

# **ANNUAL REPORT**

## **1995-96**



**Department of Scientific and Industrial Research**  
**Ministry of Science & 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 Incharge of Ministry of Science and Technology under the period of report was the Prime Minister Shri P. V. Narasimha Rao and the Minister of State for Science and Technology was Shri Bhuvnesh Chaturvedi, Minister of State in Prime Minister's Office.

**1.2** The Department of Scientific and Industrial Research (DSIR) comprises of the activities of the Council of Scientific and Industrial Research (CSIR), Technology Promotion, Development, Utilisation and Transfer (TPDU), 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** During the last five decades of its existence, the CSIR has emerged as a premier national Science and Technology (S&T) agency with a vast network of National Laboratories, Extension and Regional Centres and Complexes. The total R&D plan of CSIR was categorised into four major groups viz. industry/economy oriented programmes, social programmes, basic research programmes and research support activities.

CSIR's involvement in accelerating the industrial development of the country has been in terms of providing technical knowhow for

upgradation of existing technologies, improving efficiencies of existing processes and generating new indigenous technologies in response to the emerging needs of the industry.

CSIR laboratories have responded to the radical change and the industrial, economic and trade policies introduced by the Government to integrate the Indian economy with the Global economy. Successful technology transfers have taken place in many areas. The efforts of CSIR towards globalisation of its activities have resulted in entering into collaborative agreements, licensing of its technologies, and signing of MoUs with international organisations like DuPont Agricultural products, USA; FMC Corporation, Commonwealth Science Council, Zymogenetics, USA; Silesia SA, South Africa; Chinese Aeronautical Establishment, Beijing; University of New South Wales, Australia; University of Lancaster, UK; Special Design Bureau, Moscow. Among the major industry and economy oriented programmes, those related to Drugs, Chemicals, Environment, Metallurgy, Agrotechnologies, Leather, Electronics, Transportation, Materials and Wood Substitute have made significant contributions.

The collaborative efforts of CIMAP and CDRI on *arteether* are about to lead to the release of a drug for the control of cerebral or chloroquin-resistant malaria in the market.

An improved process for the production of 16-DPA, the key intermediate for the manufacture of a number of life saving steroidal drugs, has been developed by RRL, Jorhat. A 20 t/hr mechanical salt washery based on the CSMCRI design is expected to be commercialised shortly

by M/s CHEMFAB Alkalies (TEAM group), Madras at their salt works at Pondichery. The knowhow for the production of NML-Galvasave, a passivator which imparts very high corrosion resistance to zinc and galvanized surfaces, has been released to M/s Metoil Corporation, Jamshedpur. RRL, Bhubneswar has set up a 35 tpd capacity pan sintering plant at the Sandur Manganese and Iron Ores Ltd., and Metal and Ferro Alloys Plant, Karnataka. A tripartite collaboration between CLRI, RRL-Thiruvananthapuram and TNO Institute of Applied Physics in Eindhavan, the Netherlands has resulted in achieving a major breakthrough in chrome sludge utilisation for coloured wire cut brick manufacture. An eugenol-rich strain of *ocimum gratissimum* Linn, whose essential oil can be a substitute for clove oil, developed by RRL, Jammu has been released for commercial cultivation. The state-of-the-art Stepper Optical Lithography System developed by CSIO is ready for transfer to M/s. Semiconductor Complex Ltd., Mohali. CMRI has developed a life safety kit for the two wheelers. At the request of the International Airport Authority of India, CRRI has submitted a comprehensive traffic circulation plan to be implemented in phases at the domestic terminal, New Delhi. NAL has played a key role in the development of the fly-by wire control law for the LCA technology demonstrator TD-1. An improved version of the Automatic Visual Range Assessor (AVRA Mk-2) was fabricated and field tested at the Air Force Station, Hindon. CGCRI has standardised a process technology for coating mild steel reactors (40 litres) in the plant of M/s Vani Fab Engineering Pvt. Ltd., Hyderabad. EPS door shutters developed by CBRI are total replacements of wood shutters in buildings. Twenty five door shutters were installed by CPWD in their construction work at Delhi and were approved for commercialisation. RRL, Jammu has transferred the technology for the production of 4tpd fibre board unit based on straw to a private party at Ludhiana.

CSIR has launched the Technology Mission on Leather Technology for sustainable development. CLRI has extended complete technologi-

cal support for the modernization of the beamhouse, prepared a project report on tannery modernisation and set up a full scale demonstration unit for ammonia free and wet tanning operations in Tamilnadu.

Under the Societal programmes, achievements have been reported in the areas of food processing, slum improvement programme, agro-economic development, mushroom cultivation, improved variety of java citronella, allergens, launching of Master of Vocational Sciences programme in Footwear Technology, establishment of industry management and rural training units for Women.

Basic research studies have been categorised in four groups viz; Physical Sciences, Chemical Sciences, Biological Sciences and Engineering Sciences.

The research support activities have been grouped as National Facilities, Surveys & Analytical studies, Technical services, Testing & Evaluation and Product evaluation and Information Dissemination.

A strain bank for *Leishmania strains* has been established as a national facility at IICB to serve as a resource base for fundamental and applied research. For the Gas Authority of India Ltd., NGRI completed a feasibility study for laying submarine gas pipeline of 891 km length from Chah Bahar on the SE Iranian coast to Jhakau in India through Pakistan. CLRI has set up a new CAD (Footwear) facility at its regional centre at Kanpur. SERC, Madras has developed a software for analysis and design & drafting of three types of transmission line towers for a pvt. company in Calcutta.

