

ANNUAL REPORT

1996-97



Department of Scientific & Industrial Research
Ministry of Science and Technology
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I (A). AN OVERVIEW

1.1 The formation of the Ministry of Science and Technology was announced through a Presidential Notification dated January 4, 1985 (74/2/1/8. Cab.) contained in the 164th Amendment of the Government of India (Allocation of Business) Rules, 1961; the Department of Scientific and Industrial Research (DSIR) forms a part of this Ministry.

The Minister In-charge is Prof. Y.K. Alagh, Minister of State (Independent Charge) of the Ministry of Planning and Programme Implementation and the Ministry of Science and Technology.

1.2 The Department of Scientific and Industrial Research (DSIR) comprises of the activities of the Council of Scientific and Industrial Research (CSIR), Departmental Schemes viz. *Research and Development by Industry (RDI)*, Programme Aimed at Technological Self Reliance (PATSER), Scheme to Enhance the Efficacy of Transfer of Technology (SEETOT) and National Information System for Science and Technology (NISSAT) and two Public Enterprises viz. National Research Development Corporation (NRDC) and Central Electronics Limited (CEL).

1.3 Council of Scientific and Industrial Research (CSIR) today has a network of 40 laboratories and 80 field stations/extension centres/regional centres located all over the country that undertake R&D in various areas and disciplines. The areas vary from molecular biology to metallurgy, from seismicity to science policy, from aerospace to ocean sciences, from glass to steel, and so on. The extension and regional centres have been established to reach the diverse users and disseminate knowledge and information on R&D capabilities, techniques and technologies developed by the National Laboratories. The first three years of the Eighth-Five Year Plan were in effect the years of structural readjustment and change. In consonance with the changes

taking place in the economy, CSIR itself initiated and implemented debureaucratisation and devolution of autonomy and flexibility in decision making down the line to the laboratory level so as to make the system more user responsive and driven. Also, prudent computerised financial management systems were evolved and put in place to closely monitor the proper utilisation of the limited financial resources. The success achieved in the endeavours has been resounding; external cash flow had increased to an unprecedented Rs.177 crore during 1995-96 (from Rs. 138 crore in 1994-95), technologies generated nearly doubled during 1995-96 and patents filed abroad increased by nearly 100%. The success emboldened CSIR to chart out an ambitious agenda for the future where it seeks to emerge as a path setter in the shifting paradigm of self financing industrial R&D organisations the world over. The elements of a White Paper on 'Realising the Potential of CSIR' were presented to CSIR Society, Advisory Board and collectively to all the Directors. The vision, the strategy, and the road map to realise the goals have been endorsed by all these sections. The White Paper 'CSIR 2001: Vision & Strategy' is now being implemented in the CSIR.

The elements of strategy to achieve the targets set in the white paper CSIR vision 2001 are to : Reengineer the organisational structure; Link CSIR R&D to market needs; Mobilise and optimise the resource base; and invest in high quality science that will be the harbinger for future technologies.

Some of the recent achievements of CSIR covering a wide spectrum are as follows:

NAL, Bangalore handed over the Co-cured, Co-bonded composite fin and rudder of the LCA to ADA. As part of the National Control Law team from LCA, NAL undertook digital control law development and

design for the LCA TD 1 and TD 2 versions. A dedicated shake test facility developed at NAL was delivered to HAL for Advanced Light Helicopter Series. NBRI, Lucknow developed a method which allows the synthesis and assembly of long double stranded DNA molecules, quickly, simply and efficiently, CBT, Delhi has developed a novel process for synthesis of DMTr Cl. For the first time, propagation of endangered wild life species by genetic finger printing of the individual animals to raise healthy offsprings from select parents chosen on the basis of their genetic endowments has been undertaken at CCMB, Hyderabad. DNA genotyping of silkworms for sericulture industry is also taken up for the first time at CCMB, Hyderabad. A new strain selectant of Ashwagandha developed by RRL, Jammu yields 1000 Kg/ha of roots and is suitable for cultivation in dry and semi arid regions. CIMAP has developed and standardised bench scale processes for extracting colouring materials from plant sources which are safe as food dyes. NIO has isolated a compound from a marine sponge which is a promising environmentally friendly substitute for the generally toxic antifouling chemical. Development of a low pressure synthesis of cobalt carbonyl catalyst was taken up at IICT. A water based bitumen emulsion developed at CMRI is useful in prevention of spontaneous heating in coal mines and to prevent air permeation in coal dumps storage. CSMCRI has developed TFC membrane for desalination of seawater in single pass. A prototype unit was supplied to CLRI, Madras for further studies. CECRI has developed a cement polymer composite coating system for corrosion protection. A cap sensitive explosive composition suitable for rock excavation, shaft shrinking, road construction etc. has been developed by CMRI. IIP has developed an innovative energy efficient and environment friendly process for the extraction of lube stock. IICT has developed an innovative method for making Mefloquine which dispenses with the use of alkyl lithium reagent. IICT also has developed a process for commercial production of Ondansetron which is used in Cancer treatment. A new anti-leishmanial compound was isolated by IICB. CDRI has developed and standardised extract of Brahmi on the basis of the active chemical constituents. A simple and cost effective method for the conversion of the taxol xyloside into taxol has been developed by CIMAP. Technology for two way non-noble metal catalytic converter for gasoline driven vehicles and a particulate trap for diesel driven vehicles developed at NEERI was transferred to industry.

A chemo biochemical technology for desulphurization of gaseous fuels and emissions has been developed by NEERI. An integrated biotechnological approach for bioremediation of mine spoil dumps has been developed by NEERI. Work carried out by CMRI in collaboration with other agencies has led to the development of a system of dense filling of underground mines with fly ash and bottom ash. A microprocessor based drug infusion pump and controller has been developed by CSIO. CSIO has also developed a servo controlled baby care incubator.

Design for an automatic machine for continuous production of 600 chapaties per hour has been optimised by CFTRI. A process for cooking rice in two stages has been developed at CFTRI. RRL, Thiruvananthapuram has standardised a method of decolourisation of palm oil using kaolinitic clays from Kerala. CBRI has developed non-auto claved cellular concrete blocks. A novel high performance polymer modified bitumen binder has been developed by CRRI. INSDOC has designed and developed 'Granthalaya', a user friendly integrated library automation package conforming to international standards. INSDOC has also developed a pilot electronic library. NISCOM has acquired expertise and facilities for processing data through the premastering and mastering stages for production of CD-ROMS. NISCOM has made available three journals on Internet. CMERI has developed a machine that can be used with any natural fibre and yields yarn of better quality and strength. MERADO, Madras has developed a twin screw press for extraction of palm oil with a nominal processing capacity of 5 tonnes per hour. A new technique has been developed at RRL, Bhubaneswar for extraction of potash from feldspar. NML has designed and installed a semi commercial floatation column for industrial applications. CGCRI has developed a thin film ceramic sensor for LPG leak alarm. CGCRI has also developed an innovative process to nodulise rice husk ash for steel melting. Technology for recovery of coal from 6 to 10 m thick seam pillars under shallow to deep cover has been developed by CMRI.

Under the Basic Research, IMT, IICB and other agencies have initiated a collaborative project to develop a naturally occurring non-toxinogenic clinical isolate to construct the live oral vaccine strain for cholera. CCMB has been studying the mechanisms responsible for the

spontaneous regression of a macrophage tumour in syngenic rats. CFTRI has purified and characterised enzymes for food processing industries. CBT is the first to propose that liposomes will be good carriers of allergens for safe and effective immunotherapy. CBT has identified and characterised a glucose specific lectin from peanut roots. These findings can be utilised to identify host specific rhizobia from soils using lectin as a tool. RRL, Thiruvanthapuram has synthesised chiral intermediates useful in the elaboration of biologically active natural products belonging to the drimanes, labdanes family. The possibility of making chloroquine resistant malarial parasite susceptible to chloroquine with the help of resistance reversal agent has been established by CDRI. NCL has shown that catalysis at the interface of a two phase system can be enhanced by using a promoter ligand in the organic phase which will bind to the organometallic catalyst and thus increase its concentration close to the interface in the aqueous phase. A novel methodology of using a rotating drum bio reactor for carrying out the bio transformations using immobilised bio-catalyst for bench scale reactions has been designed by IICT. RRL, Thiruvananthapuram has synthesised a new class of squaraine dyes that contain an ionophoric moiety. Possibilities of using sisal fibre because of its high tensile modulus and low elongation at break point has been researched at CBRI. This has promising prospects in building industry for making alternate building materials which are low cost. Exhaustive work done at NAL has enabled it to develop expertise to do stress analysis by X-ray diffraction.

1.4 The major programmes of the Department of Scientific and Industrial Research (other than CSIR) have been grouped as under:

- I Research and Development by Industry (RDI) consisting of:**
 - (a) In-house R&D in Industry.
 - (b) Scientific and Industrial Research Organisations (SIROs).
 - (c) Fiscal Incentives for Scientific Research.
- II Programme Aimed at Technological Self-Reliance (PATSER) consisting of:**
 - (a) Development of new or improved technologies.
 - (b) Development of special/custom built Capital Goods.
 - (c) Absorption and Adaptation of imported technology.

- (d) Studies and interactions concerning Technology Evaluation and pre-industry feasibility of major sectors/products.
- III Scheme to Enhance the Efficacy of Transfer of Technology (SEETOT) consisting of:**
 - (a) National Register of Foreign Collaborations (NRFC).
 - (b) Industrial Technology
 - (c) Transfer and Trading in Technology (TATT).
 - (d) Promotion and Support to Consultancy Services (PSCS) which also include the Consultancy Development Centre (CDC).
- IV Linkages with International Organisations**
- V National Information System for Science and Technology (NISSAT).**
- VI Public Enterprises viz.**
 - (a) National Research Development Corporation (NRDC).
 - (b) Central Electronics Limited (CEL).

1.5 Research and Development by Industry (RDI).

DSIR is the nodal department for granting recognition to In-house Research and Development Centres; there were 1256 units having valid recognition as on 31 December 1996. 250 In-house R&D Centres incurred an annual expenditure of over Rs. 1 crore each. During the year, 54 In-house R&D centres were accorded fresh recognition and 308 centres were accorded renewal of recognition. During the year 1996-97, 12 publications were brought out; Tenth National Conference on In-house R&D in Industry was organised; DSIR National Awards were presented to 7 industrial units. 4 issues of In-house R&D in Industry Update were brought out.

Scientific Research foundations in the area of medical, agriculture, natural and applied sciences and social sciences seek DSIR approval as Scientific and Industrial Research Organisations (SIROs) under the DSIR scheme of approval of SIROs. SIROs approved by DSIR are eligible for notification under 35(1)(ii)/(ii) of I.T. Act 1961 and for availing customs duty exemption on import of equipment. During the year, 35 new SIROs have been accorded DSIR recognition and 165 SIROs

have been accorded renewal.

New plant and machinery set up based on indigenous technology and duly certified by DSIR is eligible for accelerated depreciation allowance at 40% (as against normal 25%) under Rule 5(2) of I.T. Rules. During the year, 13 certificates involving Rs.9694 lakhs as cost of plant and machinery set up based on indigenous technology were issued by DSIR.

The Government have introduced three new incentives related to Commercial R&D companies, Excise Duty Waiver and Customs Duty Exemption on Goods imported for use in Government Funded R&D projects. These are being operationalised by the DSIR. DSIR is the nodal department for registration of Public funded research institutions/Universities/IIT/IISc Bangalore/RECs for availing Customs Duty Exemption in terms of Notification No.51/96 dated 23, July 1996. During the year, nearly 600 such institutions were registered with DSIR.

1.6 Programme Aimed at Technological Self Reliance (PATSER)

Under the 'Programme Aimed at Technological Self Reliance' (PATSER), the department has provided partial financial support to about 80 industrial units for Research, Design, Development and Engineering (RDDE) projects in development and demonstration of new / improved products and process technologies, absorption and upgradation of imported technologies. The projects in progress include those of IBP Co. Ltd. concerning development of site mixed slurry explosives and heat resistant fields, SCL concerning ASICs for line card and conference card for C-DOT Exchanges, TCCL concerning development of process technology for manufacture of synthetic rutile, FACT concerning development of slow release fertilizers, MIDHANI concerning development of technology for welding of molybdenum wire to make 20 kg coil, bulk filtration of liquid metal and development of alloy steel wire with high surface finish, MECON concerning development of under burden probe for accurate analysis of hot gases, Tungabhadra Steel Products Ltd. for development of rubber seal clad with PTFE for hydraulic dam gates, SCL and C-DAC concerning development of ASIC for GIST-II and related card, SCL and ER&DC concerning development of ASIC for microprocessor based power

controller and STD/PCO machine, SCL and IRDI concerning development of ASIC for MPEG-2 decoder, SCL and BHEL concerning development of ASIC base Electronic Energy Meter, BEML concerning development of 10 Ton Backhoe hydraulic excavator, computerised transmission control for dump trucks, cast crank shaft and 460 HP wheel dozer, Turbotech Precision Engineering Pvt. Ltd., NAL and Sakthi Sugar concerning development of Low Cost Gas Turbine Generator of 500 KW power class with multifue capability using bio-gas, natural gas and diesel fuel, Andrew Yule & Co. Ltd. for development of rough top conveyor belting, Tamil Nadu Petro Products and IIF for development of technology for long-chain alcohol and multifunctional additives for fuel oils and diesel oils, Encon Thermal Engineers and IIP for development of natural gas fired industrial gas burners, ECIL and CRRIL for development of microprocessor controlled nuclear moisture and density gauge, NMDC and IICT concerning development of pigment grade ferric oxide from blue dust, NALCO concerning development of technology for special grade aluminas and hydrates, T Stanes & Co. Ltd. for development of digested organic suppliment and CEL and C-DAC for development of solid state interlocking system for Railways. The completed technology projects have resulted in significant technological and commercial returns to the industries concerned. The on-going projects are expected to result in high commercial / societal impact and will lead to commercialisation and utilisation of state-of-the-art technologies.

Technology evaluation reports in 18 sectors / products such as Electrical motor, Fruit juices, Garments, Paper mills and Textile Spinning - Weaving and Processing, etc. are under print.

1.7 Scheme to Enhance the Efficacy of Transfer of Technology (SEETOT)

The Department continued its activities relating to the scheme on National Register of Foreign Collaborations. A compilation of primary data on Foreign Collaborations approved for the year 1995 was brought out. During the year, reports on technology status of various sectors/products like high fructose corn syrup and artificial sweeteners, printing inks, carbon tetrachloride, polybutadiene, electric arc furnace, drilling/oil field chemicals etc. were finalised. With a

view to enhance capabilities in the area of Technology Management, a programme has been launched. A project in association with Administrative Staff College of India concerns with case studies of manufacturing organisations and bringing out bibliographies on various technology management areas. Assistance was rendered to some institutes in designing technology management capsules for inclusion in their curricula. Interaction meets organised include, awareness programmes on Intellectual Property System, round table conference of Chief Executives on Intellectual Property Rights for competitiveness and a lecture under the Distinguished Technologists Lecture series.

Under the scheme on Transfer and Trading in Technology, activities supported include, a study on capabilities for export of non-conventional technology intensive consultancy services from India and a project on export market development for solar photovoltaic technology and system. A compendium on technologies exported during 1994-95 was brought out. Technology demonstration project on Iono-oxidation technique of effluent treatment was concluded. Four reports relating to Technology Profiles of South Africa, Zaire and Vietnam and Technology Export Potential of Agro based Industry were printed.

The scheme relating to Promotion and Support to Consultancy Services essentially aims to strengthen consultancy capabilities for domestic and export markets. The activities have been mainly towards completing the studies already initiated prior to 1993 towards documenting consultancy needs and capabilities in important industrial sectors and at State levels, and providing institutional and programme support to Consultancy Development Centre (CDC).

CDC was promoted in January, 1986 as a non-profit society, with a view to implement some of the programmes of DSIR. CDC is implementing a programme on Consultancy Development Promotion Assistance (CDPA) scheme, maintains a computerised database on consultants, organises training and human resources development programmes for promoting consultancy, and conducts programmes sponsored by other agencies. DSIR is providing recurring and non-recurring support to CDC. To enhance technological and managerial capabilities of consultants as well as

export capabilities, interactions with international organisations such as World Bank, APCTT, ITC and ESCAP were organised by CDC. Under the post graduate degree (MS) programme in Consultancy Management in association with BITS, Pilani, 26 trainees of the 2nd batch and 6 trainees of 1st batch were undergoing training.

1.8 Linkages with International Organisations

During the year, the Department continued to participate in the activities of various international organisations such as UNCTAD, WIPO, UNIDO, ESCAP and APCTT at various levels and forums on issues related to Technology Development and Technology Transfer in coordination with other concerned Ministries.

DSIR participated in the Twelfth Technical Advisory Committee meeting of Asian and Pacific Centre for Transfer of Technology (APCTT) and the 11th session of the Governing Board of APCTT held in Kathmandu.

'Umbrella Agreement' between the State of Israel and Republic of India on cooperation in the field of Industrial and Technological Research and Development was signed on 30 December 1996 in New Delhi.

1.9 National Information System for Science & Technology (NISSAT)

National Information System for Science & Technology (NISSAT) promotes and supports the development of a compatible set of information systems on science and technology and interlinks these into a network to facilitate the effective transfer of latest information to users in all parts of the country.

NISSAT programme continued support to 12 information centres and nine NISSAT Access Centres to International Database Services (NACIDS) to meet information needs of scientists, technologists and decision makers. The activities of the NISSAT centres were augmented and their services and revenue generation improved. The NISSAT Access Centres on International Databases Services continued services on full-cost recovery basis.

Six metropolitan library networks in Calcutta, New Delhi, Bombay, Pune, Ahmedabad and Mysore continued their services related to interlinking of information resources in a metropolitan area. NISSAT established Value Added Patent Information System (VAPIS) at NCL, Pune and CMTI, Bangalore to offer specialised value added information services.

Selective Dissemination of Information (SDI) is provided by institutions by using databases like ADONIS, BIOSIS, BNB, BOOKFIND, COMPENDEX, CHEMBANK, DISCOVER, IFIS, INSPEC, NTIS, TTD, World Research Database and ISDS,

Library automation software programmes viz. SANJAY and TRISHNA were developed and maintained.

The quarterly NISSAT Newsletter viz. Information Today & Tomorrow (ITT) is produced in cooperation with NISSAT centre at CLRI, Madras for dissemination of information activities.

1.10 Public Enterprises

Two public enterprises namely, National Research Development Corporation (NRDC) and Central Electronics Limited (CEL) attached to the DSIR were engaged in important activities of development and commercialisation of indigenously developed technologies.

Some of the major technologies licensed by NRDC during 1995-96 include Invert Sugar, Zeolite A Powder - Detergent grade, Resorcinol, glycol based automobile coolant and BOD Biosensor. The ongoing projects include : Glucose Biosensors, Single Piece Intra Ocular

Lenses, Sand Lime Bricks and Carbon Fibre for Braiding Applications. The Corporation has successfully completed the exported projects related to preparation of project report for setting up 4 STEPs in Egypt and identification of projects for an industrial park in Gabon.

Central Electronics Limited (CEL) holds a unique position among the family of Public Sector Enterprises in electronics, 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. The activities of CEL are sharply focused in three thrust areas:

- (i) Solar photovoltaics cells, modules and systems for a variety of applications.
- (ii) Selected Electronic Systems-Equipment for Railway Signaling and Safety, Cathodic Protection Equipment for Oil Pipelines, Switching Systems and Very Small Aperture Terminals (VSATs).
- (iii) Selected Electronic components-Professional (Soft) Ferrites, Electronic Ceramics, Piezo Electric Elements and Microwave Components.

CEL has been the pioneer in the country in the areas of solar photovoltaics, ferrites and piezo ceramics. Today, it enjoys the international status of being among the top producers of single crystalline silicon solar cells in the world.

2.0 During the year 1996-97, there was an alround progress and growth in the activities under different programmes of DSIR.

I(B). FINANCIAL SUMMARY

The financial summary giving the Actuals 1995-96, BE 1996-97, RE 1996-97 and BE 1997-98 of various Plan and Non-Plan schemes (headwise/
broad category wise) is as under:-

(Rs. in crores)													
Sl. No.	Head of Development Projects Programmes/Schemes	Actual Expenditure 1995-96			Budget Estimates 1996-97			Revised Estimates 1996-97			Budget Estimates 1997-98		
		Plan	Non-Plan	Total	Plan	Non-Plan	Total	Plan	Non-Plan	Total	Plan	Non-Plan	Total
1.	Assistance to Council of Scientific and Industrial Research	160.00	251.68	411.68	161.00	251.68	412.68	161.00	278.00	439.00	204.00	410.05	614.05
2.	Technology Promotion Development and Utilisation Programme	6.09	0.04	6.13	16.27	0.07	16.34	16.27	0.07	16.34	18.30	0.07	18.37
3.	Research and Development	2.24	0.00	2.24	2.15	0.00	2.15	2.05	0.00	2.00	2.00	0.00	2.00
4.	Investment in Public Enterprises												
4.1	Central Electronics Limited	3.77	0.00	3.77	3.05	0.00	3.05	3.05	0.00	3.05	2.50	0.00	2.50
4.2	National Research Development Corporation	0.15	0.00	0.15	0.20	0.00	0.20	0.20	0.00	0.20	0.25	0.00	0.25
	Total (1 to 4)	172.25	251.72	423.97	182.67	251.75	434.42	182.57	278.07	460.64	227.05	410.12	637.17
5.	Loans of Public Enterprises												
5.1	Central Electronics Limited	3.77	0.00	3.77	3.05	0.00	3.05	3.05	0.00	3.05	2.50	0.00	2.50
5.2	National Research Development Corporation	0.15	0.00	0.15	0.20	0.00	0.20	0.20	0.00	0.20	0.25	0.00	0.25
	Total (5)	3.92	0.00	3.92	3.25	0.00	3.25	3.25	0.00	3.25	2.75	0.00	2.75
6.	Secretariat Economic Services	0.00	1.14	1.14	0.08	1.22	1.30	0.08	1.35	1.43	0.20	1.42	1.62
7.	Support to CEL for VRS	2.59	0.00	2.59*	1.00	0.00	1.00*	1.00	0.00	1.00*	0.00	0.00	0.00
7.1	Deduct Expenditure from NRF	-2.59	0.00	-2.59	-1.00	0.00	-1.00	-1.00	0.00	-1.00	0.00	0.00	0.00
	Grand Total	176.17	252.86	429.03	186.00	252.97	438.97	185.90	279.42	465.32	230.00	411.54	641.54

* Note : This does not constitute a net expenditure to the Govt. as this is matched by an equivalent recovery from the National Renewal Fund.

II. COUNCIL OF SCIENTIFIC & INDUSTRIAL RESEARCH (CSIR)

1. INTRODUCTION

Council of Scientific and Industrial Research (CSIR) today has a network of 40 laboratories and 80 field stations/extension centres/regional centres located all over the country that undertake R&D in various areas and disciplines. The areas vary from molecular biology to metallurgy, from seismicity to science policy, from aerospace to ocean sciences, from glass to steel, and so on. The extension and regional centres have been established to reach the diverse users and disseminate knowledge and information on R&D capabilities, techniques and technologies developed by the National laboratories. The first three years of the Eighth-Five Year Plan were in effect the years of structural readjustment and change. In consonance with the changes taking place in the economy, CSIR itself initiated and implemented debureaucratisation and devolution of autonomy and flexibility in decision making down the line to the laboratory level so as to make the system more user responsive and driven. Also prudent computerised financial management systems were evolved and put in place to closely monitor the proper utilisation of the limited financial resources. The success achieved in the endeavours has been resounding; external cash flow had increased to an unprecedented Rs.177 crore (from Rs. 138 crore in 1994-95), technologies generated nearly doubled in the year and patents filed abroad increased by nearly 100%. The success emboldened CSIR to chart out an ambitious agenda for the future where it seeks to emerge as a path setter in the shifting paradigm of self financing industrial R&D organisations the world over. The elements of a White Paper on 'Realising the Potential of CSIR' were presented to CSIR Society, Advisory Board and collectively to all the Directors. The vision, the strategy, and the road map to realise the goals have been endorsed by all these sections. The White Paper 'CSIR 2001: Vision & Strategy' is now being implemented in the CSIR.

1.1 Policy Initiatives

The White Paper defines for the first time a mission for CSIR as:

"To provide scientific & industrial R&D that maximises the economic, environmental and social benefits for the people of India".

The realisation of CSIR's Mission is envisaged through appropriate technology development efforts viz.

Technology for Economic Growth

- (a) partnering Indian industry to emerge as a significant global player, and
- (b) assisting in deriving enhanced value from indigenous resources.

Technology for Human Development

Providing S&T based solutions to improve the quality of life of the people and to ameliorate poverty.

Science for Technology

Encouraging, directing & nurturing highest quality of science for innovative technology development.

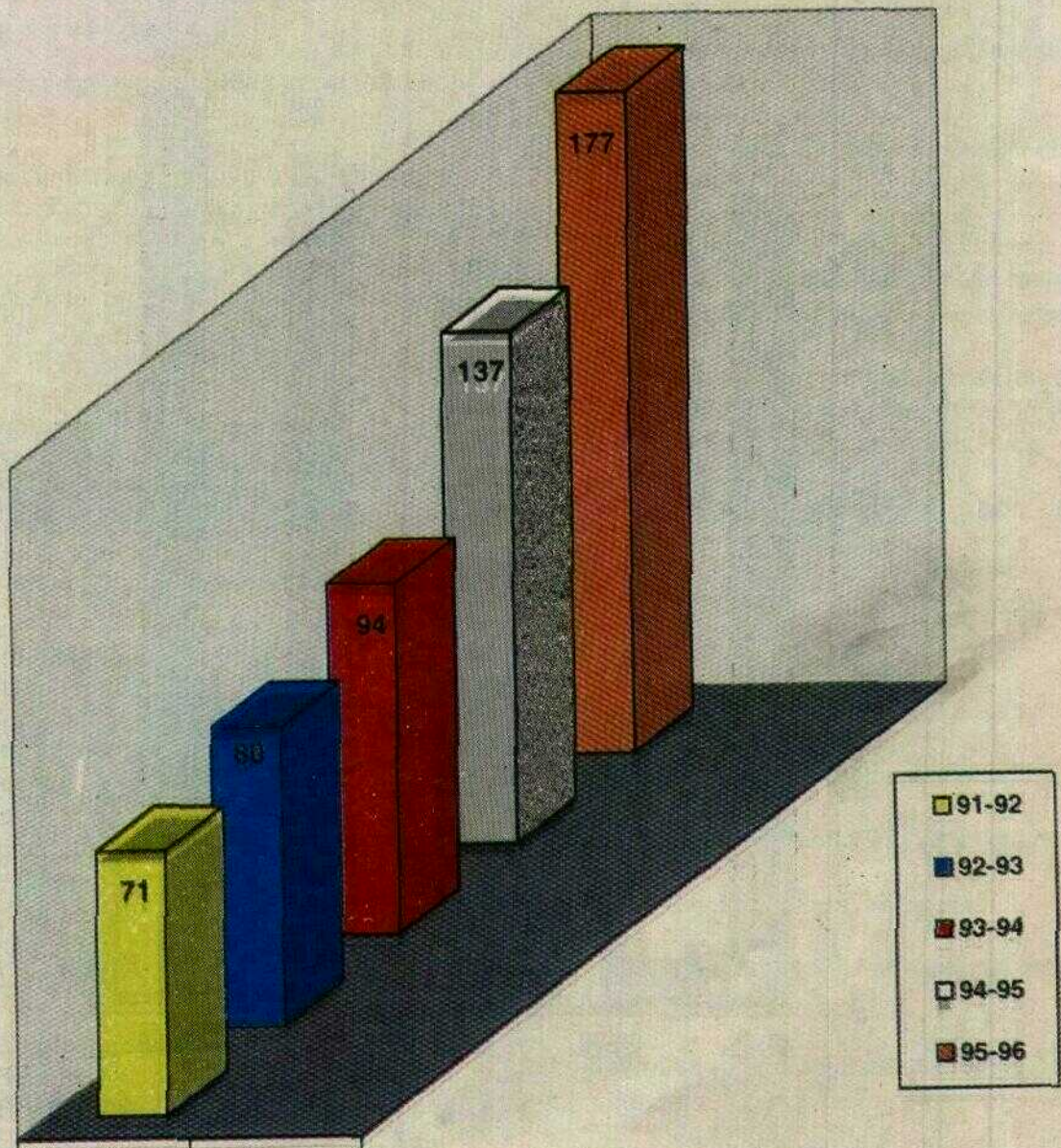
1.2 The Strategy

The elements of strategy to achieve the targets are to:

- (a) Reengineer the organisational structure
- (b) Link CSIR R&D to market needs
- (c) Mobilise and optimise the resource base

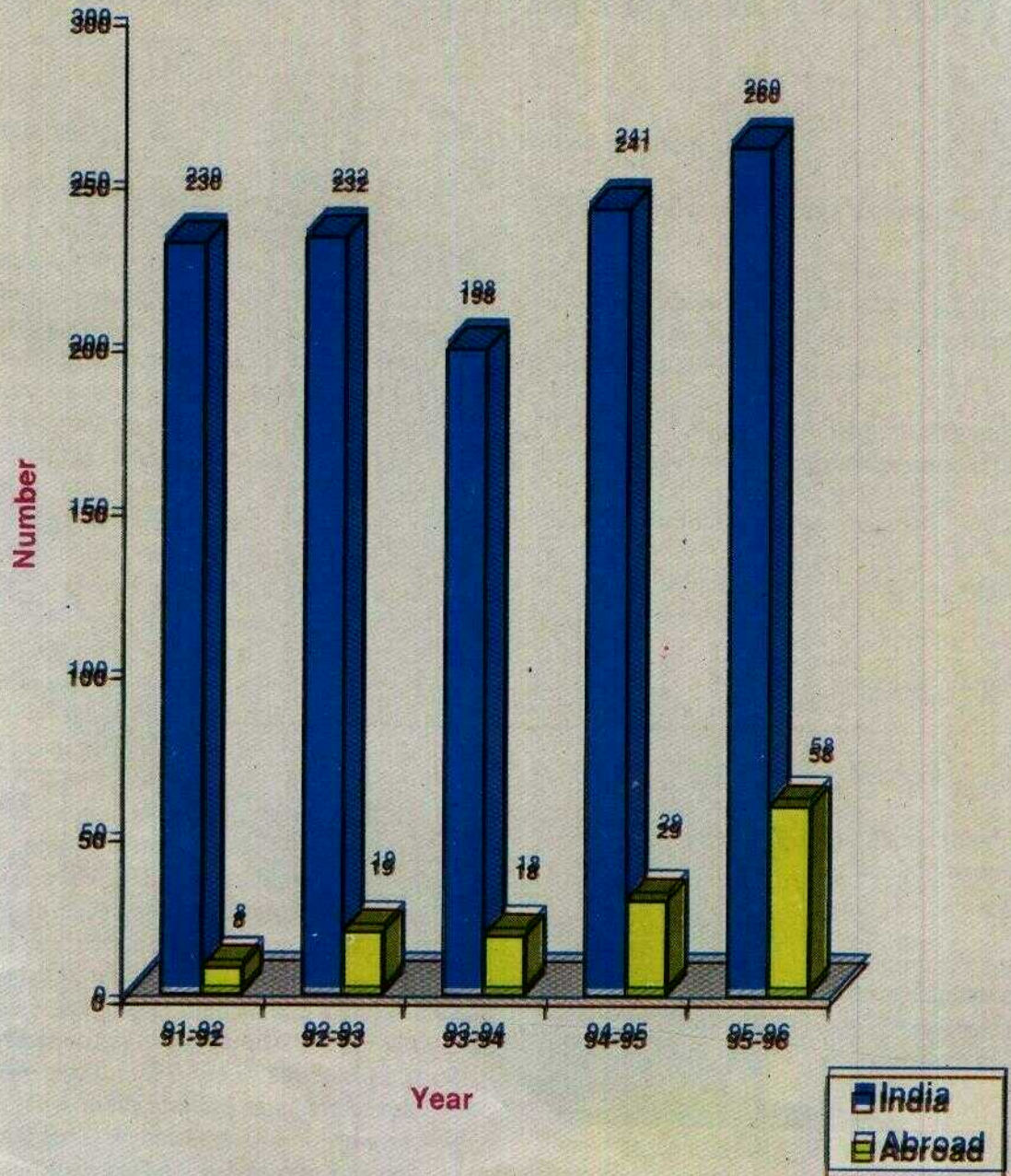
EXTERNAL CASH INFLOW Contract R&D and Consultancy

(Rs. Crore)



II.1 External Cash Inflow through contract R&D and Consultancy

PATENTS FILED



II.2 Patents Filed

- (d) Invest in high quality science that will be the harbinger for future technologies

The details of the elements have been worked out as follows:

- (a) Reengineering the organisational structure by:

- Inculcating a corporate culture
- Defining new role of HQ as a policy maker, a catalyst and a facilitator
- Revamping management structures at HQs and laboratories
- Realising functional autonomy by reformulation of rules and procedures (recruitment, purchase, travel, audit)
- Negotiating for performance linked autonomy

- (b) Linking CSIR Research to Market Needs through:

Reorienting programmes and activities

- Viewing research as a business
- Evolving business plans for each laboratory by involving professional consultants
- Emphasizing programmes that maximise value addition and returns
- Defining niche areas and shedding non viable programmes
- Balancing R&D portfolio that creates new markets and responds to existing markets
- Promoting synergistic inter lab projects through special funding operated through TABs
- Operationalising effective marketing systems
- Establishing professional marketing groups in all labs
- Setting up commercial arms for selected Labs
- Revitalising Scientist Entrepreneur scheme to set up spin off firms

- Acting as technology scouts for Indian/Foreign organisations (Search, Evaluate, Select, Transfer, Upgrade, Value Add)

- Targeting large business houses & MNCs for R&D partnerships

- (c) Stimulating IPR Oriented Outlook

- Providing IP leadership to the nation
- Enunciating CSIR IPR policy in tune with the national policy
- Launching an active implementation of CSIR IPR policy in Labs
- Developing skills through training in India/abroad to understand, interpret and analyse the technological information in patent documents
- Involving professional consultants for establishing systems/ procedures to record, document and capture results and data
- Stimulating enhanced IP creation through incentives and rewards
- Marketing and leveraging patent portfolios to generate alliances globally

- (d) Mobilising/Optimising Resource Base by:

Reengineering & Management of Human Capital

- Enhancing the productivity of human capital
 - Evolving long range HRM plans
 - Enhancing avenues for professional and career advancement
 - Providing professional training for R&D support groups
- (Administration, finance, materials and information)
- Rejuvenating the aging organisation through large influx of young talent

(e) Mobilising and Management of Financial Resources

- Setting up a strategic group for resource mobilisation
- Adopting novel routes to financing R&D in labs
- Allocating resources to labs based on performance and output
- Using fully underutilised assets
- Creating Enabling Infrastructure
- Launching a major modernisation drive
- Improving intra lab, interlab and international communication through extensive computer networking
- Improving housing satisfaction especially for younger people

1.3 CSIR Vision 2001

The White Paper has set quantifiable targets to achieve viz.,

- Move towards the path of self financing : Aim to generate 50% of overall budget or 100% operational expenditure from non governmental sources
- Develop exclusive knowledge based technologies (e.g. new catalysts, new materials, bioactive molecules, biotechnology, information technology, environmental technology)
- Aim to hold a patent bank of 500 Foreign Patents (up from < 50)
- Reach annual earnings of \$ 50 million by providing from global R&D services (up from < \$2 million)
- Realise at least 10% of operational expenditure from intellectual property licensing (up from < 1%).

1.4 Implementation

Some of the concepts outlined in the White Paper have already been operationalised namely:

- (a) Restructuring of the HQs by formation of appropriate functional Divisions for Research & Development Planning and Business Development, Intellectual Property Management, International Scientific and Technology Affairs, Societal and Technology Missions and Rural Technology.
- (b) Enunciation and adoption of Intellectual Property Policy: CSIR is the first organisation in the country to announce an Intellectual Property Policy. CSIR not only files and owns more patents than any other organisation but has (perhaps) the best understanding of Intellectual Property strategy in the country. It is thus continuing initiatives to not only educate its own people in patent literacy but also externally as well. It has taken pioneering initiatives to establish value added patent information service for the chemical industry and is spearheading other diverse initiatives as well.
- (c) Forging synergistic alliances with diverse agencies of the innovation chain.

MoUs have been executed with ICICI, CII & FICCI and Global Exchange of Technology, USA & Hawk Petroleum Co. Ltd., Singapore for marketing of CSIR technologies/expertise in US and ASEAN markets. The CSIR-ICICI MoU is the first ever alliance of a major financial institution with a research organisation. Inter alia it seeks for CSIR scientists to get hands on training in project appraisal and be nominated on Boards of Directors of ICICI assisted companies. It is envisaged that these umbrella MoUs will significantly enhance CSIR's standing in the market place.

- (d) Professional Indian consultants have been engaged to prepare studies on restructuring of HQs and suggest system of resource allocation to labs and for preparation of a Business Plan for two laboratories (NEERI, IIP). Assistance of World Bank to provide international resource persons to review these studies is being sought.

- (e) Every laboratory has prepared its Human Resource Management Plan, these are being vetted for fine tuning and implementation.

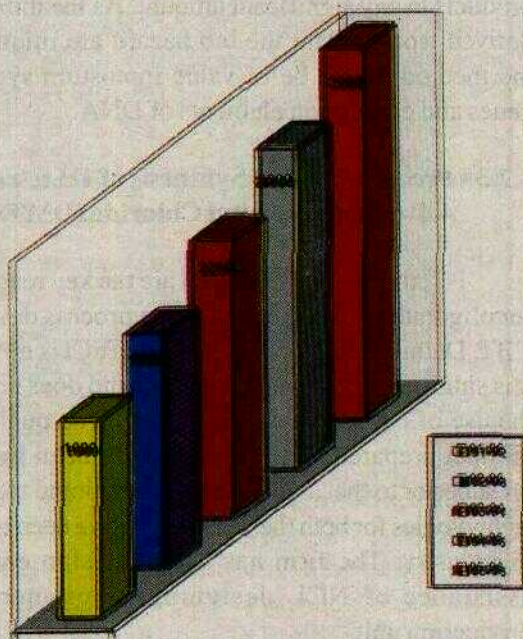
Despite these and other new initiatives, much still needs to be done to create a vibrant and modern network of laboratories that share a focused corporate vision but have the flexibility and freedom to operate individually.

2. SCIENTIFIC & TECHNOLOGICAL ACHIEVEMENTS

It may be pertinent to mention that CSIR carries out R&D and provides services of value not only to industry but also to other diverse sectors of the economy e.g. agriculture, health, energy, rural development, transport & defence. CSIR's assistance to domestic industry is not only by way of relevant/competitive technologies but also through search of raw materials and components, pollution control, productivity enhancement etc. A few of the more significant indicators are shown in the charts and some of the recent achievements covering a wide canvass are listed here.

ANNUAL INDUSTRIAL PRODUCTION BASED ON CSIR KNOWHOW

(Rs. Crore)



11.3 Annual Industrial Production based on CSIR know-how

2.1 Aerospace

2.1.1 Support to LCA Programme

(a) LCA Fin and Rudder

NAL handed over the CO-cured, CO-bonded composite fin and rudder of the LCA to ADA on 8

September 1995. This development signifies a major step towards achieving self-reliance in strategic technologies. Both the fin and rudder have been developed according to specially formulated quality procedures using CO-curing fabrication technology which has facilitated effective consolidation of parts, there now being only 7 major parts. Also, a new method has been developed to carry out non-destructive evaluation of CO-cured components using through transmission squirter type ultrasonic C-scan system.

The rudder designed by HAL (ADA) was fabricated by NAL using composite tools. The rudder comprises of integral rib-skin construction for inter spar box (ISB) and has a sandwich aft box. The ISB has been produced as a single jointless CO-cured unit using composite tooling with inflatable rubber mandrills. Specially designed composite moulds have been used for skin-core bonding of the sandwich aft box. The fin and rudder were assembled using jigs and fixtures, developed in-house.

(b) LCA CFC wings

The first set of CFC wings for use on the LCA were delivered to HAL/ADA by NAL in October 1995. The wings were subjected to ground vibration testing and their performance was found to be close to theoretical predictions. It is expected that NAL will complete the task of delivering the sets of CFC wings for LCA by March 1997.

(c) LCA Control Law

The performance (manoeuvrability, control etc.) of a fighter aircraft is largely dependent on the quality of the flight control software available on the aircraft's on board computer. As part of the National Control Law team for LCA, NAL undertook digital control law development and design for the LCA TD 1 and TD 2 versions. Substantial progress was made on refining the control laws; through extensive off line and real time simulation studies. Inflight simulation was carried out on the USAF NT-33A Variable Stability Research Aircraft at USAF base at Niagara Falls. The results from each flight evaluation were analysed to refine the control law.

2.1.2 Advanced Light Helicopter (ALH) Shake Test Facility

A dedicated shake test facility developed at NAL was delivered to HAL, for ground resonance testing of helicopters of their Advanced Light Helicopter (ALH) series. The state of the art computer controlled multi input/output (MIMO) test facility incorporates specially developed user friendly application software interface to graphically depict the helicopter's vibration characteristics.

This comprehensive system, ideal for structural dynamic testing of other complex structures like aircrafts and automobiles as well, was developed in record time of three years.

