribution in various ESCAP programmes and activities during the reporting period:

(a) Identified and suggested names of experts (e.g. from India, Japan and Nepal) for the 'Regional Dialogue on technology facilitation for sustainable development' on 18 May 2014 in Pattaya, Thailand organized by ESCAP Sub-Regional Office for East and North-East Asia, Incheon, Republic of Korea.

(b) Participated in the (i) Regional Dialogue on technology facilitation for sustainable development' on 18 May 2014 in Pattaya, Thailand, organized by ESCAP Sub-Regional Office for East and North-East Asia, Incheon, Republic of Korea, and (ii) Asia-Pacific Regional Forum on Sustainable Development (regional preparatory meeting for the High-level Political Forum) on 19-21 May 2014 in Pattaya, Thailand which was hosted and organized by ESCAP and the Government of Thailand.

(c) Provided inputs on technology facilitation mechanisms for sustainable development in the draft Background paper for Regional Dialogue on Technology Facilitation for Sustainable Development, 18 May 2014, Pattaya, Thailand.

(d) Provided inputs on STI capacity building in the draft background document for the Asia Pacific Forum on Sustainable Development (APFSD) on 19-21 May 2014 in Pattaya, Thailand.

(e) Provided inputs in the draft briefing note on the ES talking points for HLPF regional sessions, namely (a) HLPF/ECOSOC Dialogue with Executive Secretaries of the Regional Commissions, 3rd July 2014, and (b) HLPF/ECOSOC Session on HLPF Ministerial Dialogue 'Weaving regional realities and regional priorities into the post-2015 development agenda, 7th July 2014.

(f) Provided summary inputs on APCTT's programmes and activities during the period 2013-2014 for (i) ESCAP annual Report, and (ii) 70th Commission Session of ESCAP.

(g) Provided inputs for ESCAP draft Programme budget implications (PBI) of the draft resolution on 'Promoting Sustainable Agricultural Development in Asia and the Pacific through Technology Transfer'.

(h) Developed the template and compiled detailed information for the Survey of Science, Technology and Innovation (STI) Experts and Institutions in Asia Pacific.

19. APCTT works with other United Nations agencies in India through various channels. During the past year, APCTT engaged with different UN agencies in India on a range of areas relevant to its work programme.

a) United Nations in India on its United Nations Development Assistance Framework (UNDAF) Under the United Nations in India on its United Nations Development Assistance Framework (UNDAF), APCTT is currently involved in the activities related to Outcome 6 'Government, industry and other relevant stakeholders actively promote a more

sustainable environment and enhanced resilience of communities in the face of challenges of Climate Change, Disaster Risk and natural resource depletion'. APCTT continued to share information on technologies, best practices and it's 'Guidebook of Technologies for Disaster Preparedness and Mitigation' with other UN Agencies.

b) During the reporting period, APCTT continued to serve as a member agency of the United Nations Disaster Management Team (UNDMT) in India which functions under the overall umbrella of the *United Nations Development Action Framework (*UNDAF). APCTT regularly participated in the UNDMT India meetings and provided inputs related to technology transfer aspects of disaster risk reduction (DRR) and shared information related to best practices in the region based on APCTT project outputs. As a UNDMT member agency, APCTT participated in the following meetings during the reporting period:

(i) 'Stakeholder Consultation on Post-2015 Framework for Disaster Risk Reduction' on 19 September 2014 in New Delhi, India jointly organized by the Ministry of Home Affairs (MHA), Government of India and UNDP India.

(ii) 'National Workshop on Uttarakhand Recovery Action: Sharing of Experience', 27 August 2014, New Delhi, India, which was jointly organized by the UNDMT-India and the National Centre for Good Governance, Government of India and the Centre for Disaster Management, Lal Bahadur Sastri National Academy of Administration, India as the knowledge partner.

(iii) Seminar on 'Building Disaster Resilient Structures', 17 January 2014, New Delhi, India, organized by the Times of India in collaboration with National Disaster Management Authority (NDMA), Government of India as strategic partner and the United Nations Development Programme (UNDP) as a knowledge partner.

(iv) On 6 January 2014, APCTT participated in the NDMA-UNDMT Meeting which discussed on the linkages between activities and plans of NDMA and UNDMT.

c). In April 2013, APCTT joined the Research and Knowledge Team (RKT) which has been established as one of the UNCT's Core Committees, to promote creation and sharing of knowledge and research by the United Nations entities active in the country. During 2014, APCTT continued to participate in the RKT meetings and shared outputs and experience related to normative and analytical works with other member agencies in India. During these engagements, APCTT shared its comments and suggestions on the RKT-led draft MDG report for India.

d) APCTT, as a member of the United Nations Communication Group (UNCG), India participated in the advocacy and inter-agency communication meetings organized by UNCG time to time and also contributed inputs to the following issues of UN Development Supplement (UNews) published by United Nations Information Centre for India and Bhutan:

UNews - January 2014, Theme: *The Future We Want*

UNews - May 2014, Theme: Vulnerable Communities

UNews- October 2014, Theme: Managing Climate Change

20. The Centre strengthened its continued partnerships in new areas and also developed new partnerships with key institutions in the Asia-Pacific region as listed below:

(a) In partnership with the Council for Renewable Natural Resources Research of Bhutan (CoRRB) of the Ministry of Agriculture and Forests, APCTT organised a National Training Programme on Cost-Benefit Analysis (CBA) of Agricultural Technologies in Thimphu, Bhutan during 25-27 November 2013.

(b) APCTT collaborated with Catholic Relief Services (CRS) to organise a National Training Programme on Stress-tolerant technologies: Using livelihood and productivity enhancing approaches for small holder farmers in Patna, India during 5-7 December 2013.

(c) In cooperation with and hosted by the National Nanotechnology Directorate (NND), Ministry of Science, Technology and Innovation (MOSTI), Malaysia, APCTT jointly organized and delivered Nano Malaysia 2013 - Convention and Expo and National Workshop on Strengthening R&D Management Capacity of Researchers and Research Managers in the Area of Nanotechnology in Malacca, Malaysia, during 10-13 December 2013.

(d) APCTT collaborated with Iranian Research Organization for Science and Technology (IROST) to organize and deliver the Workshop on Strengthening R&D Management Capacity of Researchers and Research Managers in the Area of Nanotechnology, 25-26 February 2014, Tehran, Islamic Republic of Iran.

(e) APCTT, in partnership with National Plant Protection Centre (NPPC) of the Ministry of Agriculture and Forest (MoAF), Bhutan organised two National Training Programmes namely, Bio-Intensive Pest Management of Economically Important Agriculture Crops from 24-25 February 2014; and National Training on Mass Scale Production of Biocontrol Agents and Establishing a Biocontrol Laboratory from 26-28 February 2014 in Thimphu, Bhutan.

(f) APCTT collaborated with the Nepal Agricultural Research Council (NARC) of the Ministry of Agriculture to organise two National Training programmes in Kathmandu, Nepal namely, Cost-Benefit Analysis of Agricultural Technologies from 3-4 March 2014 and National Training Programme on Biological Control of Agricultural Pests and Diseases from 5-7 March 2014.

(g) In partnership with the Pakistan Agricultural Research Council (PARC) of the Ministry of National Food Security and Research, Pakistan, APCTT organised two National Training programmes in Islamabad, Pakistan namely, Cost-Benefit Analysis of Agricultural Technologies from 17-18 March 2014; and National Training Programme on Biological Control of Agricultural Pests and Diseases from 19-21 March 2014.

(h) APCTT collaborated with Nepalese Farming Institute (NFI), Kathmandu to organise a National Training Programme on Best Practices in Integrated Nutrient Management and Organic Farming (Jeevatu Technology) in Kathmandu, Nepal during 23-25 April 2014.

(i) In partnership with Bangladesh Agricultural Research Council (BARC) of Ministry of Agriculture, Bangladesh, APCTT organised three National training programmes in Dhaka, Bangladesh namely, National Training Programme on Food safety and Quality Assurance for Agricultural Trade Facilitation from 1-2 June 2014; National Training Programme on Biological Control of Agricultural Pests and Diseases from 3-5 June 2014; and National Programme on

Bangladesh Agricultural Technology Innovation System - Opportunities and Challenges from September 2-3, 2014.

(j) In collaboration with the Department of Food Science and Technology, Pondicherry University, India, APCTT organised a National Training Programme on Post-harvest Technologies for Increasing Shelf Life of Agricultural Products in Pondicherry, India during 18-21 June 2014.

(k) APCTT, in partnership with Institute of Rural Management Anand (IRMA), India organised a National Training Programme on Strengthening Market Linkages and Enhancing Trade Facilitation for Value Chain Actors in Small-Scale Food and Agro-Processing Sectors in Anand, India during 29-31 July 2014.

(l) In partnership with the Technology Application and Promotion Institute, Department of Science and Technology (TAPI-DOST), Philippines, APCTT organized and serviced the Stakeholder Workshop on Critical Aspects of Nanotechnology R&D Management, 24-25 July 2014, Manila, Philippines.

(m) In collaboration with the Technology Application and Promotion Institute, Department of Science and Technology, APCTT organized and facilitated an Expert Group Meeting on Testing, Standardization and Certification of Nanomaterial and Nanoproducts, 23 July 2014, Manila, Philippines.

(n) APCTT in cooperation with in cooperation with the National Nanotechnology Directorate, Ministry of Science Technology and Innovation, Malaysia will organize and service a Regional Open Innovation Forum on Promoting Nanotechnology and Agriculture for Sustainable Development, 27-28 October 2014, Kuala Lumpur, Malaysia.

(o) APCTT partnered with prominent institutions to jointly publish two of the VATIS Update periodicals. VATIS (Ozone Layer Protection) was co-published with support from the Ozone Cell of the Ministry of Environment and Forests of the Government of India. VATIS (Biotechnology) was also co-published with the Biotech Consortium India Limited (BCIL), a Government of India undertaking.

(p) In partnership with International Renewable Energy Agency (IRENA) and the Ministry of Science and Technology, Royal Thai Government with APCTT organised an Expert Group Meeting (EGM) on Renewable Energy Resource Assessment for Countries in the Asia-Pacific Region' from 25-26 September 2014 in Bangkok, Thailand.

(q) In partnership with the National Nanotechnology Directorate, Ministry of Science Technology and Innovation, Malaysia, APCTT jointly organised a Nano Safety Workshop, in Kuala Lumpur, Malaysia on 29-30 October 2014.

(r) In partnership with the Human Life Advancement Foundation (HLAF) APCTT co-organized a Technology Transfer workshop in Kuala Lumpur, Malaysia on 9 June 201.

(s) In partnership with the China Association of Inventions (CAI) APCTT will co-organise a Consultative Meeting with Chinese Inventors and Technology Stakeholders on Technology Facilitation for Sustainable Development in Kunshan, China on 20 November 2014. CAI is hosting the tenth session of APCTT's Technical Committee in parallel with its International Exhibition of Inventions 2014.

(t) APCTT, in collaboration with the World Vegetable Centre (AVRDC)- South Asia will be organising a Regional Training Programme on Postharvest Management and Market Linking for Vegetables and Fruits in South Asia in Hyderabad, India during 26-28 November 2014.

21. The Centre works closely with the Business and Development Section of Trade and Investment Division (TID) of UNESCAP due to the emphasis placed by this section on the development of small and medium enterprises. In accordance with ESCAP embarking on a "Programmatic Approach" for the development of the programme of work for the biennium 2012-2013, APCTT worked closely with TID in developing the Capacity Development Project Document to ensure greater synergy and more effective backstopping support.

22. The Human Resources Management Section (HRMS) of UNESCAP organized several training programmes for APCTT staff during the reporting period:

(a) As part of the HRMS/Learning Team, APCTT's designated Learning Coordinator (LC) participated and shared the Centre's training in the regular LCs' meetings organized by HRMS delivered via Video Teleconference (VTC) from time to time.

(b) APCTT staff participated in the PPD organized Resource mobilization and Project Management workshop in APCTT premises in New Delhi in July this year. The workshop led to an enhanced understanding of resources available within the UN system i.e. Section 23 and UNDA funds which could be targeted for resource mobilization.

(c) APCTT staff attended the HRMS-organized WebEx-based 'United Nations Project Management Skills Workshop Virtual Course' on 14-16 July 2014.

(d) One APCTT staff participated in the advanced project management workshop held in ESCAP, Bangkok from 16-18 June 2014.

(e) APCTT staff participated in the HRMS-organized WebEx-based "Client Service Skills" training course on 9-10 October, 2014.

(f) APCTT staff participated in the ESCAP-organized *Integration of the Three Dimensions of Sustainable Development Training* on 6-7 November 2014, Bangkok, Thailand

23. The Centre is placing a renewed focus on the use of ICT tools to assist in increasing the impact and reach of its program delivery efforts. The completed initiatives from 2014 under its Digital Strategy include:

- redevelopment of the APCTT website www.apctt.org to modernise its layout and update the content;
- development of new digital communications channels for APCTT using Twitter (twitter.com/UNAPCTT) and Facebook (facebook.com/UNAPCTT) to provide a wider audience with regular updates on the activities of the Centre; and
- the digital knowledge centre project – e-archiving APCTT's past publications.

24. APCTT is continuing to evolve the Digital Strategy with a planned website consolidation and updating program planned for 2015. The many subsidiary websites operated by APCTT will be consolidated under the main institutional website and content will be merged and updated. Out of date websites will be archived. This will create a one stop shop for all information and knowledge products, reducing confusion, making content more easily accessible and will raise the profile and visibility of APCTT's brand.

25. In keeping with broader UN goals to reduce the environmental impact of its operations, APCTT began an initiative to measure its emissions of greenhouse gases. Work was done in 2014 to reduce carbon footprint. Opportunities to reduce the carbon footprint and save operational costs identified in 2013 have been explored and evaluated. Based on this, APCTT is proceeding with a feasibility study of installing a solar photovoltaic generating system on the APCTT premises to generate renewable energy on site. A solar power company has completed a survey of APCTT's roof space and advised that a 20 to 30 kW solar power system is feasible. If implemented this would reduce emissions by up to 45 tons per annum and reduce electricity costs by up to $6000 per annum. DSIR has agreed to contact CPWD to undertake a cost estimate for the same. To address emissions from air travel, APCTT has established a dedicated videoconferencing facility in its office to enable remote participation in international events where this is possible.

Further efforts will be made to further reduce the Centre's carbon footprint by the next reporting period.

APCTT Technical Committee and Governing Council Meetings:

The Tenth Meeting of the Technical Committee of APCTT was held from 19-20 November, 2014 in Kunshan, China and the 10th Session of the Governing Council of APCTT was held on 27 November, 2014 in Colombo, Sri Lanka.

D: Information Technology and E-Governance.

1. INTRODUCTION

Information Technology and e-Governance (IT-eG) group was formed during mid of the 10th Plan period in order to create an IT enabled work environment in the Department through accelerated usage of various Information Technology opportunities. Primarily aims to convert the existing procedures and processes into *citizen centered*, IT-eG division implements e-Governance in the Department progressively that needs be in conformance to the National eGovernance Action Plan. For the implementation of an IT Action Plan IT-eG Division operates on a separate IT Budget Head that came into effect in DSIR since FY 2004-05.

2. IT ACTION PLAN

For IT and e-Governance activities a comprehensive IT-Action Plan in the department as formulated in line with the Government directions issued during Tenth Plan remains

- *Infrastructure Development:* Provide and maintain Personal Computers (PCs) and other essential IT- equipment and software to all the functionaries.
- *Networking:* Up gradation, extension and maintenance of the Local Area Network (LAN).
- *Office Automation:* Implement various applications software that not only maintain records of receipt, issue of letters and movement of files but also offer enhancement in accountability, responsiveness and transparency in governance.
- *IT Training:* Provide relevant training courses to the officers/ staff that enable them to work on computers by using application software developed.
- *e-Reports*: Convert the Acts, Rules, Circulars and other published materials of interest or relevance to the public, in the electronic form.
- *Website*: Enrich the contents of the DSIR website by including downloadable forms and guidelines relevant to various citizen services that Department provides.

- *IntraDSIR*: Enrich the contents of the IntraDSIR by including downloadable forms and circulars relevant to employees of the Department.

3. AUTOMATION OF DSIR OPERATIONS

DSIR essentially focuses on enabling Indian industry to reach state-of-the-art innovation excellence and competitiveness through research & technological interventions.

Design, Development, Implementation of Enterprise Application and Maintenance Support Services

Information Technology and e-Governance (IT-eG) group within DSIR has got it developed and implemented an IT enabled work environment and Enterprise Resource Planning (ERP) application to automate all the operations of DSIR and link it to providing online services to the Industries and relevant stakeholders. Incidental benefits include reduction of costs / efforts in seeking and obtaining information and services and minimization of administrative overheads.

The purpose of ERP application is to evolve a highly productive and user-friendly workplace that offers the effective C2G & G2C services, ensuring minimized overheads and prompt information availability while adhering to Government of India Rules, Regulations and Policies.

Automating all the activities of grants-in aid Scheme of DSIR so as to operate it under an effective work culture, minimize overheads in various processes and facilitate in information dissemination as well as reproduction in a desired form through (i) System Study, (ii) Analysis, (iii) Application of thought, knowledge, concepts, applications and Experiences / expertise (iv) Validation of proposed approaches and (v) Suggesting innovative designs, strategies, approaches, methods, tools, policies etc to guarantee successful implementation

Specific innovative ideas implemented in ERP and their impact on services has been:

- The ERP Solution encompasses On-line submission of applications by industries, SIROs & PFRIs in web-enabled form in alignment with the schemes, programs implemented and as per prescribed business processes, business rules, requirements and guidelines as disseminated & made available on DSIR Website in secure mode.
- On-line processing of applications within DSIR involving stakeholder/industry.
- Provision of entering legacy data into the system.
- Analytics and Decision Support to discern performance gaps and develop appropriate action plans for industry engagement.
- Design Description, SRS, User Documentation, Quality Assurance and various reports as per the IEEE Standards for the purpose of maintenance & management, trouble shooting, compliance with protocols and standard operation procedures.
- The applicant has the flexibility of knowing the status of his application, making the process of scrutiny, decision making more transparent and making the Officers more accountable for performances and results.
- The outcome/decision made is automatically generated from the ERP solution and communications are auto-dispatched as emails avoiding word processing, communication delays etc.
- Electronic transfer of funds to the applicant is made upon approval and sanction.

- Online Analytics and Dashboards indicate information such as quarterly progress reports from the applicants, conveying acceptance of the reports by the competent authority, on-line status updates to the applicant.

- ERP Software ensures that the data once captured is not re-entered. Also data gets validated during entry.

- Required hardware and ICT Infrastructure is IPv6 Compliant.

3.1 Enterprise Integration, Program Implementation and e-Service Delivery

A user friendly online application form submission for recognition and renewal to In-House R&D, SIRO, PFRI and Fiscal Incentives to Industry for Submission of report in FORM 3CK, generation of 3CM certificate & submission of yearly returns in the Form 3CL has been developed. User friendly and time efficient backend application approval process has been developed. The workflow for each scheme has been configured as per the hierarchy in the department.

System for on-line submission of application in web-enabled form as per the prescribed application format under PACE Program has been developed for technology providers and seekers along with submission of proposals under Technology Development and Demonstraion. Time efficient backend application approval process has also been developed.

System for on-line submission of application in web-enabled form as per the prescribed application format under PRISM Program has been developed along with backend application approval and workflow for grant release.

System for on-line submission of application in web-enabled form as per the prescribed application format under Grant-in-Aid Support to Autonoumous Bodies, Public Sector Enterprises and APCTT has been developed along with backend application approval and workflow for grant release.

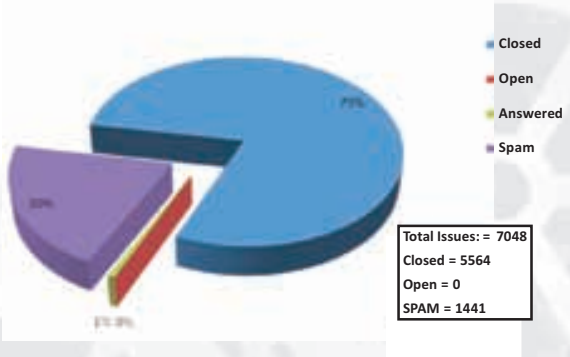
The application has provision of entering legacy data into the system.

In addition to several technical reports, various directories of RDI, SIRO and PFRI; along with departments Annual Reports of the years 1991-2013 are accessible to the citizen. Scientists of department can access analytics, business reports, dynamics and dashboards of various schemes and link it with business output and decision support.

A platform is designed for continuous tracking of issues across users. The usage of the system can be monitored through logs, system reports and electronic traces across transactions.

System for on-line submission of application in web-enabled form as per the prescribed application format under Grant-in-Aid Support to Autonoumous Bodies, Public Sector Enterprises and APCTT has

Open vs Closed Issues upto 29th Dec 2014



been developed along with backend application approval and workflow for grant release.

3.2 Office Automation Solution, Workflow Management, Record Management, and Data Warehousing

Scope of ERP include various modules such as Office Automation Solution, Workflow

Management, Record Management, Data Warehousing and additional modules such as HR Management and processes, Store and Purchase, Planning, Budget and Audit, revamping of existing website bilingual, m-governance compliance, RFID implementation in record room. For achieving these objectives, value added through Document Management and Business Process management solution designed, developed and tested to suit and adequately addresses the requirements within any Government environment.

For harmonization of physical and online file processing RFID tagging (long range type having intelligent chip and antenna) has been implemented. RFID tag is being attached on every file/record stored in record room. RFID Number will be auto generated and will be mapped with the File Number by the Record Room In charge manually.

The progress made under ERP project is being reviewed and monitored through regular meetings. Training to the Users along with Hand-hold sessions has been regularly conducted by the consultant.

An online application form has been designed and implemented in DSIR against the advertisement of recruitment for the posts of Scientists.

3.3 DSIR Website

The DSIR Website has been made compliant to the Guildelines for Indian Government of Websites (GIGW). The website has been regularly updated. The users when they log in to the ERP Portal, are presented with a customized adaptive landing page and electronic desktop with links related to tasks to be performed by them. The Graphical User Interface (GUI) of this re-designed website is user-friendly and rich in appearance since uses superior graphics, self-explanatory, promptly guiding the user to different sections, offer appropriate navigation assistance to user in the form of tooltips, messages, images etc. wherever required / applicable. The user can switch between different themes / color schemes, and choose the font-size out of a number of pre-

defined sizes as per their convenience. Once fully developed it would be compliant to Standards & Guidelines namely as (1) UUU Trilogy – Usable, User Centric, and Universally Accessible (2) Guidelines for Indian Government Websites (GIGW) issued by the Government of India and offer an easy-to-understand navigation and would be bilingual - supporting English and Hindi languages. This newly designed website has been visited 945619 times.

3. 4 IntraDSIR (An electronic Workdesk)

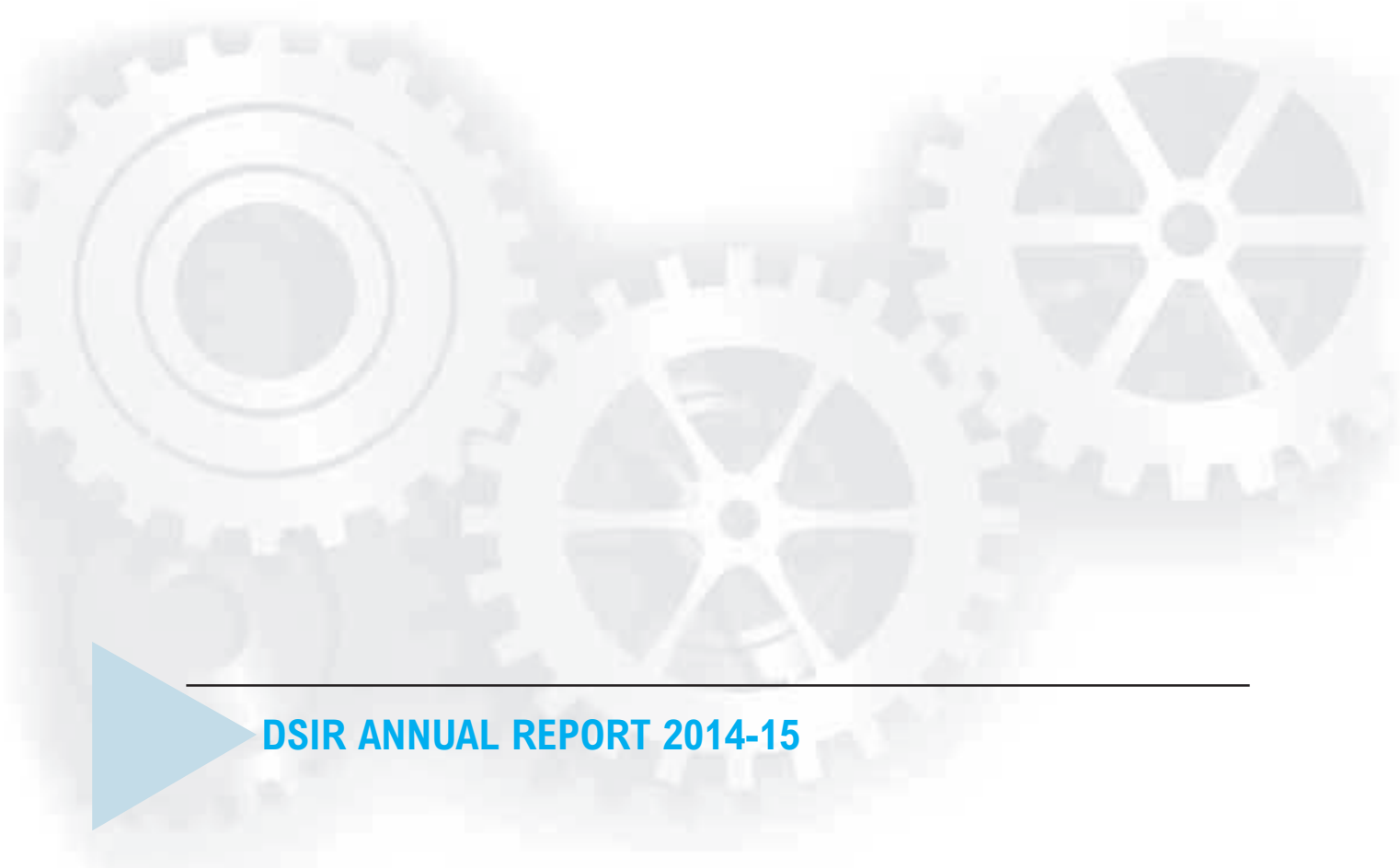
IntraDSIR (An electronic Workdesk) has been created, wherein all the employees of DSIR can accss through a username and password to communicate with each other as well as the electronic workdesk of all the employees of DSIR. An employee can perform activities assigned to him/her. An employee has the facility of switching the roles (if s/he has multiple roles) and performs the tasks which appear in the in-tray and all the completed tasks are shown in his the out-tray. The employee has online access to he Employee Self services such as Medical Claim, LTC, Leave, GPF, ACR information etc.

3.5 Skoch Order-of-merit Award

DSIR got the Skoch Order-of-merit Award to DSIR for Newgen's eGov Suite during 37th Skoch Summit

on September 19, 2014 at New Delhi. Other recipients of awards include NIC (for various projects), Gujarat, Maharashtra State Government departments and other organizations.

V Patent Acquisition and Collaborative Research and Technology Development (PACE)



DSIR ANNUAL REPORT 2014-15

Patent Acquisition and Collaborative Research and Technology Development (PACE)

1. PREAMBLE

The scheme Patent Acquisition and Collaborative Research and Technology Development (PACE) aims at facilitating acquisition of early stage technologies from academic and research institutions, including industry and other sources in India and abroad by Indian industries on an exclusive or a non-excusive basis with a view to manufacture "Made in India" products. The scheme also aims at supporting up-scaling of a lab-scale technology for development and demonstration of innovative products and processes that can be commercialized. Support is provided for proposals which give clear evidence of existence of proof-of-concept and aim at developing an innovative content for fulfilling an unmet need. Development and demonstration of technologies can be undertaken by industries alone (including in-house R&D centres of the industry recognized by DSIR) or in collaboration with Universities, Public Funded Research Institutions or academic institutions in India or abroad. The technology development projects supported under the scheme aim at development of a new product or a process with attractive market potential which will result in significant benefits to the industry concerned in terms of raising its technological level, turnover, energy and material savings/recovery, export sales etc. Focus sectors include (i) Energy & Environment, (ii) Affordable healthcare including Drugs & Pharmaceuticals and Medical Equipment & Devices (iii) Agriculture, food & nutrition, (iv) Engineering (auto-components, machine tools & foundry), (v) Specialty Chemicals etc.

2. OBJECTIVES

The objectives of the scheme are:

- To facilitate Indian industries to acquire patented technology at an early stage from within the country or overseas on an exclusive as well as non-exclusive basis, add value to the acquired technology for exploitation in Indian/foreign markets and develop "Made in India" innovative and socially relevant products for public consumption in India and abroad;
- To encourage and accelerate development and demonstration of indigenous product / process technologies by in-house R&D centres of the industry for commercialization;
- To create enabling environment for collaborative research between Indian Industry and R&D organizations/ academic institutions/ universities in India or abroad and formulate collaborative projects for development and demonstration of lab scale technologies aimed at commercialization of new products and processes;

- To develop a dynamic database on existing expertise and IPs available in the R&D organizations/ academic institutions/ universities in India or abroad to facilitate PPP and tie-ups with Indian industry for collaborative projects.

3. PROJECTS/ACTIVITIES DURING 2014-15

Details of important projects/activities that were completed or were in progress during the year under report are given below:

3.1 Facilitating Technology Acquisition

Following up from the workshops organized during 2013-14, 1st Meeting of the Patent Valuation Committee (PVC) for "Patent Acquisition and Collaborative Research and Technology Development (PACE) Scheme" was held on 15th April, 2014. A total of 579 organisations participated in the 4 Workshops organized by CII at Pune, Coimbatore, Ahmedabad and Bangalore. Out of the 579 participants, 385 were from industry, 124 from Research Institutes, Academics Institutes and Universities, 37 from Industry Associations and 33 from Central & State Govt. organizations. A total of 381 organizations participated in the 4 Workshops organized by Foundation for MSME Clusters at Hyderabad, Ludhiana, Kolkata and Jaipur. Out of these, 58% were from industry, 28% were individual Patent Holders, 5% were from Industry Associations, 4% from Govt. Technical Institutes, 3% from Private Technical Institutes and 2% from various Ministries and Govt. Departments. The outcome of the Workshops suggested that industries are interested in technological solution to their problems rather than having access to a technological know-how. It was agreed that DSIR will not only focus on acquisition of patent (primarily implying know-how), but also acquisition/licensing of technology covered by a patent. Outcome of the Workshops and the sectors of interest to the industries in which they are interested to acquire patents/ technologiesinclude: instrumentation (eg. sensors, measuring instruments, pollution control equipment, compressors, power saving devices etc), medical devices, pharmaceutical (new drug delivery mechanisms), chemicals & materials (eg. Coating, fluorescent ink etc), effluent treatment for leather and textile industries, sports goods (application of composites), welding, controlled blasting techniques for rocks/mines etc. It was agreed that DSIR needs to identify agencies/facilitating organizations, who may be assigned the task of interacting with the SMEs in clusters of identified areas, and come up with need assessment of patents and technologies in a time bound fashion.

Further, a meeting was held on 15th October, 2014 regarding engagement of intermediary agencies for scouting of SMEs and patented technologies for acquisition and transfer to SMEs. A mechanism to scout for SMEs and technologies was proposed. It was suggested to select 10 intermediary agencies by inviting proposals from prospective agencies, deploying them in different SME clusters simultaneously so that they can come out with 10 sets of SMEs and 10 sets of corresponding patented technologies of interest to the SMEs. It was recognized that the process is complex since it involves technology valuation on the one hand and on the other, if a single SME shows interest in a technology to be acquired, it may be very difficult for the single SME to pay for the cost of acquired technology. Thus, the aim should be to identify at least two or three SMEs interested in one technology (or its different applications) so the acquisition cost of the technology is shared between the two or three SMEs. It was proposed that a pilot may be attempted in the first place, involving CSIR-URDIP. CSIR-URDIP may identify certain technologies in select focus areas that could be infused in SMEs, list/ identify patents around those technologies, carry out patent valuation and identify SMEs who will be ready to acquire/implement the identified patented technologies.

Efforts were also made to engage MSME-DIs in the process of scouting for SMEs and technologies. In

this connection, a meeting was held with DC-MSME. CSIR technology database of 642 products was mapped with MSME Development Institutes, Districts and Clusters to explore the interest of MSMEs in CSIR technologies.

3.2 Technology Development and Demonstration

The following six proposals were approved and Agreements signed till December, 2014.

(i) Technology up gradation of pelletization facility for herbal veterinary feed supplements: Demonstration in terms of value addition to produce quality supplements at low cost - Natural Remedies Pvt. Ltd., Bengaluru

M/s Natural Remedies Pvt. Ltd., Bangalore have undertaken to demonstrate a steam based pelletization facility using semi-automated equipment and improved pelletization machine for herbs & herbal powders to produce improved quality veterinary feed supplements with reduced microbial load and in the process reduce electricity consumption and wastage of biomass for the three products viz. *Zigbir* (hepatoprotective – it helps in optimizing growth, weight gain, feed conservation ratio (FCR) and livability in poultry), *Natchol* (Choline replacer – it is a natural choline supplement that helps in mobilization of liver fat) and *Phytocee* (Vitamin C and electrolytes supplier – it is a natural Vitamin C source which helps in reducing free radical formation induced lipid peroxidation). Animal healthcare has far reaching implications. Effective and comprehensive animal healthcare is expensive which is currently in practice in most western developed nations. The side effects of synthetic drugs such as presence of antibiotic residues leading to antibiotic resistance in humans, toxic metabolites remaining in meat and bio-products are a matter of concern in long term usage of synthetic products. Besides, this healthcare is unaffordable to most of the Indian livestock owners. Thus traditional herbal medicines in veterinary practice have great potential as an alternative therapy. Production of clean feed supplements for the benefit of livestock, such as Poultry, aqua ruminants, small ruminants, etc. is essential for not only to protect the animal but also to human's health who are end consumers as meat, egg and milk to meet their nutrient requirements. Therefore, production of microbe-free feed supplements using improved technologies is required for the benefit the society. The project has been supported by DSIR with a soft loan support of Rs. 200.0 Lakhs out of a total project cost of Rs. 599.30 Lakhs.

(ii) Development of Genetically Engineered Cellulose-free Alkaline Xylanase through submerged fermentation process (SMF) - Kaypeeyes Biotech Pvt. Ltd., Mysore

M/s. Kaypeeyes Biotech Pvt. Ltd., Mysore has already purchased *Bacillus pumilus* culture from RRL, Trivandrum which was producing Cellulase free Xylanase in a laboratory level. This culture was upgraded by company in their laboratory for pilot level production of xylanase and the yield was very good. They characterized the kinetics and developed 2 products viz. Chlorzyme – AX (Xylanase for bio-bleaching of paper pulp) and Recyclase – X1 (for use in Bio-refinery). These 2 products were evaluated by CPPRI, Saharanpur and found suitable for paper industry use. The company then commercialized the above products, but the yield of the products were inconsistent through Solid State fermentation (SSF) method. Also bulk production of products in SSF in wheat bran media had difficulties/ problems in fermentation parameters, downstream processing and reduced storage stability. Therefore the company took the route of recombination of gene viz. *Bacillus pumilus* in *Pichia pastoris*. *Pichia pastoris* is a well studied host used in the production of recombinant enzymes world over and being methyl tropic in nature can produce large quantity of enzyme. They plan to develop, validate and produce recombinant Cellulase - free alkaline Xylanase for application in paper and pulp industries. The project has been supported by DSIR with a soft loan support of Rs. 206.0 Lakhs out of a total project cost of Rs. 468.00 Lakhs.

(iii) Design, Manufacturing, Proving, Supply of Three Roller Flow Forming Machine - Paras Flowform Engineering Ltd., Mumbai

M/s. Paras Flowform Engineering Ltd., Mumbai took up design and manufacturing of 3 Roller CNC Flow-forming machines with advance controls after successful in-house refurbishment of 3 roller Flow-forming machine (procured as scrap) from overseas in the year 2010. The same machine is presently running successfully in their plant & producing Pinaka Motor Tubes, Components for RGB-12, RGB-60, Titanium Tubes & many more. The company's two decade experience in machine building & highly motivated in-house competent machine building team and their management decided to take a challenge of Design & Manufacturing the Flow-forming machine first time in INDIA. The proof of concept has already been finalized in collaboration with IIT, Mumbai & ARDE-DRDO, Pune. They have state of the art manufacturing facilities with highly competent and qualified team which is self sufficient in manufacturing & building the machine. They have tied up with IIT, Mumbai and ARDE, Pune for up-scaling in the areas like Design, Electronics before commercialization. The innovation lies in carrying out the mechanical fabrication maintaining the roundness, concentricity & straightness of the tubes with high precision. The project has been supported by DSIR with a soft loan support of Rs. 500.0 Lakhs out of a total project cost of Rs. 1900.00 Lakhs.

(iv) To manufacture Magnesium Hydroxide from Dolomite mineral and Calcium Nitrate as by product - Rudraksha Allied Chemicals Pvt Ltd., Nagpur

M/s. Rudraksha Allied Chemical Pvt. Ltd., Nagpur have undertaken to demonstrate the manufacture Magnesium Hydroxide from Dolomite mineral at a pilot plant, having specifications same as commercially available pharmaceutical grade from sea water source, but with a lower cost and Calcium Nitrate as a byproduct. Dolomite has never been used to manufacture Calcium and Magnesium compounds separately and Pharmaceutical grade MHD from dolomite will be first time in the country. The processes and technology for Magnesium largely depends on the availability of raw material. The most abundant source of mineral form is Magnesite (MgCO3). The current Indian deposits have limitation of purity ranging only upto 80-85% MgO. Magnesium carbonate occurs along with Calcium carbonate in Dolomite (CaCO3.MgCO3). Commercially viable values of Mg and Ca cannot be realized by existing technologies. Sea water brine is the biggest source of Magnesium element when high purity is desired, up to 98-99%. On the other hand Dolomite (CaCO3.MgCO3) is abundantly available and least costly mineral in various parts of India. The cost of MgO source from dolomite is one fifth of source from Magnesite and the comparative cost of MHD from dolomite source can be 33% lower than sea water source. The project has been supported by DSIR with a soft loan support of Rs. 66.50 Lakhs out of a total project cost of Rs. 170.80 Lakhs.

(v) Macroalgal Biorefinery for CO_2 Sequestration and Production of Biofuel and Value-Added Compounds - AquAgri Processing Pvt. Ltd., New Delhi & DBT-ICT Centre for Energy Biosciences & CSIR- CSMSRI, Bhavnagar

M/s AquAgri Processing Pvt. Ltd., New Delhi in collaboration with DBT-ICT Centre for Energy Biosciences, Institute of Chemical Technology (ICT), Mumbai and CSIR- Central Salt & Marine Chemicals Research Institute, Bhavnagar (CSIR-CSMCRI) have undertaken to demonstrate at a reasonable scale the concept of sequestration of CO_2 through large scale controlled growth of macroalgal species in closed bioreactors using waste CO_2 generated by power plants or other industries, and making the technology sustainable through conversion of the grown macroalgal biomass to bioenergy and other value-added products. Globally the dry sea plants are used to manufacture hydrocolloids and these have a wide application as food ingredients, cosmetics and toiletry industry.

Aqua Sap derived from the fresh living Algal plants is a plant nutrient, which contains substantial amounts of micro and macronutrients, naturally occurring Plant Growth Regulators (PGRs) and amino acids. The PGR's such as Auxins, Cytokinins and Gibberellins, accelerate the metabolic function of the plant there by boosting yield and productivity. The concept of a Multi-Product Macroalgal Refinery using Modular Photobioreactors for CO_2 Capture and Growth of Ulva in Vertical Reactors Glass Sections on MS structure to demonstrate efficient CO_2 sequestration through high biomass productivities of Ulva coupled with downstream processing technologies for biomass deconstruction and separation of value-added products i.e. proteins and Sap and validation of entire technology for economic sustainability is an innovative concept. This project has been supported by DSIR with a soft loan support of Rs. 225.00 Lakhs to M/s AquAgri Processing Pvt. Ltd., New Delhi and grant support of Rs. 85.00 Lakhs to ICT and Rs. 45.00 Lakhs to CSIR-CSMCRI out of a total project cost of Rs. 580.00 Lakhs.

(vi) Chitosan Based Drug Delivery system for Dental and Oral Diseases - ICPA Health Products Ltd., Ankleshwar & Govt. College of Pharmacy, Amravati

M/s. ICPA Health Products Ltd., Ankleshwar proposes to scale-up production of chitosan films from lab scale (400 units/ batch/day) to pilot scale (20,000 units/ batch/day). They intend to complete successfully pilot batches and target at 200000 patches/ batch/day to cater the market demand. The company has signed MOU with Collaborator Govt. College of Pharmacy, Amravati on various chitosan based technologies. Govt. College of Pharmacy, Amaravati has developed chitosan based thin film at lab-scale wherein manually film patches are casted. They have been producing 75 pieces/ films in 4 hours costing Rs. 6.50 lakhs manually. The project has been supported by DSIR with a soft loan support of Rs. 72 Lakhs to M/s. ICPA Health Products Ltd and a grant of Rs. 72 lakh to Govt. College of Pharmacy, Amravati out of a total project cost of Rs. 260.00 Lakhs.

3.2.2 The following five proposals, recommended by the TAC were at various stages of approval as on 31st December, 2014.

(i) Development of Portable Power Supply (Desktop Model) using Lithium Ion battery - D-Espat Pvt. Ltd., Chennai

M/s d-ESPAT Pvt. Ltd, Chennai have undertaken to design, develop and pilot quantity manufacture of a high quality (Light weight, High energy density) Modular portable power supply with output Range: 600W to 1000W and operation time capability of 2/ 3 hours up to 6 hours" using high capacity Li-ion Battery with AC/DC charging including Solar Input. The Portable Power Supply shall have features like; capable of re-charging quickly in 2-3 hours, modular design with facility to plug and play depending on operation time requirement, option for output as AC, DC or Dual output (AC & DC) applicable to all AC, DC portable equipment, light weight and easy to carry, portable, single chip microcomputer control, LCD display, LED indicator, output control, easy switching, ergonomic design, independent of the sleep function, not more than 2 minutes automatic shutdown and efficient in conservation of energy, high current output with multiple charge modes i.e. AC charging or solar charger. Using gadgets on the move need a portable power source to work unplugged. This has created a huge platform for R&D in batteries and portable power storage devices. Packing more power in a small area is a key requirement in every consumer product today. Li-ion battery packs are much lighter and smaller than other battery chemistries, making them highly suitable for LED lighting and UPS backup applications. The concept of using Lithium ion/ polymer battery in medium sized invertors/UPS or other forms of power supply for commercial / industrial or residential use is relatively new in India. Given the constraints of Indian grid power situation, varied climate conditions & power availability situations in the city and sub-urban areas, the

proposed product provides a huge opportunity for storage, recovery and use of electrical power for critical systems like computers, lighting, cooling needs, communication and other business needs. The project has been recommended by the Technical Advisory Committee and was being processed for approval and support.

(ii) Development of Controller Release [CR] Formulation of Natural Highly-Purified Human Chorionic Gonadotropin [hCG] - Sanzyme Ltd. Hyderabad & ICT Mumbai

Sanzyme Ltd., Hyderabad in collaboration with Department of Pharmaceutical Sciences & Tech., Institute of Chemical Technology, Mumbai had submitted a project proposal "Development of Controlled Release [CR] Formulation of Natural Highly - Purified Human Chorionic Gonadotropin[hCG] for possible support under PACE-TDD scheme. 99% pure hCG is used as a surrogate for LH [Lutenising Hormone] for triggering ovulation and maintenance of pregnancy. However recent developments, have shown that the role of hCG is not restricted to infertility treatment alone but has wider applications in the field of metabolic disorders such as Diabetes and other clinical conditions where hCG is being used for a process known as angiognessis in the fields of vascular surgery and CNS surgery. Currently two forms or variants of hCG are available either as highly purified form or the recombinant version of hCG. Despite recombinant being available, only a single dosage form is available for clinical use. The project aims to improve compliance and reduce the frequency of injections and make the treatment more affordable and available to masses rather than class alone. The CR- release formulation using nano technology with release rates of either 15 or 30 days will reduce the frequency of injections required in infertility problems, maintenance of pregnancy and metabolic disorders such as Diabetes. The project has been recommended by the Technical Advisory Committee and was being processed for approval and support.

(iii) Cold plasma based technology development for green ammonia/urea production - Nagarjuna Fertilizers and Chemicals Limited, Hyderabad

Nagarjuna Fertilizers and Chemicals Limited, Hyderabad had submitted a project proposal "Cold Plasma based Technology Development for Green Ammonia / Urea Production" for possible support under PACE-TDD scheme. The project aims at developing a technology platform for production of Green Ammonia / Urea by non-conventional production route using cold plasma based technology and process simulation and engineering designing for the upscale of the process to multi ton stage. The project shall develop a non-conventional source for ammonia/urea production where the requirement of pressure is not limiting. The process once optimized can be operated in integrated manner with existing urea/ ammonia industries and also possible to decentralize production. Therefore to validate the technology it is essential to study the developed technology in higher scale. Additionally strategies for production of ammonia/urea will also be studied in packed bed reactor which may be cold plasma based or packed bed reactor connected to cold plasma with metal oxide catalyst to maximize the production capabilities. The project has been recommended by the Technical Advisory Committee and was being processed for approval and support.

(iv) Design and Development of low cost Switched Reluctance Motor & Controller for Electric Vehicle (EV) - Ampere Vehicles Private Limited, Coimbatore

M/s Ampere Vehicles Pvt. Ltd., Coimbatore have undertaken to indigenously develop, design and manufacture low cost, high efficiency, reliable Switched Reluctance Traction Motor (650W, 1500W and 3000W) for a complete replacement of BLDC Motor for every electric vehicles (three wheelers & four wheelers) and for other industrial applications. SR Motor is a technological innovation to save energy and increase efficiency. SR motor for electric vehicle is a new product idea that will help innovatively to create electromagnetism without the dependence on permanent magnets. Design of SR

motors has the specific design benefits of a motor free from magnets with high efficiency, high torque, high rpm and low cost which perfectly meets Electric Vehicles Traction demand, simple manufacturing process which makes the motor to be produced locally, DC voltage Operation that works from battery power, Electric Vehicle specific application as most EVs are DC based etc. which could be innovated in India for rapid deployment. The project has been recommended by the Technical Advisory Committee and was being processed for approval and support.

(v) Pilot / Scale-up studies and Commercialization of CLONZAb, a recombinant Monoclonal Antibody to treat Non-Hodgkin's Lymphoma - Clonz Biotech Pvt. Ltd., Hyderabad

M/s. Clonz Biotech Pvt. Ltd., Hyderabad has carried out cloning of heavy chain and light chain of anti-CD20 (Clonz Ab-di-cistronic) synthetic gene with the suitable vector of the licensed technology from Selexis, SA and has completed DNA sequencing. Further they have cloned the synthetic gene into Selexis DNA vector (pSLX-082) and expressed it in CHO cell line. They have established/ achieved proof-of-concept in a 10 Liter fermentor with a yield of 2 grams/liter and have completed pre-clinical safety studies by getting RCGM approval. The company will be scaling up the technology by installing a 500 Liter fermentor and running five consistency batches for 10-11 days. The company hopes to bring down the cost of the technology when compared to their competitors presently in the business. The project has been recommended by the Technical Advisory Committee and was being processed for approval and support.

3.2.3 The following project though approved could not be taken up since the company was unable to furnish bank guarantee.

High end integrated anesthesia delivery system - Avasarala Technologies Limited, Bengalore

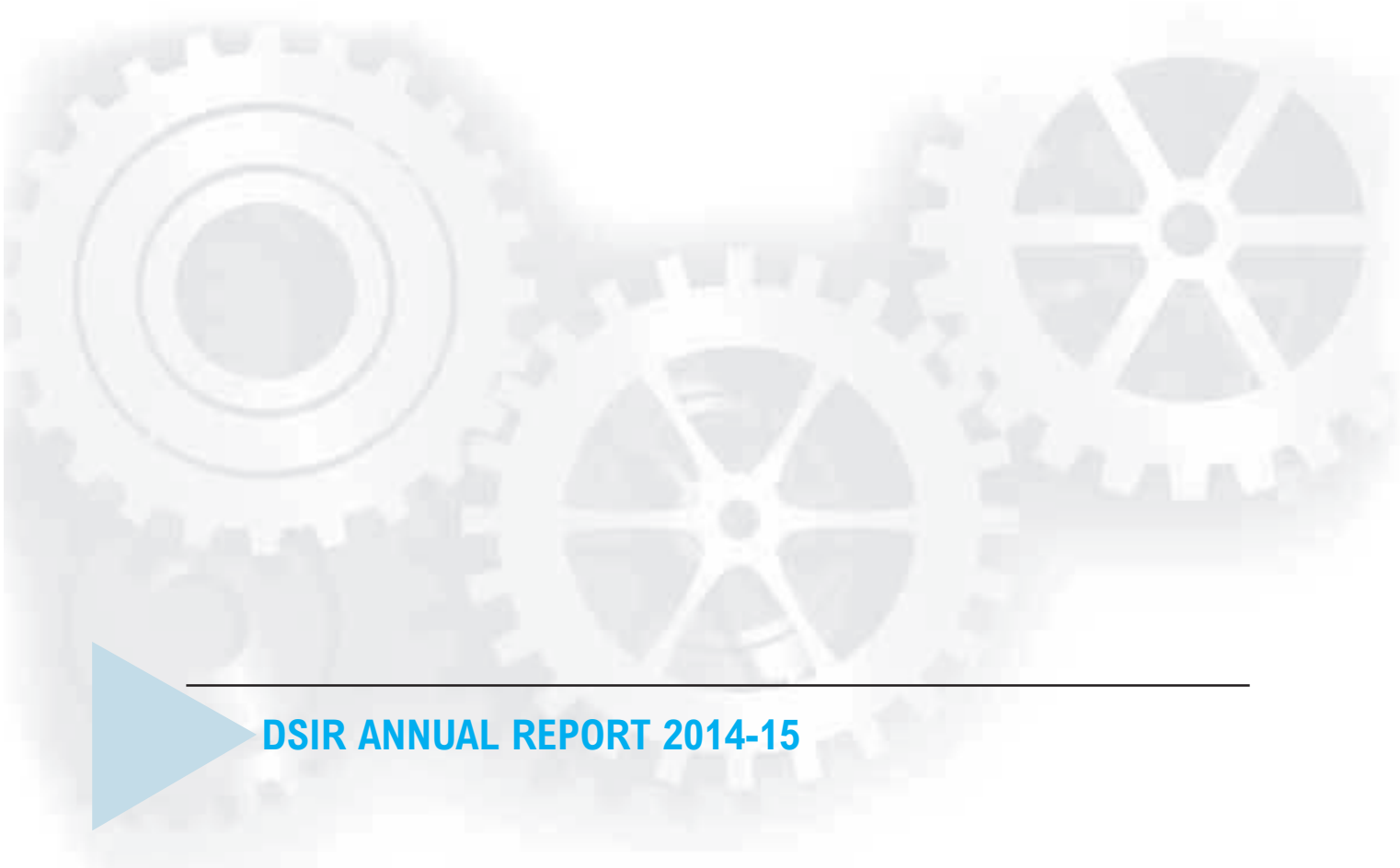
Avasarala Technologies Ltd., Bangalore submitted a project for Indigenous development & demonstration of a high-end integrated anesthesia delivery system which would be an import substitute. The Company claims that the anesthesia delivery system produced as a result of the project would have advanced features such as *Synchronized Intermittent Mandatory Ventilation (*SIMV), P*ressure Controlled Ventilation (*PCV), Wave Form Display, Oxygen Supply Monitoring and Touch Screen Settings, which could be offered to hospitals and doctors in India at a much lower cost as compared to the imported systems. The project involves innovation in integration of ventilator, pneumatic and electronic systems in the anesthesia machine. The project out lay was Rs. 445 lakh and DSIR approved a loan of Rs. 185 lakh for the project.

3.2.4 Advertisement in the National Dailies were released in August 2014 calling for IV batch of technology development and demonstration proposals and in October, 2014 calling for V batch of proposals from industries and research institutions. The Technical Advisory Committee (TAC) met in July, 2014 and is again expected to meet in February, 2015 to consider the proposals received.

3.3 Development of Database of Experts:

A dynamic database on experts available in the R&D organizations / academic institutions / universities / industries in India or abroad to facilitate PPP and tie-ups with Indian industry for collaborative projects is envisaged to be developed under the "PACE" scheme. A Database Advisory Committee (DAC) was constituted to suggest a structure of the database and to evolve a mechanism for launching and maintaining the database. Three meetings of the DAC were held. It was agreed that the database will have four categories of experts, viz, Individual and those affiliated to Academia (colleges and universities), Institutes or Industries. It was also agreed that since the database would involve giving vide publicity, populating the database and updating it on a dynamic basis, it will have to be developed through an external expert agency. The process of obtaining necessary approvals and inviting proposals from suitable agencies was underway.

VI Implementation of RTI Act 2005



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IMPLEMENTATION OF RTI ACT 2005

IMPLEMENTATION OF RTI ACT 2005

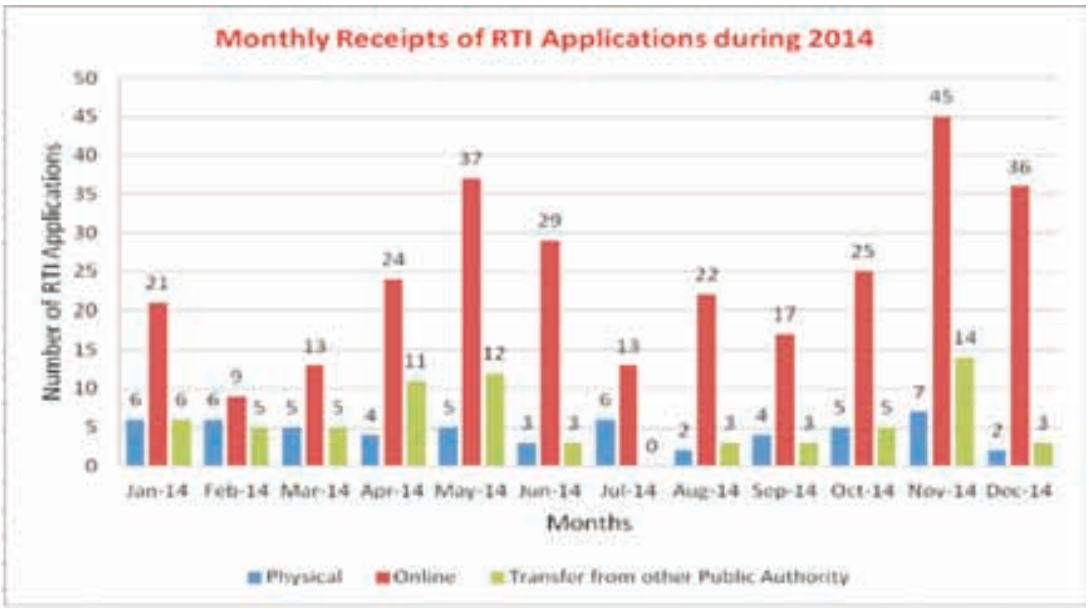
The Right to Information Act 2005, enacted on 15th June 2005, has been implemented successfully in the department. As per the provisions of the RTI Act 2005, following officers are designated:

Appellate Authority	Dr (Ms) Jyoti SA Bhat, Scientist 'G' Department of Scientific and Industrial Research 19-C, Administrative Block Technology Bhawan, New Mehrauli RoadNew Delhi-110016	Tel: 26590256 TeleFax: 26960098 jsabhat[at]nic[dot]in
Transparency Officer	Shri G M Bagai, Scientist 'G'Department of Scientific and Industrial ResearchRoom No. 6, Hall BTechnology Bhawan, New Mehrauli Road New Delhi-110016	Tel: 2660 2185, 26590382 Fax: 26960629 gbagai[at]nic[dot]in
Nodal Officer and Central Public Information Officer	Shri Vimal Kumar Varun, Scientist 'F' Department of Scientific and Industrial Research14-B, Administrative Block Technology Bhawan, New Mehrauli RoadNew Delhi-110016	Tel: 26590416 TeleFax: 26516078 vkv[at]nic[dot]in
Central Assistant Public Information Officer	Dr (Ms) Sujata Chaklanobis, Scientist 'F'Department of Scientific and Industrial ResearchRoom No.15, Hall - BTechnology Bhawan, New Mehrauli Road New Delhi-110016	Tel: 26520887, 26590277 Fax: 26960629 priya[at]nic[dot]in
Central Assistant Public Information Officer	Dr Prabhat Kumar Dutta, Scientist 'F'Department of Scientific and Industrial ResearchRoom No. 43, TIFAC BuildingTechnology Bhawan, New Mehrauli RoadNew Delhi-110016	Tel: 26534823, 26590394 Fax: 26960629 pkdutta[at]nic[dot]in

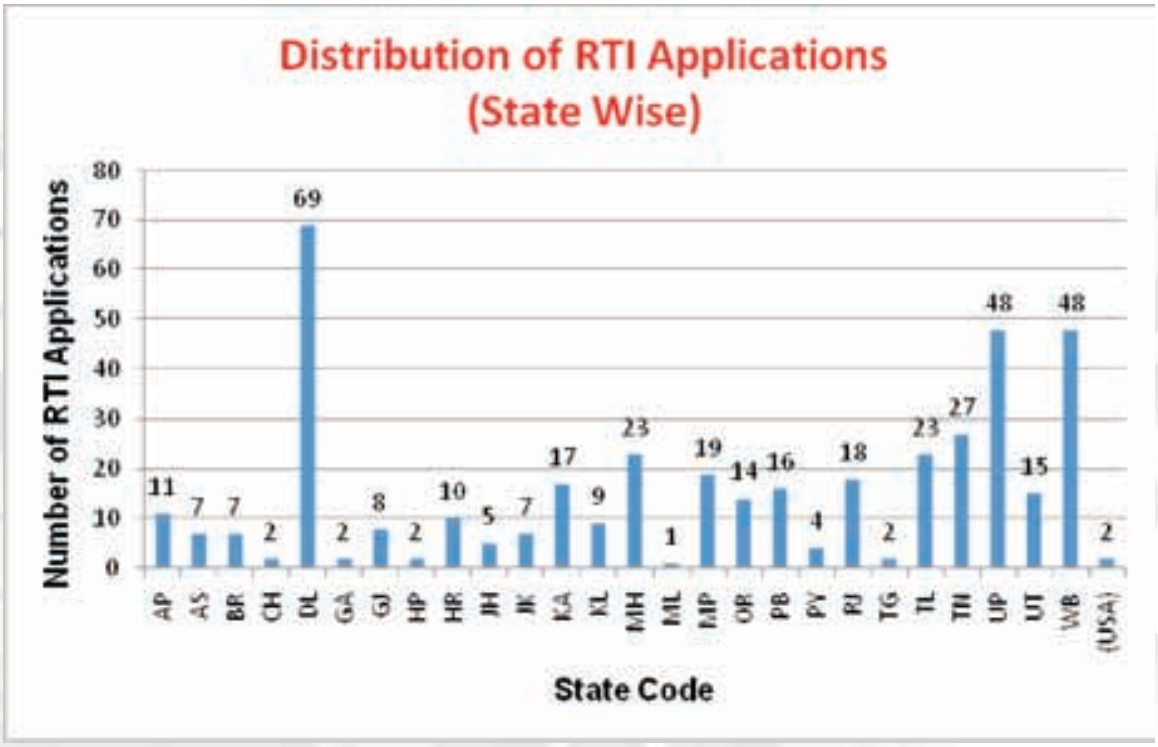
The proactive disclosures under Section 4 (1) (b) of the RTI Act 2005 enacted on June 15, 2005 are regularly updated and available on the DSIR Website at *http://dsir.gov.in/rti/rti-dsir.htm*.