SAARC Documentation Centre (SDC) set up at INSDOC for exchanging S&T information among SAARC nations has started functioning. PID continued to publish twelve journals in English in different areas of science & technology and the three popular science journals, one each in English, Hindi and Urdu. A number of special

issues on themes of contemporary relevance were also brought out. PID also publishes a Hindi journal, *Bhartiya Vaigyanik Evam Audyogik Anusandhan Patrika*, which covers original research work in all disciplines of S&T. Under a new scheme introduced recently, advance abstracts of the forthcoming issues of the PID journals are sent to *Nature*, *New Scientist*, *Chemistry in Britain*, etc. for possible coverage in the 'News and Views' section. The publication of "The Wealth of India - Raw Materials" has also been a major activity.

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-feasibility reports 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) Linkages with International Organisations including Asian and Pacific Centre for Transfer of Technology (APCTT).

(e) Promotion and Support to Consultancy Services (PSCS), including the Consultancy Development Centre (CDC).

IV National Information System for Science and Technology (NISSAT).

V 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 1242 units having valid recognition as on 31 December 1995. 239 In-house R&D Centres incurred an annual expenditure of over Rs. 1 crore each. During the year, 69 In-house R&D centres were accorded fresh recognition and 421 centres were accorded renewal of recognition. During the year 1995-96, 12 publications were brought out; Ninth National Conference on In-house R&D in Industry was organised; DSIR National Awards were presented to 15 industrial units; and 4 issues of In-house R&D in Industry Update were brought out.

Scientific Associations, Institutions, Universities and Colleges which undertake research in the area of medicine, agriculture, natural and applied sciences seek approval to avail the fiscal incentives provided for pursuing such work. During the year, 32 institutions were recognised as SIROs.

The Government had notified an incentive and relief to the user of know-how developed in the country. This would be in the form of depreciation allowance at higher rate on the cost of plant and machinery installed after 1 April 1987. During the year, 23 certificates involving Rs.3944 lakhs as cost of plant and machinery set up based on indigenous technology were issued.

The Government has also introduced a provision of weighted tax deduction at 125% for sponsored research programmes. DSIR is the nodal department for technical approvals.

### **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 and absorption and upgradation of imported technologies. The projects in progress include those of IBP Co. Ltd. concerning development of heat resistant explosives, 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 building of molybdenum wire, bulk filtration of liquid metal and development of alloy steel wire with high surface finish, MECON concerning development of under burden probe, 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-2 and related card, SCL and ER&DC concerning development of ASIC for microprocessor based power controller and STD PCO machine, SCL and IRDL concerning development of ASIC and related MPEG-2 card, SCL and BHEL concerning development of ASIC based Electronic Energy Meter, BEML concerning development of 10 ton back-

hoe hydraulic excavator, computerised transmission control for dump trucks, cast crank shaft and 460 HP wheel dozer, Turbotech Precision Engineering Pvt. Ltd., NAL, HAL and Sakthi Sugars concerning development of Low Cost Gas Turbine Generator of 500 KW power class with multifuel 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 IIP 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 CRRI for development of nuclear based 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 supplement and CEL and C-DAC for development of soil state interlocking system for Railways. The completed technology development 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 14 sectors / products such as Electrical motor, Fruit juices, Garments, Paper mills and Textile Spinning - Weaving and Processing, etc. have been finalised during the year. The department along with NRDC will provide guidelines to the IITs and IISc in spotting the right industrial partner in 7 Technology Missions recently launched by the Ministry of Human Resources Development in the IITs and IISc.

### **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 (FC). A compilation of

primary data on FCs for the year 1994 was brought out. Computerisation of data collected on foreign collaborations for the period 1981 to 1994 has been completed. During the year, reports on technology status of various sectors/products like Polyols, Paracetamol, Toluene, Radiators, Vitamin C & Sorbitol, Energy Meters etc. were printed. Interaction meetings with manufacturers, users, Government Departments, R&D organisations, Technical Institutes, Industry Associations and others were organised to finalise the reports. With a view to enhance capabilities in the area of Technology Management, a programme has been launched.

Under the scheme of Transfer and Trading in Technology, activities supported include: Demonstration and Commercialisation of Exportable Technologies; conducting studies related to technology profiles of select countries and technological capabilities in select industrial sectors. Studies on Technology profile of South Africa and Technology export potential of Agro based Industry were completed and released for printing. Technology demonstration project on Cell Type Air Washer was completed. In connection with the project on Iono-Oxidation technique of effluent treatment, further experiments were carried out.

The department continued to play the role of focal point for Asian and Pacific Centre for Transfer of Technology and participated in the Eleventh Technical Advisory Committee meeting and the Tenth Session of the Governing Board meeting.

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 and also promote and strengthen the consultancy capabilities in the country. It is not to undertake any commercial activity itself but, at the same time, earn revenues to the extent possible, through specialised programmes and activities. CDC is implementing programmes such as Consultancy Development Promotion Assistance (CDPA) scheme, computerised database for consultants, training and human resources development for consultancy, and programmes sponsored by other agencies. DSIR is providing recurring and non-recurring support to CDC. It has occupied its own office space at India Habitat Centre, New Delhi and is functional from its new office since May, 1994. 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. The one year consultancy training programme was upgraded to post graduate degree (MS) programme in Consultancy Management in association with BITS, Pilani.

### **1.8 National Information System for Science & Technology (NISSAT)**

National Information System for Science & Technology (NISSAT) envisages promotion and support to the development of a compatible set of information systems on science and technology and interlink 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 10 information centres and nine centres to access international database services and these centres were connected through E-Mail. One centre on Management Science has been established in Ahmedabad. The activities of the NISSAT centres were augmented and their services and revenue generation improved. The national access centres on international databases continued services on full cost recovery basis.

Six metropolitan library networks in Calcutta, New Delhi, Bombay, Pune, Ahmedabad and Mysore continued their services. Library



automation activities were initiated in more than 1150 institutions. 27 training courses on information technology application were conducted.

SDI and CD-ROM services on databases like ADONIS, BIOSIS, BNB, BOOKFIND, COMPENDEX, CHEMBANK, DISCOVER, DRUG INFO. SOURCE, IFIS, INSPEC, NTIS, TTD, World Research Database, ISDS, SCI were initiated in 10 centres.