2.1.3 Portable Flight Data Readout System

A portable UFDR (Universal Flight Data Recorder) developed by NAL enables direct data acquisition from the DFDR and thus eliminates the need for cumbersome hardware interface for the readout facility or the removal of the DFDR from the aircraft. The system is built around a laptop PC and uses special circuitry to convert Harvard bi phase data to parallel form. The UFDR approved by the Director General, Civil Aviation (DGCA), incorporates a fully menu driven data acquisition software which can perform all requisite functions such as track increment, fast forward, rewind etc. Developed basically to cater to the requirements of air taxi operators in the country, the system software has been extended for the Airbus A-320 aircraft as well.

2.1.4 Re-engining and Test Flying of HANSA 2 RE

The HANSA series of all composite light aircraft is ideal for abinitio training, sports, hobby flying, surveillance, aerial photography and environment monitoring as well. The HANSA series of aircraft have been designed and developed by NAL, in association with Taneja Aerospace and Aviation Limited (TAAL). The first version of HANSA 2 has been flying for over two years. One of the limitations found in the aircraft performance was the relatively poor climbing rate. To correct this, the 100 BHP engines has been replaced by Teledyne IO-240, 125 BHP engine. The re-engined version HANSA-2RE was test flown in January 1996. The new engine is a fuel efficient engine and its acceleration qualities are very good as well.

2.2 Biology and Biotechnology

2.2.1 Chemical Synthesis of Gene Encoding HEGF

The gene coding human epidermal growth factor (HEGF) has been synthesised, cloned, sequenced and expressed in E-coli: the protein has been purified and shown to be biologically active. CBT has standardised the recombinant DNA technology and is exploring avenues for its commercialisation.

2.2.2 Chemical Synthesis and Assembly of Double Stranded DNA

There has been a continuous effort world wide to simplify the protocols and reduce the error rate for synthesis of DNA. The method developed at NBRI allows the synthesis and assembly of long double stranded DNA molecules, quickly, simply and efficiently. It consists of extending the double stranded DNA by step through polymerase chain reaction, with final amplification being done at high annealing temperatures. The method does not require ligation, extensive purification of oligonucleotides and does not give wrongly amplified products in any significant amount. As the initial gene is derived from a plant the bio hazard are minimum and the method would be of value in custom synthesis of genes and expression elements of DNA.

2.2.3 Processes for the Synthesis of 1H tetrazole and 4,4' dimethoxytrityl Chloride (DMTr Cl)

1-Tetrazole and DMTr Cl are the key reagents used for oligonucleotide synthesis. The process developed at CBT, Delhi for the synthesis of DMTr Cl is novel in that it is single step continuous process and does not involve the use of expensive raw materials. The quality of the product prepared by this process has been found to be far superior to that available in international market. The technologies for both these products have been transferred to industry. The firm has sought design engineering assistance of NCL designing a commercial size production unit.

2.2.4 Wild Life Conservation by DNA Finger Printing

For the first time ever, propagation of endangered wild life species by genetic fingerprinting of the individual animals to raise healthy offsprings from select

parents chosen on the basis of their genetic endowments has been undertaken at CCMB. In a collaborative programme with the Central Zoo Authority of India, CCMB has worked on 250 blood samples from a range of animals viz. tigers, lions, leopards, elephants, wolf etc. for chromosomes isolation and analysis for abnormalities and DNA fingerprinting. Protocols for experimental requirements like tranquilizing and capturing of animals, storage and transportation of samples etc. have been standardised. Analysing of semen samples of several tigers for features desirable for production of healthy cubs by artificial insemination is being planned.

2.2.5 The Molecular Characterization of Silkworm Races by DNA Finger Printing

DNA genotyping of silk worms for sericulture industry is yet another programme of its kind being taken up for the first time. CCMB is collaborating with the Central Silk Board of India in identifying and selecting the best races of *Bombyx mori*, the most economically important silk secreting worm that can be used by farmers and sericulturists for the production of high yields of quality silk. DNA from 13 different ecotypes and inbred lines of *Bombyx mori* have been finger printed; the presence of bands specific to diapausing and non-diapausing strains and particular genotypes, of use for marker-assisted breeding of silkworms have been found.

2.2.6 Reference Seed Culture (BODSEED) for BOD Determination

Biochemical Oxygen Demand (BOD) is the most important and common parameter to assess the quality of waste waters. In conventional BOD test, the domestic sewage is added as a seeding material (for microbial population) to decompose organic matter present in the sample. The sewage used is not of uniform nature and hence there are variations in microbial density in terms of number and species which leads to variation in the estimation of BOD. To alleviate this problem, CBT, Delhi has developed a uniform, dehydrated microbial composition (BODSEED) covering a broad selection of microbial population. The BODSEED thus reduces the variability of the seeding material and hence the chances of error and also makes BOD analysis clean and convenient.

2.2.7 Agrotechnology of Ashwagandha

Ashwagandha (*Withania somnifera* L.) is one of the most important medicinal plants used in Ayurvedic

and Unani systems of medicine. The root extract is used in a number of formulations as a nervine tonic, sedative, antihepatotoxic aphrodisiac, and for rejuvenating. Recently the plant has also gained prominence as an antistress, anti-inflammatory, antitumour and CNS depressant agent. A new strain-selectant developed by RRL, Jammu yields 1000 kg (dry)/ha of roots and is suitable for cultivation in dry and semi-arid regions. The agro-technology has been transferred to three parties and the seed material of the strain is also being distributed to growers for multi-locational field testing.

2.2.8 Edible Natural Food Dyes

CIMAP has developed and standardised bench scale processes for extracting colouring materials from plant sources which are safe as food dyes. The dyes are:

- Betacyanin, red dye from *Beta vulgaris* (Chukandar)
- Carthamin, red dye from *carthamus tinctorium* (Safflower)
- Butein, yellow dye from *Butea monogperma*
- Xanthophyl, yellow dye from *Tagetes erecta* (Marigold)
- Violet coloured dye from *Daucus carota* (Black carrot)
- Capsanthin, deep carmine red from *Capsicum annum* (Chilli)

2.2.9 Antifouling Agent

NIO's search for a promising environmental friendly substitutes for the generally toxic antifouling chemicals led to the isolation of a compound from a marine sponge which at 0.5 to 5 ppm concentration exhibited total growth/settlement inhibition of various diatoms and at 25 and 10 ppm, those of mussels and barnacles larvae respectively. A process for the isolation and application of the chemical compound has been developed and an Indian patent application has been filed.

2.3 Chemicals

2.3.1 Co-Based Chemicals

Development of a low pressure synthesis of cobalt carbonyl catalyst under sponsorship from an industrial

unit was taken up at IICT. The catalyst sodium tetra carbonyl cobaltate was synthesized at low pressure (20 kg/cm²) in toluene solution with recovery of cobalt after carbonylation reaction. The catalyst is useful for carbonylation of benzylchloride, chloroethyl acetate and chloromethyl naphthalene into phenyl acetic acid, diethyl malonate and naphthalene acetic acid, respectively. It has been used in the process of preparation of phenylacetic acid.

2.3.2 Cyanuric Chloride

The technology for cyanuric chloride, a valuable intermediate in the manufacture of diverse chemicals, is the monopoly of only two companies the world over. A technology package was developed by IICT covering, process knowhow and detailed design for a 720 TPA plant along with hazard and risk analysis data, under sponsorship of an industrial firm.

2.3.3 Biosynthesis of Aspartame

Biochemical reactions offer environmentally cleaner and more cost effective processes for the production of chiral compounds. Aspartame an artificial sweetener, comprises of L aspartic acid and methyl ester of L phenylalanine coupled through a peptide bond. A process of continuous production of high purity L aspartic acid using immobilised E.coli cells was developed by CCMB. A collaboration was forged with IICT for synthesis of L-phenylalanine. CCMB is developing the enzymatic route, using a bacterial protease, thermolysin, to carry out the coupling between the two amino acids. The utility of alternative enzymes in place of thermolysin is being explored to make to process more cost effective.

2.3.4 Fire Protective Coating to Prevent Heating in Coal Mines

A water based bitumen emulsion developed at CMRI is useful in prevention of spontaneous heating in coal mines and to prevent air permeation in coal dumps storage. The emulsion allows a uniformly thin coating of the order of 0.50 mm to be applied. It is cheap, durable, easy to spray and water proof.

2.3.5 Organoclays for Grease Making

CSMCRI in collaboration with R&D Centre of Indian Oil Corporation has developed organo clays to

produce greases with superior properties of water repelling and better friction reduction at both extremely high and low temperatures.

2.3.6 Thin Film Composite membrane for desalination and other applications

Thin film composite (TFC) membranes provide choice in selecting two different polymers for the layers as a result and there is direct control on the formation of the "top" layer responsible for the separation of dissolved salts from an aqueous system.

CSMCRI has developed TFC membrane for desalination of seawater in single pass with 98.3-98.7% separation with 30+3 gfd as the flux. The substrate is a polysulfone and the thin film is of polyamide, both prepared under optimised conditions, using the casting and coating machines designed and fabricated at the institute. A prototype RO unit fabricated using the TFC was supplied to CLRI, Madras for treatment of ground water and to study the membrane performance with tannery effluent.



11.4 Prototype RO Unit for Performance Evaluation

2.3.7 Cement-Polymer Composite Coating System for Corrosion Protection

In a corrosion reaction, the metal ions leaving the metal lattice are irretrievably lost due to oxidation. Suppression of the reaction is generally attempted by the introduction of agents which inhibit either the dissolution or the oxidation process. In the cement

polymer composite coating formulation developed at CECRI, the polymeric film itself inhibits the oxidation process through interaction or nullification of the electrons involved and enables corrosion protection. This composite coating system includes a top coat based on a polyblend of the constituent polymer which provides compatible environment with the cementitious material and necessary mechanical and physical properties. During experimentation, a typical prestressing strand was coated with cement polymer system and tensioned to a load of 10 tonnes at a specially designed anchorage bed. Simultaneously, uncoated strands were also tensioned in the same anchorage bed. Both the uncoated and coated strands were subject to periodic salt-spray over a period of 18 months. The coated strand remained in excellent condition whereas the uncoated strands are found to have corroded and snapped.



11.5 Testing of Coated and Uncoated Steel Strands

2.3.8 Explosive Composition

A cap sensitive explosive composition suitable for rock excavation, shaft shrinking, road construction, etc. has been developed by CMRI which does not use metal powder and molecular explosive ingredients. The explosive composition compares favourably in cost to metal powders.

2.3.9 NMP based Lube Extraction

IIP has developed an innovative, energy efficient, environment friendly process for the extraction of lube stock using NMP as a solvent. The process has been

adopted by a major refinery with significant gains in productivity.

2.4 Drugs & Pharmaceuticals

2.4.1 Mefloquine

Mefloquine hydrochloride is the preferred drug for use in chloroquin resistant and cerebral malaria. Mefloquine is not easily available because there is only one manufacturer of the drug in the world. The known process routes for making Mefloquine are fraught with many difficulties, the most serious being the use of alkyl lithium reagent. IICT has developed an innovative method for making Mefloquine which dispenses with the use of alkyl lithium reagent. The process was optimized on bench scale and licensed to three parties, of which one has already established commercial production.

2.4.2 Ondansetron

Ondansetron is used as a therapeutic agent to mitigate emesis due to chemotherapy treatment for cancer. The IICT developed process, now in commercial production, uses 1,3-cyclohexandione as a key intermediate and other raw materials available indigenously. The process replaces the more expensive chromatographic separation techniques for purification by crystallization. As a consequence, the price of the domestically produced product is several times lower than the prevailing international price.

2.4.3 Citirizine

Citirizine is the preferred non-sedative, anti-histamine. A modified process for production of citirizine developed by IICT has been transferred to industry for commercialisation.

2.4.4 Stavudine

Stavudine (duT) is an anti-AIDS drug recently approved by FDA, USA, for the treatment of AIDS in combination with AZT. The knowhow for production of Stavudine developed at IICT under sponsorship from industry has been licensed to the sponsor for commercialisation.

2.4.5 New antileishmanial compound from indigenous origin

A new antileishmanial compound was isolated by IICB from the crude extract of indigenous swertia

chirata. The active component is an irridiod glycoside. The pure compound showed highly leishmanicidal properties in minimum dose levels with the niosomal form being more potent than the liposomal form. Toxicity studies in the form of LD50, histological staining of tissue, blood pathology and specific enzyme level related to normal liver function showed that the compound is apparently non-toxic to the host. Detailed toxicological studies are underway in CDRI/ITRC, Lucknow. A patent application has been filed for the development.

2.4.6 Memory drug from Brahmi extract

The effect of Indian herb brahmi (*Bacopa-monniaria*) for augmentation of memory and sharpening of intellect is well established in ancient traditional system of medicine. CDRI has developed a standardised extract of Brahmi on the basis of the active chemical constituents — Bacosides. The Bacosides significantly enhance brain protein synthesis known to be linked to memory formation, thus linking their role in improvement of memory. The standardised preparation has been tested and found to facilitate learning in animal models and its safety has been established through regulatory pharmacology and toxicology studies. The technology has been licensed to one party which has already established commercial production.

2.4.7 Isolation of Natural Analogues of Taxol from *Taxus Wallichiana* (syn. *taxus baccata*)

Himalayan yew (*T. baccata*) trees containing as high as 0.5 taxol xylosides have been identified by CIMAP. Around 20 taxanes and rearranged taxanes have been isolated and characterized, of which three are new. Conditions have been standardized for initiation of callus cultures from young stem and needle explants; two taxanes have been detected in the callus cultures.

A simple and cost effective method for the conversion of the taxol xyloside into taxol has been developed by CIMAP. Six patents have been filed and technology transferred to industry.

2.5 Ecology & Environment

2.5.1 Catalytic Converter for Auto exhaust Emission Control, and Diesel Particulate Trap

Technologies for two way non-noble metal catalytic converter for gasoline driven vehicles and a particulate trap for diesel driven vehicles developed at

NEERI have been transferred to industry. Internationally available cordierite honeycomb monolith supports from different sources were examined and their surface area improved to the desired level by alumina washcoating. A crucial alumina washcoating process was also developed and standardized by NEERI. The catalyst was a perovskite type coated on the alumina washcoated support. Vehicle specific modifications in the catalytic converter(s) were incorporated using mass transfer, pressure drop and thermal gradient modelling to optimize the dimensions. The specific designs ensure minimum pressure drop across the converter, and adequate retrofitting for the existing Indian vehicles. The particulate trap comprises of baffles, aggregation chamber and a particulate collection system consisting of high efficiency multicyclone and rotary stream separation. The trap has an efficiency of over 65%. The plant for commercial production of the converter and diesel particulate trap is being established at Vadodara by the entrepreneur.

2.5.2 Desulphurization of Gaseous Fuels and Emissions

A chemo biochemical technology for precombustion desulphurization of gaseous fuels and emissions containing hydrogen sulphide with concomitant recovery of elemental sulphur has been developed by NEERI under the sponsorship of DBT. H_2S present in fuel gas and emissions is selectively oxidized to elemental sulphur by an oxidant which is biologically regenerated using a microbial culture. Application for desulphurization of refinery fuel gas and emissions indicated H_2S removal with an efficiency of 99 percent selectivity, without affecting other constituents of the fuel gas.

Technology transfer for the chemo-biological process is under negotiation with two national refineries and several industries besides three international agencies in USA, Japan and Singapore.

2.5.3 Oil Spill Remediation & Treatment of Petroleum Refinery Wastewater by Microbial Consortium

A microbial consortium of well defined microorganisms, where the individual organisms perform designated functions, has been developed by NEERI for remediation of crude oil spills, and for pollution control of refinery wastewaters under sponsorship from DBT.

The two step process includes the application of alkali treated sawdust, as the first step to recover most (90-95%) of the spilled oil and in the second step biodegradation of remaining oil by using the bacterial consortium. The consortium constituents have been transformed with pro 'U' operon which imparts osmotolerance to the microorganisms and enables them to work under hypersaline/marine conditions as well.

2.5.4 Bioremediation of Mine Spoil Dumps

An Integrated Biotechnological Approach (IBA) for bioremediation of mine spoil dumps developed by NEERI ensures reclamation within 3-4 years. The process appropriately blends spoil and organic waste(s) for the establishment of the plants microflora, inoculation of plants with specialized culture(s) of nitrogen fixing microorganism and strains of endomycorrhizal fungi for profuse root development and stress tolerance. The process is applicable for bioremediation of all types of mine spoil dumps with due modifications with respect to the mine dump characteristics, type of organic waste available in the vicinity, and microbial cultures. It is also a promising process for reclamation of wastelands.



II.6 Barren Manganese Mine Spoil Dump

2.5.5 Dense-filling with Flyash

Work carried out by CMRI in collaboration with Ministry of Environment and Forests, Govt. of India, National Thermal Power Corporation, Singareni Collieries Company Ltd., Central Coalfields Ltd. and Damodar Valley Corporation has led to the development

of a system of dense filling of underground mines with flyash and bottom ash. This method is expected to be a better and more cost effective alternative to sand stowing in underground mines to reduce subsidence, mine fires etc. More importantly, the technique will enable the utilisation of flyash in large quantities.



II.7 Reclaimed Manganese Mine Spoil Dump using Integrated Biotechnological Approach

2.6 Electronics & Instrumentation

2.6.1 Infusion Pump & Controller

A microprocessor based drug infusion pump and controller has been developed at CSIO in technical collaboration of PGI, Chandigarh. The instrument regulates the flow of fluid through gravity feed in intravenous therapy system and maintains a precisely selected delivery rate from 1 drop/min to 99 drops/min. the instrument has LCD display of diverse parameters and in built audio and visual alarms for patient safety.

2.6.2 Servo controlled baby care incubator

A servo controlled baby care incubator, was developed by CSIO in collaboration with PGI, Chandigarh. The device provides appropriate controlled environment to premature or sick new born babies. The temperature is maintained with an accuracy of $\pm 0.3^{\circ}\text{C}$ with a resolution of 0.1°C . The Incubator has special safety and alarm provisions additionally to the usual alarms and safety circuits.

2.6.3 NICAM Receiver for Digital Stereo Sound in TVs

CEERI has developed a NICAM receiver that can be interfaced with existing TV receivers as an add-on-card or as a stand-alone unit. It can provide one high quality digital stereo sound channel and one FM mono. The estimated cost of the add-on-card for existing TVs is less than Rs. 2000.

2.6.4 Silicon Varactor Diodes

CEERI has developed and batch produced silicon varactor diodes eminently suited as tuning devices in TV receivers. The diodes were packaged and tested at BEL and found to meet the requisite specifications. The technology is available for licensing.

2.6.5 Hybrid PIN/FET Optical Receiver

The design uses InGaAs/InP photodetector and GaAs MESFET and thin film hybrid approach. Technology licensing is being negotiated by CEERI.

2.7 Food Processing

2.7.1 Chapati Making Machine

Design for an automatic machine for continuous production of 600 chapatis per hour has been optimised by CFTRI. The unique design enables rolling and baking of chapatis. The wheat flour dough is conveyed continuously to the extruder and a fish tail die moves the sheet of the dough to a belt conveyor. The sheet of dough then passes through a rotary cutter and a circular shape chapati is baked on both sides in a baking chamber. The machine can be easily manufactured by an existing equipment manufacturer.

2.7.2 Quick Cooking Rice

A process for cooking rice in two stages with a yield of over 75% has been developed by CFTRI. The quick cooking rice can be used as a base for the preparation of a variety of quality, convenience, cost effective and nutritious food products.

2.7.3 Decolorisation of Palm Oil

RRL (Tvm) has standardised a method of decolorisation of palm oil using kaolinitic clays from Kerala. The decolorising activity of these activated clays was higher (>75%) than that of commercial bleaching

earth's (~60%). A detailed report has been submitted to STEC, Kerala, who had funded the project.

2.8 Housing & Construction

2.8.1 Non-autoclaved Cellular Concrete Blocks

The cellular blocks developed by CBRI are made from flyash, cement lime and a foaming agent and are cured at atmospheric temperature and conditions. The blocks exhibit low thermal conductivity, good fire resistance and are superior to normal RC slabs in sound absorption. The blocks are easy and economical to manufacture and can be taken up conveniently for in situ production.

2.8.2 Geogrid Reinforced Pond Ash Retaining Wall

For the first time in India, CRRI has successfully optimised a technique on the construction of a retaining wall (for Okhla Flyover) using geogrid reinforcement and pond ash (from Badarpur Thermal Power Station). This technique will lead to bulk disposal of pond ash, a waste material, by effective use in large scale civil construction works.

2.8.3 Polymer Modified Bitumen

A novel high performance polymer modified bitumen binder has been developed by CRRI. Although costlier than the conventional bitumen, its total life span is significantly higher and has improved engineering characteristics. The polymeric bitumen thus has a good market potential for applications at bus stops, road crossings, bridge deck and runway surfacings. The binder technology has been licensed to two firms.

2.9 Information Services & Facilities

2.9.1 Library Automation

'Granthalaya' a user friendly integrated library automation package conforming to international standards was designed and developed at INSDOC. Granthalaya, has several unique and distinct features from other library automation softwares: (a) a novel data entry concept based on dictionaries which ensures data integrity and accuracy and permits data entry without a trained operator; (b) a totally modularised object-oriented paradigm system to suit varying requirements; and

(c) availability on a variety of platforms like single user DOS or WINDOWS, multi-user UNIX using a variety of RDBMS platforms such as INGRES, ORACLE and even a LAN version running under Novel Netware TCP/IP environment. Granthalaya due to its versatility holds the potential of emerging as one of the preferred advanced library automation packages especially in India.

2.9.2 Electronic Library

A Pilot Electronic Library developed at INSDOC is a storehouse of information with over 6000 foreign journals acquired in electronic form including 2142 in full text and the rest with abstracts of articles, besides 360 IEE/IEEE conference proceedings, about 725 IEEE standards and colloquium digest, US patents since 1990 etc. Based on this information resource, INSDOC now offers several new information dissemination services of value not only to researchers but to corporate sectors as well viz.: Standing Order Abstracts Service (SOAS); Chemical Abstracts Keyword Index Service (CAKIS); Patent Watch Service (PWS); Competitor Watch Service (CWS); Global Tender Watch Service (GLOBTEND); and Full Text Journal Service (FTJS).

2.9.3 Multi-Media Databases

INSDOC has developed inhouse capability for handling multi-media databases involving textual, video, audio and multi-lingual data for a wide spectrum of applications e.g. preparation of photo-identity cards, educational kits, electronic encyclopaedic publications, presentations etc. One of the projects undertaken by INSDOC was for preparing electoral photo identity-cards for 12 assembly constituencies for the state of Delhi covering about 12 lakh voters. A database of voters was prepared in Hindi and English, and this data was then merged with the image of a voter captured on the computer using an inhouse designed sophisticated software. The file was then used to prepare (print) an identity card of the voter.

2.9.4 Electronic Publishing

National Institute of Science Communication (NISCOM) has acquired the expertise and facilities for processing of data through the premastering and mastering stages and recording of full text and bibliographic databases for production of CD-ROMs. Under a collaborative project 'Asian Health, Environment

& Allied Databases (AHEAD)' sponsored by the International Development Research Centre (IDRC), Canada, the encyclopaedic publication 'Wealth of India' has been produced on CD-ROM entitled 'Wealth Asia'. Besides inhouse applications, NISCOM offers CD-ROM publishing services externally.

2.9.5 NUCSSI on CD-ROM

National Union Catalogue of Scientific Serials in India was the first major database created at INSDOC on a CD-ROM format. It lists 38000 serial titles available in about 350 libraries of academic and research institutions and industrial R&D units. The CD-ROM database has been found to be very helpful reference for librarians for co-operative acquisitions, resource sharing and library lending.

2.9.6 NISCOM Journals on Internet

Electronic publishing has led to a shift in S&T communication from the print media to online dissemination of information. NISCOM has also made a start in this direction. Under an agreement signed with Bioline Publications, UK, three of NISCOM journals, Indian Journal of Biochemistry & Biophysics, Indian Journal of Experimental Biology, and Indian Journal of Marine Sciences were made available for on-line distribution on Internet. While the contents lists and abstracts will be available free of cost, full text and graphics are to be paid for. It is planned to put the remaining NISCOM journals on the Internet in a phased manner.

2.9.7 Enlargement of NISCOM MAPA Database

A bilateral collaboration between NISCOM and Commonwealth Agricultural Bureau International, UK (CABI) has been initiated for enhancement of coverage of literature relating to medicinal and aromatic plants databases. Under this project, 300 records annually are exchanged each way by CABI and MAPA database.

NISCOM is the national node for Asian and Pacific Information Network on Medicinal and Aromatic Plants (APINMAP) in which 14 countries from the Asian and Pacific region are participating. Each country contributed data to the APINMAP Integrated Bibliographic database maintained at the APINMAP Network Centre based in Los Banos, Philippines.

NISCOM contributes Indian and Japanese data from the MAPA database.

2.9.8 Electronic Office

It is estimated that about 50,000 offices in India are likely to become 'paperless' through the use of electronic systems. To accelerate this conversion, INSDOC has developed an electronic filing system that facilitates quick and faster retrieval of any document field.

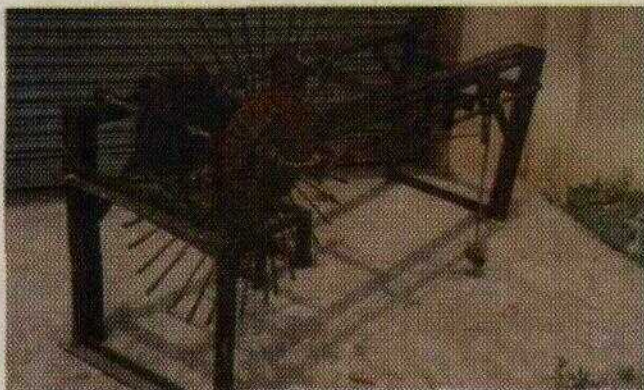
2.10 Machinery & Equipment

2.10.1 Universal Fibre Yarn Machine

Rope making from agricultural byproducts is done manually all over the country. CMERI has developed a machine that can be used with any natural fibre and yields yarn of better quality and strength. Besides licensing the technology to a firm, CMERI itself is making 100 machines for distribution and field testing in different parts of the country.

2.10.2 Circular Coir Mat Loom

MERADO, Cochin has developed a mat making machine that weaves circular mat around rods arranged radially and a rod pulling machine that pulls out the rods and feeds the coir ropes in their place. The machine significantly enhances the productivity and quality of the product. The development was sponsored by the Coir Board.



11.8 Circular Coir Mat Loom

2.10.3 Palm Oil Twin Screw Press

MERADO, Madras has developed a twin screw press for extraction of Palm Oil with a nominal processing capacity of 5 tonnes of fresh fruit bunches per hour. The project was sponsored by the Technology Mission on Oilseeds and Pulses and the knowhow has been handed over to them for further dissemination and licensing.

2.10.4 Mine Support System Using Rock Bolts

Mine support systems using rock bolts as primary support have been designed for various geomining conditions at CMRI. The support is faster in installation and cost effective compared to conventional supports. Stability of a pillar at the mine below the railway line has also been evaluated for extraction of ore in the vicinity of the pillar at Balaria Mine of Hindustan Zinc Ltd.

2.11 Minerals, Metals and Materials

2.11.1 Potassium From Feldspar

A new technique has been developed at RRL (Bhu) for extraction of potash from feldspar by roasting it at 900°C for 4-5 hours with calcium carbonate and calcium sulphate in defined proportions. The water leached extract of the roast mass has been utilised as a liquid fertiliser which is gaining importance because of its low volatile and homogeneous nature. This is very essential for a country like India where no commercially exploitable resource of potash is available but there is abundant reserves of feldspar in the states of Rajasthan and Uttar Pradesh.

2.11.2 Semicommerical Flotation Column for Industrial Applications

Based on the performance and the experience gained over the years, NML recently designed and installed a semi commercial flotation column of 0.5m diameter with a capacity to treat 2-4 tonnes of ores per hour. The column has a special sparger designed and developed at the Madras Regional Centre of NML. The Sparger consists of special sintered detachable tubes capable of giving fine and uniform air bubbles at relatively low air pressures of 2-3 kg/cm² only. The sparger tubes can be removed for declogging while in

operation. The column has been tested at BGML in the beneficiation of gold ores with the spargers rendering excellent services.

2.11.3 Fused Tungsten Carbide

Fused tungsten carbide exhibits high hardness and superior resistance to wear and abrasion, and finds extensive applications for the manufacture of wear resistance components such as spraying, injection and blasting nozzles; thread guides in textile machinery micrometer anvils; burnishing tools; centres for lathe and grinders; ball point tips; teeth and jaws for excavators, etc. A new process for production of fused tungsten carbide using extended arc thermal plasma has been developed at RRL (Bhu). The argon gas used for making plasma maintains a protective atmosphere to prevent oxidation during melting. The fused product has excellent hardness.

2.11.4 Hydrocyclone Classification Studies on China Clay at Ultra Fine Size Ranges

Value-added clays for use as paper coating and pigment grade clays, require ultra fine size separation. An extremely fast continuous separation process in which the settling is aided by centrifugal forces was developed at RRL (Tvm) under sponsorship from a firm in Kerala which has already installed 40 number of 25 mm hydrocyclones in their existing plant. The process has helped in enhancing the plant capacity and product quality.

2.11.5 Aluminium Metal Matrix Composites

SiCw (Silicon Carbide Whiskers) reinforced aluminium metal matrix composites for aerospace applications have been developed by RRL (Bho) under a project supported by ISRO.

2.11.6 Warm Forging/Hot Extrusion of Metal Metal Composites (MMC)

NPL has successfully developed thin walled aluminium alloy MMC tubes using SiCp of different particle sizes. Extrusion parameters and hot pressing parameters for MMC ingots, have been optimized for the development of these tubes.

2.11.7 A thin film ceramic sensor for LPG leak alarm

A prototype ceramic liquid petroleum gas (LPG) alarm has been fabricated at CGCRI, based on a Zinc

Oxide (ZnO) thin film ceramic gas sensor. The sensor element responds through decrease in its resistance when LPG is present in its surrounding; which in turn triggers a flashing red light and a buzzer. This electronic alarm can be used both in domestic and commercial environments as an essential safety device.

2.11.8 Rice Husk Ash Nodules for Steel Melting

Rice husk ash is pure microporous silica. CGCRI has developed an innovative process to nodulise the ash. The nodules are used as heat insulating material on top of steel ladles, which disintegrate and form a monolithic layer on top of molten steel. Patents have been filed abroad and the technology licensed in India.

2.12 Mining

2.12.1 Mining of Thick Coal Seam Standing on Pillars

Technology for recovery of coal from 6 to 10 m thick seam pillars under shallow to deep cover has been developed by CMRI. This development facilitates extracting of coal from high seams which has been a global problem of mining engineers. India has nearly 56% of its coal reserves, locked up in pillars. The development of this technique has thus opened new vistas for exploitation of the locked up coal. The technique is being implemented in the select 3 mines of different subsidiaries of Coal India after the successful trial at NCPH mine of SECL. An allied development was to utilize the discarded coal haulage rope in the form of cable bolt. The roof support technology ensures safety to the workers and the workings enhancing the level of recovery of coal by 25 per cent.

The novel feature of the cable bolt, is its strength independent of the height of working and capable of offering anchorage upto 12 tons, more than that required for the support of the workings in depillaring panels.

2.12.2 Wedge Cut Blasting to Improve Productivity of Coal Mines Drivages

A novel and cost-effective wedge cut blast pattern has been developed at CMRI which improves the pull per round of drivages in coal production and thus enhances the productivity and machine utilization time. This new pattern of blasting can also be used for the underground development of drivages in mechanised

coal mines and has also been proved to be effective for the improvement of drivage rate through multiple formation in tunnels for hydro electric projects.

2.12.3 Air deck Blasting to Improve Productivity in open pit Mines

Feasibility of introduction of air deck blasting technique developed at CMRI in opencast mines has been studied. It is found that this technique of blasting is effective in opencast mines and leads to higher production through proper fragmentation, increased machine utilization time and reduction in blasting cost.

3. BASIC RESEARCH

3.1 Biological Sciences

3.1.1 Development of Live Oral Recombinant Vaccine for Cholera

Cholera is the most feared among the enteric diseases. However a saving grace is that cholera is a highly immunizing disease conferring long time protection to the patient. While complete eradication of cholera is unachievable because of environmental reservoirs for *Vibrio cholerae*, it is possible to develop a safe efficacious live oral vaccine. The recent recombinant vaccines developed have been found to be reactogenic in human volunteer studies, causing residual diarrhoea and other side effects. The reaction for this reactogenicity could be the presence of other yet unknown virulence genes. In order to tackle this problem a collaborative project between IMT, IICB and National Institute of Cholera and Enteric Diseases, Calcutta was initiated to develop a naturally occurring non-toxinogenic clinical isolate to construct the live oral vaccine strain.

The vaccine strain was developed from a nontoxinogenic clinical isolate by mobilizing 'ctxB', the immunogenic component of cholera toxin in the *V. Cholerae* chromosome at hemolysin locus using recombinant DNA technology. In RITARD model, the vaccine was nonreactogenic and offered hundred percent protection against homologous challenge with toxinogenic *V. Cholerae* 01 strain. Attempts are being made for human volunteer trials. An international patent application to cover the strain is under process. If successful in trial studies, the vaccine is expected to be introduced in the market in about three years time.

3.1.2 Spontaneous tumour regression

CCMB has been studying the mechanisms responsible for the spontaneous regression of a macrophage tumour termed AK5 generated in syngeneic rats. Natural killer cells activated by the antitumour antibody induce the tumour cells to undergo programmed cell death or apoptosis. Apoptosis of tumour cells was inhibited when they were transfected with the Nedd 2 gene in antisense orientation implying that Nedd 2 expression is required for tumour regression. The identification of a gene product that can induce apoptosis, specifically in cancer cells, is of great value in cancer immunotherapy.

3.1.3 BS RNase, an anti tumour agent

Bovine Seminal RNase (BS RNase) has aroused interest because of its associated anti tumour activity. Studies of CCMB show that the relative concentration of RNase and substrate may modulate the RNase activity that is responsible for the anti tumour action. BS RNase can form two kinds of dimers: the M=M and MxM forms, each of which is held together by disulphide bridges and hydrophobic interactions. Under reducing conditions the M=M form gets converted to the monomer but the MxM form becomes a noncovalent dimer (NCD). The effects of the protein RNasin (RNase inhibitor) and the substrate RNA on the equilibria between the XMxM, M=M, NCD and monomeric forms of BS RNase were studied. The inhibitor stabilises the monomeric form (which is inhibitor sensitive) whereas the substrate stabilizes the NCD (which is inhibitor insensitive).

3.1.4 Structure of Proteins/Enzymes for Food Processing Industries

Pectinolytic enzymes which account for 10% of total food enzyme trade are produced by microorganisms and higher plants, and find application in the fruit processing industry. Polygalacturo-nase [poly(1,4 alpha D galacturonide) glycanohydrolase E.C. 3.2.1.15] is depolymerizing pectinase that catalyzes the hydrolysis of alpha 1,4 glycosidic linkage of polygalacturonase chains in pectin, thus causing structural degradation. CFTRI has purified and characterized this enzyme from various fungal and bacterial sources and has found that polygalacturonases from the same source and different sources differ in their molecular size, pH optima and

specific activity. An understanding of the structure and stability of these enzymes may lead to better applications of the enzyme in the food industry.

The development of a low cost purification protocol for polygalacturonases endows it with an immense potential as a molecular biology reagent. The characterization and purification polygalacturonase PG II could lead to cloning and expression of this enzyme for commercial exploitation.

3.1.5 Curcumin A natural non toxic antibrowning agent

Browning of fruits, vegetables, fish and beverages is a major impediment to maintaining quality of products by the food industry during processing and storage. Many food products undergo enzymatic browning reactions during processing, which cause a change in colour, appearance and organoleptic properties, and thus have an important bearing on food quality.

Studies at CFTRI aimed at finding natural enzyme inhibitors that would provide a high degree of control at low concentrations, are cheap and non toxic with no adverse effect on the organoleptic qualities of the food, have shown that curcumin, the active spice principle of the commonly used turmeric (*Curcuma longa* Linn) prevents browning. Curcumin at very low concentrations in solution prevents the browning of cut apple, potato and brinjal. Curcumin is also found to be a potent inhibitor of PPO purified from banana, pineapple and mushroom. The inhibition kinetics showed that it is a competitive inhibitor with a K_i of $2.7 \times 10^6 M$.

3.1.6 Carbocyclic lactone

A new unprecedented spherical carbocyclic lactone has been isolated and characterised by RRL (Jt) from *Baccurea sapida* seeds. *B. sapida* is a plant of the family Euphorbiaceae and grows in the Brahmaputra valley. It may be noted that several plants from Euphorbiaceae family have yielded several anti HIV lead compounds.

3.1.7 Alkylated coumarin

A new alkylated coumarin with close structural relationship with anti HIV lead compound 'Calanolide' has been isolated by RRL (Jt) from the plant *Kayea assamica*, a guttiferaceae family plant occurring only in a particular district of Assam.

3.1.8 Immunomodulation by liposomes

CBT has demonstrated that allergens incorporated in liposomes injected repeatedly in Balb C animals results in modulation of immune response leading to suppression of Th2 response and recruitment of Th1 cell. Cytokine profiles clearly indicated that IL4 secretion was reduced and r-interferon levels were increased leading to decreased IgE synthesis and increased IgG synthesis. This immunomodulation protects the sensitized animals from anaphylaxis when challenged with the sensitizing allergens. This observation has been confirmed internationally and CBT is thus first to propose that liposomes will be good carriers of allergens for safe and effective immunotherapy.

3.1.9 Gene expression using *Spodoptera litura* nuclear polyhedrosis virus (SINPV)

Polyhedrin, the hyper active gene of baculovirus, SINPV (*S.litura* nuclear polyhedrosis virus) coding for the occlusion body protein of the virus has been characterized and sequenced by CBT. This is a new baculovirus isolate of Indian origin characterized by genomic analysis. It has a circular doublestranded supercoiled DNA genome of 132 kb. Four transplacement vectors have been constructed to express the foreign genes under the polyhedrin promoter of SINPV in insect cells.

This is the first reported Indian isolate of baculovirus characterized and a patent application has been made for the transplacement vector constructs based on polyhedrin promoter of SINPV. These constructs can be utilized to express foreign genes abundantly in insect cells. In addition, this virus is an effective biopesticide for the polyphagous tobacco caterpillar, which has over hundred host plants including the commercial crops, groundnut, cotton, tobacco, chilli etc.

3.1.10 Lectin as an Important Biochemical and Diagnostic tool

CBT has identified and characterized a glucose specific lectin (Peanut Root Agglutinin, PRA II) from peanut (*Arachis hypogaea*) roots. The lectin oozes out from the cortical parenchymatous cells and remains anchored to the root surface. The carbohydrate binding site of the divalent PRA II remains free for binding with peanut specific rhizobia through their cell wall lipopolysaccharides (LPS). Highly specific interaction

between legume roots of peanut and specific rhizobia which leads to nodulation, is mediated through PRA II. The most potent inhibitor of PRA II is cell wall LPS of peanut specific rhizobia (68 fold higher than glucose) but not that of non specific rhizobia.

First step in multi step process that lead to nodulation in legumes is the recognition of specific rhizobia by the roots. This recognition process involves specific binding of nodulating rhizobia to roots. The appearance of PRA II in roots of emergence of peanut root hairs and the absence of PRA II in non nodulating variety of peanut confirms that host specificity is expressed prior to rhizobial interaction with the the roots. Host rhizobium recognition process involves specific binding of peanut root surface lectin (PRA II) and cell wall lipopolysaccharides of peanut specific rhyzobia. These findings can be utilized to identify host specific rhizobia from soils using lectin as a tool.

3.1.11 Leads from plants growing on cattle dung heaps

Cattle dung is used as a cheap source of manure in India, ironically the dung does not permit germination of plant seeds and growth of seedlings for long on these heaps, due to impeding factors such as hyperthermia from microbial respiration, growth inhibitors secreted by microorganisms and high salinity. However certain plant species have been observed to be growing on fresh decomposing dung heaps. A study was conducted at CIMAP to identify such plants (termed as coprophilous plants) and to investigate the possible relationship between this property and known biological activities of the plants. Plants belonging to 82 species under 32 different families were found growing on the dung heaps with the relative proportion of herbs,trees,climbers and shrubs as 17:5:2:1 on an average of 7 plants per dung heap. It was seen that 72% of the plant species possessed one or more biological activities, 30% antiviral, 45% antibacterial, 30% insecticidal, 25% anticancer, 20% antiprotozoal, 48% antifungal and 23% allelopathic activities. With *Azadirachta indica* and *Echinochloa crusgalli* were found present in more than 50% of the sites.

The experiment suggests that plants which are thermotolerant, salttolerant, or tolerant to growth inhibitors produced by microorganisms or be able to retard the growth of antimicrobial substances can survive

on dung heaps. The screening of such plants, that are well represented on fresh/decomposing dung will provide useful information to identify the plants for pharmaceutically and agriculturally useful chemicals for genes that provide thermal and salt tolerance to plants.