DSIR has complied with the directives received from Central Information Commission.

DSIR has received 416 Applications during 2014 [01/01/2014 to 31/12/2014] and all the Applications were registered and disposed off on RTI Request & Appeal Management Information System, https://rtionline.gov.in/RTIMIS. The monthly receipt of the RTI Applications is given below:



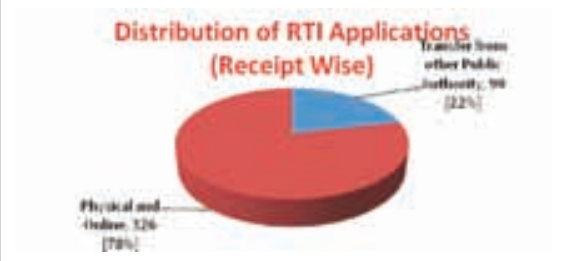
The State-wise distribution of RTI Applications received during 2014 is given below:



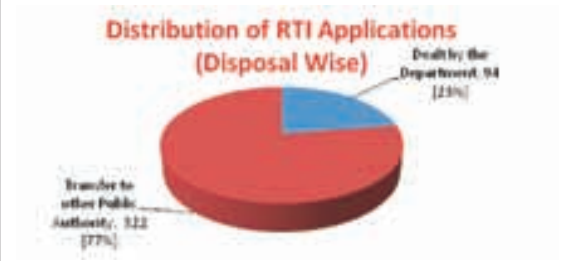
During 2014 [01/01/2014 to 31/12/2014], 14 applications were disposed off as first appeal and no applications was registered as second appeal.

The number of female applicants were 59 (14%) and male applicants were 357 (86%). The Gender wise distribution of RTI Applications received during 2014 is given below:

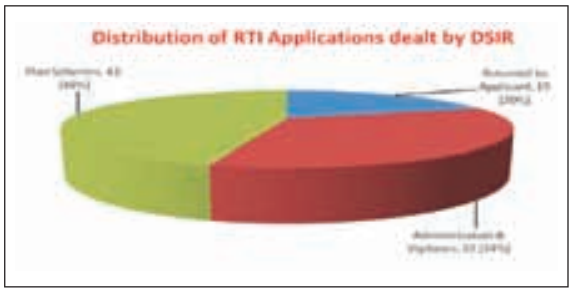
Out of 416 RTI applications received during 2014, 90 were received as transfer from other Public Authority and 326 were received as physical and online as depicted below:



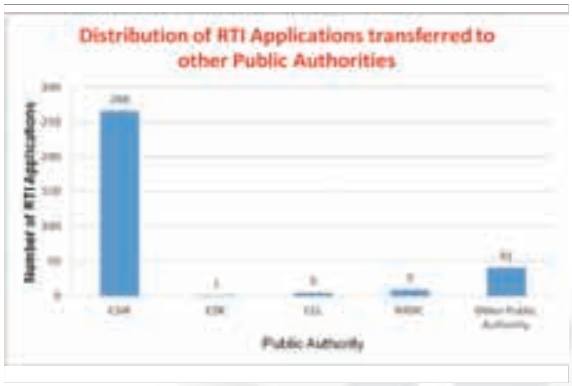
Out of 416 RTI applications received during 2014, 322 were transferred to other Public Authorities and 94 were dealt by the department as depicted below:



Out of 94 RTI Applications dealt by DSIR, 19 were returned to Applicant as the subject matter not related to DSIR, 32 were related to Administration & Vigilance, and 43 were related to Plan Schmes as shown below:



Out of 322 RTI Applications transferred to other Public Authorities, 266 were transferred to Council of Scientific and Industrial Research, 01 was transferred to Consultancy Development Centre, 5 were transferred to Central Electronics Limited (Sahibabad), 9 were transferred to National Research Development Corporation (Delhi) and 41 were transferred to other Public Authority, as given below:

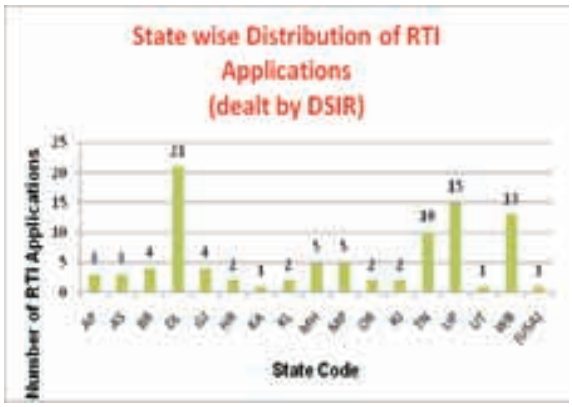


Amonst 41 RTI Applications transferred to other Public Authority (as shown above), 20 were related to Council of Scientific and Industrial Research & other Public Authority such as Academy of Scientific and Innovative Research (Chennai), Consultancy Development Centre (Delhi), University Grants Commission (Delhi), Central Electronics Limited (Sahibabad), National Research Development Corporation (Delhi), Department of Industrial Policy & Promotion (Delhi), Controller General of Patents Designs and Trademarks (Mumbai), Himalayan Mountaineering Institute (Darjeeling), Nehru Institute of Mountaineering (Uttarkashi), Atal Bihari Vajpayee Institute of Mountaineering and Allied Sports (Manali), Jawahar Institute of

Mountaineering and Winter Sports (Anantnag), and National Institute of Pharmaceutical Education and Research (SAS Nagar); 2 were related to CEL & NRDC; and 19 were related to other Public Authority such as AICTE, Department of Higher Education, Agharkar Research Institute (Pune), Biju Patnaik University of Technology (Rourkela), Controller General of Patents Designs and Trademarks (Mumbai), Department of Atomic Energy (Delhi), Department of Agriculture and Education (Delhi), Department of Higher Education (Delhi), Department of Science and Technology (Delhi), Department of Financial Services (Delhi), Department of Justice (Delhi), Institute of Banking Personnel Selection (Mumbai), Indian Council of Agricultural Research (Delhi), Indian Institute of Space Science and Technology (Bengaluru), Indian Institute of Technology (Roorkee), National Centre for Disease Informatics and Research (Bengaluru), National Research Development Corporation (Delhi), National Thermal Power Corporation (Sidhi), and University Grants Commission (Delhi).

The State-wise distribution of RTI Applications dealt by the department during 2014 is given below:

The Division provided technical support by way of lectures on 'RTI Annual Return Informaton System, RTI Request & Appeal Management Information System and RTI-MIS Updated System' during a



Programme on 'Effective Implementation of RTI Act for Appellate Authorities and PIOs in CSIR System' organized by Council of Scientific and Industrial Research at CSIR-Human Resource Development Centre, Ghaziabad on 30/05/2014.

DSIR participated in Residential Programme on 'Modern Office Management and RTI Act' organized by National Productivity Council, New Delhi during 15-19/09/2014 at Port Blair.

DSIR has been effectively using various IT applications like RTI Request & Appeal Management Information System at *http://www.rtionline,gov.in/RTIMIS*, RTI Annual Return Information System at *http://rtiar.nic.in*. The quarterly returns were uploaded on RTI Annual Return Information System at *http://rtiar.nic.in*.

RTI Annual Return Information System

RTI Request & Appeal Management Information System (Nodal Officer)

RTI Request & Appeal Management Information System (CPIO)

VII Autonomous Bodies

A. Council of Scientific & Industrial Research (CSIR)

S & T Contributions

1. Biological Sciences

2. Chemical Sciences

3. Engineering Sciences

4. Information Sciences

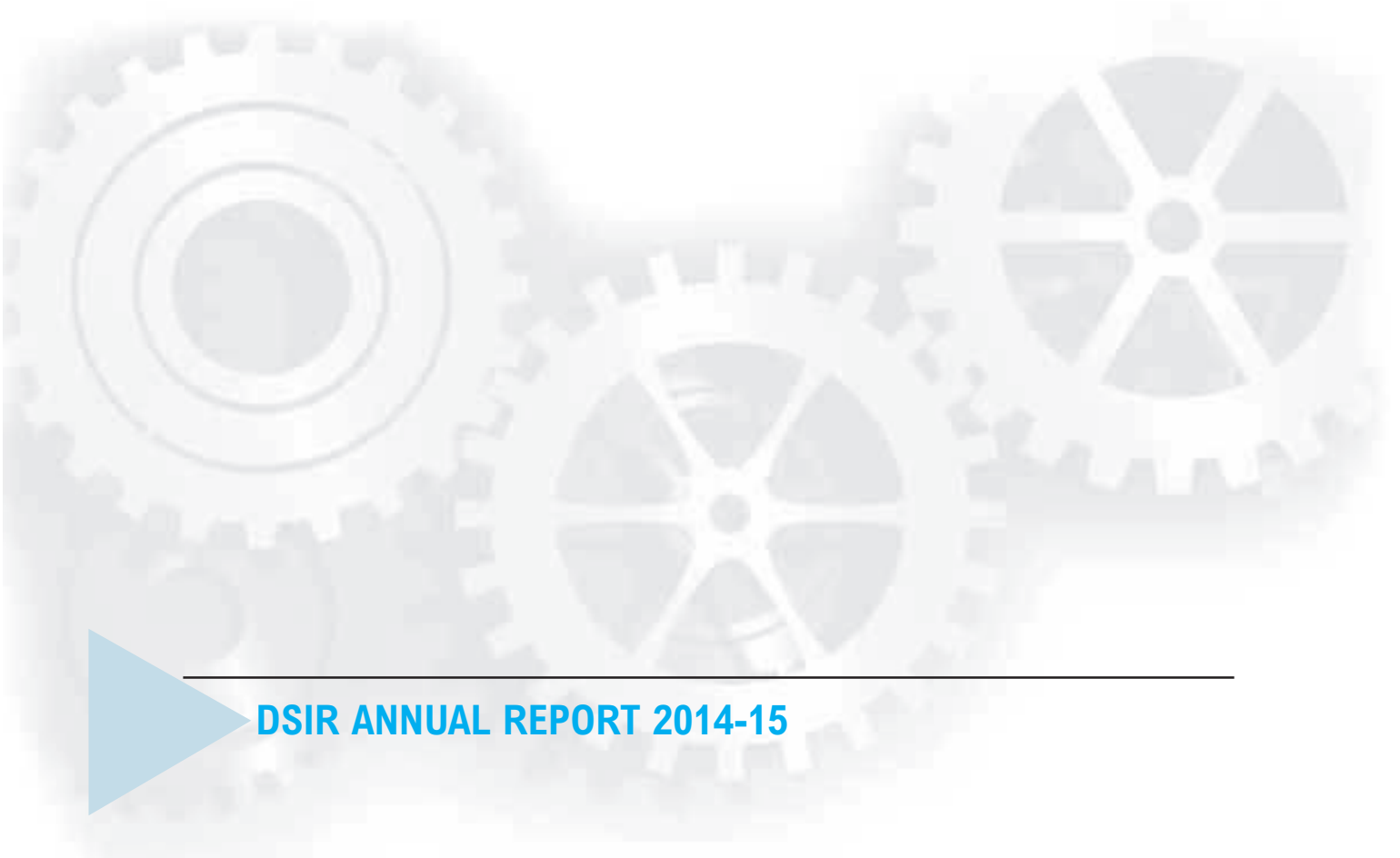
5. Physical Sciences

6. CSIR 800

B. Consultancy Development Centre (CDC)

1. New Initiatives

2. Ongoing schemes/activities/projects



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Autonomous Bodies:

A: Council of Scientific and Industrial Research (CSIR)

S & T CONTRIBUTION

1: BIOLOGICAL SCIENCES

1.1 Scientific Excellence

Chiral Proofreading mechanisms

All the proteins are made up of only L-amino acids. This 'homochirality' is common to all life on Earth. The molecular basis and mechanistic details of perpetuation of homochirality is one of the major unsolved problems in biology today. CSIR-CCMB has crystallized an enzyme called D-aminoacyl-tRNA deacylase (DTD) in complex with a molecule that mimics a D-amino acid attached to a transfer RNA molecule. By studying this structure at a high resolution, they were able to identify how the active site of DTD can specifically accommodate the 'chiral centre' of a complex made of a D-amino acid and a transfer RNA molecule. DTD is able to recognize D-amino acids because of a critical dipeptide that is inserted from one subunit of the DTD into the active site of another subunit of the enzyme. The effect of this dipeptide is to generate a binding pocket that is a perfect fit for the chiral centre of a complex that contains a D-amino acid and a transfer RNA molecule; this pocket specifically excludes complexes that contain an L-amino acid. The critical residues that form the binding pocket are highly conserved suggesting that DTD is crucial for ensuring homochirality throughout all forms of life.

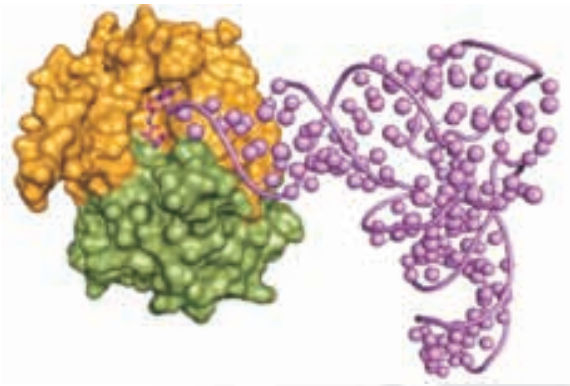


Fig:1.1 D-aminoacyl-tRNA captured by DTD for cleavage

Population structure of India

A new study by CSIR-CCMB indicates that population admixture occurred in the pre-caste era, shedding light on our understanding of the history of the present-day Indian populations. Researchers have found that modern-day India is the result of recent population mixture among divergent demographic groups. The fact that every population in India evolved from randomly mixed populations suggests that social classifications like the caste system are not likely to have existed in the same way before the mixture. Thus, the present-day

structure of the caste system came into being only relatively recently in Indian history. The results were published in ***Nature.***

Functional relevance of repetitive DNA

About 3% of the human genome is made of Simple Sequence Repeats (SSR) or micro-satellites. GATA repeat is one of the major SSRs that are enriched in human and other genomes. GATA repeats of about 50 bp show highest frequency of occurrence. CSIR-CCMB has shown that GATA repeats function as enhancer blocker boundaries in transgenic *Drosophila melanogaster.* They also find that the same is true with human cells as well, revealing the evolutionarily conserved nature of these elements for more than one billion years. In addition, this observation points to the functional relevance of non-coding repetitive component of genomes that have been accumulated in parallel to the evolution of complexity. The results were published in ***Nature Communications***.

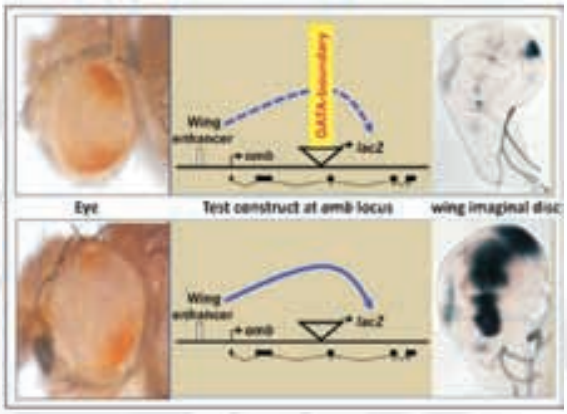


Fig: 1.2 Drosophilla eye with a bipolar pigmentation indicates the genomic site of the insertion of the transgenic construct carrying human GATA boundary test element. While access of wing enhancer to the target lacZ reporter gene is limited (upper panel), this access is unihindered when the GATA boundary has been flipped out (lower panel), seen as more prominent blue staining of the larval wing imaginal disc.

Role of optineurin in Glucoma

The optineurin mutant M98K has been described as a risk factor for normal tension glaucoma in some ethnic groups. CSIR-CCMB has reported that expression of M98K optineurin induced cell death of RGC-5 retinal ganglion cells, but not of other neuronal or non-neuronal cells. They observed increased levels of the autophagy marker, LC3-II, and enhanced autophagosome formation in cells expressing M98K optineurin. It has been found that over-expression of M98K optineurin potentiated delivery of transferrin receptor to autophagosomes for degradation. This studies show that transferrin receptor degradation and autophagy play a crucial role in retinal ganglion cell death.

Protein folding studies

Several protein conformational diseases such as Alzheimer's disease, prion disease, systemic amyloidosis, Finnish type amyloidosis and dialysis-related amyloidosis involve extracellular amyloid deposition of misfolded proteins/polypeptides. The relatively harsh extracellular conditions and the deposition of misfolded, aggregated proteins suggest the necessity for extracellular chaperones. CSIR-CCMB has studied the role of an extracellular protein, haptoglobin in prevention of amyloid fibril formation of â2-microglobulin, which is involved in dialysis-related amyloidosis. It has been shown that haptoglobin interacts with prefibrillar oligomers of â2-microglobulin preventing the amyloid fibril formation, facilitates their lysosomal degradation and the associated cytotoxicity.

Retinopathy of prematurity

Retinopathy of prematurity (ROP) is a blinding disease in premature babies with low birth weight. In order to understand the molecular mechanism of ROP, CSIR-CCMB has carried out a proteomics study of the vitreous humor of ROP patients. Pathway analysis study of differentially expressed proteins in the vitreous humor of ROP patients indicates that proteins involved in complement

activation, coagulation cascade and angiogenesis are highly up-regulated, while inhibitors of coagulation pathway, anti-angiogenic factors and enzymes involved in scavenging reactive oxygen species are highly down-regulated. Their study gives an overview of the pathological and molecular events that may contribute to the disease progression of ROP.

Nanoparticle catalyzed reaction (NPCR): ZnO-NP catalyzedUgi-reaction in aqueous medium

CSIR-CDRI has developed the first ZnO-NP catalyzed Ugi type three-component (AB^2C) reaction for the synthesis of 2-arylamino-2-phenylacetimidamide from an aldehyde, amine and isocyanide in aqueous media. This nanoparticle catalysed reaction (NPCR) is high yielding and has

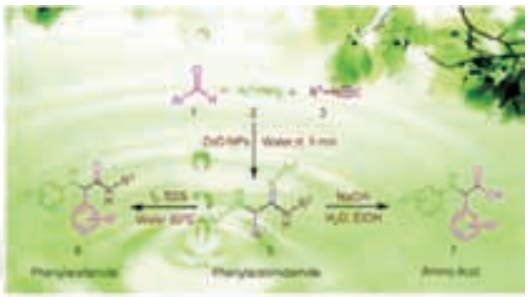


Fig: 1.3 Schematic of ZnO-NP catalyzed reaction

good atom economy as well as atom efficiency. The synthesized phenylacetimidamide yielded 2-amino-2-phenylacetamide on hydrolysis with I_2–SDS–water, whereas alkaline hydrolysis afforded the *N*-substituted á-amino acid. The research work has been published in 'Green Chemistry'.

Discovery of Coumarin-Dihydropyridine hybrids as bone anabolic agents

The concept of molecular hybridization led CSIR-CDRI to discover a novel series of coumarin–dihydropyridine hybrids that have potent osteoblastic bone formation in vitro and that prevent ovariectomy-induced bone loss in vivo. In this context, among all the compounds screened for alkaline phosphatase activity, four compounds 10, 14, 18, and 22 showed significant activity at picomolar concentrations. A series of other *in vitro* data strongly suggested compound 18as the most promising bone anabolic agent, which was further evaluated for in vivo studies. From these studies compound 18 proved to be useful, which at low oral dose of 1 (mg/kg)/day body weight increased bone mass density and volume, expression of osteogenic genes (RUNX2, BMP-2, and ColI), bone formation rate (BFR), and mineral apposition rate (MAR), improved the trabecular microarchitecture, and decreased bone turn over markers in an ovariectomized rodent model for postmenopausal osteoporosis.

Synthesis, Structure-Activity Relationships, and Biological Studies of Chromenochalcones as Potential Antileishmanial Agents

CSIR-CDRI has examined antileishmanial activities of a library of synthetic chalcone analogues. Among them, five compounds (11, 14, 16, 17, 22, and 24) exhibited better activity than the marketed drug miltefosine in *in-vitro* studies against the intracellular amastigotes form of *Leishmania donovani*. Three promising compounds, 16, 17, and 22, were tested in a *L. donovani*/hamster model. Oral administration of chalcone 16, at a concentration of 100 mg/kg of body weight per day for 5 consecutive days, resulted in >84% parasite inhibition at day 7 post-treatment and it retained the activity until day 28. The molecular and immunological studies revealed that compound 16 has a dual nature to act as a direct parasite killing agent and as a host immunostimulant Pharmacokinetics and serum albumin binding studies also suggest that compound 16 has the potential to be a candidate for the treatment of the nonhealing form of leishmaniasis.

Traceability of GMOs in processed foods

DNA quality is an important parameter for the detection and quantification of genetically modified organisms (GMO's) using the polymerase chain

reaction (PCR). Food processing leads to degradation of DNA, which may impair GMO detection and quantification. The effect of various processing treatments such as heating, baking, microwaving, autoclaving and ultraviolet (UV) irradiation on the relative transgenic content of MON 810 maize was evaluated using pRSETMON-02, a dual target plasmid as a model system. Although a profound impact on DNA degradation was seen during the processing, DNA could still be reliably quantified by Real-time PCR. The measured mean DNA copy number ratios of the processed samples were in agreement with the expected values.

This model study contributes to the accumulation of basic data necessary to consider implications of food processing on quantitative determination of GMO ingredients. The approach adapted by CSIR-CFTRI in this study is not only useful for tracing and quantifying GMOs in processed foods but is also of valuable interest for any PCR based diagnostics such as, forensic science, identifying species of origin, food allergens etc. that may be affected by DNA degradation.

Yeast lipid regulation – a transcriptional approach

CSIR-CFTRI has studied to delineate the actual mode of transcriptional regulation of Yeast lipid metabolism. Some of the yeast deletions that have increased triglyceride content also expressed some lipid genes differentially. The key regulators of this expression have been identified and their binding to these genes have been confirmed.

The three genes that form a complex (MRX) and play an important role in DNA Damage repair, when deleted singly, show increased TAG accumulation. Studies have shown the direct correlation that FKHI has on LPP1 by positive regulation. It was observed that when a mutant (phm8Ä) was grown in low phosphate conditions, triglycerides accumulated. The binding sites for this TF on the gene and the positive regulation it has on the phosphatase activity in low phosphate conditions have been investigated and reported for the first time. Transcriptional regulation of the TF IME4 on a yet to be annotated gene has revealed the positive correlation that the TF has, on the gene. Lipid Assays with the protein and its mutants have shown that this is a phospholipase, with a preference for CL, PG and PE substrates. PA, PC and PS were not preferred. This is the first report characterizing this unannotated yeast gene, by assigning a role in lipid metabolism.

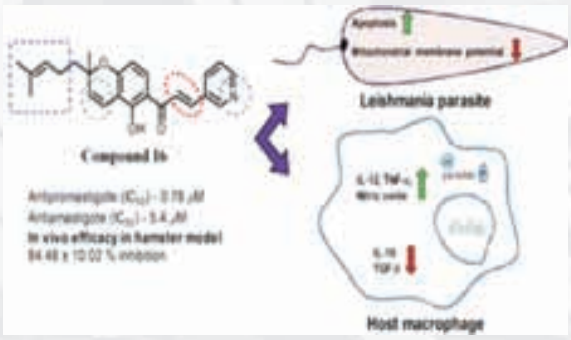


Fig: 1.4 Schematic of a compound as a potential candidate for the treatment of the nonhealing form of leishmaniasis

Synthesis of 3HPyrazolo[3,4c]-isoquinolines and Thieno[3,2c]- isoquinolines via Cascade Imination/ Intramolecular Decarboxylative Coupling

CSIR-CDRI has described the general approach for the synthesis of 3H-pyrazolo [3,4-c] isoquinolines and thieno [3,2-c] isoquinolines involving the implementation of a cascade imination/ intramolecular decarboxylative coupling between

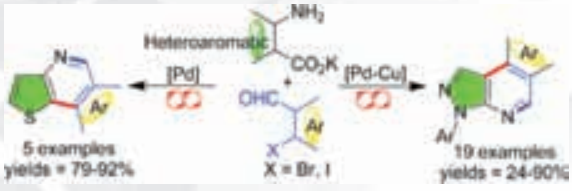


Fig: 1.5 Schematic of synthesis of 3H-pyrazolo [3,4-c] isoquinolines and thieno [3,2-c] isoquinolines

potassium 2-amino(hetero)benzoates and 2-haloarylaldehydes. The reactions of pyrazole-based substrates require a Pd–Cu bimetallic system for superior yields whereas the thienyl-based substrates afford the products in excellent yields with a Pd-catalyst only.

Sugar-Modified Foldamers as Conformationally Defined and Biologically Distinct Glycopeptide Mimics

CSIR-CDRI has shown that attached sugars play a defining role in the conformations adopted by a pair of novel SAA-derived foldamers in water and that these differences are reflected in the contrasting

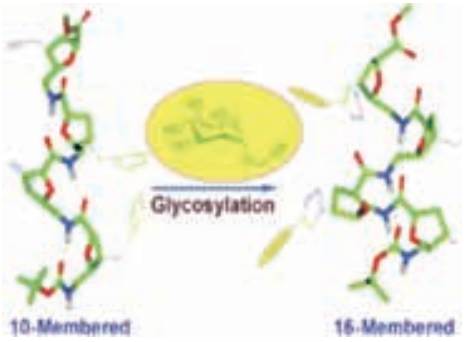


Fig: 1.6 Legends: C-green, O-red, N-blue, H-gray; yellow oval-mannose

interactions of these glycofoldamers with various biological targets. The results have been published in Angew Chem Int Engl**.**

Nutra-coconut oil rich in ω-3 and ω-6 fatty acids and health protective phytoceuticals

Coconut oil is rich in medium chain triglycerides (MCT) but lack in polyunsaturated fatty acids (PUFA) and bio-active phytoceuticals. CSIR-CFTRI has prepared nutro-coconut Oil (NCO) by blending coconut oil and flaxseed oil (70:30) and adding 3000 ppm extract of flaxseed cake concentrate using ethanol, methanol and 20% aqueous ethanol. The different bio-active molecules in flaxseed concentrate and the nutra-coconut oil were evaluated. The PUFA content was found to increase in nutra-coconut oil from 2-22%. There was no significant difference observed in physico-chemical properties of these oils. There was a significant ($p<0.05$) increase of triunsaturated TAG content (0.83 to 6.86 %) observed in nutra-coconut oil. The FT-IR spectra of nutra-coconut oil revealed that the peak at 3009 and 1651 cm-1 was associated to presence of unsaturated fatty acids. There was no significant ($p>0.05$) difference observed in sensory attributes of snack food using coconut oil and nutra-coconut oil indicating that later could be used as frying medium.

The developed nutra-coconut oil is enriched with omega-6, omega-3 fatty acids and bioactive phytoceutical, which includes sesamol, secoisolariceresinol and many other phenolic acids which are beneficial to health to protect against diseases, such as CVD, cancer etc.

Unconventional source of Functional food - Banana pseudo stem and banana rhizome

CSIR-CFTRI has developed a process for the preparation of nutraceutical beverage having total soluble solid contents (6-12%) and acidity (0.2-0.3%) from Banana pseudostem juice. Banana pseudostem juice was prepared by crushing the pseudostem. The prepared beverage showed attractive creamy white colour with overall acceptable sensory quality. It is also shown that the juice has defined antidiabetic and diuretic properties and thus can be of value world over. Further, to the process provides for utilization of the plant bio-wastes/mass for production of nutraceutical food products.

Banana Rhizome Powder

CSIR-CFTRI has developed a process to convert plant biomass into edible value added products has been developed. The prepared beverages were screened for their sensory quality. The product has good appearance (uniform cloud), peculiar banana pseudo stem flavour and overall consumer acceptability. Acute and sub-acute toxicity studies

of banana rhizome powder using animal models revealed that banana rhizome powder is non-toxic and fit for consumption. The pseudostem and rhizome, considered among banana plant bio-waste, together contribute 43-48% of plant biomass. Due to recent technique of production of banana plant through tissue culture resulted in rhizome useless for plant propagation. The total production of pseudostem in India is more than 1.5 MT. Less than 1% is used as vegetable in some states remaining are otherwise incinerated and wasted. The novelty of the product is that the product can be categorized as nutraceutical as the juice has diuretic and antidiabetic effect. Moreover, the product has great potential for commercialization as the raw material (banana pseudostem) is available at minimum/ negligible cost.

Extension of storage life of papaya by coating bioemlusion of cactus mucilage

Papaya (*Carica papaya L*) is a major popular dessert fruit of tropical and subtropical region, known for its fast growth and yield, with a number of varieties of nutritional and bio-functional importance Indian production is reported to be 3.9 million tons compared to 1.9 and 10.48 million tons respectively for Brazil and total world production. It is being exported in large volumes to Europe, the United States and Japan. Post-harvest losses are mainly attributed to mechanical damage, rapid flesh softening and decay. By the usage of cactus mucilage, a natural plant edible biomolecule, as coating, ripening was retarded along with reduced softening thereby shelf life was extended by ~ two folds at room temperature. The process is low cost, organic, non-toxic, edible, biodegradable, eco-friendly, easily adaptable and raw material is waste farm grown.

Discovery of a new oxygen sensor which prevents cell death during hypoxia

Heme protein sensors interact with various gaseous molecules, like CO, NO or O_2, and play a crucial role in transcriptional and regulatory events. In general, the sensory domains of heme proteins control signal transduction domains like histidine kinases, phosphodiesterases, DNA-binding domains, guanylate cyclases, di-guanylate cyclase and aerotaxis transducers. CSIR-IICB has reported that globin-coupled heme containing adenylate cyclase from *Leishmania major* (HemAC-Lm), which regulates O_2 dependent cAMP synthesis. Oxygen binding at heme iron of HemAC-Lm presumably triggers a conformational change in the sensor domain that, sequentially, stimulates the catalytic activity of the adenylate cyclase domain, resulting in the synthesis of the second messenger cAMP. This O_2 dependent cAMP signalling is likely to function in cellular adaptability during hypoxia.

Fig: 1.7 Centre of diagram depicts heme containing adenylate cyclase from Leishmania major, which regulates O_2 dependent cAMP synthesis. This cAMP signaling (red dot) is likely to function in cellular adaptability during hypoxia (light blue) and normoxia (deep blue). The color gradient from outer to inner circle represents the intracellular level of reactive oxygen species (pink), protein kinase A activity (green)and cAMP (red).

Micro RNA, miR-125b regulates spindle assembly checkpoint gene MAD1 and cell fate

The spindle assembly checkpoint (SAC) is a 'wait-anaphase' mechanism that has evolved in eukaryotic

cells in response to the stochastic nature of chromosome–spindle attachments. In the recent past, different aspects of the SAC regulation have been described. However, the role of micro-RNAs in the SAC is vaguely understood. CSIR-IICB has reported here that Mad1, a core SAC protein, is repressed by human miR-125b. Mad1 serves as an adaptor protein for Mad2 – which functions to inhibit anaphase entry till the chromosomal defects in metaphase are corrected. CSIR-IICB also showed that exogenous expression of miR-125b, through down regulation of Mad1, delays cells at metaphase. As a result of this delay, cells proceed towards apoptotic death, which follows from elevated chromosomal abnormalities upon ectopic expression of miR-125b. Moreover, expressions of Mad1 and miR-125b are inversely correlated in a variety of cancer cell lines, as well as in primary head and neck tumor tissues. It was concluded that increased expression of miR-125b inhibits cell proliferation by suppressing Mad1 and activating the SAC transiently. CSIR-IICB scientists hypothesize an optimum Mad1 level and thus, a properly scheduled SAC is maintained partly by miR-125b.

Indirect read-out of the promoter DNA by RNA polymerase in the closed complex

Transcription is initiated when RNA polymerase recognizes the duplex promoter DNA in the closed complex. Due to its transient nature, the closed complex has not been well characterized. How the initial promoter recognition occurs may offer important clues to regulation of transcription initiation. CSIR-IICB has carried out single-base pair substitution experiments on two *Escherichia coli* promoters belonging to two different classes, the "35 and the extended "10, under conditions which stabilize the closed complex. Single-base pair substitution experiments indicate modest base-specific effects on the stability of the closed complex of both promoters. Mutations of base pairs in the "10 region affect the closed complexes of two promoters differently, suggesting different modes of interaction of the RNA polymerase and the promoter in the two closed complexes. Two residues on δ^{70} which have been suggested to play important role in promoter recognition, Q437 and R436, were mutated and found to have different effects on the closed-complex stability. DNA circular dichroism (CD) and FRET suggest that the promoter DNA in the closed complex is distorted. Modeling suggests two different orientations of the recognition helix of the RNA polymerase in the closed complex. CSIR-IICB scientists propose that the RNA polymerase recognizes the sequence dependent conformation of the promoter DNA in the closed complex.

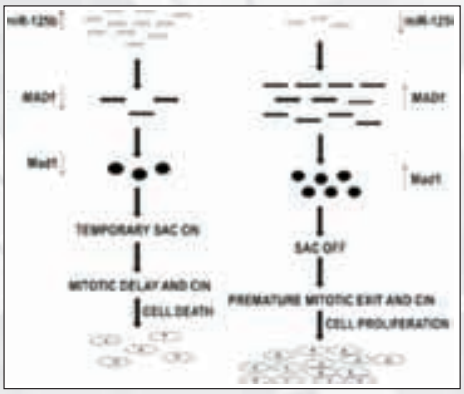


Fig: 1.8 Proposed model for the regulation of Mad1 and cell fate by miR-125b

Fig: 1.9 Docking of interacting part of σ^{70} to the λ-PR promoter (left) and the galP1 promoter (right).

Macrophage activation ensured by miRNP deactivation

How the miRNA targeted pro-inflammatory genes escape miRNA-mediated repression during

macrophage activation is a long-standing unresolved issue in immunology. CSIR-IICB has shown how a transient reversal on miRNA-mediated gene repression during macrophage activation ensures inflammatory response in mammalian macrophage cells. The laboratory identified that phosphorylation of AGO2, happening in stimulated macrophage, is necessary for miRNA unbinding and thus also for

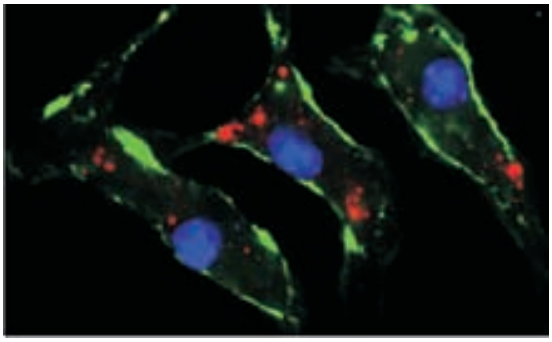


Fig: 1.10a Macrophage activation at the cost of miRNA dysfunction: Pathogen Leishmania donovani evades macrophages defective for AGO2 phosphorylation and hence poorer to show inflammatory response

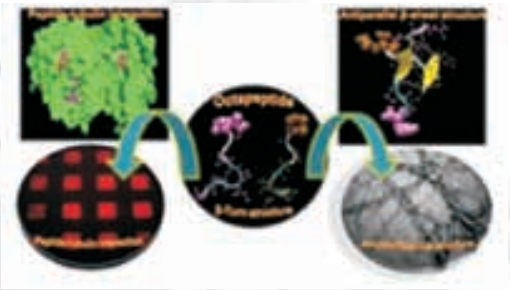


Fig: 1.10 b Proposed Model

de-repression of miRNA-targeted pro-inflammatory genes in activated macrophages. The importance of transient reversal of miRNA-activity in macrophage activation and pathogen invasion has been shown. Cells defective for AGO2 phosphorylation that could ensures de-repression of miRNA activity upon stimulation become more vulnerable for pathogen infection.

Amyloid inhibitor octapeptide forms amyloid type fibrous aggregate and affect in microtubule motility

CSIR-IICB has shown that an amyloid inhibitor octapeptide simultaneously forms amyloid type fibrous aggregate in solution and strongly binds with tubulin as well as reduce microtubule gliding speed by generation of strong friction on microtubule motility through peptide-microtubule lattice interaction. The laboratory has also developed a novel assay to show that the octapeptide interacts with tubulin on 2D micropattern surface. This finding will help for the screening of potential microtubule targeted anticancer and anti-Alzheimer's peptides and small molecules.

Potential role of Mahanine in pancreatic adenocarcinoma

Pancreatic cancer is almost always fatal, in part because of its delayed diagnosis, poor prognosis, rapid progression and chemoresistance. Oncogenic proteins are stabilized by the Hsp90, making it a potential therapeutic target. CSIR-IICB investigated the oxidative stress-mediated dysfunction of Hsp90 and the hindrance of its chaperonic activity by a carbazole alkaloid, mahanine, as a strategic therapeutic in pancreatic cancer. Growth inhibitory potential of mahanine was exhibited in different human cancer cell lines of acute lymphoblastic leukemia, myeloid leukemia, glioma, lung, colorectal, cervical including pancreatic cancer. It induced early accumulation of reactive oxygen species (ROS) leading to thiol oxidation, aggregation and dysfunction of Hsp90 in MIAPaCa-2. *N*-acetyl-L-cysteine prevented mahanine-induced ROS accumulation, aggregation of Hsp90, degradation of client proteins and cell death. Mahanine disrupted Hsp90-Cdc37 complex in MIAPaCa-2 as a consequence of ROS generation. Client proteins were restored by MG132, suggesting a possible role of ubiquitinylated protein degradation pathway. Surface plasmon resonance study demonstrated that the rate of interaction of mahanine with recombinant

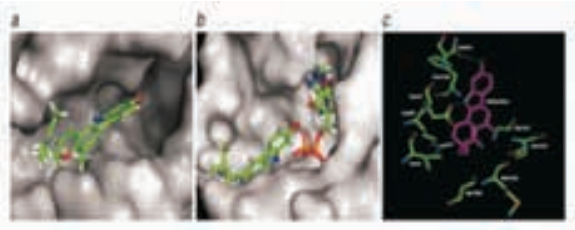


Fig: 1.11 Molecular modeling studies of Hsp90-mahanine interaction.

Hsp90 is in the range of seconds. Molecular dynamics simulation showed its weak interactions with Hsp90. However, no disruption of the Hsp90-Cdc37 complex was observed at an early time point, thus ruling out that mahanine directly disrupts the complex. It did not impede the ATP binding pocket of Hsp90. Mahanine also reduced *in vitro* migration and tube formation in cancer cells. Further, it inhibited orthotopic pancreatic tumor growth in nude mice. Taken together, these results from CSIR-IICB scientists provide evidence for mahanine-induced ROS-mediated destabilization of Hsp90 chaperone activity resulting in Hsp90-Cdc37 disruption leading to apoptosis, suggesting its potential as a specific target in pancreatic cancer.

Mycobacterium tuberculosis acquires iron by cell-surface sequestration and internalization of human holo-transferrin

Mycobacterium tuberculosis (*M. tb*), which requires iron for survival, acquires this element by synthesizing iron-binding molecules known as siderophores and by recruiting a host iron-transport protein, transferrin, to the phagosome. The siderophores extract iron from transferrin and transport it into the bacterium. CSIR-IMTECH has described an additional mechanism for iron acquisition, consisting of an *M. tb* protein that drives transport of human holo-transferrin into *M. tb* cells. The pathogenic strain *M.t* H37Rv expresses several proteins that can bind human holo-transferrin. One of these proteins is the glycolytic enzyme glyceraldehyde-3-phosphate dehydrogenase (GAPDH, Rv1436), which is present on the surface of *M. tb* and its relative *Mycobacterium smegmatis*. Overexpression of GAPDH results in increased transferrin binding to *M. tb* cells and iron uptake. Human transferrin is internalized across the mycobacterial cell wall in a GAPDH-dependent manner within infected macrophages. The study has been published in August issue of Nature Communication 2014.

Latency associated protein Acr1 impairs dendritic cell maturation and functionality: a possible mechanism of immune evasion by Mycobacterium tuberculosis

Mycobacterium tuberculosis (*M. tuberculosis*) in latently infected individuals survives and thwarts the attempts of eradication by the immune system. During latency, Acr1 is predominantly expressed by the bacterium. However, whether *M. tuberculosis* exploits its Acr1 in impairing the host immunity remains widely unexplored. Hence, CSIR-IMTECH has investigated the role of Acr1 in influencing the differentiation and function of dendritic cells (DCs), which play a cardinal role in innate and adaptive immunity. Therefore, for the first time, researchers have revealed a novel mechanism of mycobacterial Acr1 in inhibiting the maturation and differentiation of DCs by inducing tolerogenic phenotype by modulating the expression of PD-L1; Tim-3; indoleamine 2, 3-dioxygenase (IDO); and interleukin 10. Furthermore, Acr1 interferes in the differentiation of DCs by targeting STAT-6 and STAT-3 pathways. Continuous activation of STAT-3 inhibited the translocation of NF-êB in Acr1-treated DCs. Furthermore, Acr1 also augmented the induction of regulatory T cells. These DCs displayed decline in their antigen uptake capacity and reduced ability to help T cells. Interestingly, *M. tuberculosis* exhibited better survival in Acr1-treated DCs. Thus, this study provides a crucial insight into a strategy adopted by *M. tuberculosis* to survive in the host by impairing the function of DCs.

Naturally occurring plant based anti-cancer compound-Activity-Target database

Plant derived molecules have been highly valued by biomedical researchers and pharmaceutical

companies for developing drugs, as they are thought to be optimized during evolution. Therefore, CSIR-IMTECH has collected and compiled a central resource Naturally Occurring Plant-based Anti-cancer Compound-Activity-Target database (NPACT, http://crdd.osdd.net/raghava/npact/) that gathers the information related to experimentally validated plant-derived natural compounds exhibiting anti-cancerous activity (in vitro and in vivo), to complement the other databases. It currently contains 1574 compound entries, and each record provides information on their structure, manually curated published data on in vitro and in vivo experiments along with reference for users referral, inhibitory values (IC(50)/ED(50)/EC(50)/GI(50)), properties (physical, elemental and topological), cancer types, cell lines, protein targets, commercial suppliers and drug likeness of compounds. NPACT can easily be browsed or queried using various options, and an online similarity tool has also been made available. Further, to facilitate retrieval of existing data, each record is hyperlinked to similar databases like Super Natural, Herbal Ingredients' Targets, Comparative Toxicogenomics Database, PubChem and NCI-60 GI(50) data.

Curcumin-loaded nanoparticles potently induce adult neurogenesis and reverse cognitive deficits in Alzheimer's disease model via canonical Wnt/â-catenin pathway

Neurogenesis, a process of generation of new neurons, is reported to be reduced in several neurodegenerative disorders including Alzheimer's disease (AD). Induction of neurogenesis by targeting endogenous neural stem cells (NSC) could be a promising therapeutic approach to such diseases by influencing the brain self-regenerative capacity. Curcumin, a neuroprotective agent, has poor brain bioavailability. CSIR-IITR has reported that curcumin-encapsulated PLGA nanoparticles (Cur-PLGA-NPs) potently induce NSC proliferation and neuronal differentiation in vitro and in the hippocampus and subventricular zone of adult rats, as compared to uncoated bulk curcumin. Cur-PLGA-

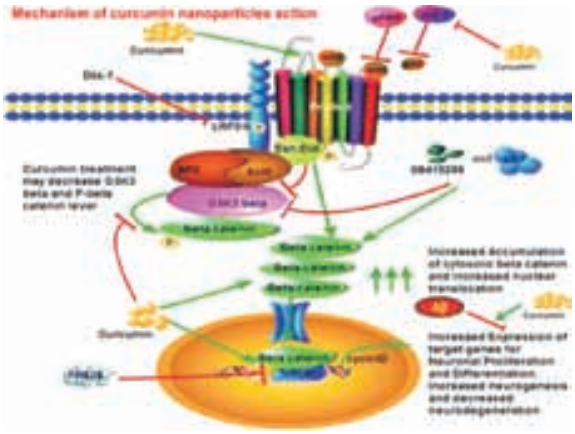


Fig: 1.12 Mechanism of Curcumin Nanoparticles action

NPs induce neurogenesis by internalization into the hippocampal NSC. Cur-PLGA-NPs significantly increase expression of genes involved in cell proliferation (reelin, nestin, and Pax6) and neuronal differentiation (neurogenin, neuroD1, neuregulin, neuroligin, and Stat3). Curcumin nanoparticles increase neuronal differentiation by activating the Wnt/â-catenin pathway, involved in regulation of neurogenesis. These nanoparticles caused enhanced nuclear translocation of â-catenin, decreased GSK-3â levels, and increased promoter activity of the TCF/LEF and cyclin-D1. Pharmacological and siRNA-mediated genetic inhibition of the Wnt pathway blocked neurogenesis-stimulating effects of curcumin. These nanoparticles reverse learning and memory impairments in an amyloid beta induced rat model of AD-like phenotypes, by inducing neurogenesis. In silico molecular docking studies suggest that curcumin interacts with Wif-1, Dkk, and GSK-3â. These results suggest that curcumin nanoparticles induce adult neurogenesis through activation of the canonical Wnt/â-catenin pathway and may offer a therapeutic approach to treating neurodegenerative diseases such as AD, by enhancing a brain self-repair mechanism.

Activity against Ehrlich's ascites tumors of doxorubicin

Doxorubicin (DOX) is a well-known anticancer drug used for the treatment of a wide variety of cancers.

However, undesired toxicity of DOX limits its uses. To address the issue of minimizing toxicity of DOX by making it targeted towards cancer cells, DOX was entrapped in self-assembled 6-O-(3-hexadecyloxy-2-hydroxypropyl)-hyaluronic acid (HDHA) nanoparticles. CSIR-IITR has hypothesized that by encapsulating the drug in biodegradable nanoparticles, its therapeutic efficacy would improve, if targeted against cancer cells. We synthesized cell receptor targeted, DOX loaded HDHA nanoparticles (NPs) and non-targeted DOX loaded O-hexadecylated dextran (HDD) nanoparticles (NPs) and characterized them for their entrapment efficiency, percent yield, drug load, surface morphology, particle size and in vitro drug release. The anticancer efficacy of DOX loaded HDHA-NPs was evaluated by measuring the changes in tumor volumes, tumor weights, and mean survival rate of Swiss albino mice grafted with

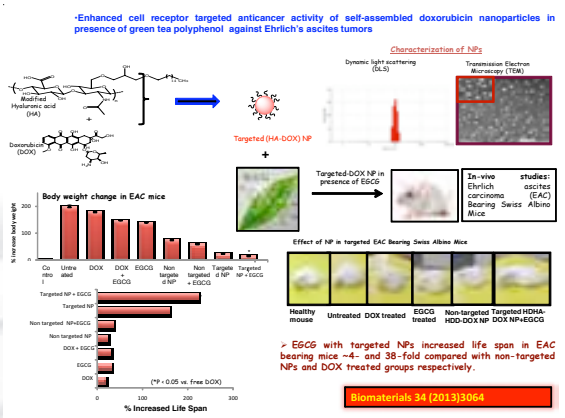


Fig: 1.13 Enhanced cell receptor targeted anticancer activity of self-assembled doxorubicin nanoparticles in presence of green tea polyphenol against Ehrlich's ascites tumors

Ehrlich's ascites carcinoma (EAC) cells. For this, the animals were given HDHA-DOX-NPs (1.5 mg/kg b.wt.) intravenously and a green tea polyphenol, Epigallocatechin-3-gallate (EGCG) (20 mg/kg b.wt.), orally through gavage. The targeted NP dose with EGCG significantly increased mean survival time of the animals and enhanced the therapeutic efficacy of the drug compared to the non-targeted NPs and free DOX. Further, we showed that these NPs (HDD and HDHA) were more active in the presence of EGCG than DOX alone in inducing apoptosis in EAC cells as evident by an increase in sub-G1 cells (percent), Annexin V positive cells and chromatin condensation along with the reduction in mitochondrial membrane potential (MMP). The study demonstrates that DOX loaded HDHA-NPs along with EGCG significantly inhibit the growth of EAC cells with <"38-fold dose advantage compared to DOX alone and thus opens a new dimension in cancer chemotherapy.

Adverse respiratory health and hematological alterations among agricultural workers occupationally exposed to organophosphate pesticides: a cross-sectional study in North India

Non-protective work practices followed by farm workers during spraying of pesticides lead to occupational exposure among them. CSIR-IITR has explored respiratory health and hematological profile of agricultural workers occupationally exposed to OP pesticides. A cross sectional study was undertaken among 166 pesticide sprayers working in mango orchards of Lucknow district in North India compared with 77 controls to assess the respiratory illness, lung functions, cholinesterase levels and hematological profile. A questionnaire based survey and clinical examination for respiratory health were conducted among study subjects. Lung function test was conducted among study subjects by using spirometer. Cholinesterase level as biomarker of OP pesticides and hematological profile of study subjects were investigated in the laboratory by following the standard protocols. Overall respiratory morbidity observed among exposed subjects was 36.75%. Symptoms for respiratory illness like dry cough, productive cough, wheezing, irritation of throat and blood stained sputum were found to be significantly more ($p<0.05$) among pesticide sprayers than controls. Lung function parameters viz. PEFR, FEV1, %PEFR predicted, %FEV1 predicted and FEV1/FVC were found to be significantly decreased ($p<0.05$) among

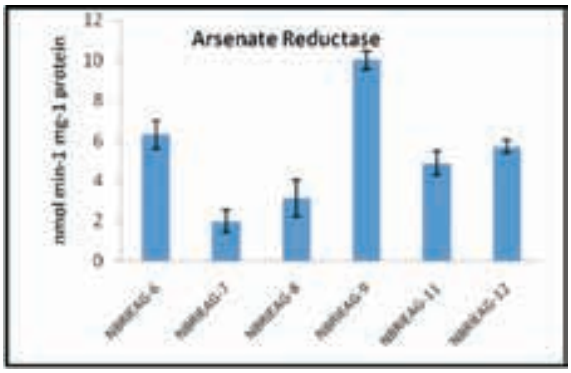


Fig: 1.14 Arsenate reductase activity in isolated bacterial strains

pesticide sprayers as compared to controls. Exposure wise distribution of respiratory illness and lung functions among pesticide sprayers show that the exposure duration significantly elevates ($p<0.05$) the respiratory problems and significantly decreases ($p<0.001$) lung functions among pesticide sprayers. Activities of acetylcholinesterase and butyrylcholinesterase were found to be significantly depleted ($p<0.001$) among pesticide sprayers as compared to controls which show the exposure of OP pesticides among them. The hematological profile viz. RBC, WBC, monocytes, neutrophils, MCV, MCH, MCHC and platelet count were significantly altered ($p<0.001$) in pesticide sprayers than controls.

Study conducted by CSIR-IITR scientists shows that the unsafe occupational exposure of OP pesticides causes respiratory illness, decreased lung functions and hematological alterations among pesticide sprayers.

Arsenic detoxification and arsenate reductase activity in bacterial strains isolated from West Bengal of India

Arsenic (As) is in general toxic to living forms. However, there are some microorganisms capable of detoxifying the toxic form of As. Metal resistance in bacteria is often encoded by genes located on plasmids. A typical *ars* operon contains either (*ars*RBC) or five (*ars*RDABC) genes that generally transcribe as a single unit. Six bacterial strains (NBRIEAG-6, 7,8,9,11,12), resistant to high arsenic content in soil of West Bengal CSIR-NBRI has tested for the presence of the *ars* operon. For amplification of *ars* genes, primers used were designed specifically for arsR, arsC, arsC* arsD, arsA, arsB, arsB*, arsAB, arsH, arrA, arrB, aoxA, aoxB, aoxC, aoxD, aroA, aroB. These primers amplified a gene fragment corresponding to the respective *ars* operon from the genomic DNA of thebacterial strains. The presence of *ars* operon was confirmed in all the isolated bacterial strains. These six bacterial strains encoded most of the genes, in which *ars*R is the first gene within the operon and is only transcribed after the cells come into contact with As. *ars*R gene express the regulatory protein and overexpression of these As specific regulatory proteins increased the cellular concentration of As. Expression of *ars* gene in bacterial cell greatly methylates As (III) to relatively less toxic pentavalent species - DMA^V and TMAO. This mechanism is more appropriate in NBRIEAG-8 strain and enhances the rate of volatilization. Arsenate reductase assay demonstrated that all the six isolated strains were capable to reduce arsenate to arsenite by the enzyme arsenate reductase. This activity was very high in NBRIEAG-9 strain. This result is supported by the presence of *ars*C gene in the bacterial genome.

Transcriptome analysis elucidates papaverine biosynthesis in poppy

CSIR-NBRI has carried out transcriptome analysis of high papaverine mutant (*pap1*) and normal cultivar (BR086) of *Papaver somniferum* in an attempt to elucidate papaverine biosynthesis and identify putative genes involved in uncharacterized steps. This natural mutant synthesizes more than 12-fold papaverine in comparison to BR086. More than 238 Mb transcriptome data separately for *pap1* and BR086 was established. Assembly of reads generated 127,342 and 106,128 unigenes in *pap1* and BR086, respectively. Digital gene expression analysis of transcriptomes revealed 3,336

differentially expressing unigenes. Enhanced expression of (S)-norcoclaurine-6-O-methyltransferase (6OMT), (S)-3'-hydroxy-N-methylcoclaurine, 4'-O-methyltransferase (4'OMT), norreticuline 7-O-methyltransferase (N7OMT) and down-regulation of reticuline 7-O-methyltransferase (7OMT) in *pap1* in comparison to BR086 suggest (S)-coclaurine as the route for papaverine biosynthesis. This study also identified several methyltransferases and dehydrogenases with enhanced expression in *pap1* in comparison to BR086.

Transgenic plants with improved anti-osteoporosis activity

CSIR-NBRI has developed transgenic tobacco lines, constitutively co-expressing *AtMYB12* and *GmIFS1* (soybean *IFS*) genes and their phytochemical and molecular analyses carried out to develop strategies for isoflavonoid biosynthesis in non-leguminous plants. Leaves of co-expressing transgenic lines were found to have elevated flavonol content along with accumulation of substantial amount of genistein glycoconjugates being at the highest levels that could be engineered in tobacco leaves. Estrogen deficient (ovariectomized, Ovx) mice fed with leaf extract from transgenic plant coexpressing *AtMYB12* and *GmIFS1* exhibited significant conservation of trabecular microarchitecture, reduced expression of osteoclastogenic genes, higher total serum antioxidant levels and increased uterine estrogenicity compared to Ovx mice treated with vehicle (control). The skeletal effect of the transgenic extract was comparable to estrogen treated Ovx mice. Together, these results establish an efficient strategy for successful pathway engineering of isoflavones and other flavonoids in crop plants and provide a direct evidence of improved osteoprotective effect of transgenic plant extract.