The quarterly NISSAT Newsletter for dissemination of information activities was published. The library automation software/programs SANJAY, TRISHNA and MAITRAYEE were developed and maintained.

### 1.9 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 in the commercialisation of indigenously developed technologies.

Some of the major technologies licensed by NRDC during the year include, Rice Husk Fired Sheet Type FBC Boilers, Cyclosporin A, Invert Sugar, Glycol based Hydraulic Fluid 'PEGCOL 89 and Diethyl Phenyl Acetamide. The ongoing projects include: Artificial Heart Valve, Acid Proof Cement from Rice Husk, Glucose Biosensors, Synthetic Absorbable Sutures, Sand Lime Bricks and Carbon Fibre for Braiding Applications. The Corporation has successfully transferred technologies for Rice Husk Particle Board in Malaysia, Cell Type Air Washer System in Philippines and Textile Instruments in Philippines.

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-photovoltaic 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 Projection Television Systems.
- (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 the fifth largest producer of single crystalline silicon solar cells in the world.

The company supplied 3200 SPV Power sources to DOT, 89 very low power TV Transmitters to Doordarshan, 23 SPV Pumps to users through IREDA and exported a 10 KWp SPV system to Cuba during 1994-95.

2.0 During the year 1995-96, there was an around growth and progress in the activities under different programmes of DSIR.

## I(B). FINANCIAL SUMMARY

The financial summary giving the Actuals 1994-95, BE 1995-96, RE 1995-96 and BE 1996-97 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 1994-95			Budget Estimates 1995-96			Revised Estimates 1995-96			Budget Estimates 1996-97		
		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	142.35	215.00	357.35	161.00	223.85	384.85	160.00	251.68	411.68	161.00	251.68	412.68
2.	Technology Promotion Development and Utilisation Programme	10.55	0.00	10.55	13.91	0.04	13.95	11.91	0.04	11.95	16.27	0.07	16.34
3.	Research and Development	2.04	0.00	2.04	2.25	0.00	2.25	2.25	0.00	2.25	2.15	0.00	2.15
4.	Investment in Public Enterprises												
4.1	Central Electronics Limited	0.00	0.00	0.00	4.27	0.00	4.27	4.02	0.00	4.02	3.05	0.00	3.05
4.2	National Research Development Corporation	0.15	0.00	0.15	0.15	0.00	0.15	0.15	0.00	0.15	0.20	0.00	0.20
<b>Total (1 to 4)</b>		<b>155.09</b>	<b>215.00</b>	<b>370.09</b>	<b>181.58</b>	<b>223.89</b>	<b>405.47</b>	<b>178.33</b>	<b>251.72</b>	<b>430.05</b>	<b>182.67</b>	<b>251.75</b>	<b>434.42</b>
5.	Loans of Public Enterprises												
5.1	Central Electronics Limited	2.67	0.00	2.67	4.27	0.00	4.27	4.02	0.00	4.02	3.05	0.00	3.05
5.2	National Research Development Corporation	0.15	0.00	0.15	0.15	0.00	0.15	0.15	0.00	0.15	0.20	0.00	0.20
<b>Total (5)</b>		<b>2.82</b>	<b>0.00</b>	<b>2.82</b>	<b>4.42</b>	<b>0.00</b>	<b>4.42</b>	<b>4.17</b>	<b>0.00</b>	<b>4.17</b>	<b>3.25</b>	<b>0.00</b>	<b>3.25</b>
<b>Total (1 to 5)</b>		<b>157.91</b>	<b>215.00</b>	<b>372.91</b>	<b>186.00</b>	<b>223.89</b>	<b>409.89</b>	<b>182.50</b>	<b>251.72</b>	<b>434.22</b>	<b>185.92</b>	<b>251.75</b>	<b>437.67</b>
6.	Secretariat Economic Services	0.00	1.07	1.07	0.00	1.14	1.14	0.00	1.18	1.18	0.08	1.22	1.30
7.	Support to CEL for VRS	0.00	0.00	0.00	0.00	0.00	0.00	*3.00	0.00	*3.00	*1.00	0.00	*1.00
7.1	Deduct Expenditure from NRF	0.00	0.00	0.00	0.00	0.00	0.00	-3.00	0.00	-3.00	-1.00	0.00	-1.00
<b>Total (7)</b>		<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>
<b>Grand Total</b>		<b>157.91</b>	<b>216.07</b>	<b>373.98</b>	<b>186.00</b>	<b>225.03</b>	<b>411.03</b>	<b>182.50</b>	<b>252.90</b>	<b>435.40</b>	<b>186.00</b>	<b>252.97</b>	<b>438.97</b>

\* 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

## 1. INTRODUCTION

The Council of Scientific & Industrial Research (CSIR) is a premier national S&T agency with a network of 40 national laboratories, two complexes and 81 Extension and Regional Centres spread all over India (Annexure II.1)

Over the last five decades of its existence, CSIR has made significant contributions in R&D and technical services resulting in Industrial and Socio-Economic development. CSIR has also achieved excellence in Basic Research and is creating a strong infrastructure in terms of S&T Manpower in the country.

CSIR's involvement in accelerating the industrial development of the country has been in terms of providing improved efficiencies of existing processes and generating new indigenous technologies in response to the emerging needs of the industry. CSIR laboratories have responded to the radical changes and the industrial, economic and trade policies introduced by the Government to integrate the Indian economy with the Global economy. Successful technology transfers have taken place in many areas.

The laboratories are participating in several national missions and emphasis has also been given to the rural development programmes. CSIR laboratories have also continued the basic research programmes in several areas. The laboratories also provided wide ranging research support services.

A new orientation is sought to be given to the R&D activities of science and the realm of technology in the socio-economic sphere. CSIR

has the potential, the ability and the will to initiate and be in the forefront of such an exciting endeavour, as it has great strengths in its manpower and infrastructure and covers a wide spectrum of R&D knowledge space.