3.1.12 Synthesis of some biologically active natural product using chemoenzymatic techniques

The asymmetric synthesis of biologically active compounds, especially complex natural products is an extremely challenging task. Among the various methodologies that have been developed for enantioselective synthesis, the use of enzymes as chiral catalysts has attracted much attention. RRL (Tvm) has synthesised chiral intermediates useful in the elaboration of biologically active natural products belonging to the family of drimanes, labdanes, hopanes etc., using lipase catalysed acylation. The methodology is useful for the synthesis of chiral feedants and pheromones which are being used as pest control agents.

3.1.13 Mechanism of benzene toxicity

Study carried out by ITRC on benzene toxicity revealed that benzene 1,2,4 benzenetriol (BT) was found to release significant amount of iron from ferritin dependent on the concentration. The iron release from BT enhanced lipid peroxidation and also catalyzed the release of aldehydic products from bleomycin dependent degradation of DNA. Addition of BT to bone marrow cell lysate resulted in an increase of iron release as a function of time indicating that BT is a potent reductant of ferric iron of ferritin and also mobilizes and releases iron from ferritin core. The release of iron from bone marrow lysate by BT may assume toxicological significance as this could lead to disruption of intracellular iron homeostasis in bone marrow cells. The study thus offers new information that the iron released from ferritin by BT could affect maturation and differentiation of bone marrow cells resulting in bone marrow depression which is expressed in humans as well as experimental animals during benzene exposure.

3.1.14 Pulmonary toxicity of coal fly ash

Effect of intratracheally injected fly ash on the development of pulmonary and systemic immunity was studied in rats by ITRC. Following intratracheal and interaperitoneal immunisation with sheep red blood cells

(SRBC) there was an appearance of antibody forming cells (AFC) in lung associated lymph nodes (LALN) of animals exposed to either flyash or physiological saline. These results demonstrate that fly ash burden on lungs results in an impairment of the local immune response of the lungs without an associated effect on the systemic immunity. The study shows that native and metal coated flyash, brings down the local immune response of lungs without affecting systemic immunity. The immunosuppression appears to be due to the presence of the metallic constituents.

3.1.15 Heme oxygenase in sensitive strains of Plasmodium berghei

The possibility of making chloroquine resistant malarial parasite susceptible to chloroquine with the help of resistance reversal agent has been established by CDRI. Chloroquine-resistant (CQR) and - sensitive (CQS) Plasmodium berghei K173 strains possessed significant activities of heme oxygenase, biliverdin reductase and heme polymerase. The cause of resistance to chloroquine has been attributed to the overproduction of plasmodial heme oxygenase and high heme - polymerisation activities in resistant parasites. The study suggests the importance of heme oxygenase and related components in the biochemical regulation of malaria parasites and in understanding the mechanism of the acquisition of chloroquine resistance.

3.1.16 Diagnosis of tuberculosis

A 1.3 kb cloned DNA fragment of M. tuberculosis containing repetitive sequences has been identified by CDRI which hybridizes to clinical isolates of M. tuberculosis DNA with 100% specificity. Analysis of DNA fragment and restriction analysis establish it as a new fragment not reported earlier. A patent has been filed for the development.

3.2 Chemical Sciences

3.2.1 Interfacial catalysis in a biphasic system

To avoid the problem of separation of products from catalyst in homogeneous catalysis, two phase systems have been developed in which the catalytic complex (usually a water soluble organometallic complex) remains in one (generally aqueous) phase, while the products remain in a second immiscible phase. Catalysis relies

on the transfer of organic substrates into the aqueous catalyst phase, but the limited solubility of the substrates in water leads to reaction rates much lower than those for conventional homogeneous catalysis. NCL showed that catalysis at the interface of a two phase system can be enhanced by using a promoter ligand, in the organic phase, which will bind to the organometallic catalyst and thus increase its concentration close to the interface in the aqueous phase. This novel concept of promoting interfacial catalysis has been suitably demonstrated for the hydroformylation of several olefins using a Rhodium complex catalyst. This concept is also found to work in reverse. NCL has been granted a US Patent [US 5498801 dated 12.3.96] for an improved process for hydroformylation of alkenes, based on this approach. It is believed that future hydroformylation technology will be based on such two phase catalytic processes which combines the advantage of high activity/selectivity and efficient separation of catalyst and product.

The concept of promoting an interfacial catalytic reaction to enhance the rates of reaction is generic in nature, and can also be applied to other industrially important homogeneously catalysed process. Proper choice of a biphasic system for these reactions can give enhancement in the rates of reaction. This is a very simple concept to operate on a large scale and hence may help in opening newer areas of application of homogeneous catalysis.

3.2.2 Synthesis of azamacrolides

Azamacrolides are a new class of alkaloids with insects repellent activity attributed to their molecular skeleton. Structure of one of the five azamacrolides isolated by IICT, viz, epilachnene, constituting 90% of the secretions was confirmed by NMR spectroscopy, while those of the other azamacrolides were characterised by mass spectral and vapour phase IR studies. Scarcity of the natural product precludes a detailed study. IICT, initiated a project to synthesize the azamacrolides and their major component, (+) 9-propyl-10-azacyclodecan-12-olide. Some success has already been achieved.

3.2.3 Solubilization of gelatin and formation of organogels

A reversible sol-gel phase transition phenomenon is observed for solubilized gelatin in AOT reverse micelles. The phenomenon has been applied by IICT

for immobilization of enzymes such as lipase, x-chymotrypsin, horse radish peroxidase, alcohol dehydrogenase and esterase from thermophilic bacteria at low temperatures. The immobilized enzymes have been tested for their performance in resolution of various racemic alcohols, synthesis of aspartame, resolution of naproxen, etc. The parameters are being optimized for obtaining chiral products of high optical purities.

3.2.4 Enzyme catalyzed stereospecific reduction of carbon-carbon double bonds

Enzyme enoate reductase (E.C.1.3.1.31) and enzyme alcohol dehydrogenase (E.C.1.1.1.1.) present in Baker's yeast (*Saccharomyces cerevisiae* NCIM 3305) can act simultaneously on alpha, beta-unsaturated ketones, ketoacids and ketoesters. The reduction of prochiral carbon-carbon double bond and the keto function occurs stereospecifically yielding chiral products of high optical purity (87-99%). A novel methodology of using a rotating drum bioreactor for carrying out the biotransformations using immobilized biocatalyst for bench scale reactions has been designed, by IICT.

3.2.5 Synthesis of antiviral acyclonucleotides

A new synthesis method via catalytic processes to get 2-(Hydroxymethyl)-1, 4-butanediol by hydroformylating the ketal of cyclohexanone and 1, 4-butene-diol has been developed by IICT. The aldehyde is reduced to alcohol and hydrolysed to give the said triol. Hydroxymethylation of the hydroformylation product led the new synthesis of homopentaerythritol. The triol is used in the synthesis of famciclovir and penciclovir which are virucidal acyclonucleosides.

3.2.6 Photochemistry of Squaraine Dyes

Squaraine dyes have important applications in imaging science and in the sensitization of wide band gap semiconductor materials. The symmetric D-A-D (donor-acceptor-donor) arrangement of symmetrical squaraine dyes causes an interesting effect on the formation of intramolecular charge transfer states. As a result, the photophysical properties of these dyes are highly sensitive to substituent groups and the solvent medium. RRL (Tvm) has synthesised a new class of squaraine dyes that contain an ionophoric moiety. Ionophores that are covalently linked to chromophores

exhibit intramolecular charge transfer (ICT) transitions. Excitation of such molecule causes a redistribution of their charge densities, which can significantly affect the metal ion binding ability of the ionophoric unit.

3.3 Earth Sciences

3.3.1 Hydrothermal deposits in the Andaman basin

An exploration project was initiated for the search of hydrothermal deposits along the backarc basins with the main thrust on the Andaman basin on the eastern side of the linear Andaman islands. Detailed surveys with the multi beam bathymetry system and other geophysical surveys inclusive of magnetic, gravity and single channel seismic were carried out. The survey revealed complex morphotectonic structure of the Andaman backarc. A seamount chain parallel to the island arc system was observed. Few samples were collected which indicate a possibility of a hydrothermal activity. A distinct chimney like structure within a basaltic crust sample was observed along with the few disseminated and vein type sulfide samples. The geophysical studies have delineated the presence of the backarc ridge system with one active and one passive ridge segment forming the part of the Andaman backarc ridge along which hydrothermal activity is expected.

3.3.2 Oxygen, and carbon dioxide in the Arabian Sea

Extensive observations under Joint Global Ocean Flux Study (India), a core project of the International Geosphere Biosphere Programme, suggested strong seasonal variations in oxygen, nutrients and inorganic carbon dioxide in the Arabian Sea. Near zero oxygen levels were noted in winter but during monsoon the values were ~15 microns. Their distributions revealed the occurrence of intense reducing conditions in winter because of the sluggish renewal of intermediate waters and high surface productivity. The average nitrate deficits suggest increasing reducing conditions in the order of Southwest monsoon (1.6 microns), intermonsoon (3.7 microns) and winter (4.0 microns). Total and partial pressure of carbon dioxide exhibited seasonal variability with pronounced north south gradient in the surface layers. Total carbon dioxide in surface waters was higher by 100 microns during winter as compared to the intermonsoon period that results from winter cooling and convective mixing. The carbon dioxide flux to atmosphere reached a maximum of ~40 microns mole

m-2 d-1 at around 16°N in the central Arabian Sea during monsoon. The results strongly suggest that the seasonal variability in carbon dioxide is controlled largely by physical than biological processes in the Arabian Sea.

3.4 Engineering Sciences

3.4.1 Mathematical Modelling of Fires in Buildings.

Mathematical models, (CALFIRE and NEST) based on the first principle's approach, have been developed at CBRI to predict the consequences of a fire in a building. These models are data based computer programs in user friendly mode and contain data on physical, chemical, and thermodynamical properties of number of combustibles as well as building material used for construction.

CALFIRE has potential to study the behaviour of fires in a building much before it actually comes up. The model has been designed to measure the response of building and its fire protection systems to the anticipated size of a fire and also the human response and escape aspect.

3.4.2 Studies on sisal/ polyester composites for building application

There is great interest in using natural fibres as a reinforcement in polymer matrices and also in some cases as a replacement of glass fibres for making low cost composite building materials. Possibilities of using sisal fibre because of its high tensile modulus and low elongation at break point has been researched upon at CBRI. Surface modification of sisal fibre not only improved the physico-mechanical properties but also shifted the failure mode from interphase controlled to the internal strength of the fibre/matrix.

An optimum system for particulate hybrid composite laminates with the help of filler, sisal fibre, glass fibre and unsaturated polyester resin was developed. The suitability of these laminates was assessed in relation to the requirements laid down by BIS for medium density fibre board (IS 12406 88) and high density particle board (IS 3478 66). The new composite has good physico mechanical properties and performance characteristics. The potentiality of combination of sisal and wollastonite as part

replacement to glass fibre was also attempted. These developments have promising prospects in building industry for making new/alternate building materials such as roofing, wood substitutes and other low cost housing elements.



11.9 Sisal Fibre Hybrid Composite Laminates

3.4.3 Direct Simulation of Turbulent Flow

The unsteady three dimensional turbulent flow was simulated by NAL. The turbulent flow problem has been computed by solving the Navier Stokes equations without the approximation of any turbulence models. This approach, though restricted to low Reynolds numbers, is more reliable as it is verified by comparison with the available experimental data. The method requires very powerful computers and with the available modest facilities at NAL results are comparable to the best available in the world for this class of problems in the area of DNS.

This work has led to the research in the area of Large Eddy Simulation (LES), for application in 3 dimensional wing design and also has the potential of being an industrial tool in predicting realistic flows.

3.4.4 Fluid Instability and Transition

A stability theory for spatially developing flows has been proposed by NAL which accounts for the non parallel nature of the flow over boundary layers over flat plates. It has been shown that non parallel effects (surprisingly) appear at a lower order than $1/R$ (where

R is the boundary layer Reynolds number) and a lower order stability equation is derived and shown to contain most non parallel effects. As a derivative of this research an industrial code useful in the design of laminar airfoils has been developed. The e^n method has been used in this code which not only predicts the extent of laminar flow to be expected but it can also be used to eliminate excess acceleration upstream in order to minimise downstream pressure recovery.

3.4.5 Finite Element Package with Expert System Advisor and Control

NAL was able to make a significant breakthrough in FE literature by (i) the introduction of the variational correctness principle and its axiomatisation from the HU Washizu principle and (ii) the establishment of the stress correspondence paradigm as the basis for the working of the finite element process (and not the displacement correspondence paradigm as has been assumed so far in the literature comprising over 350 book and above 50,000 papers) and the axiomatisation of this from the same Hu Washizu principle. These principles were used to incorporate thermal stress analysis capabilities to the existing static, dynamic and instability capabilities for beam and plate elements based

on the Lo Christensen Wu higher order theory. Design of non linear finite elements is being taken up based on these principles has been done. Software based on these new ideas has been licensed/sold to about five organisations in the last two years.

3.4.6 Stress Analysis by X-ray diffraction

The presence of stresses (residual or applied) in polycrystalline specimen causes a shift of the x-ray diffraction line which makes it possible to calculate the stress in the specimen from the measurement of the shift. This conversion of the measured shift of the diffraction line to the stress that causes it requires the use of an appropriate function containing elastic constants. Since the crystallites present in the specimen are elastically anisotropic, the elastic constants are represented by a fourth rank tensor. The calculations are further complicated by the fact that x-ray diffraction introduces a strong selectivity, implying that the crystallites of all possible orientations do not contribute to the diffracted intensity at the point of observations. Exhaustive work done at NAL over the last 25 years has enabled it to develop expertise to measure such stresses and it offers this service externally.

III. RESEARCH AND DEVELOPMENT BY INDUSTRY (RDI)

The scheme on Research and Development by Industry covers the following activities:

- A) In-house R&D in Industry
- B) *Scientific and Industrial Research Organisations (SIROs)*
- C) Fiscal Incentives for Scientific Research

Activities and achievements in each of above are presented here.

III.(A) IN-HOUSE R&D IN INDUSTRY

1. RECOGNITION OF IN-HOUSE R&D UNITS

A strong S&T infrastructure has been established in the country. This covers a chain of national laboratories, specialised R&D centres, various academic institutions, training centres, which continuously provide expertise, technically trained manpower and technological support to the industry. Various policy measures and organizational structures have also been evolved from time to time to meet the changing industrial and technological requirements of the country. The Government have 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.

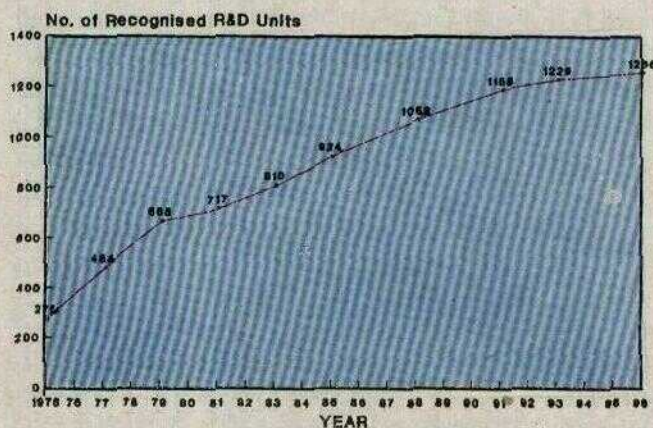
A scheme for granting recognition to in-house R&D units in Industry is operated by the Department of Scientific & Industrial Research in the Ministry of Science & Technology. The incentives and support measures presently available to recognised in-house R&D units include: Income tax relief on R&D expenditure as per IT Act, 1961; Weighted Tax

Deduction for sponsored research; Custom Duty Exemption on goods imported for use in Government Funded R&D Projects; Five year Tax Holiday for commercial R&D Companies; Excise Duty Waiver for 3 Years on goods produced based on indigenously developed technologies and duly patented in any one of the countries in European Union and in USA or Japan or in both; Accelerated Depreciation Allowance on plant and machinery set up based on indigenous technology; Exemption from Price Control for bulk drugs produced based on indigenous technology; Financial Support for R&D Programmes; National Awards for Outstanding in-house R&D achievements and Commercialisation of public funded R&D, and other indirect benefits.

The in-house R&D units qualifying for recognition are expected to be engaged in research and development activities related to the manufacturing activity of the firm. For this purpose R&D would include: efforts for development of new technologies, design and engineering, process/product/design improvements, export promotion, testing and analysis related to these efforts, development of new products or discovering new methods of analysis, productivity research for increased efficiency in use of resources, capital equipment and materials, fuel efficiency, recycling of wastes and research for efficient use of scarce materials.

The R&D activities are expected to be separate from routine activities of the firm such as production and quality control. It is not necessary to have all the R&D activities segregated and located in a separate building. It is appreciated that in-house R&D activities are likely to be intermingled with the activities related to manufacturing in the factory and often part of the production equipment and infrastructure would be utilised to carry out certain aspects of their R&D activity.

In-house R&D in Industry



III.A.1 Growth of In-house R&D Units.

The in-house R&D units should have some staff exclusively engaged in R&D and there would be full-time Head for the R&D who would have direct access to the Chief Executive or to the Board of Directors depending upon the size of the unit.

Number of in-house R&D units recognised by DSIR has increased steadily from about 100 in 1973 to about 250 by 1975, to over 600 by 1980, over 900 by 1985, and 1256 as on 31 December, 1996. The growth is also represented in Figure III.A.1. Of these 1256 units, about 170 are in public sector and joint sector and the remaining are in private sector. A revised and updated Directory of Recognised in-house R&D units was brought out during November 1996.

For the purpose of recognition, the R&D units are to apply to DSIR as per a standard proforma. The proforma and other details about the scheme are available in the DSIR publication "Promotion and support to Indigenous Technology". The applications after scrutiny in the DSIR are circulated for comments to various other Departments/Agencies such as concerned administrative Ministries, DCSSI, CSIR, ICAR, ICMR, DCPC, DRDO and NRDC. The units seeking recognition are normally visited by expert teams comprising of representatives of DSIR as well as outside agencies like administrative Ministries, CSIR, NRDC, ICAR, ICMR, DRDO, IITs and local educational and Research Institutions before they are taken up for consideration. The applications along with comments from outside agencies, visit reports, discussion reports along with the Department's evaluation are considered in an Inter-Departmental Screening Committee

constituted by the Secretary DSIR. The Screening Committee is presently Chaired by Adviser (RDI), DSIR with members from Department of Chemicals & Petrochemicals, Department of Biotechnology, Department of Telecommunications, Department of Electronics, CSIR, DCSSI, and NRDC along with the DSIR officers. The Committee meets every month to consider the applications and makes recommendations to the Secretary, DSIR for : (a) Granting recognition for a specified period ranging upto 3 years, or (b) for rejecting the application, or (c) for deferring the case for obtaining further details, discussions with the company or visit to the unit for clarification of various points.

During the year 1996 the Screening Committee met 12 times and considered 75 applications for fresh recognition; 54 R&D units were granted fresh recognition, 4 R&D units were endorsed on the existing letters of recognition in respect of other R&D units of their company and 17 applications were rejected.

The pendency at the end of December 1996 was 22. A statement giving monthwise receipt, disposal and pendency of applications for recognition of R&D units is given at Annexure III.A.1.

118 in-house R&D units were visited till the end of December 1996 by expert teams for a first hand assessment of the R&D work, infrastructural facilities and other claims made by the in-house R&D units. Also, nearly 300 discussions/meetings were held with heads of in-house R&D units.

2. RENEWAL OF RECOGNITION

Recognition to R&D units is granted for a period ranging from 1 to 3 years. The R&D units are advised to apply for renewal of recognition well in advance (3 months) of the date of expiry of the recognition. Applications received for renewal of recognition are circulated to CSIR, NRDC and/or the Administrative Department for comments. The application is examined in the Department taking into account the inputs received from other agencies and recommended to the Secretary for grant of renewal of recognition for a specified period. During 1996, 348 in-house R&D units were due for renewal of recognition beyond 31 March 1996. Based

Recognition granted to 40 Companies was allowed to lapse. All applications received for renewal were dealt with. A statement showing monthwise receipt, disposal and pendency of the cases of renewal of recognition of the R&D units is given at Annexure III.A.2.

3. ZONAL DISTRIBUTION OF IN-HOUSE R&D UNITS

The in-house R&D units are distributed throughout the country. There are nearly 200 units in the Northern Zone comprising of Delhi, Haryana, Punjab, Uttar Pradesh, Jammu & Kashmir, around 100 units in Western Zone covering Rajasthan and Gujarat, over 450 units in the Central Zone covering Maharashtra, Madhya Pradesh and Orissa, over 350 units in the Southern Zone covering Andhra Pradesh, Karnataka, Kerala and Tamil Nadu and around 150 units in the Eastern Zone covering Bihar, West Bengal, Assam and others.

Majority of the in-house R&D units are located in and around major cities. There are about 325 units in and around Mumbai; over 100 in and around Delhi; over 100 around Chennai, 75 in and around Bangalore, 75 near Hyderabad, nearly 50 in and around Ahmedabad. The reason for such large numbers around these major cities is the fact that several of the industrial units are also located around these cities.

4. 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. 200 crores for over 600 units. By 1985-86, it was of the order of Rs. 500 crores for about 900 units. It is estimated that the present R&D expenditure of the 1256 recognised R&D units is of the order of Rs. 1575 crores. About 35% of this is accounted by over 150 public sector and joint sector units and about 65% by about 1100 R&D units in private sector. 250 R&D units spend over Rs. 1 crore each on R&D, 356 R&D units spend between Rs. 25 lakhs to Rs. 1 crore each per annum on R&D. The list of these R&D units is given in Annexure III.A.3 and III.A.4 respectively.

The major R&D units in public sector undertakings are Hindustan Aeronautics Limited, Indian Telephone Industries Ltd., Bharat Heavy Electricals Ltd., Steel Authority of India Ltd., Indian Petrochemicals

Corporation Limited, Indian Oil Corporation Limited. Some of the major R&D units in the private sector are Tata Engineering & Locomotive Company Ltd., Tata Iron & Steel Co. Ltd., Reliance Industries Limited, Ranbaxy Laboratories Limited, Lupin Laboratories Limited, Crompton Greaves Limited, Bajaj Auto Limited, Hindustan Lever Limited, Mahindra & Mahindra Limited, Larsen & Toubro Ltd.

5. R&D INFRASTRUCTURE

The in-house R&D Centres have created impressive infrastructural facilities including sophisticated instrument facilities and equipment as well as pilot plant facilities for carrying out high level R&D work relating to the areas of manufacturing activities of the firms. It is estimated that the R&D assets possessed by the in-house R&D units are around Rs. 1300 crores at present. Some of the sophisticated facilities available are: HPLCs, gas chromatographs, IR spectrophotometers, UV-Vis spectrophotometers, thermo-analytical equipment, NMR spectrometers, electron microscope, high temperature test and evaluation facilities, creep measuring equipment, prototype development facilities, CAD-CAM facilities, multipurpose pilot plant facilities and a host of others including excellent library facilities.

6. 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 nearly 400 units. By 1981-82 the figure was over 30000 for about 750 units. The present estimated manpower for the 1256 in-house R&D units is around 50000. Of this, there are 2700 Ph.Ds, 16500 post graduates, 14000 graduates and the rest are other qualified personnel.

7. SECTOR-WISE BREAK-UP OF IN-HOUSE R&D UNITS

A broad sector-wise break-up of the recognised in-house R&D units is as below :

(i) Chemical and Allied Industries	-	425
ii) Electrical and Electronics Industries	-	325
iii) Mechanical Engineering Industries	-	250

- iv) Processing Industries - 200
(Metallurgical, Refractories, Cement, Ceramics, Paper, Leather and others)
- v) Agro Industries and others - 56

8. IN-HOUSE R&D UNITS : OUTPUT

Contributions from the in-house R&D units can broadly be summarised as under :

- Availability of R&D facilities.
- Availability of trained manpower for industrial R&D.
- Interface with public funded institutions.
- Participation in national and international seminars and workshops.
- Papers published in journals/seminars; patents and designs.
- Joint research projects/programmes/sponsored research.
- Pilot plant and semi-commercial plant level investigations.
- Import substitution of materials/components.
- Assist in technology absorption.
- Diversification.
- Technology Improvement/upgradation of technology.
- Assist in technology transfer/negotiations.

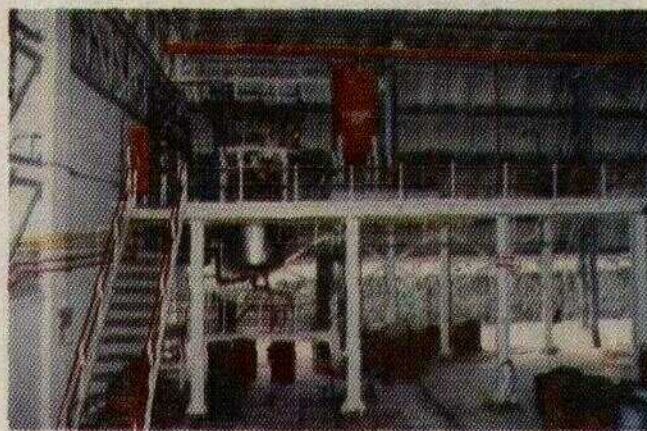
Some of the R&D achievements reported by the recognised in-house R&D units are listed below:

Chemical and Allied Industries

- Process development of Certirizine Dihydrochloride, Lomefloxacin Hydrochloride, Amlodipine Besylate, Sparfloxacin, Ramipril, N-1(S)-Ethoxy Carbonyl - 3 Phenyl Propyl-L-Alanine
- Process development of Chlorpheniramine Maleate, Mepyramine Maleate, Cetirizine Dihydrochloride, Felodipine, Amlodipine Besylate, Sodium Stearyl Fumarate.
- Process development and formulation of Nimesulide, Gemfibrozil, Cinnarizine, Finasteride, Lansoprazole, Novaldiamine
- Process development for recovery of

mononitrochloro-benzenes from waste residue of nitro chlorobenzene plant

- Process development for Volini Gel, Ultra K Tablets, Permite & Perlice, Ultrazox Tablets
- Process development for the production of Naproxen Sodium, N-methyl Glucamine, Sparfloxacin, Lansoprazole, Melatonin
- Development of Process route for Manufacture of Dextro-metorphan hydrobromide,
- Development of drugs from Herbal origin on sexual Performance and Hormone levels in rats.
- Development of Fluidised bed Heat Exchanger for fouling liquids
- Development and technology improvement for manufacture of Export quality sandalwood Oil without involving redistillation
- Development of Emulsion Booster, Hand Grenade Simulator, Sqibs for Gyro Ignitor, Gyro Squibs
- Development of Ammoxidation process for conversion of picolines to cyano-pyridines.



III.A.2 Reactor for Phenolic Resins

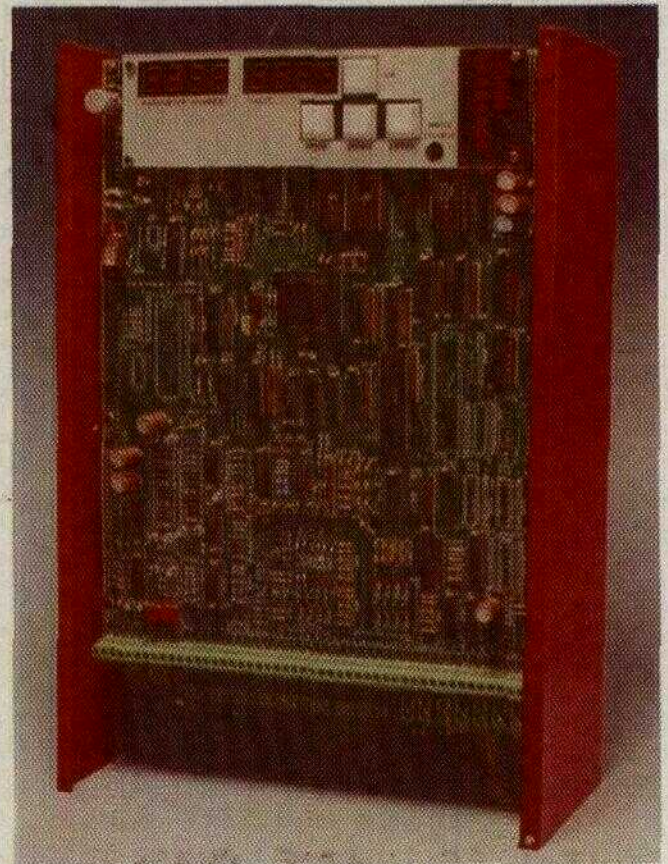
- Development of manufacturing Process Technology for Trichlorocarbanilide (TCC)
- Development of Hexaconazole, Cypermethric acid methyl ester.
- Development of Ortho-Toluene Sulphonamide and Para Toluene Sulphonamide for fluorescent dyes.

- Development of HT grease for concert mills, High EP Aluminium complex grease, solid lubricant paste, water resistance grease and technology for refining of used lubricating oils.
- Development of Epoxy polyamide system, coal tar Epoxy and Zinc rich Epoxy paints for corrosion resistant primers.
- Development of biological treatment process for epichlorohydrin plant waste waters.
- Process development for Bio-degradation of ammonia in liquid effluent.
- Process Development of Thermal Urea Hydrolyzer cum stripper technology - a device for the treatment of urea plant effluent to abate pollution through recovery and reutilisation.

Electrical & Electronics Industries

- Development of Lightning Arrester Disconnecter.
- Development of Impact (Paging Control Terminal), Convex (voice processing system), ADAM (advanced digital answering machine), Comex (personal telecom manager).
- Development of Global Positioning System Receiver (GPSR)
- Development of Automotive Direction Indicator-integrated circuit (BEL1041B), 2-Channel Led Level Meter Driver (BEL 2281) for Use in Stereo Systems, Range Processor HMC for Laser Range Finder.
- Development of New GTO based single-phase static converter for Loco Auxiliaries, Microprocessor based Turbine stress-controller, Microprocessor based Electro-hydraulic Turbine Controller (EHTC), Microprocessor based steam Temperature control system for 210/250/500 MW Thermal Power Plant controller, Microprocessor based Electrohydraulic Governor for Hydro Turbines.
- Development of Programmable power controller for Thermo Vaccum chamber for Testing satellites, Programmable Weft selector for Rapier Power Loom, Microprocessor based Electro-static Precipitator controller BAPCON/COMCON/RAPCON, Microprocessor Based Automatic Transmission Controller,

Microprocessor based Automatic Concrete Mixing Controller, Microprocessor based Packaging Machine Controller.



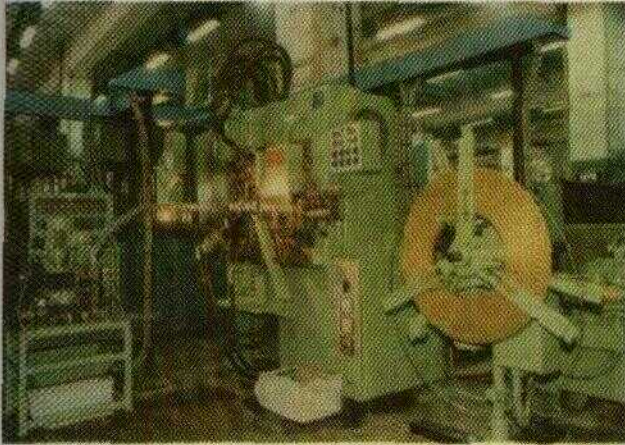
III.A.3 Digital Regulator Phase-I

- Development & Productionisation of Four layer diode with specific breakover voltage & switching current, 2GHz, 2 Mbps, 1KW Digital Static Troposcatter Communication equipment, Radar Video Extractor.
- Development of Microprocessor based system for Ship Installed Radiac system SIRS 4012, Disturbance Recorder, Latent Print Finder, EC Double Beam Atomic Absorption Spectrophotometer Element As AAS 4139, EC Micrpscan MS 5805A-ELISA Reader.
- Development of 5000 A LT Air circuit-breaker (3 Pole) 4 Pole LT Air Circuit - breakers from 600 A to 4000 A rating, Air Circuit breakers of 2000 A & 4000 A for warships and sub-marines of the Indian Navy.

- Development of Transmission Line Towers of 400 KV & 765 KV Power Line.
- Development of Electronic Flash Key Telephones, tone pulse switchable telephones. Export of technology for manufacture of electronic push button telephones.
- Development of Technology 250 W DC-DC Converter for Loco application, wheel flange lubricating system, energy cum speed monitoring system for EMUs.
- Development of On Line process Gas Chromatograph, Low cost gas chromatograph and Dissolved gas Analyser.
- Development of Ringless Flyback Transformer with stray emission and switch off spot suppression unit for CTVs, Cable TV Tuner.
- Development of Phoenix - 200 CNC, Viking - 150 CNC, Photoverter, Digitrak - Mark II.
- Development of Co-axial Resonator, Microwave, Band Pass Filters, Suspended Substrate Stripline, Microwave, Low Pass Filters.
- Development of Low cost modulator for CATV home computer & video cassette recorder.
- Development of low maintenance batteries for lighting and airconditioning purposes in Indian Railways with life expectancy of 3-4 years.
- Design and Development of 55 KW and 200 KW Wind Electric Generators, 4KW Wind Electric Generator for Battery Charging.
- Development and commercialisation of technology for the manufacture of machines namely swing Arm Clicker (Model M-251), Band knife splitting machine (400 mm) Model No. M-101, Beam cutting press, Combined finishing machine Model No. M-281 for making components of Leather products and footwear products.
- Development of Twin Spindle CNC Internal Grinder Model GCI - 300 -CNC, High Prodn. CNC External Profile Grinder (GCE-CNC). 2000 Table Dia Vertical Rotary Surface Grind.
- Design & development of Tempo traveller 'Ambulance'; Tempo 'OX 45' tractor, Minidoor pick up.
- Development and production of Main Gear Box (MGB) housing casting with special minicore technology for Advanced Light Helicopter (ALH).
- Development and introduction of micro irrigation system, commercialisation of Floppy/Pop-up Floppy Sprinkler.
- Development of CFC Free Hermetic Refrigeration Compressors using OZONE friendly referigerant.

Mechanical Engineering Industries

- Design and development of Quartz Analog Wrist Watch slim movement
- Design and development of TBL-70 Back HOE loader; TMX 20 Mini Excavator, TFC-380 long crawler.
- Design and development of Aesthetic Steel cars type IND-140 for AC 1 Model 1 Speed microprocessor operation control NE300 with automatic rescue device for elevators with manual doors, solid state controller.
- Design and development of Hydrostatic drive for shunting Loco; 120 Ton hose crimping machine.
- Development of Woven Asbestosfree Technology for Clutch facings.
- Development of Low capital cost continuous oil fired high temp. tunnel kiln to attain temperatures upto 1700°C.
- Development of four colour and five colour printing machine for export.
- Development of micro processor welder with energy window, ultrasonic tube cleaning machine.
- Development of Grid Assisted Photovoltaic power system, Solar Photovoltaic Pump, solar powered refrigerator for vaccine storage.

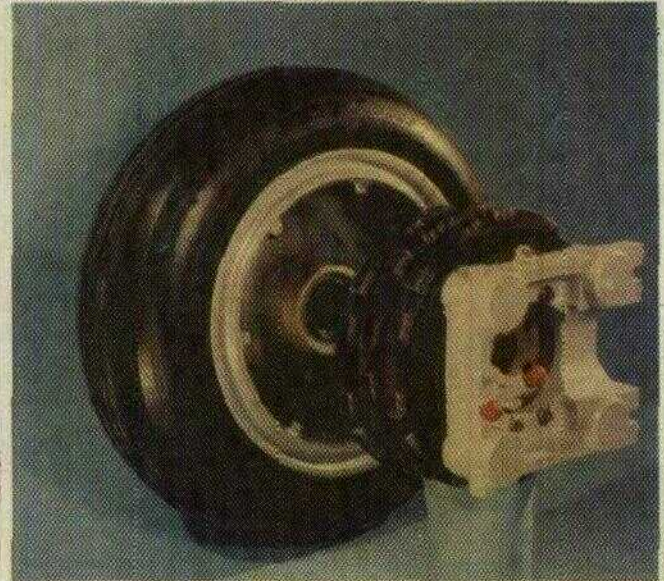


III.A.4 Hydraulic Multislide Machine

- Design and development of Electric Car, IVTFE valves upto 600 mm.
- Development of a Hydraulic Multislide Pressworking Centre
- Development of Vertical Glandless Pump, Non-Metallic Pumps
- Development of Tata SUMO vehicles for domestic and Export markets, TATA 709 light commercial vehicle for domestic and export markets.
- Development of Heavy Duty Rickshaw Tyre using different type of synthetic tyre cord, Butyl Tubes in all available sizes using dunlop, american, french (Presta) valves for export market.
- Development of Soya Milk Processing Plant.
- Development of Automatic Milk Collection station machine, Weighing Machine Digitiser, Low Cost Platform scale.



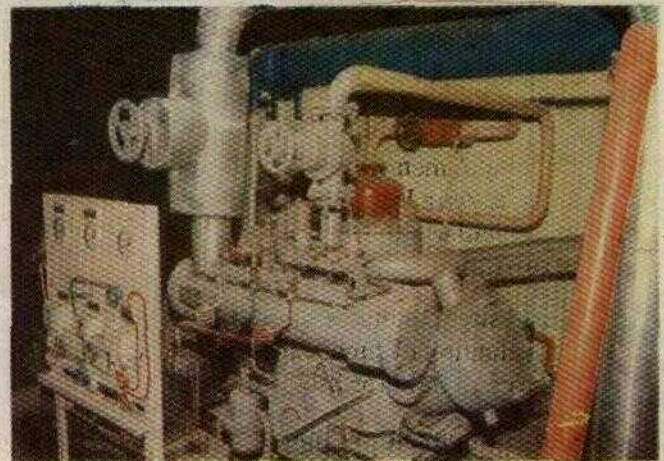
III.A.5 TMX-20 Mini Excavator



III.A.6 Wheels & Brakes System

Processing Industries

- Development of Technology for manufacture of precision blade forgings for Aeroengine.
- Development of powder-metallurgy based Metallo ceramic brake pads for Jaguar aircraft.
- Development of EPDM sponge compound for critical section of Maruti YE-2/ZEN Door Rubber profiles.
- Development and Commercialisation of Rice Husk Particle Board technology.
- Technology development for locowheel for Indian Railways, Automation in Rolling Mills for Improving quality and Productivity,
- Development of high strength steels (SAILCOR),



III.A.7 Environment Test Chamber

- Commercialisation of process for manufacture of glassy carbon.
- Development of process for Semi conducting laminate, Nomex prepreg, Polycom Link/Tubes/Laminate, CF (High Impact Glass Phenolic Laminate, Polyimide Slot Wedges.
- Development of Resin Transfer Moulding technology package for Moulding FRP products.



III.A.8 Laser Particle Size Analyser

- Development of process for the manufacture of High density fine grained isotropic Graphite
- Development of process for continuous flexible graphite foil manufacture plain and reinforced
- Process optimisation of Deoxidation Practice for Improving Chromium Recovery in Production of Stainless Steel through EAF-VOD route.
- Development of Fully indigenous commercial plant, machineries and preform for drawing Optical Glass fibres for light guide and imageguide application.

Agro Industries

- Development of hybrid varieties of Cotton, Okra, Brinjal & Chilli, Sunflower, Cucurbits.
- Development and release of an early maturing super okra leaf type hybrid resistant to disease particularly to insect pests.
- Development of micro propagation technologies for sugar cane, Pilot scale production and evaluation of sugar cane tissue culture plants at farmers field for its performance.
- Development of superior disease tolerant sub clones of sugarcane through in-vitro method.

- Development of Testing procedures for synthetic milk, Idometric Evaluation of oxidation Rancidity (Peroxide value of Milk Powders).
- Production of Hybridoma lines to produce monoclonal antibodies, Commercial production of MAbs using mouse ascites system.
- Development of hybrid rice seed production technology for Raising genetic ceiling productivity in rice through hybrid breeding,
- Development of immuno diagnostic kits for poultry diseases of viral origin. Investigation of Leechi Heart Disease of Hydro Percadium Syndrome in commercial broilers.
- Development of coloured mycoplasma galilispeticum plate antigen and tube antigen.
- Development of inactivated vaccines for coryza, fowl cholera, and infectious bursal diseases (Bursal derived)



III.A.9 Equipment in Special Grade Alumina Pilot Plant

9. IMPORTS MADE BY 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 : HPLC/GPC Instruments Shimadzu-10A; SIM DIST Analyser; Saybolt Chromometer; Perkin Elmer gas chromatograph; Carl Zeiss Stereo Zoom Microscope Stemi 2000C with 35mm Photomicrography system, Single Beam UV-VIS-NIR Fiber-Optic spectrophotometer for absorbance, transmittance, reflectance, Twist Tester; Karl Fischer Titrator, Digital Fibrograph with Fibrosampler; Mooney viscometer and moving die rheometer; Mechanical stability test apparatus, Ultra centrifuge with rotor and Refrigerated table top centrifuge; Brightness meter; X-ray diffractometer; UV-VIS Dual Beam Spectrophotometer Brookfield viscometer; Perkin-Elmer GC-FTIR system, Differential scanning calorimeter controller, Ozone resistance/ exposure tester, Hydraulic through feed buffing machine, Hydraulic splitting machine, Hydraulic shaving machine, FT-NMR spectrometer, Dissolved oxygen meter, digital model 58, Gallon blender, adapter, X-Ray diffraction system, Colour image analysis system, Inverted phase contrast fluorescence microscope, 4 channel 100 MHz Oscilloscope, Power scope, Portable non-contact thermometer, Microsheen Digital Opacity Reflectometer; Haze Gloss with standards, Partical size analyzer, Mettler balance; Mettler autotitrator; Buchi Rotary Evaporators; Cased leaf drier; Infrared Moisture Meter; Score Ratio Tester; Automatic Weight Classifier; Inverted research microscope & zoom stereo microscope, Thermometer non-contact infrared temperature/ humidity meter, CO Sensor and Filter, Portable Digital Pneumatic calibrator, Binary gradient HPLC system, Microprocessor controlled glass disc preparation unit; Laboratory attritor; Sedigraph particle size analyser with auto sampler; Coulter particle size analyser, Variable speed peristaltic pump, Rotavapor and Vacuum systems.