Role of gluconokinase in senescence

The gluconokinase gene was previously found to be induced at the time of flower senescence in gladiolus to understand its role in senescence in detail CSIR-NBRI has standardized, assays for studying gluconokinase (GK) activity. Gluconokinase activity was found to progressively increase during the course of floral senescence starting from stage 0 (open flower) onwards, concomitantly with an increase in transcript level. In view of the increase in gluconokinase transcript and activity during senescence, the effect of the GK substrate gluconate was studied on leaves and flowers. Feeding gluconate to excised leaves and flowers led to an increase in petal and leaf wilting

Fig: 1.15 Gluconate induced wilting and loss of turgidity in flowers of tobacco (left) and gladiolus (right)

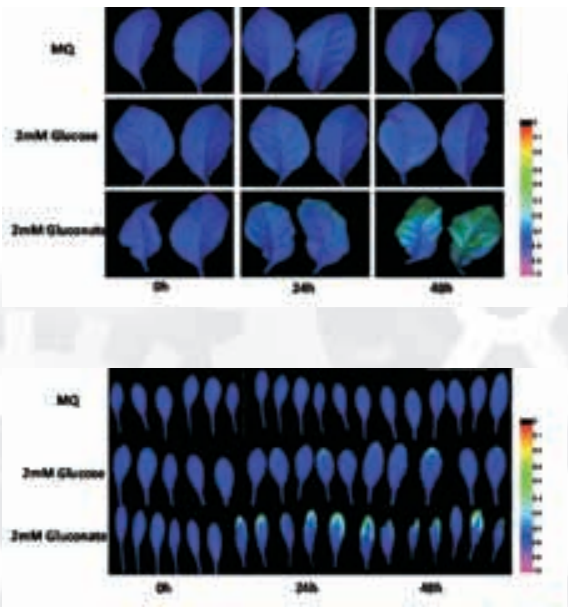


Fig: 1.16 Chlorophyll fluorescence images of tobacco (top) and Arabidopsis (bottom) leaves upon treatment with gluconate (scale on the right indicates the colour code for corresponding Fv/Fm ratios)

and loss of structure within 36-48 hrs (Fig. 1.15). In leaves, a decrease in Fv/Fm values upon gluconate treatment was observed using Imaging PAM Chlorophyll Fluorometer (Fig. 1.16). The decrease in Fv/Fm values within 48h of treatment indicates either the inactivation of reaction centres or chlorophyll degradation. No such change was observed in flowers and leaves treated with water or with an equivalent concentration of glucose. These studies provide evidence for a hitherto unknown role for gluconokinase-gluconate in senescence in plants.

Identification and functional characterization of methyl jasmonate-elicited transcriptional responses and pentacyclic triterpene biosynthesis in Sweet Basil

Sweet basil (*Ocimum basilicum*) has been widely used in traditional systems of medicine for the treatment of various ailments and is well recognized for the pharmacological activities of its diverse secondary metabolites. CSIR-CIMAP has studied transcriptional changes in sweet basil after methyl jasmonate (MeJA) treatment and several candidate MeJA-responsive unique transcripts, including transcripts of the secondary metabolic pathways, such as terpenoids and phenylpropanoids/flavonoids have been identified. Integrated transcript and metabolite analysis revealed MeJA-induced biosynthesis of the medicinally important ursane-type and oleanane-type pentacyclic triterpenes in sweet basil. The outcome of this research will be helpful in developing metabolic engineering strategies for enhanced production of medicinally important ursane-type and oleanane-type pentacyclic triterpenes.

Non-dormant seeds in cleistogamous strains of periwinkle (*Catharanthus roseus*)

CSIR-CIMAP has developed Cleistogamous strains in periwinkle to facilitate maintenance of genetic purity and seed production in the absence of pollinators. These strains did not exhibit any seed dormancy, with seeds germinating on the second day after their harvest. Advantages being low seed dormancy would be useful in reducing the occurrence of volunteer plants in periwinkle fields. Cleistogamy coupled with low seed dormancy would be ideal for development of transgenics in periwinkle.

Increase in stress resistance, ROS scavenging activity and life span by Ocimum sanctum extracts in model organism *Caenorhabditis elegans*

The discovery of a wide range of chemical modulators of aging in model organisms encourages new strategies for attacking age associated diseases. The compounds which could have similar effect would prove a boon to mankind. In the present study, effect of different pharmacological doses of Ocimum sanctum extracts were used to determine their impact on life span, thermo tolerance, brood size and ROS scavenging activities. Some of the extracts significantly extended life span and increased resistance to thermal stress. It is suggested that the protective and life span prolonging action of the aqueous extracts are not only due to their antioxidant capacity but may also be mediated by modulation of some signaling pathways thereby increasing stress tolerance and life span in *C. elegans*.

Genome-Wide Identification and Expression Analysis of NBS-Encoding Genes in *Malus x domestica*

Plants have evolved sophisticated mechanisms to identify and produce specific defense response against wide range of pathogens. Highly stringent computational methods resulted in identification of NBS-LRR gene family comprising of 1015 NBS-LRRs in *Malus x domestica*. CSIR-IHBT has characterized the family based on structural diversity among NBS-LRR proteins, annotations of functional domains using MEME, chromosomal location within the genome and identification of duplication events. The identified candidate proteins were further analyzed for comparative phylogeny between apple NBS-LRR proteins and functionally known

NBS-LRR proteins of other related plant species. Digital expression analysis using an expressed-sequence tags (EST) database and quantitative real-time PCR (qRT-PCR) of selected genes under various disease conditions was also carried out. This investigation will be helpful in selecting candidate disease resistance genes which would serve as a potential resource for improvement of disease resistance in apple.

Land use land cover mapping of Chamba district of Himachal Pradesh

CSIR-IHBT has mapped techniques the land use land cover (LULC) mapping of Chamba district of HP using remote sensing. The classification of LANDSAT satellite image resulted in nine broad LULC classes in the region (Fig.1.17). The result

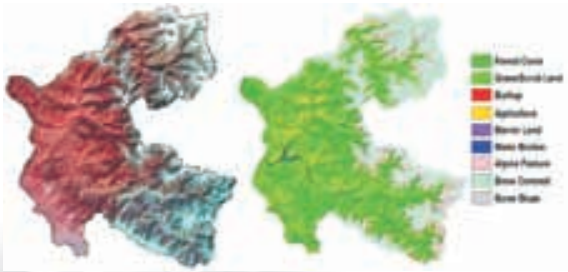


Fig: 1.17 Satellite image and land use land cover map of Chamba district (HP)

illustrates that major portion of land constituting 54.20 % is under forest cover and alpine pastures. The grass/scrub land and barren land constitute 9.65 % area. Its 9.71 % region is occupied by agricultural and built-up areas. The 26.42 % region is under snow, scree slopes and water bodies.

1.2 Technology Developed

Novel Uricase Enzyme

CSIR-IMTECH has discovered two novel mutant uricases having better enzymatic efficiency (2 to 3 times fold higher) compared to that of the wild type uricase enzyme. The main advantages of the present invention are higher activity and optimum pH of activity is close to the biological pH 7 which helps the enzyme to retain almost entire activity (close to 100%) when administered as drug. This enzyme can be used in clinical diagnosis kits to measure the serum uric acid levels and for their use as a potential drug. An Indian patent has been filed for these enzyme mutants.

Designer whole cell biocatalysts

CSIR-IMTECH has developed whole cell-biocatalysts referred as "designer whole cell biocatalysts" having significantly enhanced conversion rate for asymmetric reduction of variant ketones to their alcohols specially efficient conversion of ethyl 4-chloro-3-oxobutyrate to produce ethyl (S)-4-chloro-3-hydroxybutyrate in >99.9% e.e., which is useful as chiral building block and an intermediate for the production of hydroxymethylglutaryl-CoA (HMG-CoA) reductase inhibitors.

Method for assaying glycated protein

An assay system has been developed by CSIR-IMTECH for the detection of glycated hemoglobin and glycated albumin fractions in the diagnosis of diabetic patients. The innovation is based on affinity separation of the non-glycated and glycated fractions in the sample wherein the glycated portion remains bound to the affinity matrix while the non-glycated fraction elutes out. The total analyte (glycated + non-glycated fraction) and eluted fraction (non-glycated) are measured separately using a receptor molecule for the analyte. The percentage glycation is measured by subtraction of the total with non-glycated fraction. The innovation could be extended to measurement of percentage of glycation of other glycated proteins in a sample. An Indian patent has been filed for this assay system.

CSIR Developed Clot Specific Streptokinase Enters into Phase-2 Human Clinical Trials

The Clot Specific Streptokinase (CSSK), a novel patented thrombolytic biopharmaceutical therapeutic protein drug licensed from the CSIR-

IMTECH has received permission from the Drugs Controller General of India (DGCI) in February 2013 to conduct Phase-2 human clinical trial to test the efficacy of CSSK in the patients of heart attack, a condition known as Acute Myocardial Infarction. M/s Symmetrix Biotech Pvt. Ltd. has been carrying out the clinical development of CSSK, also known as SMRX-11.

Candidate Drugs under Advance Stages of Development from CSIR-CDRI

Diseases/ Disorders	*Candidate Drugs*	*Clinical Status*	*Licensees & Collaborators*
Malaria	**97-78** Antimalarial	Phase-I Clinical pharmacokinetic studies has been completed in 16 healthy male volunteers at PGIMER, Chandigarh in collaboration with IPCA. The Phase-I Clinical Trial Multiple doses studies at PGIMER, Chandigarh to commence soon pending procurement of the formulation from IPCA.	IPCA Lab., Mumbai
Diabetes &Dyslipi-demia	**CDR134D123** Anti-hyperglycemic	Awaiting clearance from DGCCRAS New Expert committee for inclusion of the plant in the Extra Ayurvedic Pharmacopia to avail marketing permission in herbal mode.	TVC Sky Shop Ltd., Mumbai
	CDR134F194 Anti-hyperglycemic	The process of formulation of CDR134F194 in a GMP certified company is in progress. The Phase- I Clinical trial to be initiated soon at KEM Hospital & Seth GS Medical College.	

Potential New Leads from CSIR-CDRI

Diseases / Disorders	**Lead & Efficacy**	**Current Status**	**Licensees & Collaborators**
Osteoporosis	**CDR914K058** Ossteogenic	Synthetic process is being developed. Project has been submitted under BIPP scheme for funding for further studies.	Kemxtree, USA2012
	S007-1500 Rapid fracture healing	Mechanism of action studies show that compound stimulates osteoblast differentiation by activating ER/BMP2signaling pathway. PK studies are in progress. It is safe in Single Dose Toxicity Studies in Rat and mice by oral route (50,100 mg/kg bw)	Open for licensing

Cancer	**S007-1235** Anti-leukemic	Compound found Cytotoxic to T315IBCR -ABL mutant leukemia patient samples as well as CD133+ colon cancer stem cells, with higher efficacy than salinomycin. Target identified as PTX sensitive GPCRs. Confirmation of target ongoing	Under negotiation
	S-009-131 (Anticancer)	Oral administration resulted in regression of tumours induced by HeLa cell xenografts in nod SCID mice. Inhibited proliferation of HeLa and C33A by inducing apoptosis & arresting cell cycle	Open for licensing
Thrombosis	**S007-867** Antithrombotic	Platelet-collagen interaction inhibition by this chiral compound led to inhibition of platelet adhesion and aggregation. It exhibited potential antithrombotic efficacy in various experimental models of thrombosis with nominal increase in the bleeding time. Safety pharmacology and toxicity studies have found it safe. It is a first in class approach for potential anti-platelet molecule.	Under negotiation
	S002-333 Antithrombotic	This is yet another prototype to prevent platelet collagen interaction and potential anti-platelet racemic molecule. Safety studies conducted so far have demonstrated it to be safe.	
Diabetes & Dyslipidemia	**CDR267F018** Antidyslipidemic	This standardised fraction from mangrove fruit has potent anti-dyslipidemic activity in various animal models of Dyslipidemia having both preventive and curative potential. The compound has been found safe in Monkey toxicity studies and have been recommended by the MOES project steering Committee for filing IND.	Open for licensing
	CDR914K058	Compound showed protection against dex-induced insulin resistance. In db/db mice K058 induced robust glucose clearance, drastically improved lipid profile, eliminated hepatic steatosis, protected pancreatic beta cells against diabetes-induced apoptosis and induced browning in white adipose tissue. Detailed mechanistic analysis revealed that K058 is the first in class orally active small molecule adiponect in mimetic. Patent has been filed	Open for licensing

New processes for food products for commercial exploitation

CSIR-CFTRI has developed new processes for seven food products for commercial exploitation which include: Annatto seed separator; Fruit jam slices; Shelf-stable convenience mix: A cooking base; Shelf-stable varieties of curry pastes for vegetarian and non-vegetarian traditional cuisines; A device for continuous forming and frying of boondi; Production of turmeric powder from fresh turmeric rhizome; and Low fat expanded green snack using moringa leaves.

Nutraceutical products from pumpkin

Four commercial cultivars of pumpkin viz., Disco, Arjun, Nati long and Nati round, CSIR-CFTRI has screened for their physicochemical compositions. Cultivar, Nati endowed with highest carotenoid content was selected for the development of different nutraceutical products. Pumpkin dry powder was obtained by spray drying, drum drying and hot air drying methods and instant beverage mix, pumpkin custard mix were developed.

Value added products from Black grapes

CSIR-CFTRI has developed Anthocyanin-rich value added products from black grapes. Ready to serve beverage (RTS) containing peeled whole grapes showed higher anthocyanin (2.52 mg/100g) content than normal grape beverage (1.52 mg/100g). Anthocyanin content of the products viz. dehydrated black grapes (48.5 mg/100g), grape jam (2.40 mg/100g) and grape candy from peeled grapes (10.3 mg/100g) revealed that these products had substantially higher anthocyanin content. Chemical and sensory quality profiling of the products showed that these products were highly acceptable during 3 months storage at room temperature.

Plant proteins- based staple foods

CSIR-CFTRI has replaced flour obtained from wheat of two different commercial wheat varieties viz. *Triticum durum* and *Triticum aestivum*, by black gram (Vigna mungo) at 30, 40, 50 and 60% proportions for pasta preparation. With incorporation of black gram, farinograph water absorption (FWA) increased in flour blends due to increased protein content. Sensory, colour, particle size distribution, cooking loss and texture studies favoured 40% replaced blends of both aestivum and durum which were optimised for pasta preparation. These pasta samples were subjected to biochemical and nutritional evaluations. SDS PAGE showed an increase of protein bands supporting the increase in crude protein value (15%) compared to control (11%). SEM exhibits increase in protein matrix distribution entrapped starch granules. In vitro protein digestibility (IVPD) increased from 70% (control) to 89% (40% BG). Mineral content levels of iron and calcium increased relative to control. Sensory analysis showed high consumer acceptance with the samples.

Anti-diabetic and diuretic banana pseudostem juice

CSIR-CFTRI has developed Banana pseudostem juice by crushing the pseudostem. The pseudostem juice was converted to RTS beverage by increasing total soluble solid contents (6-12%) by adding sugar and acidity (0.2-0.3%) by adding citric acid. The prepared beverages were screened out by testing their sensory quality and overall acceptability. The juice showed attractive creamy white colour with white sediments during storage undisturbed for 1-2 h. The juice was then filled into sterile glass bottles followed by airtight sealing and pasteurization in hot water (85°C) for 15 minutes. Diuretic property of the juice was confirmed by animal model studies.

NBRMAP-DB: A safe hypoglycaemic herbal formulation for diabetes

Diabetes mellitus is a complex metabolic disorder resulting from either insulin insufficiency or insulin dysfunction. Type II diabetes is the more common form of diabetes constituting 90% of the diabetic population. Therefore, considering the prevalence and emergence of herbal drugs based on traditional

knowledge, CSIR-NBRI and CSIR- CIMAP jointly developed a novel, safe poly-herbal formulation for management of diabetes conditions.

A new Gladiolus cultivar: 'NBRI-Heerak'

A new Gladiolus cultivar – 'NBRI-Heerak' was developed from a cross between the parents: 'Yellow Stone' (Female) x 'My Love' (Male). The specialty of the new cultivar is its exceptionally large floret

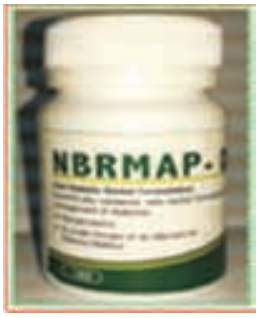


Fig: 1.18 Packing of NBRMAP

Fig: 1.19 Left : Gladiolus cv. 'Heerak'; Right : His Excellency Shri BL Joshi, the then Governor, UP, releasing the new Gladiolus cultivar

size with attractive colour combination (creamy-yellow, pink and red) in unique pattern. This Gladiolus cultivar was released by Shri BL Joshi, the then Governor of Uttar Pradesh during the Annual Rose and Gladiolus Show on January 19, 2014.

'CIM-Kranti' - cold tolerant variety of *Mentha arvensis*

CSIR-CIMAP has developed a new improved variety of *Mentha arvensis* named CIM-Kranti through half-

Fig: 1.20 High yielding and cold tolerant variety 'CIM-Kranti' of Mentha arvensis

sib selection in variety 'Gomti'. The variety is high yielding and cold tolerant and yields more than 100 kg/ha oil with 80% menthol during winter sucker producing crop along with 250-300 q suckers/ha whereas the main summer crop of this plant also yields 10-12% more oil yield than the best available check variety CIM-Saryu. It has erect growth behavior, hardy, hairy and green stem. Its suckers are white in colour, soft and fibrous in nature.

Development of a high citral rich essential oil yielding variety 'CIM-Jyoti' of lemon scented basil (*Ocimum africanum Lour*)

CSIR-CIMAP has developed a new variety 'CIM-Jyoti' of *Ocimum* through intensive breeding efforts for high yield of herb and essential oil with desirable quality of higher citral (68-75%). The variety 'CIM-Jyoti' consistently shows higher herbage and oil content and citral content in the field evaluation yield trials. The average herb yield is 200 q/ha and oil yield 150 kg/ha in variety 'CIM-Jyoti'. The essential oil having good amount of citral is in high demand. The lemongrass crop is the only source of essential oil for the extraction of citral. However, lemongrass is a 4-5 years crop and farmers hesitate to cultivate lemongrass crop for such a long time in their fields. Farmers would like to take this type of oil from a short duration crop without disturbing their traditional cereal and other crops. This variety will produce citral in a short duration of 70-80 days. It also fits in crop rotation/intercropping between

wheat and paddy and with other vegetable crops of small farmers. Leaves of this variety can also be used in lemon tea.

Early Mint Technology- A novel agro-system for minimizing cost of production of Menthol mint oil

CSIR-CIMAP has introduced an 'Early mint technology' which involves improved method the production of planting material (suckers / roots) by raising seedlings from suckers in winter season in poly houses/ polytunnels/ polycovers using modified method of transplanting/planting on ridges, withdrawing irrigation for about 10-15 days before harvest and using improved method of distillation. This technology has been adopted very well by the farmers. The technology is responsible for bringing earliness of about 20-30 days and minimizes expenditure on land, labour, water and fuel by about 20-25% with 15-20% increase in productivity.

A new topical formulation 'Relaxomap'

It is an aroma therapeutic topical formulation, in the form of oil which utilizes unique combination of plant extracts, medicinally proven aromatic oils and is useful for relieving pain resulting from exhaustion. It also reduces inflammation and swellings.

Popularization of seeds of Chia and quinoa along with growing practices to farmers from different parts of the country

Chia and quinoa are extensively used in western cuisines and are increasingly consumed for their nutritional value and health benefits even in India. These seeds are not grown in India, and the seeds that are consumed in India are imported and hence prohibitively expensive. Hence, to make chia and quinoa commonly available to Indians, CSIR-CFTRI has developed high yielding quality seeds in its farms, and distributed to farmers from different parts of India free of cost, besides educating them about the seeds and agronomy practices.

Fig: 1.21 Lemon scented variety 'CIM- Jyoti' of Ocimum

Recognizing the technical competence of vast scientific pool of CSIR-CFTRI; Food Safety and Standards Authority of India (FSSAI) designated it as National Referral Laboratory under the provisions of Food safety and Standards Act (FSSA). By providing valuable scientific inputs, the institute contributed significantly in strengthening the National Food regulatory system. The laboratory has a team of highly qualified and competent professionals supported with modern analytical infrastructure and state-of-art equipments. The laboratory has maintained the Accreditation requirements and status of ISO/IEC 17025-2005 standard. The laboratory is accredited by NABL for over 300 test parameters under Chemical and Biological discipline.

Conservation of halophytes and their exploitation for potential gene resource: raising of halophytic park and greening of Salt Farm

Halophytes are major unique genetic resource in the coastal are of Gujarat. CSIR-CSMCRI has developed a halophytic park has been developed by planting 18 different species of halophytes Greening of salt farm was made by planting *Salvadora persica* at the border of salt pan after modification by adding fresh soil. The tissue culture work is conducted to establish the regeneration protocol in *Salicornia brachiata* using somatic embryogenesis and direct regeneration. *Aleuropus lagopoides* plant was studied in detail for the salt excretion and crystal composition and it was

observed that these plants secrete Na^+ crystals from the leaf surface.

'Him Glow'and 'Him Peace'

CSIR-IHBT has developed and released new cultivars of *Gerbera jamesonii viz*. Him Glow (CSIR-IHBT-Gr-23-1) and Him Peace (CSIR-IHBT-Gr-E-3). These have been developed by through hybridization and selection approach. The cultivars were selected based on flower shapes, bright colours and long vase life. The cultivars have been

Fig:1.22 Him Glow

Fig:1.23 Him Peace

developed through controlled hybridization programme using characterized gerbera lines as parents and selecting the promising hybrid genotypes based on floral attributes and field performance. The cultivars have illustrated promising nursery performance and show vigorous growth and adaptability under greenhouse conditions.

New Advances in the integrated Management of food processing waste in India and Europe: use of Sustainable Technologies for the Exploitation of by-products into new foods and feeds (NAMASTE)

Under the coordinated call between the European Union (EU) and the Department of Biotechnology (DBT), Government of India, with participants from both EU countries (Italy, United Kingdom, Spain, Hungary, Netherlands, Germany) and India (Assam, Karnataka, Maharashtra, Tamil Nadu). The NAMASTE project is aimed to develop innovative, comprehensive and industry-relevant approaches for the valorization of citrus, mango and pomegranates by-products and wheat and rice bran through environmentally and economically sustainable conversion of these by-products into healthy food ingredients, foods and feeds.

The strategic objective of the project is to interface the complementary and synergic needs and expertise of EU and India and to exploit common, industrially-driven, innovative and sustainable processes for converting locally abundant common/ complementary fruit and cereal processing by-products into new food products and feed products of local and transnational interest. CSIR-NEIST is the coordinating institute form India and has worked intensively on Rice bran for development of new potential products.

Protocols have been developed for stabilization and preservation of rice bran, extraction of natural colour (anthocyanin) from pigmented rice bran, fermented rice bran and dietary fibre from rice bran. The products are shown below:

Fig.1.24a Stabilized Rice Bran obtained from Black Rice variety(Mn)

Fig. 1.24b Fermented Rice Bran from white Rice Variety (Ms

Fig. 1.24c Fermented Rice Bran from Black Rice Variety (Mn).

Fig: 1.24d Dietary Fiber Component extracted from the white Rice Bran sample (Ms).

Fig 1.24e Anthocyanin component extracted from pigmented Rice Bran Sample(Mn).

1.3 Unique Major Facilities

CSIR-CFTRI as Food Regulatory Body

Recognizing the technical competence of vast scientific pool of CSIR-Central Food Technological Research Institute, Mysore; Food Safety and Standards Authority of India (FSSAI) designated it as National Referral Laboratory under the provisions of Food safety and Standards Act (FSSA). By providing valuable scientific inputs, the institute contributed significantly in strengthening the National Food regulatory system. The laboratory has a team of highly qualified and competent professionals supported with modern analytical infrastructure and state-of-art equipments.

The laboratory has maintained the Accreditation requirements and status of ISO/IEC 17025-2005 standard. The laboratory is accredited by NABL for over 300 test parameters under Chemical and Biological discipline.

Customer Service Cell of the Institute provided support to 364 food industries / agencies. A total of 1212 regulatory food samples received from courts, port/customs and FSSA were also analysed for compliance to National food regulations.

2 CHEMICAL SCIENCES

2.1 Scientific Excellence

Reversible anionic redox chemistry in high-capacity layered-oxide electrodes

Li-ion batteries have contributed to the commercial success of portable electronics and may soon dominate the transportation market. Classical positive electrodes for Li-ion technology operate mainly through an insertion–deinsertion redox process involving cationic species. However, this mechanism is insufficient to account for the high capacities exhibited by the new generation of Li-rich ($Li_{1+x}Ni_yCo_zMn_{(1"x"y"-z)}O_2$) layered oxides that present unusual Li reactivity. In an attempt to overcome both the inherent composition and the

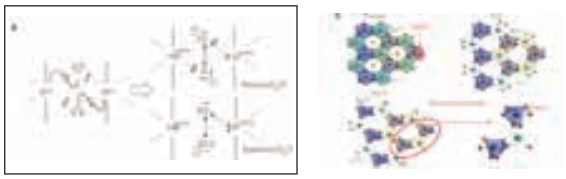


Fig: 1.25 Shows anionic redox chemistry in high capacity layered oxides electrodes. a, The reductive coupling mechanism of two oxo-ligands coordinated to the transition metals leads to a single or double metal reduction depending on the coordination mode of the O_2 moiety. b, structural representation of reductive coupling mechanism in one of the LiM_2 honeycomb layer of the $Li_xRu_{1-X}Sn_XO_3$.

structural complexity of this class of oxides, CSIR-CECRI has designed structurally related $Li_2Ru_{1"y}Sn_yO_3$ materials that have a single redox cation and exhibit sustainable reversible capacities as high as 230 mA.h $g^{"1}$. On the basis of an arsenal of characterization techniques, the reactivity of these high-capacity materials towards Li entails cumulative cationic ($M^{n+} \rightarrow M^{(n+1)+}$) and anionic ($O^{2"} \rightarrow O^{2"}$) reversible redox processes, owing to the *d–sp* hybridization associated with a reductive coupling mechanism. Because Li_2MO_3 is a large family of compounds, this study opens the door to the exploration of a vast number of high-capacity materials.

High Performance $Li_2Ru_{1-y}Mn_yO_3$ ($0.2 \leq y \leq 0.8$) Cathode Materials for Rechargeable Lithium-Ion Batteries

Understanding the origin of the high capacity displayed by Li_2MnO_3–$LiMO_2$ (M = Ni, Co) composites is essential for improving their cycling and rate capability performances. To address this issue CSIR-CECRI has investigated the $Li_2Ru_{1-y}Mn_yO_3$ series between the iso-structural layered end-members Li_2MnO_3 and Li_2RuO_3. A complete solid solution was found, with the $0.4 \leq y \leq 0.6$ members showing sustainable reversible capacities exceeding 220 mAh·g^{-1} centered around 3.6 V vs Li^+/Li. The voltage"composition profiles display a plateau on the first charge as compared to an S-type

curve on subsequent discharge which is maintained on the following charges/discharges, with therefore a lowering of the average voltage. It has been shown that this profile to evolve upon long cycling due to a structural phase transition as deduced from XRD measurements. Finally it is demonstrated, via XPS measurements, the oxidation and reduction of ruthenium (Ru^{5+}/Ru^{4+}) during cycling together with a partial activity of the Mn^{4+}/Mn^{3+} redox couple direct evidence for the reversibility of the $O^{2-} \rightarrow O^{-}$ anionic process upon cycling, hence accounting for the high capacity displayed by these materials.

Fluorinated Graphene Oxide; a New Multimodal Material for Biological Applications

Recent advancement in drug delivery using nanotechnology achieves enhanced half-life and controllable drug release. Some of the newer drug delivery approaches utilize a combination of materials to achieve multimodality, such as, one material serves as a biocompatible photothermal near infra-red (NIR) laser inducible agent that can be loaded with drug, while the second material in the system might work as a clinical contrast agent for magnetic resonance imaging (MRI) or ultra-sound. However, few single materials with such multimodal capabilities are reported. CSIR-CECRI has studied carbon based material – known as fluorinated graphene oxide (FGO), for its multimodality capabilities where it can find applications in NIR photothermal treatment, MRI imaging, photoacoustic and ultrasound contrast enhancement.

FGO is a novel carbon material with clinically translatable multimodal capabilities. These include the ability to serve as MRI, ultrasound and photoa-coustic contrast agents, as well as having the potential to load hydrophobic therapeutic agents to the hydrophilic FGO basal plane. Notably, it can serve as a photothermal ablation agent when irradiated with a NIR laser. Future renement and differential size selection of FGO as well as testing targeted nano-FGO for its synergistic hyperthermia and drug release in vitro and in vivo will make FGO a more attractive agent for various diseases including cancer.

Electrochemical Resolution of Multiple Redox Events for Graphene Quantum Dots

This is the first report on single-electron behaviour either in solution phase or in solid state for GQDs graphene quantum dots with a clear demonstration of a discrete single-electron transfer behavior of GQDs in the 2.2±0.3, 2.6±0.2, and 3±0.3nm regime, where confinement of charge carriers creates an energy gap. CSIR-CECRI has observed a series of evenly spaced redox peaks at 273K which corresponds to the limiting currents controlled by the diffusion of smaller particles towards the electrode surface, thus also facilitating the adsorption of GQDs. A sequential, single-electron charging process of monodisperse graphene quantum dots (GQDs) encapsulated in a dodecylamine envelope, facilitating a capacitance of a few attofarads is reported. The average GQDs dimensions, as ascertained from high-resolution transmission electron microscopy and atomic force microscopy, of about 3±0.3, 2.6±0.2, and 2.2±0.3nm control this unprecedented behavior. Single electron devices could be fabricated using this property.

Effect of organic additives and temperature on the micellization of cationic surfactant cetyltrimethylammonium chloride: Evaluation of thermodynamics

CSIR-CLRI has reported the effect of organic additives and temperature on the micellization of cationic surfactant cetyltrimethylammonium chloride (CTAC) has been reported. The micellization behavior of CTAC were studied at different fixed temperatures and fixed concentration of organic additives (*viz*., sugar, amino acid, etc.) in aqueous solutions. The critical micelle concentration (*CMC*) of CTAC, were measured by the conductivity and dye solubilisation methods. The CMC values first increases with increasing temperature (up to 298 K) and then decreases with temperatures;

whereas the increasing trend found with organic additive concentrations. The thermodynamic parameter values (*viz*., standard Gibbs energy (ΔG_m^0), standard enthalpy (ΔH_m^0), and standard entropy (ΔS_m^0) of micellization of CTAC) clearly indicate less stability of the CTAC solution in presence of additives.

Polyhedral oligomeric silsesquioxane-based fluoroimide-containing poly(urethane-imide) hybrid membranes

CSIR-CLRI has studied the gas permeation rates of O_2, N_2 and CO_2 gases and selectivity of O_2/N_2 and CO_2/N_2 using synthesized fluorinated poly (urethane-imide) polyhedral oligomeric silsesquioxane (FPUI-POSS). FPUI-POSS membranes having different amount s of fluorinated imide were synthesized via simple condensation reaction of isocyanate terminated prepolyurethane (PU) and anhydride terminated fluorinated prepolyimide (FPI).It was concluded that the fluorinated imide content increased in the polymeric membranes simultaneously increases the surface roughness (48 nm) and thereby lowering the density (1.02 g/cm^3). There is a strong relationship between fractional free volume and the gas permeability.

Influence of Moieties on Morphology, Thermal, and Dielectric Properties in Polyamide-Polyhedral Oligomeric Silsequioxanes Nanocomposites

CSIR-CLRI has prepared a series of new hexafluoroisopropylidene, isopropylidene, carbonyl, and ether moieties substituted polyamides from aromatic diamines and various moieties substituted aromatic dianhydrides. The synthesized polyamide-polyhedral oligomeric silsequioxanes (PA-POSS) polyamides were readily soluble in polar solvents. The morphological properties of the polymeric nano-composites depend both on their chemical structure of dianhydride and the aggregation of POSS were investigated by scanning electron microscopy, transmission electron microscopy, and atomic force microscopy. The dielectric constants of PA-POSS were found to be decreased from 3.75 to 3.29 by changing the substitution. These polyamides showed good thermal stability up to 353 ^{0}C (due to the presence of C-F bond) for a 10 % weight loss.

Facile fabrication of mesoporous ZnO nanospheres for the controlled delivery of captopril

CSIR-CLRI has synthesized Mesoporous ZnO nanospheres by simple soluble starch-insertion method, followed by loading of captopril using ultrasonic force. The materials were characterized by PXRD, SEM, FESEM, TEM, TGA, FT-IR, and BET analyses, and biocompatibility studies. The ZnO nanocrystallites have given porous properties

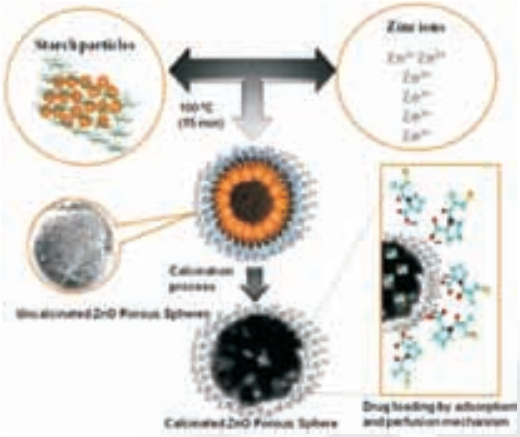


Fig: 1.26 Schematic of synthesis of ZnO nanospheres

on the spherical surface leads to the drug adsorption. The in vitro experiments have indicated the considerable promise of mesoporous ZnO nano spheres, fabricated by the soluble-starch-insertion method acting as a biocompatible carrier for the controlled delivery of captopril in oral route of administration.

GFRP Rebars for the tannery waste water storage tank structures

CSIR-CLRI has produced different types of GFRP (Glass fibre reinforced plastic) Rebars which can replace the conventional steel rebar to use in harsh

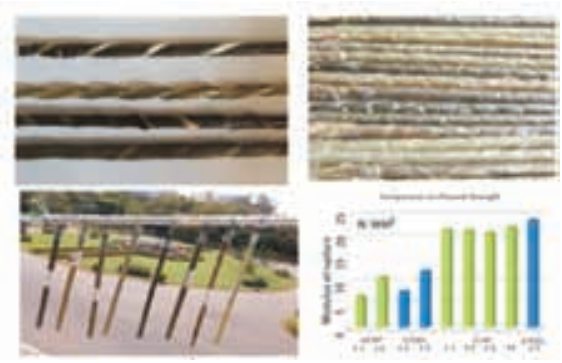


Fig: 1.27 Different types of Rebars with different diameters

environmental structural application. The currently used iron rebars rust easily and weakens the structures. GFRP-rebars have been designed and fabricated using epoxy formulated polymers having diameter of 8mm, 10mm, 12mm, 16mm and length of 700mm by the hand-made process. The tested samples were characterised and found to exhibit less weight, high strength (850.955 Mpa) excellent corrosion resistance properties.

Study of insect-pest of stored pulses & cereals and its controls

CSIR NEIST has collected identified and records the following six potential insect pests of stored grains of this region.

Callosobruchus chinensis (Bruchidae: Coleoptera); *Callosobruchus maculates* (Bruchidae: Coleoptera); *Callosobruchus analis* (Bruchidae: Coleoptera); *Sitophilus oryzae* (Dryophthoridae: Coleoptera); *Rhizopertha dominica* (Bostricidae: Coleoptera); *Triboleum castaneum* (Tenebrionidae: Coleoptera).

The frequency of occurrence of various insect pests in collected samples is found to be highest (29.51%) for *C. chinensis* in case of stored pulse grains & *S. oryzae* (35.67%) for stored cereal grains. Therefore, it can be interpreted from the observations that the major insect pest associated with stored pulses is *C. chinensis & S. oryzae* in case of cereals in Assam.

Callosobruchus chinensis(L.) is one of the major insect pest infesting stored pulses in India. Recourse of synthetic insecticides to protect stored pulses often lead to dangers of the development of resistant strains, toxic residue and users' safety. Locally available and less toxic pest management alternatives such as the use of effective botanicals are important. Essential oils of two variants of *Cinnamomum verum* Presl.Syn.*C. zelanicum* Blume from North East India (RRL L 1620 and RRL J 1622) were characterized and tested for their biological activity in vapour form against *Callosobruchus*

Fig: 1.28 Major insect pest of Stored Pulses have identified as C Cinensis

chinensis (L.) Choice and no-choice tests showed that leaf and bark oil of two variants of *C. verum* Presl had significant repellent action and reduced the fecundity and decreased egg hatchability of *C. chinensis* (L.). However, leaf oil with higher percentage of eugenol exhibited better activity than the bark oil in both the tests. Hence, the volatile essential oils of both the variants of *C. verum* Presl. can be used safely as fumigants.

Study of mode of action of bioactive molecule exhibiting in-vitro anti-prostrate cancer activity

CSIR-NEIST has designed and studied the mode of action of bioactive molecule isolated from endophytic fungi on the test pathogens (*Candida albicans* and *Escherichia coli*), Fluorescein Isothiocyanate (FITC) and Propidium Iodide (PI). From the experimental study, it has been observed that no fluorescence was seen in the microbial cells in the absence of targeted molecule. Because the

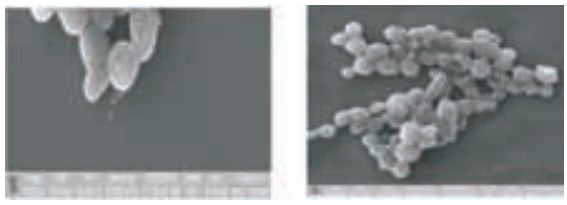


Fig: 1.29

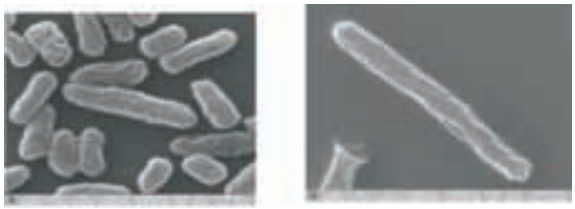


Fig: 1.30 SEM images of E.coli (A-treated, B-control/untreated

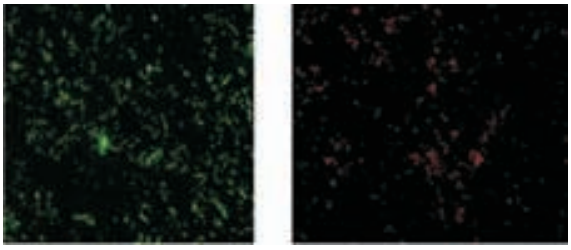


Fig: 1.31 Fluorescence images in SEM (FITC) and (PI) of E.coli

entry of Fluorescein Isothiocyanate (FITC) requires significant membrane damage, the observed fluorescence behavior of the cells suggests that the molecule rendered the cells permeable to FITC. The DNA binding dye PI stains only dead cells. Besides, Scanning Electron Microscopy (SEM) analysis of treated and untreated cells was also carried out. SEM images showed morphological alterations including deformation and shrinkage in both the cells. The test was carried out at NCL, Pune under the joint R&D programme.

Hierarchically ordered porous lotus shaped nanostructured MnO_2

Design of hierarchical nanostructures towards a specific morphology is an important research area due to their shape dependent properties. CSIR-CSMCRI has synthesized 3D hierarchically assembled lotus shaped porous MnO_2 using a simple aqueous solution based chelating agent (citric acid) mediated growth of $MnCO_3$ followed by calcination at 350 °C. $MnCO_3$ in other shapes, such as rods, spheres and nano aggregates, is also synthesized just by varying the chelating agents. The synthesized porous MnO_2 shapes exhibit excellent shape dependent catalytic oxidation of a-pinene to verbenone using molecular oxygen as the oxidant. The lotus shaped porous MnO_2 shows superior activity, with 94% conversion of a-pinene and 87% selectivity of verbenone, to that of other MnO_2 shapes. The activity is reasonably high compared to heterogeneous as well as homogeneous catalysts reported in the literature and bulk MnO_2 with respect to both their conversion and selectivity. The synthesized lotus shaped MnO_2 also showed good catalytic activity towards oxidation of allylic compounds to corresponding ene–ones using molecular oxygen as oxidant and is reusable.

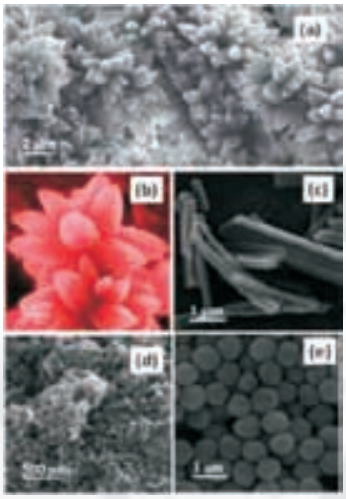


Fig: 1.32 SEM images of lotus shaped MnO_2

Occurrence and distribution of selected heavy metals and boron in ground water of Gulf of Khambhat region, Gujarat, India

CSIR-CSMCRI has measured the concentration of selected heavy metals, like As, Co, Cr, Cu, Fe, Mn, Ni, Pb and Zn as well as B, by Inductively Coupled

Plasma-Optical Emission Spectrometry (ICP-OES) in groundwater samples from various locations in Gulf of Khambhat (GoK), an inlet of the Arabian Sea in the state of Gujarat, India, during post-monsoon, winter and pre-monsoon seasons in a year. Most of the heavy elements were characterized with low mobility under slightly alkaline and reducing conditions; concentrations in confined aquifers were within the Maximum Permissible values for drinking water. The temporal changes indicate that a majority of metals was entering the aquifer during monsoon. Principle component analysis of the heavy metal data suggests interrelated of Co, Cu, Cd and Zn with each other and derived significantly from anthropogenic route, while input of Pb and Cr may be due to atmospheric deposition in the study area. Both weathering of rocks and anthropogenic input were found to be the main sources of elements in the ground water. The heavy metal levels in ground waters of GoK region in comparison with some of European and Asian sites were higher; however, these metal levels were found to be comparable with few urban sites in the world.

Controlled hydration of nitriles to amides by transition metal-free sodium borohydride

CSIR-IHBT has developed a transition metal–free process for the convenient and selective hydration of nitriles to corresponding amides using catalytic amount of sodium borohydride. The developed protocol was applicable for aromatic, aliphatic, and hetero-aromatic nitriles with wide functional group tolerance. The regioselective hydration of nitrile as well as utilization of water: ethanol as a co-solvent made the process environment friendly and economical.

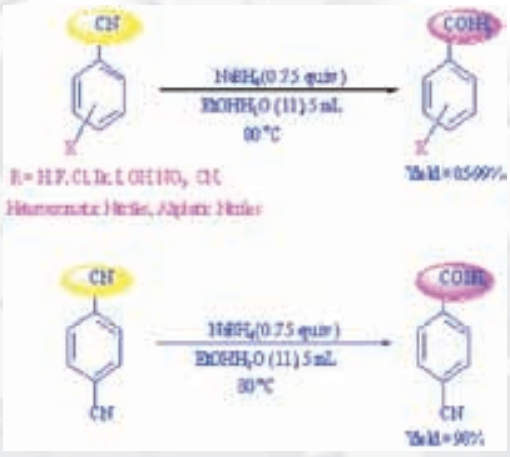


Fig:1.33 Schematic for conversion of nitriles to amides

Cobalt Phthalocyanine Immobilized on Graphene Oxide: an Efficient Visible Active Catalyst for Photo-reduction of Carbon Dioxide

CSIR-IIP has synthesized Novel graphene oxide (GO)-tethered Co(II) phthalocyanine complex [CoPc–GO] via a step-wise procedure and was demonstrated to be an efficient, cost- effective and recyclable photo-catalyst for reduction of carbon dioxide to produce methanol as the main product. The developed GO-immobilized CoPc was characterized by X-ray diffraction (XRD), FT-IR, XPS, Raman, diffusion reflection UV-Vis spectroscopy, inductively coupled plasma atomic emission spectroscopy (ICP-AES), TGA, BET, SEM and TEM. FTIR, XPS, Raman, UV-Vis and ICP-AES along with elemental analysis results showed that Co(II) Pc complex was successfully grafted on GO. The prepared catalyst was used for photo-

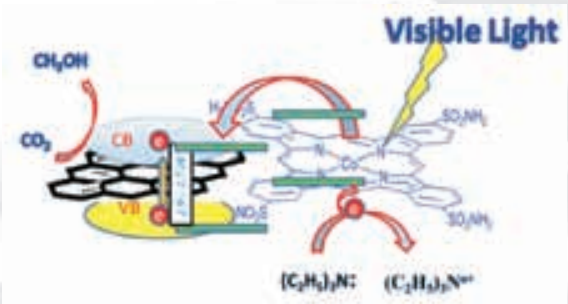


Fig: 1.34 Photo-redcution of CO_2 using GO-CoPc catalyst

catalytic reduction of carbon-di-oxide by using water as a solvent and triethylamine as the sacrificial donor (*see below*). Methanol was obtained as the major reaction product along with formation of a minor amount of CO (0.82 %). It was found that GO-grafted CoPc exhibited higher photo-catalytic

activity than homogeneous CoPc as well as graphene oxide and showed good recoverability without significant leaching during the reaction. Quantitative determination of methanol was done by GC-FID and confirmation of product was done by NMR. The yield of methanol after 48 hours of reaction by using GO-CoPc catalyst in the presence of sacrificial donor tri-ethylamine was found to be 3781.8881ìmol.g^{-1}-cat and the conversion rate was found to be 78.7893 ìmol.g^{-1}cat.h^{-1}. After the photo-reduction experiment, the catalyst was easily recovered by filtration and reused for the subsequent recycling experiment without significant change in the catalytic efficiency.

2.2 Technology Developed

Electrochemical technology for recovery of tetramethylammonium content as pure tetramethylammonium chloride from impure tetramethylammonium hydroxide

CSIR-CECRI has developed a technology for recovery of letramethylammonium content as pure tetramethylammonium chloride from impure tetramethylammonium hydroxide. This technology employs a double electrolysis of impure tetramethylammonium hydroxide employing electrochemical cell. During the first electrolysis the aromatic organics are isolated and the subsequent electrolysis these organics are polymerized and removed leaving alone the pure tetramethylammonium chloride. This technology is especially employed in special production used in rubber production industries. About 75% of the rubber chemical is produced in India by the above firm and the rest is imported. The parent chemical viz. Tetramethylammonium chloride is 100 times costlier than the special chemical used in the rubber industry. Employing this process the investment of the basic raw material is saved.

Plastic chip electrode cartridge

The "Plastic Chip Electrode" (PCE), developed by CSIR-CSMCRI is a complete materialized three electrode electrochemical system comprising of bulk conducting polymer composite material, ideal for disposable and on-site applications due to its economic viability. The bottleneck with current day's coated and screen-printed electrodes is that the conducting layers are not the integral part of the base/ substrate on which it is fabricated therefore can easily get delaminated due to mechanical jerk or high current. Further the system is a substitute to noble metals and technologies like screen printing for electrode fabrication. They are easy to prepare under normal conditions, bulk conducting, self-standing and mechanically stable. This cartridge electrode has enormous potential of requirement based tailoring and can be used in any aqueous medium electrochemistry.

Dissemination of high purity solar salt technologies and establishment of model salt farms across the country

In continuation to CSIR-CSMCRI's effort in disseminating high purity solar salt technologies to grass root level across the country, salt cluster development assignment was undertaken in Gujarat wherein marginal salt producers in the Santhalpur and Adesar region of Gujarat have been trained for good quality salt production and recovery of marine chemicals. Novel methodologies of high purity salt production developed at CSIR-CSMCRI also percolated to masses Model Salt Farm at Marakkanam of Vellupuram District in Tamil Nadu has been established. Scientists during monitoring visits conducted training programs for the small scale salt producers to produce good quality salt with improved yield and demonstrated salt manufacturers of Marakkanam Society the knowhow for good quality salt manufacture in the model salt farm.

Addressing the burning issue of saline waste streams

Saline waste streams of industries create environment hazards. The recovery of value added chemicals from these streams not only mitigates the environment pollution but also helps in creation of

wealth. CSIR-CSMCRI has developed process know-how for recovery of value added chemicals. The liquor was neutralized with HNO_3 and solid KNO_3 of 99% purity was recovered at ambient temperature by volume reduction and pH adjustments. After recovery of KNO_3, the liquor containing remaining KNO_3 and $NaNO_3$ was treated with either $NaClO_4$ to convert $KClO_4$ or by tartaric acid to get potassium tartrate selectively. The recovery of these salts was >99% with a purity of higher than 99.5%. The final left out liquor after separation of value added salts was subjected to evaporation for recovery of high purity $NaNO_3$. Recovery of equivalent amount of CO_2 in lime water was also demonstrated. The know-how of the process is transferred.

Commercial farming and Method of cultivation of economically important seaweed *Gracilaria dura*

Gracilaria dura occurring in Indian waters has been reported to be potential sources of agarose (US Patent 2005/0267296A1). The scanty biomass and restricted occurrence at the bottom of deep tide pools along few locations of the north western coast of India limited its exploitation for industrial utilization. An innovative, cost effective and green method has been developed by CSIR-CSMCRI to obtain high quality agarose from dry algal biomass. The holistic cultivation approach has been developed at MARS, Mandapam. The process has been transferred to M/s. Aquagri Processing Ltd., New Delhi.

Fig: 1.35 Clonal propagation and tube culture of Gracilaria dura

Fig: 1.36 Various method of farming Gracilaria edulis in the open sea

Five different cultivation methods namely, floating bamboo raft, poly propylene net, net bag, hanging rope technique and net pouch were investigated for their suitability to undertake farming in the open sea. Among these, polypropylene net method yielded highest biomass (1.764 ± 0.82 kg fr.wt/m^2) with corresponding daily growth rate (DGR) of 3.748 ± 0.91% day^{-1}, followed by floating bamboo raft (1.05 ± 0.39 kg fr.wt/m^2, 2.61 ± 0.45% day^{-1}) and net bag (0.904 ± 0.57 kg fr.wt/m^2, 0.985 ± 0.45% day^{-1}) methods respectively.

Commercialization of Thin Film Composite (TFC) Reverse Osmosis (RO) membrane manufacturing technology

CSIR-CSMCRI has developed and transferred technology for thin film composite RO membrane manufacturing. TFC RO membrane manufacturing is a multistage process. In the first stage polyester non-woven fabric supported polysulphone based microfiltration membrane (120-130 micron thickness) is manufactured according to phase

Fig: 1.37 Inauguration TFC RO membrane manufacturing by Mr. Kirloskar, MD Kirloskar Engg. and Mr. Unnikrishnan, MD, Thermax

inversion process at a rate of 500-600 sq m/h. In the second stage, an ultrathin polyamide layer (0.15-0.20 micron thickness) is prepared on top of the microfiltration membrane according to in situ interfacial polymerization process between a diamine and a multifunctional carboxylic acid chloride at a rate of 25-50 sq.m/h. The nascent TFC membrane is subjected to M/s Uniqflux Membranes LLP, Pune various chemical treatment processes. Subsequently, spiral modules of different sizes are made from the membrane. The technology has transferred chemical science.

3 ENGINEERING SCIENCES

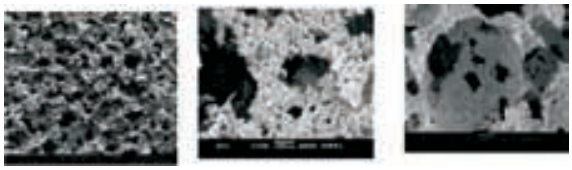
3.1 Scientific Excellence

Highly Porous Open Cell Ti Foam for Bio-implants Applications

Process flow chart for making Ti Foam using different kinds of space holder has been developed. Using the process Ti-foams of wide range of porosities (50 to 85%) and cell sizes (50 to 300 μm) were produced. CSIR-AMPRI has developed the process for making large size (50mmx50mmx15mm) foams using the developed process. The developed foams exhibits coarser cells due to removal of space holders and fine micro pores at the cell wall (10 to 15 μm). These fine pores at the cell wall make the foams to be capable to allow fluid to move through it. In case of highly porous foam (>75% porosity) the macro cells are largly open to the neighbouring cells make it faster flow of fluid. This has been examined through filtration of water and other liquid through it. These foams are characterised interms of its strength, modulus and energy absorption. The strength of these foam varies in the range 15 to 90 MPa and the modulus varies in the range of 8 to 26 GPa depending on the cell size and porosity fraction. These porous Ti- foam with cell size of +250 μm (average size 300 μm) and -250 (average size 130 μm) were examined for cell viability test considering standard biofluid as the control. The test was conducted using HELA and A549 cells. 7000 cells were seeded in 24-well plate with metals spherical and rest 7000 cells were added after 4hr

(a) (b) (c)

Fig:1. 38 Ti-foams of varying porosities : (a) 65%, (b) 75% and (c) 85%



(a) (b) (c)

Fig: 1.39 Microstructure of foams (a) Ti-foam of 75% porosity with spherical Ti-particles, (b) Ti-foams with 80% porosity with angular Ti-particles and (c) Ti-foams with 85% porosity using spherical Ti-particles.

per well then cells were incubated for 72hr before assay. 100ng/ml LPS for 30hr were taken as positive control. Details studies are under progress.

Technology Transfers from CSIR-AMPRI

CSIR-AMPRI has transferred technologies for 'Hammer Tips for Sugar Mills' and 'Cement-free green cement to M/s Asugar Engineering Services, Sai Maa, at Kawadi Post and M/s Jindal Steel & Power Limited, Raigarh.

The above technology/knowhow transfer will lead to improvement of the economy as these knowhow

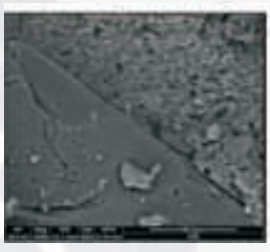


Fig: 1.40a FESEM images of OPC mortars at 90 days

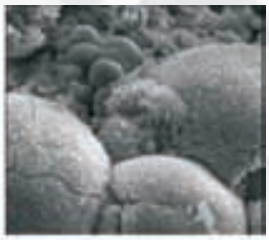


Fig: 1.40b FESEM images of fly ash based GPC mortars at 90 days

are environment and user friendly besides giving a boost in the economy for the industry partners.

CSIR-CBRI has assessed the potential reactivity of siliceous and sandstone aggregate in geopolymer concrete using fly ash and GGBS (ground granulated blast furnace slag) composite under accelerated condition. The mix proportioning of mortar bars was carried out as per ASTM C1260 using fly ash/GGBS, aggregate and activators. The cast samples were immersed in NaOH solution and the ordinary portland cement (OPC) mortar bars were taken as control specimens. The exposed mortar bars were assessed for their expansion and microstructural changes. A comparison in the expansion of geopolymer concrete was also made with its corresponding OPC concrete. It was observed that the expansion in geopolymer mortars at 16 days exposure was less than 0.1% as specified in ASTM C1260 whereas OPC mortars expanded beyond the threshold limit. When the exposure period was extended up to 90 days, the expansion in the fly ash based geopolymer approached the threshold (0.1%) while fly ash-GGBS composite mixes exhibited expansion in the range of 0.31-0.56%. It was also noted that fly ash based geopolymer mortars had 60% less expansion than the OPC mortars. Contrary to this, geopolymer mortars made with fly ash-GGBS composite mixes exhibited 23-46% more expansion than the OPC mortars. Evidences of deterioration in the exposed OPC and geopolymer mortar bars were viewed in FE-SEM micrographs. In OPC mortars, a rim of reaction products was observed around the aggregate. The fly ash based geopolymer mortar showed an intact interface between the paste and the aggregate while in the case of fly ash/GGBS based geopolymer, a clear demarcation between the paste and the aggregate was observed at the interfacial transition zone.

The study resolved that geopolymer concrete were less susceptible to the expansive alkali-silica reaction. However, for longer periods, expansion beyond the prescribed limit was observed in the case of fly ash-GGBS composite mix based mortars. The deleterious alkali-silica reaction in geopolymeric environment thus can be prevented through a dense matrix formation by utilizing/ immobilizing dissolved silica in geopolymer, and also by involving CaO in the Na/Ca-A-S-H phase formation through ternary binder system.

Rare-earth doped glass/glass-ceramics and metal glass nanocomposites to improve the efficiency of Si-PV cell

CSIR-CGCRI has studied a number of glass systems doped with different combinations of rare-earth ions for their Down Shifting (DS), Down or Up-conversion (DC or UC) mechanisms. In (Nd^{3+}/Yb^{3+}) doped glass systems. An efficient visible to NIR (~1mm) energy down-shifting (DS) was achieved with Nd^{3+}!Yb^{3+} transfer efficiency in the range 95-100% due to excellent matching of the host phonon energy with that of the energy difference between donor (Nd^{3+}) and acceptor (Yb^{3+}) energy levels. In Eu^{3+}/Eu^{2+}-Yb^{3+} co-doped oxyfluoride glass ceramics containing BaF_2 nanocrystals, a Down-conversion (DC) phenomena (UV to NIR region) based on cooperative energy transfer from $Eu^{2+}$to Yb^{3+} ions was evidenced resulting in intense NIR emission. Further, a series of Pr^{3+}-Yb^{3+}co-doped low phonon glasses exhibited an efficient VIS to NIR DC emission under 474nm excitation from Pr^{3+} to $Yb^{3+}$with an estimated DC efficiency of around 170%. An efficient IR to NIR UC from Er^{3+}-Yb^{3+}

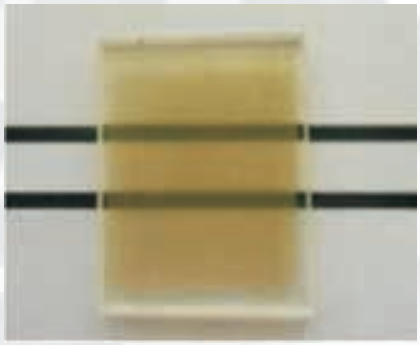


Fig: 1.41 Ag-glass nano composite coated silica glass substrate

pair was realized in the same host with an intense Yb^{3+} NIR emission at ~1 mm (where c-Si PV cell showed maximum spectral response) under 1550nm excitation (where c-Si PV did not respond to the solar spectrum).