Recognising that technological advancement holds the key to India's economic and social renaissance, the focus of technology development efforts in CSIR would be on those activities that yield appropriate advantage for the nation. This would be sought to be achieved by directing its R&D activities that lead to technology development for economic growth and for human welfare.

CSIR's endeavour for promoting economic growth would be twofold i.e. promoting Indian industry as a partner and enabling it to emerge as a significant global player; and assisting the nation in deriving enhanced and sustainable value from endogenous resources.

Based on the above vision, CSIR programmes relate to globalisation, industry and economy, societal, basic research and research support activities.

## 2. GLOBALIZATION

CSIR has made efforts towards globalisation of its activities. The highlights are as follows :

### 2.1 Agrochemicals

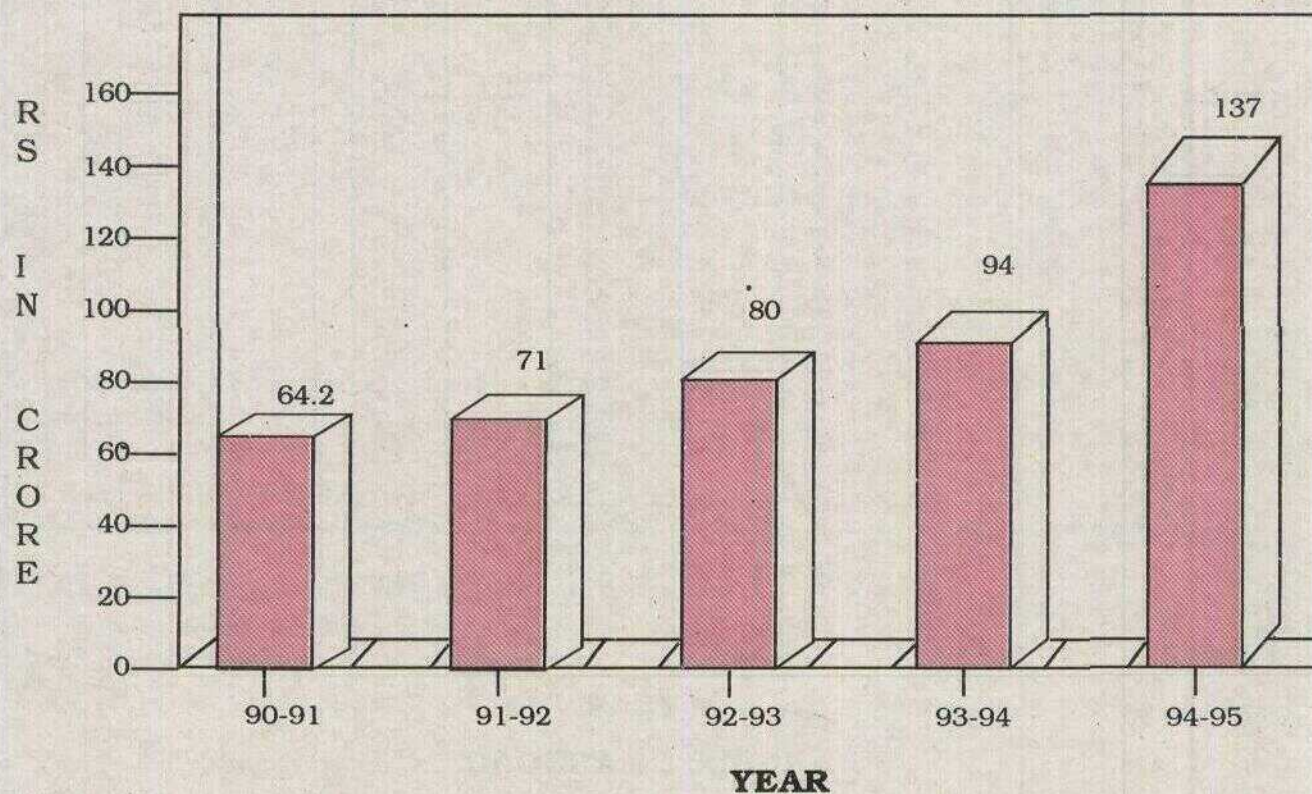
IICT has signed a collaborative agreement with DuPont Agricultural Products for undertaking R&D to discover safe and effective plant



## CSIR OUTPUT INDICATORS

Indicator	1994-95	Cumulative
Knowhow licensed (no.) (First time)	47	2022
Licence agreements	187	6299
Industrial production based on CSIR Knowhow (Rs. crore)	2600	18250
Saving in productivity accruing through CSIR R&D efforts (Rs. crore)	200	3100
Patents filed (No.)	269	6160
In India	241	
Abroad	28	
<b>Contract value (Rs. crore) (of projects in hand)</b>		
(a) Contract Research	230	
(b) Consultancy	35	
<b>Cash Flow (Rs. crore)</b>	<b>137</b>	