10. CERTIFICATE OF INDIGENOUS DEVELOPMENT OF TECHNOLOGY/ KNOW-HOW FOR BULK DRUGS

Bulk drugs manufactured through process know-how developed through In-house R&D are eligible for exemption from the Price Control for a period of five years after their introduction in the market. The

Department examines the requests of the in-house R&D Units for issuance of a certificate of indigenous technology development for seeking price control exemption. The examination is through detailed discussions, inputs and views of experts in the field of drug development and discovery, technical visits by expert terms. Taking into account to various inputs and also considering the novelty and innovativeness of the process as also the cost considerations, the certificate of indigenous development of process know-how is issued for seeking price control exemption to deserving cases.

During the Year 1996, two certificates of indigenous development of technology/process for manufacture of bulk drugs for seeking exemption from Price Control was issued in respect of the bulk drugs Captopril and Dextropropoxyphene to M/s Wockhardt Limited, Bombay.

11. 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: engagement of foreign experts for R&D and for maintenance/ commissioning of imported R&D equipment requiring such expertise, allotment of special controlled materials for R&D etc. are dealt with.

A number of cases regarding locational clearance with respect to expansion of R&D have been dealt with. A number of applications regarding disposal of R&D equipment and also pilot plant produce were examined and the decisions of the Department conveyed.

12. COMPUTERISATION OF DATA ON IN-HOUSE R&D UNITS

Names, addresses location of in-house R&D units as well as validity of recognition, and other relevant data of all the recognised in-house R&D units are computerised and updated. As on 31 December 1996, there were 1256 in-house R&D units recognised by DSIR and whose data are entered in the computer.

13. CONFERENCES, AWARDS, PROJECT SUPPORT AND PUBLICATIONS

The EFC Memorandum for the plan scheme Research and Development by Industry for the Eighth Plan Period (1992-97) was approved in 1992 with an allocation of Rs. 4 crores. The broad objectives of the scheme are :

- bring in-house R&D into sharper focus;
- strengthen R&D infrastructure in industry and 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.

Activities undertaken towards achieving the above are presented below:

a) Tenth National Conference on in-house R&D in Industry

Department of Scientific and Industrial Research (DSIR) organised the Tenth National Conference on in-house R&D in Industry in association with the Federation of Indian Chambers of Commerce and Industry (FICCI) during 10-11 December 1996 in New Delhi. Attended by nearly 500 delegates from industry, National Laboratories, IITs and Universities, Scientific and Industrial Research Organisations (SIROs), Consultancy Organisations, Government Departments, the Conference was inaugurated by Shri Yoginder K. Alagh, Union Minister of State (Independent Charge) for Planning & Programme Implementation and Science and Technology in the Convention Hall, Ashok Hotel, New Delhi. The Minister gave away the 1996 DSIR National Awards for Outstanding in-house R&D Achievements to seven industrial units. The Valedictory address was delivered by Dr.M.R.Srinivasan, Member (Science), Planning Commission. Dr.Srinivasan also released the DSIR publication "Compendium on in-house R&D Centres -1996."



III.A.10 Shri Yoginder K. Alagh, Union Minister of State (Independent Charge) for Planning & Programme Implementation and Science & Technology at the inaugural session.

b) National Awards for R&D Efforts in Industry

In order to provide recognition to the efforts of the industry towards innovative research and technological development, the DSIR has instituted National Awards for R&D Efforts in Industry in 1987. These awards are in the form of shields made of sterling silver and are presented along with citations at the inaugural session of the Annual National Conference on in-house R&D in Industry. During 1988, National Awards were presented to 7 firms; in 1989 to 9 firms; in 1990 to 12 firms; in 1991 to 8 firms; in 1992 to 9 firms; in 1993 to 9 firms, in 1994 to 12 firms, in 1995 to 15 firms and in 1996 to 7 firms for Outstanding R&D Achievements.



III.A.11 DSIR National Award Winners

Following is the list of the award winners in 1996:—

Chemical and Allied Industries

1. Armour Polymers Limited., Mumbai

Drugs and Pharmaceuticals Industries

2. Hetero Drugs Ltd., Hyderabad

Electrical Industries

3. Lamco Lightning Arrester Mfg. Company Pvt. Ltd., Hyderabad

Electronics Industries

4. Patwa Kinarivala Electronics Ltd., Vadodara

Mechanical Engineering Industries including Capital Goods Development

5. Titan Industries Limited, Hosur

Agro Industries

6. Ankur Seeds Pvt. Ltd., Nagpur

Technology Absorption

7. Jain Irrigation Systems Ltd., Jalgaon

c) Compendium on in-house R&D Centres - 1996

At present there are over 1250 in-house R&D units recognised by the Department of Scientific & Industrial Research. Efforts have been initiated to assess the contributions made by these in-house R&D units. While some of them have claimed achievements in the areas of import substitution, technology absorption and improvements to the technologies in use, a more qualitative and quantitative assessment of the same and appropriate corrections are necessary to ensure that the contributions made by the in-house R&D units dovetail adequately in the overall efforts of technological and industrial development. Since 1985, DSIR has brought out publications highlighting the achievements claimed by the in-house R&D Centres. The first publication of "Compendium on in-house R&D Centres" was brought out during 1985 covering 193 in-house R&D Centres, a second one in 1986 covering 132 Centres, third one in 1987 covering 209 Centres, fourth one in 1988 in 4 volumes covering 589 Centres, fifth one in 1989 covering 188 Centres, sixth one in 1990 in two volumes covering

448 Centres, seventh one in 1991 in two volumes covering 439 Centres, eighth one in 1992 in two volumes covering 384 Centres, ninth one in 1993 covering 291 Centres, tenth one in 1994 in two volumes covering 491 Centres and the eleventh one in 1995 in two volumes covering 376 Centres.

The Compendium on in-house R&D Centres - 1996 was compiled by DSIR based on the information and material received from 283 in-house R&D Centres along with their applications for renewal of recognition beyond 31 March 1996. This was released during the Valedictory Session of the Tenth National Conference on in-house R&D in Industry on 11 December 1996 by Dr.M.R.Srinivasan, Member (Science), Planning Commission.



III.A.12 Dr.M.R. Srinivasan, Member (Science), Planning Commission releasing DSIR Special Publication.

d) Outstanding in-house R&D Achievements - 1996

DSIR had brought out a special publication "Outstanding in-house R&D Achievements (1988 — 91)" during December 1991 covering the award winning achievements of 36 companies. A second publication "Outstanding in-house R&D Achievements (1992 & 1993)" was brought out during November 1993, covering the award winning achievements of 18 companies. A

third publication "Outstanding in-house R&D Achievements (1994 & 1995)" was brought out during November 1995, covering the award winning achievements of 27 companies. A fourth publication "Outstanding in-house R&D Achievements - 1996" was brought out during December 1996, covering award winning achievements of 7 companies. The information contained in these publications give an indication of the excellent R&D capabilities of some of the in-house R&D centres and their contributions to the industrial development in the country.

e) In-house R&D in Industry - Information Update

As the number of in-house R&D Centres has increased while the activities of DSIR have also diversified significantly with respect to in-house R&D Units, it was felt appropriate to devise a quick communication system between DSIR and in-house R&D Units. Accordingly, the DSIR started bringing out a quarterly Information Update on in-house R&D in Industry on a regular basis since April 1988. The Information Update is intended to provide a fast communication link between DSIR, in-house R&D Units and SIROs and serve to disseminate useful and important information relevant to R&D in Industry.

During 1996-97, four issues of in-house R&D in Industry were brought out in April, July, October 1996 and January 1997. These have been widely disseminated to industry, SIROs, Government Departments, missions abroad and others and are well received.

f) Support for Joint R&D Projects

DSIR under the plan scheme "Research and Development by Industry" considers providing catalytic support for industrial R&D projects taken up by recognised in-house R&D units jointly with National Laboratories/Universities/IITs. The projects should be in high priority areas of importance to domestic technology development.

DSIR has approved partial financial support of Rs.2.45 lakhs as project grant to Centre for Development of Electronic System (CDES), Madras for development of high performance TMS320C30 based DSP board for IBM PC-AT computers with relevant softwares. Design and development of hardware and development of testing softwares like TMS320C30 assembler and disassembler was the responsibility of CDES. The applications

softwares was developed by M/s. Vi Microsystems Pvt. Ltd., Madras. The project is completed and completion report is received in DSIR.

DSIR has also approved financial support of Rs.11.75 lakhs as project grant to M/s. Hormone Research Foundation, New Delhi to conduct developmental studies for producing commercially viable ELISA kits of cortisol, progesterone, testosterone and estradiol. The project is expected to be completed by March 1997.

DSIR has commissioned a study to bring out a status report on industries sponsored research programmes in government laboratories and other public funded institutions at a total cost of Rs.3.0 lakhs through the National Research Development Corporation, New Delhi. NRDC has submitted the final report to DSIR.

g) Publications

Following 11 publications were brought out during the year 1996-97 :

- i) Compendium on in-house R&D Centres — 1996
- ii) Outstanding in-house R&D Achievements — 1996
- iii) National Awards for R&D Efforts in Industry (1996)
- iv) Research and Development in Industry — An Overview (1996)
- v) In-house R&D in Industry — Information Update (April 1996)
- vi) In-house R&D in Industry — Information Update (July 1996)
- vii) In-house R&D in Industry — Information Update (October 1996)
- viii) Directory of Recognised in-house R&D Centres (November 1996)
- ix) Directory of Recognised Scientific and Industrial Research Organisations (November 1996)
- x) In-house R&D in Industry — Information Update (January 1997)
- xi) Profile on Scientific Industrial Research Organisations (1996) (In Press)
- xii) Proceedings of the Tenth National Conference on In-house R&D in Industry. (In Press)

III (B). SCIENTIFIC AND INDUSTRIAL RESEARCH ORGANISATIONS

1. INTRODUCTION

Scientific Research Associations, Institutions, Universities and Colleges which undertake research in the area of medical, agriculture, natural and applied sciences and social sciences seek approval under section 35 (1) (ii) or (iii) of the *Income Tax Act, 1961* if they wish to obtain donations from industry or other sources. The institutions notified under the section obtain benefit to the effect that any sum paid to them for research purposes is wholly exempted from the levy of Income-Tax. The donors who pay sums to such notified institutions are allowed deductions from the profits and gains of their business.

Prior to 1 June 1982, ICAR, ICMR or ICSSR were the Prescribed Authorities for approving research foundation for notification by the Ministry of Finance in the areas of agricultural sciences, medical sciences and social sciences respectively. With effect from 1 June 1982, Secretary, Department of Science & Technology was designated as the single Prescribed Authority to deal with approval of all the above areas. Consequent to the creation of Department of Scientific and Industrial Research, Secretary, DSIR has been designated as the single Prescribed Authority for approval U/s 35(1)(ii)/(iii) of I.T. Act, 1961.

Through an amendment by the Direct Tax Laws (Amendment) Act, 1987, effective from 1 April 1988, certain provisions under Section 35 inter-alia was deleted. Government however, reintroduced the provisions withdrawn earlier under Section 35 of the *Income Tax Act* with modifications by Direct Tax Laws (Amendment) Act 1989 w.e.f. 1 April 1989. The Prescribed Authority for Section 35 is the Director General (Income Tax Exemptions) in concurrence with Secretary, Department of Scientific and Industrial Research, Ministry of Science and Technology, Government of India.

2. RECOGNITION OF SCIENTIFIC AND INDUSTRIAL RESEARCH ORGANISATIONS (SIROs)

The DSIR has launched a scheme of granting recognition to Scientific and Industrial Research Organisations (SIROs) in 1988 and Secretary, DSIR is

the authority for granting such recognition. SIROs recognised by DSIR are eligible for Customs Duty Exemption on import of equipment, spares and accessories for R&D; they are also eligible for notification under section 35 (1) (ii)/(iii) of the *Income Tax Act* for availing associated tax benefits.

The DSIR has brought out Guidelines for Recognition of Scientific and Industrial Research Organisations (SIROs) and Approval Under Section 35 (1) (ii)/(iii) of *Income Tax Act, 1961*, which gives procedural details and application proforma for seeking recognition under the SIRO Scheme. Functional Scientific and Industrial Research Organisations (SIROs) having broad based Governing Council, Research Advisory Committee, Research Personnel, Infrastructural facilities, well defined research programmes and clearly stated objectives of undertaking scientific research are considered eligible for recognition by DSIR.

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), University Grants Commission, and Central Board of Direct Taxes (CBDT)/Director-General-Income Tax (Exemptions). The Committee is presently Chaired by Adviser (RDI), DSIR. The recommendations of the Screening Committee are put up for approval of Secretary, DSIR, who is the concurrent Prescribed Authority for notification U/s 35(1)(ii)/(iii) of IT Act. The concurrence of Secretary, DSIR, is communicated to the Director-General-Income Tax (Exemptions), Calcutta, for notification under section 35 (1)(ii)/(iii) of IT Act.

During the year 1996, the Screening Committee met 11 times and recommended 35 cases for recognition as Scientific and Industrial Research Organisations and notification U/s 35(1)(ii)/(iii) of IT Act, 1961. List of these SIROs is furnished at Annexure III-B.1. and III-B.2.

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 of 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 and ICSSR depending on the area. Based on the evaluation made by the Research Review Group, renewal of recognition is granted to SIROs and concurrence of Secretary, DSIR is communicated to DG, ITE for notification of SIROs u/s 35 (1) (ii)/(iii) of I.T. Act, 1961.

At present there are 531 SIROs duly recognised by DSIR. Of these, 191 are in the area of Natural &

Applied Sciences, 164 are in the area of Medical Sciences, 37 are in the area of Agricultural Sciences, 116 are in the area of Social Sciences and 23 are Universities/Colleges. DSIR has printed Directory of Recognised Scientific & Industrial Research Organisations in November 1996.

The SIROs have employed qualified scientists and researchers and also established good 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 papers/reports/books in several areas. DSIR has compiled a profile on Scientific Industrial Research Organisations (1996) which is under print.

III(C). FISCAL INCENTIVES FOR SCIENTIFIC RESEARCH

1. INTRODUCTION

Government have 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. The incentives change from time to time. Some of the incentives like weighted tax deduction under section 35(2B) and enhanced investment allowance under section 32A(2B) of the I.T. Act have been discontinued. Similarly preferential treatment in licensing, delicensing of industrial set-ups and commercialisation of indigenous technologies by MRTP companies have been further liberalized and absorbed in the new Industrial Policy. The union budget for 1996-97 has introduced a set of new incentives to encourage investments in R&D by industry.

Fiscal incentives and support measures presently available include: (a) Income tax relief on R&D expenditure; (b) Weighted Tax Deduction for sponsored research; (c) Customs Duty Exemption; (d) Five year tax holiday for commercial R&D companies; (e) Excise duty waiver for 3 years on goods produced based on indigenously developed technologies and duly patented in any one of the countries in European Union and in USA or Japan or in both; (f) Accelerated Depreciation Allowance on plant and machinery set-up based on indigenous technology; (g) Price Control exemption on domestic R&D based bulk drugs; (h) International R&D collaborations; (i) Direct financial support for R&D Programmes in industry; (j) National Awards for Outstanding In-house R&D achievements and commercialization of public funded R&D, and (k) other indirect benefits.

2. INVESTMENT ALLOWANCE ON PLANT AND MACHINERY SET UP BASED ON INDIGENOUS TECHNOLOGY.

To accelerate the growth of industrial development through research, design and development within the country, several incentives have been evolved from time to time. One such incentive was in the form of investment allowance at enhanced rate, U/s 32A(2B) of IT Act, 1961 on new plant and machinery installed after 30 June 1977 but before 1 April 1987.

Secretary, Department of Scientific and Industrial Research, Ministry of Science and Technology, is the prescribed authority for certifying the investments made on plant and machinery based on indigenous technology.

Applications received in DSIR for such certificates are examined in details as followed by discussion and / or technical visits to the plants by expert teams set up for verifying the claims made by the applicant company. After carefully considering all the information, the cases along with all details are put up to the Secretary for his approvals in deserving cases.

During the year 1996, one certificate u/s 32A (2B) of I.T. Act, 1961 involving Rs. 397 lakhs as cost of plant and machinery was issued by DSIR. Details are given in Annexure III C.1.

3. DEPRECIATION ALLOWANCE ON PLANT AND MACHINERY SET UP BASED ON INDIGENOUS TECHNOLOGY

Government have introduced a system of allowing accelerated depreciation in respect of blocks of assets and rationalised the rate structure by reducing the number of rates as also by providing for depreciation at higher rates.

Secretary, Department of Scientific & Industrial Research, Ministry of Science and Technology, is the Prescribed Authority to certify expenditures where higher rate of depreciation is to be allowed for the plant and machinery using indigenous know-how. Guidelines have been issued for making applications for obtaining the aforesaid certificate. All such applications received are examined in the department, and discussions and technical visits to verify the claim are made to the plants by expert teams. Based on a detailed examination, certificates in deserving cases are issued for eligible expenditure.

During the year 1996, 13 certificates involving Rs. 9694 lakhs as cost of plant and machinery were issued by DSIR. Details of these cases are given at Annexure III.C.2.

4. WEIGHTED TAX DEDUCTION FOR SPONSORED RESEARCH

Government have introduced a provision of allowing a Weighted Tax Deduction of 125% of the financial contribution made by industry on R&D projects and programmes sponsored by industry in approved National Laboratories under CSIR, ICAR and ICMR. This has now been extended to cover Universities, Indian Institutes of Technology and National Laboratories functioning under the aegis of the Defence Research and Development Organisation, Department of Electronics, Department of Biotechnology and Department of Atomic Energy, vide Gazette Notification dated 23 November, 1994 issued by Department of Revenue, Ministry of Finance.

Applications for obtaining approval for such Weighted Tax Deduction under section 35(2AA) of the Income-tax Act, 1961 are made by the sponsor to the Department of Scientific & Industrial Research in the Ministry of Science and Technology. Projects and programmes approved by Secretary, DSIR are intimated to the Director General (Income-tax Exemptions), Calcutta for issuance of the necessary Weighted Tax Deduction Order.

The Union Budget for 1996-97 has introduced an amendment to delete the requirement of approval of the programme by the aforesaid prescribed authority and the requisite approval to the programme is now given by the Head of the concerned National Laboratory or the University or the Indian Institute of Technology. The amendment has taken effect from 1 October 1996.

Three sponsored research programmes involving Rs. 142.3 lakhs were approved by DSIR during April-September 1996. Details of this scientific programme are given at Annexure III.C.3.

5. CUSTOMS DUTY EXEMPTION ON GOODS IMPORTED FOR USE IN GOVERNMENT FUNDED R&D PROJECTS

The Union budget for 1996-97 introduced the provision of customs duty exemption on specific goods imported for use in R&D projects funded partly by any Department of the Central Government and undertaken

by the company in their in-house R&D unit recognised by DSIR. A certificate from the Ministry or Department, as the case may be, funding the research project stating the essentiality of the item/s in each case at the time of importation would make the item/s eligible for duty free import for that R&D programme by the company.

6. SCIENTIFIC RESEARCH ASSETS AND ACTIVITIES REFERRED UNDER SECTION 35(3) OF I.T. ACT, 1961

In the implementation of various incentive schemes for the promotion of research and development, the Income Tax act inter alia provides that expenditures made on capital equipment and related to research activities should be written off 100% in the year in which the expenditures are incurred. The Government however, provided that in complex cases where the Income Tax Department of the Government is unable to appreciate the technical activity involved in research or the equipment are sophisticated and intricate and the Department is unable to appreciate the use of equipment regarding research, then the matter should be referred to the Prescribed Authority through CBDT/DG(ITE). Director-General of Income Tax (Exemptions) in concurrence with Secretary, DSIR is the prescribed authority for deciding such cases.

On receipt of the reference in DSIR, the department collects information/background regarding the description of the activity claimed as scientific research, date of commencement of the relevant projects, date of completion of research work as also the results obtained from the specific project. After obtaining all these details, the matter is examined in DSIR. In case where it is considered necessary, a team of technical experts is constituted for on the spot appreciation of the research work done at the premises of the company.

After receiving the technical assessment report from the visiting team, a discussion is also normally held so that the point of view of the Company is taken into account before arriving at a decision. After completing the processing of the case in the above fashion, the case file is placed before the Secretary DSIR for giving a decision. The Secretary DSIR gives his decision by setting out a reasoned order duly signed by him which is communicated to Director General of Income Tax (Exemptions).

During the year one case of M/s Nuchem Plastics Ltd., Faridabad was dealt with.

7. APPROVAL OF COMMERCIAL R&D COMPANIES

In order to promote research and development activities in the commercial research and development companies the Union Budget for 1996-97 has proposed to provide for a five year tax holiday under section 80-1A of the Income Tax Act, to approved companies engaged in scientific and industrial research and development activities on commercial lines. This incentive is available to any company that has as its main objective, activities in the area of scientific and industrial research and development and which has been accorded approval by the prescribed authority. Secretary, Department of Scientific & Industrial Research is the Prescribed Authority for this purpose.

The tax holiday is available to any company whether new or existing, which is accorded approval by the prescribed authority at any time before the first day of April 1998. The 100% deduction for a five year period commences from the assessment year relevant to the previous year in which the approval by the Prescribed Authority is accorded to such a company.

The proposed amendment will take place from 1st April, 1997 and will accordingly apply in relation to the assessment year 1997-98 and subsequent year.

Guidelines for implementation of the scheme have been evolved. The scheme will be implemented as soon as necessary Gazette notification are issued by the Finance Ministry.

8. EXCISE DUTY WAIVER

The Union budget for 1996-97 introduced the provision of exemption of all goods falling under the *Schedule to the Central Excise Tariff 1985 (5 of 1986)* from the whole of the duty of excise leviable thereon provided such goods are manufactured by a wholly *Indian owned company such goods are designed and developed by such Indian company, the goods so designed and developed are patented by such Indian company in India and in any one or more of the countries of the European Union and in United States of America*

or Japan or in both, for a period of 3 years from the date of commencement of commercial production. The manufacturer, before commencement of commercial production, should produce a certificate from the Department of Scientific & Industrial Research to the effect that the said goods are designed and developed by a wholly Indian owned company and patented in any one of the countries of the European Union and in United States of America or Japan or in both, to the Jurisdictional Commissioner of Central Excise.

9. CUSTOMS DUTY EXEMPTION TO RECOGNISED SIROs

All Scientific and Industrial Research Organisations recognised by DSIR 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 procedure for issuing the essentiality certificates to SIROs for obtaining the customs duty exemptions has been formalised. A Committee was set up with two Directors and two Principal Scientific Officers which meets normally once a week to examine the requests. The Committee's recommendations are put up to Adviser (RDI) for approval.

During the year 1996, 594 essentiality certificates were issued for claiming customs duty on import of scientific equipment, accessories and components, including consumable items. The value of scientific equipment instruments and the consumables was around Rs. 37.90 crores.

Some of the major equipment, spare parts and accessories for which essentiality certificates were issued were:

Shimadzu HPLC, Metler electronic balances, Fermentation monitor column, Nikon Japan inverted microscope model TMS-F-PH4, Olympus Inverted research microscope & zoom stereo microscope, Molecular Imager PC system, High speed centrifuge, Minolta Illuminance meter, adapter cord, Flexi-dry

personal freeze dryer, Hybrid Omnigone thermal cycler & accessories, Perkin Elmer LS 30 luminescence spectrometer, GEL drying system, EPI-fluorescent attachment for Nikon Japan trinocular research microscope, Camera tripod, Laser systems 9 kw with accessories, Fan motor, fan thermostat, Biolistic particle delivery system for gene transfer to plants, Cryogenic light alloy container model TR-26, Fisons GCMS model MD 800 with negative chemical ionisation upgrade kit, Waters HPLC system, Sequential ICP spectrometer;

Sheen paint testing equipments, Diaphot-200 & Trinocular stereoscopic zoom microscope model SMZ-2T-D, Microprocessor controlled CO2 incubator, FID Detector for HP 5880 GC, Compaq server model Proliant 1500R, IKA Microliter plate shaker, colour squid, Laboratory centrifuge, Horizontal Gel electrophoresis unit, DNA sequencer, Densitometer, Table top refrigerated centrifuge GS 15R rotor, Ultra freezer, UV-VIS Spectrophotometer, Zeiss tissue culture inverted microscope, Thermal cycler, Incubator oven shaker, U-V Transilluminator Foto UV 300/MP-ST photographic system, Ultrasonic homogenizer needle hold with stand digital air pressure, Water purification system, MiLiQ reagent grade water purification system, Potapak 250 water treatment unit, Potapak gravel prefilter unit, Millipore water purification system, Analytical balance model AB 104 & PM 400, Vortex mixer.

10. REGISTRATION OF PUBLIC FUNDED RESEARCH INSTITUTIONS AND OTHERS

The Union Budget for 1996-97 introduced rationalisation of customs duty exemption on import of equipment, spares and accessories and consumables for research purposes by public funded research institutions, universities, IITs, IISc, Bangalore; Regional Engineering Colleges, (other than a hospital) for availing the customs duty exemption. The pass book scheme which was hitherto operated by the Department of Science and Technology and the Ministry of Human Resources Development is superseded by a simple registration with the Department of Scientific & Industrial Research. The ceiling on the value of goods imported for R&D is also removed and the head 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. This notification has come into effect from 1 September 1996.

During the year around 500 registration certificates were issued to such public funded research institutions, universities, IITs, IISc, Bangalore, Regional Engineering Colleges for availing customs duty exemption on import of scientific equipment, spares and accessories and consumable items.

IV. PROGRAMME AIMED AT TECHNOLOGICAL SELF RELIANCE (PATSER)

1 OBJECTIVES OF PATSER

The objectives of the scheme on "Programme Aimed at Technological Self Reliance (PATSER)" include:

- (i) Supporting industry for technology absorption, development and demonstration.
- (ii) Building indigenous capabilities for development and commercialisation of contemporary products and processes of high impact.
- (iii) Involvement of national research organisations in joint projects with industry.

2. ACTIVITIES

The activities under PATSER include the following:

2.1 Financial Support to Research, Development, Design and Engineering (RDDE) Projects of Industry:

The Department provides on a selective basis partial financial support to research, development, design, engineering (RDDE) projects to be proposed by industry in the following areas:

- a) Development and demonstration of new or improved product and process technologies including those for specialised capital goods, for both domestic and export markets.
- b) Absorption and Upgradation of imported technology.

The partial financial support by DSIR in the above areas primarily covers prototype development and pilot

plant work, test and evaluation of products flowing from such R & D, user trials etc. Bulk of the cost of the project is met from industry's resources.

The Department under PATSER Scheme has so far supported about 80 Industrial units. These projects cover products and processes in various important industries such as metallurgy, electricals, electronics, instrumentation, mechanical engineering, earth moving and industrial machinery, chemicals and explosives.

During the year, a number of new R&D projects of industry were supported on partial financial support basis and the technology evaluation studies in the pipe line are being completed. The Department had invited, through advertisements in leading news papers, project proposals for technology absorption, development and demonstration from industrial units whose in-house R& D Units had been recognised by DSIR. Consequently, over 300 responses from industrial units seeking further details about the scheme, indicating their technology development projects were received by the Department. During the year 22 projects were considered for partial financial support by DSIR.

The progress of various projects under PATSER Scheme during the year is given below:

2.1.1 M/s Balmer Lawrie & Co. Ltd., Calcutta.

M/s Balmer Lawrie & Co. Ltd., Calcutta has undertaken a project for the development of a set of machines viz Conical Expanding Machine, Flanging and Curling Machine and material handling system for the manufacture of Conical Open Top Steel Drums. This project involves a DSIR support of Rs. 18 lakhs out of a total project of Rs. 72 lakhs. The firm has designed, fabricated and assembled the machines. The plant is likely to be commissioned for commercial production and demonstration in Madras by March, 1997.

2.1.2 M/s Metallurgical & Engineering Consultants (I) Ltd. (MECON), Ranchi

M/s MECON (I) Ltd. has undertaken a project for development of hydraulic AGC (Automatic Gauge Control) system with a DSIR support of Rs. 10 lakhs out of total project cost of Rs. 75 lakhs. The project is in progress.

2.1.3 M/s. Kerala Minerals & Metals Ltd. (KMML), Quilon

M/s KMML is undertaking two projects viz. (a) Recovery of Chlorides, synthetic rutile and heavy metals from the effluent of Titanium Dioxide with DSIR support of Rs. 13 lakhs out of a project cost of Rs. 73 lakhs and (b) Reduction of ilmenite using Sodium Carbonate catalyst in collaboration with RRL, Trivandrum with a DSIR support of Rs. 14.50 lakhs out of the project cost of Rs. 75.00 lakhs.

In the first project, about 60-70% of the chlorides would be recovered and these would be used as the feed to acid recovery plant, saving over 7000 MT per year of HCl worth around Rs. 75 lakhs.

In the second project, the pilot plant work on ilmenite reduction using Sodium Carbonate as the catalyst has been completed at a pilot plant scale at RRL, Trivandrum. Use of this catalyst in ilmenite reduction is expected to lead to reduction in the peak temperature in the rotary kiln by 50 - 75 °C while attaining reduction efficiency of 96%. The project is completed.

2.1.4 M/s Bharat Earth Movers Ltd. (BEML), Bangalore

The project for technology upgradation of 50 ton dumper being manufactured by M/s BEML in collaboration with M/s Westinghouse Air Brake Co. USA was undertaken by the firm with a DSIR support of Rs. 25 lakhs out of total project cost of Rs. 155 lakhs. The project aims to develop and commercialise 'state-of-the-art' equipments. The prototype for Dump Truck has undergone field trials successfully. The project has been completed.

2.1.5 M/s Triveni Structurals Ltd. (TSL), Naini

M/s TSL is undertaking a project for development of various types of 400 KV and 765 KV Self supporting and Guyed type transmission line towers, with a DSIR support of Rs 20 lakhs out of the total project cost of Rs 86 lakhs. Structural Engineering Research Centre

(SERC), Madras is assisting the firm in design and testing of the towers. One prototype of 400 KV guyed wire single circuit 0°-2° Transmission Tower has been developed and has successfully cleared the trials at SERC, Madras. The project is in progress.

2.1.6 M/s. Semiconductors Complex Ltd. (SCL), Chandigarh and Centre for Development of Telematics (C-DoT), New Delhi

This joint project is being executed by M/s SCL and C-DOT for the development of Application Specific Integrated Circuits (ASICs) for Line Card and Conference Card of the C-DOT switching system. This project involving a DSIR support of Rs 20 lakhs out of total project cost of Rs 60 lakhs, is nearing completion.

2.1.7 M/s. Electrical Research & Development Association (ERDA), Vadodara

The project of ERDA is for the development of 7.5 KW Switched Reluctance Motor (SRM) drive system for variable speed applications having good torque speed characteristics, such as for electric vehicles, textile industry, conveyor systems and mining equipments. This project has been undertaken by Electrical Research and Development Association (ERDA), Vadodara in association with M/s Jyoti Ltd., Vadodara. The controller for the SR Motor is being developed by Electronics Research and Development Centre (ER&DC), Thiruvananthapuram. The prototype of the controller has been developed and interfaced with SR Motor developed by Jyoti Ltd. The final testing is in progress at ER&DC.

2.1.8 M/s. Travancore Cochin Chemicals Ltd. (TCCL), Cochin. and Regional Research Laboratory, Trivandrum

M/s Travancore Cochin Chemicals Ltd.(TCCL), Cochin has undertaken a project, in collaboration with Regional Research Laboratory, Trivandrum, for the development of process technology and a capital goods package for the manufacture of synthetic rutile through a new environment friendly route. This project involves DSIR support of Rs. 71 lakhs out of a total project cost of Rs.193 lakhs. A pilot plant has been set up in TCCL at Cochin, and successfully operated based on new process route. The project has been completed. Metallurgical Engineering Consultants (I) Ltd. (MECON) have prepared a feasibility report for

commercial plant of 30,000 TPA capacity for production of Synthetic Rutile. The report has indicated that such a commercial plant will have a good economic viability. Based on the report, TCCL is likely to take an investment decision shortly.

2.1.9 M/s. Litex Electricals Pvt. Ltd., Pune and Society for Applied Microwave Electronics Engineering and Research (SAMEER), Mumbai

The project of M/s Litex Electricals Pvt. Ltd. is for development of Xenon and Krypton filled lamps for laser pumping is being undertaken in association with SAMEER, Mumbai. This project involving DSIR support of Rs.8 lakhs out of total project cost of Rs. 25 lakhs is in progress.

2.1.10 M/s. Orissa Industries Ltd., Rourkela

The project of M/s Orissa Industries Ltd. is for development of Chemical Leaching Technology to reduce Calcium Oxide (CaO) in Bauxite with a view to improve the life of High Alumina refractories. This project was undertaken in collaboration with IIT, Kharagpur, involving DSIR support of Rs. 16.50 lakhs out of total project cost of Rs. 75 lakhs. The project has now been closed.

2.1.11 M/s. CS Zircon, Kala Amb and Institute of Plasma Research (IPR), Ahmedabad

The project of M/s C.S. Zircon is for the development of Plasma based reduction process to manufacture Zirconia, in collaboration with IPR, Ahmedabad, a research society under the Department of Science and Technology. This project involving DSIR support of Rs. 9.5 lakhs out of a total project cost of Rs. 60 lakhs. The project is nearing completion.

2.1.12 M/s. Electronics Research & Development Centre (ER&DC), Thiruvananthapuram

The project of M/s ER&DC is for development of a controller for switched reluctance motor involving DSIR support of Rs. 11.5 lakhs. The prototype of the controller has been successfully developed and displayed in the exhibition of International Conference in Power Electronics Drive Energy System 96 (PEDES-96) at New Delhi. The controller has been interfaced

with Jyoti Motors and ER&DC have undertaken the trials of this combination. These trials have indicated that Jyoti Motor would need to undergo some modifications, and ER&DC have provided the required inputs to Jyoti Ltd. in this regard. The project has been completed.

2.1.13 National Fertiliser Ltd.(NFL), New Delhi and Centre for Study of Man and Environment (CSME), Calcutta

The project for bench scale development and field testing of Zinc Polyphosphate based Slow release micronutrient fertilizers was successfully undertaken by CSME with DSIR support of Rs. 1.25 lakhs out of a total project cost of Rs. 2.50 lakhs. CSME has also been successful in undertaking repeat trials for residual effects with a further support by DSIR of Rs. 1.10 lakhs out of a total cost of Rs. 2.20 lakhs. NFL has supported the remaining costs of both the phases of this project. The project has been completed.

2.1.14 M/s. Central Electronics Ltd. (CEL), Sahibabad

The project for "Development of Hybrid (SPV-Diesel) Pilot power Plant was undertaken by M/s Central Electronics Ltd. with DSIR's support of Rs. 14 lakhs out of the total project cost of Rs. 21 lakhs. The project is targeted at meeting the requirements of Defence Radio Relay (RRD) and the Deptt. of Telecommunication's Repeater Station for Rural and Remote Telecommunications Networks. The part of the project pertaining to DOT applications has been completed and development of SPV sets for Defence application is in progress.

2.1.15 M/s. Central Electronics Ltd. (CEL), Sahibabad

The project for "Development and Evaluation of Plasma Etching and Edge Grinding System for Edge Separation" was undertaken by M/s CEL, Sahibabad. DSIR has provided financial support of Rs. 30 lakhs out of the total project cost of Rs. 130 lakhs. The project is in progress.

2.1.16 M/s. Gujarat Mineral Development Corporation (GMDC), Ahmedabad

The project of M/s GMDC is for demonstration of Column Flotation Technology for improvement of

the existing process for beneficiation of composite Zinc-Lead-Copper ores, in association with NML, Madras involving DSIR support of Rs. 10.00 lakhs out of total project cost of Rs. 50 lakhs. The trial experiments on multimetal sulphide ores have been successfully undertaken. The project has been completed.

2.1.17 M/s. IBP Co. Ltd., Gurgaon

Four projects for (a) Development of Site Mixed slurry (SMS) Explosives for deep bore-hole applications. (b) Adaptation and upgradation of Emulsion Explosive Technology (c) Development of Detonating Card for shaped charges used for perforation of wells in oil fields and (d) Development of Heat Resistant fields (with the assistance of CMRI, Dhanbad) were undertaken by M/s IBP, Gurgaon with DSIR support of Rs. 41.50 lakhs out of total project cost of Rs 137.00 lakhs. The project on Detonating Card for shaped charges is completed and the firm has supplied to ONGC the detonating cards for field trials. The firm has filed an Indian patent on Detonating card. The field trials on Site mixed slurry is also completed. Other two projects are in progress.

2.1.18 M/s. FACT, Cochin

The project for development of slow release fertilizers and their application on Paddy, Banana, sugar cane and Coconut crops is being undertaken by M/s FACT in association with Kerala Agricultural University, Coimbatore with a DSIR support of Rs. 12.00 lakhs out of a total project cost of Rs. 46.00 lakhs. The project is in progress.

2.1.19 M/s Mishra Dhatu Nigam Ltd. (MIDHANI), Hyderabad

The project by MIDHANI is for welding of Molybdenum wire to make 20 kg coil. MIDHANI has the capability to make 4-5 Kg coils of Molybdenum wires, whereas, the electrical lamps industries require larger coils weighing at least 20 Kgs. A special welding machine has already been developed in the project for this purpose. DSIR support to this project is Rs. 10 lakhs out of a total project cost of Rs. 20 lakhs. The project is in progress.

2.1.20 M/s Mishra Dhatu Nigam Ltd. (MIDHANI), Hyderabad

MIDHANI has taken up a project to produce clean steel through filtration. Currently such steels are being

produced through Electro-slag Refining (ESR) route which is relatively expensive. Technology developed through the present route is expected to produce clean steels at reduced production costs. Several filters have been identified for the project and trials are being conducted on them. DSIR's support to the project is Rs. 37.00 lakhs out of a total project cost of Rs. 74.00 lakhs. The project is in progress.

2.1.21 M/s Mishra Dhatu Nigam Ltd. (MIDHANI), Hyderabad

The project for production of wires with high surface finish has been taken up by MIDHANI with a DSIR support of Rs. 12 lakhs and project cost of Rs. 36 lakhs. Such wires find extensive use in spark plugs and electrostatic precipitators. Diamond dies needed for the project have already been procured. The project is under progress.

2.1.22 M/s. Tungabhadra Steel Products Ltd. (TSP), Tungabhadra Dam

The project for development of Rubber Seal cladded with PTFE for use in hydraulic dam gates was undertaken by M/s TSP with DSIR support of Rs. 9.0 lakhs out of total project cost of Rs. 20 lakhs. National Chemical Laboratory (NCL) is assisting the firm in test specifications and other trials. The prototype of the PTFE cladded seal has been successfully developed and test result of Energy Hydraulic gate of Tungabhadra Dam has been satisfactory. The firm has furnished the completion report.

2.1.23 M/s. Metallurgical & Engineering Consultants (I) Ltd. (MECON), Ranchi and M/s Durgapur Steel Plant (DSP), Durgapur

The project for development of Under Burden Probe for accurate analysis of hot gases inside the stack of a blast furnace was undertaken by M/s MECON in association with Durgapur Steel Plant (DSP) with DSIR support of Rs.30.00 lakhs out of total project cost of Rs.82.00 lakhs. The underburden probe has been developed and installed on the blast furnace along with the related instrumentation. The project is in progress.

2.1.24 Central Power Research Institute (CPRI), Bhopal and M/s G.K. Electricals, Bhopal

The joint project of CPRI and M/s G.K. Electricals, Bhopal is for development of 12 KV load break switches

for use in Electrical Sub-Stations involving a DSIR support of Rs.5.5 lakhs out of total project cost of Rs.50.00 lakhs. The project is in progress.

2.1.25 M/s Punjab Tractors Ltd, (PTL) Chandigarh and M/s Crompton Greaves Ltd. (CGL), Bombay

The project for development of 'state-of-the-art' electronic controller for forklift trucks is being undertaken by M/s PTL in collaboration with M/s CGL, Bombay, with DSIR support of Rs.10.00 lakhs out of total project cost of Rs.30.00 lakhs. Two prototypes have been developed and tested by CGL. The project is nearing completion.

2.1.26 M/s. Semiconductor Complex Limited, (SCL), Chandigarh and C- DAC, Pune.

The joint project of M/s SCL and C-DAC is for development of ASIC (Application Specific Integrated Circuit) for GIST-II and the related card involving DSIR support of Rs. 30 lakhs out of total project cost of Rs. 50 lakhs. The project is in progress.

2.1.27 M/s. Semiconductor Complex Limited, (SCL), Chandigarh and Electronics Research & Development Centre, Thiruvananthapuram.

The joint project of M/s SCL and ER&DC is for development of ASIC for microprocessor based power controller involving DSIR support of Rs. 50.50 lakhs out of total project cost of Rs. 93 lakhs. The project is in progress.