The efficiency of silicon solar cell are increased by applying active layer of nanometal such as silver, gold, copper, etc particles containing glass nanocomposites. In further investigation, nanosilver (Ag^0) containing glass nanocomposites was developed. The precursor glass paste was coated on pure silica glass substrate and heat treated at 800°C for 30 minutes. The recorded absorption spectra indicated a strong absorption band at 424 nm which can be attributed to SPR peak characteristic to the silver nanoparticles.

TiB-TiN reinforced Ti_6Al_4V alloy composite coatings for orthopedic implants

CSIR-CGCRI has fabricated TiB-TiN reinforced Ti_6Al_4V alloy composite coatings via in-situ laser processing which revealed stable phases, fine ceramic reinforcements and relatively better mechanical properties. The composite coatings containing 5 and 15 wt% BN were deposited at 300W and 400W laser powers with a scan speeds of 10 mm/s and 20 mm/s to study their influence on the coating microstructures and the related properties. The experimental data showed that the average Young's modulus increased from 184±4 GPa in 5BN-400/10 coating to 204±14 GPa for 15BN-400/10 coating. In vitro tribological tests on the coatings showed lowest wear rate of 1.9×10^{-6} mm^3/Nm for 15 wt.% BN coating, which is order of magnitude lower than Co-Cr-Mo alloy. Similar In vitro PI positivity (8-12 % of gated cells) of the coatings demonstrated similar biocompatibility of all the surfaces towards MG63 cells.

Ballistic testing of Ceramic tiles

CSIR-CGCRI has carried out Finite Element Analysis on alumina based ceramic and aluminum based metal plates. Interaction of 7.62 mm 30 mm AP bullets with ceramic and metal plates of different thicknesses was modeled. The performance of bare and encased alumina against 30 mm AP bullet suggested that the resistance of the encased alumina is much better compared to bare alumina against the projectile. 164 numbers of 50x50x 5 mm^3 dense alumina plates were fabricated by machining. One complete alumina ceramic panel (300x300 mm^2 in 500 x 500mm^2 frame) with aluminium backing plate

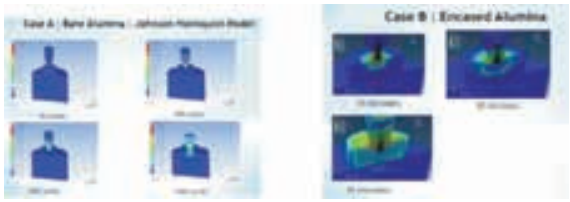


Fig: 1.42a Simulation results against 30 mm AP bullet

Fig: 1.42b (L) Alumina Ceramic composite armour test plate (500 X 500 X 50) mm^3 of weight = 29.7 kgs and (R)) Testing of ceramic armour panel at

was fabricated for testing. It was tested against 30 mm AP bullet at TBRL. Alumina and Silicon Carbide Ceramic tiles were fabricated for ballistic testing.

Fabrication and Characterization of Flat Sheet Membranes

CSIR-CMERI has fabricated polyvinylidenefluoride (PVDF) membranes of high porosity are fabricated by phase inversion technique. This involves mixing the additives to the base polymer to form a solution, followed by extrusion of this solution on a glass plate to form a film of desired thickness and extraction of the membrane in a non-solvent. Inorganic filler materials are also used to improve thermal stability

of the separator. To obtain optimized performance, the composition of filler material and the solvent used for fabricating the separator were varied, and the electrochemical performance of the fabricated separator investigated.

Smart and Intelligent Actuators Based Micro Manipulation Systems for Robotic Micro Assembly

Desirable characteristics of fabricated separator include enhanced wettability, dimensional stability at elevated temperature and chemical resistance. Through the aforementioned exercise, a simplistic approach has been demonstrated to appreciably enhance the thermal stability of the fabricated separator by incorporating inorganic nano fillers (SiO_2). Fabricated membranes were analyzed for their wettability, thermal stability and electrochemical performance, which exhibited excellent miscibility with the liquid electrolyte

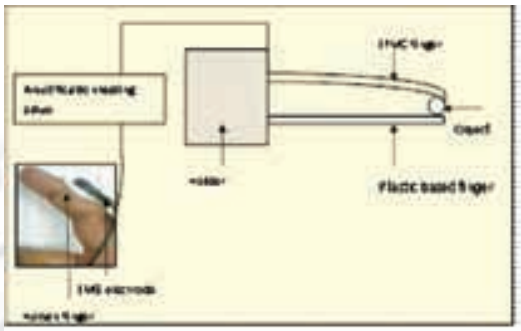
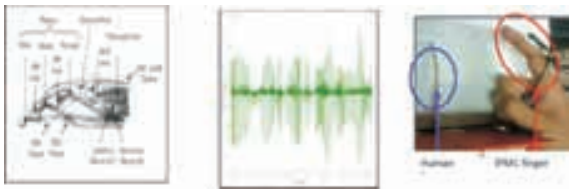


Fig: 1.43 Layout of IPMC based micro gripper driven by EMG signal

desirable for developing better Lithium ion rechargeable batteries. Effort is being made to investigate advanced materials and develop separators with even better electronic insulation, uniform pore size distribution, mechanical strength and good electrochemical performance.

Design and control of an IPMC artificial muscle finger for micro gripper using EMG signal

CSIR-CMERI has made an attempt is to design and control of IPMC based artificial finger for micro



(a) Index Finger *(b) EMG signal* *(c) Activated state of finger*

Fig: 1.44 Behavior of IPMC finger for micro gripper using EMG

gripper. In this work, IPMC based micro finger is actuated by controlled electromyography (EMG) signal as shown in Figure 3. The EMG signal is taken from human index finger via EMG sensor. This signal is pre-amplified before transferring to IPMC for achieving the large bending behaviour of IPMC. The bio-mimetic actuation behaviour of IPMC is studied by movement of index finger muscles through long tendons. The stability analysis of EMG signal from human index finger is carried out by providing the PID control system. Experimentally, it is observed that IPMC finger can hold the load upto 100 mg when IPMC finger is activated through EMG via human muscles and an IPMC based finger for micro gripper is demonstrated as shown in Fig. 1.44.

Multi micro manipulation system using piezoelectric actuators based micro grippers for robotic micro assembly

CSIR-CMERI has developed a multi micro manipulation system for robotic micro assembly

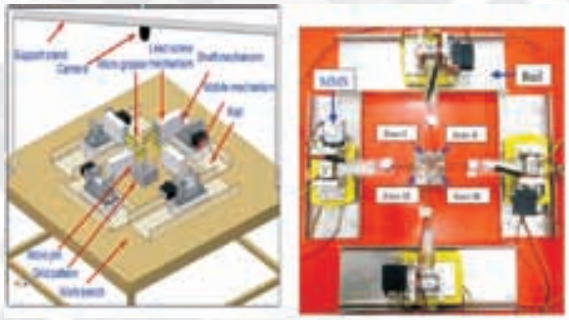


Figure 1.45: Multi Micro Manipulation System Using Compliant Piezoelectric Micro Grippers for Robotic Micro Assembly

using four micro-manipulation systems (MMS) are placed on a single work bench as shown in Fig. 1.45. Each MMS are placed on specific rails which are positioned at equal distance and perpendicular to each other. These rails are constructed for providing the lateral motion of MMS towards picking and placing of the object from one hole position to another. Each MMS is identical in shape & size and it has 3-DOF for attempting the pick & place and peg-in-hole assembly in 3-dimesional space. These MMS can perform the operation of robotic assembly in sequential or random manner through automatic or joystick controls.

Characterization and processing of natural gemstones of Odisha

CSIR-IMMT has studied various collections of ruby, sapphire, garnet, and iolite from southern Kalahandi and Nuapada districts of Odisha. Processing such

As received Polished *Surface cleaning* *Heat Treatment & Oxide filling*

Fig: 1.46 Successive stages of treatment in ruby gemstone

as heat treatment, lead oxide filling, laser heat treatment and Li incorporation have been taken up for typical ruby gemstones to improve color, contrast, refractive index, matching and tuning of shade.

Hybrid nanostructures for photoelectrochemical water splitting

CSIR-IMMT has synthesized Sodium niobate nanorods by a facile surfactant free hydrothermal method to explore their potential for photoelectrochemical water splitting under visible light. Core-shell nanorods were fabricated by grafting CdS on sodium niobate nanorods. Better

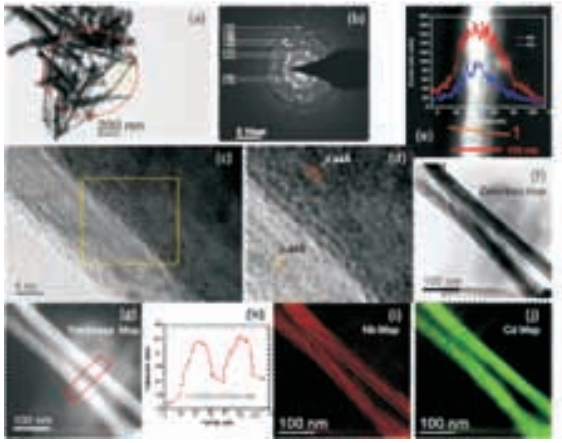


Fig: 1.47 Electron microscopy of CdS-SNR samples(a) Low magnification TEM image, (b) Selected area electron diffraction from a region marked by dotted circles in (a), (c) HRTEM image showing lattice fringes, (d) Fourier filtered image from a region marked by dotted box in (c), (e) STEM-HAADF images and in inset the EDX line profile from a region marked by a line 1. (f-j) EFTEM images taken from another core-shell nanostructure; (f) zero-loss image, (g) relative thickness map, (h) profile of thickness map from region marked by a rectangle in (g) showing rod like structure, (i) chemical map of Nb (red), (j)chemical map of Cd (green), indicating the locations of different atoms across the structure.

photo-generated charge carrier separation exhibited here will help in the design of hybrid photocatalysts with solar hydrogen generation efficiently. TEM analysis shows the formation of sodium niobate nanorods which are of the order of 40 ± 5 nm in width and 1300 ± 100 nm in length. Presence of the thin layer on nanorods as observed in TEM image CdS-sodium niobatenanorod, and the XRD and SAD analysis reveal the grafting of hexagonal CdS on orthorhombic sodium niobate nanorods.

Defect evaluation in pipes using Magnetostrictive sensors made from nanostructured soft magnetic materials

CSIR-NML has expertise on development of rapidly solidified amorphous and nanostructured magnetic materials. Activities on inspection of pipes using Magnetostrictive sensor (MsS) is being carried out

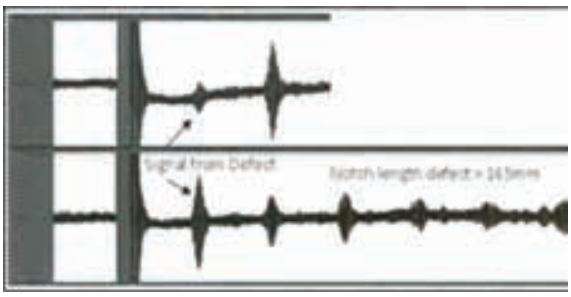


Fig: 1.48 Typical signals obtained for notch length of 30mm and 165mm

in the laboratory using the development materials. CSIR-NML has made an attempt to modify the magnetostrictive sensor (MsS) for enhanced sensor output signal and detection of different types of defects in the pipe using the MsS sensor. Amorphous or nanostructured sensing core in the form of $Fe_{80}Si_8B_{12}$ melt sun magnetostrictive ribbon was used. The sensor comprised of a transmitter (T_c) cable, receiver coil (R_c) and DC biasing cable (B_c). Defects with increasing notch lengths were created in the pipe. The amplitude of reflected signal from the defect increases with increase in length of the notch and thus the defect size in ferrous pipe.

Process for production of DRI using iron ore slime with middling and rejected coal

CSIR-NML has developed a process for production of highly metalized low sulphur direct reduced iron (DRI) utilizing waste iron ore slime and waste reducing agents. Waste middling coal and reject coal are used as reducing agents which contain more than 30 and 50% ash respectively. Iron ore slime pellets of 12 - 20 mm were made by the conventional method of pelletizing with optimized moisture content to obtain optimum green and dry strength. These iron ore slime pellets were dried in an ambient atmosphere and reduced in a bed of middling and reject coal containing premixed desulphurizing agent. Reduction temperature, time, size of pellets and reducing agents were optimized to yield highly metalized (>95%) low sulphur DRI. It is interesting to note that reduction of iron ore slime pellets were carried out without indurations/firing at high temperatures compared to the conventional DRI route. In addition to this, the reducing agents required for the present invention is only about 5 to 8% higher than the theoretical value which is 40 to 50% less than the conventional DRI process. An innovative process with optimized process parameters has been developed for production of highly metalized low sulphur DRI utilizing waste iron ore slime with waste middling and rejected coal. The DRI produced from this process have high metallization (> 96%), low sulphur content « 0.006), high cold crushing strength (> 200 Kg) suitable for blast furnace, induction furnace and electrical furnace for iron and steel making.

Potash recovery from feldspar with simultaneous recovery of ferro-silicon

India neither has any high grade primary potash reserve nor produces any potash based fertiliser. Total potash requirement of our country is met through imports. India has a reasonably good amount of low grade surface deposit of potash in the form of glauconite and feldspar with average potash content of about 5-12%. However, the K present in this explored mineral is chemically bound with aluminum and silicon and is not in water soluble form, which cannot be absorbed by plant crops. Hence it is not suitable for direct application in the fields. Potash from such minerals needs to be recovered as K_2O/potash salt for agricultural purposes. Feldspar containing 10- 12% K_2O can be considered as a very good raw material for recovering potash for its use in agriculture. CSIR-NML has developed an interesting process for the recovery of potash from feldspar ($K,O.Al_20.6Si0_2$) containing about 11% K,O. The process recovers' potash by volatilization during smelting and simultaneously producing metallurgical grade Fe-Si. Various smelting parameters were optimized and tested on a two kg scale. However, the potassium vapor generated during smelting could not be collected in the open arc furnace.

Silica, magnesia and alumina are the major gangue materials in this sulfide ore of copper. CSIR-NML

has developed bench scale beneficiation to achieve the objective through the flotation route. It was observed that the sample was 95% liberated at 75 micron size and liberation was not a major issue with the sample. Effective depression of the gangue was of major concern. It has been established that a pH of around 10 in the roughing stage and around 10.5 in the cleaning stages was required for effective flotation of the ore and no regrinding stage was necessary. Several depressants were investigated to bring down the gangue content to around 10% and the most effective depressant was recommended. The insoluble content was brought down to slightly below 10% in the final concentrate with this depressant. It was recommended that the pulp density must be low in the re-cleaner stages. The suggested PD values are around 30-34% in the rougher, scavenger and cleaner. The PD values must be gradually decreasing in the re- cleaners in the range of 15-25%.It was also established that the efficiency of the suggested circuit would improve if the ore is mixed with another ore investigated in the ratio of 80:20.

Smelting study of chromite ore of different grades to produce ferro-chrome in 50 kVA EAF

Chromite ore mined in Sukhinda mines are rich in Cr and Cr:Fe ratio is increasing day by day which leads to increase in its refractoriness. Its reduction and smelting is very difficult. In the present practice, this high grade ore is being blended with low grade ores to maintain Cr:Fe ratio of 2:6. However, in practice difficulties in furnace operation and Cr loss in slag occurs due to the frequent fluctuation of blend percentage. Process parameters need to be established for smelting reduction of refractory chromite ore for their optimum utilization in existing submerged arc furnace (SAF) process with an aim to produce 62% Cr in ferro-chrome with a maximum of 10% Cr loss in slag. CSIR-NML has conducted experiments in 50 kVA EAF in 12 kg batch (ore in charge) to study the metallic recovery, optimum power consumption with varying ore grades and flux composition. Tata Steel is conducting further study on produced slag and metals. Power requirement for smelting reduction in 50 kVA EAF is around 55 kWh. Soderberg paste (Graphite lining) has shown better performance than magnesite refractory. A good metallic recovery has been found in all cases, even for the refractory ores (Fe/ratio up to 4) and this is comparable with conventional sintered pellet charging.

Beneficiation strategy for low grade copper ore from Zambia

Silica, magnesia and alumina are the major gangue materials in this sulfide ore of copper. CSIR-NML has developed bench scale beneficiation to achieve the objective through the flotation route. It was observed that the sample was 95% liberated at 75 micron size and liberation was not a major issue with the sample. Effective depression of the gangue was of major concern. It has been established that a pH of around 10 in the roughing stage and around 10.5 in the cleaning stages was required for effective flotation of the ore and no regrinding stage was necessary. Several depressants were investigated to bring down the gangue content to around 10% and the most effective depressant was recommended. The insoluble content was brought down to slightly below 10% in the final concentrate with this depressant. It was recommended that the pulp density must be low in the re-cleaner stages. The

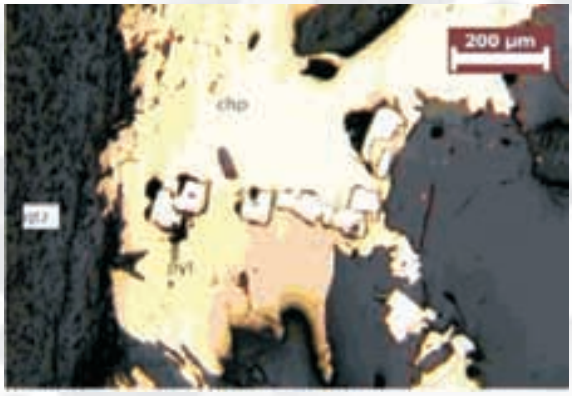


Fig: 1.49 Optical photomicrograph of the ore: inclusions of pyrite (pyt) within chalcopyrite (chp) and quartz (qtz)

suggested PD values are around 30-34% in the rougher, scavenger and cleaner. The PD values must be gradually decreasing in the re- cleaners in the range of 15-25%.It was also established that the efficiency of the suggested circuit would improve if the ore is mixed with another ore investigated in the ratio of 80:20.

Magnetoresistance based Sensor

CSIR-NAL has developed magnetoresistance element based gear tooth sensor for industrial sensor applications using GMR films deposited on 2-inch SiO_2 and Si_3N_4 coated wafers consisting of more than 200 sensors. Giant magnetoresistance (GMR) is a quantum

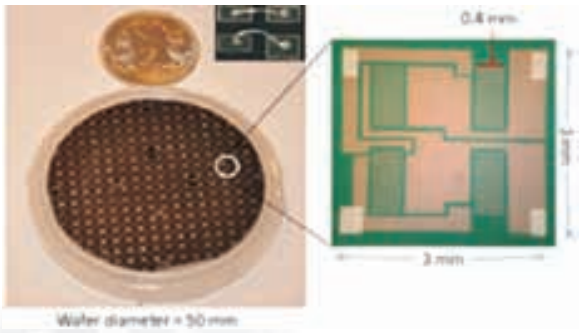


Fig: 1.50. 2-inch wafer level deposition and sensor patterning along 1.2 micron al bond pads and wire bonding.

mechanical magnetoresistance effect observed in thin-film structures composed of alternating ferromagnetic and non-magnetic conductive layers. The main application of GMR is in magnetic field sensors, which are used to read data in hard disk drives, biosensors, microelectromechanical systems (MEMS) and other devices.

3.2 Technology Developed

Contributions BrahMos Programme

CSIR-NAL has made notable contributions especially to the strategic sector which has brought both honour and pride. A drop test of stores from a SU-30MKI aircraft model in NAL's 1.5m low speed wind tunnel using Froude scaling principles has been carried out, which enables the tests to be carried out at low speeds (M<0.3). The study provided the ideal conditions for the stores release at actual flight Mach Nos. including the deflection setting angles for the fore and aft fins. The software developed allowed tracking of the time-resolved displacement, velocity, acceleration and Euler angles. The Fig. 1.51a shows a composite image of the missile recorded at four different instances along the trajectory. The tests used 1/30th scale model of SU- 30MKI aircraft and store. Further, wind tunnel tests were also carried out on a scaled isolated store model in the 0.6m trisonic wind tunnel to obtain the aerodynamic loads. The same store model was attached to a scaled SU-30MKI aircraft model and aerodynamic loads on the complete con- figuration were determined in the 1.2 m wind tunnel (Fig.1.51b). Tests were carried out in the Mach number range 0.55 to 1.2 at various angles of attack and sideslip to ascertain installation effects, store load in carriage position and in aircraft interference flow-field. For this breakthrough

Fig:1.51a Composite image of Store release trajectory

Fig: 1.51b Models mounted in 0.6m and 1.2m wind tunnels. (i) Isolated store model in 0.6m WT. (ii) Parent aircraft model in 1.2m WT

Fig:1.51c 'Best Laboratory Award 2014' conferred to CSIR-NAL during the celebrations of BrahMos day in New Delhi, 12th June 2014.

technology development and associated outstanding contributions, National Aerospace Laboratories has been conferred with "Best Laboratory Award 2014" by BrahMos. Dr. Abdul Kalam, former President of India, presented the Best Laboratory Award 2014 to CSIR-NAL during the celebration of BrahMos Day in New Delhi on 12 June 2014 (Fig 1.51c).

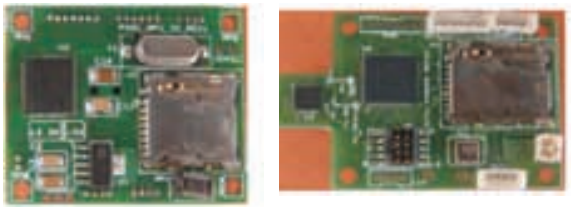
Contributions to LCA (Tejas) Programme

CSIR-NAL led National Control Law Team (CLAW) played a crucial role in Tejas flight envelope expansion and up-gradation of control laws for obtaining the aircraft Initial Operation Clearance. On 20th December 2013, Tejas received the second of three levels of operational clearance (IOC-2). Also, the Air Data System (ADS) calibration was carried out using the flight data from high AOA PID test experiments. This process has led to the successful clearance of Initial Operational Clearance (IOC) version of the Air Data System. Using IOC standard Air Data System as the baseline, ADS for the Naval and two seater Airforce (Trainer) variants have been developed. After successful ground testing, Naval ADS version is integrated onto the aircraft and is currently undergoing flight tests. As a part of LCA series production, new production standard tools were designed and fabricated in association with the production partner M/s TATA Advanced Materials Ltd. Two sets of components were fabricated and First Article Inspection (FAI) was successfully carried out on composite products. The first set of components was also cleared by the Directorate General of Aeronautical Quality Assurance (ORDAQA) for aircraft assembly.

Contributions to Space Programmes

CSIR-NAL has played a crucial role in the acoustic qualification of subsystems for the indigenous cryogenic stage used in GSLV–D5 for the Department of Space. These tests helped in the first successful flight (January 5, 2014) of the GSLV Mark II using the indigenously developed cryogenic engine, the CE-7.5 by ISRO. The LH2 Vent and Relief line along with the vent valve and the Protection plate in the Inter-Tank Truss region were crucial subsystems of the indigenous cryo stage which underwent acoustic qualification at CSIR-NAL (Fig.1.52a&b). Further, complete aerodynamic recharacterization of the LVM 3 vehicle with fully simulated wind tunnel model has been carried out at NTAF of CSIR-NAL. The major challenge was to design, manufacture and test models for force measurements, steady and unsteady pressure measurements in a very short time frame. Further, the acoustic qualification of ISRO's recent

Fig:1.52 (a) GSLV LH2 vent & Relief line and (b) GSLV ITT protection plate ready for acoustic test at ATF



APV1 Version<10gms *APV2 Version< 10gms*

APV3 Version 12gms *APV4 Version 14gms*

Fig: 1.53 Indigenous PSoC based autopilot hardware for MAV.

successful Mars Orbiter Mission (MOM) satellite has been carried out at the new ATF facility at ISITE (ISRO Bengaluru) designed, built and commissioned by CSIR-NAL. NAL's ATF scientists were closely associated with these acoustic qualification tests. CSIR-NAL is very proud to be associated with the successes of ISRO's GSLV-D5 and Mars Orbiter Mission programmes.

Indigenous PSoC based autopilot hardware for MAVs

CSIR-NAL is the lead agency for Micro Aerial Vehicle (MAV) development in the country. In the current period, efforts have gone in for the improvement of fixed wing MAVs like Slybird of 1.5 m wing span and Pushpak of 450 mm wing span related to product engineering aspects. The Slybird mini UAV and Pushpak 450 Micro UAV were successfully demonstrated to CRPF and NSG at Manesar during November 2013. In a notable achievement CSIR-NAL has successfully designed and developed state-of-the art indigenous Autopilot hardware using Programmable System on Chip (PSoC) based controller, 10 Degree of Freedom (10 DoF) sensor suite, pressure altimeter sensor, micro SD real-time recording device, interfaces to Servo

Fig: 1.54 Integration of autopilot hard ware with data logger to the Powered Hang Glider.

actuators, interface to GPS receiver, and other sensors/ devices (Fig. 1.53). The autopilot hardware has been integrated and test flown successfully in plat- forms like Slybird, Sky Surfer, and Hang Glider apart from various ground vehicles (Fig.1.54).

Advanced sensor-based technique for raw materials beneficiation

CSIR-NML has developed a technique for an online gradation of iron ores based on alumina content. After a preliminary exploration of the few existing techniques for ore gradation, IR thermography was selected for this purpose. Iron ores with Fe composition in the range of 58 to 67 wt. % and alumina (Al_2O_3) from 1.0 to 6.0 wt. % were collected from Noamundi mines, Tata Steel, Jamshedpur. The

Fig: 1.55 Microstructure of biphasic block

bulk amount of iron ore specimens was weighed and divided into portions of equal quantity. Each portion of ore specimens were taken in a petri dish and heated uniformly using a microwave oven for a duration of 10 second which is sufficient to create a difference in IR emission between the ore specimens. Infrared Thermography (make FUR Agema 550) with 0.1°C resolution was configured to capture the thermal image of the heat radiated by iron ore specimens placed at fixed distance from the IR camera. Calibration was done on 150 samples collected from Noamundi. During this period, a flow sheet shown in the figure below was prepared for predicting alumina in the iron ores. The technique was demonstrated and implemented at Noamundi in September, 2013. An on-site training to personnel was provided and this process has since been continuously used at Tata Steel, Noamundi.

Graphene based composite coating for corrosion inhibition of steel

Graphene, a single atomic layer of fused sp2 hybridized carbon atoms, exhibits unusual electronic properties owing to the linear dispersion of valence and conduction band. Besides, it has been shown recently that the graphene sheet is impermeable to all the chemical ions, which motivates many researchers to use graphene as a coating material on metals for corrosion inhibition. CSIR-NML has developed a process for coating of graphene on steel from seedlac as a carbon source. Subsequently, coating of a layer of cooked oil on the graphene coated steel followed by heating yields a composite coating. The composite coating showed good corrosion inhibition of steel in 3.5 wt.% salt solution. The corrosion properties measured by salt spray technique revealed that the coating lifetime of composite on steel is more than 200 h. The developed process has potential to make cost-effective graphene coated steel for corrosion inhibition.

Process flow sheet for beneficiation of low grade Iron ore sample from Shire-Mentebteb, Ethopia

About 500 million tonnes of iron ore resources are located in Shire-Mentebteb region of Ethiopia. The deposit is a lean grade goethitic ore and it is to be concentrated to a level suitable for utilization through blending with high grade concentrate for iron and steel making. CSIR-NML has developed a process flow- sheet for beneficiation of the low grade iron ore as saying 33.17% Fe to produce concentrate with 51% Fe.

Mineralogical studies of the ore revealed that goethite is the main iron-bearing mineral although its abundance is less compared to the gangue minerals. Major gangue minerals are quartz and clay. Clay, which forms the main matrix, contains finely dispersed goethite, quartz and occasionally hematite. From the texture of the ore it may be inferred that while the minerals like oolitic/pisolitic goethite, quartz will be liberated at a relatively coarser size, the finely dispersed goethite and clay at extremely fine sizes below 63 μm. The lean grade, complex mineralogy and goethitic nature of the ore posed a challenging task in developing the process flow sheet.

Processes for recovery of Cobalt from discarded Li-ion- batteries of mobile phone

In recent years generation of electronic waste (E-Waste) or waste electronic and electrical equipment (WEEE) has posed a new environmental challenge . Mobile phone batteries constitute a major fraction of e-waste, which contain rare and strategic metals such as cobalt, lithium, nickel etc that can be recovered in an eco-friendly manner following the zero waste concept. CSIR-NML has developed a cost effective process which to helps in reduction of e-waste and its inefficient recycling and dissolution of metals. The leach liquor generated is employed for removal of impurities following precipitation, solvent extraction or ion-exchange techniques. The purified solution containing cobalt in sulfate medium is used for the recovery of cobalt as salt or metal using crystallization/relectro-winning processes. The process has been transferred to M/s Adv. Metal Combine Ltd.

Lab Scale Aerospace Grade Autoclave

An affordable lab scale aerospace grade autoclave was conceived and designed by CSIR-NAL with the state of the art features to meet the growing need of the academia and R&D institutions. The first order was received from IIT Kanpur. It was indeed a proud moment as the first aerospace grade lab scale autoclave was formally handed over to IIT- Kanpur

Fig: 1.56 Lab Scale Autoclave : 900mm dia x 1000mm length, Maxm. temp 200 deg C, Maxm. Pressure-7 bar(g), power 23kW.

on 25th March 2014. The compact lab scale autoclave (0.9m diameter and 1.0m length work space) provides all the features of a large industry standard autoclave. The lab scale autoclaves was delivered by the CSIR-NAL led PPP consortium consisting of M/s. Unique chemo plant Equipments, Mumbai and M/s.Datasol India Private Ltd.

Technology transfer of Low Ozone Depletion Potential (0.01-0.5) Innovative Fire Suppression System

CSIR-CBRI has developed an all class water-mist based and low ozone depleting fire extinguisher. It is suitable for: Class Á' combustible material fires such as wood, clothe; class B flammable liquid fires such as petrol, diesel, and kerosene; class 'K 'kitchen fires for safety of Women; and electric fires. It is a low-cost equipment which can be made available at prices of Rs. 100, 200, 500 and 1000. The technology

Fig: 1.57 Technology transfer ceremony on the "CSIR-CBRI Liquid Extinguish anti Fire Extinguisher"on National Technology Day in May 2013

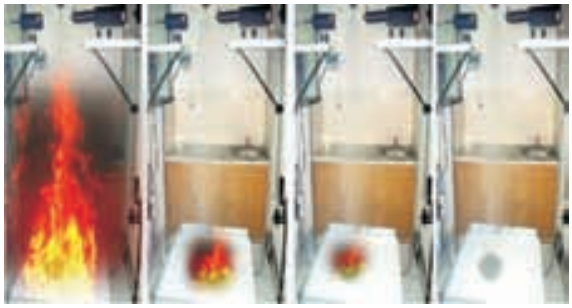


Fig: 1.58 Experiments with water-mist and other indigenously developed liquid extinguish ants in the 18,000nm to 10,00,000nm size range for effective extinguishment

has been transferred to M/s Aska Equipments, Ltd., New Delhi on Technology Day 2013.

Control measure and stabilization of a Landslide in Chamoli-Joshimath region of Garhwal Himalaya

CSIR-CBRI has carried out the stability analysis of the landslide to recognize the state of stability condition of the landslide area which helps to design the suitable control measures. The analysis was carried out for different land profiles as shown in the Fig: 1.51.Fig:

Factor of safety were calculated using limit equilibrium methods at different moisture conditions

1.59 Sections for stability analysis

varying from dry to 94% saturation. The factor of safety of a section was found to be 1.3 which decreases to 1.1 under full saturation. The analysis has revealed almost the similar results for different slip circles and for other sections also. The factor of safety of a critical slip surface was found to be just 1.00 under saturated condition. It was observed from the analysis that in dry condition a shallow part of the slope mainly comprising sandy silt becomes unstable while under saturated condition a significant portion of slope becomes unstable containing sandy silt and sandy gravel layers. The depth of the slip surface varies from 10-15m in different condition.

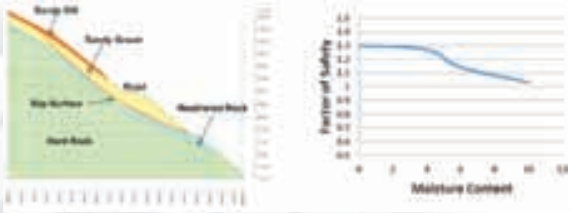


Fig: 1.60 Stability analysis of landslide slope

Fig: 1.61 Composite scheme of control measure prepared for stabilization of this landslide

A composite scheme of control measure has been prepared for stabilization of this landslide as shown in the following figure. The measures include reinforced soil structure, gabion wall, soil nailing, surface drainage and bio-measure.

This study was conducted through geological, geotechnical and geophysical investigations, and mathematical modeling of an active landslide of Chamoli- Joshimath region of Garhwal Himalaya to arrive at design and implementation of appropriate control actions.

Breathe analyzer for diabetes and sensor for asthma

Diabetes mellitus is a global epidemic and to date there is no non-invasive, cost-effective, user friendly, portable device available for detection of diabetes. Sensor and Actuator Division of CSIR-CGCRI has developed prototype of a breath analyser for detection and monitoring of diabetes based on ã-Fe_2O_3 sensor material with different dopants and tested its sensitivity/selectivity at laboratory level.

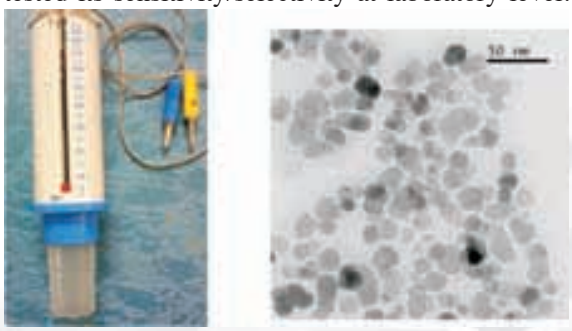


Fig: 1.62 (L) Prototype of humidity sensor and (R) monodispersed γ-Fe_2O_3 nanoparticles

In case of humidity sensor for asthma shown in the figure, the testing of sensor showed a response time of 2-4 sec for 6% moisture sensing which is aimed to reduce to 1-2 sec.

Fine Mg-Al layered double hydroxide nanopowders

CSIR-CGCRI has developed a new hydrothermal technique was developed to obtain fine Mg-Al

Fig: 1.63 (L) Nanoceramic vehicle (50-200 nm) in aqueous suspension and (R) Nanoceramic based SR (sustained release) tablet formulation for treatment of rheumatoid arthritis

layered double hydroxide nanopowders. The synthesized powder was found to exhibit excellent suspension properties. Using this process the drug loading (20-30%) was very effective (without denaturisation of drugs). *In vitro* drug loading and release studies were completed and typical tablets were developed from the powder are shown in the picture .

CSIR-CGCRI Glass Lining Technology goes into Production

CSIR-CGCRI has developed a suitable composition for a special type of impervious glass lining coating material and a process of application of the same on metallic substrates. Following an Agreement for Licensing of Know-how signed by CSIR-CGCRI with Standard Glass Lined Equipments Pvt Ltd Hyderabad, the company initially assimilated the technology on a small scale but subsequently established a full scale industrial manufacturing unit of 30,000 litres capacity. A section of the production line in the glass lining manufacturing unit based on CSIR-CGCRI technology is shown in picture.

Handing over of the Ceramic Membrane Plant at Taki, West Bengal

A plant (30000 LPD capacity) commissioned at Puratan Bazar, Hasnabad under office of Taki municipality, North 24 Parganas district, West Bengal for supply of safe drinking water has been handed over to office of Municipal Councilors of Taki on August 27, 2013 after six months of successful demonstration. The plant is designed to purify water of river *Ichamati* in two steps using Microfiltration cum Reverse Osmosis based membranes developed by CSIR-CGCRI and CSIR-CSMCRI.

Supercontinuum Light Source Inaugurated

India's first Supercontinuum light source designed and developed from a industry project under CSIRs New Millennium Indian Technology Leadership Initiatives jointly executed by CSIR-CGCRI and Vinvish Technologies, Thirivananthapuram has been inaugurated by Mr S Jaipal Reddy, Hon'ble Minister for Science Technology and Earth Sciences on 26th

Fig: 1.64 glass lining coating

September 2013 at New Delhi. CSIR-CGCRI has contributed the Photonic Crystal Fiber(PCF) medium to the development of commercial grade SC source. During Supercontinuum light generation, an intense laser pulse is passed through PCF medium that generates white light of stabilized high output power. The said Supercontinuum light source covers a broad wavelength range of 40 to 220nm and emits white light spectrum of 1.5W average power.

Transfer of Technology of Ceramic Membrane for Arsenic and Iron removal

CSIR-CGCRI has signed an agreement on July 22, 2013 on ceramic membrane based technology for removal of arsenic and iron (including the process for media preparation) with Entech Metals Pvt Ltd, Kolkata. Under this agreement, CSIR-CGCRI has granted license to Entech to utilize process know

how up to capacity of 20,000 LPD on non-exclusive basis for a period of seven years.

License for Know-how for the Manufacture of Low Sodium Content Glass Beads (SiBNa-9.5)

On February 17, 2014 CSIR-CGCRI signed the agreement with HR Johnson(India), Mumbai to license the knowhow for the Manufacture of SiBNa-9.5. Under this agreement, the Institute will place an order for supply of 3 tonnes of the product as demonstration production to HRJ within a period

Fig: 1.65 Handing over document to office of Muncipal Councellors of Taki

of sixty days of the signing of the agreement at a mutually agreed price. The Institute will also hand over the documents of technology transfer to HRJ within two months from the effective date.

Manufacturing of Glass Beads/ Nodules

CSIR-CGCRI has signed an agreement on February 27, 2014 with IFGL Refractories Limited, Sundargarh, Odisha to grant permission for manufacturing of glass beads/ nodules for encapsulation of nuclear wastes. The permission has been granted to make the product on the basis of CGCRI knowhow for a period of three years on non-exclusive basis from the date of the signing of agreement subject to successful completion of initial trials.

Technology for clean coal from high ash and high sulphur Indian coals

CSIR-IMMT has beneficiated high ash coking and non-coking coals and desulphurize north-east coal to achieve clean coals with 10% ash and low sulphur. Large number of samples from various sources including the mines and washeries of Jharia, Satabdi, Kathara, Sonepur Bazari, Hingula, Basundhara, north Karnapura, Meghalaya, and Assam were studied. Experiments suggest that it is possible to attain coking coal of standard 10% ash with up to 70% overall yield and non-coking coals with 10% ash and yield up to 45% by employing different mineral processing stages. These products can be used in blast furnaces and other metallurgical and smelting processes. Coal fines and washery rejects were also beneficiated using flotation techniques. Specific experiments involving Hingula non-coking coal led to a concentrate with 9.5% ash at 73% yield by grinding the coal to 100 microns and subjecting to jigging, tabling and flotation. This product can be used for blast furnace injection. Further it was possible to remove 50% of sulphur and about 8% ash in Maghalaya coal through biological treatment. Up to 30% sulphur removal was achieved in Assam coal by chemical leaching. Techno-economic feasible reports are being prepared with best process packages for specific coal types.

Hybrid nanostructures for photoelectrochemical water splitting

Sodium niobate nanorods have been synthesized by a facile surfactant free hydrothermal method to explore their potential for photoelectrochemical water splitting under visible light. Core-shell nanorods were fabricated by grafting CdS on sodium niobate nanorods. Better photo-generated charge carrier separation exhibited here will help in the design of hybrid photocatalysts with solar hydrogen generation efficiently. TEM analysis shows the formation of sodium niobate nanorods which are of the order of 40 ± 5 nm in width and 1300 ± 100 nm in length. Presence of the thin layer on nanorods as observed in TEM image CdS-sodium niobatenanorod, and the XRD and SAD analysis reveal the grafting of hexagonal CdS on orthorhombic sodium niobate nanorods.

Lead recovery from de-copperised anode slime

CSIR-IMMT has developed a process flow sheet for the recovery of lead values from de-copperised anode slime. Two different materials containing 22.35% and 47% lead along with other metal values such as Te, Se, Cu, Sb, As and precious group metals were studied. The flow sheet integrates with existing anode slime flow sheet available at M/s Hindalco Industries Ltd., Dahej. Unit operations process flow sheet includes brine leaching to solubilise lead values and PbS precipitation. Lead was recovered as lead sulphide and the overall recovery of lead was about 80%.

Extraction of potassium from Nepheline Syenite

Potassium (K) is mainly imported to meet internal requirement. Main potassium mineral resources, like soluble K-chlorides/sulphates present in some minerals (sylvite, sylvinite, kainite, and polyhalite) are not available in India. Alternatively, K values are associated with the silicate minerals like feldspar, mica, biotite, muscovite, and nepheline. Nepheline syenite is igneous rock largely made up of nepheline, feldspars without any free silica. The K_2O and Al_2O_3 value in it varies from 5-14% and 22-26% respectively and can be the potential future source for both alumina and potassium. Considering the huge deposits of nepheline syenite in Odisha, CSIR-IMMT has explored feasibility of recovering potassium values. Intensive characterization studies indicate that potassium present in nepheline syenite is in complex matrix form and requires high energy to unlock the K value. The chloridizing roasting-leach route was therefore applied for the extraction leading to recovery of all the potassium values (99.6%) by converting to sylvite phase by $CaCl_2$ roasting at 900° C followed by leaching using water at ambient temperature. Potassium being an essential element for plant nutrition, its demand for agricultural use is growing steadily at 3-3.5% per annum. It is expected that India's potash import would likely to go up in future from the present import level of 2.4 million tons per annum. The technology, after perfection, act as import substitution.

Design and development of improved Mineral Jig

A pilot scale improved mineral jig has been designed, developed and commissioned for beneficiation of low grade iron ores. It operated successfully at the capacity of 3 t/hr. The equipment has shown better performance in the beneficiation

Fig: 1.66 Improved Mineral Jig

of flaky and near gravity characteristics in processing Indian iron ores and will provide suitable raw materials for iron and steel industries. The technology has been transferred to M/s Arthur Turnkey Projects Ltd, Kolkata in 2013.

Tribo-electrostatic separator for coal beneficiation

CSIR-IMMT has developed a lab scale tribo-electrostatic separator with vibratory feeder and fluidized bed tribo-charger system for beneficiation of high ash Indian coal fines. Optimal operational conditions for the equipment have been established at 10 kg/hr scale for the raw coking coal rejects and washery fine rejects of Dugda washery, Jharkhand. The dry technology employed in the system will provide solutions for water management in washeries, tailing disposal, transportation and energy consumption. he equipment has shown 10% ash reduction at 60% yield from high ash coking and non-coking coals. The technology, on up-scaling and commercialization shall help the nation on efficient resource utilization and employment generation in coal sector.

Production of green steel by hydrogen plasma smelting process

CSIR-IMMT has developed a novel environmental friendly technology to produce steel without any polluting effluent gas. Unlike the conventional iron extraction process which requires multiple stages of processing in coke oven plant, sintering plant and blast furnace, the hydrogen plasma smelting would involve only one step process. The reduction reactions involving hydrogen and iron oxide will

Fig: 1.67 Hydrogen plasma smelting reactor

also eliminate the emission of CO/CO_2, thereby greatly minimizing the air pollution. It has been possible to produce pure iron containing more than 99.54 % Fe by hydrogen plasma smelting process in one kg scale. IMMT is exploring possibilities to scale-up the futuristic process with industry participation.

Cold setting fly ash brick manufacturing technology

CSIR-IMMT's technology employing non-firing process of mineral cementation and geopolymerization in the making of construction materials, like bricks and blocks has received market acceptance. The process has been licensed to 3 large industries and 13 MSMEs in the last two years. A pilot plant facility has been created at CSIR-IMMT for large scale production of fly ash brick. Apart from utilization of high volume fly ash in the making of bricks and blocks, the process is flexible and economic for utilization of red mud, crusher and granite dust, iron and chromite tailings, gypsum, blast furnace slag, red soil and dichromate residue.

Full scale implementation of zero-liquid discharge (ZLD) system based on two-stage SBR process for effluent treatment in agrochemical industry and full scale implementation

CSIR-NEERI developed know-how to bio-oxidize organic compounds and ammonia that are present in high strength agrochemical effluents in a two-stage Sequential Bio Reactor (SBR) process.

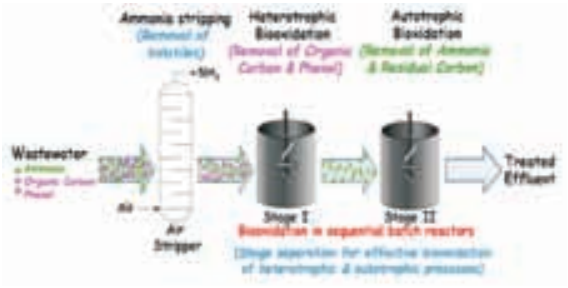


Fig:1.68 The developed process know-how

The process encompasses step-by-step oxidation of organic compounds and ammonia by heterotrophic and autotrophic groups of microorganisms in two different stages. The growth rate and metabolic activities of heterotrophic and autotrophic microorganisms determine the natural separation of these microbial groups in the first and second stages of SBR respectively. Stage separation eliminates competition between two groups of microorganisms for space, oxygen and nutrients and ensures sustained and efficient bio-oxidation.

Fig: 1.69 The concept of stage separation

The developed process is implemented at full-scale and commissioned at M/s Nagarjuna Agrichem Ltd., (NACL), Srikakulam, A.P. with a designed capacity of 600 m^3/d.

Deployment of of electronic nose for monitoring of obnoxious odourous constituents generated from pulp and paper industries

A electronic nose (e-nose) system jointly developed by CSIR-NEERI and C-DAC, has been deployed at two industries - M/s. Tamil Nadu Newsprint and Papers Limited, Karur, Tamil Nadu and M/s. Mysore Paper Mills, Bhadravati, Karnataka. The e-nose system consists of three units: sampling unit, sensor unit and purging unit. CSIR-NEERI imparted training to the industry personnel for operating the e-nose system and sample collection from various source points. The data generated from these industries is regularly monitored by CSIR-NEERI and CDAC teams. The samples were collected from the digester, work environment and evaporator points from both the industries. Application of this e-nose system in tanneries and distilleries is being further explored for monitoring of obnoxious odors.

Fig: 1.70 Electronic nose deployed at Mysore Paper Mills, Bhadravati, Karnataka

Water security plan for villages in Rajnandgaon district (Chhattisgarh)

CSIR-NEERI, in collaboration with UNICEF and Public Health Engineering Department (PHED), has prepared Water Security Plan for nine villages in Rajnandgaon district, Chhattisgarh. It is based on watershed concept by integrating hydro-geochemical and hydro-chemical approaches along with field studies. The groundwater budgeting in the study area (9 villages), which is the part of Lumti micro- watershed, reveals that about 97% ground water is utilised for irrigation and about 3% for domestic requirement including human and cattle population. The total water availability is estimated to be 26.21 mcm in the selected micro-watershed. The stage of ground water development which is calculated about 300% and it appears as over exploited zone for groundwater. Over exploitation of ground water for rabi irrigation and green vegetable crops and / or commercial crops during summer periods is the main cause of drinking water scarcity in these villages in summer months, which in turn create depression to receive artificially recharge water. The balance water (19.37 mcm) which flows through surface runoff has to be arrested by cost effective artificial recharge structures such as rejuvenation of existing percolation tank, channel bed modification for the augmentation of ground water in surrounding hand pumps, dug wells, tube wells and retention of soil moisture for longer period. Water Security Plan also consists of structures identified for conserving storm water runoff and groundwater recharge, to address the problem of water scarcity and poor water management. The engineering design and other details of these sustainability structures have been provided in the detailed report. The proposed village wise action plan in the study area (9 villages) is recommended for interventions along with the cost estimates based on detailed field studies.

3.3 Unique Major Facility

The National Trisonic Aerodynamic Facility (NTAF)

NTAF of CSIR-NAL continued its S&T support to the major national aerospace projects of the Departments of Space, ADA, Defense using the 1.2m Trisonic wind tunnel. The tunnel time was utilized for projects from VSS, DRDO, and ADA. Apart from contributing to the National security, during the year 2013-14 the NTAF carried out blow-downs worth Rs.10.65 crore.

Acoustic Test Facility

The Acoustic Test Facility (ATF) continued to play a crucial role in environmental qualification of satellites, launch vehicle inter-stages and their subsystems for the Indian Space Programme. During the year ATF successfully completed acoustic test programmes on the GSLV –D5, ISRO's heavy lift launch vehicle and the gsLVM3.

Failure Analysis and Accident Investigations

CSIR-NAL has been widely recognized as India's premier organization for carrying out failure analysis and accident investigations, and it has been doing this with distinction for more than 40 years. During the year 2013-14, fifty three investigations were taken up and completed. Majority of these investigations were under taken for Indian Air Force, India Navy, HAL, ADA, DGCA etc. The laboratory contributed significantly in identifying the causes of failures and suggesting recommendations for prevention of similar failures in future. The recommendations suggested encompassed design modification, selection of appropriate material and fabrication methodology, maintenance and inspection schedule as applicable depending on the nature of failure.

Forward Velocity Deceleration Sled

This unique facility is part of an integrated impact and crashworthiness research facility (ICRF) conceptualized and developed by, CSIR-NAL. The

Fig: 1.71 Forward Velocity Deceleration Sled

forward velocity deceleration sled which can generate deceleration pulses as required by FAR 23.562 / 25.562 for design of aircraft components is the first of its kind in the country. The sled is designed for a maximum speed of 60Kmph and with impact mass of 2200kg (1200 kg sled and 1000kg payload). The sled was designed jointly with ARIES, Spain. ICRF has been developed as a high technology facility that will carry out research in the vital area of flight safety and occupant safety, applicable to both aerospace and automotive customers.

Vapour Cycle Refrigeration Test Facility

A Vapour Cycle Refrigeration System (VCRS) test facility has been established by CSIR-NAL during

Fig: 1.72 Vapour Cycle Refrigeration System Test Facility

the year. The VCRS test facility will generate design data like heat transfer coefficients and two phase friction factor coefficients for both wavy and serrated fins. This data is essential for the design of condenser and evaporator of all Electric Environmental Control System (ECS) of an aircraft.

Cookstove testing facility

A cookstove test centre equipped with advanced equipment and instruments has been established at CSIR-IMMT. The facility is carrying out tests for efficiency and emission parameters of various types

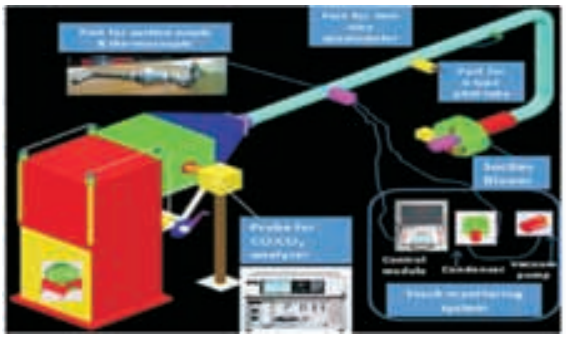


Fig: 1.73 Schematic of Cookstove Testing facility

of cookstoves. In 2013, the test facility conducted performance evaluation of fourteen different types of cookstoves as per the revised Indian standard. CSIR-IMMT has also participated in the development of Indian standard on portable biomass cookstove (IS 13152 (Part 1): 2013.

4 INFORMATION SCIENCES

4.1 Scientific Excellence

First algorithm for finding analytical solutions of quasiperiodic solutions of non-linear oscillators using the Homotopy Analysis Method

CSIR-4PI has proposed a technique to obtain limit cycles and quasi-periodic solutions of forced nonlinear oscillators. Scientists of 4PI has applied technique to the forced Van der Pol oscillator and the forced Van der Pol Duffing oscillator and obtained for the first time their limit cycles (periodic) and quasi-periodic solutions analytically. A modification of the homotopy analysis method has been introduced to obtain these solutions. Also the square residual error was minimized to obtain accurate approximations to these solutions. The obtained analytical solutions are convergent and agree well with numerical solutions even at large times. Time trajectories of the solution, its first derivative and phase plots are presented to confirm the validity of the proposed approach. A rough criteria for the determination of parameter regimes which led to limit cycle or quasi-periodic behavior.

To estimate seismic hazard, the basic law of seismicity, the Gutenberg–Richter recurrence relation, CSIR-4PI has applied in a modified form involving a spatial term: logN(M,L)=A-B(M-5)+ClogL, where N(M,L) is the expected annual number of earthquakes of a certain magnitude M within an area of linear size L. The parameters A, B, and C of this Unified Scaling Law for Earthquakes (USLE) in the Himalayas and surrounding regions have been studied on the basis of a variable space and time-scale approach. The observed temporal variability of the A, B, and C coefficients indicates significant changes of seismic activity at the time scales of a few decades. At global scale, the value of A ranges mainly between -1.0 and 0.5, which determines the average rate of earthquakes that accordingly differs by a factor of 30 or more. The value of B concentrates about 0.9 ranging from under 0.6 to above 1.1, while the fractal dimension of the local seismic prone setting, C, changes from 0.5 to 1.4 and larger. For Himalayan region, the values of A, B, and C have been estimated mainly ranging from -1.6 to -1.0, from 0.8 to 1.3, and from 1.0 to 1.4, respectively. Scientist of 4PI have used the deterministic approach to map the local value of the expected peak ground acceleration (PGA) from the USLE estimated maximum magnitude or, if reliable estimation was not possible, from the observed maximum magnitude during 1900–2012. Using these data a seismic hazard map of the Himalayas with spatially distributed PGA was prepared. Further, an attempt has been made to generate a

series of the earthquake risk maps of the region based on the population density exposed to the seismic hazard.

A Preliminary Study on Rainfall(Pattern before and after the January 26, 2001 Bhuj Earthquake (M_W 7.7) over Kachchh Region of Western Peninsular, India

Today it is an established fact that heavy rainfall can trigger earth- quake at the faults or fractures depending upon the local geology. CSIR-4PI has made an attempt to check relation between earthquake and rainfall with different scientific approaches. Institute has tempted to critically examine the relation between the Bhuj earthquake-aftershocks sequence and the rainfall pattern over the region as large earthquake (*Mw* 7.7) has occurred on January 26, 2001 in Kachchh region of western peninsular shield of India and the aftershocks are being reported till the date. The rainfall data for 20 years, *i.e.* 10 years before and 10 years after the main shock of January 26, 2001, recorded by three meteorological observatories in the Kachchh region has been analyzed. Further scientists of 4PI has studied annual total rainfall for two decades, annual rainfall departures from the climate normals, number of rainy days and number of heavy rainfall days during the period for all the three meteorological observatories of Kachchh region. A significant increase in all the measured rainfall parameters *i.e.* annual total rainfall, number of rainy days and number of heavy rainfall days over the Kachchh region during last decade *i.e.*, from 2001 to 2010 after the main shock was observed. Numbers of negative departures have been decreased during the last decade com- pared to previous decade. Thus rainfall pattern over Kachchh region is being changed. This increase in rainfall activity over Kachchh region may have been influenced by large earthquake and continuing aftershock activities over the region.

Contemporary deformation in the Kashmir-Himachal, Garhwal and Kumaon Himalaya: significant insights from 1995-2008 GPS time series

For the first time CSIR-4PI has observed surface deformation in West and northwest Himalaya, a region of considerable tectonic interest but very few previous geodetic studies. Well constrained time averaged velocity, convergence and extension rates using 13 years (1995-2008) of high precision GPS times series of ~56 stations in Kashmir-Himachal, Garhwal, Kumaon Himalaya were analysed. The results give significant insights in to the strain partitioning and regional deformation pattern involving both convergence and extension in various litho-tectonic units of the region and indicate that the future seismo-tectonic models in the Himalaya need to account for this pattern. In addition GPS time series also give an estimate of the co and post - seismic displacement due to 1999 Chamoli earthquake which is used to model the rupture plane associated with the earthquake. This research has for the first time recorded extension in Thethyan Himalaya which is highly vulnerable to earthquake.

A comparative study on S&T innovation and development strategies of China & Korea vis-à-vis India

S&T has played a very distinctive role in the economic transformation of both China and South Korea in last three decades. CSIR-NISTADS has studied in detail, the process that facilitated build-up of S&T capabilities in China and Korea by analyzing their S&T and innovation policies in the last three decades. Comparisons were made with India in terms of deriving lessons. For Both China and Korea, the path of development has been strengthening the manufacturing sector by following Japan's model in which State played a critical role in formulating a growth strategy and implementing it with appropriate policy instruments. Some of the strategic moves of both China and Korea include (i) targeted development and commensurate resource mobilization, (ii) continually evolving policies with strict enforcement and implementable instruments, (iii) a differentiation between success and failure,

and (iv) a will to acknowledge failures and efforts to correct them. The focus of both the countries on strengthening the S&T infrastructure for developing commensurate technological capabilities and strengthening the innovation infrastructure has turned out to be the most crucial factor in the transformation process.

Anusandhan – Indian Science & Technology Portal (www. anusandhan.net)

A single window on Indian Science and Technology that integrates Science, Technology and Industry related information with an objective to create research networks and communities. It lists about 2500 publicly funded R&D institutions and about 1500 privately funded in-house R&D units and about 500 research centres of Multinational corporations. CSIR-URDIP had made a pioneering attempt to create a unique kind of portal on Indian Science and Technology that covers all branches of Science & Technology.

CSIR CENTRAL - Open Access Institutional Repositories and a Centralized Harvester Service for CSIR Institutes (www.csircentral.net)

Open Archives Initiative (OAI) Compliant Interoperable institutional open access repository for research papers, electronic theses and dissertations are being set up at each of the CSIR laboratory. CSIR-URDIP had set up a central harvester that harvests the full-text and metadata of all these papers/documents. The Harvester follows Open Archives Initiative Protocol for Metadata Harvesting (OAI-PMH). Individual OAI-PMH Compliant Institutional Repositories have been configured and customized on the central server for each of the CSIR labs which do not have Institutional Repositories on their own data centre. All CSIR lab's repositories are being regularly harvested by the central harvester. This value added service enables the research community to search and view the R & D literatures from different CSIR Institutes through a single console. The csircentral.net is a main domain under which sub domains for each laboratory's IR are created like ncl.csircentral.net, npl.csircentral.net etc. This serves the purpose of 'One CSIR'.