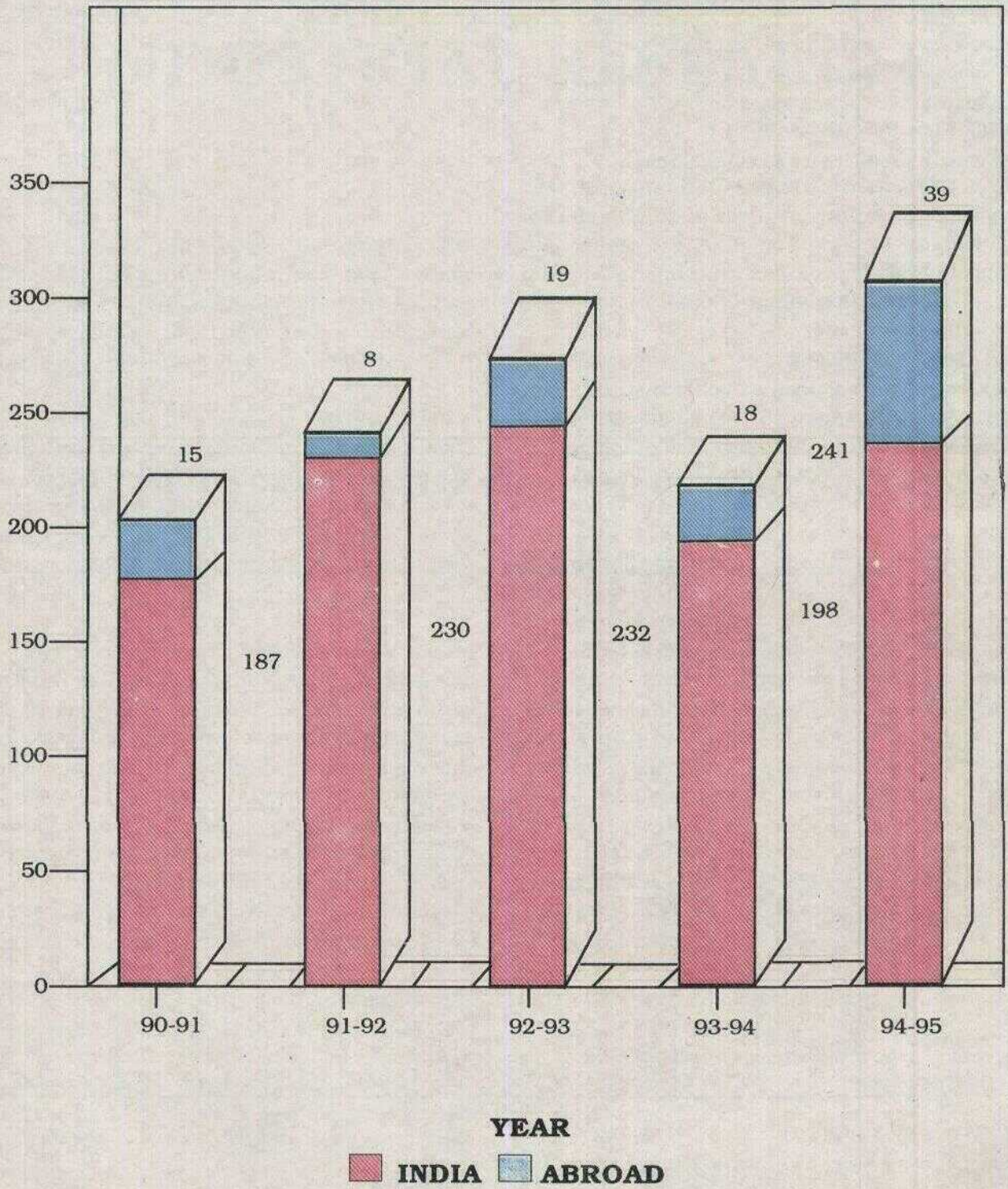
## CASH FLOW THROUGH SPONSORED RESEARCH AND CONSULTANCY



II.1 CSIR Output Indicators (Table) and Cash Flow through Sponsored Research and Consultancy



# PATENTS FILED



11.2. Patents Filed

protection agents, and develop sustainable, globally competitive and market driven products for application in agriculture. The agreement, executed in March 1995, comes as an addendum to DuPont's ongoing agreement with CSIR for evaluation of novel compounds with potential agrochemical activity. It stipulates discovery of new molecules by IICT and evaluation and optimisation of the most promising leads, jointly by IICT and DuPont. Selected molecules will be developed for commercialisation. The collaboration will be effective for three years. DuPont will also evaluate compounds from other current research projects of IICT.

Another agreement has been signed by IICT with FMC Corporation Agricultural Chemical Group for a two-fold interactive R&D programme for research to develop commercially viable processes for manufacture of chosen compounds identified by FMC; and preparation of target compounds in limited quantity identified by FMC, through the processes developed by FMC or known in literature.

Process research will be taken up for bench scale development for two target compounds each year with process scale up studies taken up only if needed. The collaboration is initially for a period of three years.

## 2.2 Drugs

CDRI has entered into secrecy agreements with Zymogenetics, USA and laboratories Silesia SA, Chile, and a South African firm for sharing of data on various products. The Institute also signed confidentiality agreements with WHO Tropical Diseases Research Programme.

CDRI continued to supply its compounds/ plant extracts for testing to DuPont De Nemours & Co. and the National Cancer Institute, USA and LVMH, France under agreements signed earlier.

## 2.3 Environment and Toxicology

ITRC consolidated its linkages with international agencies and built up new ones. The

Commonwealth Science Council has launched a programme on Chemical Research in Environmental Needs (CREN) for which ITRC has been identified as the component coordinator.

## 2.4 Aerospace Research

A three-member delegation from Boeing, headed by Mr. Robert Spitzer, Vice President (Engineering), visited NAL in May 1994 to explore avenues which can lead to mutually beneficial projects and establish a long term relationship with NAL. The delegation invited R&D proposals which Boeing could consider and support depending on its interest and usefulness to programmes at Boeing. Fifteen specific R&D proposals in various areas were presented and discussed with Boeing. Interest was evinced in twelve proposals. However, following this visit, Boeing has sponsored a programme on lug damage tolerance studies. They have also sponsored a programme on relaminarization.

## 2.5 Mining

CMRI has signed an MOU with the University of New South Wales, Australia to work on (i) damage criteria and stability of underground roofs and pillars due to surface blasting, (ii) distinguishable characteristics between blasting cracks and subsidence cracks in surface structures in the vicinity of mining areas, (iii) fragmentation prediction based on rock mass classification and (iv) mathematical and computer models for the prediction of fragmentation.

## 2.6 Computer Aided Design (CAD) of Travelling Wave Tubes (TWTs)

A collaborative project between CEERI and the University of Lancaster has been completed. Under this programme, a large number of CAD activities for both Helix and Coupled-Cavity TWTs have been completed. There is a vast potential for commercial sale of these packages outside the country.