2.1.28 M/s. Semiconductor Complex Limited, (SCL), Chandigarh and Electronics Research & Development Centre, Thiruvananthapuram.

The joint project of M/s SCL and ER&DC is for development of ASIC and the related STD PCO machine involving DSIR support of Rs. 18.00 lakhs out of total project cost of Rs. 65 lakhs. The project is in progress.

2.1.29 M/s. Semiconductor Complex Limited (SCL), Chandigarh and M/s. Indchem Research and Development Laboratory (IRDL), Madras.

The project for the development of ASIC for MPEG-2 (Motion Picture Expert Group) Decoder is being undertaken jointly by M/s SCL and IRDL with

DSIR support of Rs. 70 lakhs out of the total project cost of Rs. 225 lakhs. The project is in progress.

2.1.30 M/s. Semiconductor Complex Ltd. (SCL), Chandigarh and M/s. Bharat Heavy Electricals Ltd. (BHEL), Bangalore

The joint project of M/s SCL and M/s BHEL is for development of the Application Specific Integrated Circuit (ASIC) and ASIC based 3 Phase multifunctional electronic energy meter for industrial applications involving DSIR support of Rs.23.00 lakhs out of total project cost of Rs.43.00 lakhs. The project is in progress. The ASIC design and fabrication has been completed. The ASIC will be integrated with the rest of the meter.

2.1.31 M/s Bharat Earth Movers Ltd. (BEML), Bangalore

The project for design and development of 10 T class Backhoe Hydraulic Excavator (Crawler version and Wheeled version models) is being undertaken by M/s BEML with DSIR support of Rs. 40 lakhs out of project cost of Rs.85 lakhs. The design of the equipment has been completed. The prototypes of crawler and wheeled version have been developed and are undergoing trials. The project is in progress.

2.1.32 M/s Bharat Earth Movers Ltd. (BEML), Bangalore

The project for development of computerised transmission control for off highway dump trucks is being undertaken by M/s BEML with DSIR support of Rs.10.00 lakhs out of total project cost of Rs.30.00 lakhs. The prototype has been successfully developed and has undergone test trials successfully. The project is nearing completion.

2.1.33 M/s Bharat Earth Movers Ltd. (BEML), Bangalore

The project for development of Cast Crank Shaft used in their heavy duty engines was undertaken by M/s BEML with DSIR support of Rs.27.00 lakhs out of total project cost of Rs.65.00 lakhs. The prototypes of the S.G. Iron and Austempered Ductile Iron (ADI) Crank shaft have been successfully developed and are undergoing testing. The project is in progress.

2.1.34 M/s. Turbotech Precision Engineering Pvt. Ltd.(TPEL) and National Aerospace Laboratories (NAL), Bangalore

The project being executed by of M/s TPEL in collaboration with NAL, and Sakthi Sugars, Erode is for the development of low cost gas turbine generator set of 500 KW power class, with multi fuel capability (biogas, piped natural gas and diesel fuel) involving DSIR support of Rs.73 lakhs out of total project of Rs.238 lakhs. The sub-systems of the Gas Turbine system such as turbine and planetary gear box are under advance stages of development. The compressor and the combustor are undergoing tests at National Aerospace Laboratory, Bangalore. The project is in progress.

2.1.35 M/s Andrew Yule & Co. Ltd., Calcutta

The project for development of rough top rubber conveyor belting being undertaken by M/s Andrew Yule & Co. Ltd. involves DSIR support of Rs.40 lakhs out of a total project cost of Rs.110 lakhs. The prototypes of Rough Top Conveyor Belting has successfully developed and has undergone adequate testing. The project has been completed.

2.1.36 M/s Tamilnadu Petroproducts Limited (TPL), Madras and Indian Institute of Petroleum (IIP), Dehradun.

Two projects for (a) development of technology for Long chain (C10-C14) Alcohols by oxidation of n-Paraffin arising in the production of Linear Alkyl Benzene (LAB) with a DSIR support of Rs. 55 lakhs out of total project cost of Rs. 144 lakhs and (b) development of Multifunctional additives for Fuel oil and Diesel oil with DSIR support of Rs. 34 lakhs out of a total project cost of Rs. 94 lakhs, are being undertaken by M/s TPL, in collaboration with Indian Institute of Petroleum, Dehradun. 49 compounds have been synthesised. These compounds have been evaluated for their multifunctional performance characteristic in diesel and fuel oils. Use of a novel catalysts system has given n-paraffins 40-45% conversion of secondary alcohols into n-paraffins per pass at a selectivity of about 95%. The project is in progress.

2.1.37 M/s. Encon Thermal Engineers and Indian Institute of Petroleum (IIP), Dehradun

The project of M/s Encon Thermal Engineers in

collaboration with IIP, Dehradun, is for development of Natural Gas Fired Industrial Gas Burners having a capacity of 50 and 100 cu. m. of natural gas per hour and involves financial support from DSIR and M/s Gas Authority of India Ltd. (GAIL), New Delhi of Rs. 11 lakhs each out of a total project cost of Rs.30 lakhs. Three types of burners have been designed and fabricated. Setting up LPG Storage and handling facility for trials of burners is in progress.

2.1.38 M/s Electronics Corporation of India Ltd. (ECIL), Hyderabad and Central Road Research Institute (CRRI), New Delhi

The joint project of M/s ECIL, Hyderabad and CRRI, New Delhi is for the development of a microprocessor controlled Nuclear Moisture and Density Gauge with a DSIR support of Rs.18 lakhs out of a total project cost of Rs.28 lakhs. 5 prototypes of moisture and density gauges will be given to user agencies such as Border Road Organisation and State PWDs for user's trials in construction projects and based on the feed back of the performance of the prototypes, CRRI and M/s ECIL would modify the gauges, if required. The project is in progress.

2.1.39 M/s Hindustan Zinc Ltd. (HZL), Udaipur.

M/s HZL has undertaken a project to recover copper sulphate from Zinc plant waste using solvent extraction technique with a DSIR support of Rs. 40 lakhs out of a total project cost of Rs. 80 lakhs. The project is nearing completion.

2.1.40 M/s. National Mineral Development Corporation (NMDC), Hyderabad and Indian Institute of Chemical Technology (IICT), Hyderabad

The project taken up by NMDC with a DSIR support of Rs. 54.50 lakhs out of a project cost of Rs. 131.00 lakhs, is for development of process for production of pigment grade ferric oxide from "Blue Dust". The project is under progress.

2.1.41 M/s. National Aluminium Company Limited (NALCO), Bhubaneswar

NALCO has taken up a project, at a project cost of Rs. 262.70 lakhs, to develop technology for the production of Special Aluminas and Hydrates which are used in a variety of diverse applications such as grinding wheels, tooth paste, etc. DSIR is supporting the project with a financial grant of Rs. 100 lakhs. The project is under progress.

2.1.42 M/s T.Stanes & Company Limited, Coimbatore

The project of M/s T.Stanes & company is for development of Digested Organic Supplement (DORs) and its applications in a variety of crops involving a DSIR support of Rs.40.00 lakhs, out of a total project cost of Rs.131.00 lakhs. The pilot plant has been installed at Madurai and production of DORs has started. The product is being tested in green house as well as IARI's Centres located in several States.

2.1.43 M/s. Central Electronics Ltd.(CEL), Sahibabad and Centre for Development of Advanced Computing (C-DAC), Pune

The joint project is being executed by M/s CEL and C-DAC is for the development of Solid State Interlocking System (SSI) for Railways. This project was approved during the year, with a DSIR support of Rs.70 lakhs out of a total project cost of Rs.95 lakhs. The project is in progress.

2.1.44 M/s Bharat Earth Movers Ltd.(BEML), Bangalore

The project of M/s BEML is for the design and development of 460 HP Wheel Dozer. This project was approved during the year with a DSIR's support of Rs. 20 lakhs out of a total project cost of Rs. 85 lakhs. The prototype of the Wheel Dozer is under development. The project is progressing satisfactorily.

2.1.45 M/s JSL Industries Ltd., Vadodara

The project of M/s JSL Industries Ltd. Vadodara for upgradation of Air Circuit Breakers in collaboration with Electrical Research and Development Association (ERDA), Vadodara was approved during the year with a DSIR support of Rs. 13.75 lakhs out of total project cost of Rs. 34 lakhs. The project is in progress.

2.1.46 M/s INTRA Industries Pvt. Ltd., Pune

The project of M/s INTRA industries Pvt. Ltd., Pune for development of 14.5 KVA Inverter for Railways was approved during the year with a DSIR support of Rs. 21.80 lakhs out of total project cost of Rs. 62 lakhs. The project is in progress.

2.1.47 M/s Central Electronics Ltd. (CEL), Sahibabad

M/s CEL has undertaken a project for "Upgradation of the Process Technology in the existing production line for Single Crystalline Silicon Solar Cells" with a DSIR's support of Rs. 219 lakhs out of the total project cost of Rs. 492 lakhs based on laboratory scale technology developed by Inter-university Micro Electronic Central (IMEC), Belgium. The project is in progress.

2.1.48 M/s Central Electronics Ltd. (CEL), Sahibabad and Electronics Research & Development Centre (ER&DC), Thiruvananthapuram

The joint project of CEL and ER&DC is for "development and design of SPV Charger for Ni-Cd batteries using Smart charging technology" with DSIR's support of Rs. 24 lakhs out of the total project cost of Rs. 71.80 lakhs. The SPV chargers will find applications for charging the batteries of man-pack/portable Radio sets of the Military and Para-military forces. The project is in progress.

2.1.49 M/s Central Electronics Ltd. (CEL), Sahibabad and CMS Traffic System Pvt. Ltd., New Delhi

The project for the "Experimental Design and Development of SPV Powered Traffic Signalling System" has been taken up jointly by M/s CEL, Sahibabad and CMS, New Delhi, with DSIR's support of Rs. 9.50 lakhs, out of the total project cost of Rs. 19.52 lakhs. The Delhi Traffic Police has also provided financial support of Rs. 2 lakhs for the project. The experimental system is expected to be ready for demonstration by April, 1997.

2.1.50 M/s. Gujarat Narmada Valley Fertilisers Limited (GNFC), Bharuch, Gujarat

The joint project of M/s GNFC, Bharuch and Engineers (India) Ltd. (EIL), New Delhi, for demonstration of Liquid Phase Oxidation Process for

Hydrogen Sulphide Removal and Recovery to Sulphur from sour gases at ONGC, Hazira was approved during the year for a DSIR support of Rs. 100 lakhs, out of total cost of project Rs. 207 lakhs. The project is in progress.

2.1.51 ABR Organics Limited (ABROL), Hyderabad

A project on Technology upgradation of polyimide resins and their applications from M/s ABR Organics Limited (ABROL), Hyderabad was approved during the year. A DSIR support of Rs. 35 lakhs has been approved out of a total project cost of Rs. 150 lakhs. The project is in progress.

2.2 Proposals Being Processed for Approval

Besides the above on going projects, 17 Technology Development Projects are being processed for DSIR support.

2.3 Studies for Technology Evaluation of Various Sectors/Products and Capital Goods

During the Plan period, several Technology Evaluation Studies had been initiated in various important industrial sectors and products. These studies inter-alia aimed at identifying major technological gaps and formulating time targeted projects / programmes for technology acquisition, R & D, and operational improvements, in order to bridge, wherever relevant, the technology gradients existing between the present operations and international level of operations. Technology evaluation studies covering 65 sectors and products have been so far commissioned.

Technology Evaluation reports covering 45 sectors and products have till now, been finalised and printed. In addition to this 18 final reports are under printing which involve electrical motors, fruit juices, continuous castings, garments, hoisery-knitting, calcium carbide, industrial and control valves, galvanising, bakery, soaps & detergents, paper mills, textile spinning, textile weaving and textile processing. These reports have been finalised in consultation with industry and other related

organisations. The reports covering 2 products are under finalisation.

2.4 Technology Missions of Ministry of Human Resource Development

Another initiative taken by the DSIR is supporting 7 Technology Missions recently launched by the Ministry of Human Resource Development, in the IITs and IISc. These missions are in hi-tech areas viz. photonics, genetic engineering & biotechnology, new materials, food processing & engineering and integrated design & competitive manufacturing. The DSIR, along with NRDC, is assisting IITs and IISc in spotting the right industrial partner in these missions, and products and in other areas. Patent search, which would be an important input to R&D in each of these missions, is being provided by NRDC. Assistance in patenting, both nationally and internationally, of the products and/or processes generated as an output of the R&D undertaken by the missions, would also be provided the NRDC. NRDC has already established Centres for providing such assistance in IISc (Bangalore), IIT (Madras) and IIT (Kharagpur). NRDC Centre in IIT (Bombay) and IIT (Kanpur) will also be set up.

3. EXPECTED OUTPUTS AND BENEFITS

The completed technology development projects supported under PATSER Scheme have resulted in significant technological and commercial returns to the industries concerned such as cost reduction, higher quality, improved products and processes as well as foreign exchange savings, while building up the R&D capabilities of the industrial units. The on-going projects are expected to result in high commercial / societal impact and will lead to commercialisation and utilisation of 'state-of-the-art' technologies. There have been useful interactions and linkages with other concerned Government departments, National Research Organisations and users during evaluation, approval and implementation of various projects supported under PATSER scheme.

V. SCHEME TO ENHANCE THE EFFICACY OF TRANSFER OF TECHNOLOGY (SEETOT)

The "Scheme to Enhance the Efficacy of Transfer of Technology (SEETOT)" covers the following programmes :

- A) National Register of Foreign Collaborations (NRFC)
- B) Industrial Technology
- C) Transfer and Trading in Technology (TATT)
- D) Promotion and Support to Consultancy Services(PSCS) which also includes the Consultancy Development Centre (CDC).

Activities and achievements of each of the above programmes are presented here. Although, Industrial Technology is not a part of the plan scheme, SEETOT, the information emanating out of the activities under Industrial Technology is mainly useful for SEETOT and hence it is covered here.

V(A). NATIONAL REGISTER OF FOREIGN COLLABORATIONS

1. PREAMBLE

The "National Register of Foreign Collaborations" (NRFC), which is an ongoing plan scheme, continued its operations during the year 1996-97. It has completed a number of programmes that were targetted for the year.

2. OBJECTIVES AND ACTIVITIES

The main objective of NRFC scheme is to facilitate acquisition of technology in the country, efficiently. The following major activities are carried out under NRFC :

- Compilation and analysis of data on approved foreign collaborations .

- Undertake analytical studies in select areas.
- Carry out technology status studies covering state of the art technology in use in the country, international trends and other related issues.
- Provide assistance in the effective transfer of technology process and efficient management of technology.
- Coordinate with Ministries of Industry, Commerce, Finance and others by providing technology data inputs.

Activities initiated, so far, under the NRFC scheme can be put into following broad categories :

- Compilation and analysis of basic data on foreign collaborations (FCs) approved.
- Analytical studies in selected areas.
- Preparation of reports on technology status in identified sectors/products.
- Organisation of Interaction meets to enhance effectiveness of technology transfer process.
- Programmes for enhancing technology management capabilities

3. FOREIGN COLLABORATIONS DATA COMPILATION

The work of in-house compilation of primary data on foreign collaborations approved, continued during the year. The compilation for the year 1995 was brought out. It contained information such as name of Indian companies, the names of foreign collaborators, products

covered under the collaborations, duration, nature and amount of payments involved. The compilation for the year 1996 is in progress.

4. ANALYTICAL STUDIES

A project to study trade related laws of France and Japan with special reference to technology transfer was commissioned to the National Law School of India University, Bangalore. The study inter-alia aims to analyse broadly the legal system in France as it relates to technology transfer. It covers areas like Commercial Law, Contract Law, Commercial Transaction Law, Intellectual Property Rights and Technology Transfer etc. The report in respect of the French Law has been completed. The work on Japanese Law is in progress.

A project to study the Market and Development Prospects of Fruits and Vegetables Processing industries in Eastern and North Eastern Regions and Andaman & Nicobar Islands was taken up. This had been entrusted to West Bengal Consultancy Organisation Ltd., Calcutta. The main objective of the study is to analyse the growth, performance and bottlenecks of fruits and vegetables processing industries in the region; sources, availability and prices of various raw materials with reference to production and marketable surpluses of different types of fruits and vegetables in the region and identifying potential project opportunities with sources of appropriate technology for ready guidance to prospective entrepreneurs. The work on the project is in progress.

5. TECHNOLOGY MANAGEMENT

With a view to enhance capabilities in the area of Technology Management, a project has been commissioned on the Administrative Staff College of India, Hyderabad. The project has several components comprising of case studies, training programmes, generation of bibliographies and others. The output of the project would benefit the industry, R&D organisations, consultants, technical and management institutes and others concerned. The project is in progress. Case studies on Technology Management in two manufacturing organisations were brought out. Bibliographies, on various technology management areas, such as technology transfer, R&D management, technology absorption and others are being finalised.

There has been close interaction with Institutes of Management, Institutes of Technology & others with a

view to enhance the technology management capabilities in the country. Assistance was also rendered to some of these Institutes in designing technology management capsules for inclusion in their Graduate and Post-Graduate curricula.

A capsule on Management of Technology as part of the CDC-BITS M.S. Consultancy Management Programme was developed and implemented during the first session of the programme from August-December 1996, at the Consultancy Development Centre, New Delhi. The course covered subjects such as the Basics of Technology Management, Technology Sourcing, Technology Transfer, Role of Consultants in Technology management and Intellectual Property Rights.

Assistance in designing & developing the structure and content of a new course on Management of R&D and Innovation proposed to be launched by Indira Gandhi National Open University (IGNOU) has been rendered.

6. TECHNOLOGY STATUS STUDIES

6.1 One of the objectives of the NRFC scheme, is to carry out technology status studies covering state-of-the-art of technology in use in the country, international trends and other related issues. The task of preparation of status reports is entrusted to experts/organisations/professionals/consultants in respective fields. More than 150 reports have so far been finalised. These reports have been priced and are now being sold through the National Research Development Corporation (NRDC) and Publications Division of the Ministry of Information & Broadcasting.

6.2 During the year, reports on the technology status of a number of sectors/products were finalised.

These reports deal, at length, with important aspects relating to these sectors/products. These aspects include: current status of technology, efforts by the industry to absorb and adapt technology, current international trends, technology gaps etc. The reports identify technology gaps in Indian industry.

Recommendations for action by industry, R&D institutions, Government and other concerned organisations to bridge these gaps have also been made. Reports on studies under NRFC are being used inter-alia as inputs to the PATSER Scheme operated by the Department.

6.3 The following are the major findings of reports which have been finalised during the year.

6.3.1 High Fructose Corn Syrup and Artificial Sweeteners

High Fructose Corn Syrup (HFCS) also known as Isomerase syrup, Isoglucose or synthetic honey is manufactured from starch obtained from grains like maize, jowar, rice and tubers like potatoes, tapioca, sorghum etc. It is a concentrated solution containing primarily fructose and dextrose with small quantities of higher molecular weight saccharides. It is also considered to be an ideal substitute for cane sugar in industrial uses, for imparting sweetness and enhanced flavour. HFCS is manufactured in stages involving production of aqueous starch slurry, saccharification, isomerization and finally chromatographic separation. United States is the major producer of HFCS in the world. In India, the HFCS industry is at a nascent stage. The cost of production in the country is high and the demand is yet to pick up due to the general non awareness about HFCS and its usefulness. The know-how for the manufacture of maize starch and its subsequent conversion to liquid glucose, meltodextrins, dextrose and sorbitol is indigenously available. Research work for the development of the process know-how for making HFCS from starch has been undertaken at Indian Institute of Technology, Kanpur. Work related to isolation of *Streptomyces fradiae* (SCF) culture used in production of HFCS and isomerization to fructose is being carried out at CFTRI, Mysore; Forest Research Institute, Dehradun and other places. It has been brought out in the report that measures to increase awareness of HFCS and its benevolent use needs to be intensified.

Organic compounds other than Carbohydrates, that taste sweet are known as artificial sweeteners. These pretend to be sugar like but do not change the blood glucose levels. Some of the known artificial sweeteners are saccharin, cyclamate, aspartame, stevioside, thoumatin and acesulfam-K. Most of them suffer from one or the other drawback in comparison with natural sugar. The report suggests that protein based sweeteners and peptide sweeteners need be developed and that safety norms for the use of artificial sweeteners need be established.

6.3.2 Printing Inks

The use of Printing Inks came into prominence

with the discovery of Letterpress and Lithography. Various types of Printing Inks are now being manufactured in the country, which include Letterpress Inks, Lithographic Inks, Offset Inks, Flexographic Inks and Rotogravure Inks, out of which the maximum demand is for Letterpress and Offset Inks. Some of the major manufacturers in the country are Coates of India Ltd, Calcutta, JBA Printing Ink Company, Bombay, United Ink and Varnish Co.Ltd., Bombay. Inks are classified according to their composition & texture, application, end use and drying manner. They may be based in oil or paste, solvent or liquid and consist of colourants, vehicles, additives and solvents. The end uses of printing inks are in news publications, commercials, folding cartons, books, corrugated boxes, paper bags, plastic films, containers, tools, sanitary paper, textiles and several others. Advanced countries are developing *enviro-friendly, water based and UV cured inks*. The report brings out that research and development efforts need be initiated in large measures for development of high gloss, instant setting, high speed quick drying inks and also for adequate pollution control systems and energy management systems for use in the industry. The report also brings out the need for formulation and implementation of suitable standards to yield improvement in quality of inks manufactured indigenously.

6.3.3 Carbon Tetrachloride

Carbon Tetrachloride was the among the earliest organic chemicals produced on a commercial scale. Chloro Fluoro Carbons, CFC-11 and CFC-12, were developed from Carbon Tetrachloride and were found to be excellent refrigerants and aerosol propellants. Later it was discovered that these CFCs and Carbon Tetrachloride are detrimental to the stratospheric ozone layer. Production of these chemicals, in accordance with the Montreal Protocol, are to be phased out. Out of the six processes used for manufacture of Carbon Tetrachloride, three of them i.e. one using thermal chlorination of methane, the second using hydro chlorination of methanol and chlorination of methyl chloride and the third based on carbon disulphide are being used in the country. The technologies of Indian manufacturers using methane and methanol are comparable with the world standards. Their performance can only be marginally improved through operational measures. Technology based on carbon disulphide as

used in the country, is not as efficient as the other two processes. Technologies to convert Carbon Tetrachloride into safer products like Chloroform need be evolved. The present manufacturers of Carbon Tetrachloride may also consider manufacturing new products like raw materials for substitute refrigerants and propellants. Ozone safe new solvents need be developed to replace Carbon tetrachloride. Refrigeration and air conditioning systems using substitute refrigerants and with compatible lubricants need to be developed.

6.3.4 Polybutadiene

Polybutadiene is a term used to denote homopolymers of butadiene C_4H_6 , which is used in various applications — tyre and non-tyre sectors. Depending upon the disposition of the double bonds present in the polymer chain, polybutadiene rubber can be classified into five configurations, cis-1,4; trans-1,4; vinyl-1,2 - isotactic; vinyl-1,2- syndiotactic; and vinyl-1,2 atactic. The report bring out that currently polybutadiene rubber is being produced by only one unit in India i.e. Indian Petrochemicals Limited (IPCL). IPCL set up Polybutadiene rubber manufacturing facilities with installed capacity of 20,000 TPA with the know-how from Polymer Corporation of Canada in early 1970. This facility adopted the technology to produce high cis polybutadiene rubber, which involves solution polymerization using stereo-specific Ziegler-Natta type catalyst system, based on cobalt and benzene as a solvent. Report further brings out that polybutadiene consumption has substantially increased from around 100 tons in 1973-74 to over 33000 tons today. To meet the increased demand of polybutadiene rubber, IPCL has planned to set up another 30,000 TPA capacity plant based on nickel catalyst system in collaboration with Japan Synthetic Rubber Co. Ltd (JSR), Japan. Report further brings out that IPCL is producing products that are more suited to Indian conditions than those originally specified by the collaborator. The report further states that since there is no indigenous source for technology, for catalyst systems other than cobalt, import of technology for new plants appears inevitable.

6.3.5 Electric Arc Furnace

Electric Arc Furnaces (EAFs) have been used since the discovery of the carbon arc in 1800. They are used to melt steel scrap, sponge iron and pig iron to produce

liquid steel, which is subsequently refined to produce ingots, billets, blooms, slabs or castings. In India, the share of Electric Arc Furnace steel to total finished steel production was about 14% during 1993-94. Currently, around 75 units are in operation in the country. Most of the existing EAF units are producing more of value added products through secondary facilities, instead of mild steel for rebars or structurals. Some units which are currently under operation, are employing outdated technologies leading to high tap-to-tap times, refractory/power consumption. There are, however, many major units which have already been set up or are being set up, which have employed modern technologies and equipment procured from world leaders. These companies include Sunflag Iron & Steel Co. at Bhandra, Essar at Hazira, Nippon Denro at Raigad and Ispat Profiles at Pune. The international suppliers include Danieli of Italy, Demag of Germany and ABB of Switzerland. DC EAF is one of the most advanced technologies being adopted in the advanced countries with advantages such as reduced consumptions of electrode, bottom electrode, lining and power. Problems faced by the industry include scarcity and high cost of power, high cost of raw materials like sponge iron and scrap. Among the modern technologies that have recently been adopted in India are use of Ultra High Power Transformer, Water Cooled Panels for side walls and roofs, Eccentric Bottom Tapping Facilities and Slide Gates for Ladles and Tundishes. It has been suggested in the report that some technologies which need be developed, include submerged inert gas stirring, submerged oxygen and coke injection, use of series reactors with the transformer to control system reactants, ladle induction stirring and artificial intelligence system for automation. It has also been recommended that the technology of using hot metal in the EAFs may be adopted, specific R&D activities in this field need be initiated and more capacity of sponge iron need be created to reduce dependence on imported scrap.

6.3.6 Linear Alkyl Benzene

Linear Alkyl Benzene (LAB) is the basic raw material for a widely used surfactant, LAS, with a global consumption exceeding 2.5 million MT per year. The technology for LAB manufacture is being held by UOP Inc of USA. This technology is based on dehydrogenation and alkylation using Hydrofluoric acid as catalyst. This process has found to be more superior compared to other processes involving chlorination, as

the yields are better, the product quality is superior and pollution problems are *minimum*. There are three manufacturing units in India viz., Indian Petrochemicals Corporation Ltd. (IPCL), Vadodara, Tamil Nadu Petro Products Ltd. (TPL), Chennai and Reliance Industries Ltd (RIL), Mumbai. The total installed capacity is nearly 200,000 MT per year. The quality of LAB produced in the country is acceptable in the international market. Nearly 25% of the country's production is being exported. The latest technological breakthroughs in the international arena are related to the development of better catalysts in terms of yield, ease of operation, lesser side reactions and safety. National Chemical Laboratory, Pune and IPCL have developed a solid catalyst for use in the alkylation stage. It has been brought out in the report that R&D activities leading to the commercialization of this catalyst need be expedited. Refineries should also make available more C_{10} to C_{30} paraffins by processing suitable crude. Efforts to develop indigenous alternatives for Iso-Octane and N-Pentane which are currently being imported need also be made.



V.A.1 A Linear Alkyl Benzene Manufacturing Plant

6.3.7 Drilling/Oilfield Chemicals

Drilling/Oilfield chemicals used in various operations for completion of an oil well are grouped into categories like drilling fluid/mud chemicals & additives,

cement & its additives, production chemicals, water injection chemicals, well stimulation chemicals and process chemicals. These chemicals influence the drilling rate, cost, efficiency and more importantly safety of drilling operations. Production of Oilfield Chemicals and speciality chemicals has recently made a breakthrough in the country. Major indigenously manufactured chemicals include Chrome Ligno Sulphonate, Ferro Chrome Ligno Sulphonate, Diaseal M Equivalent, Cement Additives, Oil Well detergents, De-emulsifiers and scale inhibitors. Dextrin and Poly Anionic Cellulose are among chemicals, which are still being imported. Among the Indian manufacturers are Kalpana Chemicals of Hyderabad, Dai-Ichi Karkaria of Mumbai, Baker Oil Treating of Mumbai and Hindustan Magcobar Chemicals of Vadodara. Major international manufacturers are Baroid, International Drilling Fluids & Union Carbide of USA, Hoechst of Germany, Rhone Poulenc of France and Shell of UK. Developments at the international level include use of Poly Hydroxy Poly Acrylamide based Drilling mud, low solid 100% Oil mud and Bio-Polymer Fluids. ONGC has a number of R&D centres like Institute of Drilling Technology (IDT) to identify, evaluate and develop oilfield chemicals. These centres are equipped with modern sophisticated instrumentation, facilities and services. Sulpho Methylated Lignite, Slag cement, low temperature retarders and turbulence inducers are some of the products that have been developed as a result of the R&D efforts of IDT. The private sector has also brought about a number of developments in the area of pour point dispersants, acid corrosion inhibitors, hydroxy propyl guar-gaum and gelling agents. It has been brought out in the report that efforts for the indiginization of chemicals like dextrin and spotting fluids, which are being imported, need be stepped up. Application of materials like guar-gaum to produce gelling agents and viscosifiers also need be intensified.

6.3.8 Laser Printers

Laser Printers are among the most sophisticated type of printers in use today. They produce ultra density matrix images with the help of laser beams instead of conventional print wires. The images are stored in memory and then transferred onto drums using the lasers and then transferred onto paper by the photocopying process. The laser engine is the most important part of this printer. The main advantages of using such printers

are the high quality of printing, high speed of printing, availability of scalable fonts and possibility of combining text with graphics. Hewlett Packard is the leader in this technology although the first development was pioneered by Canon of USA. During the year 1994-95, around 23,000 pieces valued at nearly Rs 150 crores were sold in India. Yet, these volumes are considered too small to propel manufacturing activities in the country. The Desk Top Publishing industry and Corporate sectors are major users of these printers. It has been reported that India possesses the technical capability to manufacture various components of the laser printer except the optical mechanism. Critical areas such as the feeding mechanism, processor frequency and toner powder content are patented technologies which are not being made available. It has been emphasized in the report that under the circumstances mentioned above, there is hardly any scope for setting up a manufacturing facility to cater to the domestic market, given the low domestic demand. Only if the demand increases substantially in future, steps need be initiated to support manufacture of these items, the report suggests.

6.3.9 Dicyandiamide

Dicyandiamide is an odorless, colorless, non-volatile powder with a monoclinic prismatic crystal structure. It is the simplest organic compound containing the C-N, C-N and C-N groupings. Dicyandiamide is formed in quantitative yield by the dimerization of cyanamide in alkaline solution. The reaction occurs most readily at pH 8-10 by the addition of the anionic cyanamide species to the nitrile group. Dicyandiamide is not being produced in India by any manufacturer and is being imported from countries like USA, China, Japan and Germany to meet the indigenous demand, which is estimated to be approximately 3,000 MT per annum. The report brings out that at present there is over capacity situation throughout the entire world in producing Dicyandiamide and the demand for this product worldwide is shrinking. Demand for Dicyandiamide as an intermediate for a number of organic nitrogen compounds such as guanamides, bignanides, and guanidine salts exists. National Chemical Laboratory, Pune has developed technology to produce Dicyandiamide and its raw material calcium cyanamide on both laboratory and pilot plant scales. But so far no plant has been set up based on the technology developed by NCL, Pune. The report further brings out that the

leading manufacturers of Dicyandiamide world wide are not interested to transfer technical know-how. Therefore to meet the internal demand it may be beneficial if the product could be manufactured through indigenous technology which has been developed by NCL, Pune. This would obviate imports and may also be cheaper as compared to price of the imported product.

6.3.10 Acetone

The report brings out that the current commercially important technologies are (a) cumene-hydroperoxide process as by-product of phenol and (b) Dehydrogenation of isopropyl alcohol. It is estimated that at present nearly 85 percent of world capacity, is based on cumene oxidation route for coproduction of acetone and phenol. Cumene is synthesised from propylene and benzene, followed by oxidation for the formation of hydroperoxide and splitting the same into acetone and phenol. In India there are eight units, one each in Kerala and Gujarat and rest in Maharashtra with total installed capacity of 68700 TPA. Technologies for all these units are from different sources and cumene oxidation process alongwith phenol as co-product accounts for nearly 60 percent the total capacity and current installed capacity is just about adequate to meet the domestic demand, if all units operate at optimum level. The feed stock for Hindustan Organics Chemicals and Herdillia Chemicals Ltd. is cumene made in the same premises from propylene and benzene, for National Organic Chemical Industries Ltd. it is isopropanol also made in the same premises and the rest five units based on ethanol feed stock. The units with ethanol as feed stock normally do not run throughout the year. Report further brings out that cumene and isopropanol based technologies are considered contemporary ones, but the cumene based technology is preferred due to economic as well as technological considerations. The performance of these units is satisfactory except for the ethanol based units. Cumene, isopropyl and ethanol based technologies have been fully absorbed by the Indian industry. Apart from absorptioff of technology, some of the units have improved the imported technology through their in-house research & development. The report recommends that sponsored R&D work is desirable for the improvement of the existing ethanol based acetone (including other alcohol based chemicals) producing unit as a long term strategy to avoid dependence on petrochemical based inputs. Report also recommends that Zeolite based catalyst for

cumene production should be used instead of conventional ones for pollution prevention as well as improved productivity.

7. INTERACTION MEETS

Two one-day awareness programmes on Intellectual Property Systems (IPS) were organised, one at the Indian Institute of Technology, Madras on 15th October 1996, and the other at the Indian Institute of Technology, Kharagpur on 18th December 1996. The main objective of these programmes was to enhance knowledge and awareness about issues relating to Intellectual Property for the benefit not only of industry, R&D institutes and consultants but also students, researchers and faculty of educational institutes; all of whom are significant components of the country's intellectual wealth, involved in generation, development and commercialisation of technology.

A Round table of Chief Executives on Intellectual Property Rights for Competitiveness was organised in association with Administrative Staff College of India at Hyderabad on 3rd Sept 96. The main objective was to enhance awareness of chief executives steering industrial enterprises, technical institutes and other organisations in the area of intellectual property rights and the manner in which these rights can be effectively used to enhance competitiveness. Chief executives from several public and private sector enterprises, R&D and academic institutions and others attended the programme and found it very useful.

A lecture on Technology Management by Dr S M Patil, former Chairman & Managing Director of HMT, was organised under the Distinguished Technologists Lecture series of DSIR at Bangalore on 21st Sept 96.

The main objective of these lecture series is to disseminate information relating to the technology management experiences of leading intellectuals, scientists, technologists and managers in the institutions and enterprises they built. This programme was well acclaimed and attended by representatives of industry, researchers, technologists, educationists, consultants and others.



V.A.2 A lecture under the Distinguished Technologists Lecture Series

A workshop on Concurrent Engineering was organised at Hyderabad in association with Administrative Staff College of India on 10-11 February 1997. The major objective was to explain the various methodologies of concurrent engineering and their strategic applications and use.

A one-day interaction meet on Transfer of Technology from Abroad is planned to be organised at Chandigarh on 6th March 1997, in association with the North India Technical Consultancy Organisation Ltd (NITCON). The main objective was to provide inputs to assist industrial units in enhancing the effectiveness of technology transfer from abroad.

V(B). INDUSTRIAL TECHNOLOGY

1. INTRODUCTION

The industrial technology deals with the proposals received from Secretariat for Industrial Approvals (SIA) for grant of Letter of Intent, foreign collaboration from Indian entrepreneurs, foreign entrepreneurs/organisations, from NRIs and those willing to set up 100% export oriented projects.

The broad activities are: (i) receiving and examining proposals for grant of LOI, FC and import of CG, including those for 100% EOU and from NRIs; (ii) participating in Approval Committees//Project Approval Board and Board of Approvals for 100% Export Oriented Units.

2. INDUSTRIAL LICENSING

About 530 proposals for grant of Letter of Intent were received during the year. The number of proposals have remained almost same as in the last year.

22 meetings of Licensing Committee organised by SIA during 1996 were attended.

3. FOREIGN COLLABORATIONS

During the year, the number of foreign collaboration and composite proposals exceeded 1250.

Of these, the Department received around 250 proposals from Secretariat for Industrial Approvals as compared to 400 in the previous year. These excluded such proposals involving foreign investment, which were directly considered by the Foreign Investment Promotion Board.

During the year, the Department participated in the 15 meetings of the Project Approval Board and 10 meetings of the Board of Approvals for 100% Export Oriented Units organised by SIA during 1996.

4. INFORMATION/DATA PROCESSING

The Department has a database for Foreign Collaboration proposals and Composite applications since 1988. The databases for proposals were updated for the year 1996.

The Department also maintained and updated the software for editing, preparing summary, processing and quick retrieval of the desired information. The software has been developed in-house. Retrieval of information and updation of databases is continuously done with the help of the above softwares.

V(C). TRANSFER AND TRADING IN TECHNOLOGY (TATT)

1. OBJECTIVES

The TATT scheme aims to promote and support activities towards the export of technologies, projects and services. The measures adopted include:

- Support to preparation of technology profiles of developing countries;
- Support to preparation of reports related to *technology export capabilities and experiences in select industrial sectors*;
- Publicity and dissemination of Indian capabilities through workshops, trade fairs, delegations and video films;
- Supporting demonstration of exportable technologies overseas as well as *within India*;
- Supporting Small and Medium Enterprises (SMEs) for value addition and export production;
- Facilitating linkages between R&D institutions and industry in hi-tech areas for technology exports.

2. ACTIVITIES

The TATT scheme became operational during the year 1986-87 through a cell set-up in DSIR for this purpose. A number of programmes and projects aimed towards its objectives were completed during the 7th Five Year Plan. A reorganisation of schemes took place at the beginning of 8th Five Year Plan, when TATT scheme became a part of SEETOT programme and the Technical Advisory Committee was reconstituted. The thrust of the projects during 1985-1992 has been towards documenting our technological expertise and capabilities, preparation of technology profiles of select developing countries and *enhancing export efforts in the area of technology transfer through seminars/workshops, and video films*. The focus during the 8th five year plan has been towards commercialisation of exportable technologies through setting up demonstration plants and export market development. Other activities undertaken related to compilation of data on technology exports and promotion

of export of technology intensive services. Details of some of the projects/activities completed or in progress during the year under report are given below:

2.1 Compendium on Technology Exports from India

The work on bringing out a publication, providing ready information on exports of technologies including exports of turnkey and consultancy projects, consultancy exports and export of capital goods has been initiated.

The publication consists of 2 parts, viz. (a) an Introduction, wherein a brief background on relevance and importance of Technology Exports and the TATT scheme and an analysis of the data/information collected is given and (b) data on technology exporting companies and joint ventures abroad through which technology exports have taken place, in a format designed for the purpose. The data comprises of 55 instances of exports of technologies, projects and related services by some 34 companies. The cumulative value of export earnings through these 55 cases is estimated as Rs.900 crores. Additionally, data on some 50 Joint Ventures set up abroad by Indian companies through which technology exports have taken place has been included in the publication. The analysis of the technology export responses received from organisations has highlighted the various modes of technology exports such as know-how, turnkey projects, consultancy, construction and joint ventures; sectors in which technology exports have taken place such as electrical power, industrial plant engineering, textiles, engineering products, computer software etc.; and the geographical distribution of technology exports such as SE Asia, Africa, Middle East, USA, SAARC, CIS etc. Similarly, an analysis of data on joint ventures set up abroad has highlighted the sectors of technology exports in terms of manufacturing, consultancy services etc.; *distribution of manufacturing exports in specific areas e.g. chemicals, pharmaceuticals, steel, machinery etc.*; geographical distribution of technology exports; and Indian company's equity participation. About 90% of the feed back received from companies relates to exports by way of construction and turnkey projects and consultancy services including computer software. The exports were

directed mainly to 3 regions viz. SE Asia, Africa and SAARC. In case of joint ventures, 60% of the exports were in the manufacturing sectors and were mainly directed to Middle East, SAARC and CIS. The first issue of the publication covering data for the period 1994-95 was brought out during the year, which is the only publication of its kind available in the country today. The information in this publication is far from exhaustive because of limited data available and not so encouraging response from the exporting companies. Further work to bring out future issues of the publication is in progress.

2.2 A study on Capabilities for Export of Non-conventional Technology Intensive Consultancy Services from India.

Indian Institute of Foreign Trade, New Delhi is being supported to carry out a study on export potential of non-conventional technology intensive consultancy services. The study will broadly cover six areas, viz. technical education & training, hospitals and specialised health services, printing services, maintenance of industrial plants and materials management services, standardisation and quality assurance services and industrial waste management services. The study will highlight our capabilities to provide technology intensive services in six sectors. The report would include profiles of service providers in each of the six sectors. The study will also contain an analysis of the WTO provisions on the general agreement on trade in services and recommend the potential areas where India can take advantage to tap the available opportunities. The project is in progress and information from companies in the six identified sectors is being collected.

2.3 Export Market Development for Solar Photovoltaic Technology and Systems in select African Countries.

Central Electronics Ltd., Sahibabad is being supported to conduct a market survey in select African countries such as Uganda, Mauritius and South Africa for supply, installation and commissioning of sample Solar Photovoltaic Systems for demonstration purposes followed by transfer of technology for manufacturing SPV modules and systems. The project would cover visits of CEL experts to the African countries to find out the potential and applications for SPV systems and technology and precise specifications of the equipment

required in those countries, preparation of market promotion material such as brochures, pamphlets and video films, manufacturing of sample SPV systems based on the precise specifications, supply and commissioning of SPV systems, training of engineers from the African countries, preparation and handing over of technology transfer documentation etc. The sample SPV systems being supplied include SPV stand alone domestic lighting system, SPV stand alone street lighting system, SPV community room system, SPV system for primary health centre, SPV shallow well water pumping system, SPV deep well water pumping system, SPV lantern and portable manpack SPV battery chargers. The project is expected to generate foreign exchange earnings in the form of know-how fees, royalty and sale of SPV modules, systems and components. The first phase of the project covering preliminary visits to the African countries and preparation of publicity material is in progress.