- Misappropriation of Traditional Knowledge and bio-piracy of Genetic Resources are the issues of great concern for all the developing countries and these issues are being pursued at several multilateral forums such as Convention on Biological Diversity, TRIPs Council, World Trade Organization and at World Intellectual Property Organization.

- Traditional Knowledge Digital Library (TKDL) has been created to prevent the misappropriation of India's Traditional Knowledge at International Patent Offices (IPOs) so that the cases like misappropriation of 'Turmeric' and '*Neem*' could be prevented.

- The reason for misappropriation of India's traditional knowledge at IPOs was that since such traditional medicinal knowledge exists in local languages and was either not available to patent examiners or even in case of availability it was incomprehensible for them. In other words there exist language and format barriers due to which patents are being taken on the existing knowledge. TKDL has overcome the language and format barriers by scientifically converting and structuring the available information contents in 34 million A4 size pages of the ancient texts into five international languages, namely, English, Japanese, French, German and Spanish, with the help of information technology tools and a novel classification system - Traditional Knowledge Resource Classification (TKRC). Today, India through TKDL is capable of protecting about 0.297 million medicinal formulations similar to those of neem and turmeric.

- Since July 2009 till date India has been able to prevent misappropriation of India's Traditional Knowledge at International Patent offices in 200 cases without any cost and in few weeks of time,

Fig: 1.74 TKDL Success against Biopiracy attempts of MNCs

Fig: 1.75 Successfully safeguarded Biopiracy to patent medicinal plants

whereas cancellation of only few claims in wrong patent granted on *Basmati* costed more than seven crores to APEDA.

- During year 2013 – 2014, TKDL Unit has identified 392 patent applications on India's Traditional knowledge and has filed 321 Pre-grant oppositions & has been successful in preventing the grant of wrong patents on India's Traditional Knowledge in 58 cases wherein the applications of the pharmaceutical companies of United States, Great Britain, Spain, Italy, China, etc. have been withdrawn by the applicants / claims rejected by the examiners / claims amended by the applicants due to the Pre-grant opposition filed by TKDL Unit along with prior -art evidences from TKDL. Similar outcomes are expected in the remaining cases which are still under examination.

- In March, 2014 India has signed TKDL Access Agreements with The National Institute of Intellectual Property (INAPI) is the Intellectual Property Office of Chile similar to the one earlier signed with other seven International Patent Offices like EPO, USPTO, UKPTO, CIPO, GPO, AIPO and JPO, which would further prevent the grant of wrong patents on India's Traditional Knowledge and negotiations are in very advance stage to conclude TKDL Access Agreement with Russian Patent Office and Malaysia Intellectual Property Office.

- Several International delegations from countries like Malaysia, Kenya and Thailand etc. had visited TKDL during 2013-14. The delegations from all countries commended the progress of TKDL and highly appreciated the Global leadership position of India in the area of Traditional Knowledge protection and sought the assistance of TKDL for setting up their National TKDL(s).

- World Intellectual Property Organization (WIPO), Geneva, has proposed to Internationalize the TKDL for protection of traditional knowledge of other countries, especially developing nations. In March 2013 WIPO in collaboration with CSIR and Department of Industrial Policy & Promotion (DIPP) organized a 'Study Visit to TKDL' for 19 countries interested in replicating TKDL for protection of traditional knowledge of their country in pursuant to the International Conference organized by the WIPO in collaboration with CSIR in March, 2011 at New Delhi wherein 33 developing countries participated. Several countries are approaching India firstly for getting TKDL replicated (mainly

developing nations) and for getting access to TKDL for improving quality of examination of patent applications filed on traditional knowledge, which include developed nations also.

5 PHYSICAL SCIENCES

5.1 Scientific Excellence

Chronic kidney disease in two coastal districts of Andhra Pradesh, India: role of drinking water

A number of people of a few coastal regions of Srikakulam district and Chimakurthy mandal (4~ 30 to 40 km away from the coast) in the Prakasham district of Andhra Pradesh, India have suffering from Chronic kidney disease (CKD). Some medical experts and the local population have apprehensions that the drinking water is the sole reason for this disease in these areas. As the source of drinking water for these two regions is only groundwater, CSIR-NGRI has measured major ions and trace elements on waters from different sources to identify the causative elements(s), if any. Comparison of hydrochemical data of both the areas indicates that groundwater in Srikakulam coastal region is less mineralized than that of the Prakasham region, which may be due to geological, hydrological and climatic reasons. The concentrations of various inorganic chemicals such as Cl, F and NO_3 are within the permissible limits and are thus not expected to lead to any deleterious effects on human health, including any effect on the kidneys. Though the concentration of most of the chemical constituents is relatively higher in Chimakurthy area, the renal problems are much more severe in the Uddanam area (Srikakulam dist). Thus, it is doubtful whether drinking water quality has any bearing on CKD and it is unlikely that the inorganic chemicals cause ill health, including CKD, in the study areas. However, as there is a continuing suspicion that the kidney damage in people living in the study areas is due to chemicals in drinking water, it is necessary to investigate for other organic and inorganic chemicals known to be associated with kidney damage.

Subduction Related Tectonic Evolution of the Neoarchean Eastern Dharwar Craton, Southern India: New Geochemical and Isotopic Constrains

CSIR-NGRI has analysed geochemical, common Pb and Nd isotopic data for syn-kinematic granitoids, stratigraphically well constrained felsic and mafic volcanic rocks from three major Neoarchean greenstone belts of the northern part of Eastern Dharwar Craton (EDC), namely the Sandur, Kushtagi and Hutti belts. The study has helped understanding the tectonic processes responsible for the petrogenesis and evolution of the EDC and to verify whether the granitoids and felsic "adakitic" rocks display true slab melt signatures similar to the modern adakites. The proposed petro genetic mechanism involves multi stage processes in a supra subduction regime involving slab dehydration, formation of hydrous basaltic melts, and re-melting; interaction with the sub-arc basaltic crust at low pressures where amphibole÷/-plagioclase is the dominant residual phase. There is a notable systematic decrease in the extent of older crustal involvement from west to east in the EDC. The radiogenic Pb and evolved Nd isotopic signatures, coupled with older Nd depleted mantle model ages suggest the significant role of recycled Mesoarchean crust for the evolution of these rocks in the northern part of EDC. The systematic decrease in the extent of older crustal involvement from west to east is in concurrence with the systematic younging of Dharwar Craton from west to east and its east ward subduction. The contrasting variations in terms of the involvement of predominant juvenile crustal additions and that of older recycled crust for the felsic magmatic rocks of EDC their trace elemental variations can be explained in a subduction tectonic framework.

Crustal Heterogeneity and Seismotectonics of the National Capital Region, Delhi India

National Capital Region (NCR), Delhi has been experiencing earthquakes of magnitude 6 and above since long. CSIR-NGRI has carried out local P- and

S—velocity tomography beneath the NCR to understand the relationship between crustal heterogeneity and seismotectonics in the National Capital Region (NCR), Delhi, in a better way. First arrival times of the first P- and S-wave from 275 crustal earthquakes recorded by the Seismic Telemetry Network in and around Delhi of the India Meteorological Department, India, are inverted to obtain crustal P- S-velocity and V (P) /V (S) variations in the region. Tomographic images of the upper crust reflect well the surface geological and tectonic features. The Delhi fold belt is identified as low V (P), high V (S) and low V (P), high V (S) and low V (P)/V (S). The Sohna hot spring region is appearing as low V (P), low V (S) and high V (P) /V (S) correlating with the possible presence of fluid-filled rocks. The crustal seismicity is distributed in both the high and low-velocity zones, but most distinctly in the low V (P) /V (S) region. Although the present study could delineate the main tectonic features in the NCR, they are a sort of preliminary results with the limited data and further work is required to obtain detailed seismic structures with higher special resolutions through installation of more seismic stations.

CSIR-NGRI Research Attracts Global Media

New research by CSIR-NGRI suggests that a vast area in southeast India measuring more than 200,000 sq km is conducive for diamond stability and needs to be explored for kimbelite and lamproite rocks. Their method hinges on a suitable and cost-effective reconnaissance technique for diamond prospecting that uses passive seismological data generated at carefully chosen seismic stations and can be deployed as a quick-search tool over large areas. This research was published in the August 2013 issue of Lithosphere, a peer-reviewed journal of the Geological Society of America. This paper also featured in the "Most-Read Articles" during August 2013 and attracted global media coverage.

Excerpts from a media report by Laura Poppick. Staff Writer LiveScience.com (August 13, 2013)

"Still, this new study demonstrates how to use effective and relatively cheap techniques that could help smooth the way for future diamond exploration programs around the world, according to Alan Jones, a media coverage at the Dublin Institute for Advanced Studies in Ireland who was not involved in the Study"; and

"This has really cleared up this Indian lithosphere issue, " Jones told Live Science. "In terms of global impact, I would say the paper is on part of the cutting edge along with other people's work."

Assessment of heavy metal contamination in soils around chromite mining areas, Nuggihalli, Karnataka

Toxic heavy metals represent one of the possible environmental hazards from mine lands, which affect many countries having historic mining industries. CSIR-NGRI has investigated the degree of soil pollution occurring near chromite mines, and made a systematic evaluation of soil contamination based on geoaccumulation index, enrichment factor and pollution index. Institute has reported the pollution load of toxic heavy metals (As, Ba, Co, Cr, Cu, Mo, Ni, Pb, Sr, V, Zn and Zr) in 57 soil samples collected around three different active (Tagdur), abandoned (Jambur) chromite mining sites as well residential zone around Hikkondanahalli of the Nuggihalli Schist Belt, Karnataka, India. Soil samples were analyzed for heavy metals by using Wavelength dispersive X-ray fluorescence spectrometry. Results indicated that elevated concentrations of Cr, Ni and Co in soils of the study area exceed the Soil Quality Guideline limits (SQGL). The high enrichment factor for Cr, Ni and Co obtained in the soil samples show that there is a steady increase of toxic heavy metals risk in this area, which could be correlated with the past mining activity and post abandoned mining in the area. The data was also treated to study the geo accumulation index, pollution index and spatial distribution of toxic elements. Risk assessment based upon soil quality guidelines limits proves that the soil is a serious health risk to humans. Emphasis needs to be put on control measures of pollution and remediation techniques in the study area.

Lithospheric structure of southern Indian shield and adjoining oceans: integrated modelling of topography, gravity, geoid and heat flow data

The capacity to map the density anomalies at lithospheric scales across large regions both on- and offshore provides scopes for establishing the present-day structure of the lithosphere and its links with the observed surface topography. Gravity anomalies may help to determine the state of the lithosphere under the assumption of isostatic equilibrium, which can be interpreted as a result of past processes due to which the lithosphere acquired its actual architecture. CSIR-NGRI has explored the links between subcrustal mass distribution and surface expression in the topography and geomorphology of the southern Indian shield, south of 16°N, and its extension into the adjoining oceans. Previous work on the isostatic state of southern Indian shield has speculated that the region is over compensated, that is , the mean elevation of the region is less than that predicted by Airy's model. Solution to this enigma has been put forward by postulating the decrease in the crust-mantle density contrast exerting reduced buoyancy and counteracting the orogen's isostatic response to denudation. However, a single cause such as the reduced buoyancy may not be valid for the entire southern Indian shield. Rather, the mechanism of isostatic compensation must involve lateral variations in density in both the crust and upper mantle. Lithospheric structure of the southern Indian shield is thus essential for understanding the organic processes that mediated crustal evolution and sustained their topography through buonyancy forces. To image the lithosphere beneath the southern Indian shield, Scientist of CSIR-NGRI used an integrated density model based on the combined interpretation of gravity and geoid anomalies and topography and geothermal data. 2-D lithospheric models along three profiles (one N-S and two E-W trending) crossing the southern Indian shield and adjoining Indian Ocean has been presented. It has been found that the deepest regions of the 800°C isotherm underneath the Dharwar Craton and the Southern Granulite Terrance are at about 90 and 60 km depth, respectively. This corresponds to a effective elastic thickness (Te) of 35 and 13 km in the Dharwar Craton and the Southern Granulite Terrane, respectively.

Evaluation of Hydrocarbon Prospects Using Surface Geochemical Data With Constraints From Geological and Geophysical Observations: Saurashtra basin, India

The Saurashtra Basin in western India is considered to have significant hydrocarbon potential. However conventional exploration methods, particularly for Mesozoic prospects, have been hampered by the thick basalt cover. CSIR-NGRI, used near-surface geochemical methods to investigate the generation of thermogenic gaseous hydrocarbons in the basin. Shallow soil samples were collected from favourable locations identified by integrated geophysical and geochemical studies. The compositional and isotopic signatures of adsorbed gaseous hydrocarbons (methane through pentane) together with soil iodine concentrations were used as surface indicators of petroleum micro-seepages. High concentrations of adsorbed thermogenic methane (C_1= 518 ppb) and ethane plus higher hydrocarbons (ÓC_{2+}=977 ppb) along with iodine concentrations up to 68.5 ppm were observed. Total organic and inorganic carbon (TOC and TIC) measurements, fluorescence and X-ray diffraction (XRD) studies showed that the near-surface hydrocarbon occurrences were seepage related. Elevated hydrocarbon and iodine concentrations were coincident with dykes and lineaments in the study area, which probably served as conduits for the micro-seepage of hydrocarbons.

Occurrence of 'pecular' Sand dunes in Prakasam district of Andhra Preadesh

CSIR-NGRI has reported inland sand dunes from Andhra Pradesh (SE India) spread over an area of ~500 km^2, ~75 km inland from the east coast. The dune sands are examined to understand their provenance, transportation, timing of sand aggradation and their relationship to past climates. The dune distribution, grain morphology and the

grain-size studies on sands suggest an aeolian origin. Physiography of the study area, heavy mineral assemblage, and abundance of quartz in the parent rocks indicate that the dune sands are largely derived from first-order streams emanating from hills in the region and from weathering of the Nellore schist belt. It appears that the geomorphology and wind direction pattern both facilitated and restricted the dune aggradation and preservation to a limited area. OSL dating of 47 dune samples ranged from the present to ~50 KA, thereby suggesting a long duration of sand-dune aggradation and/or reworking history.

Linking a prolonged Neo-Tethyan magmatic arc in South Africa: Zirocon U-Pb and Hf isotopic constraints from the Lohit Bathaht, North East India

The east-west elongated belt of granitorids that occurs to the north other Yarlu-Tsangpo suture within the Lhasa terrane of southern Tibet is collectively referred to as the Transhimalayan batholiths' and regarded as the major component of an Andean type convergent margin along South Asia resulting from subduction of the Neo- Tethyan oceanic lithosphere. Moreover, the Neo-Tethyan subduction gave rise to the Wuntho-Popa magmatic arc in West. It remains unclear how the Transhimalayan (Gangdese) batholiths along southern Tibet extend east and south-east into Burma as the batholith is truncated by younger and some still active faults around the Namcha Barwa oreastern Himalayan syntax is. CSIR-NGRI has reported the first set of precise zircon U-Pb ages and Hf isotoperations from the Lohit Batholith, NE India. These new data make up the 'missing link' that, together with available information from the Lhasaterrane, western Yunnan and Burma, enable to uncover the distribution of the Neo- Tethyan arc system in South Asia. The Neo-Tethyan subduction that operated before the India-Asia collision resulted in an Andean-type convergent marginin South Asia and was associated with extensive are magmatism that formed the Transhimalyayan batholiths. Magmatismin the Gangdese Batholith, the largest batholith exposed in the Lhasa terrane of southern Tibet, is considered to have lasted from the early Jurassic to Eocene. However, eastward correlation of the Gangdese Batholith is uncertain because it is truncated by the eastern Himalayan syntaxis.

It is reported new data from the Lohit Batholith, NE India, including: (i) zircon U-Pb ages of five granitoids from ca. 148 to 96 Ma; and (ii) zircon Hf isotopes of these rocks that yield high and positive eHf (T) values. Based on the data analysis it has been argued that the Lohit Batholith is theeastward extension of the Gangdese Batholith, and can be correlated southward to the Wuntho-Popa are in West Burma, thus linking a prolonged Neo-Tethyan magmatic are system from southern Tibet to Southeast Asia.

Resistivity Structure of the Central Indian Tectonic Zone from Multiple Magnetotelluric Profiles and Tectonic Implications

The Central Indian Tectonic Zone (CITZ) is a major tectonic feature extending across the Indian subcontinent formed in the Paleoproterozoic when the Bastar Craton and the Bundelkhand Craton were sutured together. This region is recognized in the geological record as a persistent zone of weakness with many tectonothermal events occurring over geologic time. The weakness of this region may have caused the late Cretaceous/early Tertiary Deccan volcanism to have been localized in the CITZ. The CITZ is also known to have acted as a zone of crustal weakness that controlled the location of the main eruption channels of the Decean flood basalts. The zone is still tectonically active, as evidenced by sustained levels of seismic activity. CSIR-NGRI has proposed the first systematic investigation of the resistivity structure of the CITZ using multiple magnetotelluric (MT) transects. Two-dimensional (2D) resistivity models were generated for five north-south profiles that cross the CITZ eneompassing an area of *60,000 km^2. The models were based on the joint inversion of transverse

electric (TE), transverse magnetic (TM) and tipper (Hz) data. All the profiles showed a low restive (10-30 ohm-m) middle to lower cost beneath the CITZ with a crustal conductance of 300 -800 S. The presence of an interconnected fluid phase and/ or hydrous/metallic minerals appears to be the most likely explanation for the elevated conductivity that is observed beneath the CITZ. The presence of fluids is significant because it may indicate the cause of persistent weakness at crustal depths. A northward dip of both the crustal conductive layer and coincident seismic reflections favor a northward polarity of the subduction process associated with the formation of the CITZ.

This study brought out a systematic picture of the crustal resistivity structure of the CITZ, with the goal of understanding the structure of the entire CITZ its tectonic evaluation.

Uranium estimation in drinking water samples from parts of Punjab and Himachal Pradesh

CSIR-NGRI has measured the uranium concentration in drinking water samples collected from areas of Punjab and Himachal Pradesh using inductively uranium plasma mass spectrometry. The sources of water comprise hand pumps and tube wells. The uranium concentration lies in the range of 1.24-45.42 μgl^{-1} with mean value of 14.91 μgl^{-1} in drinking water samples from Punjab and 0.56-10.11 μgl^{-1} with a mean value of 2.17 μgl^{-1} in Himachal Pradesh. The measured uranium content in 4 water samples from Punjab has been found to be higher than the limit of 30 g 1(1) recommended by the World Health Organization (WHO) and US Environmental Production Agency. However, the uranium concentration in all the water samples from Himachal Pradesh is well below the recommended limit. The annual effective dose associated with drinking water due to uranium concentration is estimated from its annual intake using dosimetric information based on International Commission on Radiological Protection 72. The resulting value of the annual effective dose from drinking water sources is in the range of 0.33-37.78 μSv, which is well within the limit of 100 μSv recommended by the WHO.

Structural stability of methane hydrates in porous medium: Raman spectroscopic study

CSIR-NGRI, using Raman Spectroscopy, has investigated thermal and temporal stability of the methane hydrates (MH) at ambient pressure, synthesised in a spherical silica (solid and hollow, with average diameter of 70 μm) matrix,. Identical Raman spectroscopic spectral features for all the synthesized hydrate samples indicate structural resemblance irrespective of matrix. It is observed that the growth of hydrates in hollow silica matrix is homogeneous, while that with solid grain is highly heterogeneous. Temporal and thermal stability of MH depends on the silica matrix. Appearance of the Raman signatures characteristic of MH, in hollow silica, indicates that the hydrates are stable over several hours (upon preserving at 153 K and 0.1 MPa) and until similar to 273 K at 0.1 MPa. However, MH in solid silica matrix is highly unstable under similar P, T conditions and they are readily dissociated within 2 h. The thermal stability of these samples at 0.1 MPa is also significantly lower.

Hafnium-neodymium isotope systematics of the 2.7 Ga Gadwal greenstone terrane, Eastern Dharwarcraton, India: Implications for the evolution of the Archean depleted mantle

The Neoarchean Gadwal greenstone belt in the eastern Dharwar craton, India, hosts a well preserved metavolcanic sequence that is dominated by tholeiitic and calc-alkaline basalt-andesite-dacite-rhyolite series, which includes boninitic geochemical varieties. Bulk-rock Lu-Hf and Sm-Nd isotope systematics of these apparently arc-related volcanic rocks yield indistinguishable ages of 2.701 +/- 0.024 Ga and 2.702 +/- 0.026 Ga, respectively. On the basis of the close spatial association and identical ages of the different rock types CSIR-NGRI has suggested 2.70 +/- 0.03 Ga as the age of

crystallization of the different rock types within the Gadwalmetavolcanic sequence. In contrast, bulk-rock Pb-Pb isotope systematics of the same samples yield a significantly younger and less precise age of 2.466 Ga (+ 0.068/-0.110 Ga). This younger age is tentatively interpreted to represent a metallogenic and crustal reworking event in the Dharwar craton, which disturbed the U-Pb system but not the Lu-Hf or Sm-Nd systems. The adwalmetavolcanic rocks have positive initial epsilon Hf-(2.70Ga) = + 1.6 to + 8.7 and slightly negative to positive epsilon Nd-(2.70Ga) = 0.1 to + 3.0 values, consistent with an origin from a long term depleted source relative to a chondritic reservoir at similar to 2.7 Ga. Lack of correlation between initial isotopic compositions and major or trace element indices of fractionation and alteration suggest that the observed isotope variability probably effects compositional variation in the Gadwal source, similar to that observed in modern day island arcs. Two boninitic samples of the Gadwal sequence have eHf similar to 8.3 and 8.7, and are more radiogenic than average depleted mantle for the time period 3.2 to 2.5 Ga (epsilon(Hf) = 4 to 6). Early (perhaps Hadean) differentiation events that led to a depleted and heterogeneous mantle are apparent in the Nd and Hf isotope systematics of 3.7-3.8 Ga Isuasupracrustal rocks. The radiogenic Hf isotopes of the Gadwal boninites and the Hf, Nd isotope systematics of rocks from other locations in the 3.4 to 2.5 Ga time period are consistent with the survival of fragments of an early depleted mantle later in the Archean. From similar to 2.0 Ga to present, the time-integrated Lu- 176IHf-177 and Sm-147/Nd-144 of the depleted mantle appears nearly constant and similar to the present day average MORB source. These data indicate that progressive elimination of early (> 4.5 Ga) formed heterogeneities in the depleted mantle dominated the history of the Archean mantle, and that portions of early depleted reservoirs survived through the Mesoarchean. These results have implications for the mixing scales for the early terrestrial mantle and the timing of the initiation of present day plate tectonics.

Heavy metal contamination in sediments of Balanagar industrial area, Hyderabad, Andhra Pradesh, India

CSIR-NGRI has carried out environmental geochemical studies to find out the extent of contamination in sediments due to heavy metals in Balanagar industrial area, Hyderabad. The industrial area consists of 350 small and large industries manufacturing battery, steel plating, pharmaceutical chemicals, metal plating, etc. Scientist of CSIR-NGRI has studied sediment contamination in the industrial area, to determine the extent and distribution of heavy metals (Cu, Cr, Ni, Pb, Zn, As) and to delineate the source. There is no treatment plant in the industrial area, and many industries release the effluents into nearby nalas and lakes. Solid waste from the industries is also being dumped along the roads and near the open grounds due to which heavy metals migrate from solid waste to the groundwater. The sediments samples were analyzed for their heavy metals by X-ray fluorescence spectrometry. The concentration ranges of different heavy metals were Cr, 96.2-439.6 mg/kg; Cu, 95.7-810 mg/kg; Ni, 32.3-13,068.2 mg/kg; Pb, 59.2-512 mg/kg; Zn, 157.1-4,630.5 mg/kg; CO,1.8-48.3 mg/kg; and V, 35.2-308.5 mg/kg. High concentration of heavy metals in sediments can be attributed to some pharmaceutical and metal industries in the study area. Based on the results obtained, suitable remedial measures should be adopted such as phyto remediation and bio-remediation for reduction of heavy metals in sediments.

New chapter in Groundwater Hydrology from Heliborne Geophysical Investigations

CSIR-NGRI has carried out 13,800 line km of helicopter borne Time domain Electromagnetic (HeliTEM) and Magnetic (HeliMAG) surveys- the globally acclaimed state-of-the-art geophysical technique- on an experimental basis in six hydrogeologically representative pilot areas in the states of Rajasthan, Bihar, Maharashtra, Kamataka and Tamil Nadu to delineate the principal aquifers at 1 :50,000 scale. These studies helped to identify

the principal aquifers in diverse hydro geological provinces of India, viz., in Gangetic alluvium, Tertiary-sediments underlying the Thar Desert, Deccan basalts and the Gondwana sediments, weathered and fractured granite gneisses and schists and the Coastal alluvium and Tertiary sediments. The study also helped in identifying the subsurface structures controlling the groundwater conditions, the regional continuity of principal aquifers, the variations in lithological character of aquifers and the quality of water in terms of salinity.

Deglaciation in the tropical Indian Ocean

CSIR-NIO has indicated that deglaciation in the tropical Indian Ocean driven by interplay between the regional monsoon and global teleconnections. High resolution climate records of the ice age terminations from monsoon-dominated regions reveal the interplay of regional and global driving forces. Deglacial weak monsoon intervals WMIs are interpreted as the result of cold temperature anomalies generated by sea ice feedbacks in the North Atlantic, most prominently during the Heinrich Events. However, recent modeling results indicate that WMIs reflect changes in the intensity of the Indian rather than the East Asian monsoon. Mg/Ca, Ba/Ca and stable isotope records from a sediment core off the Malabar coast in the southeastern Arabian Sea with centennial-scale resolution were used to test this hypothesis and to constrain the nature and timing of deglacial climate change in the tropical Indian Ocean. The results suggest that Sea Surface Temperature (SST) at the Last Glacial Maximum was lower by 2.7±0.5 °C than the pre-industrial SST. Deglacial warming started at 18.6 (95% CI range 18.8-18.1) kyr BP, within error of the onset of warming at other tropical sites as well as in Antarctica and the Southern Ocean and either coeval with or up to 1 kyr before the atmospheric CO_2 rise. Warming took place in two steps separated by an interval of stable SST between 15.7 (16.2-14.9) and 13.2 (13.9-12.0) kyr BP. The delta $^{18}O_{sw}$ record and the Ba/Ca record indicate that the last ice age termination was marked by a prominent weak Indian Monsoon interval interrupted by an intense monsoon phase, as seen in speleothem records and predicted by modeling. A strong correspondence between the timing of the Malabar delta $^{18}O_{sw}$ record and the Hulu Cave monsoon record suggests that deglacial delta ^{18}O changes in both localities dominantly reflect compositional changes in precipitation, likely driven by changes in the North Atlantic.

Monsoon variability over the past 16,700 years

CSIR-NIO has observed that variations in the Indian summer monsoon (ISM) intensity during the last 16.7 ka have been studied using organic carbon (C_{org}), delta ^{15}N of sedimentary organic matter, $CaCO_3$, sediment texture, delta $^{18}O_C$, and Mg/Ca-derived sea surface temperature, delta ^{18}O of sea water and sea surface salinity, in a ^{14}C-dated sediment core from the eastern Arabian Sea. The results reveal that between 16 and 15.2 ka BP, the ISM was weak with minor fluctuations and started intensifying around 15.2 ka BP, at the onset of the Bolling-Allerod (B-A) event. The B-A event is characterized by higher water column denitrification rates comparable to the present day. The ISM signatures observed in the delta $^{18}O_C$ record of B-A event compare well with those from Timta cave of the western Himalayas and also the Asian summer monsoon signatures from the Hulu caves in China and warming signatures in Greenland Ice Sheet Project 2 (GISP2) suggesting atmospheric teleconnections through Intertropical Convergence Zone. The boundary between the Younger Dryas and the Holocene is discernible with small episodes of abrupt events of increased ISM intensity. This decrease in delta $^{18}O_C$ values at~11.8 ka BP is contemporary with June solar insolation maximum at 30° north and the increase in methane in the GISP2 ice core supporting episodes of warmer climate and increase in ISM intensity. The ISM seems to have been most stable between 7 and 5.6 ka BP. The core exhibits periodicity of 500 years that is comparable to the Atlantic water formation and the Chinese monsoon.

Bottom simulating reflector in fracture-filled gas hydrates

The amplitude variation with angle (AVA) pattern of bottom-simulating reflectors (BSRs) beneath fracture-filled gas hydrate deposits when the effective medium is anisotropic has been studied for the first time by CSIR-NIO. AVA analysis of the BSR shows normal-incidence reflection coefficients of -0.04 to -0.11 with positive gradients of 0.04 to 0.31 indicating class IV pattern. The acoustic properties from isotropic rock physics model predict class III AVA pattern which cannot explain the observed class IV AVA pattern in Krishna-Godavari basin due to the anisotropic nature of fracture-filled gas hydrate deposits. The observed class IV AVA of the BSR was modelled by assuming that the gas hydrate bearing sediment could be represented by horizontally transversely isotropic (HTI) medium after accounting for anisotropic wave propagation effects on BSR amplitudes. Anisotropic AVA analysis of the BSR from the inline seismic profile shows 5-30 percent gas hydrate concentration (equivalent to fracture density) and the azimuth of fracture system (fracture orientation) with respect to the seismic profile is close to 45 degrees. Free gas below the base of gas hydrate stability zone is interpreted in the vicinity of fault system.

Sea level variability in the tropical Indo-Pacific Ocean

CSIR-NIO has analysed Decadal and long-term steric sea level variations over 1966-2007 period in the Indo-Pacific sector using an ocean general circulation model forced by reanalysis winds. The simulated steric sea level compares favourably with sea level from satellite altimetry and tide gauges at interannual and decadal timescales. The amplitude of decadal sea level variability (up to approx. 5 cm standard deviation) is typically nearly half of the interannual variations (up to approx. 10 cm) and two to three times larger than long-term sea level variations (up to 2 cm).

CO_2 fluxes in the Indian Ocean

The Indian Ocean (44° S–30° N) plays an important role in the global carbon cycle, yet it remains one of the most poorly sampled ocean regions. Several approaches have been used to estimate net sea–air CO_2 fluxes in this region: interpolated observations, ocean biogeochemical models, atmospheric and ocean inversions. CSIR-NIO has combined these different approaches to quantify and assess the magnitude and variability in Indian Ocean sea–air CO_2 fluxes between 1990 and 2009. All models capture the observed pattern of fluxes in the Indian Ocean with the following exceptions: underestimation of upwelling fluxes in the northwestern region (off Oman and Somalia), overestimation in the northeastern region (Bay of Bengal) and underestimation of the CO_2 sink in the subtropical convergence zone. These differences were mainly driven by lack of atmospheric CO_2 data in atmospheric inversions, and poor simulation of monsoonal currents and freshwater discharge in ocean biogeochemical models. Overall, the models and inversions do capture the phase of the observed seasonality for the entire Indian Ocean but overestimate the magnitude. The predicted sea–air CO_2 fluxes by ocean biogeochemical models (OBGMs) respond to seasonal variability with strong phase lags with reference to climatological CO_2 flux, whereas the atmospheric inversions predicted an order of magnitude higher seasonal flux than OBGMs. The simulated interannual variability by the OBGMs is weaker than that found by atmospheric inversions. Prediction of such weak interannual variability in CO_2 fluxes by atmospheric inversions was mainly caused by a lack of atmospheric data in the Indian Ocean. The OBGM models suggest a small strengthening of the sink over the period 1990–2009 of -0.01 PgC decade^{-1}. This is inconsistent with the observations in the southwestern Indian Ocean that shows the growth rate of oceanic pCO_2 was faster than the observed atmospheric CO_2 growth, a finding attributed to the trend of the Southern Annular Mode (SAM) during the 1990s.

Effect of copper on iron stress in diatoms

CSIR-NIO has investigated the responses of the coastal diatom *Chaetoceros gracilis* to variable Copper concentrations using a local isolate from the

SW coastal Bay of Bengal. The results suggested that Cu acted as a growth-promoting factor up to concentrations of 125 nM (growth-promoting range), and became inhibitory thereafter (growth-inhibiting range). The cells in the control treatments had high ratios of photoprotective to light harvesting pigments (PP:LH) and high BSi:Chl-a, both indicative of Iron (Fe) stress. Within the growth-promoting range, an increase in Cu supply significantly increased Chl-a concentrations, and decreased the ratios of PP:LH and BSi:Chl-a. Interestingly, iron (Fe) supplemented cells of *C. gracilis* revealed similar responses. In the presence of Fe, the growth response of *C. gracilis* to variable Cu concentrations was not significant. It is inferred that, under Fe sufficient conditions, the need for Cu is minimized. It has been suggested that Cu plays a significant role in the physiology of coastal diatoms beyond the simple toxicological effects.

Textile dye de-colorization

The Textile Industry uses over 800000 tonnes of colors for various purposes, the main being in textile industry. The massive quantum of effluents dumped into streams not only deteriorate the water for further uses but also arrests the basic process of photosynthesis by microalgae, the fundamental producers of food for other biotic forms. CSIR-NIO has used marine bacterial strains to bioremediate the colored effluents. Notably, decolorization of as many as six of the eight different textile dyes at @2000mg l^{-1} [twice that of the regularly used concentrations in the dyeing process] was achieved using marine bacterial isolates. Only 8 of 500 marine bacterial strains screened can decolorize the water effluent. These first time collections of unique marine bacteria highlight the importance of marine microflora in bioremediation of textile/colored effluent pollution. Further, reuse of decolorized water by a marine bacterium that withstood 500mg L^{-1} of widely used Victoria Blue (VB-B) was also demonstrated at lab scale.

Establishment of observation systems for measurement and real time reporting of coastal sea level, surface meteorological and related parameters

CSIR-NIO has collected Sea-level data from several remote and coastal locations using absolute pressure gauges deployed at known level- chart datum and used data collected from microwave radar and an absolute pressure gauge deployed at Verem, Goa (January 2009 to May 2010), Tuticorin, and Mandapam, Tamil Nadu (June 2010 to March 2011) to carry out comparative studies. The root-mean-square difference between the estimated sea level from radar and pressure gauge (incorporating atmospheric pressure correction) is <"2.69, 2.73, and 1.46 cm at Verem, Tuticorin, and Mandapam, respectively. Harmonic analysis of the two time-series of sea-level data at Verem produces similar residuals and tidal constituents the results indicate the importance of concurrent measurement of atmospheric pressure along with subsurface absolute pressure gauge measurements.

Waste assimilative capacity of coastal waters along Mumbai mega city, west coast of India

Coastal waters are the ultimate receivers of the organic waste materials generated by upstream cities and towns. This waste can cause dissolved oxygen depletion due to increased oxygen demand, affecting the natural ability of water bodies to withstand certain amount of pollution – the waste assimilative capacity. CSIR-NIO has calculated the pollution load (biochemical oxygen demand) using the population equivalent value of 0.225 m^3/day for the present Mumbai population of 13 million is 731250 kg/day. Simulations using MIKE-21 and WASP models along with the observed water quality data as well as current meter data indicated that the coastal waters can withstand the present pollution load since the simulated biochemical oxygen demand was within the range of 0.2–1.5 mg/L, the National Standard limits. A projected population increase exceeded the target biochemical oxygen demand value of 2 mg/L, indicating the deterioration of ambient quality of coastal waters.

Waste assimilative capacity studies are crucial in the present day regional, as well as global issues, such as population explosion, water shortage, and climate change.

5.2 Technology Developed

Launch of RV Sindhu Sadhana

Dr. Jitendra Singh, the then Vice President, Council of Scientific and Industrial Research and Honorable Minister of State for Ministry of Science and Technology and Ministry of Earth Sciences (Independent charge), PMO, Personnel Grievances and Pensions, Department of Atomic Energy, Department of Space dedicated first indigenously built multi-disciplinary research vessel to the Nation on 12th July, 2014.

Fig: 1.76 First indigenously built Research Vessel 'Sindhu Sadhana' dedicated to Nation

The ship is 80 meters long and 17.6 m wide and can accommodate 57 personnel including 29 Scientists and 28 crew members. She is designed for a cruising speed of 13.5 knots and an endurance of 45 days. The research vessel has 10 laboratories which are fitted with state-of-the-art equipment facilitating high precision data and sample acquisition. The ship is equipped with a number of laboratories for on-line data collection and data processing from single beam and multi beam echo sounders, water column and sub-bottom profiler, gravimeter, magnetometer, acoustic doppler current profiler, conductivity-temperature-depth profiler, autonomous weather station, air quality monitors as well as sampling gears such as A-frame, Gamma frame, and deep sea winches with supporting cranes. The vessel is also equipped with dynamic positioning system that allows holding the vessel at a point for sampling including 24 meter long sediment cores. It also facilitates precise deployment of instrumented moorings, towing of Remotely Operated Vehicles (ROVs) and Autonomous Underwater Vehicles (AUVs).

Contributions to Strategic area

CSIR-CEERI has developed five different versions of Low temperature co-fired ceramics (LTCC) micro-hotplates. These micro-hotplates have achieved a temperature of 300 °C with power consumption less than 1 watt and size 3.5x3.5 mm^2. These micro-hotplates have high temperature stability, mechanibilty strong interconnects and are

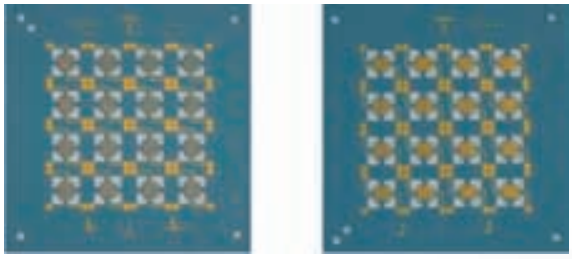


Fig: 1.77 4 x 4 LTCC micro hotplate array

reliable and ruggedized for harsh adverse environment. These are being used by Solid State Physics Laboratory (DRDO lab), Delhi, CSIR-CGCRI, and CSIR-CSIO for various sensor applications. Armament Research Board of Ministry of Defence, Government of India has issued an appreciation letter to CSIR-CEERI recently recognizing the contributions.

Enhanced Green Florescent Protein Arsenometer

CSIR-CEERI, jointly with Birla Institute of Technology and Science, has developed a portable, easy-to-use, cheap, and non-toxic field test system to monitor the levels of arsenic in drinking water wells. This battery-operated and low cost per test novel bio-electronic system based on fluorometric

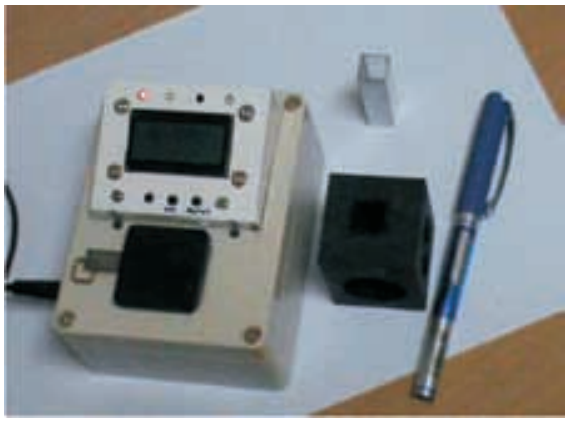


Fig:1.78 EGFP Arsenometer

method display numerically the concentration of arsenic in water. Such numerical display of arsenic concentration has been done for the first time. In this method, Enhanced Green Florescent Protein (EGFP), known as bio-sensor, emits green florescence of 520 nm wavelength when excited by blue light of 480nm wavelength. The intensity of the green light increases with the increase in the content of arsenic present in water. The system comprises of light-tight fluorescence collecting device made of black nylon material, LED source, optical filter, light-to-voltage converter, arsenic collection cuvette, electronic circuitry on a small PCB, 9 volt battery and LCD. The dimension of the device as shown in figure 1.79 is 514 cm^3 (height= 5.5 cm, width=8.5 cm and length is 11 cm).

Penning plasma discharge (PPD) based VUV-spectrometer-detector-system calibration source

CSIR-CEERI has developed a laboratory based large volume penning plasma discharge (LVPPD) source has been developed in three anode configurations. The developed source has simultaneous diagnostics facility using Langmuir probe and optical emission spectroscopy (OES). The three anode configurations, namely single ring, double ring and rectangular configurations have been studied and compared for optimum use of the geometry for efficient light emissions and recording. The double ring penning plasma discharge configuration has been optimized as an efficient emission source, which is able to produce strong visible (400 nm-750 nm) and VUV (20 nm-150 nm) lights simultaneously. The approach with double anode ring is an unique arrangement and is a conciliation between optical confinement and anode transparency for effective spectroscopic and Langmuir probe measurements inside the large volume penning plasma source. The plasma is produced using helium gas and admixture of three noble gases including helium, neon and argon. The optimized

source is capable to produce identified eight spectral lines for pure helium in the VUV range from 20 nm

Fig. 1.79 Developed Large Volume Penning plasma discharge (LVPPD) source for VUV-spectrometer-detector-system calibration at CSIR-CEERI

Fig.1.80 Large Volume Penning plasma discharge (LVPPD) source delivered to Institute for Plasma Research, Bhat, Gandhinagar

to 60 nm and total 24 spectral lines covering the wavelength range from 20-106 nm for the admixture of gases. The absolute intensity curve in the VUV range for helium gas has been achieved using a novel analytical model based of collisional-radiative model, ADAS database, singular value decomposition technique and chi-squire minimization that ultimately leads a number of calibration factors for the observed VUV spectral lines. It has been demonstrated that using this source a VUV-spectrometer-detector system can be calibrated from 23 nm to 106 nm. The developed source has been delivered to Institute for Plasma Research, Gandhiangar, a Department of Atomic Energy Agency Research Unit, under national fusion programme. The developed and delivered source is shown in figures below.

5.3 Unique Major Facilities

The National Trisonic Aerodynamic Facility (NTAF)

NTAF of CSIR-NAL continued its S&T support to the major national aerospace projects of the Departments of Space, ADA, Defense using the 1.2m Trisonic wind tunnel. The tunnel time was utilized for projects from VSS, DRDO, and ADA. Apart from contributing to the National security, during the year 2013-14 the NTAF carried out blow-downs worth Rs.10.65 crore.

Acoustic Test Facility

The Acoustic Test Facility (ATF) continued to play a crucial role in environmental qualification of satellites, launch vehicle inter-stages and their subsystems for the Indian Space Programme. During the year ATF successfully completed acoustic test programmes on the GSLV –D5, ISRO's heavy lift launch vehicle and the gsLVM3.

Failure Analysis and Accident Investigations

CSIR-NAL has been widely recognized as India's premier organization for carrying out failure analysis and accident investigations, and it has been doing this with distinction for more than 40 years. During the year 2013-14, fifty three investigations were taken up and completed. Majority of these investigations were under taken for Indian Air Force, India Navy, HAL, ADA, DGCA etc. The laboratory contributed significantly in identifying the causes of failures and suggesting recommendations for prevention of similar failures in future. The recommendations suggested encompassed design modification, selection of appropriate material and fabrication methodology, maintenance and inspection schedule as applicable depending on the nature of failure.

Forward Velocity Deceleration Sled

This unique facility is part of an integrated impact and crashworthiness research facility (ICRF) conceptualized and developed by CSIR-NAL. The forward velocity deceleration sled which can generate deceleration pulses as required by FAR 23.562 / 25.562 for design of aircraft components is the first of its kind in the country. The sled is designed for a maximum speed of 60Kmph and with impact mass of 2200kg (1200 kg sled and 1000kg payload). The sled was designed jointly with ARIES, Spain. ICRF has been developed as a high technology facility that will carry out research in the vital area of flight safety and occupant safety, applicable to both aerospace and automotive customers.

Vapour Cycle Refrigeration Test Facility

A Vapour Cycle Refrigeration System (VCRS) test facility has been established by CSIR-NAL during

Fig. 1.81 Vapour Cycle Refrigeration System Test Facility

the year. The VCRS test facility will generate design data like heat transfer coefficients and two phase friction factor coefficients for both wavy and serrated fins. This data is essential for the design of condenser and evaporator of all Electric Environmental Control System (ECS) of an aircraft.

6 CSIR 800

Krishi Shakti – a small range (11.2 hp) diesel engine tractor launched

As a new leaf in the CSIR efforts to empower the Indian farmers, Krishi Shakti – a small range (11.2 hp) diesel engine tractor designed and developed by CSIR-CMERI was launched on 20th November, 2014 by Hon'ble Minister, Science and Technology and Earth Sciences and VP, CSIR, Dr. Harsh Vardhan. He handed over five tractors to the farmers. The Krishi Shakti would benefit Indian farmers possessing small land holdings. Dr. Harsh Vardhan, while launching the Krishi Shakti said that "the development has bridged a long felt technology gap. There is an urgent need to develop state-of-the-art technology of agriculture implements. The implements need to be suiting Indian agro climates and should be energy efficient. These agriculture implements should remove farmer's drudgery". Dr. Harsh Vardhan appreciated CSIR efforts contributing for 'Make in India' mission of Hon'ble Prime Minister. The Krishi Shakti has received CMVR Certification as an Agricultural Wheeled Tractor after rigorous trials and testing. The Technology of Krishi Shakti was transferred to M/s Singha Components Pvt. Ltd., Howrah, West Bengal, who have started manufacturing. In India, about 85 percent households cultivate about 36 per cent of entire cultivable land. The average land holding of the small Indian farmer normally does not exceed even 1 hectare. It is therefore quite difficult for the average Indian farmer to afford mechanized farming utilizing standard tractors of 35 hp and above ratings, which in 2 turn tells upon the productivity and per unit yield. As a result, there has been tremendous demand for developing small, compact and easily maneuverable tractors of rating in the range of 10-12 hp, which are deemed fittest for small and fragmented land holdings. CSIR's Krishi Shakti, a small tractor, is an apt CSIR response to this necessity enabling farm mechanization in an affordable manner. Furthermore, this small tractor and its matching implements are based on available diesel engine and available tractor parts in the market. Krishi Shakti is the latest in the legacy of CSIR interventions in enabling mechanized agriculture.

Fig: 1.82 10 HP Krishi Shakti Tractor

Training on Medicinal & Aromatic Plants

To introduce medicinal and aromatic crops in new areas three training- cum-awareness programmes were organized by CSIR-CIMAP. 150 persons were trained on the cultivation and processing aspects of medicinal and aromatic plants. About 50 demonstrations of menthol mint were organized on tribal farmer's fields in different parts of India. Knowhow for cultivation of menthol mint, artemisia, lemongrass, vetiver, kalmegh, satavar, etc. adopted

Fig: 1.83 Demonstration of aromatic crops in newer areas in eastern region of the country in Angul and Sambalpur districts of Odisha

by farmers of the villages was dissenminated. Technology of mentha oil distillation was adopted by many farmers.

Introduction of mentha, lemongrass ,palmarosa, kalmegh and basil in farmers' fields belonging to SC & Sahariya tribal communities in different villages in Gorakhpur, Jhansi, Lalitpur and Mahoba, Uttar Pradesh. 280 farmers have been trained for

Fig: 1.84a Distillation in progress

Fig:.1.84b CIMAP Scientists interacting with farmers

commercial cultivation of medicinal and aromatic crops under rain-fed conditions of Bundelkhand. Farmers have started commercial cultivation of lemongrass, palmarosa and basil. Tribal communities of Sahariya of district Lalitpurin , U.P have also started cultivation of palmarosa.

Development and Deployment of Improved Samba Mahsuri

Bacterial blight (BB) is a serious disease of rice that is caused by the bacterial pathogen, *Xanthomonas oryzae* pv. oryzae (Xoo). Effective chemicals are not available for controlling yield losses due to BB. During the last few years, several rice varieties and some hybrids have been developed that carry multiple genes for resistance against bacterial blight. One of these bacterial blight resistant rice varieties that has been jointly developed by the CSIR-CCCMB and the Directorate of Rice Research using the Marker Assisted Selection methodology is Improved Samba Mahsuri.

This is one of the first rice varieties developed through the use of biotechnology and released for commercial cultivation in India. It is not a transgenic plant. This variety has become a boon for rice farmers in bacterial blight endemic areas of the country. In particular, during the last few years in the Nandhyal area of Kurnool district, the variety was found to be resistant during epidemics of bacterial blight and very much appreciated by farmers in Andhra Pradesh and Tamil Nadu.

To reach all the farmers in need, CSIR-CCMB and DRR have started a program to provide 10 kg seeds of Improved Samba Mahsuri, free of cost, to each of many rice farming households.

Contributions to the Uttarakhand Flood Relief

CSIR-IIP, being closest to the Uttarakhand hills, was made the Nodal Laboratory to coordinate with the state-level Disaster Management team on behalf of CSIR Headquarters and its laboratories.

Following help & support provided:

CSIR-CFTRI, Mysore provided *mathi* (60 cartons), *roti* (15 Cartons), tomato sauce (1 carton), *murmure* (300 bags), energy powder (200 bags), high-protein rusks (63 cartons), *Bissi Bele Bhaath* (South Indian *Khichadi* – 189 cartons), *imli poha* (56 cartons), ORS (153 cartons) and bread (4 cartons). CSIR-NCL, Pune, came forward with Water Filtration Unit (20 boxes) and hand pumps (20 boxes); CSIR-IMMT, Bhubaneshwar provided water filters (500 units); CSIR-CLRI, Chennai had footwear (2000 pairs) to offer and CSIR-NEERI, Nagpur donated

NEERI-ZAR, a Water Filter Unit (100 units), while CSMCRI, Bhavnagar came forward with two big RO units at Rishikesh and Srinagar (Garhwal) to ensure supply of pure water, with a capacity of i.e upto 30000 lt/day.

CSIR-IIP Dehradun had these to offer: raincoats (1000 nos), tarpaulins (100 nos.), stainless steel utensil sets (200 nos), plastic tags (200 nos), candles (44 pkts of 968 pieces each) and match-boxes (63 pkts of 900 pieces each).

Further, the relief operations team at the CSIR-IIP readied 100 bags of essential items for distribution in the hills. Each of these bags contained 15 items, viz., wheat flour, rice, pulses, salt, cooking oil, match boxes, candles, footwear, tents, rain-coats, tumblers, spoons, bowls, plates and mugs. CSIR-IIP also arranged rations worth Rs.1,40,400/-. Villages of the Thatyur Block in the Tehri Distt. covered were: Purodi, Dugadda; Papra ;and Sirwa.

Free food-related technologies from CSIR-CFTRI

A few of the selected technologies developed at CSIR-CFTRI were offered free in terms of technology dossiers that can be downloaded from the Institute website for the manufacture of such products to generate employment, entrepreneurship, effective utilization of raw material. The technologies include: Amla Candy, Composite Ragi Bread, Curing and Polishing –Turmeric, Dosa Batter in Retail Packs, Idli Batter in Retail Packs, Fruit Spread, Ginger Dehydration, Green Chilli Sauce and Protein Enriched Buns. More than 1000 downloads of technical dossier have been recorded so far.

Under CSIR-800 initiatives, large number of awareness programs for the benefit of farmers was held at different locations of Karnataka. These include interactive programs arranged at Haradanahalli, Kollegal, Chamarajanagar, Gundulpet, Udupi, Mala, Jadkal, Kolar and Shimoga. Demonstrations were also held at CSIR-CFTRI on technologies such as virgin coconut oil, energy food, turmeric processing and processing of fruits and vegetables. An MoU was signed for the transfer of turmeric processing and maize processing with various farmers clusters.

The first high end super resolution gated confocal microscope of the country was procured by CSIR-CFTRI this year. Genome wide screening of yeast deletion mutants for lipid droplets using Confocal Microscopy was undertaken. More than 100 deletion strains of the budding yeast, *Saccharomyces cerevisiae* were grown under rich and minimal media until stationary phase, to study the pattern of lipid droplet formation within the cells. Variations were observed between strains and also between media types, pertaining to number and size of lipid droplets. Further, in-house training to research students on operation and sample analysis with various instruments were organized.

B: Consultancy Development Centre (CDC)

During the year 2013-14, CDC has undertaken various schemes, programs & projects in a "Programmatic Cluster Driven Approach" in which all the activities are strategically re-grouped in various clusters which comprises of consultancy promotion, services, national program for competency development, technology delivery, transfer & commercialization, international collaboration, research & analysis, developing national knowledge repository standards & contribution to national projects, financial consulting and training & development.

During the year plan support of Rs. 360.00 lacs was received from DSIR for carrying out specific projects & activities. Besides plan support activities, CDC undertook various funded projects from various Ministries/Departments of the Government of India.

1. NEW INITIATIVES

Some of the new initiatives undertaken during the year are as follows:

1. Assignment on Development on State specific training module for capacity building for use of consultancy services by Ministries/ State Govt. Departments/ PSUs etc.

This assignment proposes to develop States-specific Training modules, taking into consideration the present practices being followed for building capacity among the State Government officials required for procurement and utilization of consulting services effectively.

2. Training Programme Seminars/ Workshops – TCDPAP Countries

Two Training Programme on Information Security were conducted at Hanoi: 25-26 March, 2014 and at Hochiminh: 28-29 March, 2014 in Vietnam.

3. Assessment of market & opportunities for water sector in three African Countries viz. Ghana, Botswana & Mozambique

The assignment was conceptualized on assessment of market & opportunities for water sector in the three developing countries of Africa i.e. Ghana, Botswana & Mozambique with the objective to develop the water sector market intelligence that can influence the decision of Indian players.

2. ONGOING SCHEMES/ACTIVITIES/ PROJECTS

1. Capacity Building Programmes on Selection of Consultants with Technical Consultancy Organizations (TCOs)

CDC carried out 75 capacity building programmes through 12 TCOs in the financial year 2013-14 titled "Selection and Effective Use of Consultants" and 2263 participants of State Govt./Ministries/ Departments were trained through these programmes.

2. Designing and Developing a virtual network through a portal for clients and consultants

Through this portal Consultant/ Expert will submit their profile including area of expertise and detailed services, the same will be examined by the committee members to accept/ reject their profile based on the requirements/ objectives of the portal.

3. Accreditation Scheme for Consultants and Consulting Firms

Total of 48 applicants have been recommended by Accreditation Advisory Committee (AAC) for the next stage of evaluation, comprising of physical verification.

CDC has worked out a suitable arrangement with NABET, QCI for carrying out the physical verification process.The Process Document, Assessment Formats (including Assessment Checklist) & other guidelines have been developed for consideration of Accreditation Advisory Committee (AAC) before initiating the physical verification.

4. Scheme for Exposure of Consultants & Client's to International Consulting Practices through Seminars and Conferences

During the year 2013-14, Support was provided to clients and consultants in the following international conferences:

a) FIDIC World Consulting Engineering Conference 2013 on the theme "Quality of Life: Our Responsibility" from 15-18 September, 2013 at Barcelona, Spain

b) The TCDPAP-FIDIC(ASPAC) Annual Conference at Bali, Indonesia from 2-5 March, 2014

5. Scheme for Women Consultants Programme- One Day workshop on "Building Awareness among Women Consultants in India" in various states – by TCO's

Under the scheme, CDC conducted a total of 27 workshops in India with the help of its well-established network of TCOs on the theme "Building Awareness among Women Consultants in India".

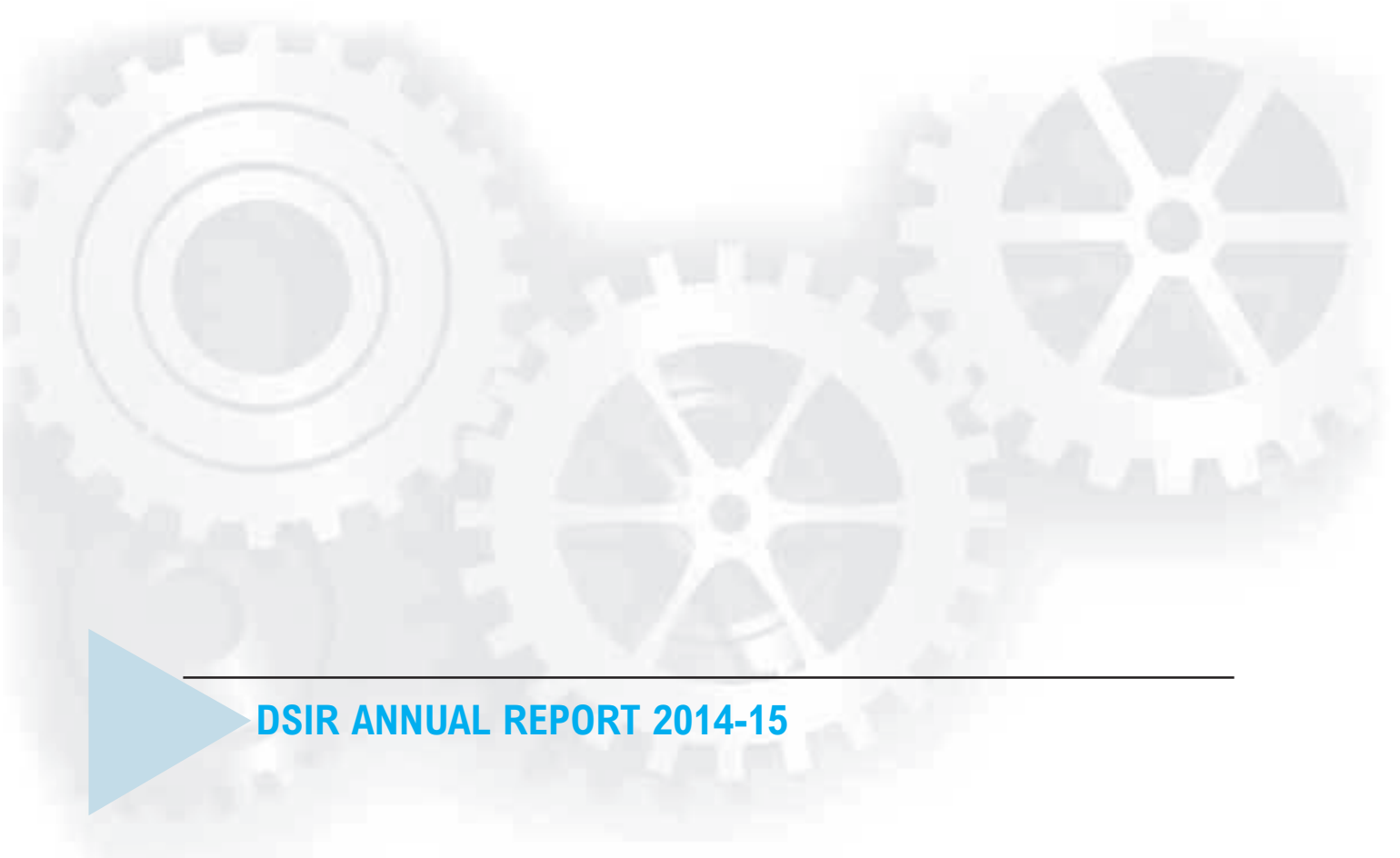
6. Study on "Export Potential of Consultancy Services in Asia-Pacific and SAARC Countries viz. Malaysia, Sri Lanka, Bhutan, Brunei"

The Final Country-wise Reports have been prepared highlighting the following:

- Thrust consulting opportunities available currently and estimated in future in the identified Priority sectors / services in the Asia-Pacific and SAARC and database of major local consultants
- Entry barriers / constraints / requirements for doing consulting business in the host country
- Recommendations and Action Plan indicating the role of various stakeholders for enhancing export of consulting services from India to these countries

7. Study on "Export Potential of Consultancy Services in South East Asian Countries viz. China, Indonesia, Thailand, Nepal, Bangladesh and Myanmar"

Secondary Research carried out through various sources analyzing the sector profiling and services driven consulting demand in both Engineering and Management across the sectors. Details of key stakeholders both within the country and in these target countries for interaction has been prepared.