## 2.7 Fabrication and Supply of Seismographs

CSIO entered into a memorandum of understanding and signed an agreement with the



Special Design Bureau (SDB), Moscow, of the Russian Academy of Sciences for the supply of Seismic Sensors viz, Triaxial Seismometer TS-1 and Single Component Vertical Seismometer SM-3. Analog and Digital Seismic Recorders built by CSIO were interfaced with the above-said seismometers supplied by SDB of Russia. The performance of these instruments was evaluated by India Meteorological Department (IMD) on a long term basis in its observatory at Ridge. As per the request of IMD, CSIO supplied twenty units of Seismographs for strengthening and modernisation of the seismological network in India and made them operational.

### 3. INDUSTRY AND ECONOMY ORIENTED PROGRAMMES

#### 3.1 Drugs

Collaborative-cum-licensing agreements have been signed by CDRI with industries for development of:  $\alpha/\beta$  Arteether (blood schizontocidal antimalarial); Compound 81/470 (broad spectrum anthelmintic); Primaquin (antimalarial); and Compound 80/53 (antirelapse antimalarial).

The progress in case of some drugs development by CDRI is as follows:

*Consap* (local contraceptive cream): Permission for conducting Phase III clinical trials granted by the Drugs Controller (India); *Centchroman* (antibreast cancer): Results of Phase III clinical trials at 8 centres showed improvement in about 57% cases; *Centpropazine* (antidepressant): Comparative data generated during Phase III clinical trials from four centres revealed efficacy of centpropazine comparable to imipramine, a common drug for depression.

##### 3.1.1 Plant Based Drug

Towards developing arteether into a drug for the control of cerebral or chloroquin - resistant malaria, relatively economic procedures have been developed for the extraction of artemisinin from *Artemisia annua* plant material

and conversion of artemisinin into arteether. By screening a large population of plants individually, using a rapid procedure developed within the laboratory, single plants with high artemisinin content and seed fertility have been selected for deriving high artemisinin yielding and fertile *A. annua* seed material. The Phase III trials of  $\alpha/\beta$  arteether are nearing completion. The collaborative efforts of CIMAP and CDRI on arteether are about to lead to the release of the arteether drug in the market.

##### 3.1.2 Mefloquin

The drugs presently available for cure of malaria are not effective to combat cerebral malaria. IICT has developed an innovative process for the production of mefloquin, the drug for treatment of cerebral and other types of chloroquin resistant malaria. M/s CIPLA, to whom the knowhow was licensed, have commenced commercial production of the drug. The knowhow has been extended to LUPIN, Bhopal and Unichem Laboratories, Bombay.

##### 3.1.3 Improved Technology for the Production of 16-DPA

An improved process has been worked out by the RRL(Jorhat) for production of 16-dehydropregnenolone acetate (16-DPA) from diosgenin. 16-DPA is the key intermediate in the manufacture of a number of life saving steroidal drugs such as betamethasone, prednisolone, prednicarbate, corticosteroids, sex-hormones etc. The annual domestic demand for these intermediates is about 60 tonnes and the demand in the international market is about 2000 tonnes.

#### 3.2 Chemicals

##### 3.2.1 Sodium Perborate Tetrahydrate

The availability of oxygen for detergent action is now well established because of its eco-friendly effects. Sodium perborate is one of the main sources for oxygen in detergents. CECRI has developed a process for the production of



sodium perborate tetrahydrate. In spite of its being required in large quantities, only one firm is catering to the demands at the rate of 200 tonnes per annum. The development by CECRI is simple and can be taken up by a small scale industry.

Batch preparation of sodium perborate tetrahydrate has been carried out to yield 0.5 kg to 5.0 kg of the product per batch. The product conforms to ISI specifications and has an available oxygen content of more than 10%.

It is estimated that with an investment of about Rs. 30 lakh on plant and machinery and about Rs. 35 lakh for a 3-month working capital, the profitability of a 300 tonnes per annum industry would be about 72%.

### 3.2.2 Industrial Bio-chemicals

In its efforts to standardize methodologies for the preparation of important biochemicals required for industrial use, CBT has developed a process for the preparation of 4-4 dimethyltrityl chloride (DMTrC1) on a semi-pilot scale (2-5 kg batch size) using indigenous raw materials; a novel method for 1H-tetrazole; and a process for acetyl tyrosine. Negotiations are on for transfer of these technologies for commercial exploitation.

### 3.2.3 Salt & Marine Chemicals

A 20 t/hr mechanical salt washery based on CSMCRI design is likely to be commercialised shortly by M/s CHEMFAB Alkalies (TEAM Group), Madras at their salt works in Pondichery.

A process for recovery of bromine from bitterns has been released by CSMCRI to M/s Ashoka Bromine and Marine Chemicals Pvt. Ltd., Ahmedabad through NRDC. The firm has set up and commissioned a 600 kg/day capacity plant near Kharaghoda.

### 3.2.4 Zeolite -A

National Aluminium Co., (NALCO) Bhubaneswar is manufacturing aluminium metal

and alumina hydrate on large scale from Bauxite. In these processes, Sodium Aluminate liquor is produced during leaching of Bauxite using alkali. As per the request of the NALCO, CSMCRI could successfully modify the process and prepare Zeolite-A (detergent grade) — a value added chemical— of desired specification using sodium aluminate liquor. The process has been developed at 75 kg./batch on a pilot scale and successfully demonstrated. NALCO envisages setting up a 10,000 t/annum capacity plant.

### 3.2.5 Thin Film Composite (TFC) membrane based on Reverse Osmosis (RO) (CSMCRI)

A prototype RO plant of 500 l/day capacity to test laboratory scale Thin Film Composite (TFC) membrane based spiral element with sewage water was installed at Madras refineries Ltd. (MRL) and is under test. It is observed that 95% salt rejection has been recorded. The data generated will be very useful in designing a system for reuse of waste water. Developmental work for scaling up for commercialisation of the process for sea water desalination (single-pass) is being carried out. The cellulose acetate membrane casting machine has been modified to produce 1 meter wide polysulfone membranes. The thin film coating machine has been designed and is being fabricated.