2.4 Commercialisation of Iono-Oxidation technique for Effluent Treatment.

The project implemented jointly by Ahmedabad Textile Industry's Research Association (ATIRA) and National Research Development Corporation (NRDC) was concluded after its objectives were partially fulfilled. The results from a demonstration plant set up in a textile mill in Bombay established the effectiveness of the technique in colour removal but failed to meet the norms of Maharashtra Pollution Control Board as regards COD & BOD levels of 250 ppm & 30 ppm respectively in the treated effluent. The demonstration plant set up in the Bombay mill has been dismantled and ATIRA is negotiating with other mills to install the equipment. Further work regarding refinement of the technology will be done by ATIRA on its own.

3. TATT REPORTS

Since the inception of TATT scheme, a total of 36 reports have been completed and printed. The reports printed during the year are given below:

(i) Technology Profile of South Africa

The report highlights South Africa's economic structure, natural resources, government plans & policies, industrial infrastructure & growth and

technology development. Sectors identified in the report for technology transfer from India include small scale and cottage industries such as toys, handicrafts, decorative items, home furnishings etc, construction of low cost housing complexes, public transport system, textile machinery, computer software, drugs & pharmaceuticals and hotel management services.

(ii) Technology Profile of Zaire

The report highlights Zaire's economic structure, natural resources, government plans & policies, industrial infrastructure & growth and technology development. Sectors identified in the report for technology transfer from India include, agro industries such as vegetable oil processing preservation of fruits, vegetables and fish/meat, processing of mangoes & tomatoes etc, leather such as tanneries, garments and shoes, bagasse based pulp & paper plants, pharmaceutical, plastic processing, consultancy services and small scale industries in hand tools, animal glue, paper envelopes, domestic utensils etc.

(iii) Technology Profile of Vietnam

The report highlights Vietnam's economic structure, natural resources, government plans & policies, industrial infrastructure & growth and technology development. Sectors identified for possible technological cooperation between India and Vietnam include, transport and telecommunication, power, textile machinery, sugar mills, mining, paper, rubber, tourism, construction, leather, chemical, pharmaceuticals, packaging and computer software.

(iv) Technology Export Potential of Agro based Industry

The report assesses our technological status and capabilities for export of agro based technologies, projects and related services. Specific areas identified in the report for technology transfer from India include dehydration and canning of fruits and vegetables, frozen foods, mango processing, baby milk powder, coffee processing, bread & biscuit making plant, flour and rice milling plants, maize processing complex, beer plants, solvent extraction, refining of soyabean oil, corrugated sheets, hand made paper etc.

V(D). PROMOTION AND SUPPORT TO CONSULTANCY SERVICES

The Scheme on Promotion and Support to Consultancy Services was one of the initiatives of the Seventh Five Year Plan and is a continuing scheme during the Eighth Plan period.

1.OBJECTIVES

The objectives of the Scheme are:

- To promote and strengthen consultancy capabilities for both domestic and export markets.
- Support to Consultancy Development Centre and other promotional organisations related to consultancy.
- Human Resource Development including fellowships to bright and promising engineers as apprentice with eminent consultancy organisations, arrange training etc.
- Support R&D efforts of consultancy organisations and commercialisation of indigenous technology.
- Organise Seminars, Workshops, etc. and document consultancy capabilities.
- Create awareness among users of consultancy.

2.ACTIVITIES

The activities under the scheme were reviewed in December, 1992 in the light of the new policy environment. It was decided that the emphasis should hence forth be on support for consultancy for development and commercialisation of indigenous technologies, besides continuing the ongoing activities. At the same time, funding was to be only through PATSER window. As such, activities during the year have been rather limited, and were mainly towards completing the ongoing studies. Some of the programmes/ activities carried out during the year are briefly indicated below:

(a) Documentation of Consultancy Capabilities and Experiences

With a view to assess the status of consultancy capabilities in important sectors of economy as well as

in almost each of the States in the country, studies have been commissioned through experts/ consultancy organisations and reports have been prepared after *detailed interactions and discussions with the concerned agencies*. These reports include profiles of consultants, facilities and infrastructure available and recommendations for strengthening consultancy capabilities in the concerned sector or the State.

About 30 reports (consultancy capabilities) have been printed and widely disseminated under the scheme so far. Six reports are under print including the following three reports:

(i) Consultancy Capabilities in the State of Kerala

The Industrial scene in Kerala is not considered very bright generally. Kerala is one of the States in the country where the growth of industries has been very low over the years. This is inspite of the fact that the State is one of the country's biggest consumer markets. The number of industrial units to the population ratio is one of the lowest in the country.

There are 249 medium and large scale manufacturing industries in Kerala as on December 1991. In addition to this, there are about 50 units under implementation. Out of the 249 units, 18 are in the central sector and 49 in the state sector. There are 15 units in the co-operative sector and 34 in the joint sector. Balance 133 units are in the private sector. The total capital investment is about Rs.4,000 crores, the share of Central investment being very low when compared to other States.

In the small scale sector, the State has 73,522 units registered as on 1991 with a total investment of about Rs.74,000 lakhs and employing about 4.45 lakhs persons. However 8388 units are either closed or sick. 60 sick units were revived. There has been only a marginal increase in the number of registered units over the years and the cumulative growth rate for the last 7 years (ending 1990) was only a moderate 14.35%.

The State has potential for further development in electronics, agrobased and food industries, biofertilizers, clay based industries, rubber and plastics, coir, marine and petrochemicals. The Industrial potential survey conducted by KITCO of the various districts in the State has identified the thrust areas feasible in each district and also highlighted the infrastructural facilities needed for development.

The study reveals that with the improvement in industrial investment climate in the State, a number of multi-core joint venture projects are in the offing in the fields of petrochemicals, electronics, food processing, etc. Thus, the future of business opportunities for the consultancy services looks bright, yet their growth is restricted due to various reasons as detailed in the report. The main problems faced are the lack of a proper data base and high establishment cost. The awareness among the entrepreneurs and industrialists on the existing consultancy capabilities in the State is very poor and discouraging.

The study has emphasised the need to develop and strengthen the consultancy capabilities by soliciting government action on legal procedures for registration of consultancy firms, and financial assistance for technology transfer and foreign tie-up etc.

According to the study, there are over 200 Consultants/ Consultancy firms in the State providing services in management, techno-economic feasibility studies and technical services related to civil engineering, design of equipment, electrical engineering and computer services. However services were considered lacking in areas such as petro-chemicals, plastics, textiles, electronics, agro/ food processing, energy management and conservation and pollution control. It is estimated that annual turnover of the consultants is around Rs.15 crores.

The study was based on response from 75 out of 180 consultants/ consultancy firms, 25 users of consultancy and 11 R&D/ Academic institutions and other concerned Organisations.

(ii) Consultancy Capabilities in the State of Karnataka

Karnataka over the years has emerged as a centre of technology-driven enterprises. Various hi-tech industries such as information technology, precision engineering, aerospace, machine tools, electrical

machinery, telecommunications, electronics, etc., form the industrial map of Karnataka. Besides, the State also has strong presence in silk, cement, granites, food processing, metallurgy, non-metallic minerals, garments etc. The State presently has 746 medium and large scale units and 1.5 lakhs small scale units.

Karnataka witnessed unprecedented industrial investment since August 1991, representing the post-liberalisation phase. As of March 1994, there are 23 mega projects with an envisaged investment of over Rs.10,820 crores, and 475 medium and large projects with a total investment of about Rs.2869 crores, in various stages of implementation in the State. These have given a boost to the consultancy profession in the State.

The report is based on responses from 193 out of 255 consultants/ consultancy organisations, 346 users, 44 R&D & Academic Institutions and support service organisations, supplemented by visits, workshops/seminars held in the State and a host of secondary sources. The study is limited to segments of consultancy relevant to industrial sector.

Technical consultancy capabilities in the State do not exactly match the hi-tech industry mix and the gap is filled-in by foreign collaborations, inflow from other States and institutional support. Capabilities in project consultancy, management consultancy and valuation segments are adequate. Consultancy capabilities in segments such as energy management, environmental management and total quality management are emerging. Karnataka is the leading State in the country in software consultancy. To upgrade the consultancy capabilities in the State, the study recommends: creation of sound data base, consultants accreditation, consortium approach, training, upgradation of expertise in specialised areas, more effective role of consultants in technology tie-ups, financial assistance to form consultant's association and greater interaction among consultants, R&D institutions and consultancy users.

(iii) Consultancy Capabilities in the State of Andhra Pradesh

According to the study, there are around 275 consultants, firms, consultancy divisions of industry, in-house R&D units, machinery manufacturers, R&D/ Academic institutions, etc. providing consultancy

services. The Study is based on response from 63 (out of 215) consultants/ consultancy organisations, 11 R&D/ Academic institutions and 17 industrial units.

The study estimates that professional/ technical manpower engaged in consultancy is of the order of 1200, and turnover of 215 consultants/ consultancy organisations in the State is of the order of Rs.9 crores. Infrastructural facilities available with the consultants, barring a few, are meagre. While majority of them provide services in preparing the feasibility and project reports, other services include market survey, detailed project consultancy, plant and machinery design and development, material management, technology upgradation and modernisation, pollution control, productivity enhancement, human resource development and export services.

The study has also brought out the causes of under-utilisation of the available consultancy services and consultancy potential, such as lack of awareness amongst the user group, and the areas of specialization the consultants possess; absence of any nodal body to cater to the needs of the consultancy profession, data bank and supporting facilities. Major areas of their expertise cover management consultancy, energy conservation, pollution control & environmental studies, design engineering, project management, industrial valuation and technology sourcing & development. The consultants are also aware of inadequate utilisation of consultancy services by the industry. They have recommended a number of measures to bridge the gap. These include interaction between consultants through workshops and seminars, insistence by banks and institutions on preparation of reports and appraisals by consultants. The study suggested that registration of consultants should be introduced and a Data Bank should be created, where consultancy capabilities would be recorded and the data required by consultants on source of technology, status of industry, etc. stored. This report would be useful to institutions like banks and promotional agencies looking for consultants in specific areas of specialization, existing and potential entrepreneurs, who either want to expand, diversify or set up new units.

The major thrust of economic development in Andhra Pradesh in the next five years is expected to be in sectors based on minerals, natural gas, agro produce, marine products (like prawns, shrimps lobsters, etc.) and electronics and software.

(b) Institutional Programme Support

DSIR has been substantially supporting the capital and recurring needs of Consultancy Development Centre (CDC).

3.REPORTS/ PUBLICATIONS

A number of technical papers/reports relating to technology & consultancy, including the following were prepared and presented in various technical fora.

- (i) "R&D Infrastructure in India and Role of Consultants" for the National Seminar on "Industrial Infrastructure and role of consultants" organised by ACE(I) in New Delhi.
- (ii) Policies and Measures for Promoting Technical Consultancy in India - An overview" for the Xth National Conference on In-house R&D in Industry organised by DSIR & FICCI at New Delhi.
- (iii) "Registration of Consultants in India - Need and Relevance" for International Workshop on Professional practices to be organised by International Society for Soil Mechanics and foundation Engineers, UK in January '97.
- (iv) "Role of Consultants in Infrastructure Development" for National Seminar on 'Enhanced Role of Consultants in Infrastructure with respect to Common Minimum Programme' organised by CDC at New Delhi.
- (v) "Technology Flows from Advanced Developing Countries to Less Developed countries" for ESCAP.
- (vi) A technical report on "Industrial Science and Technology in India" for APEC

4.ADVISORY SERVICES

Advisory services were made available to various Departments and Organisations in relation to their various programmes and activities.

4.1 Representation in Committees

- (i) Governing Council, Executive, Membership, and CDPA Committees of CDC.

- (ii) Consultancy Committee of FIEO
- (iii) Programme Committee of WASME.
- (iv) Board of Directors of U.P. Industrial Consultancy Ltd., Kanpur, UP, and Water and Power Consultancy Services Ltd. (WAPCOS), New Delhi.
- (v) Working Group in Ministry of Commerce for WTO on professional services.
- (vi) Subgroup meetings on 'R&D in Textile in IX Plan' at ATIRA Ahmedabad, 'IX Plan on S&T in Electronics' at DOE, and 'R&D in Non-Conventional Energy sources at MNES.
- (vii) SFC meetings for NRDC programmes.
- (viii) Governing Body of National Institute of Construction Management & Research, Bombay.
- (ix) DSIR representative acted as Rapporteur for Technology Session of IXth World Conference on SMEs organised by WASME in New Delhi.

4.2 Participation in Seminars/Workshops/Meetings

- (i) Experts group meeting was held by DSIR for the UNFSTD conference on Information Technology for Development to be organised in May '97.
- (ii) Preparatory meeting for CDC National Seminar on Consultancy for Infrastructure development.
- (iii) Steering committee meeting for International Seminar on Non-Conventional Energy Sources to be held in March '97.

4.3 Projects/ Proposals

Issues related to project documents for the Ministry of HRD mission on "Communication Networking and Intelligent Automation" were dealt with for possible participation and contribution of DSIR in the implementation of the project.

5. CONSULTANCY DEVELOPMENT CENTRE (CDC)

5.1 Background

CDC came into being as a registered society in January 1986 and initially started operating from the

premises of FIEO at PHD House, New Delhi, and was, subsequently shifted to rented apartments at Qutab Hotel, New Delhi in mid of 1987. CDC now occupies its own office space at Indian Habitat Centre complex and is functioning from this office since May 1994. The centre is managed and guided by a Governing Body consisting of representatives of consultancy organisations, R&D institutions, Government Departments, academic institutions, public sector units etc. CDC has a membership of about 170, representing various types of consultancy organisations and individuals connected with the consultancy. The CDC has concentrated mainly on development of human resources, providing computerised data/ information services, and strengthening of technological and managerial consultancy capabilities through a scheme known as "Consultancy Development, Promotion and Assistance (CDPA)" Scheme.

5.2 DSIR Support

Since the inception of CDC in January 1986, DSIR has been providing support for its capital and recurring expenses, in addition to programme support. An amount of Rs. 37 lakhs was provided as grant during 1995-96 and a release of Rs. 20 lakhs is made during 1996-97 till Dec. 1996. CDC had been allotted 1000 sq.mtrs. built-up space for its office at India Habitat Centre, Lodhi Road, New Delhi, at an estimated cost of Rs.2 crores. DSIR has paid entire amount to CDC for onward payment to India Habitat Centre. The capital assets at CDC include computer systems with peripherals and accessories as well as some software. This facility is used for collection, analysis and dissemination of data, for training of engineering graduates and for small consultants. It is estimated that these investments have resulted in useful activities for nurturing consultants and users of consultancy for better returns on investments and enhanced earnings of foreign exchange directly and indirectly, besides several other qualitative advantages bringing long term benefits to the country. The Centre is also equipped with Library facilities.

5.3 Review Committee Report

In Oct. 1993, DSIR constituted a "Review Committee" on CDC to review and recommend the activities/ programmes, organisational and management structure, as well as financing of the centre. This committee submitted its report to DSIR in January 1995.

In addition to various recommendations related to CDC programmes and its organisational structure for future, the committee recommended-

".....that for remaining years of 8th Plan and for 9th Plan, DSIR may assure CDC a minimum level of core funding. Since the next two years will involve certain basic activities to re-orient and strengthen CDC, it is suggested that for the next two years (i.e. 1995-96 and 1996-97) the amount of core funding by DSIR (as distinct from any special projects it may sanction) may be a little more than the current level in addition to the releases that may be specifically done to complete the work on basic infrastructure in the new premises of CDC. For the first three years of 9th Plan the core funding per annum may be restricted to 60% and for the last two years of 9th plan about 50%. With this frame work, CDC may be given full freedom to go in for programmes, projects and customer services which can provide it better short term and long-term financial returns. If CDC earns more during this period CDC may be allowed to use it to build itself further and for future reserves. DSIR's assured core fund releases should not be reduced or deferred on the pretext that CDC has "cash in hand".

5.4 Registration Scheme

The committee of Secretaries had decided in its meeting held on 1.1.1987 that CDC should be developed into a "Certifying Agency" for screening the activities and certifying the capabilities of Design Engineering Consultancy Companies in the country. Accordingly, CDC had initiated a "Registration Scheme" for registering consultants based on certain criteria and then providing referral services to the users of consultancy. Till December 1994, about 75 consultants had been registered. Since then the scheme is discontinued and the registered consultants are now members of CDC.

Efforts are being made for "Accreditation of CDC as certifying agency for ISO-9000 Quality Management System for Consultancy and other services".

5.5 Technical consultancy Development Programme for Asia and the Pacific (TCDPAP)

In order to enhance technological and managerial

capabilities as well as the export capabilities of consultants, interactions with international organisations such as - World Bank, Asian Development Bank, African Development Bank, International Trade Centre (ITC), UNIDO, ESCAP, APCTT, have been held and programmes have been arranged for consultants at national and international levels which have proved to be useful to promote consultancy businesses. CDC has been identified to be a nodal agency for Technical Consultancy Development Programme for Asia and the Pacific (TCDPAP) by ESCAP. The second meeting of Advisory/Promotional Committee of TCDPAP was held during August, 96 in China in which CDC is again nominated to function as secretariat upto 2000 AD. The meeting was followed by an international workshop on 'Engineering Consultancy for the service of Economic Development and Technology Transfer'. The next meeting of the Technical Advisory/ Promotional Committee of TCDPAP is planned to be held in February, 97 in Bangladesh. Besides, ITC, ESCAP and APCTT and other agencies have supported CDC training programmes in the past.

5.6 Activities

Salient features of some of the activities carried out by the CDC during 1996 are:

(a) Consultancy Development, Promotion and Assistance (CDPA) Scheme:

The scheme primarily aims to support and encourage small and independent consultants and the consultancy profession as a whole. The following activities were continued.

- National Awards for Consultants '1996' were given away in January 1997.
- Use of Principal Consultants: Three consultants were retained at CDC. Their services were mainly utilised for implementing programmes at CDC.
- Trainee Consultants : Eight engineers completed their one year consultancy training at CDC during 1995-96. This one year training programme has been upgraded to Post Graduate Degree (MS) training

programme in Consultancy Management since August 1995 in association with Birla Institute of Technology and Science (BITS), Pilani. As of December 1996, twenty six trainees were undergoing training at CDC under the second batch of this programme, in addition to six trainees of first batch.

Shortterm Training / Interaction Contact Programmes:

ISO 9000 Training Programme

- (i) Awareness programme on ISO 9000 Quality Management System for Consultancy profession and service sector was organised in collaboration with MITCON, Pune at World Trade Centre, Bombay. Its objective was to make the consultancy organisations aware of ISO 9000 Quality Management System.
- (ii) Awareness Programme on ISO 9000 Quality Management System for CDC members was organised at CDC Conference Room.
- (iii) ISO 9000 training programme for CDC employees was organised in April 1996. The aim of this training was to create an awareness amongst the CDC staff to enable them to complete documentation and implementation of quality system prior to accreditation.
- (iv) ISO 9000 System Design and Implementation Training programme for consultants and professionals working in Health Care Hospital and Nursing Home Sector was organised in April, 1996.
- (v) ISO 9000 awareness seminar for medical sector was held at Sir Gangaram Hospital in June, 1996. The seminar was inaugurated by Shri Sahib Singh Verma, Chief Minister of Delhi. It was attended by 120 Doctors/ Professionals/Consultants.
- (vi) ISO 9000 awareness seminar for medical sector was held at CDC Conference Room during July, 1996. The seminar was inaugurated by

Dr. Pratap C.Reddy, Chairman Apollo Hospitals Group. It was attended by 50 Doctors/ Professionals/Consultants.

- (vii) Awareness-cum-implementation training programmes on ISO 9000 Quality Management System for consultancy organisations and service sector was held during September, 1996 in CDC Conference Room. 16 participants attended.
- (viii) Awareness programme for construction industry on ISO 9000 Quality Management System was organised in collaboration with Bureau of Indian Standards and Construction Industry Development Council (CIDC) in CDC Conference Room in October, 1996. It was inaugurated by Shri K.K.Madan, Director General, CPWD. It was an interactive programme with construction industry representatives giving their experiences of construction projects both in India and in foreign countries. 16 Participants attended the programme.
- (ix) Awareness-cum-implementation Training Programme on ISO 9000 for CSIR Research Laboratories was held during October 1996 in CDC Conference Room. 29 participants attended the programme.
- (x) Awareness-cum-implementation programme for construction industry on ISO 9000 Quality Management System was organised in CDC Conference Room in November, 1996. 20 participants attended the programme.

Interaction Meets/Contact Programmes:

Programmes were held on the following subjects:

- (i) "New Economic Policies and Indian Consultancy - Strategies & Vision" was held at New Delhi in January, 1996.
- (ii) "Consultancy Opportunities in Printing and Allied Industry", was held in January, 1996 at New Delhi

- (iii) "Outcome of VII Conference of Parties to Montreal Protocol" held in Vienna, was organised at New Delhi in January 1996.
- (iv) "Criticality in Coal Haulage in Planning of Power Projects" was held in March 1996, New Delhi.
- (v) "Comprehensive Transport Model system used in China for Coal Transportation to Thermal Power Stations" was organised at New Delhi in April 1996.
- (vi) "Consultancy Opportunities in Environmental Impact Assessment" was held at New Delhi in May 1996.
- (vii) "Consultancy for Co-generation in Process Industries" was held at New Delhi in June 1996.
- (viii) Consultancy for Self Enforcing Environment in Industrial Safety" was held at New Delhi in August 1996.
- (ix) "Information Technology for Consultants" was held at New Delhi in October 1996.
- (x) "Enhanced Role of Consultants in Infrastructure with respect to Common Minimum Programme" was held at New Delhi in December 1996.

(b) Consultancy business activities

- (i) Computerised Information and Computer Aided Design (CAD) facilities were strengthened at CDC and the Centre is now better equipped with these facilities to help the small industries/consultants in this area. This facility is mainly for the trainees at CDC. The Centre is also equipped with E-mail and Internet facilities. It has strengthened its library facilities also.
- (ii) CDC has been designated as the coordinating agency for the implementation networking to the Data Base Programmes of the Asian and Pacific Centre for Transfer of Technology (APCTT).

- (iii) A computerised data base is available for about 3500 consultants as against 500 in 1989-90 and 2500 in 1993-94. The data base is being continuously updated.
- (iv) CDC had made an agreement with the Ministry of Environment & Forest, for undertaking work related to Ozone Cell established by the Ministry for implementation of projects related to ODS, and the work was being completed satisfactorily. The agreement included the occupation of some space by the cell at CDC, besides various kinds of services from CDC. The agreement is now in the process of renewal for another two years with effect from January 1996.

(v) Publications/Brochures of CDC

Brochure on Consultancy Business Development

The brochure gives details of the facilities available at CDC for Business Development of consultancy services. It has been widely disseminated.

Brochure on MS Post Graduate Consultancy Management Training Programme

The brochure gives objectives, scope, implementation modalities and guidelines for the programme. The same has been widely disseminated to Consultants, academia and others.

Brochure on "Technical Consultancy Development Programme for Asia and Pacific (TCDPAP)"

The brochure gives information about the initiation and establishment of TCDPAP. It further highlights how consultants can avail facilities under this programme.

First Decade of Activities of CDC

The document on First Decade of Activities and achievements of CDC was printed.

National Directory of Consultants

The National Directory of Indian Consultants/ Consultancy Organisations having information of about

1700 Consultants/ Consultancy Organisations was printed.

CDC News Letter - Consultancy Vision

CDC brought out IInd, IIIrd and IVth issues of its News Letter "Consultancy Vision" which were widely disseminated.

News Letter on TCDPAP Focus

The first issue of the "TCDPAP FOCUS" was brought out and disseminated in India and Abroad.

5.7 Revenue

CDC has made serious efforts to generate revenues on its own towards becoming almost self supporting in the long run. CDC has earned a record revenue of about Rs. 16 lakhs during the year 1995-96 from services rendered to various agencies, membership fee, sale of directories, etc.

VI. LINKAGES WITH INTERNATIONAL ORGANISATIONS

During the year, the Department continued to participate in the activities of various international organisations such as UNCTAD, WIPO, UNIDO, ESCAP and APCTT at various levels and forums on issues related to Technology Development and Technology Transfer in coordination with other concerned Ministries.

APCTT and ESCAP

The matters pertaining to the Asian and Pacific Centre for Transfer of Technology (APCTT) under ESCAP, were dealt with in cooperation with Ministry of Commerce. The Department of Scientific and Industrial Research continued to play the role of a focal point for the APCTT. DSIR helped in preparing a brief, covering technological issues for the use of Indian delegation to the 52nd Annual Session of ESCAP held in April 1996 at Bangkok.

Dr. V.V. Subba Rao, Adviser, DSIR participated in the Twelfth Technical Advisory Committee meeting of APCTT held in Kathmandu during 26-27 November 1996 and the 11th session of the Governing Board of APCTT held in Kathmandu during 28-29 November 1996. These meetings were

attended by participants from Bangladesh, China, India, Bhutan, Islamic Republic of Iran, Nepal, Pakistan, Republic of Korea, Russian Federation, Sri Lanka, Vietnam and by observers from Bhutan, Democratic People's Republic of Korea, Malaysia and Myanmar.

Senior officers of the department also participated in various workshops/seminars conducted by the APCTT during the year.

Umbrella Agreement

An 'Umbrella Agreement' between the Republic of India and the State of Israel on Cooperation in the field of Industrial and Technological Research and Development was signed in New Delhi on 30th December 1996 in presence of the President of Israel and Prime Minister of India. It is expected that joint industrial R&D projects may be taken up by interested Indian and Israeli companies for technology development under the above Agreement. It is also expected that broad cooperation among in-house R&D centres in industry in India and those in Israel would take place under the above Agreement.

VII. NATIONAL INFORMATION SYSTEM FOR SCIENCE & TECHNOLOGY (NISSAT)

1. INTRODUCTION

The increasing role of science and technology in the economic and social development of the country has generated a pressing demand for faster technology transfer to the industries. Apart from access to information generated within the country, it is also necessary to draw from the externally generated information to support internal efforts on research and development. Information centres that have come up to serve the needs of different industries and R & D units are therefore required to be coordinated and organised into an integrated system to avoid a haphazard growth and duplication of activities and in conformity with national and international standards.

The National Information System for Science & Technology (NISSAT) programme envisages promotion and support to the development of a compatible set of information systems on science and technology and interlinking these into a network. The approach adopted is to bring the existing centres, systems and services to a higher level of operation so that the interests of the national community of information users could be better served. For this purpose, the programme also contemplates experimentation with and introduction of modern information handling tools and techniques and the development of endogenous capabilities.

2. OBJECTIVES

2.1 NISSAT functions with the following objectives:

- * Development of National Information Services
- * Promotion of Existing Information Systems & Services
- * Introduction of Modern Information Handling Tools & Techniques
- * Promotion of National & International Cooperation in Information.
- * Development of Indigenous Products & Services

- * Support to Education, Training and R&D in Information

Strategies

- * Emphasis on Contents Aspects
- * Use of Existing Infrastructural Facilities
- * Commercialisation of Information Services

NISSAT programme is being implemented through several sub-programmes which include *inter alia* :

- establishment of information centres in specific sectors, subjects and products
- development of information resource sharing systems like library networks, union catalogues and consultative committees
- establishment of international database access centres
- promotion of application of modern information technologies
- development of skills in information technologies and information handling tools, techniques and so on.

3. NISSAT INFORMATION CENTRES

3.1 Sectoral Information Centres

The major instrument for information resource development and dissemination is the information centre which provides bibliographic as well as factual and numeric information on a product, discipline or mission. A series of information centres (Table - VII.1) were established to create information awareness and to meet information needs of academicians, scientists, technologists, entrepreneurs, management executives and decision makers.

TABLE - VII.1 : NISSAT CENTRES

No.	Subject Area	Acronym	Host Institution
(i)	Leather Technology	NICLAI	Central Leather Research Institute Madras
(ii)	Food Technology	NICFOS	Central Food Technological Research Institute, Mysore
(iii)	Machine Tools & Production Engineering	NICMAP	Central Manufacturing Technology Institute, Bangalore
(iv)	Drugs and Pharmaceuticals	NICDAP	Central Drug Research Institute, Lucknow
(v)	Textiles & Allied Subjects	NICTAS	Ahmedabad Textile Industry's Research Association, Ahmedabad
(vi)	Chemicals & Allied Industries	NICHEM	National Chemical Laboratory, Pune
(vii)	Advanced Ceramics	NICAC	Central Glass and Ceramics Research Institute, Calcutta
(viii)	Bibliometrics	NCB	Indian National Scientific Documentation Centre, New Delhi
(ix)	Crystallography	NICRYS	University of Madras, Madras
(x)	CD-ROM	NICDROM	National Aerospace Laboratory, Bangalore
(xi)	Management Science	NICMAN	Indian Institute of Management, Ahmedabad
(xii)	Marine Science	NICMAS	National Institute of Oceanography, Goa

The Information Centres were built around the existing information resources and facilities. They maintain extensive collections of published and unpublished documents in the form of books, periodicals, research reports, development and trade reports etc., in the relevant subject areas. Besides providing documents and preparing bibliographies on request, they offer SDI, CAS, reprographic, micrographic, industrial and technical enquiry, translation and other services.

3.1.1 The core activities of the NICLAI centre were focused on its development as a national centre for information on leather and allied industries. The areas of specialisation covered are:

- *Leather Science and Technology, Footwear, Leather goods, Chemical engineering, colleges, polymers, leather economics, biochemistry, etc.*

LESA (Leather Science Abstracts) is being regularly brought out. It also provides wide spectra of services including colour photography, slide making, video coverage. NICLAI brought out eight special publications during the period of report. The major database developed using CDS/ISIS includes LESA (Leather Science Abstracts), LECAT (Library Catalogue), PBCLRI (Publication of CLRI), PERHOL (List of periodical holdings of CLRI Library). The centre also created E-Mail facility for faster communication. Server facility has been established under ERNET and NICNET. NICLAI is actively participating in the MALIBNET, a cooperative network for effective resource sharing in the region. The centre also provides technical support to MCA students in the preparation of project reports as a part of their curriculum.

3.1.2 NICFOS centre is a clearing house for all types of information on food processing in the country and has initiated several information oriented programmes to fulfill the information needs of the food sector. It earned a revenue of Rs.5.04 lakhs during 95-96. The services provided by the centre includes: Documentation services, Reprography, and computer-based SDI services. The regular publications of the centre includes: Food Technology Abstracts (monthly), Food Digest (quarterly), Food Patents (quarterly) and Library Bulletin. The centre maintains eight databases on Food tech-

nology. The centre also conducted a user survey to assess the utility of the centre.

3.1.3 NICMAP is acting as a clearing house of information on Machine Tools and Production Engineering. It earns about Rs. 6.5 lakhs from its membership subscription, sale of publications and document supply services. NICMAP maintains about 6 databases on Bibliographical, Statistical and Product categories. The centre is planning to host its data on TIFACLINE of CMC for on-line accessing by users.

The centre has already selected Informatics and Silver platter for producing their databases in CDROM. The silver-platter will provide the software and market the product.

NICMAP is providing expert consultancy to African Regional Centre for Engineering Design and Manufacturing (ARCEDEM), Nigeria for establishing an information centre. NICMAP will also conduct sensitisation programmes in different African countries to make them aware of the new services for ARCEDEM.

3.1.4 The activities of the NICDAP centre includes publication of Drugs and Pharmaceuticals bulletins, document delivery services, query services on industrial R&D and patents, and database development. The centre organised a user group meeting to assess the usefulness of the services of the centre. The centre earned a revenue of Rs.2.32 lakhs from its services.

The centre provides CDROM based services using Medline, Chemical Abstracts, Popline, Excerpta Medica, International Pharmaceutical Abstracts, Biotechnology Abstracts, Drug information, NUCSSI, PID Environment Asia and Current Contents. The centre also provides on-line services using Datastar -Dialog and STN. The centre has INTERNET connectivity through RENNIC.

3.1.5 Services provided by NICTAS includes Literature Searches, Translation, Reference Service, E-mail facility, marketing of ASTINFO Document Delivery Services. NICTAS continued the Publication of TEXINCON and other state-of-the-art reports. The centre organised a user-interaction meet.

3.1.6 NICHEM centre continued to perform well during the year 95-96. About 70% of its services are provided for industry, primarily chemical and pharmaceutical industry. There has been a marked increase in the demand for patents and translation over the previous year. The revenue generation of the centre is Rs.38 lakhs including the receipt of Rs. 9.11 lakhs from the on-line services.

NCL has an active research group in the area of polycarbonate process chemistry. An integral part of this activity is to track emerging patents in this area world wide and disseminate the information to research groups in an organised way. Therefore the centre has decided to bring out a quarterly publication of "Polycarbonate Monitor" and the first issue has already been published.

3.1.7 The NICDROM centre continued its activities. The bi-monthly publication of the centre, namely CD-FOCUS is being brought out regularly and sent to 50 institutions. The CD-ROM holding list of institutions has been prepared. The centre procured NTIS, Aerospace, Inside information and TFPL directory CDROM databases. The centre realised an amount of Rs.5,036 from its services.

3.1.8 NICMAN centre acquired the computer hardware and integrated it with the network of the library. The centre is using the VSAT facility existing in the institute for remote accessing. The centre started providing services using the databases of the NICMAN centre and CDROM databases. The centre has acquired ABI/INFORM Global, Econlit, Predicasts and IMI and the CDROM databases are available on-line within the institute.

3.1.9 NICMAS centre started in April 1996 only. The centre has procured the equipment and appointed project staff. The activity for the development of database on "Indian Ocean" is initiated and earned a revenue of Rs.20,000/-.

3.2 Lisoforum

An Electronic Mail Discussion Forum for providers and users of information services in India, called LISFORUM has been set at NCSI in Nov. 95.

LISFORUM provides an E-Mail based electronic forum for its participants to discuss issues of relevance to library and information services. The facility is available to users of ERNET and other networks that have connectivity to ERNET.

3.3 VAPIS - Value-Added Patent Information System

With the changing economic scenario in the country and the impending IPR regime, it is imperative to strengthen the patents information activities in India. The fierce competition faced by Indian industries, the necessity of the awareness of competitions, innovations and the availability of foreign technology have made the patent information vital for the industry.

Considering the expert manpower available in the national R&D systems and the increasing need from industries for technical information, NISSAT established Value Added Patent Information System (VAPIS) at National Chemical Laboratory, Pune and Central Manufacturing Technology Institute at Bangalore to offer specialized, value added information services. The services are based on databases pertaining to US, European, World, Japanese and other patents available on CDROM. Separate subset of the database on Chemicals is located at NCL, Pune and on Engineering in CMTI, Bangalore. The information on patent and IPR legislations, etc of various countries are located at patent office of CSIR.



VII.1 Inauguration of VAPIS centre of NISSAT at NCL, Pune

The main objective of the centre is to take advantage of the expertise available with the host institutions to add value to patent information and offer such services to industry. The addition of value to patent information is made by analysing contents of the patents. Value addition to patent information involved understanding the contents of patents, and adding to them details of technology options, technology gaps, and other items of crucial information.

The orientation of the centres would be towards market needs with a clear indication of activities, target clientele and revenue earning projections.

4. INFORMATION RESOURCE SHARING

With a mandate to facilitate provision of broad based information services in the country, NISSAT has taken the initiative for promoting resource sharing activities. These initiatives are aimed at ensuring better utilisation of S & T information resources, minimisation of functional load of information centres and encouragement of motivational factors to a large extent by better means of communication.

4.1 Library Networks

The ultimate goal of information/library networks is to interlink information resources in a metropolitan area such that users could access information irrespective of its location, format, medium, language, script etc. Further, the development of such networks requires actions in several areas such as training, rationalization of information resource acquisition, diffusion of standards, preparation of union lists, generation of database services apart from setting up hardware, software and communication facilities. To meet this end, the NISSAT has initiated library/ information network development activities such as: ADINET in Ahmedabad, BONET in Mumbai, CALIBNET in Calcutta, DELNET in New Delhi, MYLIBNET in Mysore and PUNENET in Pune.

NISSAT strives to develop self-sustaining information systems. With this end in view, NISSAT only goes to the extent of setting up general infrastructural facilities like network service centres including hardware, software, manpower and other organizational requirements, communication facilities etc. With a change in

the development and implementation strategy, the participating institutions in a network are to arrange their own terminal hardware, software, manpower and data conversion.

4.1.1 ADINET has ten institutional members, five associate institutional members and two professional members. A centralised database has been created at ADINET which contains Institute Master, Journal Master and Book database. It also organised six workshops and training programmes. Adinet provided email connectivity to 30 libraries of Ahmedabad.

4.1.2 About 36 libraries networked under BONET through an IIP027 computer named SAKTI for providing access to members. It also uses a locally developed software named "Request". Under Bonet, the following databases were created.

- (i) 15,000 items in a bibliographic database on computers and software technology.
- (ii) Union Catalogue of journals and other periodicals in 10 libraries in the region.
- (iii) Tables of contents of 250 Indian periodicals created by the National Centre for information.

A number of CDROM databases have been mounted on a Novell Server for use in training activities and for demonstration to members.

4.1.3 CALIBNET has adopted a two way system for networking i.e

- (i) the network route with a library automation and networking through its own application software "Maitrayee" and
- (ii) the E-mail route connecting member libraries with online access to various databases within network and Internet access.

CALIBNET established a high-tech resource-base and provides the following services:

- Online/ CDROM based Global information search and retrieval services
- Full-text Document Delivery
- Database services

4.1.4 DELNET at present has 57 libraries as its members. The libraries that have more than 10,000 books are taken as institutional members and those which have less than 10,000 are given Associate Institutional memberships. Delnet has 50 institutional members and seven associate institutional members.

The following four databases created by Delnet are available online to member libraries and other Delnet users.

- (i) Union Catalogue of books in member libraries.
- (ii) Database of Indian Specialists
- (iii) Multi-lingual books database
- (iv) Union list of current serials

Delnet provided email connectivity to its members through ERNET. The libraries have access to ERNET users and also to Internet.

4.1.5 MYLIBNET is the first library network established in a small city. The launching of MYLIBNET in association with Mysore City Library Consortium (MCLC) took place in 12th June 1995. A high-level coordination committee has been constituted under the chairmanship of Director, CFTRI, Mysore. There are 16 institutional members. The holding list of Mysore city libraries has been computerised and a software has been developed to enable the users to access the software on-line. MYLIBNET provided Email facilities to its members.

4.1.6 Presently, 24 libraries and 15 professionals from Pune city are accessing the PUNENET through modem. The users not only access PUNENET data, but also use the E-mail and Internet facilities. Following databases are available on PUNENET for its members.

- * Catalogues of holding of all member libraries.
- * UC of current periodicals in Pune libraries and information centres.
- * Publishers and book sellers database.
- * Information on Indian Databanks
- * Deluxe Abstract edition of Reference Update for SDI services.

- * Database on International grants and fellowships in the Health Sciences.
- * Hard databanks in Biotechnology
- * Access to NICNET and databases available on NICNET viz. MEDLARS, AIDS Database, US patent databases etc.
- * Access to Internet and various databases available on Internet.
- * Patent information
- * Union catalogue of Books available in British libraries in India.

4.2 E-Mail Connectivity

NISSAT has established E - Mail connectivity with its information centres, library network societies, etc. through ERNET. This connectivity greatly enhances the resource sharing capabilities among these centres and also the provision of user services more efficiently. The ERNET group of the Department of Electronics, Government of India has provided the overall know how in these venture.

4.3 Union Catalogue

NISSAT intends to promote & support development of *Union List of Current Scientific Serials (ULCSS)* in major cities - Ahmedabad, Bangalore, Bombay, Calcutta, Delhi, Goa, Nagpur, Pune, & Ranchi. Also completed a union list of scientific serials in Oil sector. ULCSS software has been developed on CDS/ISIS platform. These Union Lists will serve as a valuable resource for scientists, researchers, academicians and library professionals to provide information on the availability of serials in the selected cities, to identify the gaps in the acquisition of serials and to help in the rationalisation of acquisition of serials by encouraging resource sharing.

5. SDI / CUSTOM SEARCH : ONLINE AND CD-ROM BASED

5.1 NISSAT Online Access Centres to International Data Services.

In order to bring the information support services to the scientists and technologists in India on par with

those available to their counterparts in the developed countries, NISSAT has established nine NISSAT Access Centres to International Database Services - NACIDS as listed in Table - VII.2.

TABLE - VII.2 : NISSAT Access Centres to International Database Services (NACIDS)

S.No.	Place	Host Institution
i)	Bangalore	National Aerospace Laboratory
ii)	Calcutta	Indian Association for Cultivation of Science
iii)	Madras	Central Leather Research Institute
iv)	New Delhi	Indian National Scientific Documentation Centre
v)	Pune	National Chemical Laboratory
vi)	Ahmedabad	Ahmedabad Textile Industry's Research Association
vii)	Bombay	Victoria Jubilee Technical Institute
viii)	Hyderabad	Centre for Cellular & Molecular Biology
ix)	Thiruvananthapuram	Kerala State Industrial Development Corporation

The NACIDS use PSTN telephone lines upto the local PAD of Videsh Sanchar Nigam Limited (VSNL) and there onwards, the international carriers via the Gateway Packet Switching Services (GPSS) at Bombay. NACIDS have trained intermediaries to assist or conduct online searches. The centres are gaining popularity considering that there is an increasing number of users and full search costs are recovered from them.