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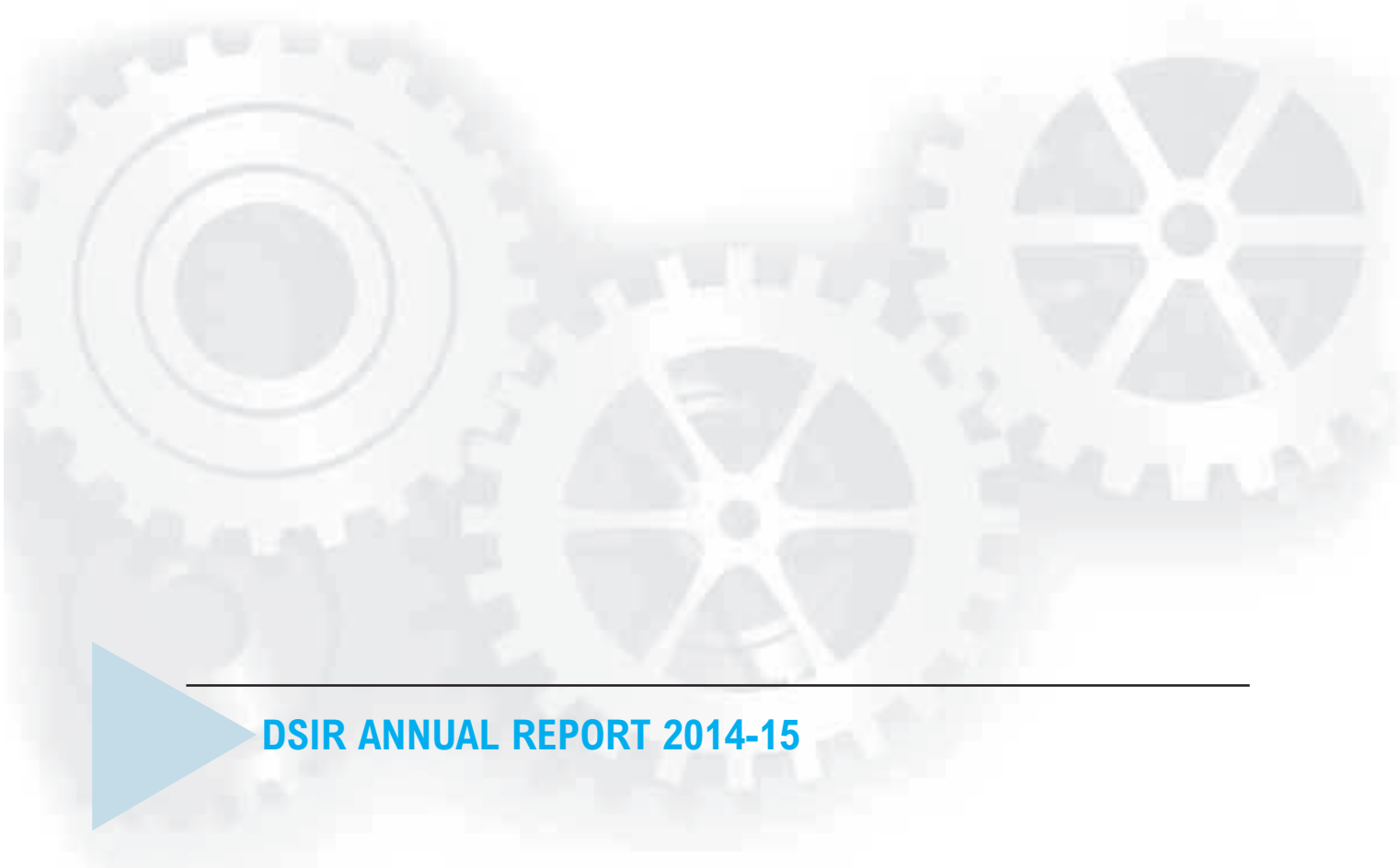
VIII Public Sector Enterprises

A. National Research Development Corporation (NRDC)

B. Central Electronics Limited (CEL)



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Public Sector Enterprises:

A: National Research Development Corporation (NRDC)

1. INTRODUCTION

The National Research Development Corporation (NRDC) is a premier organisation, under Department of Scientific & Industrial Research (DSIR), Ministry of Science & Technology, engaged in the development, promotion and commercialisation of the R&D results / technologies emanating from Research Institutes/ Universities / Industries, etc. The Corporation provides comprehensive technology transfer services and acts as a catalyst for transforming innovative research into marketable industrial products. NRDC is a unique organisation because it is the only public enterprise wholly dedicated to transfer of technologies developed at R&D laboratories to industry. During the past six decades of its existence, the Corporation has developed strong links and network with various R&D organisations in the country as well as abroad for transfer of technologies. Its operations cover the entire spectrum of industrial technologies ranging from chemicals to metallurgy, mechanical engineering, electrical engineering, electronics, biotechnology and so on.

2. PROFIT

During 2013-14, the Corporation continued to face leadership crisis and hardship and as a result could not maintain all round progress in its activities. The dedicated, hard and sincere work of the employees of the Corporation could not fetch enough revenue earnings to overcome the financial obligation. The Corporation's gross income was Rs. 766.20 lakhs, as compared to Rs 709.86 lakhs in the previous year.

The Corporation ended up with deficit before tax of Rs. 170.42 lakhs as compared to a deficit of Rs. 247.60 lakhs in the previous year.

3. PROCESSES ASSIGNED AND LICENCE AGREEMENTS CONCLUDED

The Corporation continued to lay emphasis on broadening and strengthening the technology resource base by nurturing long-term relationships with R&D institutions as well as universities, technical organizations, industries and also individual inventors. This endeavour is reflected in the Corporation signing Memorandums of Understanding/Agreements with 14 new

Signing of MoA with EBTC

organizations for assignment of technologies developed by them. Some of hese organizations are indicated below:

- National Institute of Ocean Technology (NIOT), Chennai
- Indian Institute of Technology (IIT), Kanpur
- Indian Institute of Petroleum (IIP) (CSIR), Dehradun
- European Business and Technology Centre (EBTC), Delhi

Process Assigned

During the year, 68 new processes were assigned to the Corporation as compared to 66 no. of processes in the previous year. Some of the commercially important processes assigned to the Corporation from various research institutes, universities were:

National Physical Laboratory, New Delhi

- Smart epoxy conducting polymer composite for corrosion protection
- Photoactive scratch resistant TiO2 thin coating on Glass

Central Silk Technological Research Institute, Bengaluru

- CSTRI Eco-Degumming Machine
- An Automatic Tasar Cocoon Separating Machine
- An Improved Reeling Cum Twisting Machine (Wet Reeling)

KIIT University, Patia, Bhubaneswar (Odisha)

- Live attenuated salmonella vaccine

National Institute of Ocean Technology, Chennai

- Tsunami test rig system
- Tsunami detection system

Maharshi Dayanand University, Rohtak, Haryana

- Acrylamide Biosensor

Major Technologies Licensed

The Corporation managed to sign 19 license agreements during the year compared to 28 license agreements signed in the previous year. Some of the major technologies licensed by the Corporation in the financial year were:

RMRC, Port Blair

- **Recombinant IgM Elisa Kit for the Diagnosis of Leptospirosis**

IIHR, Bengaluru

- **A process for preparation of Arka Vegetable Foliar Spray Formulation**

CSR&TI, Mysore

- **Vijetha Supplement Powder (Silkworm Bed Disinfectant)**

Indian Institute of Spices Research, Kozhikode (Calicut)

- **A micronutrient composition for ginger and a process for its preparation (for soils with pH above seven)**

During the 12th five year Plan the Corporation has taken up two new schemes viz.

1. Programme for Inspiring Inventors and Innovators (PIII)

2. Programme for Development of Technologies for Commercialisation (PDTC)

4. PROGRAMME FOR INSPIRING INVENTORS AND INNOVATORS (PIII)

Prize Award for Meritorious Inventions

The activity is aimed at stimulating the spirit of inventiveness not only among scientific and technical personnel and industrial workers but also

Prize Award Ceremony

among technicians, artisans, craftsmen and the merging youth force in the community, so that the creative talent which lies hidden in individuals or groups outside the organized R&D System could be harnessed for the benefit of the nation.

'Innovate India' is in sequence to the NRDC's regular event that goes simultaneously with the Meritorious Invention Awards Ceremony of NRDC, along with a brainstorming conference. The conference aims to provide a forum to academia, industries and government to share their experience and exchange ideas on latest technological innovations and developments.

The success of Innovate India events, organized by NRDC over the years, has been a motivating factor in staging this year's event to stimulate thought processes among delegates of the conference about the creation of a vibrant innovation ecosystem in the country which could help in harnessing the innovative talent among the youth and enabling transformation of knowledge into products, processes and services that would fuel economic growth, create employment and wealth, and thus result in significant improvement in the standard of living.

In order to deliberate on "enabling the eco system for innovation through R&D, academia and industry linkages", NRDC organized this year Prize Award distribution ceremony followed by one day conference on "Innovation Ecosystem-Indian Perspective" under the banner "Innovate India" at Vivekananda Auditorium, UPES, Dehradun on February 27 and 28, 2014.

The Chief Guest, Dr. R. Chidambaram, Principal Scientific Advisor to Government of India & Chairman Cabinet Committee Scientific Affairs, Government of India, gave away NRDC Meritorious Invention awards to 25 Innovators for their 10 Innovations. Presentations on the awarded inventions by the awardees were made in the inaugural session. The Conference provided an opportunity to deliberate on the various aspects of Innovation Ecosystem in the following interactive sessions:

- Innovation Ecosystem - How fertile it is?
- Nurturing Technological Innovations/ Inventions
- Innovations –Taking Them Forward
- Technology Transfer: Challenges and Pit Falls

Science Model and Science Poster Competition was also organized in association with Uttarakhand State Council for Science and Technology, Dehradun, for students and Research Scholars from Higher Education and Technical Education institutions and universities in and around Dehradun on February 27,2014. The theme of this competition was "Innovation in Science and Technology for the Service of Mankind". Around 30 educational institutions/ university participated in this Competition. The first, second and third winners/ entries of Science Model and Science Poster Competition were awarded with Certificate, Memento and Cash Prize. Two consolation cash prizes under each Category were also awarded.

Intellectual Property and Technology Facilitation Centres

The Micro, Small and Medium-sized Enterprises (MSMEs) are often the driving force behind such innovations. Their innovative and creative capacity,

however, is not always fully exploited, as many MSMEs are not aware of how these emerging trends can help and safeguard them. To help MSMEs to fully utilize the emerging trends in their business activities, NRDC has established a facilitation center at Bangaluru with support of MoMSME. The objective of the Intellectual Property Facilitation Centre for MSME is to focus on protection and management of IP for the MSME by facilitating IP protection and innovation management in changing economic environment.

The cente is now functional at the campus of M.S. Ramaiah School of Advanced Studies located in Peenya Industrial Estate which is one of Asia's largest small-scale industrial hub.

The IPFC has been catering to the micro, small and medium enterprises in the region providing consultation and facilitation services for protection of their intellectual properties like patent, trademark, design registration, copyright and geographical indication. The industries in the region are being sensitised regarding their intellectual properties and protection of the same by way of organizing awareness programmes, IPR workshops, participation in industrial meets, etc. The Centre has facilitated filing of ten patent applications, three trademark applications and one copy right application. Research and documentation work for filing of one geographical indication from Karnataka is in progress. Several patent search and analysis has been carried out for various industry clients from Karnataka.

Intellectual Property & Innovation Facilitation

NRDC with its vast experience in technology transfer and IP management proposed to take up the task of setting up of Innovation Facilitation Centres during the current five year plan in the selected Universities, National Institutes of Technology (NIT's), Autonomous Institutions & Academic Institutions in India involved in Research and Development in various scientific disciplines where innovation activities would be promoted and would facilitate the effective management of Intellectual Property, development of an association with manufacturing enterprises and subsequently transfer of the IP to the industry and entrepreneurs.

The Corporation during the financial year 2013-14 has set up two NRDC – Innovation Facilitation Centres, One at All India Institute of Medical Sciences (AIIMS), Ansari Nagar, New Delhi and another at Amity University Uttar Pradesh (AUUP), Sector-125, Noida, Uttar Pradesh premises.

The Centres will provide a platform that can integrate R&D results generated by these organizations, evaluate and promote area specific technologies for the industries by utilizing R&D capabilities of the host institutions. The Centres will develop and strengthen the Industry-Academia partnership for effective transfer of know-how from the Institutions and act as a potent resource of IP protected technologies.

Under the Programme for Inspiring Inventor and Innovator (PIII), the Corporation endeavors to inculcate and stimulate the spirit of inventivity and innovation among scientific community and MSMEs and supports the protection and management of their IP. The Corporation is also organizing and conducting seminars/workshops in the universities/research institutions to create awareness about various aspects of IP protection, its management and issues relating to transfer of technologies.

1. IP Protection

In order to encourage innovators/inventors, the Corporation is providing financial and technical assistance to them without any obligation of assignment of the patent to the Corporation. In the current financial year, NRDC has filed 51 patent applications in India on behalf of inventors.

2. Patent Search Facility

Patent search enables scientists, inventors or business managers to identify and source patents

IPR Workshop for MSME at Cuttack

which can be used to provide a state-of-the-art technology survey and determination of novelty of the invention and also helps in tracking technological advances or to monitor R&D landscapes and marketing strategy. For the current financial year, NRDC has conducted 42 patent searches which provided bibliographic references and abstracts from published literature, business information, text of articles, journal and other relevant patent information.

3. IPR Seminar/ Workshop/Training

In the current financial year, NRDC has organized 12 seminars/workshops in the title theme on **"Intellectual Property and Innovation Management in Knowledge Era"**. NRDC officials have also given more than 35 lectures on different issues of IPR and technological innovation in various seminars/workshop

4. Online Intellectual Property Rights and Knowledge Management Courseware for Certificate Programme [IPKMCP]

NRDC has envisaged a programme for Online IPR and Knowledge Management to create awareness on Intellectual Property and Innovation Management to grass root innovators/students/ professionals through digital based medium. During the year, Corporation identified the resource persons for formulating and designing the courseware and interacted with other stakeholders for preparing action plan. The work is in progress.

Knowledge Management Programme for Promotion of Innovation/Technologies

KMP is a self-propelled mechanism for systematic identification and evaluation of the technologies, by a team of experts for value addition to the extent possible for making a complete technology package for commercialization of technologies, so that the chances of success become high. Three Expert Panels in the areas of Biotechnology, Agriculture, Ayurveda & Herbal were formed. During 2013-14, 20 technologies related to Biotechnology, Agriculture, Ayurveda & Herbal were discussed in four meetings of expert panel. The Committee suggested various value additions required for the technology(ies) including market survey, test results, preparation of technology document/feasibility report of Detailed Project Reports etc. Technology evaluation carried out for some of the following:

1. Nano-transmucosal patch for insulin delivery
2. Live-attenuated Salmonella Typhimurium vaccine
3. A Biocompatible, Self-Digestive and Antimycotic Intra Ocular Natamatrix
4. A Process for the preparation of an Ayurvedic herbal compound, Ayush QOL-2C for supportive therapy for the improvement of quality of life in Cancer patients

5. PROGRAMME FOR DEVELOPMENT OF TECHNOLOGIES FOR COMMERCIALISATION (PDTC)

Basic Engineering Design Package (BEDP)

The activity of developing a Basic Engineering Design Package (BEDP) was initiated for value addition and making a complete technology package for the entrepreneur, so that setting up of the commercial plant becomes easier and its chances of success become high. In order to take the process to a pilot scale or to a commercial level, it requires a detailed study for working out the final process scheme, which can be obtained through series of

simulation of the laboratory scale process and then incorporating required engineering input so that the process is workable. Once the BEDP is prepared based on the data the feasibility study and Detailed Project Report (DPR) can be prepared. With these reports it becomes easy for the Entrepreneur to carryout detailed engineering for setting up the commercial plant. The reports also help the corporation in planning for marketing of its technologies.

The BEDP was prepared for the following technologies assigned to the Corporation during the FY 2013-14:

1. Improved Neem Larvicidal Composition
2. A slow or controlled release mosquito Larvicidal composition
3. A novel formulation of growth promoting rhizobacteria with enhanced shelf life
4. Oral insulin delivery
5. Process for extraction of biopesticide from cassava biowaste
6. Keratinase Enzyme.

Market Survey

The Corporation carried out Market Surveys for the assigned technologies to adjudge its market potential. These Market Survey Reports have played an important role in finding out the Commercial potential of the technologies and demand of the product. The following market surveys were conducted during the FY 2013-14:

1) Primary Cervical Epithelial Cell Line From Cervical Lavage.
2) Natasol & Natamatrix eyedrop formulation.
3) Monoclonal antibody based ELISA kit for diagnostic of animal viral disease with specific reference to rota virus.
4) Oral Insulin delivery.
5) Salmonella vaccine (human).
6) Conducting polymer composite for corrosion protection.
7) Process for extraction of biopesticide from cassava biowaste.
8) Cigarette filter.
9) Coimmobilization of deteregent enzymes onto plastic bucket.
10) Process for ultra light Mg() and Zn0 nanocrystallimne powders.
11) Gluconate Salts.
12) Keratinase Enzyme.
13) Crop specific foliar micronutrient formulations.
14) Wheat based snack bar.
15) A slow or controlled release mosquito Larvicidal composition.
16) Impact of EDP on North Eastern States.

Programme for Innovation in Rural and North-Eastern States

The Corporation with an objective to create employment opportunities and capacity building of development agencies for skill upgradation through the application of innovative technologies in rural and backward areas carried out the following activities during 2013-14.

1. EDP on "Innovative Environment Friendly Building Materials and Technologies" implemented in association with Institute of Leadership Development (ILD), Jaipur

   EDP was conducted at Rajasthan Housing Board Building, Bhiwadi and 40- Civil Engineering students from nearby Govt Polytechnic participated in the above programme.

2. Training cum Demonstration for the Preparation of Herbal Shampoo and Hair Oil for Rural Youth and Women at Kannauj" implemented in association with Fragrance and Flavour Development Centre (FFDC), Kannauj(U.P)

   80 trainees comprising members of women Self Help Groups (SHGs) and unemployed youths were given hand on training for setting up micro-enterprises/ cottage industry..

3. EDP on "Demonstration of Processing Technology for Oils from Apricot and other Medicinal Fruit Seeds" in Gairsain, Uttarakhand implemented in association with Science Technology and Development Initiative (STAD), New Delhi

   53 trainees comprising members from Women SHGs and youngsters from nearby colleges participated in the above programme(s).

4. EDP on "Manufacture of Agarbatties in Backward and Rural Areas through Innovative Appropriate Technologies" implemented in association with United Sports Association, At Dhalapathar, P.O. Kalapathar, Dist. Khurda-754009, Orissa

   30 Members of Women SHGs participated in the programme.

5. EDP on "Technology Demonstration and Dissemination for Development of High Land Water Harvesting for Drinking and Pisciculture-cum-irrigation Reservoir using Plasticulture Technology" implemented in association with Shibah Welfare, Opp. D.I.S office, High School Colony, Half Nagarjan, Dimapur-797112 (Nagaland)

   25 local farmers were imparted demonstration and training on the design and construction of High Water Harvesting System using Plasticulture Technology.

6. Technology Transfer for Production of Extended Inoculums for the Production of Compost among Rural Women in Uttarakhand implemented in association with SARG Vikas Samiti, Dina Lodge, Mallital, Nainital - 263001 (Uttarakhand)

   150 farmers were imparted training and demonstration on inoculum's production, structure design construction etc.

Socio Economic Development of North-East

The corporation has taken up two projects in North-eastern regions for creating employment opportunities through implementing projects like extending the shelf life of perishable fruits and vegetables and undertake organic fruit Cultivation & Processing Programme at Mizoram.

a) Enhancing shelf life of fruits and vegetables through innovative technological intervention. Under this activity, the Corporation would set up Demonstration Centres in various North-Eastern states where unemployed youths can be imparted training for fruit coatings for setting up their own micro business. During the year, one centre was established at

Training Program at CDAR

Mizoram.The training and demonstration for coating the fruits and vegetables was carried out at CSIR-CMERI-CDAR, Tuirial Airfield, Aizwal (Mizoram).3 batches of 50 nos. of farmers, vendors and interested entrepreneurs from 13 villages near the capital city of Mizoram, Aizwal participated in the programme.

b) Certified Organic Fruit Cultivation & Processing Programme at Mizoram The major objective of the project is identification of geographical areas in Mizoram suitable for adopting organic farming and introduction of appropriate cultivation technologies and establishment of processing centres to cater premium markets.

This project would facilitate the utilization of abundantly available natural resources of Mizoram for the betterment of the local community.

NRDC Stall at an Exhibition

The use of modern farming practices would result in better yield, production of good quality of season fruits, healthy and quick growth of plant seedlings and saving in time and labour.The use of bio-fertilizers would save the ecosystem of the hills.the proposed project would, thus, contribute in the overall Socio-economic development of the region.

The programme has been initiated and awareness programme organized for the farmers at 4 villages in Mizoram in association with CSIR-CMERI – CDAR(Community Development Action & Reflection). The programme was attended by more than 500 farmers, who were educated regarding organic farming techniques and its importance.

Exhibitions and Publicity

Participation in exhibitions, seminars, workshops and entrepreneurship development programs are of vital importance for the creation of awareness about the role of the Corporation in technology transfer and technologies available with the Corporation for transfer. With this objective in view, the Corporation

NRDC Stall at an Exhibition

participated in 21 exhibitions, seminars and get-togethers, industry meets etc.

Publications

NRDC continued to publish its Hindi science monthly magazine Awishkar. The main objectives of the magazine are to disseminate information and create awareness about new technologies, inventions, innovations, IPR issues, etc. amongst the masses and foster the spirit of inventiveness, innovativeness and entrepreneurship amongst the students, scientists, technicians, budding entrepreneurs, etc. Some of the important topics covered in Awishkar are: Increasing applications of Laser in industries; Leading Science Communicator Ruchi Ram Sahani; Pant-ICAR animal driven six-in-one tillage outfit. Increasing role of Quantum Physics in the technological development; Traditional Knowledge Digital Library; India's Mars Mission; Innovate India 2013 Conference on "Innovation for equitable Growth". Is Silicene the future of Electronics; CSIR-NEISTs Technologies having direct bearing on public utilities; Elastrography a painless substitute for biopsy; New dimensions of Bio-informatics; Radiation – myths and realities; Use of Radioisotpoes in Agriculture; Contribution of Indian Space Programme in the development of the nation; Science, Technology and Innovation 2013 policy of India; Increasing role of Nano-technology in food Industry. 3-D Printing Technology for manufacturing; Science Nobel Prizes (2013); Nano-technology-new applications; Assessment of Climate Change; Bharatratna Prof. C N R Rao; New Agri-technologies; New dimension

in Space Communication - Laser Broadband; NRDC Meritorious Invention Awards 2012 etc.

List of Publications 2013-14

- Prize Award (Folder) – Conference on Innovation Ecosystem-Indian Perspective
- Citation- NRDC Meritorious Invention Awards (2012)
- Fruwash-Fruits and Vegetables for Continued Freshness

Technology and Project Export

The Corporation has been endeavouring for transfer of technology and undertaking projects in many of the West African countries.

ARSM, Senegal visited India along with officials of their Government namely, General Sangue Ndao, Director General of ARSM, Mr Moussa Baldé, Director General of SODAGRI, Dr Ndéné DIOUF, Head of Division of ANIDA and Mr Demba Camara, Counsellor of Economic and Commercial Affairs, Senegal Embassy to have technical co-operation for projects for livelihood of retired Military personnel.

The Corporation is pursuing with them for signing of MOA for the project.

A delegation from National Employment Fund (NEF), Cameroon consisting of Mr. Moute A Bidias Camille, GM and Mr. Kisso Benjamin, Regional Manager visited NRDC office for the identification of technologies and machines suitable for Cameroonian entrepreneurs, identification of areas for providing training to the entrepreneurs in collaboration with NRDC.

The Corporation has signed a supplementary licence agreement with M/s Medhmak Int. Real Estate LLC, Sharjah for transfer of technology on Cocolawn developed at CCRI, Allepey for extension of licence period and exclusivity and received US $ 40,000 as an additional fee.

The Corporation had signed MoA with Ministry of External Affairs (MEA), Govt. of India for financial support for "Pilot Research Project for production of Tomato in Ghana. Govt. of Ghana. The cost of the project is US$2.088M.

6. HUMAN RESOURCE DEVELOPMENT

The thrust for better utilisation of Human Resource and improvement in work practice continued during 2013-14. Training and development at all levels of employees was given due priority by the Corporation to increase effectiveness. Special emphasis was given to organisation building and shaping right attitudes, team building and work culture, besides preparing employees to understand the trends in fast changing technology and switching over to latest technology for achieving higher results in productivity and profitability.

The real asset of any company is its human resource. The total manpower of the Corporation as on 31st March 2014 is 86, viz., (Group A-25, Group B-27, Group C-22, Group D-10, and Group D (contractual)-2. The employee-management relationship was cordial throughout the year.

7. TECHNOLOGY ABSORPTION, ADAPTATION AND INNOVATION

While a major objective of the corporation is the development and commercialisation of indigenous technology, the Corporation itself does not carry out any R&D. However, it promotes and finances R&D on a selective basis in both laboratories and industry. Hence the requirement to furnish information in respect of Technology Absorption, Adaptation and Innovation under Rule 2(B) of Companies (Disclosure of Particulars in the Report of Board of Directors) Rules, 1988, is not applicable to the Corporation.

8. IMPLEMENTATION OF OFFICIAL LANGUAGE

The Corporation continued to make efforts to fulfil the targets prescribed by Govt. of India in the Official

Language Act and Rules framed there in with regard to increasing the use of Hindi Rajbhasha in office during the year 2013-14. Employees were motivated to use their working knowledge of Hindi in day-to-day official work. All the Standard Forms, Files, etc are bilingual. Significant progress has been made in the field of correspondence, noting and drafting in Hindi. All Hindi letters are being replied in Hindi only. The Annual Report of the Corporation is being published in diglot form in both Hindi & English since 1986-87. The Corporation also publishes a popular Science & Technology monthly magazine in Hindi, entitled 'Awishkar'.

To enrich Hindi vocabulary of the employees of the Corporation as well as visitors, an English word with its Hindi meaning is written daily on a writing board as 'Today's word' at the reception of the Corporation.

B: Central Electronics Limited (CEL)

1. INTRODUCTION

Central Electronics Limited (CEL) is a Public Sector Enterprise under the Department of Scientific and Industrial Research (DSIR), Ministry of Science & Technology, Government of India. It was established in 1974 with an objective to commercially exploit the indigenous technologies developed by National Laboratories and R & D Institutions in the country. CEL is one of the companies that utilized home grown technologies during all these years of its existence. The Company is primarily engaged in production of strategic components for defence applications of national importance, equipment for railway safety and solar photovoltaic modules and systems.

The Company has developed a number of products for the first time in the country through its own R & D efforts and in close association with the premier National & International Laboratories including Defense Laboratories. In recognition of all these efforts, CEL not only have the distinction of being a DSIR recognized R & D Company, but also has been honored a number of times with prestigious awards including **"National Award for R & D by DSIR"**. CEL holds a unique position among the family of Public Sector Enterprises in the country, with its emphasis on indigenous technology inducted both from its in-house developments and from the National Laboratories, for its production programme in diverse high-technology areas of national importance. CEL has facilitates networking with leading research laboratories and leading institutions in India (IIT, IICT, NCL, NPL etc.) and abroad (UNSW, Georgia Institute of Technology, EPFL etc.). The company is already approved from the year 1994 as an R & D centre from the DSIR.

CEL has already established partnerships and linkages with various stake-holders and business associates in the areas of railways, telecom, police, power generation and distribution companies, service providers in the energy sector, public funded institutions and even rural communities through the state governments. The existing marketing channels are being consolidated and expanded harnessing the unique advantage CEL has in terms of its product base and Government backing.

The renewed mandate of CEL includes development and harnessing technology for **(i)** Solar Energy Systems and Solutions **(ii)** Strategic Electronic Components and systems required for Defense, Space, Atomic Energy. **(iii)** Signaling and Safety in Public Transport Systems **(iv)** Infrastructure, Eco-systems management and energy conservation and **(v)** Security and Surveillance in strategic establishments. CEL has been the pioneer in the country in the different areas of manufacturing & proprietary manufacturer of the many strategic electronic components for use by defense organizations in the country.

OPERATING RESULTS

During the year the Company recorded production of Rs. 175.81 Crores and sales of Rs. 172.05 Crores against the previous year's production of Rs. 183.92 Crores and sales of Rs. 192.13 Crores.

(Rs. in Crores)

Year	2013-14	2012-13
Production	175.81	183.92
Sales	172.05	192.13
Gross Margin	11.15	5.19
Gross Profit	8.40	2.51
Net Profit (+)/Loss(-) before tax and extra-ordinary items	3.15	-2.41
Net Profit after tax	3.09	-2.41

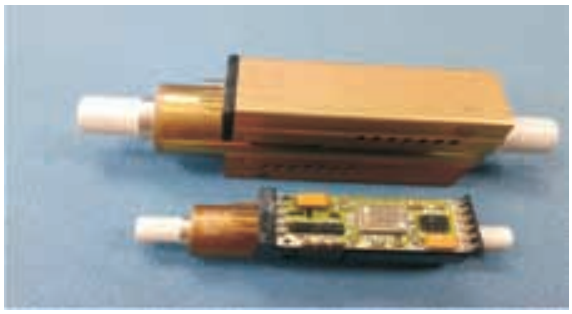
During the year (2013-14) under review the Company has achieved the Gross Margin of Rs. 11.15 Crores against Rs. 5.19 Crores in the previous year. The Company has also achieved Net Profit after Tax of Rs. 3.09 Crores against loss of Rs. 2.41 Crores in the previous year.

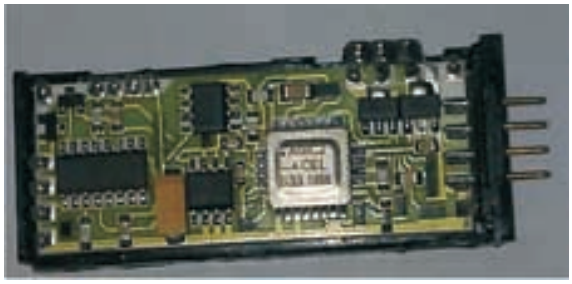
2. EXPORTS

During the year 2013-14, exports have been Rs 7.06 Crores.

2.1 Major Achievements

- During the year, the Company has supplied 36,215 Nos. of Phase Control Modules (PCMs) to Bharat Electronics Limited (BEL), Ghaziabad. The Company also executed the prestigious export order of USD 302,000 for supply of PCMs to Poland. The Company has also enhanced manufacturing capacity of PCMs for AKASH Missiles.





- Company has implemented ERP for cost effective management
- The Company has successfully commissioned a 5 MWp Module Manufacturing Plant at Maputo, Republic of Mozambique.
- Company has developed large size Cadmium Zinc Telluride (CZT) substrate.
- Company has expanded production for three new products for railways High Availability Single Section Digital Axle Counter (HASSDAC), Multi Section Digital Axle Counter (MSDAC) and Block Proving by Axle Counter using Universal Fail Safe Block Interface (UFSBI).
- The Company has exported various Solar PV Systems worth Rs. 2.87 Crores during the year under review.
- The Company has setup two 500 KWp roof top Power Plant in Greater Noida.

NBCC, Lodhi Road, New Delhi

Kanshi Ram Multi –Speciality Hospital, Gr.Noida

- The Company has taken up work for installation of a 1 MWp Power Plant using latest technology high efficiency cells.
- Company has shifted to 6x6 inch solar cell manufacturing.
- Company has introduced a six months certificate training course for diploma holders in two branches (i) Solar, Photovoltaic, System–Installation, Commissioning, Operation & Maintenance (ii) Manufacturing of Solar Photovoltaic Cells & Modules.

3. FUTURE STRATEGY:

FUTURE OUT LOOK & VISION 2020

All the four areas that the Company operates in (viz. Solar Photovoltaic, Railway Signaling systems, Integrated Security & Surveillance Systems and Defence Electronics) are Per-Se high growth, core sector areas. The Company can make huge contribution to the national interests and future potential for the Company is immense.

SOLAR PHOTOVOLTAIC'S (SPV)

India has launched the Jawaharlal Nehru National Solar Mission (JNNSM) with ambitious targets of 20 GW of Grid connected and 2 GW of Off-grid capacity by 2022.

CEL is capable of playing an important role in these efforts and is targeting to capture at least 2.0% (Grid-tied) & 20% (Off-grid) market by 2022. In this regard, the Company has already in the process of up-grading its module production facility to 40 MW under DSIR funded project. This will bring down the cost of CEL modules and make it competitive in the domestic & international markets. The Company is further taking a project active step for development of high efficiency HIT solar cells with the funding from, DSIR.

The Company has entered into a new market segment i.e. partnering with CPSEs to execute their Corporate Social Responsibility (CSR) activities through integrated rural development programme. This would be another major focus area for the Company, in times to come.

RAILWAY ELECTRONICS

CEL had been engaged in design and manufacture of Railways signaling equipments such as Analog and Digital Axle Counters & Block Signaling Equipment for last 30 years.

Indian Railways is planning major investment in the area of safety as well as capacity enhancement / new lines. This is expected to result in a huge demand for signaling and control equipments. CEL is working towards further developing its own R&D as well as production facilities in these areas and expanding its product value with support from the DSIR.

The Company has already taken up a project for indigenous development of Train Protection and Warning Systems (TPWS) which is expected to be a major requirement, of Indian Railways. At present, there are no indigenous manufacturers and the entire requirement will need to be imported. In future, the Company plans to develop new interfaces for its existing equipment to make them work through optical fiber cables that are being now used in Railways.

STRATEGIC ELECTRONICS

CEL has involved in the development of strategic electronic components such as Phase Control Modules (PCMs) for the Akash Missile, Piezo Generators for HEAT Fuse 551 & 651 for Carl Gustaf Gun etc. Company is also planning to expand the product portfolio using state-of-the art technology for manufacturing of strategic components.

INTEGRATED SECURITY SYSTEMS

The current security scenario in the country has made security systems (Including Baggage Scanners, DFMDs surveillance equipment, intelligent systems, Bomb detection and disposal equipment etc.) a very high growth area. There is a need for a reputed and reliable Public Sector entity in these areas. The Company is focusing on these areas as an important business segment for future growth.

4. FOREIGN EXCHANGE RECEIPTS AND OUTGO

During the year under review, Company has spent Rs. 14.05 Crores in foreign exchange as against Rs. 18.71 Crores in the previous year towards purchase of raw material, components and spares, capital goods, travel and agency commission etc. The Company earned foreign exchange of Rs. 4.81 Crores as against Rs. 5.09 Crores in the previous year from export of its products.

5. ENERGY CONSERVATION

The Company continues its efforts to reduce energy consumption with the Objective of optimal use of energy resources and cost reduction to the Company. Keeping in mind the philosophy that **"ENERGY SAVED IS ENERGY PRODUCED",** the Company has taken following actions for conservation of energy:

(a) Encouraging employee to save electricity by switching off fans/lights/working equipment, when not needed.

(b) Minimizing idle running of machine during start-up through strict planning and close coordination among different activities of the plant.

(c) Display energy conservation posters in all the production divisions on lighting, Pumps, Compressor and A/C.

(d) Replacement of flourcent tube lights with CFL's/ LED lights etc.

(e) Regular Maintenance of electrical equipment, switch gear & motor pump sets for optimal performance.

6. PARTICULARS OF EMPLOYEES

In compliance with Section 217(2A) of the Companies Act, 1956 read with Companies (Particulars of Employees) Rules, 1975 as amended, none of the employees of the Company either employed throughout the year or employed for a part of the year was in receipt of remuneration more than that minimum prescribed in the Rules.

7. IMPLEMENTATION OF HINDI, INDUSTRIAL RELATIONS AND HUMAN RELATIONS

The company had very cordial industrial relations during the year. The management also initiated programmes for upgrading the skills of the employees. In order to ensure the use of Hindi, the employees continued to be trained in Prabodh, Praveen, Pragya Hindi Courses, Hindi typewriting and use of Hindi Computers. Hindi week has also been organized from 14.9.2013 to 20.9.2013.. Various short-time training programmes and workshops were conducted for workers and officers during the year. Special workshops and various competitions in Hindi were organized and awards distributed to the winners. Half-yearly Hindi Newsletter 'HAMARA CEL' was also published.

8. WELFARE OF RESERVED CATEGORIES

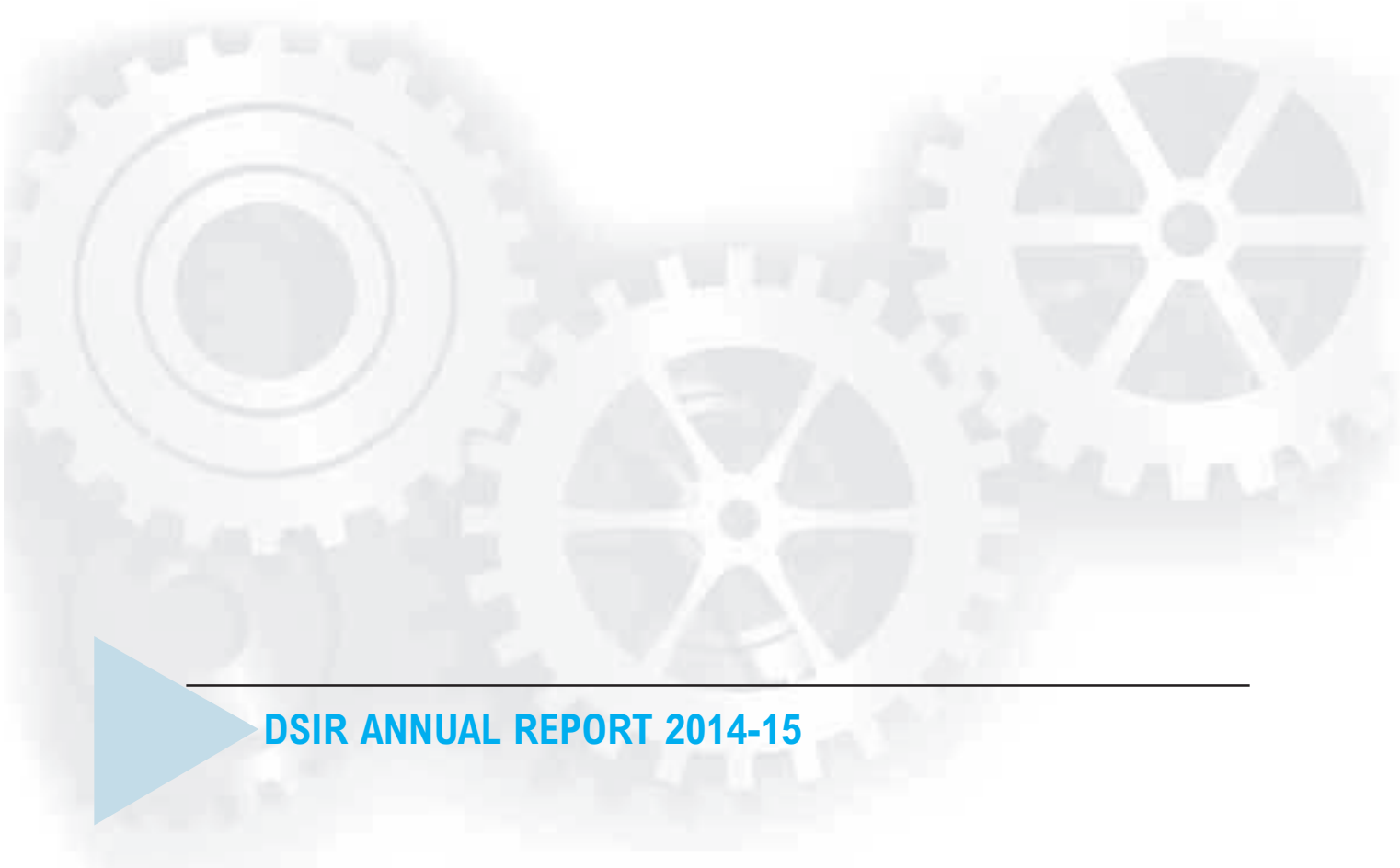
All Government Directives relating to the reserved categories such as SC, ST, Physically Handicapped, Ex-servicemen etc. continue to be implemented during the year.

IX Administration & Finance

1.Administration

2. Finance

3. Audit Observations by CAG



DSIR ANNUAL REPORT 2014-15

Administration and Finance

1. ADMINISTRATION

The Department of Scientific & Industrial Research (DSIR) was created in January 1985. The Administrative Division of the Department, comprising Establishment Section, General Section and Vigilance Unit, looks after activities related to personnel, implementation of the Flexible Complementary Scheme (FCS) promotion mechanism meant for the Scientists (Group 'A'), foreign deputations of officers, vigilance matters, administrative reforms mechanism, work relating to CGHS facilities, staff welfare, coordination etc.

Since both DST & DSIR are situated in same premises, all the celebrations such as S & T Foundation Day, Technology Day, Retirement Meetings, Hindi Pakhwada, Vigilance Week, etc. are celebrated as a common event with active cooperation of both Departments.

1.1 Staff Strength

The staff in position in different groups in the Department other than that of autonomous bodies viz. Council of Scientific and Industrial Research (CSIR) and Public Sector Undertakings viz. National Research Development Corporation (NRDC)/ Central Electronics Limited (CEL) as on 1st January 2015 is given below:

1.2 Promotion of Rajbhasha

The Official Language Section of the Department is manned by Deputy Director(OL) and has made relentless efforts towards carrying out the instructions issued by the Department of Official Language for implementation of the Official Language Policies in the Department and the Autonomous Bodies and Public Sector Undertakings under its administrative purview.

	General	SC	ST	OBC	Total
Group 'A' (Gazetted)	33*	04	03	01	41
Group 'B' (Gazetted)	07	01	01	01	10
Group 'B' (Non-Gazetted)	18	04	01	00	23
Group 'C'	03	07	01	04	15
Total	**61**	**16**	**06**	**06**	**89**

* Excluding 1 post of JS (Admin) which is on notional basis.

The Department has taken the following steps for progressive use of Rajbhasha in the Official Language Policies of the Government:

- In pursuance of Section3(3) of Official Language Act, Department's Annual Report, Budget Materials, Parliament Questions, Cabinet notes, Advertisements, General orders and Notifications etc were issued in Hindi and in English.

- Quarterly meetings of Official Language Implementation Committee held and timely follow up action taken.

- The Quarterly Progress Report and Annual Assessment Reports regarding use of Rajbhasha in the Department sent to the Department of official Language.The new initiative of online submission of these reports has been introduced.

- Rajbhasha inspections carried out in the Attached Offices of the Department regularly.

- Officers in the Department requested to make use of the services of stenographers, Personal Assistants(PAs) and Private Secretaries (PSs) who are trained in Hindi Stenography for doing their official work in Hindi. Stenographers who are not knowing Hindi Stenography are being nominated for such training as per training programme prescribed by the Department of Official Language from time to time.

- General Administration Section has been advised to do their entire work in Hindi as per rule 8(4) of Official Language Act. Effective Check Points in the Department have also been prescribed for compliance of the implementation of the Official Language Policy.

- In an effort to fulfill the provisions of the Official Language Policy in electronic mode, the Department has hosted its official website in English and Hindi. Unicode has been installed in all computers to enable officers/staff to use Rajbhasha Hindi in the electronic mode. Employees are being imparted Hindi/computer training.

- During the year, to create conducive environment for promotion of Hindi in official work 04 workshops were organized in the Department in which various issues of Rajbhasha were discussed including use of (Hindi) Mangal Font in computers.The subordinate offices also were represented in these workshops.

- The process of purchasing of books in Hindi on various subjects by noted writers including Gyanpeeth awardees is being carried out.

Hindi Pakhwada observed from 12-26 September, 2014 in collaboration with Department of Science and Technology. On this occasion, various competition viz Hindi Poetry, Essay writing, Hindi typing and shorthand, noting and drafting. translation, quiz and Hindi dictation (for MTS employees) were conducted and cash prizes awarded to successful participants.

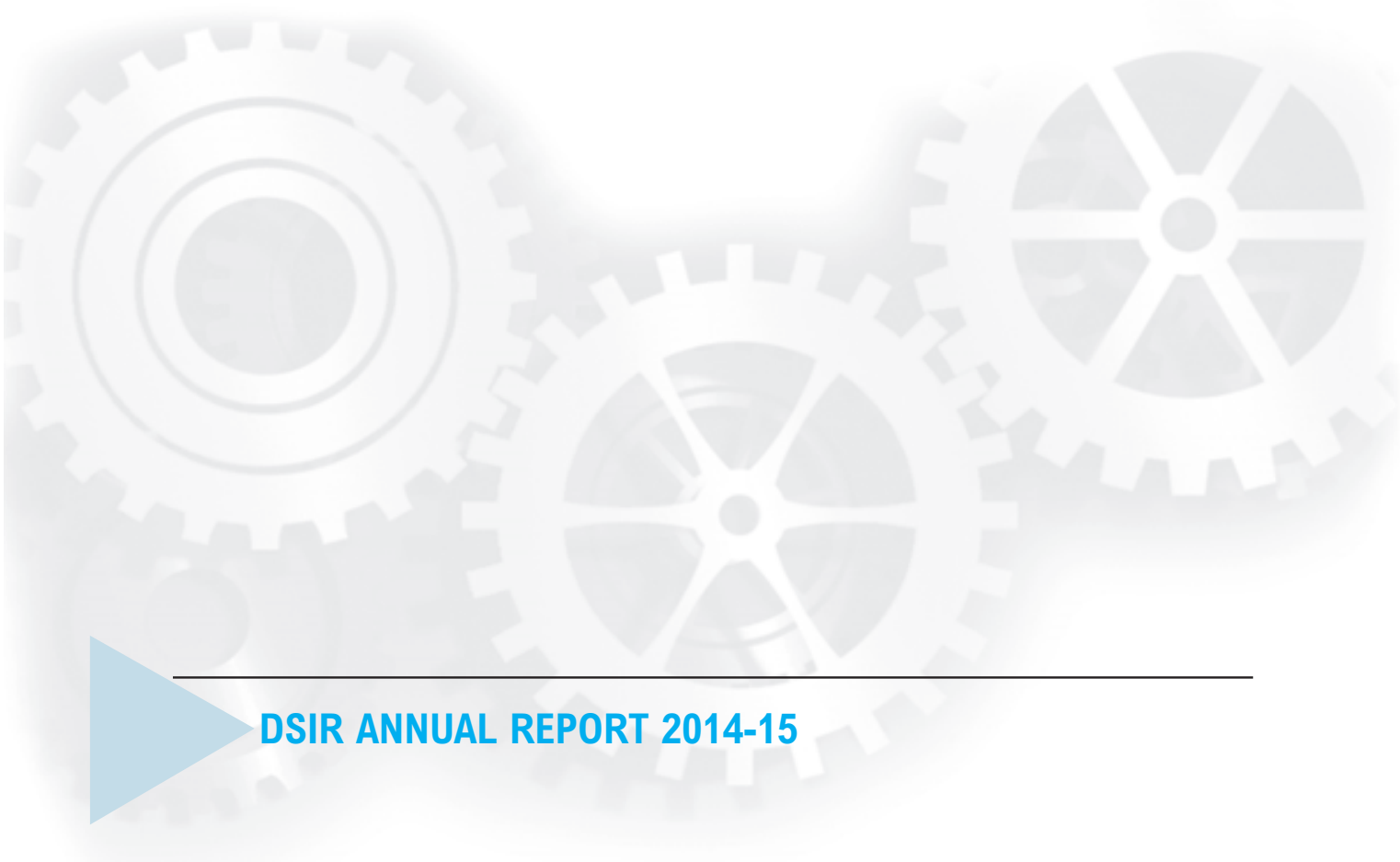
2. FINANCE

The financial summary giving the AE 2013-14, BE 2014-15, RE-2014-15 and BE 2015-16 of various Plan and Non-Plan schemes of DSIR is given in **Table 1**.

3. AUDIT OBSERVATION BY CAG.

The extracts from CAG's report are given at Annexure-13.

X Financial Summary



DSIR ANNUAL REPORT 2014-15

Table 1: FINANCIAL SUMMARY(Rs. in Crores)
AE-2013-14, BE-2014-15, RE-2014-15, AE-2014-15, BE-2015-16(PROPOSED)

SCHEME	ACTUAL EXPENDITURE 2013-14			BUDGET ESTIMATES 2014-15			REVISED ESTIMATES 2014-15			ACTUAL EXPENDITURE 2014-15 (UPTO DEC.14)			BUDGET ESTIMATES 2015-16 (PROPOSED)		
	Plan	Non- Plan	Total	Plan	Non- Plan	Total	Plan	Non- Plan	Total	Plan	Non-Plan	Total	Plan	Non-Plan	Total
1. DSIR															
Secretariat Economic Services – DSIR	0.00	8.72	8.72	0.00	10.32	10.32	0.00	10.12	10.12	0.00	7.62	7.62	0.00	11.30	11.30
PRISM	1.83	0.00	1.83	18.00	0.00	18.00	2.50	0.00	2.50	1.00	0.00	1.00	18.00	0.00	18.00
PACE	0.19	0.00	0.19	20.00	0.00	20.00	2.85	0.00	2.85	0.65	0.00	0.65	25.00	0.00	25.00
BIRD	2.61	0.00	2.61	20.00	0.00	20.00	6.45	0.00	6.45	5.14	0.00	5.14	18.50	0.00	18.50
A2K+	22.18	0.00	22.18	21.50	0.00	21.50	12.20	0.00	12.20	6.56	0.00	6.56	20.00	0.00	20.00
CEL	16.00	0.00	16.00	29.00	0.00	29.00	20.00	0.00	20.00	3.00	0.00	3.00	30.00	0.00	30.00
NRDC	5.70	0.00	5.70	9.00	0.00	9.00	8.00	0.00	8.00	5.80	0.00	5.80	10.00	0.00	10.00
CDC	3.60	0.00	3.60	2.00	0.00	2.00	2.00	0.00	2.00	1.66	0.00	1.66	3.00	0.00	3.00
DSIR Bldg. & infrastructure	0.00	0.00	0.00	0.50	0.00	0.50	0.00	0.00	0.00	0.00	0.00	0.00	3.50	0.00	3.50
TOTAL : DSIR	**52.11**	**8.72**	**60.83**	**120.00**	**10.32**	**130.32**	**54.00**	**10.12**	**64.12**	**23.81**	**7.62**	**31.43**	**128.00**	**11.30**	**139.30**
2.CSIR & ONGOING SCHEMES															
Administration	34.00	560.50	594.50	45.00	600.83	645.83	20.00	750.00	770.00	34.00	560.50	594.50	40.00	1040.00	1080.00
National Laboratories	1236.70	875.00	2111.70	1605.50	880.00	2485.50	1279.75	923.88	2203.63	1236.70	875.00	2111.70	2105.00	1265.00	3370.00
Scientists Pool	0.00	7.50	7.50	0.00	8.00	8.00	0.00	8.00	8.00	0.00	7.50	7.50	0.00	10.00	10.00
National S&T HRD (res sch	175.00	105.00	280.00	180.00	108.00	288.00	180.00	108.00	288.00	175.00	105.00	280.00	335.00	170.00	505.00
Intellectual Property & Tech. Dev.	35.00	0.00	35.00	40.00	0.00	40.00	35.00	0.00	35.00	35.00	0.00	35.00	40.00	0.00	40.00
New Millennium Indian Tech. Leadership Initiative	30.00	0.00	30.00	30.00	0.00	30.00	20.00	0.00	20.00	30.00	0.00	30.00	40.00	0.00	40.00
Innovation Complexes	38.00	0.00	38.00	63.00	0.00	63.00	10.00	0.00	10.00	38.00	0.00	38.00	30.00	0.00	30.00
CSIR : NEW SCHEMES															
CSIR-800 Scheme	1.00	0.00	1.00	5.00	0.00	5.00	1.00	0.00	1.00	1.00	0.00	1.00	23.00	0.00	23.00
CSIR scheme for open innovation	1.00	0.00	1.00	10.00	0.00	10.00	0.25	0.00	0.25	1.00	0.00	1.00	50.00	0.00	50.00
CSIR initiative for inclusive participative and collaborative research & Dev.	0.00	0.00	0.00	0.50	0.00	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
National Civil . Aircraft Dev	0.00	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TOTAL: CSIR	1550.70	1548.00	3098.70	1980.00	1596.83	3576.83	1546.00	1789.88	3335.88	1550.70	1548.00	3098.70	2663.00	2485.00	5148.00
GRAND TOTAL(CSIR+DSIR)	1602.82	1556.72	3159.54	2100.00	1607.15	3707.15	1600.00	1800.00	3400.00	1574.51	1555.62	3130.13	2791.00	2496.30	5287.30

ANNEXURE -1

DETAILS OF COMPLETED PROJECTS SUPPORTED UNDER ERSTWHILE TECHNOPRENEUR PROMOTION PROGRAMME

Completed Projects During the Year 2014-2015

Sl. No.	Name of the project
TePP Phase - I	
i.	Evaluation of laccase production under solid state and submerged fermentation
ii.	Rapid detection and differentiation of torch infections by one-step PCR assay
iii.	Development of MAMMO ONCOMETER (A digital device to detect breast cancer based on cell membrane potentials)
iv.	Formulation and development of nutraceutical formulation with anti-cancer activity
v.	Development of low cost diagnostic tool to identify cardiac patients at risk of restenosis
vi.	Production and testing of selected Probiotic products as poultry feeds
vii.	Development of EPD Kits for diagnosing early pregnancy in cattle
viii.	Electronic retrofit kit for cam dobby
ix.	Non-invasive Oral Cancer Detection System
x.	An unbreakable Multi-directional LED based replaceable lighting system
xi.	Development of cost-effective new generation Electronic Energy Meter for Domestic Use
xii.	Prepaid cash card for ATM system for Electric Bill
xiii.	Belt system for body support
xiv.	Interactive Surfaces – Multi touch walls and tables
xv.	Bio-medical engineering application tool kits (BEAT)
xvi.	Sports car with hybrid engine
xvii.	An innovative cost-effective process for synthesis of peptide designer molecules for bio-medical applications
xviii.	Digital safety cane for visually impaired
xix.	Eco-friendly leisure boat
Micro-technopreneurship	
i.	Mobile presence authentication system
ii.	A novel method for biometric recognition
iii.	Low cost airborne surveillance system
iv.	Multi-purpose cooling jar

ANNEXURE - 2

LIST OF TDDP/PATSER PROJECTS COMMERCIALIZED

S. No.	Agency	Project Title
1	ACE Designers Pvt. Ltd., Bengaluru	Development of PC Based CNC System
2	Aesthetic Technologies Pvt. Ltd., Kolkata	Dev. of an Interactive Multimedia Package for Intellectual Property Rights Training
3	Aishwaraya Telecom Pvt. Ltd., Hyderabad	Hand Held Optical Test Equipments
4	Aishwaraya Telecom Pvt. Ltd., Hyderabad	Design & Development of Optical Power Meter and Optical Talk Set
5	Andrew Yule & Co. Ltd., Kolkata	Development of Rough Top Conveyor Belting
6	Anu's Lab Ltd., Hyderabad	Development of process for manufacture of 1-Bromo-3-chloropropane (B.C.P.) and 1-3-dibromo Propane (D.B.P.) in pilot plant
7	Arch Pharmalabs Ltd., Mumbai	Development of Polymorphic Form-I of Clopidogrel Bisulphate Process
8	Ardee Business Services Pvt. Ltd., Vishakhapattanam	Dev. of a Mobile, Four Channel Modular, RAMDARS System for Dry Beneficiation of Coal.
9	Ardee Business Services Pvt. Ltd., Vishakhapattanam	Development of Higher Dimension Aluminum Granules Coded Wire along with Complete High speed Wire Feeder
10	ATCOM Technologies Ltd., Mumbai	Development of Microbalance of 200 gm. Capacity with 1 mg. Accuracy
11	Bharat Earth Movers Ltd. (BEML), Bengaluru	Up gradation of 50 T Dumper 200 HP Front end loader
12	Bharat Earth Movers Ltd. (BEML), Bengaluru	Dev. of Technology for Design and Manufacture of 460 HP Wheel Dozer
13	Biocon Ltd.	Glargine Process Improvement
14	Celestial Labs Ltd., Hyderabad	Development of Toxicity Prediction Module and Integration with CELSUITE - A Computer Aided Drug Design Tool
15	Central Electronics Ltd., Sahibabad	Digital Axle Counter for Railway Signaling
16	Delta Agro Chemicals Ltd., Krishna	Dev. of process for manufacture of Furfural Alcohol by Hydrogenation of Furfural
17	Dolphin Industrial Co-operative Society Ltd., Vizianajaram	Glazing of terra-cotta Clay Products
18	Eddy Current Controls Ltd.	Development of 90 KW Brushless Eddy Current Clutch Gear Unit for Radiator Cooling fans in diesel electric locomotives of the Indian Railways
19	Elkay Chemicals Limited, Pune	Development of Next Generation Amino Silicone based on Hydrosilation Technology
20	Encon Thermal Engineers (P) Ltd., Faridabad	Dev. of Technology for Design and Manufacture of Improved Industrial Natural Gas Burners
21	Enercon Systems Pvt. Ltd., Bengaluru	Development of Centralised Electrical Energy Management System

Annexure-2-Contd.