II.3. TFC membrane based spiral elements.



### 3.2.6 Agrochemicals

Knowhow for Trimethyl Phosphite from Phosphorous Trichloride, developed by IICT, was demonstrated at a pilot scale of 12 kg. batch. Commissioning of the 6.5 TPD commercial plant was successfully completed at Sarigam in December '94. The basic and detailed designs for the commercial plant were provided by IICT. The process operating parameters specified by IICT were practically applicable, in achieving the plant capacity and product quality. M/s Lupin Agrochemicals India Ltd., Bombay was the second licensee for the knowhow.

TMP is the key intermediate for organic phosphorous pesticides, such as Monocrotophos (MCP), Dichlorovos (DDVP) and Phosphomidon.

### 3.2.7 Thiophenate Methyl (TPM)

Knowhow for this fungicide has been demonstrated to the sponsors at a pilot scale of 3-5 kg/batch. Preparation of basic design engineering package for a 300 TPD commercial plant is in progress. TPM is an important fungicide active both as a preventive and a curative agent. Its widespread applications include seed treatment and post harvest treatment of fruits (deciduous and stone) and vegetables. The process involves two reaction steps — a catalytic reaction to obtain methoxy carbonyl isothiocyanate (MC II) and then conversion of MC II to thiophenate methyl. The catalyst is recovered for further use.

### 3.3 Petroleum and Petrochemicals

#### 3.3.1 Petrochemical grade hexane from food grade hexane.

Petrochemical grade hexane is used in petrochemical plants. This ultra pure hexane has very low aromatics and sulphur content. Presently, its requirement in the country is met by imports. IIP has developed technology for its

production through adsorptive separation. This technology was successfully demonstrated by IIP in the laboratory to the sponsor and M/s. Engineers India Ltd (EIL). The data required for engineering design have also been handed over to EIL.

### 3.3.2 Auto - Exhaust Emissions

IIP is a partner in the multiagency project on development of a catalyst convertor, with specific responsibilities on development of the noble metal based catalyst, wash coat technology and noble metal incorporation of the developed catalyst system on engine test beds. The project is being funded by DST and the other collaborating partners are BHEL, ARAI and NCL. Two catalyst samples were prepared and tested in a 4 stroke 1089 cc passenger car. The results are very encouraging on engine dynamometer as well as on chassis dynamometer. Five catalyst samples have been evaluated on the moped engine test bed and motor cycle engine test bed for conversion efficiency.

### 3.4 Metallurgy

#### 3.4.1 NML-Galvasave

The NML developed passivator, known as 'Galvanized-B' is a low hexavalent chromium based product which imparts very high corrosion resistance to zinc and galvanized surfaces. It is effective at lower concentrations compared to the other products available in the country. NML-Galvasave has been successfully evaluated at the Tube Division of Tata Steel for over a year and has emerged a superior product compared to others so far as corrosion resistance, consumption rate, ease of operation and pollution problems are concerned. The know-how has been released to M/s Metoil Corporation, Adityapur, Jamshedpur. The tubes passivated with Galvasave could stand the salt-spray test for 120 hours. Presently NML Galvasave is in commercial production.





11.4. NML Galvasave treated steel tube, ready for export at Tata Steel

### 3.4.2 New Method for Rare Earth Magnets

A novel method for producing Nd-Fe-B alloy powder suitable for high energy product magnets has been developed at NML. Contrary to the conventional methods which require considerable energy input during their synthesis (melting, milling etc.) the NML method requires much less energy input and employs a chemical reduction route for synthesising Nd-Fe-B alloys. Indigenously available rare earth salts and iron salts are chemically reduced using a reducing agent to get extremely fine sized Nd-Fe-B alloy powder. Methods are being worked out to make permanent magnets from this powder. Major advantages of this method would be: (i) exploitation of huge resources of rare earths present in the beach sands of Kerala and Orissa for making rare earth salts required by the permanent magnet industry, (ii) avoidance of import of expensive rare metals for making permanent magnets and (iii) reduction in cost of the magnets produced by the present methods than the ones produced by the conventional methods.

### 3.4.3 Pan Sintering Plant

RRL (Bhu) set up a 35 TPD capacity pan sintering plant at the Sandur Manganese and Iron Ores Ltd. and Metal and Ferro Alloys Plant, Vyasankere, Hospet, Karnataka. This is the third pan sintering plant set up by the laboratory. In

this plant, a twin pan system connected to the same blower has been incorporated. This has resulted in better utilisation of blower by minimizing the idle time. Further, better material handling systems and a sinter breaker have been put in for improving productivity. The gas cleaning system has also been improved to reduce the dust content in the exhaust gas, keeping in view Indian Standards. The process parameters for sintering bag house dust along with ore fines as well as the complete plant lay out, design-engineering, detailed engineering drawings, etc. have been indigenously developed by the laboratory. The plant is utilising the bag house dust and ore fines at a rate of about 40 tonnes per day. This has resulted in converting waste material to a value added product worth around Rs. 1 crore per annum.



11.5. Pan Sintering Plant

## 3.5 Environment

### 3.5.1 National Emission Standards for Brick Kilns

CBRI has been retained as a Consultant by the Central Pollution Control Board (CPCB), Delhi for preparation of a comprehensive document and National Emission Standards for brick kilns in the country.

Studies were undertaken in four zones viz, North (Ghaziabad), East (Calcutta), South



(Madras) and West (Ahmedabad). Based on the data obtained, National Emission standards have been finalised.