5.2 CD-ROM Based SDI Services

Selective Dissemination of Information (SDI) is provided regularly to users on the basis of their information needs. Such services are offered by the following institutions using various CDROM databases in their respective subject areas (Table - VII.3).

TABLE - VII.3 : NISSAT CD-ROM BASED SERVICES

S. No.	Host Institution & Place	Database
1.	Ahmedabad Textile Industry's Research Association, NICTAS Ahmedabad	Colour Index
2.	ADINET Society, Ahmedabad	Inside Information
3.	BONET, Bombay	Inside Information
4.	CALIBNET Society	Inside information
5.	Central Leather Research Institute NICLAI, Madras	BIOSIS
6.	Indian Institute of Science NCSI, Bangalore	ADONIS
7.	National Chemical Laboratory NICHEM, Pune	CA, CC & LCMARC
8.	PUNENET society, Pune	Inside Information

5.3 CD-ROM Depository Centre

The NISSAT established a facility at Foundation for Innovations and Technology Transfer at Indian Institute of Technology, Delhi in 1996, as a depository centre for acquiring all CDROM databases on India and about India. Some of the collections of the centre includes Business India, Electronic Corporate Directory, Environment Asia, Gandhi, Goa - The Pearl of Asia, Guru Nanak CDROM, Health Asia, Hindi English Dictionary, India Mystica, Invitation India, Information Interactive on Rajasthan, Innaware Educational CDs, Innovation India CD-ROM, Iyengar's Yoga for all, Kompass India 96, Mythological collection on CDROM, Suchak, Karishma, Taj Mahal, Wealth Asia, Yellow Pages etc.

6. INFORMATION TECHNOLOGY APPLICATION

The demand for use of computers ranges from automation of routine management functions in libraries to

information retrieval or analysis of global databases. Since inception, NISSAT had accorded a high priority to all aspects of computer based bibliographic information processing. As a part of the programme, NISSAT acquired proven software packages like CDS/ISIS for bibliographic information processing & retrieval and IDAMS for statistical data processing from UNESCO. NISSAT subsequently obtained the official rights for distribution of the two packages in India.

As on date, there are about 1200 installations of CDS/ISIS and 25 installations of IDAMS in India. The implementation of CDS/ISIS is monitored regularly through exchange of information, user's group meetings and periodic surveys.

"SANJAY" is one of the major tools developed with the initiative of NISSAT to help the libraries and information centres in India to improve their housekeeping and service function through automation. The package is totally menu driven and can be used even by non-professionals. The package was released for marketing on September 1995.

Though the activities of NISSAT were earlier targeted to benefit the users in scientific and academic institutions, the programme is being redesigned now to assist the business and industries as well.

NISSAT also developed another CDS/ISIS based package, known as TRISHNA. The TRISHNA, developed in collaboration with National Institute of Science Technology and Development Studies (NISTADS), New Delhi, supports the use of CDS/ISIS using a GIST CARD for materials in Devnagri and several other Indian scripts. This package was distributed to ASTINFO member countries like Nepal & Bangladesh. The package is under beta test in the Sahitya Academy.

7. DEVELOPMENT OF SKILLS IN INFORMATION TECHNOLOGIES

The education and training of information personnel in handling the modern information handling tools, techniques and information technologies

was another area of thrust. Although, existing library and information science courses have been undergoing changes to incorporate modern developments in the information field, there is a need to supplement these with continuing education programmes at various levels.

In view of the situation, NISSAT encourages and supports a variety of manpower development programmes which cover topics such as application of computers in library and information centres, use of personal computers & CDS/ISIS, TQM in library services, Science and technical communication, Scientometrics & Bibliometrics, Computer Cataloguing, CDROM/ Online search, Modern information access facilities to business and industry etc., in various parts of the country.

NISSAT has developed facilities for the conduct of regular series of courses at DRTC, Bangalore; RCC Calcutta and University of Poona, Pune. About 16 short-term courses were conducted during the reporting year.

8. SCIENTOMETRICS COORDINATED PROGRAMME

Plan of action for Scientometrics & Informetrics in India was prepared to identify the main areas in Scientometrics and informetrics with due regard to intellectual and economic gains, the investments necessary and the infrastructure already existing in the country. NISSAT has taken up the implementation of a programme of coordinated research in the area of Scientometrics/ Informetrics/ Bibliometrics. As a first step towards this, nine projects on "National Mapping of Science using CDROM databases" like CA, Compendex, Inspec, SCI, Medline plus, EMBASE, Georef, CAB, AGRICOLA, ISA etc has been taken up.

9. RESEARCH & DEVELOPMENT AND STUDIES.

NISSAT also promotes and supports studies, preparation of directories, databases, basic and applied

research in information science etc. The list of such projects/efforts is given below :

S.No.	Activity	Institute
i)	Development of databases on manufacturing of various kinds of Ferrous & Non-ferrous & Special Castings	IIF, New Delhi
ii)	Beyond Institutional Boundaries: A study of collaborative linkages of Indian science through Bibliometrics Indicators	NISTADS, New Delhi
iii)	Study on "Making use of Govt. held tradeable information in India"	ISAC, New Delhi
iv)	Preparation of basic course materials for organising a series of workshops on patent information for R&D and business based on case studies.	NISTADS, New Delhi
v)	Guidelines for the implementation of UNIMARC in India	CALIBNET Society, Calcutta
vi)	Directory Database of Chemical and Pharmaceutical Industries	NCL, Pune
vii)	Database on Indian Abstracting Services, Indexing Journals and Indian Database in S&T sector	ISAC, Delhi
viii)	Directory of Foreign Language Scientific & Technical Translators in India	ISTA, Delhi
ix)	Industrial Innovation Indicators A Pilot Study	NISTADS, Delhi

10. INTERNATIONAL ACTIVITIES

The activities of ASTINFO/UNESCO (Regional Network for the Exchange of Information and Experiences in Asia and the Pacific/UNESCO) are closely coordinated with those of NISSAT. The NISSAT Advisory Committee also functions as the National Advisory Committee of UNISIST and the National Advisory Group for ASTINFO. The activities under ASTINFO are given below:

NISSAT secretariat has been awarded a UNESCO project for the establishment of the "Clearing House on CDS/ISIS software and creation of Database on library network experts in ASTINFO region" under the Participation Programme.

Further ASTINFO document supply service promoted and supported by UNESCO is being continued. Under this scheme, the National Library of Australia

services overseas document requests. To handle the Indian requests for the services, NISSAT as the ASTINFO national coordinating unit in India, has identified a set of institutions on considerations of logistics. The request forms are also available from NICTAS/ATIRA, Ahmedabad, which has outlet for all NISSAT products and services.

NISSAT organised two day Indo-Japan Information Workshops. The Japanese side was represented by Japan Information Centre of Science & Technology (JICST) which is the central organisation for collecting, processing and providing S&T information in Japan. JICST presented its role and future plans, demonstration of Japanese databases through Internet, Japanese-English machine translation system. The corresponding scenario was presented by the Indian side.



VII.2 Exchange of CDROMs During Indo-Japan Workshop

11. MONITORING AND COORDINATION

11.1 Promotion of NISSAT activities, products and services

In order to reduce the dependence on government investments for the development of scientific & technical information infrastructure in the country, the NISSAT products and services are to be marketed aggressively. In this regard several measures have been taken for market promotion. For example, operative level personnel from various NISSAT information centres have been given orientation courses on information marketing. NISSAT supported centres are being encouraged to generate revenue and to plough back this revenue for infrastructural development. As an incentive, NISSAT provides a matching grant for the revenue earned.

NISSAT entrusted the responsibility of marketing the products and services produced/generated by NISSAT to one of its information centres namely NICTAS at ATIRA, Ahmedabad. NISSAT signed an MOU with ATIRA for this purpose.

11.2 Information Today & Tomorrow (ITT)

NISSAT Newsletter namely ITT gives an overall view of developments in information products, services, systems and technology. This covers wide ranging issues relating to information and development of information

centres and networks. News items like new concepts and services, events like seminars and training courses, new products like directories and information on status of information systems - at both national and international levels and trends in their development are covered.

Produced quarterly in cooperation with one of the centres of NISSAT at CLRI, Madras, it is distributed to 5000 individuals and institutions. The NISSAT Newsletter enjoys user appreciation and high professional esteem in India.

VIII. PUBLIC ENTERPRISES

VIII(A). NATIONAL RESEARCH DEVELOPMENT CORPORATION

1. INTRODUCTION

National Research Development Corporation (NRDC) is the principal organisation established by the Government to act as a link between scientific laboratories and industrial establishments for transferring technologies. It is a unique organisation in that it is the only public enterprise wholly dedicated to transfer of technologies from R&D laboratories to industry. What is more, its operations cover the entire spectrum of industrial technologies ranging from chemicals to metallurgy, mechanical engineering, electrical engineering, electronics, biotechnology etc.

In spite of the challenge posed by the economic policy of the Government involving the active promotion of foreign investment and induction of foreign technology into the country, the performance of the Corporation continued to be satisfactory. During the year 1995-96, the Corporation's income from its principal sources of revenue i.e. *Lumpsum Premia and Royalty* on the licensing of indigenous technologies to industry, was Rs.168.00 lakhs. The Corporation has earned a gross profit of Rs.35.67 lakhs.

2. PROFIT

Due to the sustained, hard and dedicated work of its executives and staff, the Corporation continued to earn a profit. During the year 1995-96, the Corporation earned a gross profit of Rs.35.67 lakhs against Rs.63.90 lakhs in the previous year. The fall in profits was due to the reduced income from *Lumpsum Premia* referred to earlier.

The gross income of the Corporation from all sources, including premia and royalty, but excluding Grants-in-Aid, was Rs.278.22 lakhs during 1995-96 as compared to Rs.293.91 lakhs in the previous year.

3. PROCESSES ASSIGNED AND LICENCE AGREEMENTS CONCLUDED

To widen its technology resource base, the Corporation continued its efforts to tap new sources of technologies. In this endeavour, the Corporation signed MOUs with the Indian Plasma Research Institute, Ahmedabad, the Central Silk Board, Bangalore, the Indian Institute of Technology, Kharagpur and Institute of Technology at Varanasi for the commercialisation of their technologies. As a result, 46 new processes were assigned to the Corporation during 1995-96 as against 38 in 1994-95. Some of the commercially important processes assigned to the Corporation during 1995-96 were:

- Liquid Glucose
- Enzyme based dehairing of animal skin
- Prawn feed technology
- Low carbon equivalent low cast iron
- Aluminium nitride powder
- Splice pile technology

Though the number of licence agreements signed during 1995-96 declined to 34 as compared to 52 in 1994-95, the average premium for the processes licensed increased to Rs.1.95 lakhs in 1995-96 as compared to Rs.1.43 lakhs in 1994-95. This shows that the Corporation was able to continue to increase its earnings per technology licensed.

4. MAJOR TECHNOLOGIES LICENSED

Some of the major technologies licensed by the Corporation during 1995-96 are:

- Invert Sugar
- Zeolite A Powder: Detergent Grade
- Resorcinol
- Glycol based automobile coolant
- BOD Biosensor

5. TECHNOLOGY DEVELOPMENT PROJECTS

The Corporation has been promoting and financing in collaboration with industry/R&D institutes, technology development projects for setting up pilot/semi commercial/demonstration plants. The progress on major technology development projects is given below:

5.1 Completed Projects

i) Artificial Heart Valve

The Corporation had funded a development project for the production of 300 Artificial Heart Valves at Shree Chitra Tirunal Institute of Medical Science & Technology (SCTIMST), Thiruvananthapuram for human trials. The valves have been successfully implanted in human beings at 6 centres. M/s TTK Pharma Ltd. to whom the process was licensed by the Corporation have also commenced commercial production. During 1995-96, they produced 148 heart valves valued at Rs.17.76 lakhs.

ii) Acid Proof Cement from Rice Husk Ash

The Corporation provided a financial grant of Rs.2.34 lakhs to IIT Kharagpur to upscale its laboratory scale process to a pilot plant of 20 kg/day capacity. The Monitoring Committee of the project at its meeting held in June, 1995 at IIT Kharagpur noted with satisfaction that the project had met its primary objectives. After successful completion of the project, the Corporation has also licensed the process to two more parties for commercialisation.

5.2 On going projects

i) Glucose Biosensors

The National Physical Laboratory in collaboration with the Centre for Biochemicals, Delhi and the Indian Association for the Cultivation of Science, Calcutta have designed and developed a Glucose Biosensor for the

estimation of blood sugar in human beings. The Corporation provided a financial grant of Rs.1.5 lakhs to NPL for the fabrication of 50 prototypes of such Glucose Biosensors and 50,000 glucose biosensor strips in order to conduct field trials to generate confidence among entrepreneurs. NPL has already made prototypes of the Glucose Biosensors, while the work on the fabrication of the strips is in progress. Meanwhile the Corporation has licensed the knowhow to two parties.



VIII.A.1 *Fabrication of strips to be used in Glucose Biosensors*

ii) Single Piece Intra Ocular Lenses (IOLs)

At present, generally three piece intraocular lenses are being implanted in human beings in cataract operations. However, ophthalmologists now prefer to use single piece IOLs which are mostly being imported at present. The advantages of single-piece-IOLs over multi-piece-IOLs are that (i) it has no junction as compared to the multi-piece lens; and (ii) any design of

the optics can be produced. The Venu Eye Centre, New Delhi has indigenously developed the process for the manufacture of single piece IOLs for the first time in the country. Keeping in view the increasing demand for single piece intra ocular lenses in the country, M/s Venu Eye Centre has formed a company Vision Surgicals Pvt. Ltd. to manufacture single piece IOL. NRDC has participated in the equity of the new company to the extent of Rs.12 lakhs (49% of total equity). The work of setting up the project in Delhi is in progress.

iii) Sand Lime Bricks

Sand lime bricks are advanced building materials which are superior to conventional clay bricks. The Corporation has licensed the technology for the manufacture of sand lime bricks developed at CBRI, Roorkee to M/s Periwai Bricks Ltd, Dungargarh. The Corporation has also participated in the equity of the Company amounting to Rs.30 lakhs (14.8% of the total equity). A plant with a capacity of 30 million bricks per annum has since been commissioned at a cost of Rs. 5.5 crores. However, since the output of the brick manufacturing press, indigenously produced was found to be far below the rated capacity, the Company is in the process of importing another brick manufacturing press to achieve its rated capacity.



VIII.A.2 A view of the sand lime brick plant at Dungargarh (Rajasthan)

iv) Carbon Fibre for Braiding Applications

The process for the manufacture of Carbon Fibre developed at the National Physical Laboratory, New Delhi was licensed to M/s Machining Centre (India) Ltd., Thane. The company is setting up a 5 TPA semi-commercial plant in Mumbai at a total cost of Rs.131 lakhs. The Corporation has provided a development loan of Rs.10 lakhs to the Company. Financial assistance to the tune of Rs.40 lakhs is being provided by Technology Information Forecasting and Assessment Council (TIFAC) of DST. The work on the project is in progress.



VIII.A.3 Carbon fibre pilot plant at NPL, New Delhi

6. PROJECTS SUPPORTED BY DEPARTMENT OF SCIENTIFIC AND INDUSTRIAL RESEARCH (DSIR)

DSIR has been supporting technology development projects under its "Programme Aimed at Technological Self Reliance (PATSER)" involving industry, research institutes and consultants. The Corporation has been identified as the agency to manage all matters connected with the intellectual property rights generated in these projects, as also to collect the royalty revenues accruing from the utilisation of the technology by the Company concerned and third party licensing. A few of the major projects undertaken during 1995-96 under the PATSER are:

- Copper Sulphate from Copper cement waste in collaboration with Hindustan Zinc Ltd., Udaipur.

- Micro processor based moisture and density gauges in collaboration with the Electronics Corporation of India Ltd., Hyderabad.
- Development of Application Specific Integrated Circuits (ASICS) for MPEG-2 Decoder.
- Technology upgradation of the existing Rice Husk Board plant and development of coconut/palm stem, jute fabric reinforced board and fire check doors.

7. MARKET SURVEYS

Market surveys not only make the technology to be licensed more complete and credible, but also help in assessing the realistic price at which the technology can be licensed. With this object in view, the Corporation continued to get market surveys prepared on commercially important technologies by engaging professional market survey agencies for the purpose. During the year, market survey reports on the following items were completed:

- Resorcinol
- Liquid Glucose
- B-naphthol
- Phthalocyanine Blue
- Dental Amalgam Alloy
- Biochemical Reagents
- Insulating Bricks from Rice Husk Ash

8. INVENTION PROMOTION PROGRAMME

The Corporation continued to promote and encourage inventive talent amongst scientists, engineers, industrial workers and students by awarding prizes to meritorious inventions and providing financial assistance for building prototypes and setting up pilot plants to prove such inventions.

During the year, the Corporation received 80

proposals for prize awards and 34 proposals for providing financial assistance. The Corporation announced on Independence Day (1995), cash awards amounting to Rs.2.15 lakhs to 21 inventors for 4 inventions. On Republic Day (1996), cash awards amounting to Rs.3.30 lakhs to 11 inventors for 3 inventions were announced.

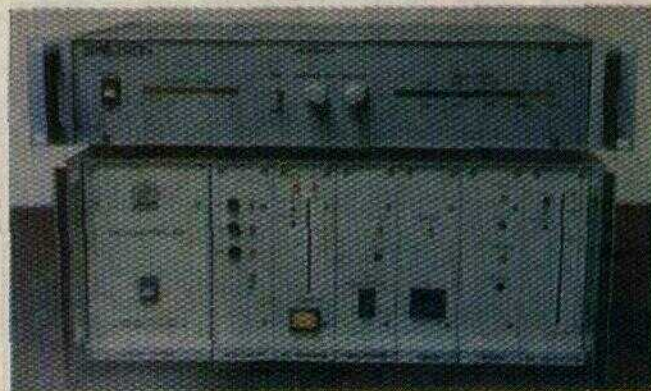
Some of the meritorious inventions recognised through awards during the year were:

- * Titanium Complex Grease
- * Dynamic Carrier Control System
- * Invert Sugar
- * Mechanised depillaring seam with cable bolt.

The Corporation also provided financial assistance to 9 inventors for fabricating prototypes.

Patent Assistance

The Corporation continued to provide technical, legal and financial assistance to individual inventors in drawing up patent specifications, processing their patent applications etc. During the year, the Corporation received 54 applications from individual inventors for such assistance. Assistance was granted to 29 inventors based on the patentability of the inventions involved and 61 patent applications were also filed on behalf of different R&D organisations.



VIII.A.4 Dynamic Carrier Control System



VIII.A.5 Mechanical Depillaring Seam with Cable bolt

9. DEVELOPMENT & PROMOTION OF RURAL TECHNOLOGY

The programme aims at the application of S&T for improving the standard of living of our rural people by increasing employment potential through the development and application of appropriate rural technologies utilising local resources. With this end in view, the Corporation continued the programme of Development and Promotion of Rural Technology as detailed below:

10. DEVELOPMENT PROJECTS

On Going Projects

i) Latex Based Products from Cactus

The Corporation funded a project at Shri Ram Institute for Industrial Research, Delhi for setting up a pilot plant for the production of products from the latex of the Euphorbia plants abundantly available in our arid and semi-arid zones. The work on the project has been successfully completed and a pilot plant having a latex processing capacity of 50 litres/day has been set up at Shriram Institute for Industrial Research, Delhi. Using that pilot plant, some latex based products such as water emulsion paints were prepared for techno-economic evaluation. It is proposed to set up a production-cum-demonstration unit in a euphorbia growing area in collaboration with a voluntary agency. Negotiations are in progress with voluntary agencies for this purpose.

ii) Design and Development of Direction Finder to Locate Radio Distress Signals from Fishermen at sea

The Rural Electronics Group of the Electronics Research & Development Centre (ER&DC), Thiruvananthapuram of Department of Electronics has developed a sea proof, floatable, Radio Beacon for use of fishermen who go to sea in open boats without any form of safety equipment or means of communication. Keeping in view the usefulness of the device, the Corporation has provided a financial grant of Rs.2.30 lakhs to ER&DC for the design and development of a Direction Finder to work with the Beacon. ER&DC has already made one prototype of the device. It is expected to be evaluated for its performance in due course of time.



VIII.A.6 Direction finder to locate Radio Distress Signals from fishermen at sea.

iii) Mud Block Making Machine

Conventional mud blocks/bricks are poor in quality and irregular in shape due to variations in soil characteristics and low compressibility. The machinery developed abroad though suitable to produce these blocks commercially is prohibitively costly and is too large in a capacity to be commercially viable under our conditions. To bridge this gap in production of efficient, low cost blocks, the Corporation funded a project for the development of manual hydraulic brick making machine at M/s Project and Engineering Service (PES), Yamuna Nagar at a cost of Rs. 80,000. PES has successfully developed and tested one prototype of the machine. The machine has been sent to our Ambassador in Cairo to be given to the Government authorities of Aswan, Egypt as a gift. Based on such promotional work, the Corporation is expecting commercial orders for the supply of such machines not only from Egypt but from other developing countries as well.



VIII.A.7 Manual hydraulic brick making machine

11. RURAL TECHNOLOGY DEMONSTRATION CUM TRAINING CENTRES (RTDT)

The methodology adopted by the Corporation is to demonstrate the utility of its rural technologies and ensure their faster dissemination by setting up RTDT Centres in collaboration with voluntary agencies in various regions of the country. Pursuant to following this approach, besides strengthening 5 of the existing 52 RTDT Centres by providing additional machines, the Corporation has also opened 3 new Centres at Ranikhet (UP), William Nagar (Meghalaya) and Udaipur (Rajasthan), during 1995-96.

12. TECHNOLOGY AND PROJECT EXPORT

The Corporation continued its efforts to export Indian technologies and technical services to developing countries of South East Asia, Africa and Latin America. During 1995-96, the Corporation completed the following export projects:

(Rs. in lakhs)

- Preparation of Project Report for setting up 4 Science & Technology Entrepreneurship Parks (STEPS) in Egypt	75.00
- Identification of Projects for an Industrial Park in Gabon	4.91

The Corporation has also been able to generate interest in parties in Vietnam, Indonesia, Malaysia, China and Japan in some of the Corporation's technologies particularly that for Rice Husk Particle Board and the blood clot removing drug, Thrombinase. Negotiations with these parties are under way.

13. FOREIGN EXCHANGE EARNINGS

The foreign exchange earnings of the Corporation amounted to Rs. 52.35 lakhs in 1995-96 as compared to Rs. 148.47 lakhs during the previous year.

14. PUBLICATIONS

An important activity of the Corporation is to disseminate information on new processes to industry, entrepreneurs and the general public for the promotion and commercialisation of technologies. One of the means of doing so is through publications of various types. During the year, the Corporation continued to bring out the following regular publications:

- Awishkar - (Monthly in Hindi)
- Invention Intelligence - (Monthly in English)

The following special publications were also brought out by the Corporation during the year:

- Process Diary
- "NRDC at Your Service"
- "NRDC Technologies"

15. SALE OF DSIR PUBLICATIONS

The Department of Scientific and Industrial Research has entrusted NRDC with the marketing and sale of their publications on Technology Status Studies/Technology. Evaluation Studies/Project Profiles/Consultancy and other Studies. During 1995-96, the Corporation sold 753 reports valued at Rs. 2.89 lakhs.

16. EXHIBITIONS AND PUBLICITY

Participation in exhibitions, seminars, workshops entrepreneurship development programmes etc. are of vital importance for the creation of awareness about the role of the Corporation in technology transfer. With this end in view, the Corporation participated in exhibitions, seminars and get-togethers organised by various agencies as detailed below:

- (i) Career Mela, Jabalpur
(20-24 Sept. 95)
- (ii) Life 2000, Bombay
(5-8 Oct. 95)
- (iii) Exhibition on Building Materials, New Delhi
(12-14 Oct. 1995)
- (iv) India International Trade Fair, New Delhi
(14-27 Nov. 95)
- (v) Tech Bazar, New Delhi
(14-16 Dec. 95)
- (vi) Industrial India Trade Fair, Calcutta
(21-31 Dec. 95)
- (vii) 71st All India Medical Conference,
Bhubaneswar
(27-30 Dec. 95)
- (viii) Impact '96, New Delhi
(12-14 Jan. 1996)

- (ix) Intechmart, New Delhi
(22-25 Jan. 96)
- (x) Wisitex, Bombay
(7-13 Feb. 96)
- (xi) India Intechmart, New Delhi
(17-20 Feb. 96)
- (xii) Haryana Vision 2000, Gurgaon
(10-17 March, 1996)
- (xiii) Indian Exhibition, Indonesia
(19-23 March, 1996)
- (xiv) Quang-Trung International Trade Fair, Vietnam
(24-30 September, 1995)
- (xv) World Tech 95, Thailand
(4-16th December, 1995)

17. IMPLEMENTATION OF OFFICIAL LANGUAGE

The Corporation continued making efforts to implement the provisions of the Official Language Act and Rules framed there under to ensure the continued use of Rajbhasha in its day to day working. Significant progress has been made in the field of correspondence, noting and drafting in Hindi. 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 and technology monthly in Hindi, entitled Awishkar. To popularise the use of Hindi, the Corporation celebrated the "HINDI PAKHWARA" from Sept.14-29, 1995. A workshop on "Noting and Drafting" in Hindi was conducted on 29th Sept. 1995. The Hindi-English Glossary of Administrative Terminology was distributed during the workshop. Under the Hindi Incentive Scheme, certificates and cash awards were also given to selected managers and staff for their use of Hindi in official work. Two stenographers were sent for training in Hindi typing.

VIII(B). CENTRAL ELECTRONICS LIMITED

1. INTRODUCTION

Central Electronics Limited (CEL) holds a unique position among the family of Public Sector Enterprises in Electronics, with its emphasis on indigenous technology inducted both from its in-house developments and from the country's National Laboratories, for its production programmes in diverse hi-technology areas of National Relevance. The activities of CEL are sharply focussed in three thrust areas:

- (i) Solar Photovoltaic Cells, Modules and Systems for a variety of both Rural and Industrial applications.
- (ii) Selected Electronic Systems - Equipment for Railway Signalling & Safety, Block Proving System using Axle Counter, Cathodic Protection Equipment for Oil Pipelines, Rural Automatic Exchanges (RAX) and Very Small Aperture Terminals (VSATs).
- (iii) Selected Electronic Components - Professional (Soft) Ferrites, Electronic Ceramics, Piezo Electric Elements and Microwave Components.

CEL has been the pioneer in the country in the areas of Solar Photovoltaics, Ferrites and Piezo-Ceramics. Today, it enjoys an internationally recognized status of being among the top producers of Single Crystalline Silicon Solar Cells in the world.

2. PERFORMANCE IN 1995-96

2.1 Operating Results

The production & sales achieved during the year as compared to the previous year are given below:

	(Rs. in Crores)	
	1994-95 Actuals	1995-96 Actuals
Production	46.79	37.96
Sales	40.50	50.12

The shortfall in production has been due to non-availability of basic Raw Material as the Company was facing severe financial crisis during the last quarter of the year.

2.2 Highlights of Operations

2.2.1 Solar Photovoltaics (SPV)

In the Solar Photovoltaics Group, 996 KWp of SPV Modules were produced and 1452 KWp of SPV Modules were sold during 1995-96 as against 1166 KWp and 945 KWp respectively in 1994-95. A total of 11310 SPV Power Sources were supplied to DOT for its Rural Telecom Network as against 3200 SPV power sources supplied during 1994-95.

20 Nos. of Very Low Power TV Transmitters were supplied to Doordarshan during 1995-96.

In the 2nd year of the National SPV Pump Programme of the Ministry of Non-conventional Energy Sources (MNES), the Company supplied 21 nos. of SPV Pumps to various users through Indian Renewable Energy Development Agency (IREDA). During 1995-96, 3560 nos. of SPV Lanterns as per the MNES specifications were supplied.

The Company has also supplied SPV Modules of 30 W, 35 W and 15 W (total 400 KWp Approx.) to various customers including Nodal Agencies and Govt. Departments.

Exports

The Company exported 7 KWp of SPV Systems and modules consisting of Domestic Lights, Street Lights, Solar Power Generating Systems, foldable Battery Chargers, Solar Powered Vaccine Refrigerator etc. to various countries namely Oman, Bangladesh, Egypt, Mauritius and Bhutan.



VIII.B.1 Yahya Bin Mahtoudh Al Mantheri, Minister of Higher Education and President of Sultan Quaboos University inaugurating CEL's Solar Project in Oman.



VIII.B.2 Solar Powered Street Lights supplied and installed by CEL at the Rusayl Industrial Estate (RIE), Oman.

2.2.2 Electronic Systems

The Systems Group produced 7000 nos. of Charge Controllers for the SPV power systems for the DOT's Rural Telecom Network. In the area of Railway Electronics, all the Block Equipments against Aligarh-Chola Project in the Northern Railways and 7 Nos. of Block Equipments in the Central Railways were installed and commissioned successfully. 66 nos. of Universal Axle Counters were sold during 1995-96. Against an order for supply of materials, received from Western Railway worth Rs. 80 lakhs, the project was successfully completed during 1995-96.

The Company supplied 23 nos. of 256 Port Rural Automatic Exchanges (RAXs) with know-how taken from Centre for Development of Telematics (C-DOT).

The Company produced and supplied 2 nos. of VSATs to C-DOT/DST against orders received from C-DOT and obtained further order for 7 Nos. of VSATs from DST. Turnkey Orders valued at Rs. 273 lakhs were obtained from Indian Oil Corporation Limited, for supply of Cathodic Protection Systems in Chakshu-Panipat pipeline. A substantial part of the supply and work was completed during 1995-96. 16 nos. of PTVs were sold during 1995-96.

2.2.3 Electronic Components

In the Ferrites Plant, in addition to the normal mix of Ferrite Cores, 2500 nos. of C-Band Microwave Ferrite Yokes and Rods were successfully completed and supplied for the Phase Shifter Assemblies. The Company

also supplied 20000 complete PZT Electric Systems to the Defence for their 84 mm Carl Gustaf ammunition. A further order for 7000 nos. of the same was also received. The Company supplied 2500 nos. of C-Band Phase Shifters against the order received from Electronics Research & Development Establishment (LRDE), Bangalore of Defence Research & Development Organisation (DRDO). The Company had also supplied 26 no. of Frequency/Phase Correlator to Defence Electronics Research Laboratory (DLRL), Hyderabad.

Exports

The Company exported 17000 nos. of Piezo Ceramic Tubes for second successive year and is likely to obtain further recurring export orders of this component, valued at US\$ 1,40,000.

3. OTHER HIGHLIGHTS OF 1995-96

3.1 Visits of Important Dignitaries

As in the previous years, a number of VIPs visited the Company particularly the SPV Plant. These included foreign delegations from South Africa, Uganda, Netherlands, Paris, and China. The other notable visitors were:

Shri Shailendra Pandey—Member Audit Board, Maj. Gen. GL Chadha—ADG(T), Army Hqr., AVMP.S. Rao—ACAS (Sys.) Air Hqrs., Shri M. Varadarajan—Member, and Shri Trilochan Singh, Secretary, National Commission for Minorities, Shri R.N. Sharma—Joint Director, DTD & P (AIR), Ministry of Defence, Shri S. Mendiratta—Director (IEC), Ministry of Rural Area & Employment, Prof. V.S. Rama Murthy, Secretary (DST), etc.

3.2 Capital Restructuring

The Company's Capital Restructuring Proposal was under consideration of the Ministry of Finance (Deptt. of Expenditure) during 1996-95 and discussions were held with Secretary, Deptt. of Expenditure. The proposal aims at improving the financial position of the company and improving its profitability.

3.3 Voluntary Retirement Scheme (VRS)

During 1995-96, for the first time, Company introduced the Voluntary Retirement Scheme on the lines of the already DPE approved scheme to reduce the manpower and to bring down the fixed costs. The Company had received the necessary grant for payment of VRS compensation from the NRF through the Administrative Ministry. 64 employees could get the benefit under the said scheme in 1995-96 and a further 28 employees during the year 1996-97.

3.4 Technology Transfer

The Company had obtained technology transfer from C-DOT for the production of VSATs for which necessary production and infrastructural facilities were established. The Company produced and supplied 2 nos. of VSATs against the order received from C-DOT/DST for the India Meteorological Departments, 127 Agro-Met Centres Programme. In a similar manner, the company also supplied 23 Nos. of 256 Port RAX's based on know-how transfer from C-DOT made in the earlier years.

The Company has entered into an agreement with Inter University Micro Electronics Centre (IMEC), Belgium for the upgradation of its existing Screen Printing technology for the fabrication of Solar Cells. This envisages the improvement in Cells efficiency from the SPV Solar Cell Plant through grafting the technology obtained from IMEC and achieve a minimum 14.5% bare cell efficiency. This project is being funded by DSIR through its PATSER (Programme Aimed at Technological Self Reliance) scheme for Technology Absorption.

4. ROLE IN NATIONAL TECHNOLOGY MISSIONS

The Company's SPV group supplied about 11310 SPV Power Sources for the DOT's VHF Rural Telecommunication Net-work.

5. DESIGN AND DEVELOPMENT

Design and development team of SPV Group has successfully commissioned a Hybrid SPV-Diesel Power Plant. The product has been developed for a target market

of remote repeater stations of DOT, Defence and Private entrepreneurs in the field of telecommunications. Hybrid Power Plants shall provide un-interrupted power supply to un-manned repeater stations in all climate conditions and facilitate automatic start/stop of Diesel generators in case of additional battery charging requirements during low sun or sunless days.

One prototype of SPV-Educational kit has been produced by Design & Development team of SPVG. The product shall cater to the target market of educational institutions. This Educational Kit contains a number of additional features over the similar product already existing in the market.

In the Microwave Electronics Division (MED), significant progress has been made on Phase Shifters area. The design of C-Band phase control modules has been improved using the driver with new ASIC developed by the Company and supplied 1500 C-Band PCMs to LRDE, Bangalore. MED has been identified as the production agency for frequency and phase correlators for 0.5 to 2 and 2.8 GHz. Also, sufficient ground work has been made in getting orders from DLRL, Hyderabad for a number of Microwave components, such as power dividers and hybrid Microwave antennas. Emphasis has also been made to identify CEL as a potential manufacturer of Microwave sub-systems, mainly for electronic warfare applications.

Indian Railways have presently deployed relay logic based Route Interlocking equipment, in their railway network for signalling & interlocking requirements to control the movement of railway traffic in a fail-safe way through a station yard. Though these systems have performed satisfactorily over the years, but they are inherently limited in their performance as being inflexible, fully hard wired & station-specific custom-built equipment involving extensive use of relays & expensive cabling for their installation and also require elaborate preventive maintenance schedule.

Microprocessor based Solid State Interlocking Equipment has been inducted as an intelligent, flexible, field upgradable and cost-effective alternative with increased performance parameters & post fault analysis capabilities, to these relay based equipment in the railway networks of advanced countries. Indian Railways have also now planned its induction in their network as a part of their modernisation plan in the signalling area.

To meet this emerging requirement of Railways, with a very good market and growth potential, CEL has taken up the development with subsequent productionisation of Solid State Interlocking Equipment, jointly with Centre for Development of Advanced Computing (C-DAC) under PATSER scheme of DSIR, essentially with a view to synergise the efforts by pooling the expertise & experience of both the organisations in their respective areas to develop a rugged, fully engineered state-of-the-art equipment meeting fully stringent operational & field performance related Railways specifications for the same.

While some of the hardware work in this system had already been done at CEL, the new fully developed system is expected to be offered to RDSO for field trials and approval towards January 1997.

6. INDUSTRIAL RELATIONS AND HUMAN RESOURCES DEVELOPMENT

The Company had generally cordial industrial relations during 1995-96 as a result of the Management's continuous dialogue with the recognised Workers Union and with the Officers/ Executives Associations.

Agreement towards Wage revision due from 1st January 1992, was signed with the recognised Employees Union on 28.6.1995. The approval of the Govt. towards salary revision w.e.f. 1.1.1992 in respect of Non-Executives, Supervisors and Executives of the Company was also received during 1995-96.

Employees' participation in management continued through the forums of Shop Level and Plant Level Committees constituted for the purpose. 9

Meetings of the Shop Floor Committees and 3 of the Plant level Committees of the different divisions of the Company were held during 1995-96 as against 9 and 7 respectively in 1994-95.

7. WELFARE OF WEAKER SECTIONS

All Government directives relating to the Reserved Categories such as, Scheduled Castes, Scheduled Tribes, the Physically Handicapped, Ex-Servicemen etc. continued to be implemented during 1995-96. As on 31 March 1996, the total number of employees in these categories were 245 which represents about 28% of the total strength of the Company as on 31st March, 1996.

8. USE OF HINDI

With a view to ensure proper implementation of official language policy of Government of India and the directives received from time to time in this regard, Official Language Implementation Committee, Official Language Implementation Sub-Committee and branch of Kendriya Sachivalaya Hindi Parishad have been constituted in the Company. The employees have been trained in Prabodh, Praveen, and Pragya, Hindi type-writing and Hindi Computer Software. Hindi week and Work-Shops have been organised. The employees are being encouraged and motivated to work in Hindi. The work for writing notes, reports and letters etc. in Hindi has already been started.

9. REVISED PLAN FOR 1996-97

The BE/RE targets for 1996-97 are Rs. 52 crores for production and Rs. 54 crores for sales. These are also the MOU targets for 1996-97.

IX. ADMINISTRATION

1. ADMINISTRATION

The Department of Scientific & Industrial Research was created through a Presidential Notification of January 1985. The Administrative functions of recruitment of personnel, provision of general facilities, redressal of grievances of employees, parliament work and use of Hindi are being performed by the Department of Scientific and Industrial Research. Other house-keeping jobs are being performed by Department of Science & Technology. Activities related to promotions of scientific staff and officers (under the flexible complementing scheme) are also looked after by the Department.

2. PROMOTION OF HINDI

DSIR made the following efforts for the use and promotion of Hindi in the official work and implementation of official language policy of the Government :

- (a) The meetings of the Official Language Implementation Committee were held regularly in DSIR.
- (b) The Quarterly Progress Report regarding use of Hindi in the Department was sent to the Department of Official Language regularly and in time.
- (c) Under Hindi Teaching Scheme, non-Hindi Knowing employees of the Department were nominated for Praboth, Praveen and Pragya courses. Employees of the Department were also nominated for training in Hindi Stenography and Hindi Typing.

(d) From 16th to 30th September 1996 (combined), Hindi Week was observed by the Department of Science and Technology and Department of Scientific and Industrial Research at Technology Bhavan. To promote the use of Hindi in the official work, essay, noting and drafting, speech, typing, shorthand and quiz competitions were organised in the Department during this period and officials of the Department were given prizes. Hindi versions of Orders, Notifications, Letters, Standard Drafts, Annual Report and Performance Budget were provided.

(e) To review the progress of the use of Hindi, the offices under the control of the Department i.e. Central Electronics Limited, Sahibabad, National Research Development Corporation, New Delhi and Consultancy Development Centre, New Delhi and eight divisions within the Department were inspected.