Sl. No.	Agency	Project Title
22	Engineers India Ltd. (EIL) , New Delhi	Development of Membrane Technology for Natural Gas Separation
23	Gujarat Narmada Valley Fertilizers Co.Ltd., Bharuch	Dev. and Demo. of Liquid Phase Oxidation Process for Hydrogen Sulfide Removal
24	Haryana Leather Chemicals Ltd., Haryana	Technology Development and Demonstration for application of Cross Linkable Aqueous Aliphatic Polyurethane Dispersions for Leather and Shoe Finishing
25	HERO Cycles Ltd., Ludhiana	Design, Development, Installation and Commissioning of 6-Hi Cold Rolling Mill
26	Hindustan Zinc Ltd., Udaipur	Extraction of Cobalt to Extract Copper Sulphate
27	IBP Co. Ltd., Gurgaon	Development of Detonating Cord
28	Innovation Communications Systems Ltd., Hyderabad	Development of Interactive Voice Response System With Multilingual Capability
29	Insecticides (India) Limited, Bhiwadi	A new approach to synthesis of an import substitute 3-methyl-N-nitroimino perhydro-1,3,5-oxadiazine (MNIO), an intermediate for the manufacture of Thiamethozam.
30	JSL Industries Ltd., Anand	Dev. of Air Circuit Breaker
31	Klas Technology Ventures Ltd., Bengaluru	Research & Development of Aluminum Cylinders for Liquefied Gases for Domestic, Automotive Applications
32	Lifecare Innovations Pvt. Ltd., New Delhi	Liposomal Amphotericin-B
33	Litex Electricals Ltd., Pune	Laser Pumping Lamps
34	Maini Materials Movement Pvt. Ltd., Bengaluru	Development of In-plant Material Handling Equipment
35	MECPRO Heavy Engineering Ltd., New Delhi	Development and Demonstration of Eco-friendly and Efficient Edible Oil Refining technology of Twin Bleaching system and De acidification-cum-Deodorization System
36	MECPRO Heavy Engineering Ltd., New Delhi	Demonstration of on Efficient Solvent Extraction Plant & Technology with the Vent Air Cracking system
37	MIC Electronics Ltd., Hyderabad	Development of Fraud Management and Control Centre (FMCC)
38	Minda Industries Ltd., Delhi	Development of Auto Electrical Switches using Rapid Prototyping Facility of I.I.Sc.
39	Mishra Dhatu Nigam Ltd., Hyderabad	Development of Technology for producing Wires With Superior Surface Finish employing Wet Drawing Technique
40	Mishra Dhatu Nigam Ltd., Hyderabad	Development of Technology for Welding Molybdenum Coils to make coils in single coil weight of 20 kgs.
41	NALCO, Bhuvneshwar	Dev. of Technology at Pilot Scale Production of Special Grade Alumina
42	NED Energy Ltd., Bengaluru	Development of High Energy Density Valve Regulated Lead Acid Batteries
43	Ogene system India P. Ltd., Hyderabad	Nano Labeled DNA/RNA compounds
44	Organic Coatings Ltd., Mumbai	Development of (I) Water-based flexo inks used for absorbent stock (craft paper) (ii) U.V. radiation curing inks used for coated stock and non-absorbent substrates such as PVC, Polyester etc.

Annexure-2-Contd.

Sl. No.	Agency	Project Title
45	Pan India Electromech Pvt. Ltd., Gurgaon	Development and Demonstration of Complete Automated Solution for Hydrography
46	Pennwalt Ltd., Mumbai	Dev. of Tech. for coating of Chemical process equipment with fluoro polymers and other high performance polymeric products.
47	Poona Health Services Ltd., Pune	Development of Implants for Knee Joints
48	Priya Klay Pvt. Ltd., New Delhi	Development of Technology, Equipment and related "Product(s)" for Production of Stone Ware/ Vitrified Clay Pipes and other Pipes of other materials, made/produced as a result of this Project having large Diameters of 600 mm to 1000 mm and above.
49	Pure Tech India, Trichy	Liquid Coolant Recovery System
50	Radiant Cables Pvt. Ltd., Hyderabad	Development of (a) Low loss RF cables for higher frequency above 10GHZ,(b) Data Bus cable with fire survival, low capacitance dielectric properties and © Laser marked loom assemblies.
51	Rishabh Instruments Pvt. Ltd., Mumbai	Design, development & manufacture of (i.) 5 3/4 digit multi meter & (ii) 6 3/4 digit multi meters
52	Rishang Keishing Foundation for Management of Tribal Areas, New Delhi	Ginger Oil
53	Sami Labs Limited, Bengaluru	Development and Pilot Plant Trials Towards Commercialization of two Products, namely (I) A pent peptide with a Natural Triterpenoid Conjugate (ii) Extraction of Pterostilbebe from Pterocarpus Marsupium & Conversion to Resveratrol
54	Select Packaging Machines Ltd., Thane	Special Blister Packaging Machines/Form Fill-seal Machine
55	Sequent Scientific Ltd., Thane	Development of Nitroscanate
56	Sequent Scientific Ltd., Thane	Development of Dorzolamide HCl
57	SM Telesys Ltd (SMTL), Noida	Dev. of Two Line Indian Language Multilingual Pager (ILP)
58	Solaris Chemtech Ltd. (formerly BILT Chemicals), Mumbai	Dev. and demo. of Technology for the manu. of Tetra Bromo Bisphenol-A (TBBA) on a pilot plant level
59	Steel Strips Wheel Ltd., Chandigarh	Technology Development and Demonstration of Improved Manufacturing Process for Automotive Wheel Discs
60	T. Stanes & Company Ltd., Coimbatore	Establishing and Producing bio Control Agents on Pilot Plant Scale
61	T. Stanes and Company Limited, Coimbatore	Development of Bio fertilizers (Emulsifiable concentrate) for Nutrient Management of Agricultural Crops
62	T. Stanes and Company Ltd., Coimbatore	Dev. of technology for manufacture of Digested Organic Supplement.
63	The Maharashtra State Seeds Corporation Ltd., Mumbai	Design, Development and Fabrication of Mini Dry Gas Cotton Seed Delinting Plant (0.5 TPH Capacity)
64	Transasia Bio-Medicals Ltd., Mumbai	Fully automated high speed blood chemistry analyzer for through put of around 1000 tests/hour
65	United Telecom Ltd., Bengaluru	Asymmetric Digital Subscriber Line (ADSL) System
66	United Telecom Ltd., Bengaluru	Development of AAM (ATM Access Multiplexer)
67	Zen Technologies Ltd., Hyderabad	Design and Development of 6 DoF Electrical Motion Platform
68	Zen Technologies Ltd., Hyderabad	Interactive Small Arms Training Simulator (ISAT)

ANNEXURE - 3

STATEMENT ON RECOGNITION OF IN–HOUSE R&D UNITS

Month	Year	Receipts	Cumulative Receipts	Disposal	Cumulative Disposal
January	2014	25	96*	33	33
February	2014	28	124	26	59
March	2014	28	152	28	87
April	2014	26	178	27	114
May	2014	16	194	26	140
June	2014	16	210	20	160
July	2014	16	226	33	193
August	2014	23	249	20	213
September	2014	18	267	35	248
October	2014	17	284	17	265
November	2014	23	307	22	287
December	2014	19	326	22	309

***A pendency of 71 applications was carried forward from year 2013**

ANNEXURE - 4

STATEMENT ON RENEWAL OF RECOGNITION OF IN-HOUSE R&D UNITS WHOSE RECOGNITION WAS VALID UPTO 31.03.2014

Month	Year	Receipts Receipts	Cumulative	Disposal Disposal	Cumulative
January	2014	79	79	-	-
February	2014	85	164	-	-
March	2014	150	314	-	-
April	2014	47	361	110	110
May	2014	22	383	80	190
June	2014	23	406	80	270
July	2014	28	434	33	303
August	2014	19	453	40	343
September	2014	13	466	39	382
October	2014	11	477	25	407
November	2014	3	480	15	422
December	2014	-	480	14	436

ANNEXURE - 5

LIST OF IN-HOUSE R&D UNITS IN INDUSTRY REPORTING ANNUAL EXPENDITURE MORE THAN Rs. 50,00 LAKHS

Sl. No.	Name of the firm	R&D Expenditure Reported (Rs. in lakhs) *
1.	Agila Specialties Private Limited	15258
2.	Alembic Pharmaceuiticals Ltd.	14200
3.	Apollo Tyres Ltd.	32058
4.	Ashok Leyland Ltd.	29286
5.	Asian Paints Ltd.	5050
6.	Aurobindo Pharma Ltd.	25667
7.	AVL Technical Centre Private Limited	6463
8.	Bajaj Auto Ltd.	23000
9.	BEML Limited	8226
10.	Bharat Electronics Ltd.	40641
11.	Bharat Heavy Electrical Limited	111400
12.	Bharat Petroleum Corporation Limited	17210
13.	Biocon India Ltd.	7097
14.	Brakes India Ltd.	5410
15.	Cadila Healthcare Ltd.	41720
16.	Cipla Limited	37805
17.	Crompton Greaves Ltd.	6100
18.	Cummins India Ltd.	6200
19.	Daimler India Commercial Vehicles Pvt. Ltd.	21922
20.	Delphi Automotive Systems Pvt. Ltd.	11136
21.	Dr. Reddy's Laboratories Ltd.	78761
22.	E-I DuPont India Pvt. Ltd.	21000
23.	Emcure Pharmaceuticals Ltd.	10102
24.	Fresenius Kabi Oncology Ltd.	11923
25.	Glenmark Pharmaceutical Ltd.	10500
26.	Greaves Cotton Ltd.	5590

Annexure-5 Contd.

Sl. No.	Name of the firm	R&D Expenditure Reported (Rs. in lakhs) *
27.	Hindustan Aeronautics Ltd.	12063
28.	Indian Oil Corporation Ltd.	22656
29.	Ind-Swift Laboratories Ltd.	8000
30.	Infosys Ltd.	26055
31.	Intas Pharmaceuticals Ltd.	21186
32.	Intellisys Technology & Research Ltd.	5329
33.	IPCA Laboratories Ltd.	12653
34.	Ispat Industries Ltd.	10000
35.	ITC Limited	15337
36.	JSW Steel Limited	7378
37.	Jubilant Biosys Limited	10054
38.	Kudos Chemie Limited	5225
39.	Larsen & Toubro Limited	25319
40.	LG Electronics India Pvt. Ltd.	6360
41.	Lupin Ltd.	56036
42.	Macleods Pharmaceuticals Ltd.	13062
43.	Maharashtra Hybrid Seeds Company Ltd.	6649
44.	Mahindra & Mahindra Ltd.	98875
45.	Maruti Suzuki India Limited	89028
46.	Medha Servo Drives Pvt. Ltd.	10102
47.	Micro Labs Ltd.	7715
48.	Monsanto Holdings Pvt. Ltd.	6060
49.	MRF Limited	9420
50.	Mylan Laboratories Ltd.	36638
51.	Novartis Healthcare Pvt. Ltd.,	7575
52.	Oil and Natural Gas Corporation Ltd.	34015
53.	Orchid Chemicals & Pharmaceuticals Ltd.	7090
54.	Panacea Biotech Ltd.	8734
55.	Piramal Healthcare Limited	18993
56.	Ranbaxy Laboratories Ltd.	49015
57.	Reliance Industries Limited	98916
58.	Rolta India Ltd.	17500
59.	Serum Institute of India. Ltd.	5240

Annexure-5 Contd.

Sl. No.	Name of the firm	R&D Expenditure Reported (Rs. in lakhs) *
60.	Shantha Biotechnics Ltd.	10470
61.	Steel Authority of India Ltd.	11692
62.	Sun Pharmaceuticals Industries Ltd.	15919
63.	Suven Life Sciences Ltd.	5009
64.	Syngene International Limited	42504
65.	Syngenta India Ltd.	6962
66.	Tata Consultancy Services (TCS) Ltd.	13400
67.	Tata Motors Ltd.	153687
68.	Tata Power Co. Ltd.	22950
69.	Tejas Networks Limited	6476
70.	TVS Motor Co. Ltd.	9804
71.	Unichem Laboratories Ltd.	6250
72.	UPL limited	6983
73.	Upper India Steel Mfg. & Engg. Co. Ltd.	6440
74.	USV Limited	15847
75.	VE Commercial Vehicles Limited	22209
76.	Vihan Networks ltd.	5117
77.	Watson Pharma Private Limited	13987
78.	Wipro Ltd.	20940
79.	Wockhardt Ltd.	11500
80.	Zoetis Pharmaceutical Research Pvt. Ltd	7932

* R&D Expenditures Reported are as claimed by the firms in their available Annual reports in DSIR/ renewal applications.

* R&D Expenditures Reported are as claimed by the firms in their available Annualreports in DSIR/ renewal applications.

ANNEXURE - 6

LIST OF IN-HOUSE R&D UNITS IN INDUSTRY REPORTING ANNUAL EXPENDITURE IN THE RANGE OF Rs. 500 LAKHS TO Rs. 5000 LAKHS

Sl. No.	Name of the firm	R&D Expenditure Reported (Rs. In lakhs) *
1.	Aarti Drugs Ltd.	770
2.	Abbott Healthcare Private Limited	149
3.	Accord Software & Systems Private Limited	550
4.	Ace Designers Ltd.	807
5.	Action Construction Equipment Ltd.	922
6.	ADAMA India Pvt.Ltd.	1815
7.	Advanced Enzyme Technologies Ltd	1000
8.	Advanta India Ltd.	1894
9.	Advik Hi-Tech Pvt. Ltd.	520
10.	Ajanta Pharma Ltd.	2196
11.	Ajeet Seeds Ltd.	767
12.	Albert David Limited	580
13.	Alicon Castalloy Ltd.	578
14.	Alpha Design Technologies Pvt. Ltd.	720
15.	Alstom Hydro R&D India Ltd.	843
16.	Amara Raja Batteries Ltd.	1200
17.	AMW Motors Limited	3264
18.	Ankur Seeds Pvt. Ltd.	2100
19.	Anthem Biosciences Pvt. Ltd.	1050
20.	Apex Laboratories Pvt. Ltd	2000
21.	Aptuit Laurus Pvt. Ltd.	3140
22.	Arch Pharma Labs Ltd.	2576
23.	Arvind Limited	4850
24.	Ashoka Biogreen Pvt Ltd.	545
25.	Asian PPG Industries Ltd.	1650
26.	Astra Microwave Products Ltd.	625
27.	Atul Limited	902
28.	Audco India Ltd.,	538

Annexure-6 Contd.

Sl. No.	Name of the firm	R&D Expenditure Reported (Rs in lakhs) *
29.	Aurangabad electricals Ltd.	700
30.	Auto Ignition Ltd.	550
31.	Autometers Alliance Ltd.	1020
32.	Avantel Limited	600
33.	Avesthagen Ltd.	2485
34.	Bajaj Electricals Ltd.	1050
35.	Balkrishna Industries Limited (BKT)	2395
36.	Balmer Lawrie & Company Ltd.	855
37.	BASF India Ltd.	1050
38.	Bata India Ltd.	565
39.	Battelle Science & Technology India Pvt. Ltd.,	780
40.	Bayer Bioscience Pvt. Ltd.	4680
41.	Bayer CropScience Ltd.	1816
42.	Behr India Ltd.	1050
43.	Bejo Sheetal Seeds Pvt. Ltd.	780
44.	BEML Ltd.	1793
45.	Bharat Bio-tech International Ltd.	750
46.	Bharat Forge Ltd.	1200
47.	Bharat Serums and Vaccines Ltd.	2580
48.	Bigtec Pvt. Ltd.	1400
49.	Bilcare Limited	3000
50.	Biological E Ltd.	820
51.	Bioseed Research India (A Division of DCM Shriram Consolidated Ltd.)	3564
52.	Bisco Bio-Sciences (P) Ltd.	605
53.	Blue Star Ltd.	4002
54.	Bosch Chassis Systems India Ltd.	1248
55.	Botil Oil Tools India Pvt. Ltd.	1038
56.	Britannia Industries Ltd.	1180
57.	C&S Electric Ltd.	800
58.	C.R.I. Pumps Pvt. Ltd.,	690
59.	Cadila Pharmaceuticals Ltd.	3424
60.	Camson Bio Technologies Limited	1774
61.	Caplin Point Laboratories Limited	621
62.	Carborundum Universal Ltd.	800
63.	Cavinkare Private Ltd.	826
64.	Ceat Limited	1400
65.	Celestial Biolabs Ltd.	564
66.	Celestial Biologicals Limited	974

Annexure-6 Contd.

Sl. No.	Name of the firm	R&D Expenditure Reported (Rs. in lakhs) *
67.	Celon Laboratories Ltd.,	1200
68.	Centaur Pharmaceuticals Pvt. Ltd.	1350
69.	Central Electronics Ltd.	655
70.	Central Mine Planning & Design Inst. Ltd.	4062
71.	Cheminova India Ltd.	1200
72.	Clinigene International Ltd.	3810
73.	Concord Biotech Ltd.	1000
74.	Connexios Life Sciences Pvt. Ltd.	2591
75.	Coromandel International Ltd.	600
76.	CTR Mfg Industries Ltd	1138
77.	Curadev Pharma Pvt . Ltd.	1365
78.	Dabur India Ltd.	835
79.	Deepak Nitrite Ltd.	725
80.	Defence Land Systems India Pvt Ltd	1200
81.	Delphi-TVS Diesel Systems Ltd.	1878
82.	Dhanuka Laboratories Limited	722
83.	Dishman Pharmaceuticals & Chemicals Ltd.	1050
84.	Divi's Laboratories Ltd.	1613
85.	East West Seeds India Pvt. Ltd.	1588
86.	Eastman Exports Global Clothing (P) Ltd	2000
87.	Eicher Motors Ltd.	3200
88.	EID Parry (India) Ltd.	792
89.	Eimco Elecon (India) Ltd.	875
90.	Eisai Pharmatechnology and Manufacturing Pvt. Ltd.	3329
91.	Elecon Engineering Company Limited	600
92.	Electronics Corporation of India Ltd.	4328
93.	Electropneumatics & Hydraulics (India) Pvt Ltd.	759
94.	Elektrolites (Power) Pvt. Ltd.	955
95.	Elgi Equipments Ltd.	3105
96.	Embio Limited	700
97.	EMCO Ltd.	628
98.	Emerson Climate Technologies (India) Ltd.	845
99.	Enaltec Labs Pvt. Ltd.	507
100.	Encube Ethicals Pvt. Ltd.	550
101.	Endurance Technologies Ltd.	1579
102.	Engineers India Ltd.	1593
103.	Enzene Biosciences Pvt. Ltd.	1647
104.	Escorts Limited	4850

Annexure-6 Contd.

Sl. No.	Name of the firm	R&D Expenditure Reported (Rs. in lakhs) *
105.	Essar Steel Ltd.	2500
106.	Excel Crop care Ltd.	650
107.	Exicom Tele-Systems Ltd.	980
108.	Exide Industries Ltd.	1272
109.	FDC Limited	1805
110.	Fenner (India) Ltd.	886
111.	Fermenta Biotech Ltd.	594
112.	Fibcom India Ltd.	2200
113.	Finoso Pharma Pvt Ltd., (Hyderabad)	565
114.	Flash Electronics (India) Pvt. Ltd.	620
115.	Flowmore Limited	2023
116.	Forbes Marshal Pvt. Ltd.	600
117.	Fowler Westrup (India) Pvt. Ltd.	725
118.	G.Surgiwear Limited	1092
119.	G7 Synergon Pvt. Ltd.	3300
120.	Gabriel India Ltd.	1200
121.	Ganga Kaveri Seeds Pvt. Ltd.	891
122.	Gennova Biopharmaceuticals Limited	3300
123.	Genome Life Science Pvt. Ltd.	522
124.	Genus Power Infrastructures Ltd.	1200
125.	Getz Pharma Research Pvt. Ltd.,	1860
126.	Gharda Chemicals Ltd.	3150
127.	Gland Pharma Ltd.	4000
128.	Glaxo Smithkline Pharmaceutical Ltd.	601
129.	GMM Pfaudler Ltd.	2085
130.	Godavari Biorefineries Ltd	950
131.	Godfrey Phillips India Ltd.	1465
132.	Godrej Agrovet Ltd.	883
133.	Godrej Consumer Products Ltd.	1045
134.	Gontermann-Peipers (India) Ltd.	575
135.	Granules India Ltd.,	700
136.	Gujarat State Fertilizers & Chemicals Ltd.	1179
137.	Havells India Ltd.	1804
138.	HCL Infosystems Ltd.	1200
139.	HCL Learning (Subsidiary of HCL Infosystems)	911
140.	HCL Services(Subsidiary of HCL infosystems)	1066
141.	Hema Engineering Industries Ltd.	750

Annexure-6 Contd.

Sl. No.	Name of the firm	R&D Expenditure Reported (Rs. in lakhs) *
142.	Hetero Drugs Ltd.	3986
143.	Hikal Limited	3500
144.	Hindalco Industries Ltd.	2871
145.	Hindustan Copper Ltd.	1075
146.	Hindustan Motors Ltd.	1320
147.	Hindustan Petroleum Corporation Ltd.	698
148.	Hindustan Zinc Ltd.	882
149.	Hi-Tech Gears Ltd.	1050
150.	HLL Lifecare Ltd.	640
151.	Hospira Healthcare India Private Ltd.,	3871
152.	HPL Electric & Power Pvt. Ltd.	659
153.	Hytech Seed India Pvt. Ltd.	801
154.	ICOMM Tele Limited	815
155.	IFB Industries Ltd.	2200
156.	ILS Bioscience Pvt. Ltd.	550
157.	Inbiopro Solutions Pvt. Ltd.	1157
158.	Indian Immunologicals Ltd.	1642
159.	Indoco Remedies Ltd.	1275
160.	Indofil Industries Ltd	2640
161.	Indus Biotech Ltd.	1432
162.	International Tractors Ltd.,	2019
163.	Inventia Healthcare Private Ltd.	1250
164.	Inventys Research Company Pvt. Ltd.	2500
165.	ITI Ltd	1500
166.	J Mitra & Co. Pvt. Ltd.	675
167.	J.B. Chemicals & Pharmaceuticals Ltd.	1824
168.	Jain Irrigation Systems Ltd.	3060
169.	Jay Ushin Ltd	520
170.	Jayem Automotives Ltd.,	1310
171.	Jindal Steel & Power Limited	1046
172.	JK Agri Genetics Ltd.	1258
173.	JK Tyre & Industries Limited	3229
174.	JNS Instruments Limited	845
175.	Johnson & Johnson Ltd.	2700
176.	JSL Lifestyle Ltd.	516
177.	Jubilant Life Sciences Ltd.	1045
178.	Jyoti CNC Automation Pvt. Ltd.	1050
179.	Jyoti Limited	780

Annexure-6 Contd.

Sl. No.	Name of the firm	R&D Expenditure Reported (Rs. in lakhs) *
180.	Kancor Ingredients Ltd.,	540
181.	Kansai Nerolac Paints Limited	1310
182.	Kasiak Research Private Limited	916
183.	Kaveri Seed Company (P) Limited	1300
184.	Kavveri Telecom Products Ltd.	1125
185.	KEC International Limited	1750
186.	Kemin Industries South Asia Pvt. Ltd	856
187.	Kemwell Biopharma Pvt. Ltd.	1075
188.	Kennametal India Ltd.	1470
189.	Kimplas Piping Systems Limited	1140
190.	Kiran Global Chems Limited	1151
191.	Kirloskar Brothers Ltd.	2600
192.	Kirloskar Oil Engines Limited	1792
193.	Kirloskar Pneumatic Co. Ltd.	533
194.	KPIT Cummins Infosystems Ltd.	1533
195.	Krishidhan Seeds Private Ltd.	899
196.	L&T Valves Ltd.	676
197.	Lakshmi Machine Works Ltd.	1376
198.	Landis+Gyr Ltd.	3784
199.	LifeCell International Pvt. Ltd.	553
200.	Lincoln Pharmaceuticals Ltd	565
201.	Link well Tele System (P) Ltd.	605
202.	Lohia Starlinger Ltd.	750
203.	Lucas-TVS Ltd.	2324
204.	LuK India Private Limited	1370
205.	Lumax Industries Limited	1984
206.	Luminous Power Technologies (P) Ltd.	2588
207.	Lyka Labs Limited	768
208.	Mabpharm Private Limited	1296
209.	Madras Engineering Industries Pvt. Ltd.	1025
210.	Mahindra Reva Electric Vehicles Pvt. Ltd	3286
211.	Mahindra Navistar Automotives Ltd.	4783
212.	Mahindra Sona Ltd.	776
213.	Makhteshim -Agan India Pvt Ltd.	1920
214.	Malladi Drug and Pharmaceuticals Ltd.	626
215.	Manisha Agri Biotech Pvt. Ltd.	2500
216.	Mankind Pharma Ltd.	1866
217.	Mann and Hummel Filter Pvt Ltd.	1619

Annexure-6 Contd.

Sl. No.	Name of the firm	R&D Expenditure Reported (Rs. in lakhs) *
218.	Marico Ltd.	516
219.	Marksans Pharma Ltd.	1519
220.	Marshall Breeders (P) Ltd.	664
221.	Matrix Comsec Pvt. Ltd	700
222.	Mayur Uniquoters Limited	612
223.	Meritor HVS (India) Ltd.	1936
224.	Metahelix Life Sciences Ltd	835
225.	Mhindra Two Wheelers Ltd.	1472
226.	Minda Corporation Ltd.	814
227.	Minda Industries Ltd.	1495
228.	Minda Stoneridge Instruments Ltd.	768
229.	Mirc Electronics Ltd.	1155
230.	Mishra Dhatu Nigam Ltd.	2151
231.	Modern Insulators Ltd.,	510
232.	Moser Baer India Ltd.	1298
233.	Motherson Sumi System Ltd.	1950
234.	MSD Wellcome Trust Hilleman Laboratories Pvt. Ltd.	4565
235.	MSN Laboratories Ltd.	3229
236.	Nagarjuna Agrichem Ltd.	625
237.	Nagarjuna Fertilisers and Chemicals Ltd.	2581
238.	NATCO Pharma Limited	3777
239.	Natco Fine Pharmaceuticals Pvt. Ltd.	506
240.	Nath Biogene (I) Ltd.	700
241.	National Aluminium Company Ltd.	2002
242.	National Engineering Industries Ltd.	1250
243.	Natural Remedies Pvt. Ltd.	700
244.	Navin Fluorine International Ltd.	581
245.	Neyveli Lignite Corporation Ltd.	1127
246.	Nirmal Seeds Pvt. Ltd.	785
247.	Nissan Ashok Leyland Technologies Pvt. Ltd.	4636
248.	NMDC Ltd.	2050
249.	NRB Bearings Ltd.	1226
250.	Nucleus Software Exports Limited	3717
251.	Nunhems India Pvt. Ltd.	1703
252.	Nuziveedu Seeds Pvt. Limited	2657
253.	OCL India Ltd.	600
254.	Oil India Limited	3459
255.	Omax Autos Limited	2250

Annexure-6 Contd.

Sl. No.	Name of the firm	R&D Expenditure Reported (Rs. in lakhs) *
256.	Omniactive Health Technologies Ltd.	507
257.	Optra Systems Pvt. Ltd.	550
258.	Orbicular Pharmaceutical Technologies Pvt. Ltd.	1273
259.	Organica Aromatics Ltd.	4819
260.	Orient Paper Mills	508
261.	Padmini VNA Mechatronics Pvt. Ltd.	550
262.	Parabolic Drugs Ltd.	4877
263.	Paramount Conductors Ltd.	2428
264.	Perrigo Laboratories India Pvt. Ltd.	2233
265.	Pest Control (I) Ltd.	863
266.	Pharmazz India Pvt. Ltd.	675
267.	PHI Seeds Ltd.	1023
268.	Philips Electronics India Limited	699
269.	Phillips Carbon Black Ltd.	1550
270.	PI Industries Ltd.	811
271.	Piaggo Vehicles Pvt. Ltd., Pune	1174
272.	Pidilite Industries Ltd.	1450
273.	Poly Medicure Ltd.	550
274.	Praj Industries Ltd.	2666
275.	Pricol Ltd.	3200
276.	Privi Organics Ltd.	625
277.	Promed Exports Ltd	1804
278.	R. N. Gupta and Company Limited	1243
279.	RA CHEM PHARMA LTD	739
280.	Rallis India Ltd.	3632
281.	Ramco Systems Ltd.	3829
282.	Rane (Madras) Ltd.	1358
283.	Rasayani Biologics Pvt Ltd.	650
284.	Rasi Seeds (P) Limited	2595
285.	Reliance Life Sciences Pvt. Ltd.	2652
286.	Reverse Logistics Company Private Limited	910
287.	RPG Life Sciences Limited	980
288.	RRB Energy Ltd.	1993
289.	Rusan Pharma Ltd.	2098
290.	Sahajananad Medical Technologies Pvt. Ltd.	689
291.	Sahajanand Laser Technology Ltd.	865
292.	Sai Advantium Pharma Ltd.	850
293.	Salzer Electronics Ltd.	615

Annexure-6 Contd.

Sl. No.	Name of the firm	R&D Expenditure Reported (Rs. in lakhs) *
294.	Sami Labs Ltd.	665
295.	San Engg & Locomotive Co. Ltd.	850
296.	Sanden Vikas (India) Pvt. Ltd.	947
297.	Sandhar Technologies Ltd.	628
298.	Sanofi-Synthelabo (India) Ltd.	2964
299.	Sanzyme Ltd.,	800
300.	SAVA Healthcare Limited	669
301.	Savannah Seeds Pvt. Ltd.	594
302.	Saveer Biotech Limited	514
303.	Secto Automotive Ltd.	1175
304.	SeedWorks India Pvt. Ltd.	748
305.	SeedWorks International Pvt. Ltd.	826
306.	Semco Electric Pvt. Ltd.,	578
307.	Sequent Scientific Ltd.	763
308.	SFO Technologies Private Limited	675
309.	SH Kelkar & Company Pvt. Ltd.	550
310.	Shahi Exports Pvt Ltd	3990
311.	Sharda Motor Industries Ltd.	900
312.	Shasun Pharmaceuticals Ltd.	3950
313.	Shilpa Medicare Limited	1975
314.	Shree Cement Ltd.	1607
315.	Shreem Electric Ltd.	1182
316.	Shriram Pistons & Rings Ltd.	1818
317.	Siechem Technologies Pvt. Ltd.,	876
318.	Sigma Electric Manufacturing Corporation Private Limited	578
319.	Simpson & Co. Ltd.	3050
320.	SKI Carbon Black (India) Private Limited	961
321.	SLK Software Services (P) Ltd	929
322.	SML Isuzu Ltd.,	2245
323.	SMR Automotive Systems India Limited	585
324.	Snam Alloys Pvt. Ltd	700
325.	Solar Industries India Limited	900
326.	Sphaera Pharma Pvt. Ltd.	961
327.	Spicer India Ltd.	557
328.	SRF Limited	3026
329.	Stempeutics Research Pvt. Ltd.	2595
330.	Sterlite Technologies Limited	1927
331.	Strand Life Sciences Pvt. Ltd.	2136

Annexure-6 Contd.

Sl. No.	Name of the firm	R&D Expenditure Reported (Rs. in lakhs) *
332.	Strides Arcolab Ltd.	4300
333.	Structwel Designers & Consultants Pvt. Ltd.	710
334.	Sudarshan Chemical Industries Ltd.	1798
335.	Suguna Poultry Farm Ltd.	834
336.	Su-Kam Power Systems Ltd.	1300
337.	Sundaram Clayton Ltd.	1250
338.	Sundaram Fastners Ltd.	1066
339.	Super Agri Seeds Pvt. Ltd.	550
340.	Super Religare Laboratories Ltd	952
341.	Symed Labs Ltd.,	919
342.	Syngenta Biosciences Pvt. Ltd.	640
343.	Tally Solutions Pvt. Ltd.	1227
344.	Tata Chemicals Ltd	2000
345.	Tata Cummins Limited	2546
346.	Tata Hitachi Construction Machinery Company Limited	2100
347.	Tata Steel Ltd.	4681
348.	TD Power Systems Limited	2027
349.	Tecmuseh Products India Ltd.	550
350.	TEVA Api India Ltd.	3500
351.	The kerala Mineral &Metals Ltd., (Kerala)	1173
352.	TherDose Pharma Private Limited	1167
353.	Thermax Limited	2520
354.	Thyssenkrupp Industries India Pvt. Ltd.	795
355.	Titan Company Ltd	2255
356.	Titan Laboratories Pvt. Ltd.	525
357.	TML Drivelines Ltd	2529
358.	Torrent Pharmaceuticals Ltd.	3191
359.	Tractors & Farm Equipment Ltd.	3943
360.	Transasia Bio-Medicals Ltd.	1194
361.	Transgene Biotek Ltd.	1200
362.	TRF Limited	570
363.	Triveni Turbine Ltd.	506
364.	TTK Prestige Limited	1469
365.	Tube Products of India	905
366.	Turbo Energy Ltd.	3700
367.	TVS Electronics Ltd.	585
368.	TVS Srichakra Limited	968

Annexure-6 Contd.

Sl. No.	Name of the firm	R&D Expenditure Reported (Rs. in lakhs) *
369.	Ucal Fuel Systems Ltd.	1013
370.	Ultratech Cement Limited	1300
371.	Unijules Life Science Ltd.	900
372.	Unimark Laboratories Ltd.	2328
373.	Unitech Machines Ltd.	3680
374.	United Spirits Ltd.	939
375.	United States Pharmacopeia India Private Limited	3586
376.	Vardhman Chemtech Limited	600
377.	Varroc Engineering Pvt. Ltd.	1657
378.	Varroc Polymers Pvt. Ltd.	1528
379.	Veeda Clinical Research Pvt. Ltd.	4327
380.	Venco Research & Breeding Farm Ltd.	2565
381.	Venkateshwara Hatcheries Pvt.Ltd.	1450
382.	Venkateshwara Research & Breeding Farm (P) Ltd.	2838
383.	Venus Remedies Ltd.	2200
384.	VerGo Pharma Research Laboratories ., (Goa	1217
385.	Vibha Agrotech Ltd.	3325
386.	Virchow Biotech Pvt. Ltd.	715
387.	Vivimed Labs Ltd.	1179
388.	VMC Systems Ltd.	3912
389.	Voltas Limited	618
390.	Vyome Biosciences Pvt Ltd.	605
391.	WABCO-TVS (India) Ltd.	1215
392.	Wanbury Ltd.	850
393.	Wheels India Ltd.	1263
394.	Whirlpool of India Ltd.	3400
395.	Yazaki India Ltd.	630
396.	ZCL Chemicals Ltd.	766
397.	Zen Technologies Ltd.	825
398.	ZIM Laboratories Ltd.	1720
399.	Zuventus Healthcare Ltd	800

LIST OF IN-HOUSE R&D UNITS IN INDUSTRY REPORTING ANNUAL EXPENDITURE IN THE RANGE OF Rs. 200 LAKHS TO Rs. 500 LAKHS

Sl. No.	Name of the firm	R&D Expenditure Reported (Rs. in lakhs) *
1.	20 Microns Nano Minerals Limited	210
2.	A S L Advanced System Ltd.,	375
3.	Acme Formulation Private Limited	269
4.	Adler Mediequip Pvt Ltd	200
5.	Ador Welding Limited	380
6.	Advanced Neuro-Science Allies Pvt. Ltd.	230
7.	Agada Medical Technologies Pvt Ltd.	296
8.	Agro Tech Foods Ltd.	285
9.	Aizant Drug Research Solutions Private Ltd.	400
10.	Alkali Metals Ltd.	500
11.	Alkyl Amines Chemicals Ltd.	280
12.	Allied Nippon Limited	265
13.	ALP Nishikawa Company Limited	221
14.	Alphamed Formulations Private Limited	219
15.	Ami Life Sciences Pvt Ltd	226
16.	Amol Pharmaceuticals Pvt Ltd.	250
17.	Amoli Organics Pvt. Ltd	374
18.	Amrutanjan Ltd.	373
19.	Anabond Ltd.	235
20.	Analogic Controls India Ltd	207
21.	Anand Motor Products Pvt. Ltd.	212

Annexure-7 Contd.

Sl. No.	Name of the firm	R&D Expenditure Reported (Rs. in lakhs) *
22.	Angiometrix Medequips India Pvt. Ltd.	234
23.	Anuh Pharma Ltd.	281
24.	Applied Electro Magnetics Pvt. Ltd.	249
25.	Aristo Pharmaceuticals (P) Ltd.	200
26.	Aron Universal Ltd	210
27.	Asahi Songwon Colors Ltd.	447
28.	Astec Lifesciences Ltd.	225
29.	Avra Laboratories Pvt. Ltd.	280
30.	Bafna Pharmaceuticals Limited	200
31.	Balaji Amines Ltd.	372
32.	Banco Products (India) Limited	430
33.	Bangalore Integrated System Solution Pvt. Ltd.	215
34.	BDR Pharmaceutical International Private Limited	200
35.	Bench Bio Private Limited	350
36.	Berger Paints India Ltd.	389
37.	Bharat Aluminium Company Ltd.	312
38.	Bharat Dynamics Ltd.	374
39.	Bharat Heavy Plate & Vessels Ltd.	338
40.	Bilag Industries Pvt. Ltd.	315
41.	Biomix Network Ltd.	500
42.	Bioviz Technologies Pvt. Ltd.,	206
43.	Bliss Gvs Pharma Ltd	304
44.	BPL Ltd.	370
45.	Bry-Air (Asia) Pvt. Ltd.	300
46.	Buhler (India) Pvt. Ltd.	496
47.	Calyx Chemical & Pharmaceuticals Pvt. Ltd.	244
48.	Centum Electronics Ltd.	300

Annexure-7 Contd.

Sl. No.	Name of the firm	R&D Expenditure Reported (Rs. in lakhs) *
49.	Century Pharmaceuticals Ltd.	200
50.	Century Seeds Pvt. Ltd.	400
51.	Charak Pharma Pvt. Ltd.	275
52.	Charoen Pokphand Seeds (India) Pvt. Ltd.	330
53.	Chemfab Alkalis Ltd.	224
54.	Chemtrols Industries Ltd.	210
55.	Chennai Petroleum Corporation Ltd.	334
56.	Cholayil Private Limited	269
57.	Christy Friedgram Industry	380
58.	Claris Lifesciences Limited	426
59.	Clause (India) Private Limited	366
60.	Clonz Biotech Pvt.Ltd.	225
61.	Colourtex Industries Pvt. Ltd.	300
62.	Concept Pharmaceuticals Ltd.	285
63.	Connectwell Industries Pvt. Ltd.	334
64.	Continental Carbon India Ltd.	300
65.	Cooper Corporation Pvt. Ltd.	450
66.	Cosmo Films Ltd.	450
67.	Crystal Crop Protection Private Limited	231
68.	Dai-Ichi Karkaria Ltd.	355
69.	Delta Finochem Pvt Ltd	200
70.	Dorf Ketal Chemicals India Pvt. Ltd.	300
71.	Dow AgroSciences India Pvt. Ltd.	200
72.	DTL Ancillaries Ltd.	458
73.	Duroshox Pvt. Ltd.	341
74.	Dynamatic Technologies Ltd.	232
75.	Easun Reyrolle Ltd.	250

Annexure-7 Contd.

Sl. No.	Name of the firm	R&D Expenditure Reported (Rs. in lakhs) *
76.	Economic Explosives Limited	500
77.	Efftronics System Pvt. Ltd.	212
78.	Elantas Beck India Ltd.	395
79.	Elcom International Pvt Ltd	359
80.	Elin Electronics Ltd.	332
81.	Emerson Network Power (India) Pvt. Ltd.	478
82.	Envision Scientific Pvt. Ltd.,	360
83.	Eureka Forbes Ltd.	424
84.	Everest Industries Ltd.	391
85.	Evolute Systems Pvt. Ltd.	400
86.	Excel Industries Ltd.	398
87.	Fiem Industries Ltd.	453
88.	Filtra Catalysts & Chemicals Ltd.	500
89.	Forus Health Pvt Ltd	244
90.	Foseco India Ltd.	242
91.	Gammon India Limited	225
92.	Gandhar Oil Refinery India Ltd.	215
93.	Garware Polyester Ltd.	261
94.	Garware Wall Ropes Ltd.	495
95.	General Industrial Controls Private Limited	368
96.	Global Calcium Pvt Ltd.	300
97.	Goa Shipyard Limited	323
98.	Godrej Industries Ltd.,	290
99.	GR Intrachem Ltd.	321
100.	Grasim Industries Ltd.	283
101.	Grauer & Weil (India) Ltd.	400
102.	Green Gold Seeds Ltd.	240

Annexure-7 Contd.

Sl. No.	Name of the firm	R&D Expenditure Reported (Rs. in lakhs) *
103.	GRP Limited	339
104.	GTZ (India) Private Limited	297
105.	Gujarat Alkalies & Chemicals Ltd.	385
106.	Gulbrandsen Chemicals Pvt. Ltd.	340
107.	Gulf Oil Corporation Limited	252
108.	Gupta H.C. Oversease (I) Pvt. Ltd.	300
109.	H&R Johnson (India)(A Division of Prism Cement Ltd.)	330
110.	Harita Seating Systems Ltd.	432
111.	Hawa Valves (India) Pvt Ltd	391
112.	Heinz India Pvt. Ltd.	423
113.	Helvetica Industries (P) Ltd.	218
114.	Heubach Colour Pvt. Ltd.	440
115.	High Technology Transmission Systems (India) Pvt. Ltd.	239
116.	Himadri Chemicals and Industries Ltd.	306
117.	Hinduja Foundries Ltd.	424
118.	Hindustan Gum & Chemicals Ltd.	355
119.	Hindustan Polyamides & Fibres Ltd.	251
120.	Hitachi Hi-Rel Power Electronics Private Limited	370
121.	Hitachi Home & Lite Solutions (India) Ltd.,	427
122.	Hitesh Plast Ltd.	376
123.	HPL Additives Limited	234
124.	Huntsman International (India) Pvt. Ltd.	248
125.	IDMC Ltd.	450
126.	Ind Swift Laboratories Ltd.	458
127.	India Japan Lighting (P) Ltd.	386
128.	India Pistons Ltd.	233
129.	Indian Rare Earth Ltd.	236

Annexure-7 Contd.

Sl. No.	Name of the firm	R&D Expenditure Reported (Rs. in lakhs) *
130.	Indo Colchem Pvt. Ltd.	229
131.	Innova Rubbers Private Limited	385
132.	Innovassynth Technologies (India) Ltd.	360
133.	Intelux Electronics Pvt.Ltd.,	270
134.	Intervet India Pvt.Ltd.	385
135.	IOL Chemicals and Pharmaceuticals Ltd.	350
136.	Ion Exchange (India) Ltd	327
137.	J.K. Agri-Genetics Ltd.	493
138.	Janatics India Pvt. Ltd.	300
139.	Jk Lakshmi Cement Limited	243
140.	Jk Paper Limited	395
141.	Kabra Extrusiontechnik Limited	472
142.	Kinetic Engineering Ltd.	251
143.	Kirtiman Agro Genetics Ltd.	360
144.	Krishidhan Research Foundations Pvt. Ltd.	263
145.	Labindia Analytical Instruments Pvt. Ltd.	246
146.	Lamco Industries Pvt. Ltd.	350
147.	LG Balakrishnan & Brothers Ltd.	260
148.	Mafatlal Industries Ltd.	268
149.	Mahabal Metals Pvt. Ltd,	200
150.	Mahagujarat Seeds Pvt. Ltd.	280
151.	Mahashakti Energy Limited	471
152.	Mahle Filter Systems (India) Ltd.	500
153.	Maini Precision Products (P) Ltd.,	408
154.	Mane India Private Limited	285
155.	Mangalam Cement Ltd.	280
156.	Manjushree Technopack Limited	339

Annexure-7 Contd.

Sl. No.	Name of the firm	R&D Expenditure Reported (Rs. in lakhs) *
157.	Manugraph India Ltd.	310
158.	Marson Ltd.	216
159.	Mecon Ltd.	333
160.	Medley Pharmaceuticals Ltd.	486
161.	Megafine Pharma (P) Ltd.	329
162.	Meghmani Organics Ltd.	370
163.	Mehta API Pvt. Ltd.	500
164.	Merck Ltd.	439
165.	Messung Systems	307
166.	MIC Electronics Ltd.	237
167.	Micromatic Grinding Technologies Ltd.	429
168.	Minda Huf Ltd.	227
169.	Mitra Biotech Pvt. Ltd.,	500
170.	Monarch Catalyst Pvt. Ltd.	348
171.	Mother Diary Fruit & Vegetabls Pvt. Ltd.	373
172.	Mro-Tek Ltd.	282
173.	Muez Hest India Private Limited	242
174.	Mukand Limited	200
175.	Namdhari Seeds Pvt. Ltd.	244
176.	Nandan Biomatrix Limited	324
177.	Napino Auto And Electronics Limited	466
178.	Naprod Life Sciences Pvt. Ltd.	238
179.	Natesan Synchrocones Pvt Ltd	425
180.	National Organic Chemical Industries Ltd.	206
181.	Navya Biologicals Pvt. Ltd.	220
182.	Newland Laboratories Ltd.	439
183.	Nicco Corporation Ltd.	225

Annexure-7 Contd.

Sl. No.	Name of the firm	R&D Expenditure Reported (Rs. in lakhs) *
184.	Nitta Gelatin India Ltd.	300
185.	Nutrahelix Biotech Pvt. Ltd.	265
186.	Oriental Engineering Works Pvt.Ltd.	200
187.	Panama Petrochem Ltd.	385
188.	Paracoat Products Ltd.	215
189.	Park Controls & Communications Ltd.	300
190.	Parthys Reverse Informatics Analytic Solutions Private Limited	226
191.	Pinnacle Industries Ltd.	375
192.	Polyplex Corporation Ltd.	252
193.	Powai Labs Technology Pvt. Ltd.	365
194.	Powerdeal Energy Sysytems (I) Pvt. Ltd Nashik	283
195.	Precision Automation And Robotics India Ltd.	425
196.	Precision Camshafts Limited	233
197.	Premas Biotech Pvt.Ltd.	462
198.	Premier Evolvics Pvt. Ltd.	290
199.	Premium Transmission Ltd.	456
200.	Prima Telecom Ltd.	250
201.	Provimi Animal Nutrition India Pvt. Ltd.	300
202.	Pulse Pharmaceuticals Private Limited	242
203.	Radhe Renewable Energy Development Pvt. Ltd.	375
204.	Radiant Corporation Pvt. Ltd.	330
205.	Rajasthan Antibiotics Limited	280
206.	Rajshree Sugars & Chemicals Ltd.	232
207.	Ramyam Intelligence Lab Pvt Ltd	300
208.	Rane Brake Linings Ltd.	462
209.	Rane TRW Steering Systems Ltd.	409
210.	Raptakos, Brett & Co. Ltd.	327

Annexure-7 Contd.

Sl. No.	Name of the firm	R&D Expenditure Reported (Rs. in lakhs) *
211.	Rashtriya Chemicals & Fertilizers Ltd.	450
212.	Ravindranath G.E. Medical Associates Pvt. Ltd.	248
213.	Reliance Cellulose Products Ltd.	225
214.	Richcore Lifesciences Pvt. Ltd.	200
215.	Rico Auto Industries Ltd.	348
216.	Rishabh Instruments Private Ltd.	400
217.	Rockman Industries Ltd.	497
218.	Rossari Biotech Limited	255
219.	Rotofilt Engineers Ltd.,	300
220.	Samtel Colours Ltd.	245
221.	Sandvik Asia Ltd.	400
222.	Shalimar Paints Ltd.	315
223.	Sharon Bio- Medicine Ltd.	350
224.	Siegwerk India Pvt. Ltd.	390
225.	Sika India Private Ltd.	263
226.	Skanray Healthcare Pvt Ltd	485
227.	Smilax Laboratories Ltd.	268
228.	SMS Pharmaceuticals Ltd.	304
229.	Sona Koyo Steering Systems Ltd.	280
230.	Sona Okegawa Precision Forgings Ltd.,	310
231.	SPC Biotech Pvt. Ltd.	200
232.	Sri Biotech Laboratories India Ltd.	212
233.	Srini Pharmaceuticals Ltd.	200
234.	SSP Pvt. Ltd.	230
235.	Stabicon Life Sciences Private Limited	426
236.	Stanadyne Amalgamations Private Limited	278
237.	Steel Strips Wheels Limited	280
238.	Steer Engineering Pvt. Ltd.	324

Annexure-7 Contd.

Sl. No.	Name of the firm	R&D Expenditure Reported (Rs. in lakhs) *
239.	Stesalit Limited	380
240.	Stumpp, Schuele & Somappa Springs Pvt. Ltd	247
241.	Sundaram Brake Linings Ltd.	275
242.	Sungro Seeds Limited	426
243.	Survival Technologies Pvt.Ltd.	500
244.	Sushen Medicamentos Private Limited	224
245.	Symphony Pharma Life Sciences Private Limited	350
246.	System Controls Technology Solutions Pvt Ltd.	280
247.	Tablets (India) Ltd.	225
248.	Tagros Chemicals India Ltd.	350
249.	Tamil Nadu Newsprint and Papers Ltd.	450
250.	Tata International Ltd.	384
251.	Telco Construction Equipment Company Ltd.	343
252.	Texmaco Limited	200
253.	The Andhra Sugars Ltd.	341
254.	The Indian Hume Pipe Company Ltd.	261
255.	Themis Laboratory Limited	475
256.	Thinq Pharma-Cro Ltd.	491
257.	Thirumalai Chemicals Ltd.,	348
258.	Tide Water Oil Co. (India) Ltd.	292
259.	Tirth Agro Technology Pvt Kltd.	206
260.	Titanium Tantalum Products. Ltd.	250
261.	Transpek Industry Ltd.	300
262.	Trimax IT Infrastructure & Services Limited	265
263.	Trimex Sands Private Limited	380
264.	Trimurti Plant Sciences Pvt. Ltd.	250
265.	Trivitron Healthcare Pvt Ltd	320
266.	TRL Krosaki Refractories Ltd	360

Annexure-7 Contd.

Sl. No.	Name of the firm	R&D Expenditure Reported (Rs. in lakhs) *
267.	Troikaa Pharmaceuticals Ltd.	245
268.	Tulasi Seeds Pvt. Ltd.	300
269.	Turbo Engineering Ltd.	228
270.	Uflex Ltd.	375
271.	Ultra International Ltd.	205
272.	Umedica Laboratories Pvt. Ltd.,	400
273.	Unicorn Seeds Pvt. Ltd.	266
274.	Uurmi Systems Pvt Ltd.	350
275.	Vaishnavi Biotech Ltd.	350
276.	Varuna Biocell Pvt. Ltd.	200
277.	Vector Bioscience Pvt. Ltd.	275
278.	VEM Technologies Pvt.Ltd.	314
279.	V-Guard Industries Limited	250
280.	Vidya Herbs Pvt. Ltd.	220
281.	Vip Industries Ltd.	425
282.	Vivo Bio Tech Ltd.	236
283.	VNR Seeds Pvt. Ltd.	224
284.	VST Tillers Tractors Ltd.	500
285.	Warkem Biotech Pvt Ltd.	250
286.	Wendt India Limited	260
287.	Wires and Fabriks (SA) Ltd.	442
288.	Yaaganti Seeds Pvt. Ltd.	245
289.	Yashraj Biotechnology Ltd.	450
290.	Zenotech Laboratories Ltd.	250

* **R&D expenditures reported are as claimed by the firms in their available Annual reports in DSIR/ renewal applications.**

* **R&D expenditures reported are as claimed by the firms in their available Annual reports in DSIR/renewal applications.**

ANNEXURE - 8

LIST OF SCIENTIFIC AND INDUSTRIAL RESEARCH ORGANISATIONS (SIROS) RECOGNIZED BY DSIR DURING THE PERIOD APRIL 2014 TO DECEMBER 2014

S.No.	Name of the Institute	Recognition granted up to
1.	Institute of Plasma Research, Gandhi Nagar	31.03.2017
2.	Dr. D.Y. Patil Vidyapeeth, Pune	31.03.2017
3.	St. James Hospital Trust Pharmaceutical Research Centre of St. James Hospital Trust, Thrissur, Kerala	31.03.2016
4.	Rural Development Society, Hyderabad	31.03.2016
5.	Tata Medical Centre Trust, Kolkata	31.03.2017
6.	Adamas Institute of Technology, Kolkata	31.03.2017
7.	Kamineni Academy of Medical Sciences of Research Centre, Hyderabad	31.03.2017
8.	Chellaram Diabetes Institute, Pune	31.03.2017
9.	Sardar Patel Post Graduate Institute of Dental & Medical Sciences, Lucknow	31.03.2017
10.	Matrivani Institute of Experimental Research and Education, Kolkata	31.03.2017
11.	Rural Identity and Cultural Education (RICE), Karuungal, K.K. District	31.03.2016
12.	Nirma University, Ahmedabad	31.03.2017
13.	Thalassemia and Sickle Cell Society, Hyderabad	31.03.2016
14.	SOUKYA Foundation Charitable Trust, Bangalore	31.03.2016
15.	Saraswati Dental College and Hospital, Lucknow	31.03.2017
16.	Madanapalle Institute of Technology & Science of Ratakonda Ranga Reddy Educational Academy, , Madanapalle Andhra Pradesh	31.03.2016
17.	Institute of Defence Scientist and Technologists, Bangalore	31.03.2016
18.	Health Related Information Dissemination Amongst Youth [HRIDAY], New Delhi	31.03.2017
19.	Raajdhani Engineering College of Samriddhi Educational Trust, Bhubaneswar	31.03.2016
20.	Central Council for Research in Siddha, Chennai	31.03.2017
21.	Vishwanand Kendra, Pune	31.03.2017
22.	Vel Trust, Avadi, Chennai	31.03.2017
23.	M.S. Ramiah University of Applied Sciences, Bangalore	31.03.2017
24.	Bioscience Research Foundation, Chennai	31.03.2017
25.	Srinivasa Educational Academy, Chittoor	31.03.2017
26.	Lata Medical Research Foundation, Nagpur	31.03.2017
27.	Sri Vishnu Educational Society, Hyderabad	31.03.2017
28.	Karve Institute of Social Service, Pune	31.03.2017

ANNEXURE - 9

CERTIFICATE FOR CLAIMING CENTRAL EXCISE DUTY EXEMPTION FOR THREE YEARS AS PER NOTIFICATION NO. 13/99-CE DATED 28TH FEBRUARY, 1999

Sl.No.	Name of the Company	Product for exemption	Patented Technology
1.	Bharat Biotech	Epidermal growth factor to treat burns and diabetic foot ulcers (REGEN-D)	i. Stable EGF compositionii. Application/use of the composition for treating wounds
2.	Arjuna Natural Extracts Ltd., Kerala	Biocurcumin (BCM-95)	i. Composition and process of preparation of composition for enhanced bioavailability of curcumin.

ANNEXURE - 10

LIST OF COMMERCIAL R&D COMPANIES APPROVED BY DSIR U/S 80IB (8A) OF IT ACT 1961

1. M/s Jubilant Chemsys Ltd., Noida
2. M/s Synchron Research Services Pvt. Ltd., Ahmedabad
3. M/s Evotec (India) Pvt. Ltd., Thane (W)
4. M/s Clintha Research Limited (Formerly M/s BA Research India Ltd., Ahmedabad)
5. M/s Advinus Therapeutics Pvt. Ltd., Bangalore
6. M/s Fine Research & Development Centre Pvt. Ltd., Mumbai
7. M/s Actavis Pharma Development Centre, Bangalore
8. M/s Orchid Research Laboratories Ltd., Chennai
9. M/s P I Life Science Research Ltd., Udaipur
10. M/s Aditya Birla Science & Technology Company Ltd., Navi Mumbai
11. M/s Sun Pharma Advance Research Company Ltd., Baroda
12. M/s Global Transgenes Limited, Aurangabad
13. M/s Fortis Clinical Research Ltd., Faridabad

LIST OF COMPANIES APPROVED U/S 35(2AB) OF INCOME TAX ACT, 1961

Sl. No.	Firm
1.	J.K. Agri Genetics Ltd.
2.	Murli Krishna Pharma Pvt. Ltd.
3.	Siechem Technologies Pvt. Ltd.
4.	Fluidtherm Technology Pvt. Ltd.
5.	Surya Roshni Ltd.
6.	JSL Lifestyle Ltd.
7.	Gujarat State Fertilizers & Chemicals Ltd.
8.	Metrochem API Pvt. Ltd.
9.	DCM Shriram Consolidated Ltd.
10.	Biocon Ltd.
11.	Savannah Seeds Pvt. Ltd.
12.	Rotofilt Engineers Ltd.
13.	Amines & Plasticizers Ltd.
14.	Sonodyne International Pvt. Ltd.
15.	Ace Manufacturing Systems Ltd.
16.	Polaris Financial Technology Ltd.
17.	FDC Ltd.
18.	Ferrterro India Pvt. Ltd.
19.	Anand Motor Products Pvt. Ltd.
20.	SynkroMax Biotech Pvt. Ltd.
21.	Steer Engineering Pvt. Ltd.
22.	Elektrolites (Power) Pvt. Ltd.
23.	ZCL Chemicals Ltd.
24.	Viswaat Chemicasl Ltd.
25.	Uurmi Systems Pvt. Ltd.

Sl. No.	Firm
26.	Essae Digitronics Pvt. Ltd.
27.	Goa Shipyard Ltd.
28.	Pratap Organics Pvt. Ltd.
29.	Medley Pharmaceuticals Ltd.
30.	Camphor & Allied Products Ltd.
31.	Suparna Chemicals Ltd.
32.	Crystal Crop Protection Pvt. Ltd.
33.	Alicon Castalloy Ltd.
34.	TD Power Systems Ltd.
35.	SSP Pvt. Ltd.
36.	PHA India Pvt. Ltd.
37.	ESSAE-Teraoka Ltd.
38.	Evolute Systems Pvt. Ltd.
39.	Kritikal SecureScan Pvt. Ltd.
40.	S Kant Healthcare Ltd.
41.	BioEra Life Sciences Pvt. Ltd.
42.	Allianz Biosciences Pvt. Ltd.
43.	Foliage Crop Solutions Pvt. Ltd.
44.	Marksans Pharma Ltd.
45.	Hospira Healthcare India Pvt. Ltd.
46.	Huntsman International (India) Pvt. Ltd.
47.	Sandeep Axles Pvt. Ltd.
48.	Thejo Engineering Ltd.
49.	BMC Electroplast Pvt. Ltd.
50.	Namdeo Unaji Agritect (India) Pvt. Ltd.

Sl. No.	Firm
51.	AMI Lifesciences Pvt. Ltd.
52.	Paturu Agri Biotech Pvt. Ltd.
53.	Bafna Pharmaceuticals Ltd.
54.	Landis+Gyr Ltd.
55.	Elantas Beck India Ltd.
56.	Radix Electrosystems Pvt. Ltd.
57.	Caplin Point Laboratories Ltd.
58.	Mazda Ltd.
59.	Precision Camshafts Ltd.
60.	Transasia Bio-Medicals Ltd.
61.	General Industries Controls Pvt. Ltd.
62.	Plazma Technologies Pvt. Ltd.
63.	Reliance Cellulose Products Ltd.
64.	Tirth Agro Technology Pvt. Ltd.
65.	Formulated Polymers Ltd.
66.	Bharat Parenterals Ltd.

Sl. No.	Firm
67.	Alps Chemicals Pvt. Ltd.
68.	Eastman Exports Global Clothing (P) Ltd.
69.	Gufic Biosciences Ltd.
70.	Elin Electronics Ltd.
71.	Sava Healthcare Ltd.
72.	Indo Colchem Pvt. Ltd.
73.	Agila Specialties Pvt. Ltd.
74.	BDR Pharmaceutical International Pvt. Ltd.
75.	Raj Petro Specialities Pvt. Ltd.
76.	Padmini VNA Mechatronics Pvt. Ltd.
77.	Realty Automation and Security Systems Pvt. Ltd.
78.	Nelcast Ltd.
79.	Balkrishna Industries Ltd.
80.	Kusum Healthcare Pvt. Ltd.

ANNEXURE -12

REPRESENTATION OF SCs, STs AND OBCs

Groups	Number of Employees				Number of appointments made during the previous Calendar year									
	(As on 01-01-2015)				By Direct Recruitment				By Promotion			By other Methods		
	Total	SCs	STs	OBCs	Total	SCs	STs	OBCs	Total	SCs	STs	Total	SCs	STs	OBCs	Total
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Group A	41*	4	3	1	08	-	-	-	-	-	-	-	-	-		
Group B	33	5	2	1	08	-	-	-	-	-	-	-	-	-		
Group C	15	7	1	4	12	-	-	-	-	-	-	-	-	-		
Total	89*	16	6	6	28	-	-	-	-	-	-	-	-	-		

Note: 1. DSIR recruits only Scientific and Technical posts.
* Excluding 1 post of JS (Admin). which is on notional basis.

REPRESENTATION OF THE PERSONS WITH DISABILITIES AS ON 1st JANUARY 2015

Group	Number of Employees				Direct Recruitment							Promotion						
					No. of vacancies reserved				No of Appointments Made			No. of vacancies reserved			No of Appointments Made			
	Total	VH	HH	OH	VH	HH	OH	Total	VH	HH	OH	VH	HH	OH	Total	VH	HH	OH
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
Group A	41*	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Group B	33	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Group C	15	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total	89*	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-

* Excluding 1 post of JS (Admin). which is on notional basis.

EXTRACTS OF AUDIT OBSERVATIONS BY CAG

1: DEPARTMENT OF SCIENTIFIC & INDUSTRIAL RESEARCH (DSIR)

Nil

ANNEXURE -13

2: COUNCIL OF SCIENTIFIC & INDUSTRIAL RESEARCH (CSIR)

Report No. 29 of 2013[PA] - Network Projects of CSIR

Network Projects were conceived as part of Tenth Five Year Plan programme of CSIR to be taken up and completed during Tenth Plan period (2002-07). CSIR issued guidelines for network projects more than two years after beginning of the Tenth Plan. As such, applicability of the guidelines to project formulation and preparation of project proposals became redundant in most of the projects. There were delays of 12 to 34 months in commencement of the projects which impacted the completion of activities of the network projects. Audit also observed shortfall of 45 per cent in meetings of the TF and 56 per cent in meetings of the MC, which adversely affected monitoring of the projects.

Equipment costing ₹48.73 crore from 15 projects were received/installed/commissioned either after completion of the project or at the fag end of the project duration and could not be utilised for the projects.

Project guidelines as well as the guidelines of Ministry of Finance for implementing high value projects emphasised the need for including measurable parameters in the project proposal. Measurable parameters were not defined in more than 60 per cent of the projects examined in audit. In the absence of defined criteria for project performance, extent of success of these projects could not be measured. In the few cases in which targets were set, actual achievement there against, except for a few noteworthy achievements in development of technologies and publication of research papers, was poor.

Outcome analysis of 27 projects implemented at cost of ₹621.80 crore revealed that projects could not generate commercialisable results in terms of development, transfer and return from sale of technologies. Out of 399 technologies developed, 51 technologies were transferred and 38 technologies were commercialised during the last 10 years. The total revenue earned through transfer/commercialisation of technologies was only ₹3.83 crore, which was less than one per cent of total expenditure incurred on implementation of the projects.

A fundamental element of network projects was effective networking by the scientists of CSIR laboratories in filing joint patents and publishing multi-laboratory and multi-author research papers. Out of 264 patents, only 41 patents constituting 16 per cent were filed jointly. Similarly out of 2008 research papers published, only 104 publications were brought out jointly.

No mechanism for impact assessment of network projects either by CSIR or by external agencies was established, even though it was a new initiative, expected to provide a learning experience to CSIR.

Audit findings from specific projects

Chapter 4 of the Report has highlighted some of the significant audit findings from specific projects, such as delays in establishment of infrastructure required for the projects, injudicious procurements, inadequate planning, incomplete activities, inadequate co-ordination, etc. as below:

4.1 Unproductive expenditure in executing a project without requisite infrastructure

Audit observed that though 41 technologies were developed under the project titled 'Development of animal models and animal substitute technologies' with a sanctioned cost of ₹33.43 crore, none could be submitted to international agencies as the tests were carried out in facilities of CDRI that did not have GLP accreditation. Although CDRI had planned (May 2003) to set up a world class drug institute (duly GLP accredited) through another network project during 2004 to 2008, but the project on "development of animal models and animal substitute technologies" was already completed (March 2007) after incurring an expenditure of ₹30.56 crore, before the said institute could be developed. The new drug research institute was still under development

(July 2012). Audit observed that injudicious decision to take up the project without having required GLP accredited facilities rendered expenditure of ₹30.56 crore unproductive from international acceptance perspective.

CSIR stated (July 2012) that effective use of these models for the ongoing drug development programme of CSIR would enable development of new drugs. The reply needs to be viewed in the context that for getting international acceptance, the models would need to be re-developed in GLP accredited laboratory.

4.2 Unfruitful expenditure due to non-utilization of equipment

Audit observed that equipment procured under the project titled 'New and improved road technologies', undertaken by CRRI (August 2003), at a cost of ₹14.05 crore, remained unutilized.

4.3 Poor planning of project leading to incomplete activity

CSIR took up (April 2004) the network project titled 'Discovery, development and commercialisation of new bio-actives and traditional preparations' at a cost of ₹39.60 crore. One of the main objectives of the project was to develop single molecules as drugs and take them to IND state for diseases of interest to India and international community.

Audit observed that though CSIR developed five single molecules for conditions of dementia, hypertension, psychosis, cancer and immunostimulatory disease, none could be translated to IND stage as essential studies on the single molecules could not be completed due to lack of specialised facilities or expertise. The Audit observed that the decision to include development of single molecules for IND stage in the network project when specialised facilities for conducting the studies were still under development reflected deficient planning.

4.4 Failure to take ethical clearance for studies on human subjects

In case of projects that require tests on human subjects, Government rules stipulate that clinical trials on a new drug shall be initiated only after approvals have been obtained from the Ethics Committee.

CCMB undertook an activity under the project titled 'Asthma and Allergic Disorders Mitigation Mission' to carry out determination of the genetic basis of asthma and study of genetic interactions between causative agents and concerned genes with a view to adopting predictive measures and develop predictive medicines related to asthmatic and allergic disorders. The activity required collection of bronchoalveolar lavage fluid from patients.

Audit observed from the project proposal that CCMB did not take clearance from Ethics Committee prior to taking up the activity, which was in contravention of Government rules.

While carrying out studies, CCMB faced problems due to ethical considerations. The main objective of adopting predictive measures and development of predictive medicines for asthma and allergic disorders was not achieved, as functional validation of genes could not be completed, rendering expenditure of ₹2.21 crore incurred on the activity as unfruitful.

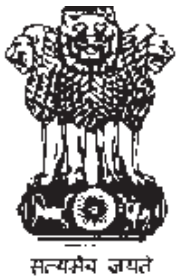
4.5 Incomplete activities under projects

Audit observed that status of completion of activities reported in the consolidated project completion reports of two projects viz. 'Developing and sustaining high science and technology for national aerospace programme' and 'Developing New Building Construction Materials', was incorrect. In another project titled 'Developing capabilities for micro electromechanical systems and sensors', objective of an activity was not achieved, reportedly due to deficient manpower, which was a fact already known to the laboratory.

3: CENTRAL ELECTRONICS LIMITED (CEL)

Report No. 13 of 2014 - Violation of CVC guidelines and extra expenditure for the purchase of silicon wafers.

Central Electronics Ltd. Placed purchase order for silicon wafers on nominations basis instead of competitive bidding, in violation of guidelines laid down by the Central Vigilance Commission based on the judgment of Hon'ble Supreme Court of India and made changes in the sales contract as finally entered into which were in variance with the approval of the Board.



Government of India

R F D

(Results-Framework Document)

for

Department of Scientific and Industrial Research

(2013-14)

Section 1:
Vision, Mission, Objectives and Functions

Vision

Enabling India to emerge as global industrial research and innovation hub

Mission

Attracting industrial research in the country through industry and institution centric motivational measures and incentives. Creating an enabling environment for development and utilization of new innovations. Enhance innovations through its resources and channelize benefits thereof to the people

Objectives

1 To promote and nurture research and development in industry with a view to enhance industry's share in national R&D expenditure.

2 Promoting Innovations in Individuals, Start-ups and MSMEs and channelize benefits for public good;

3 Patent Acquisition and Collaborative Research and Technology Development leading to industrial competitiveness.

4 Facilitating research by micro and small enterprises (MSEs);

5 Promoting access to Knowledge for Industries for Technology Development and Dissemination.

6 Providing technology based support for programmes aimed at benefitting women ;

7 To access the outcome of major technologies of national importance developed by CSIR on a continuous basis,

8 Evaluation of outcome of erstwhile Schemes

9 To track scientific innovations in the country.

10 To implement e-Governance and ERP initiatives.

Functions

1 All matters concerning the Council of Scientific & Industrial Research.

2 All matters relating to National Research Development Corporation.

3 All matters relating to Central Electronics Limited

4 Registration and Recognition of R&D Units.

5 Technical matters relating to UNCTAD & WIPO.

6 National register for foreign collaborations

Section 1:
Vision, Mission, Objectives and Functions

7 Matters relating to creation of a pool for temporary placement of Indian Scientists & Technologists

8 **********

9 Revised Proposal for Allocation of Business Rules with following entries sent to Cabinet Secretariat on 12.12.2012. This is pending approval.

10 All matters relating to Scientific and Industrial Research

11 Overall Policy Planning, Co-ordination, Evaluation and Review of the Developmental Programmes relating to enhancing the industrial self reliance and global competitiveness through scientific and industrial research

12 Promoting inclusive innovations in Industrial Research for societal benefits;

13 Registration and recognition of organizations, industries and institutions for Scientific Research and Development including approvals for implementation of fiscal incentives,

14 Documentation of traditional knowledge for protection against misappropriation

15 Promoting open innovations in Scientific and Industrial Research;

16 Administration of The Academy of Scientific and Innovative Research Act, 2011 (AcSIR).

17 All matters concerning Autonomous Organisations under the administrative control of the Department i. Council of Scientific and Industrial Research (CSIR) ii. Consultancy Development Centre (CDC).

18 All matters concerning Public Sector Undertakings (PSUs) under the administrative control of the Department. i. National Research Development Corporation (NRDC) ii. Central Electronics Limited (CEL) ;

19 Matters relating to United Nations - Asian & Pacific Centre for Transfer of Technology

Annexure-14-Contd.

Section 2:
Inter se Priorities among Key Objectives, Success indicators and Targets

Objective	Weight	Action	Success Indicator	Unit	Weight	Target / Criteria Value				
						Excellent	Very Good	Good	Fair	Poor
						100%	90%	80%	70%	60%
[1] To promote and nurture research and development in industry with a view to enhance industry's share in national R&D expenditure	22.00	[1.1] Recognition and renewal of R&D Centres	[1.1.1] Recognition & registration for new in-house R&D units Scientific & Industrial Research Organisations (SIROs) and Public Funded Research Institutions (PFRIs).	Nos	9.00	290	285	275	260	250
			[1.1.2] Renewal of recognition & registration for in-house R&D units SIROs, PFRIs	Nos	3.00	715	710	705	700	695
		[1.2] Fiscal incentives for Scientific Research	[1.2.1] Approving new companies for availing fiscal benefits	Nos	10.00	80	75	70	65	60
[2] Promoting innovations in individuals, Start-ups and MSMEs and channelize benefits for public good	10.00	[2.1] Encouraging innovations and creativity towards creating knowledge-based enterprises through implementation of PRISM scheme	[2.1.1] Support to innovative project proposals from individuals, start-ups and MSMEs	Nos	8.00	100	90	80	75	70
		[2.2] Evolving mechanisms to scout for innovative proposals from individuals, start-ups and MSMEs through implementation of PRISM scheme	[2.2.1] Establishment & sustenance of TePP Outreach cum Cluster Innovation Centres (TOCICs) in collaboration with CSIR labs	Nos	2.00	50	45	41	37	33

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Section 2:
Inter se Priorities among Key Objectives, Success indicators and Targets

Objective	Weight	Action	Success Indicator	Unit	Weight	Target / Criteria Value				
						Excellent	Very Good	Good	Fair	Poor
						100%	90%	80%	70%	60%
			[2.2] Organization of awareness-cum-training sessions on innovation and creativity	Nos	2.00	12	11	10	9	8
		[2.3] Completion of new innovative projects in the ongoing TePP projects through implementation of PRISM scheme	[2.3.1] New products and prototypes demonstrated	Nos	6.00	50	45	35	44	42
[3] Patent Acquisition and Collaborative Research and Technology Development leading to industrial competitiveness	14.00	[3.1] Evolving mechanisms for facilitating patent acquisitions through implementation of PACE scheme	[3.1.1] Organization of workshops involving technology providers and technology seekers	Nos	1.50	3	2	1	0	–
			[3.1.2] Organization of Expert Committee meetings for technology valuation and assessment	Nos	1.50	3	2	1	0	–
		[3.2] Development & demonstration of innovative product or process technologies through implementation of PACE scheme	[3.2.1] Support to innovative projects of industries with or without collaboration of R&D institutions	Nos	10.00	5	4	3	2	1
		[3.3] Facilitating linkups of industries with R&D institutions for collaborative R&D	[3.3.1] Preparation of framework for a database of experts and PIs	Date	1.00	28.02.2014	31.03.2014	10.03.2014	28.03.2014	31.03.2014

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Section 2:
Inter se Priorities among Key Objectives, Success indicators and Targets

Objective	Weight	Action	Success Indicator	Unit	Weight	Target / Criteria Value				
						Excellent	Very Good	Good	Fair	Poor
						100%	90%	80%	70%	60%
		projects through implementation of PACE scheme	available in institutions							
[4] Facilitating research by micro and small enterprises (MSEs)	5.00	[4.1] Enabling setting up of Common Research & Technology Development Facilities for micro and small enterprises (MSEs) through implementation of B RD scheme	[4.1.1] Evolving a framework for establishing common research & Technology Development facilities	Date	2.00	31.01.2014	10.02.2014	20.02.2014	01.03.2014	15.03.2014
			[4.1.2] Setting up of one common research & Technology Development Centres	Date	3.00	20.02.2014	01.03.2014	11.03.2014	21.03.2014	31.03.2014
[5] Promoting access to Knowledge for industries for Technology Development and Dissemination	14.00	[5.1] Facilitating access to e-journals by in-house R&D units of industries and SIROs through implementation of A2K+ scheme	[5.1.1] No. of scientific journals accessed online	Nos	2.00	5	4	3	2	1
			[5.1.2] No. of in-house R&D units and SIROs having online access to scientific journals	Nos	2.00	35	34	33	32	31
		[5.2] To keep abreast of latest technological developments and innovations through implementation of A2K+ scheme	[5.2.1] Sponsoring studies in futuristic areas related to technology and innovation and showcasing technological achievements and	Nos	2.00	4	3	2	1	0

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Section 2:
Inter se Priorities among Key Objectives, Success indicators and Targets

Objective	Weight	Action	Success Indicator	Unit	Weight	Target / Criteria Value				
						Excellent	Very Good	Good	Fair	Poor
						100%	90%	80%	70%	60%
			success stories through exhibitions, conferences etc							
		[5.3] Completion of on-going TDDP projects	[5.3.1] New products processes demonstrated	Nos	5.00	10	9	8	7	6
[6] Providing technology based support for programmes aimed at benefiting women	2.00	[6.1] Empowering and training women through technological interventions	[6.1.1] Support technology based proposals from a Non-Governmental Organisations (NGOs), Women Self-help Groups (SHGs) and other concerned agencies	Nos	2.00	14	13	12	11	10
[7] To assess the outcome of major technologies of national importance developed by CSIR on a continuous basis	2.00	[7.1] To carry out an economic impact assessment of major technologies of national importance developed by CSIR	[7.1.1] Identification of technologies of national importance developed by CSIR	Nos	1.00	2	1	0	–	–
			[7.1.2] Preparation of impact assessment reports	Nos	1.00	2	1	0	–	–
[8] Evaluation of outcome of ongoing schemes	4.00	[8.1] Independent evaluation of Technology Development and Demonstration Programme (TDDP)	[8.1.1] Submission of evaluation report to the department	Date	2.00	01.02.2014	15.02.2014	01.03.2014	15.03.2014	31.03.2014
		[8.2] Independent evaluation of Technopreneur	[8.2.1] Submission of evaluation report	Date	2.00	01.02.2014	15.02.2014	01.03.2014	15.03.2014	31.03.2014

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Section 2:
Inter se Priorities among Key Objectives. Success indicators and Targets

Objective	Weight	Action	Success Indicator	Unit	Weight	Target / Criteria Value				
						Excellent	Very Good	Good	Fair	Poor
						100%	90%	80%	70%	60%
		Promotion Programme (PePP)	to the department							
(B) To host scientific innovations in the country	3.00	(B1) Creation of a Scientific Innovations Database	(B1.1) Scientific innovations added in the database	Nos	1.00	300	270	250	225	200
			(B1.2) Uploading scientific innovation database in DSIR Website	Date	1.00	20.02.2014	01.03.2014	11.03.2014	21.03.2014	31.03.2014
(C) To implement e-Governance and ERP initiatives	2.00	(C1.1) Design, Development, Validation and Certification of Enterprise Resource Planning (ERP) solution for e-Office	(C1.1.1) Percentage of processes in the ERP initiative going online by 31.03.2014	%	2.00	100	95	90	85	80
* Efficient Functioning of the RFD System	3.00	Timely submission of Draft RFD 2014-15 for Approval	On-time submission	Date	2.0	28.03.2014	06.03.2014	07.03.2014	28.03.2014	11.03.2014
		Timely submission of Results for 2012-13	On-time submission	Date	1.0	01.05.2013	02.05.2013	03.05.2013	26.05.2013	07.05.2013
* Transparency, Service delivery, Ministry/Department	3.00	Independent Audit of implementation of Citizens/ Clients Charter (CCC)	% of implementation	%	2.0	100	95	90	85	80
		Independent Audit of implementation of Public Grievance Redressal System	% of implementation	%	1.0	100	95	90	85	80
* Administrative Reforms	4.00	Implement mitigating strategies for reducing potential risk of corruption	% of implementation	%	1.0	100	95	90	85	80
		Implement ISO 9001 as per the approved action plan	% of implementation	%	2.0	100	95	90	85	80

* Mandatory Objectives.

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Section 2:
Inter se Priorities among Key Objectives, Success indicators and Targets

Objective	Weight	Action	Success Indicator	Unit	Weight	Target : Criteria Value				
						Excellent	Very Good	Good	Fair	Poor
						100%	90%	80%	70%	60%
		Implement Innovation Action Plan (IAP)	% of milestones achieved	%	3.0	100	95	90	85	80
		Identification of core and non-core activities of the Ministry/ Department as per 2nd ARC recommendations	Timely submission	Date	1.0	31.01.2014	28.01.2014	26.01.2014	30.01.2014	31.01.2014
* Improving Internal Efficiency/ Responsiveness	2.00	Update departmental strategy to align with 12th Plan priorities	Timely update of the strategy	Date	2.0	10.09.2013	17.09.2013	24.09.2013	01.10.2013	08.10.2013
* Ensuring compliance to the Financial Accountability Framework	1.00	Timely submission of ATNs on Audit paras of C&AG	Percentage of ATNs submitted within due date (4 months) from date of presentation of Report to Parliament by CAG during the year	%	0.25	100	90	80	70	60
		Timely submission of ATNs on the PAC Section on PAC Reports	Percentage of ATNS submitted within due date (3 months) from date of presentation of Report to Parliament by PAC during the year	%	0.25	100	90	80	70	60
		Early disposal of pending ATNs on Audit Paras of C&AG Reports presented to Parliament before 31.3.2012	Percentage of outstanding ATNs disposed off during the year	%	0.25	100	90	80	70	60
		Early disposal of pending ATNs on PAC Reports presented to Parliament before 31.3.2012	Percentage of outstanding ATNS disposed off during the year	%	0.25	100	90	80	70	60

* Mandatory Objectives

Section 3:
Trend Values of the Success Indicators

Objective	Action	Success Indicator	Unit	Actual Value for FY 11/12	Actual Value for FY 12/13	Target Value for FY 13/14	Projected Value for FY 14/15	Projected Value for FY 15/16
[1] To promote and nurture research and development in industry with a view to enhance industry's share in national R&D expenditure	[1.1] Recognition and renewal of R&D Centres	[1.1.1] Recognition & registration to new in-house R&D units, Scientific & Industrial Research Organisations (SIROs) and Public Funded Research Institutions (PFRIs)	Nos	220	322	285	290	295
		[1.1.2] Renewal of recognition & registration to in-house R&D units, SIROs, PFRIs	Nos	720	715	710	715	720
	[1.2] Fiscal incentives for Scientific Research	[1.2.1] Approving new companies for availing fiscal benefits	Nos	72	110	75	80	85
[2] Promoting innovations in individuals, Start-ups and MSMEs and channelize benefits for public good	[2.1] Encouraging innovators and creativity towards creating knowledge-based enterprises through implementation of PRISM scheme	[2.1.1] Support to innovative project proposals from individuals, start-ups and MSMEs	Nos	–	0	90	105	120
	[2.2] Evolving mechanisms to scout for innovative proposals from individuals, start-ups and MSMEs through implementation of PRISM scheme	[2.2.1] Establishment & sustenance of TePP Outreach cum Cluster Innovation Centres (TOCICs) in collaboration with CSIR labs	Nos	--	30	45	45	50

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Section 3:
Trend Values of the Success Indicators

Objective	Action	Success Indicator	Unit	Actual Value for FY 11/12	Actual Value for FY 12/13	Target Value for FY 13/14	Projected Value for FY 14/15	Projected Value for FY 15/16
		[2.2.2] Organization of awareness-cum-training sessions on innovation and creativity	Nos	–	5	11	11	11
	[2.3] Completion of new innovative projects in the ongoing TePP projects through implementation of PRISM scheme	[2.3.1] New innovations and prototypes demonstrated	Nos	–	42	48	48	50
[3] Patent Acquisition and Collaborative Research and Technology Development leading to industrial competitiveness	[3.1] Evolving mechanisms for facilitating patent acquisitions through implementation of PACE scheme	[3.1.1] Organization of workshops matching technology providers and technology seekers	Nos	–	0	2	4	4
		[3.1.2] Organization of Expert Committee meetings for technology valuation and assessment	Nos	–	0	2	4	4
	[3.2] Development & demonstration of innovative product or process technologies through implementation of PACE scheme	[3.2.1] Support to innovative projects of industries with or without collaboration of R&D institutions	Nos	–	0	4	5	6
	[3.3] Facilitating tie-ups of industries with R&D institutions for collaborative R&D projects through	[3.3.1] Preparation of framework for a database on experts and IPs available in institutions	Date	–	–	01.03.2014	–	–

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Section 3:
Trend Values of the Success Indicators

Objective	Action	Success Indicator	Unit	Actual Value for FY 11/12	Actual Value for FY 12/13	Target Value for FY 13/14	Projected Value for FY 14/15	Projected Value for FY 15/16
	implementation of PACE scheme							
[4] Facilitating research by micro and small enterprises (MSEs)	[4.1] Enabling setting up of Common Research & Technology Development Facilities for micro and small enterprises (MSEs) through implementation of SIRD scheme	[4.1.1] Evolving a framework for establishing common research & Technology Development facilities	Date	–	–	10/02/2014	–	–
		[4.1.2] Setting-up of one common research & Technology Development Centres	Date	–	–	01/03/2014	01/03/2015	01/03/2016
[5] Promoting access to Knowledge for industries for Technology Development and Dissemination;	[5.1] Facilitating access to e-journals by in-house R&D units of industries and SIROs through implementation of A2K+ scheme	[5.1.1] No. of scientific journals accessed online	Nos.	–	4	4	4	4
		[5.1.2] No. of in-house R&D units and SIROs having online access to scientific journals	Nos.	–	30	34	60	85
	[5.2] To keep abreast of latest technological developments and innovations through implementation of A2K+ scheme	[5.2.1] Sponsoring studies in futuristic areas related to technology and innovation and showcasing	Nos.	–	0	3	3	3

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Section 3:
Trend Values of the Success Indicators

Objective	Action	Success Indicator	Unit	Actual Value for FY 11/12	Actual Value for FY 12/13	Target Value for FY 13/14	Projected Value for FY 14/15	Projected Value for FY 15/16
		technological achievements and success stories through exhibitions conferences etc						
	[5.3] Completion of on-going TDDP projects	[5.3.1] New products processes demonstrated	Nos	3	9	9	16	15
[6] Providing technology based support for programmes aimed at benefiting women	[6.1] Empowering and training women through technological interventions	[6.1.1] Support technology based proposals from Non-Governmental Organisations (NGOs) Women Self-Help Groups (SHGs) and other concerned agencies	Nos	8	9	13	14	15
[7] To access the outcome of major technologies of national importance developed by CSIR on a continuous basis	[7.1] To carry out an economic impact assessment of major technologies of national importance developed by CSIR	[7.1.1] Identification of technologies of national importance developed by CSIR	Nos	–	6	3	3	3
		[7.1.2] Preparation of impact assessment reports	Nos	..	6	3	3	3
[8] Evaluation of outcome of erstwhile Schemes	[8.1] Independent evaluation of Technology Development and Demonstration Programme (TDDP)	[8.1.1] Submission of evaluation report to the department	Date	–	–	15.02.2014	–	–

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Section 3:
Trend Values of the Success Indicators

Objective	Action	Success Indicator	Unit	Actual Value for FY 11/12	Actual Value for FY 12/13	Target Value for FY 13/14	Projected Value for FY 14/15	Projected Value for FY 15/16
	[8.2] Independent evaluation of Technopreneur Promotion Programme (TePP)	[8.2.1] Submission of evaluation report to the department	Date	–	–	15.03.2014	–	–
[9] To track scientific innovations in the country	[9.1] Creation of a Scientific Innovations Database	[9.1.1] Scientific innovations added in the database	Nos	–	120	270	280	290
		[9.1.3] Uploading scientific innovation database in DSIR website	Date	–	–	01.03.2014	–	–
[10] To implement e-Governance and ERP initiatives	[10.1] Design, Development, Validation and Certification of Enterprise Resource Planning (ERP) solution for e-Office	[10.1.1] Percentage of processes in the ERP initiative going on-line by 31.03.2014	%	–	–	95	–	–
* Efficient Functioning of the RFD System	Timely submission of Draft RFD 2014-15 for Approval	On-time submission	Date	–	–	05.03.2014	–	–
	Timely submission of Results for 2012-13	On-time submission	Date	–	–	02.05.2013	–	–
* Transparency/Service delivery Ministry/Department	Independent Audit of implementation of Citizens'/Clients' Charter	% of implementation	%	–	–	95	–	–
	Independent Audit of implementation of Public Grievance Redressal System	% of implementation	%	–	–	95	–	–

* Mandatory Objective(s)

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Section 3:
Trend Values of the Success Indicators

Objective	Action	Success Indicator	Unit	Actual Value for FY 11-12	Actual Value for FY 12-13	Target Value for FY 13-14	Projected Value for FY 14-15	Projected Value for FY 15-16
* Administrative Reforms	Implement mitigating strategies for reducing potential risk of corruption	% of implementation	%	--	--	95	--	--
	Implement ISO 9001 as per the approved action plan	% of implementation	%	--	--	95	--	--
	Implement Innovation Action Plan (IAP)	% of milestones achieved	%	--	--	95	--	--
	Identification of core and non-core activities of the Ministry/Department as per 2nd ARC recommendations	Timely submission	Date	--	--	15/10/2013	--	--
* Ensuring compliance to the Financial Accountability Framework	Timely submission of ATNs on Audit paras of C&AG	Percentage of ATNs submitted within due date (4 months) from date of presentation of Report to Parliament by CAG during the year	%	--	--	90	--	--
	Timely submission of ATRs to the PAC Sectt. on PAC Reports	Percentage of ATRS submitted within due date (6 months) from date of presentation of Report to Parliament by PAC during the year	%	--	--	90	--	--
	Early disposal of pending ATNs on Audit Paras of C&AG Reports presented to Parliament before 31.3.2012	Percentage of outstanding ATNs disposed off during the year	%	--	--	90	--	--
	Early disposal of pending ATRs on PAC Reports presented to Parliament before 31.3.2012	Percentage of outstanding ATRS disposed off during the year	%	--	--	90	--	--

* Mandatory Objective(s)

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Section 4: Acronym

Sl.No	Acronym	Description
1	[illegible]	Access to Knowledge for Industries for Technology Development and Dissemination
2	[illegible]	Advanced Scientific Computing Research
3	[illegible]	Asian and Pacific Centre for Transfer of Technology
4	[illegible]	Administrative Reforms Committee
5	[illegible]	Building Industry Research and Development
6	[illegible]	Citizen's Charter

Section 4: Acronym

Sl No	Acronym	Description
[illegible]	[illegible]	[illegible]
[illegible]	CEL	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]

Annexure-14-Contd.

Section 4: Acronym

S.No	Acronym	Description
13	[illegible]	[illegible]
14	[illegible]	[illegible]
15	[illegible]	[illegible]
16	[illegible]	[illegible]
17	[illegible]	[illegible]
18	[illegible]	[illegible]

Section 4: Acronym

Sl No	Acronym	Description
19	[illegible]	[illegible]
20	[illegible]	[illegible]
21	[illegible]	[illegible]
22	[illegible]	[illegible]
23	[illegible]	[illegible]
24	[illegible]	[illegible]

Section 4: Acronym

S.No	Acronym	Descriptor
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]

Section 4:
Description and Definition of Success Indicators and Proposed Measurement Methodology

Sl.No	Success indicator	Description	Definition	Measurement	General Comments
1	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
3	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Section 4:
Description and Definition of Success Indicators and Proposed Measurement Methodology

Sl.No	Success indicator	Description	Definition	Measurement	Seeds' Comments
3	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
4	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
5	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Section 4:

Description and Definition of Success Indicators and Proposed Measurement Methodology

Sl.No	Success Indicator	Description	Definition	Measurement	General Comments
6	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
7	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
8	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
9	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Section 4:

Description and Definition of Success Indicators and Proposed Measurement Methodology

Sl.No	Success indicator	Description	Definition	Measurement	General Comments

Section 4:
Description and Definition of Success Indicators and Proposed Measurement Methodology

Sl.No	Success indicator	Description	Definition	Measurement	General Comments
12	[5.3.1] New products / processes demonstrated	Completion of ongoing Technology Development and Demonstration Programme (TDDP) projects spilling over from previous plan	Projects only with innovative technological content are supported which involve up-scaling of proof of concept laboratory stage R&D upto the pilot plant stage and demonstrating the commercialization potential of the product / process developed	Projects that result into commercialization are measured which indicates the outcome	Commercialized projects yield royalty / lumpsum payback
13	[6.1.1] Support technology based proposals from a Non-Governmental Organisations (NGOs) / Women Self-Help Groups (SHGs) and other concerned agencies	Projects from NGOs and other organizations aimed at evolving technological solutions for the benefit of women are invited which are considered by TAC before support by DSIR	The proposals aim at training women and equipping them with improved techniques, tools, advanced technologies etc. with a view to improve their livelihood	The numbers of projects approved are the ones recommended by Technical Advisory Committee (TAC) and concurred by FD	This will create business and employment opportunities for women
14	[7.1.2] Preparation of impact assessment reports	Council of Scientific Industrial Research (CSIR) is engaged in development of a large number of technologies having a variety of industrial applications. These technologies impact the lives of common man in a significant way. This success indicator will assesses the outcome of a select number of technologies of national importance developed by CSIR and reports preparation	Technology Impact Assessment Reports estimates the outcome in terms of value to the CSIR laboratory generating the technology in terms of lump-sum royalty payments, the licensee industries income from commercialization of technology and the	Preparation of Impact Assessment Report is a year long exercise. Impact Assessment Reports for 1-2 technologies shall be prepared simultaneously	Technology Impact Assessment Reports document the benefits that accrue to the society due to the commercialization of CSIR technologies

Section 4:

Description and Definition of Success Indicators and Proposed Measurement Methodology

Sl No	Success Indicator	Description	Definition	Measurement	General Comments
14	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
15	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
16	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Section 4:

Description and Definition of Success Indicators and Proposed Measurement Methodology

Sl.No	Success Indicator	Description	Definition	Measurement	General Comments

Section 4:
Description and Definition of Success Indicators and Proposed Measurement Methodology

Sl.No	Success indicator	Description	Definition	Measurement	General Comments
18	[10.1.1] Percentage of processes in the ERP initiative going on-line by 31/03/2014	The Department is implementing an Enterprise Resource Planning (ERP) system which will automate Projects, Planning, Administrative and other functions of the Department and make the system more transparent and efficient. The ERP includes System Study, Requirement Specifications, Process Information Architectures and Development of ERP, Graphical User Interface (GUI) Validation, User Acceptance Test (UAT) and Certification	The ERP processes include e-Office (Employee Records and Services, etc.), Stores and Purchases, Audit, Planning, Court Cases, Budget, Parliament, Recognition and Renewal of In-house R&D Units, SIROs & PFRIs, Fiscal Incentives, Plan Schemes (PRISM, PACE, BIRD & A2K+), etc.	Percentage of Processes going online will be measured.	This will improve efficiency and transparency in operations.

Section 5 :

Specific Performance Requirements from other Departments

Location Type	State	Organisation Type	Organisation Name	Relevant Success Indicator	What is your requirement for this organisation	Justification for this requirement	Please specify your requirement from this Organisation	What happens if your requirement is not met
[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Section 5 :
Specific Performance Requirements from other Departments

Location Type	State	Organisation Type	Organisation Name	Relevant Success Indicator	What is your requirement from this organisation	Justification for this requirement	Please quantify your requirement from this Organisation	What happens if your requirement is not met.
				providers and technology seekers	Technologies for Transfer by Technology Transfer Agencies	To enable transfer of early stage technologies	50 technology seekers(industries): 10 Technology providers	Technolo-gies may not be licensed

Section 6:
Outcome/Impact of Department/Ministry

Outcome/Impact of Department/Ministry	Jointly responsible for influencing this outcome / impact with the following department (s) / ministry(ies)	Success Indicator	Unit	FY 11-12	FY 12-13	FY 13-14	FY 14-15	FY 15-16
1. Contribution towards making India a truly technology and innovation driven society through the PRISM scheme	TePP Outreach cum Cluster Innovation Centres, Innovators and industry	No. of knowledge-based enterprises and start-ups created	Nos			1	3	4
		No. of innovative products/ processes successfully demonstrated by industries	Nos	3	5	10	10	12
2. Increased R&D spend by industry	Director General of Income Tax (E)	R&D expenditure certified u/s 35(2AB) of Income Tax	Rs. in Crore	3500	3300	4000	4200	4400
3. Enhancing research publications and patents by industries through A2K+ Scheme	Publishers, Patent Offices, Industry	No. of research papers published	Nos			40	55	65
		No. of patents filed by industries	Nos			5	10	15
4. Enabling industries to manufacture 'Made in India' products	Institutions & agencies having technologies for transfer, Industry	No. of 'Made in India' products developed	Nos			1	3	2
5. Improvement in business and employment opportunities for women	NGOs and SHGs	No. of businesses established by women	Nos			1	2	3
		Employment Generated for Women	Nos			5	10	15
6. Economic Impact Analysis of DSIR Technologies	Economic Agencies	No. of technologies for which Economic Impact Analysis (EIA) done	Nos		6	2	3	4

Section E

Outcome/Impact of Department/Ministry

Department of Scientific and Industrial Research
RFD 2013-14: Annexure to Section 6

Measurable Parameters during 11th Five Year Plan

S.No.	Parameter	Unit	Measure/Value				
			2007-08	2008-09	2009-10	2010-11	2011-12
1.	R&D Expenditure by industry on which weighted tax deduction claimed	Rs. in Crore	667.57	1222.52	2768.78	4035.03	3590
2.	Papers Published by CSIR (Ref: CSIR Research Papers 2011 – A Report prepared by CSIR-NISCAIR and CSIR-NIIST August 1, 2012)	Nos.	3833 (2007)	3837 (2008)	3918 (2009)	4350 (2010)	4716 (2011)
3.	CSIR Papers as a percentage of total papers published from India	%age	11.83	10.47	10.28	9.41	9.43
4.	Patents filed by CSIR in India	Nos.	207	183	161	174	197
5	Patents filed by CSIR Abroad	Nos.	256	404	179	220	290
6	No. of fellowships awarded by CSIR for Ph.Ds. postdoctoral research etc.	Nos.	3187	4687	3952	3544	3389
7	World Ranking (by SCIMAGO) of CSIR among Global Scientific Institutions	Rank	--	98 2124 (2009)	121 2823 (2010)	73 3042 (2011)	82 3290 (2012)
8	National Ranking (by SCIMAGO) of CSIR among all Indian Public Funded Institutions	Rank	--	1 (2009)	1 (2010)	1 (2011)	1 (2012)

Annexure-14-Contd.

Performance Evaluation Report

Objective	Weight	Action	Success Indicator	Unit	Weight	Target / Criteria Value					Achievement	Performance	
						Excellent	Very Good	Good	Fair	Poor		Raw Score	Weighted Score
						100%	90%	80%	70%	60%			
1. To promote and nurture research and development in industry with a view to enhance industry's share in national R&D expenditure	22.00	Recognition and renewal of R&D Centres	Recognition & registration to new in-house R&D units, Scientific & Industrial Research Organisations (SIROs) and Public Funded Research Institutions (PFRIs)	Nos	9.00	290	285	275	260	250	285	90.0	8.1
			Renewal of recognition & registration to in-house R&D units, SIROs, PFRIs	Nos	3.00	715	710	705	700	695	695	60.0	1.8
		Fiscal incentives for Scientific Research	Approving new companies for availing fiscal benefits	Nos	10.00	80	75	70	65	60	90	100.0	10.0
2. Promoting innovations in individuals, Start-ups and MSMEs and channelize benefits for public good	15.00	Encouraging innovations and creativity towards creating knowledge-based enterprises through implementation of PRISM scheme	Support to innovative project proposals from individuals, start-ups and MSMEs	Nos	8.00	100	90	80	75	70	0	0.0	0.0
		Evolving mechanisms to scout for innovative proposals from individuals, start-ups and MSMEs through implementation of PRISM scheme	Establishment & sustenance of TePP Outreach cum Cluster Innovation Centres (TOCICs) in collaboration with CSIR labs	Nos	2.00	50	45	41	37	33	13	0.0	0.0
			Organization of awareness-cum-training sessions on innovation and creativity	Nos	2.00	12	11	10	9	8	1	0.0	0.0
		Completion of new innovative projects or the on-going TePP projects through implementation of PRISM scheme	New innovations and prototypes demonstrated	Nos	6.00	50	48	46	44	42	57	100.0	6.0

Annexure-14-Contd.

Performance Evaluation Report

Objective	Weight	Action	Success Indicator	Unit	Weight	Target / Criteria Value					Achievement	Performance	
						Excellent	Very Good	Good	Fair	Poor		Raw Score	Weighted Score
						100%	90%	80%	70%	60%			
3. Patent Acquisition and Collaborative Research and Technology Development leading to industrial competitiveness	14.00	Evolving mechanisms for facilitating patent acquisitions through implementation of PACE scheme	Organization of workshops involving technology providers and technology seekers	Nos	1.50	3	2	1	0		6	100.0	1.5
			Organization of Expert Committee meetings for technology evaluation and assessment	Nos	1.50	3	2	1	0		1	50.0	1.2
		Development & demonstration of innovative product or process technologies through implementation of PACE scheme	Support to innovative projects of industries with or without collaboration of R&D institutions	Nos	10.00	5	4	3	2	1	5	100.0	10.0
		Facilitating tie-ups of industries with R&D institutions for collaborative R&D projects through implementation of PACE scheme	Preparation of framework for a database of experts and IPs available in institutions	Date	1.00	20.02.2014	01.03.2014	10.03.2014	20.03.2014	31.03.2014	20.12.2014	100.0	1.0
4. Facilitating research by micro and small enterprises (MSEs)	5.00	Enabling setting up of Common Research & Technology Development Facilities for micro and small enterprises (MSEs) through implementation of B-RD scheme	Evolving a framework for establishing common research & Technology Development facilities	Date	2.00	31.01.2014	10.02.2014	20.02.2014	01.03.2014	15.03.2014	31.01.2014	100.0	2.0
			Setting-up of one common research & Technology Development Centres	Date	3.00	20.02.2014	01.03.2014	11.03.2014	21.03.2014	31.03.2014	31.12.2014	0.0	0.0
5. Promoting access to Knowledge for industries for …	14.00	Facilitating access to e-journals by in-house R&D units of industries and	No. of scientific journals accessed online	Nos	3.00	5	4	3	2	1	0	0.0	0.0

Performance Evaluation Report

Objective	Weight	Action	Success Indicator	Unit	Weight	Target / Criteria Value					Achievement	Performance	
						Excellent	Very Good	Good	Fair	Poor		Raw Score	Weighted Score
						100%	90%	80%	70%	60%			
Technology Development and Dissemination		SIROs through implementation of A2K+ scheme											
			No. of in-house R&D units and SIROs having online access to scientific journals	Nos	2.00	35	34	33	32	31	0	0.0	0.0
		To keep abreast of latest technological developments and innovations through implementation of A2K+ scheme	Sponsoring studies in futuristic areas related to technology and innovation and showcasing technological achievements and success stories through exhibitions conferences etc	Nos	2.00	4	3	2	1	0	3	90.0	1.8
		Completion of ongoing TDDP projects	New products / processes demonstrated	Nos	6.00	10	9	8	7	6	10	100.0	6.0
6 Providing technology based support for programmes aimed at benefiting women	2.00	Empowering and training women through technological interventions	Support technology based proposals from all Non-Governmental Organisations (NGOs), Women Self-Help Groups (SHGs) and other concerned agencies	Nos	2.00	14	13	12	11	10	19	100.0	2.0
7 To assess the outcome of major technologies of national importance developed by CSIR on a continuous basis	2.00	To carry out an economic impact assessment of major technologies of national importance developed by CSIR	Identification of technologies of national importance developed by CSIR	Nos	1.00	2	1	0			2	100.0	1.0
			Preparation of impact assessment reports	Nos	1.00	2	1	0			2	100.0	1.0
8 Evaluation of outcome of erstwhile Schemes	4.00	Independent evaluation of Technology Development and	Submission of evaluation report to the department	Date	2.00	01.02.2014	15.02.2014	01.03.2014	15.03.2014	31.03.2014	30.09.2014	0.0	0.0

Performance Evaluation Report

Objective	Weight	Action	Success Indicator	Unit	Weight	Target/ Criteria Value					Achievement	Performance	
						Excellent	Very Good	Good	Fair	Poor		Raw Score	Weighted Score
						100%	95%	85%	70%	60%			
				Data									
				Nos									
				Data									
				%									
				Data									
				%									
				Data									
				%									

Annexure-Contd.

Performance Evaluation Report

Objective	Weight	Action	Success Indicator	Unit	Weight	Target / Criteria Value					Achievement	Performance	
						Excellent	Very Good	Good	Fair	Poor		Raw Score	Weighted Score
						100%	90%	80%	70%	60%			
		Implement ISO 9001 as per the approved action plan	% of implementation	%	2.0	100	95	90	85	80	100	100.0	2.0
		Identify, design and implement major innovations	Timely submission of Action Plan for enabling innovation	Date	2.0	15.05.2014	16.05.2014	19.05.2014	20.05.2014	21.05.2014	15.05.2014	100.0	2.0
		Identification of core and non-core activities of the Ministry/Department as per 2nd ARC recommendations	Timely submission	Date	1.0	24.03.2014	25.03.2014	26.03.2014	27.03.2014	28.03.2014	24.03.2014	100.0	1.0
* Improving Internal Efficiency/Responsiveness	2.00	Update departmental strategy to align with 12th Plan priorities	Timely updation of the strategy	Date	2.0	10.09.2013	17.09.2013	24.09.2013	01.10.2013	08.10.2013	30.09.2013	71.43	1.43
* Ensuring compliance to the Financial Accountability Framework	1.00	Timely submission of ATNs on Audit paras of C&AG	Percentage of ATNs submitted within due date (4 months) from date of presentation of Report to Parliament by CAG during the year	%	0.25	100	90	80	70	60	100	100.0	0.25
		Timely submission of ATRs to the PAC Sectt. on PAC Reports	Percentage of ATRS submitted within due date (6 months) from date of presentation of Report to Parliament by PAC during the year	%	0.25	100	90	80	70	60	100	100.0	0.25
		Early disposal of pending ATNs on Audit Paras of C&AG Reports presented to Parliament before 31.3.2013	Percentage of outstanding ATNs disposed off during the year	%	0.25	100	90	80	70	60	0	0.0	0.0
		Early disposal of pending ATRs on PAC Reports presented to Parliament before 31.3.2013	Percentage of outstanding ATRS disposed off during the year	%	0.25	100	90	80	70	60	100	100.0	0.25

* Mandatory Objective(s)

Total Composite Score : 71.64

CSIR Establishments

BIOLOGICAL SCIENCES

CSIR-CCMB	Centre for Cellular and Molecular Biology, Hyderabad
CSIR-CDRI	Central Drug Research Institute, Lucknow
CSIR-CFTRI	Central Food Technological Research Institute, Mysore
CSIR-CIMAP	Central Institute of Medicinal & Aromatic Plants, Lucknow
CSIR-IGIB	Institute of Genomics & Integrative Biology, Delhi
CSIR-IHBT	Institute of Himalayan Bioresource Technology, Palampur
CSIR-IICB	Indian Institute of Chemical Biology, Kolkata
CSIR-IIIM	Indian Institute of Integrative Medicine, Jammu
CSIR-IMTECH	Institute of Microbial Technology, Chandigarh
CSIR-IITR	Indian Institute of Toxicology Research, Lucknow
CSIR-NBRI	National Botanical Research Institute, Lucknow

CHEMICAL SCIENCES

CSIR-CLRI	Central Leather Research Institute, Chennai
CSIR-CECRI	Central Electrochemical Research Institute, Karaikudi
CSIR-CSMCRI	Central Salt & Marine Chemicals Research Institute, Bhavnagar
CSIR-CIMFR	Central Institute of Mining & Fuel Research, Dhanbad
CSIR-IICT	Indian Institute of Chemical Technology, Hyderabad
CSIR-IIP	Indian Institute of Petroleum, Dehradun
CSIR-NCL	National Chemical Laboratory, Pune
CSIR-NEIST	North-East Institute of Science and Technology, Jorhat
CSIR-NIIST	National Institute for Interdisciplinary Science and Technology, Thiruvananthapuram

ENGINEERING SCIENCES

CSIR-AMPRI	Advanced Materials and Processes Research Institute, Bhopal
CSIR-CBRI	Central Building Research Institute, Roorkee
CSIR-CGCRI	Central Glass and Ceramic Research Institute, Kolkata

CSIR-CMERI	Central Mechanical Engineering Research Institute, Durgapur
CSIR-CRRI	Central Road Research Institute, New Delhi
CSIR-IMMT	Institute of Minerals and Materials Technology, Bhubaneswar
CSIR-NAL	National Aerospace Laboratories, Bengaluru
CSIR-NEERI	National Environmental Engineering Research Institute, Nagpur
CSIR-NML	National Metallurgical Laboratory, Jamshedpur
CSIR-SERC	Structural Engineering Research Centre, Chennai

INFORMATION SCIENCES

CSIR-NISCAIR	National Institute of Science Communication and Information Resources , New Delhi
CSIR-NISTADS	National Institute of Science Technology and Development Studies, New Delhi
CSIR-4-PI	Fourth Paradigm Institute, Bengaluru

PHYSICAL SCIENCES

CSIR-CEERI	Central Electronics Engineering Research Institute, Pilani
CSIR-CSIO	Central Scientific Instruments Organisation, Chandigarh
CSIR-NGRI	National Geophysical Research Institute, Hyderabad
CSIR-NIO	National Institute of Oceanography, Goa
CSIR-NPL	National Physical Laboratory, New Delhi

UNITS

CSIR-HRDC	Human Resource Development Centre, Ghaziabad
CSIR-TKDL	Traditional Knowledge Digital Library, Ghaziabad
CSIR-URDIP	Unit for Research and Development of Information Products, Pune
CSIR-OSDD	Open Source Drug Delivery, New Delhi
CSIR-TRISUTRA	Translational Research and Innovative Science through Ayurgenomics, New Delhi

ABBREVIATIONS / ACRONYMS

AMPRI	Advanced Material and Processes Research Institute
APCTT	Asian and Pacific Centre for Transfer of Technology
CBDT	Central Board of Direct Taxes
CBRI	Central Building Research Institute
CCMB	Centre for Cellular and Molecular Biology
CDC	Consultancy Development Centre
CDRI	Central Drug Research Institute
CDS/ISIS	Computerized Data Services/Integrated Set of Information Systems
CECRI	Central Electrochemical Research Institute
CEERI	Central Electronics Engineering Research Institute
CFTRI	Central Food Technological Research Institute
CGCRI	Central Glass and Ceramic Research Institute
CII	Confederation of Indian Industry
CIMAP	Central Institute of Medicinal & Aromatic Plants
CIMFR	Central Institute of Mining and Fuel Research
CITT	Centre for International Trade in Technology
CLRI	Central Leather Research Institute
CMERI	Central Mechanical Engineering Research Institute
CRRI	Central Road Research Institute
CSIO	Central Scientific Instruments Organisation
CSIR	Council of Scientific & Industrial Research
CSMCRI	Central Salt & Marine Chemicals Research Institute
DBT	Department of Bio-Technology
DCPC	Department of Chemicals & Petrochemicals
DCSSI	Development Commissioner, Small Scale Industries
DRDO	Defence Research and Development Organization
DSIR	Department of Scientific & Industrial Research
ESCAP	Economic and Social Commission for Asia and the Pacific
EXIM	Export-Import

FC	Foreign Collaborations
FICCI	Federation of Indian Chambers of Commerce and Industry
ICAR	Indian Council of Agricultural Research
ICAS	Indian Council of Ayurveda & Siddha
ICMR	Indian Council of Medical Research
ICSSR	Indian Council of Social Sciences Research
ICSTI	International Centre for Science & Technology Information
IDAMS	Internationally Developed Data Management System
IGIB	Institute of Genomics & Integrative Biology
IGNOU	Indira Gandhi National Open University
IHBT	Institute of Himalayan Bioresource Technology
IICB	Indian Institute of Chemical Biology
IICT	Indian Institute of Chemical Technology
IIFT	Indian Institute of Foreign Trade
IIIM	Indian Institute of Integrative Medicine
IIP	Indian Institute of Petroleum
IISc	Indian Institute of Science
IIT	Indian Institute of Technology
IITR	Indian Institute of Toxicology Research
IMMT	Institute of Minerals and Materials Technology
IMT	Institute of Microbial Technology
INFLIBNET	Information Library Network
INSA	Indian National Science Academy
IPR	Intellectual Property Rights
ISRO	Indian Space Research Organization
ITPO	India Trade Promotion Organization
LAN	Local Area Network
LCA	Light Combat Aircraft
MDR	Multi Drug Resistance
MIT	Ministry of Information Technology
MoU	Memorandum of Understanding
NACIDS	National Access Centres to International Database Services
NAFEN	National Foundation of Indian Engineers
NAL	National Aerospace Laboratories
NBRI	National Botanical Research Institute
NCAER	National Council of Applied Economic Research
NCL	National Chemical Laboratory
NCSI	National Centre for Science Information

NEERI	National Environmental Engineering Research Institute
NEIST	North-East Institute of Science & Technology
NGRI	National Geophysical Research Institute
NICMAR	National Institute of Construction Management and Research
NID	National Institute of Design
NIDC	National Industrial Development Corporation
NIFT	National Institute of Fashion Technology
NIIST	National Institute for Inter-disciplinary Science and Technology
NIO	National Institute of Oceanography
NISCAIR	National Institute of Science Communication and Information Resources
NISTADS	National Institute of Science Technology and Development Studies
NMCC	National Manufacturing Competitiveness Council
NML	National Metallurgical Laboratory
NPL	National Physical Laboratory
NRDC	National Research Development Corporation
NRFC	National Register of Foreign Collaborations
NSTMIS	National Science and Technology Management Information System
PSU	Public Sector Undertaking
SERC	Structural Engineering Research Centre
SIRO	Scientific and Industrial Research Organization
SME	Small and Medium Enterprise.
TCO	Technical Consultancy Organization
TDB	Technology Development Board
TEDO	Technology Export Development Organization
TePP	Technopreneur Promotion Programme
TIFAC	Technology Information Forecasting and Assessment Council
TM	Technology Management
TQM	Total Quality Management
UGC	University Grants Commission
UNCTAD	United Nations Conference on Trade and Development
UNDP	United Nations Development Programme
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNIDO	United Nations Industrial Development Organization
WIPO	World Intellectual Property Organization

Council of Scientific & Industrial Research (CSIR)
Anusandhan Bhawan, 2 Rafi Marg,
New Delhi 110001
http://csir.res.in

Consultancy Development Centre (CDC)
2nd Floor, Core IV-B, Indian Habitate Centre
Lodhi Road, New Delhi -110003
http://www.cdc.org.in

National Research Development Corporation (NRDC)
20-22, Zamroodpur Community Centre,
Kailash Colony Extension,
New Delhi 110 048
Website: http://www.nrdcindia.com

Central Electronics Limited (CEL)
4 Industrial Area, Sahibabad 201010
Uttar Pradesh
http://celindia.co.in