The staff strength in the different groups in the Department of Scientific & Industrial Research as on 1.1.1997 is given below:—

	Number of Employees			
	General	SC	ST	Total
Group A (Gazetted)	31	5	1	37
Group B (Gazetted)	6	2	-	8
Group B (Non-Gazetted)	9	4	-	13
Group C (Non-Gazetted)	11	3	2	16
Group D (Non-Gazetted)	12	2	-	14

ANNEXURES

LIST OF CSIR ESTABLISHMENTS

1. Central Building Research Institute (CBRI), Roorkee
2. Centre for Biochemical Technology (CBT), Delhi
3. Centre for Cellular and Molecular Biology (CCMB,) Hyderabad
4. Central Drug Research Institute (CDRI), Lucknow
5. Central Electrochemical Research Institute (CECRI), Karaikudi
6. Central Electronics Engineering Research Institute (CEERI), Pilani
7. Central Fuel Research Institute (CFRI), Dhanbad
8. Central Food Technological Research Institute (CFTRI), Mysore
9. Central Glass and Ceramic Research Institute (CGCRI), Calcutta
10. Central Institute of Medicinal and Aromatic Plants (CIMAP),
11. Central Leather Research Institute (CLRI), Madras
12. Central Mechanical Engineering Research Institute (CMERI), Durgapur
13. Central Mining Research Institute (CMRI), Dhanbad
14. Central Road Research Institute (CRRRI), Delhi
15. Central Scientific Instruments Organization (CSIO), Chandigarh
16. Central Salt & Marine Chemicals Research Institute (CSMCRI), Bhavnagar
17. Indian Institute of Chemical Biology (IICB), Calcutta
18. Indian Institute of Chemical Technology (IICT), Hyderabad
19. Indian Institute of Petroleum (IIP), Dehradun
20. Institute of Microbial Technology (IMT), Chandigarh
21. Indian National Scientific Documentation Centre (INSDOC), New Delhi
22. Industrial Toxicology Research Centre (ITRC), Lucknow
23. National Aerospace Laboratories (NAL) Bangalore
24. National Botanical Research Institute (NBRI), Lucknow
25. National Chemical Laboratory (NCL), Pune
26. National Environmental Engineering Research Institute (NEERI), Nagpur
27. National Geophysical Research Institute (NGRI), Hyderabad
28. National Institute of Oceanography (NIO), Goa

29. National Institute of Science Technology and Development Studies (NISTADS), New Delhi
30. National Metallurgical Laboratory (NML), Jamshedpur
31. National Physical Laboratory (NPL), New Delhi
32. Institute of Himalayan Bioresource Technology (IHBT), Palampur
33. National Institute of Science Communication (NISCON), New Delhi
34. Regional Research Laboratory (RRL-BO), Bhopal
35. Regional Research Laboratory (RRL-BHU), Bhubaneswar
36. Regional Research Laboratory (RRL-JMU), Jammu
37. Regional Research Laboratory (RRL-J), Jorhat
38. Regional Research Laboratory (RRL-TRI), Thiruvanthapuram
39. Structural Engineering Research Centre (SERC-G), Ghaziabad
40. Structural Engineering Research Centre (SERC-M), Madras

STATEMENT ON RECOGNITION OF IN-HOUSE R&D UNITS

Month	Year	Receipt	Cumulative	Disposals	Cumulative Disposals	Pendency at the end of the month
December	1995	-	-	-	-	23
January	1996	5	5	7	7	21
February	1996	11	16	10	17	22
March	1996	6	22	8	25	20
April	1996	5	27	10	35	15
May	1996	4	31	6	41	13
June	1996	10	41	3	44	20
July	1996	6	47	10	54	16
August	1996	4	51	3	57	17
September	1996	6	57	3	60	20
October	1996	7	64	6	66	21
November	1996	6	70	2	68	25
December	1996	4	74	7	75	22

**STATEMENT ON RENEWAL OF RECOGNITION OF IN-HOUSE R&D UNITS
BEYOND 31.03.1996**

Month		Receipts	Cumulative Receipts	Renewal applications processed	Cumulative Renewals processed in the month	Cumulative Pendency at the end of the month
December	1995	53	53	-	-	53
January	1996	148	201	-	-	201
February	1996	27	228	-	-	228
March	1996	22	250	89	89	161
April	1996	21	271	60	149	122
May	1996	29	300	59	208	92
June	1996	4	304	39	247	57
July	1996	9	313	26	273	40
August	1996	5	318	21	294	24
September	1996	-	318	7	301	17
October	1996	-	318	13	314	4
November	1996	-	318	-	314	4
December	1996	-	318	4	318	Nil
Total		318			318	

**LIST OF IN-HOUSE R&D UNITS IN INDUSTRY REPORTING ANNUAL
EXPENDITURE MORE THAN Rs. 100 LAKHS**

Sl. No.	Name of the firm	R&D Expenditure (in Rs. lakhs)
1	ARM Limited	210
2	Adarsh Chemicals & Fertilisers Ltd.	267
3	Advani-Oerlikon Ltd.	228
4	Alembic Chemical Works Co. Ltd.	221
5	Alfa Laval (India) Ltd.	600
6	Altos India Ltd.	187
7	Apollo Tyres Ltd.	262
8	Applied Electro Magnetics Pvt. Ltd.	118
9	Asea Brown Boveri Ltd.	194
10	Ashok Leyland Ltd.	806
11	Asian Paints (India) Ltd.	453
12	Associated Cement Companies Ltd.	731
13	Astra-IDL Limited	152
14	Atul Limited, The	207
15	Autopal Industries Limited	136
16	BASF India Ltd.	180
17	BPL Limited	423
18	BPL Sanyo Utilities and Appliances Ltd.	288
19	BPL Telecom Systems	203
20	Bajaj Auto Ltd.	1830
21	Bajaj Tempo Ltd.	1066
22	Ballarpur Industries Ltd.	111
23	Balmer Lawrie & Company Ltd.	141
24	Bangalore Pharmaceuticals & Research Laboratory Ltd.	133
25	Baroda Rayon Corporation Ltd., The	173
26	Bata India Ltd.	162
27	Berger Paints India Ltd.	158
28	Bharat Dynamics Ltd.	245
29	Bharat Earth Movers Ltd.	857
30	Bharat Electronics Ltd.	4762
31	Bharat Heavy Electricals Ltd.	4840
32	Bharat Petroleum Corporation Ltd.	128

Contd/-

Sl. No.	Name of the firm	R&D Expenditure (in Rs. lakhs)
33	Bharat Starch Industries Ltd.	350
34	Bicycle & Sewing Machine Research & Development Centres	112
35	Brakes India Ltd.	360
36	CMC Limited	552
37	Cadila Pharmaceuticals Ltd.	107
38	Camphor & Allied Products Ltd.	124
39	Carborundum Universal Ltd.	103
40	Castrol India Ltd.	128
41	Central Electronics Ltd.	509
42	Central Mine Planning & Design Inst. Ltd.	383
43	Cheminor Drugs Ltd.	246
44	Chloride Industries Ltd.	163
45	Cipla Limited	878
46	Clariant (India) Ltd.	292
47	Coats of India Ltd.	159
48	Colour-Chem Limited	317
49	Continental Devices India Ltd.	205
50	Core Healthcare Ltd.	202
51	Crompton Greaves Ltd.	2066
52	DCM Shriram Consolidated Ltd.	128
53	DCM Shriram Industries Ltd.	705
54	Datapro Electronics Pvt. Ltd.	120
55	Dhampur Sugar Mills Ltd., The	175
56	The Dharamsi Morarji Chemical Co. Ltd.	141
57	Dr. Reddy's Laboratories Ltd.	1053
58	Dunlop India Ltd.	504
59	E.I.D. Parry (India) Ltd.	166
60	East India Pharmaceutical Works Ltd.	105
61	Eicher Motors Ltd.	192
62	Eicher Tractors Ltd.	549
63	Electronics Corporation of India Ltd.	760
64	Electrotherm Machines (India) Ltd.	118
65	Elin Electronics Ltd.	150
66	Engineers India Ltd.	454
67	Esvin Advanced Technologies Ltd.	148
68	Excel Industries Ltd.	330
69	FDC Limited	142
70	Ferro Alloys Corporation Ltd.	120
71	Foseco India Ltd.	168
72	Fujitsu ICIM Ltd.	101
		Contd/-

Sl. No.	Name of the firm	R&D Expenditure (in Rs. lakhs)
73	GEC Alsthom India Ltd.	111
74	Gajra Gears Ltd.	144
75	Gammon India Limited	128
76	Garware Polyester Ltd.	167
77	Gharda Chemicals Ltd.	663
78	Glaxo India Ltd.	548
79	Godrej Soaps Ltd.	323
80	Goodlass Nerolac Paints Ltd.	260
81	Gujarat Communications & Electronics Ltd.	412
82	Gujarat State Fertilizers Company Ltd.	448
83	HCL Hewlett-Packard Ltd.	427
84	HMT Limited	541
85	Haryana State Electronics Development Corporation Ltd.	191
86	Herdillia Chemicals Ltd.	101
87	High Polymer Labs (HPL)	134
88	Hindustan Aeronautics Ltd.	8160
89	Hindustan Antibiotics Ltd.	252
90	Hindustan Cables Ltd.	178
91	Hindustan Ciba-Geigy Ltd.	146
92	Hindustan Copper Ltd.	155
93	Hindustan Lever Ltd.	1732
94	Hindustan Motors Ltd.	263
95	Hindustan Petroleum Corporation Ltd.	286
96	Hindustan Photo Films Manufacturing Co.	161
97	Hindustan Zinc Ltd.	138
98	Hoechst India Ltd.	919
99	Hyderabad Industries Ltd.	125
100	ICI India Ltd.	316
101	IPCA Laboratories Ltd.	310
102	ITC Limited	690
103	ITI Equatorial Satcom Ltd.	111
104	India Glycols Ltd.	192
105	India Pistons Ltd.	103
106	Indian Aluminium Company Ltd.	566
107	Indian Drugs & Pharmaceuticals Ltd.	243
108	Indian Oil Corporation Ltd.	1526
109	Indian Organic Chemicals Ltd.	135
110	Indian Petrochemicals Corporation Ltd.	2419
111	India's Rare Earths Ltd.	113

Sl. No.	Name of the firm	R&D Expenditure (in Rs. lakhs)
112	Indian Telephone Industries Ltd.	4864
113	Indo-American Hybrid Seeds	130
114	Ion Exchange (India) Ltd.	142
115	J.K. Industries Ltd.	299
116	J.K. Synthetics Ltd.	102
117	Jaysynth Dyechem Ltd.	129
118	Jenson & Nicholson (India) Ltd.	108
119	Johnson & Johnson Ltd.	165
120	Jyoti Limited	195
121	K.C.P. Limited	105
122	Keggfarms Pvt. Ltd.	138
123	Kelvinator of India Ltd.	359
124	Khandelwal Laboratories Ltd.	101
125	Kinetic Engineering Ltd.	506
126	Kirloskar Brothers Ltd.	383
127	Kirloskar Copeland Ltd.	102
128	Kirloskar Cummins Ltd.	1044
129	Kirloskar Electric Co. Ltd.	236
130	Kirloskar Oil Engines Ltd.	113
131	Kirloskar Pneumatic Co. Ltd.	108
132	Kopran Limited	424
133	Krishna Maruti Ltd.	272
134	Lakshmi Machine Works Ltd.	480
135	Larsen & Toubro Limited	1446
136	Lubrizol India Ltd.	553
137	Lucas-TVS Ltd.	381
138	Lupin Chemicals Ltd.	116
139	Lupin Laboratories Ltd.	2840
140	Lyka Labs Limited	123
141	MAX-GB Limited	190
142	MRFLimited	793
143	Madras Refineries Ltd.	232
144	The Mafatlal Industries Ltd.	126
145	Maharashtra Hybrid Seeds Company Ltd.	240
146	Mahindra & Mahindra Ltd.	1645
147	Maruti Udyog Ltd.	972
148	Maxworth Orchards (India) Ltd.	500

Contd/-

Sl. No.	Name of the firm	R&D Expenditure (in Rs. lakhs)
149	Merind Limited	327
150	Microland Limited	118
151	Minda Industries Ltd.	110
152	Mirc Electronics Ltd.	406
153	Modi Rubber Ltd.	178
154	Modi Xerox Ltd.	232
155	Modipon Limited	274
156	Monica Electronics Ltd.	177
157	Morris Electronics Ltd.	919
158	Motor Industries Co. Ltd.	1062
159	The Mysore Kirloskar Ltd.	263
160	NRC Ltd.	268
161	Natco Fine Pharmaceuticals Pvt. Ltd.	345
162	National Mineral Development Corporation Ltd.	393
163	National Organic Chemical Industries Ltd.	662
164	National Telecom of India Ltd.	641
165	National Thermal Power Corporation Ltd.	483
166	Navin-Fluorine Industries	122
167	Ncore Technology Pvt. Ltd.	107
168	Neyveli Lignite Corporation Ltd.	119
169	Oil & Natural Gas Corporation Ltd.	733
170	Oil India Limited	1043
171	Onward Technologies Ltd.	231
172	Optel Telecommunications Ltd.	451
173	Otis Elevator Co. (India) Ltd.	115
174	Pace Elcot Automation Ltd.	180
175	Padmashri Dr. Vithalrao Vikhi Patel Sahakari Sakhar Karkhana Ltd.	310
176	Petrofils Co-operative Ltd.	188
177	Pfizer Limited	220
178	The Pharmaceutical Products of India Ltd.	504
179	Philips India Ltd.	495
180	Premier Automobiles Ltd.	476
181	Premier Instruments & Controls Ltd.	249
182	Proagro Seed Company Ltd.	185
183	Procter & Gamble India Ltd.	316
184	Projects & Development India Ltd.	751
185	Punjab Communications Ltd.	189

Contd/-

Sl. No.	Name of the firm	R&D Expenditure (in Rs. lakhs)
186	Punjab Tractors Ltd.	138
187	Rallis India Ltd.	777
188	Ramco Industries Ltd.	994
189	Ranbaxy Laboratories Ltd.	4149
190	Rashtriya Chemicals & Fertilizers Ltd.	105
191	Recon Limited	228
192	Reliance Industries Ltd.	7509
193	Renewable Energy Systems Pvt. Ltd.	128
194	Royal Enfield Motors Ltd.	133
195	S.H. Kelkar & Company Ltd.	118
196	SOL Pharmaceuticals Ltd.	141
197	Samtel Color Ltd.	115
198	Sandvik Asia Ltd.	201
199	The Saraswati Industrial Syndicate Ltd.	263
200	Scooters India Ltd.	252
201	Searle (India) Ltd.	103
202	Secure Meters Ltd.	163
203	Semiconductor Complex Ltd.	304
204	Shantha Biotechnics Pvt. Ltd.	148
205	Shasun Chemicals and Drugs Ltd.	124
206	Shaw Wallace Gelatines Ltd.	204
207	Sieflex Automation & Robotics Co.	101
208	Siemens Ltd.	550
209	Simpson & Co. Ltd.	108
210	Smithkline Beecham Pharmaceuticals (India) Ltd.	134
211	Southern Petrochemical Industries Corpn. Ltd.	712
212	Standard Organics Ltd.	205
213	Steel Authority of India Ltd.	4832
214	Sudarshan Chemical Industries Ltd.	150
215	Sun Pharmaceutical Industries Ltd.	390
216	Sundaram Brake Linings Ltd.	252
217	Sundaram Clayton Ltd.	166
218	TVS-Suzuki Limited	247
219	Tamil Nadu Dadha Pharmaceuticals Ltd.	115
220	Tamilnadu Petroproducts Ltd.	241
221	Tata Elxsi (India) Ltd.	145

Contd/-

Sl. No.	Name of the firm	R&D Expenditure (in Rs. lakhs)
222	Tata Engineering & Locomotive Co. Ltd.	7530
223	The Tata Hydro-Electric Power Supply Co. Ltd.	783
224	The Tata Iron & Steel Co. Ltd.,	1155
225	Tata Sons Ltd.	357
226	Tata Tea Ltd.	291
227	Technicom Systems (India) Pvt. Ltd.	125
228	Thermax Limited	338
229	Torrent Pharmaceuticals Ltd.	300
230	Tractors & Farm Equipment Ltd.	127
231	Travancore Chemical and Manufacturing Co. Ltd.	204
232	Travancore-Cochin Chemicals Ltd., The	105
233	Unichem Laboratories Ltd.	170
234	United Catalysts India Ltd.	110
235	United Phosphorous Ltd.	650
236	United Telecoms Ltd.	207
237	Uptron India Ltd.	110
238	Venco Research & Breeding Farm Ltd.	329
239	Venkateshwara Hatcheries Ltd.	113
240	Venkateshwara Research & Breeding Farm Ltd.	343
241	Vera Laboratories Ltd.	108
242	Vitara Chemicals Ltd.	188
243	Voltas Limited (Chemicals Plant)	135
244	Webel Telecommunication Industries Ltd.	107
245	Wheels India Ltd.	133
246	Widia (India) Ltd.	530
247	Wipro GE Medical Systems Ltd.	100
248	Wipro Limited	297
249	Wipro Limited	693
250	Wockhardt Limited	1130

**LIST OF IN-HOUSE R&D UNITS IN INDUSTRY REPORTING ANNUAL
EXPENDITURE IN THE RANGE OF Rs. 25 LAKHS TO Rs. 100 LAKHS**

Sl. No.	Name of the firm	R&D Expenditure (in Rs. lakhs)
1	ACE Laboratories Ltd.	79
2	AIMCO Pesticides Ltd.	36
3	Advanced Micronic Devices Ltd.	37
4	Aerospace Systems Pvt. Ltd.	80
5	Alembic Glass Industries Ltd.	46
6	Alkem Laboratories Ltd.	30
7	Alkyl Amines Chemicals Ltd.	35
8	Amar Dye Chem Ltd.	92
9	Ambalal Sarabhai Enterprises Ltd.	75
10	Amco Batteries Ltd.	43
11	American Remedies Ltd.	45
12	Amphetronix Limited	59
13	Amrutanjan Limited	50
14	Andhra Pradesh Heavy Machinery and Engineering Ltd.	26
15	The Andhra Pradesh Paper Mills Ltd.	26
16	The Andhra Sugars Ltd.	74
17	The Anil Starch Products Ltd.	47
18	Anupam Machine Tools Ltd.	25
19	Applied Electronics Ltd.	76
20	The Arvind Mills Ltd.	65
21	Asian Cables & Industries Ltd.	60
22	The Assam Company Ltd.	41
23	Astra Microwave Products Ltd.	83
24	Audco India Ltd.	62
25	Automatic Electric Ltd.	39
26	Autometers Limited	43
27	Avantel Communications Ltd.	44
28	BPL Sanyo Technologies Ltd.	37
29	Bajaj Electricals Ltd.	36
30	Bakelite Hylam Ltd.	56
31	Bayer (India) Ltd.	49
32	Bells Controls Ltd.	44
33	Bengal Immunity Ltd.	45

Contd/-

Sl. No.	Name of the firm	R&D Expenditure (in Rs. lakhs)
34	Bharat Aluminium Company Ltd.	50
35	Bharat Forge Ltd.	56
36	Bharat Fritz Werner Ltd.	34
37	Bharat Heavy Plate & Vessels Ltd.	50
38	Bharat Pumps & Compressors Ltd.	30
39	Bharat Refractories Ltd.	30
40	Bhoruka Gases Ltd.	33
41	Binani Industries Ltd.	28
42	Biochem Synergy Ltd.	86
43	Biocon India Pvt. Ltd.	35
44	Biological E. Ltd.	59
45	Birla VXL Ltd.	46
46	Blue Star Limited	53
47	The Bombay Burmah Trading Corporation Ltd.	54
48	Bombay Paints Ltd.	34
49	Britannia Industries Ltd.	96
50	Burns Philp India Ltd.	42
51	Burroughs Wellcome (India) Ltd.	94
52	Bush Boake Allen (India) Ltd.	88
53	Cable Corporation of India Ltd.	39
54	Cadbury India Limited	85
55	Cadila Healthcare (P) Ltd.	78
56	Ceat Limited	44
57	Central Institute of Road Transport	78
58	The Century Textiles & Industries Ltd.	61
59	Chemplast Sanmar Ltd.	27
60	Cibatul Limited	47
61	Cochin Refineries Ltd.	63
62	Concept Pharmaceuticals Ltd.	37
63	Controls & Switchgear Co. Ltd.	34
64	Cosmo Films Ltd.	41
65	Croslands Research Laboratories Ltd.	35
66	Cureworth (India) Ltd.	78
67	Cyanamid India Ltd.	80
68	DE-NOCIL Crop Protection Ltd.	83
69	DGP Windsor India Ltd.	41
70	Dai-ichi Karkaria Ltd.	29

Contd/

Sl. No.	Name of the firm	R&D Expenditure (in Rs. lakhs)
71	Dave Paints Ltd.	32
72	Dey's Medical Stores (Mfg.) Ltd.	66
73	Dr. Beck & Company (India) Ltd.	28
74	Duphar-Interfran Ltd.	61
75	Dura Magnets Pvt. Ltd.	34
76	E.Merck (India) Ltd.	46
77	EM Electronix Pvt. Ltd.	28
78	EMRC Engineering Mechanics Research India Pvt. Ltd.	41
79	ESAB India Ltd.	71
80	EWAC Alloys Ltd.	84
81	Elcot Power Controls Ltd.	51
82	Electro Pneumatics & Hydraulics (I) Ltd.	60
83	Electronic Research Ltd.	45
84	Electronic Systems Punjab Ltd.	26
85	Electronica Mechatronic Systems (India) Pvt. Ltd.	85
86	Elgi Equipments Ltd.	43
87	Elgi Tyre & Tread Ltd.	36
88	Ellora Steels Ltd.	74
89	English Indian Clays Ltd.	27
90	Escorts Tractors Ltd.	93
91	Eternit Everest Ltd.	42
92	Eureka Forbes Ltd.	41
93	FGP Limited	55
94	Fenner (India) Ltd.	53
95	Fertilizers & Chemicals Travancore Ltd.	36
96	Firth (India) Steel Co. Ltd.	74
97	Fisher-Rosemount (India) Ltd.	31
98	Flex Industries Ltd.	93
99	Forbes Gokak Ltd.	36
100	Forbesons Tech Centre Pvt. Ltd.	31
101	Fort Gloster Industries Ltd.	42
102	Franco-Indian Pharmaceuticals Ltd.	42
103	Fuller K.C.P. Ltd.	70
104	GTC Industries Ltd.	34
105	Galaxy Surfactants Ltd.	46
106	Ganga Agri Seeds Ltd.	54
107	Garware Wall Ropes Ltd.	46
108	Geep Industrial Syndicate Ltd.	28

Contd/-

Sl. No.	Name of the firm	R&D Expenditure (in Rs. lakhs)
109	German Remedies Ltd.	52
110	Glenmark Pharmaceuticals Ltd.	54
111	Godfrey Phillips India Ltd.	39
112	Gontermann-Peipers (India) Ltd.	74
113	Goodricke Group Ltd.	29
114	Graphite India Ltd.	52
115	Grasim Industries Ltd.	38
116	Grauer & Weil (India) Ltd.	93
117	Grindwell Norton Ltd.	31
118	Gujarat Alkalies & Chemicals Ltd.	47
119	Gujarat Ambuja Cements Ltd.	75
120	Gujarat Heavy Chemicals Ltd.	44
121	Gujarat Machinery Manufacturers Ltd.	25
122	Harbanslal Malhotra & Sons Ltd.	34
123	Hargovind Bajaj Research & Development Centre	40
124	Hawkins Cookers Ltd.	80
125	Heavy Engineering Corporation Ltd.	96
126	Hetero Drugs Pvt. Ltd.	45
127	Hico Products Ltd.	85
128	High Energy Batteries (India) Ltd.	76
129	Himachal Futuristic Communications Ltd.	92
130	Himalaya Machinery Pvt. Ltd.	81
131	Hindalco Industries Ltd.	35
132	The Hindoostan Spinning & Weaving Mills Ltd.	47
133	Hindustan Composites Ltd.	27
134	Hindustan Insecticides Ltd.	76
135	Hindustan Latex Ltd.	45
136	Hindustan Organic Chemicals Ltd.	72
137	Hindustan Teleprinters Ltd.	83
138	Hindusthan Development Corporation Ltd.	48
139	Hutti Gold Mines Company Ltd.	30
140	IAEC Industries Madras Ltd.	34
141	IBP Company Ltd.	81
142	IDL Industries Ltd.	99
143	IOL Limited	69
144	IXL India Tele-Comp Ltd.	30
145	Imeco Ultrasonics	25
146	Incab Industries Ltd.	35

Contd/-

Sl. No.	Name of the firm	R&D Expenditure (in Rs. lakhs)
147	Ind-Swift Limited	67
148	India Foils Ltd.	36
149	India Meters Ltd.	46
150	India Nippon Electricals Ltd.	43
151	Indian Dyestuff Industries Ltd.	88
152	Indian Farmers Fertilizers Co-operative Ltd.	29
153	The Indian Hume Pipe Company Ltd.	45
154	Indian Lead Ltd.	25
155	Indo National Ltd.	35
156	Indofil Chemicals Company	41
157	Infar (India) Ltd.	49
158	Infocom Digital Systems (P) Ltd.	70
159	Infotech Enterprises Pvt. Ltd.	33
160	Instrumentation Ltd.	90
161	Intas Laboratories Pvt. Ltd.	31
162	Intra Industries Pvt. Ltd.	49
163	Ispat Alloys Limited	34
164	Jagsonpal Pharmaceuticals Ltd.	41
165	Jain Irrigation Systems Ltd.	97
166	Jaya Hind Industries Ltd.	36
167	John Fowler (India) Ltd.	35
168	Jyoti Ceramic Industries Pvt. Ltd.	58
169	KEC International Ltd.	54
170	Kadevi Engineering Co. (P) Ltd.	58
171	Kasila Farms Pvt. Ltd.	31
172	Kerala Electrical & Allied Engineering Co. Ltd.	47
173	The Kerala Minerals & Metals Ltd.	26
174	Kilburn Engineering Ltd.	52
175	Knoll Pharmaceuticals Ltd.	99
176	L&T Gould Ltd.	30
177	L&T-McNeil Ltd.	44
178	L.G. Balakrishnan & Brothers Ltd.	25
179	Lakhanpal National Ltd.	51
180	Lakme Limited	52
181	Lamco Lightning Arrester Mfg. Co. Pvt. Ltd.	67
182	Laxmi Boilers (South) Pvt. Ltd.	31
183	Lectrotek Systems (Pune) Pvt. Ltd.	55
184	Lona Industries Ltd.	35

Contd/-

Sl. No.	Name of the firm	R&D Expenditure (in Rs. lakhs)
185	M.J. Institute of Research	29
186	M.P. Electricity Board	43
187	MCE Products' Sales Service Ltd.	32
188	MPR Refractories Ltd.	90
189	Machine Tool Aids and Reconditioning	61
190	Macmet India Ltd.	26
191	The Mafatlal Fine Spinning & Mfg. Co. Ltd.	30
192	Maharashtra Electronics Corporation Ltd.	39
193	Maharishi Ayurveda Products	40
194	Mahendra Hybrid Seeds Company Ltd.	42
195	Mahindra Sintered Products Ltd.	34
196	Mahindra UGINE Steel Co. Ltd.	27
197	Malhotra Shaving Products Ltd.	31
198	Manali Petrochemicals Ltd.	31
199	Max India Ltd.	35
200	McDowell & Co. Ltd.	72
201	Measurement Systems Pvt. Ltd	28
202	Meltron Semiconductors Ltd.	49
203	Metallizing Equipment Co. Pvt. Ltd.	26
204	Metallurgical & Engineering Consultants (India) Ltd.	64
205	Metroark Limited	28
206	Metrochem Industries Ltd.	40
207	Minota Aquatech Ltd.	81
208	Mishra Dhatu Nigam Ltd.	55
209	Modern Malleable Casting Works Ltd.	40
210	Modern Woolens Ltd.	40
211	Modistone Ltd.	44
212	Montari Industries Ltd.	86
213	Motorol (India) Ltd.	98
214	Mukand Limited	57
215	Mytimasters' Engineering Pvt. Ltd.	41
216	NGEFLimited	71
217	NICCO Corporation Ltd.	47
218	Nalco Chemicals India Ltd.	93
219	National Aluminium Company Ltd.	42
220	National Peroxide Ltd.	69
221	The National Radio & Electronics Co. Ltd.	92
222	Nepa Limited	59

Contd/-

Sl. No.	Name of the firm	R&D Expenditure (in Rs. lakhs)
223	Nirlon Limited	30
224	Nitin Castings Ltd.	58
225	Nuchem Plastics Ltd.	94
226	O/E/N India Ltd.	31
227	OCL India Ltd.	40
228	Obhum Electrical Industries Pvt. Ltd.	33
229	Onida Savak Limited	36
230	Organic Coatings Pvt. Ltd.	28
231	Orient Abrasives Ltd.	30
232	Orissa Industries Ltd.	61
233	P.I. Industries Ltd.	73
234	Pacific Telecommunications & Instruments Ltd.	40
235	Paharpur Cooling Towers Ltd.	31
236	Panacea Biotec Limited	48
237	Parke-Davis (India) Ltd.	71
238	Parrys Confectionery Ltd.	59
239	Penam Laboratories Ltd.	49
240	Pennwalt India Ltd.	38
241	Pest-Control (India) Ltd.	36
242	Phillips Carbon Black Ltd.	48
243	Pidilite Industries Ltd.	63
244	Polychem Limited	57
245	Porritys & Spencer (Asia) Ltd.	46
246	Pradeep Drug Company Ltd.	38
247	Praj Industries Ltd.	48
248	Precision Fastners Ltd.	32
249	Priyaraj Electronics Ltd.	46
250	Process & Product Development Centre	35
251	Processor Systems (India) Pvt. Ltd.	52
252	Pudumjee Pulp & Paper Mills Ltd.	33
253	Punjab Wireless Systems Ltd.	55
254	Purolator India Ltd.	56
255	RES Photovoltaics Ltd.	84
256	Rainbow Ink & Varnish Mfg. Co. Ltd.	31
257	Rajasthan Electronics & Instruments Ltd.	89
258	Ralliwolf Limited	32
259	Rane (Madras) Ltd.	77
260	Rane Brake Linings Ltd.	57

Contd/-

Sl. No.	Name of the firm	R&D Expenditure (in Rs. lakhs)
261	Rapsri Engg Industries (P) Ltd.	41
262	Raptakos Brett & Co. Ltd.	50
263	The Raymond Woollen Mills Ltd.	70
264	Reckitt & Colman of India Ltd.	51
265	Resource Technologies Pvt. Ltd.	56
266	Rhone-Poulenc (India) Ltd.	28
267	Roots Industries Ltd.	54
268	Roussel India Ltd.	39
269	Rubber Products Ltd.	44
270	S.K.Dynamics Pvt. Ltd.	31
271	SMZS Chemicals Ltd.	44
272	SRFLimited	43
273	SSP (Pvt.) Ltd.	26
274	STP Limited	26
275	Sadhana Nitro Chem Ltd.	26
276	Samtel (India) Ltd.	39
277	San Engg & Locomotive Co. Ltd.	46
278	Sanmar Electronics Corporation Ltd.	52
279	Sapana Polyweave Pvt. Ltd.	38
280	The Scientific Instrument Co. Ltd.	34
281	Sealol Hindustan Ltd.	51
282	Secals Limited	75
283	Shalimar Paints Ltd.	58
284	Shaw Wallace & Company Ltd.	26
285	Shree Synthetics Ltd.	25
286	Shriram Honda Power Equipment Ltd.	32
287	Shriram Industrial Enterprises Ltd.	99
288	Shyam Antenna Electronics Ltd.	63
289	Siemens Telematik Ltd.	75
290	Smithkline Beecham Consumer Healthcare Ltd.	88
291	Solar Farmachem Ltd.	34
292	Solidaire India Ltd.	31
293	Sree Rayaleseema Alkalies & Allied Chemicals Ltd.	80
294	Sri Kannapiran Mills Ltd.	30
295	Standard Industries Ltd.	82
296	Stangen Immuno Diagnostics	42
297	Star Precision Electronics (India) Ltd.	74
298	Star Spin & Twist Machineries Ltd	43

Contd/-

Sl. No.	Name of the firm	R&D Expenditure (in Rs. lakhs)
299	Structwel Designers & Consultants Pvt. Ltd.	40
300	Sumitra Pharmaceuticals & Chemicals Ltd.	38
301	Sunbeam Castings	82
302	Sundaram Fastners Ltd.	50
303	Super Seals India Ltd.	29
304	Swadeshi Polytex Ltd.	31
305	TIL Limited	51
306	TIPCO Industries Ltd.	59
307	TTK Pharma Ltd.	30
308	TVS Electronics Ltd.	51
309	Tablets (India) Ltd.	25
310	Talbros Automotive Components Ltd.	52
311	Tamil Nadu Electricity Board	47
312	Tamil Nadu Newsprint and Papers Ltd.	42
313	Tata Chemicals Ltd	50
314	Tata Keltron Ltd.	38
315	The Tata Oil Mills Co. Ltd.	42
316	Tata Refractories Ltd.	98
317	Tata Telecom Ltd.	94
318	Tata-Robins-Fraser Ltd.	61
319	Teletube Electronics Ltd.	44
320	Television & Components Ltd.	28
321	Textool Company Ltd.	89
322	Tide Water Oil Co. (India) Ltd.	79
323	Titagarh Steels Ltd.	34
324	Titan Industries Ltd.	66
325	Top Syringe Mfg. Co.	86
326	Tractor Engineers Ltd.	46
327	Trafalgar House Construction India Ltd.	50
328	Transpek Industry Ltd.	32
329	Travancore Titanium Products Ltd.	52
330	Triveni Sheet Glass Works Ltd.	45
331	Tube Products of India	47
332	Turbotech Precision Engineering Pvt. Ltd.	36
333	UMW Industries Ltd.	33
334	USV Limited	80
335	Ucal Fuel Systems Ltd.	65
336	Unique Chemicals	39

Contd/-

Sl. No.	Name of the firm	R&D Expenditure (in Rs. lakhs)
337	Uniqe Pharmaceuticals Laboratories Ltd.	32
338	Universal Cables Ltd.	68
339	VXL Engineers Ltd.	26
340	VXL Instruments Ltd.	55
341	Vam Organic Chemicals Ltd.	73
342	Vedika International Pvt. Ltd.	48
343	Veejay Lakshmi Engineering Works Ltd.	31
344	Vidyut Metallics Ltd.	28
345	Vikrant Tyres Ltd.	56
346	Voltas Limited	29
347	Voltas Limited	40
348	W.S. Industries (India) Ltd.	40
349	Walchandnagar Industries Ltd.	84
350	Wander Limited	46
351	Wires and Fabriks (SA) Ltd.	26
352	Wolkem India Ltd.	85
353	Worthington Pump India Ltd.	26
354	Wyeth Laboratories Ltd.	97
355	Yamuna Gases & Chemicals Ltd.	45
356	The Zandu Pharmaceutical Works Ltd.	86

**LIST OF SCIENTIFIC AND INDUSTRIAL RESEARCH ORGANISATIONS
APPROVED DURING 1996***

AGRICULTURAL, MEDICAL, NATURAL & APPLIED SCIENCES

Sl. No.	Name of the Institution	Approval Valid upto
1.	K. K. Birla Academy, New Delhi	31.03.1997
2.	Tamilnadu Energy Development Agency, Madras	31.03.1997
3.	Kerala State Nirmithi Kendra, Thiruvananthapuram	31.03.1998
4.	Jadavpur University, Calcutta	31.03.2000
5.	Association for Research in Homoeopathy, Bombay	31.03.1997
6.	Poona Medical Research Foundation, Pune	31.03.1998
7.	The Kelkar Education Trust, Bombay	31.03.1998
8.	National Institute of Small Mines, Calcutta	31.03.1998
9.	Rajiv Gandhi Centre for Development of Education, Science & Technology, Trivandrum	31.03.1998
10.	Rotary Rural Eye Health Care and Research Centre, Navsari	31.03.1998
11.	Vaidya Chandra Prakash Cancer Research Foundation, Delhi.	31.03.1998
12.	Indian Research Institute for Integrated Medicine, Unsani, Howrah.	31.03.1998
13.	The Talwar Research Foundation, New Delhi	31.03.1998
14.	Dr.B.V.Rao Institute of Poultry Management and Technology, Pune.	31.03.1998
15.	Society of Biomedical Technology, Bangalore	31.03.1998
16.	Spastics Society of Karnataka, Bangalore	31.03.1998
17.	Nagarjuna Agricultural Research and Development Institute, Secunderabad	31.03.1998
18.	Pushpawati Singhanian Research Institute for Liver, Renal and Digestive Diseases, New Delhi	31.03.1998
19.	Institute of Machine Tools Technology, Batala	31.03.1999
20.	Assam Science Soceity, Guwahati	31.03.1999
21.	Baun Foundation Medical Research Centre of Baun Foundation Trust, Bombay	31.03.1999
22.	The Homoeopathic Education Society, Mumbai	31.03.1999
23.	National Institute of Pharmaceutical Education and Research, Mohali	31.03.1999
24.	Indraprastha Cancer Society and Research Centre, New Delhi	31.03.1999
25.	Madras Diabetes Research Foundation, Madras	31.03.1999
26.	Bharati Vidya Peeth's Poona College of Pharmacy, Pune	31.03.1999

* Names of these organisations were also communicated to the Director General of Income Tax (Exemptions), Calcutta for issuance of Notification u/s 35(1)(ii) of the I.T. Act. 1961.

**LIST OF SCIENTIFIC AND INDUSTRIAL RESEARCH ORGANISATIONS
APPROVED DURING 1996***

SOCIAL SCIENCES

Sl. No.	Name of the Institution	Approval Valid upto
1.	Samvaad Foundation, Bombay	31.03.1998
2.	Foundation for Research in Health Systems, Ahmedabad.	31.03.1998
3.	The Society for Capital Market Research and Development, Delhi	31.03.1998
4.	Nirmala Niketan Institute, Bombay	31.03.1998
5.	Arpana Trust, Madhuban, Karnal	31.03.1998
6.	The Indian Society of Agricultural Economics, Mumbai	31.03.1999
7.	Citizens for National Consensus, Mumbai	31.03.1999
8.	The EFI Social and Labour Research Foundation, Mumbai	31.03.1999
9.	Indian Society of Labour Economics, New Delhi	31.03.1999

* Names of these organisations were communicated to Director General of Income Tax (Exemptions), Calcutta for issuance of Notification u/s 35(1)(iii) of the I.T. Act. 1961.

**CERTIFICATE FOR INVESTMENT ALLOWANCE ISSUED BY DSIR
UNDER SECTION 32 A(2B) OF I.T. ACT. 1961**

No.	Name of the company	Source of know-how/technology	Item of manufacture	Investment Certified (in Rs.lakhs)
1.	Amrit Banaspati Co. Ltd., Ghaziabad	Forest Research Institute, Dehradun	Writing & Printing paper	397

**CERTIFICATES FOR CLAIMING ACCELERATED DEPRICIATION ALLOWANCE
ISSUED BY DSIR UNDER RULE 5(2) OF IT RULES VIDE
NOTIFICATION NO.133/342/86-TPL DATED 1.4.1988**

No.	Name of the company	Source of know-how/technology	Item of manufacture	Investment Certified (in Rs.lakhs)
1.	Radiant Telesystem Ltd Bhubneshwar.	C-DOT	SBM-RAX	61.63
2.	Bhafat Electronics Ltd. Bangalore.	In-house	Electronics Equipment	5978.58
3.	Manganese Ore (India) Ltd., Nagpur.	NML Jamshedpur	Electrolytic Manganese Dioxide (EMD)	0.93
4.	BASF India Ltd., Bombay.	In-house	Carbendazin (Bavistin)	281.60
5.	Herdillia Chemicals Ltd., Bombay	In-house	Iso-Butyl Benzene (IBB)	513.29
6.	Transmetal Ltd. Vadodara.	Transpek Industries Ltd, Vadodara	Tri Chloro Acetyl Chloride (TCAC)	353.48
7.	Vaman Prestress Ltd Bombay	RDSO	Mono-block Concrete Sleepers	17.04
8.	Necem cement Ltd., Guwahati	NCCBM, Delhi	Ordinary Portland Cement	301.54
9.	Vaman Prestress Co. Ltd Bombay	RDSO, Lucknow	Mono-block Concrete Sleepers	0.65
10.	Prestress(I) Pvt Ltd. Bombay	RDSO, Lucknow	Mono-block Concrete Sleepers	79.75
11.	Aimco Pesticides Ltd., Bombay.	IICT Hyderabad	Chlorpyrifos	695.67
12.	Punjab Communications Ltd SAS Nagar	C-DOT	EPABX, RAX, MAX	33.32
13.	Punjab Tractors Ltd. SAS Nagar	In-house & CMERI Durgapur	Tractors and Harvestors	1376.55

**SPONSORED RESEARCH PROJECTS APPROVED BY DSIR FOR
125% WEIGHTED TAX DEDUCTION UNDER SECTION 35(2AA) OF IT ACT 1961**

S.No.	Name of the Sponsor	National Laboratory	Scientific Project/ Programme	Sponsorship fee (in Rs. lakhs)
1.	Tetragon Chemie Ltd., Bangalore	IIT, Delhi	Development for process for the production of cellulose fermentation.	4.80
2.	Secure Meters Ltd. Udaipur	IIT, Kanpur	Communication Networking and Intelligent Automation.	37.50
3.	Graphite India Ltd., Calcutta	DRDL, Hyderabad	Development of carbon based friction materials for aircraft, railways and automobiles.	100.00

ABBREVIATIONS USED

ACC	Associated Cement Company
ACE	Association of Consulting Engineers
APCTT	Asian and Pacific Centre for Transfer of Technology
BEL	Bharat Electronics Limited
BHEL	Bharat Heavy Electricals Limited
CBDT	Central Board of Direct Taxes
CDC	Consultancy Development Centre
CEL	Central Electronics Limited
CMPDIL	Central Mine Planing & Design Institute Limited
CSIR	Council of Scientific and Industrial Research
DSIR	Department of Scientific and Industrial Research
ECIL	Electronics Corporation of India Limited
ERDA	Electrical Research and Development Association
ESCAP	Economic and Social Commission for Asia and the Pacific
GSI	Geological Survey of India
HMT	Hindustan Machine Tools
ICAR	Indian Council of Agricultural Research
ICMR	Indian Council of Medical Research
ICSSR	Indian Council of Social Science Research
IIFT	Indian Institute of Foreign Trade
IPCL	Indian Petrochemical Corporation Limited
ISRO	Indian Space Research Organisation
ITI	Indian Telephone Industries
NCAER	National Council of Applied Economic Research
NICMAR	National Institute of Construction Management and Research
NIDC	National Industrial Development Corporation
NISSAT	National Information System for Science and Technology
NRDC	National Research Development Corporation
ODS	Ozone Depleting Substances
PATSER	Programme Aimed at Technological Self Reliance
RDI	Research and Development by Industry
SEETOT	Scheme to enhance the Efficacy of Transfer of Technology
UNCTAD	United Nations Conference on Trade and Development
UNDP	United Nations Development Programme
UNIDO	United Nations Industrial Development Organisation
WIPO	World Intellectual Property Organisation