### 3.5.2 Development of Environmental Standards for Coal Washeries

Measurements of Suspended Particulate Matter (SPM), water quality and noise level were carried out by CFRI in five coal washeries at Chasnalla, Patherdih, Sudamdih, Jamadoba and Nandan. The ambient air, effluent water and noise level were monitored during three seasons of the year. Based on the data obtained recommendations have been made to the Central Pollution Control Board on the standards that can be stipulated in the country for all the coal washeries.

### 3.5.3 Breakthrough in Chrome Management

The disposal of chrome sludge continues to pose severe environmental challenge to Indian Tanners. A tripartite collaboration between CLRI, the Regional Research Laboratory, Trivandrum and TNO Institute of Applied Physics in Eindhoven, the Netherlands resulted in achieving a major breakthrough in chrome sludge utilization for coloured wire cut brick manufacture. The success was achieved in the existing mechanised brick unit of M/s Raja Tiles, Trichur in Kerala State. A viable technology for the manufacture of coloured wire cut bricks has been done in an extremely novel technique to prevent formation of chromium (vi). They have successfully undergone chromium leachability studies. It is proposed to encourage both the existing and new mechanised brick units in various states to adopt this cost effective technology through CLRI - TNO dissemination and Leather Technology Mission Programmes.

In-process enhancement of chrome uptake is one of the best alternatives for a long range chrome management. Two commercially attractive closed loop processes based on (a) ethanamine pretreatment and (b) Alutan-BCS combination have been developed by CLRI-TNO-BLC

(UK) joint investigation and field tested at M/s Jai Bharat Tannery, Ambur and M/s Mowchong and M/s Tital Leather Tanneries at Calcutta in West Bengal. It is expected that this technology would emerge as the logical choice of chrome management in the years to come. The exhaustion levels of chromium and aluminium exceeded 95%.

### 3.5.4. Common Effluent Treatment Plants

The Common Effluent Treatment (CET) concept has come to stay in Indian leather sector. The year 1994-95 witnessed the commissioning of two CET Units in Tamil Nadu and Karnataka State. The Pallavaram Tanners Industrial Effluent Treatment Company (PTIETC) recently commissioned its CET plant at Pallavaram with technical cooperation from UNIDO, TNPCB and CLRI. The CETP is connected to 100 tanneries with an installed processing capacity of 2.8 MLD. The total project investment is of the order of Rs.5 crore.

CLRI has provided knowhow and design engineering to the setting up of the Bangalore CETP promoted by the Leather Industries Development Corporation of Karnataka (LIDKAR) and the local tanners association. It is based on an integrated industrial and domestic waste management approach to suit the local environmental, social and economic conditions. The project serves 14 small scale tanneries and is endowed with a processing capacity of 1.25 MLD. The capital investment is about Rs.18 lakhs.

### 3.5.5 Phytosalinity

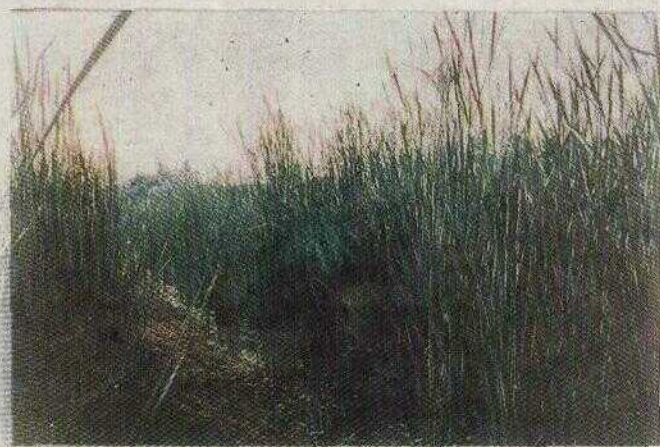
As a part of restoration of ecology of saline land on the east coast plantation of *Salvadora persica* on 25 hectares of highly saline land was taken up as a turn-key job for Vishakhapatnam Steel Plant (VSP). This has changed the entire environment of the area and VSP received a National Environmental Award. Similarly in Kutch, which receives low rainfall, revegetation with *Salvadora persica* on soil having high salt content was successfully done by M/s Pilu



Produce Company as per advice of CSMCRI. The company received 'Halpati' award from Gujarat Govt. for this project. Similarly, M/s Punotor & Sons, Bombay was also awarded for the cultivation of Jojoba on degraded land in Surendranagar Dist. of Gujarat under an agreement with CSMCRI.

### 3.5.6. Waste Treatment Using Constructed Wetlands

NEERI undertook collaborative R&D with the Orissa Water Supply and Sewerage Board, to treat the domestic wastewater from the Sainik School and adjoining locality at Bhubaneswar, using constructed wetlands. Pollutants in the system are removed through physico-chemical processes like sedimentation, precipitation, filtration, adsorption, ion exchange, aerobic and anaerobic microbial degradation. The system thus acts as an efficient nutrient sink. Macrophytes grown in the system play an important role as oxygen donors to the heterotrophic microorganisms in the rhizosphere and increase the hydraulic conductivity of the root zone bed. Soil, sand and gravel provide support to the plants grown in wetlands besides renovating the wastewater through various physico-chemical processes.



11.6. *Typha Latifolia* grown in the constructed wetland installed at Sainik School, Bhubaneswar

### 3.5.7 Environmental Impact Assessment, Risk Assessment, Environmental Audit and Carrying Capacity Studies.

NEERI has completed fifteen Environmental Impact and Risk Assessment Studies during 1994-95. The Institute also carried out Regional Environmental Impact Assessment studies for Jamshedpur and is now engaged in Carrying Capacity Studies for the National Capital Region, Doon Valley, Damodar Basin and Tapi Estuary region. In these studies, Environmental Management/Developmental plans for hot spots prepared by the institute ensure that the resources are utilized efficiently, waste generation is minimised, residuals are treated cost effectively and by-products are recovered and recycled to the extent possible.

NIO continued monitoring the environmental quality of our seas and estuarine system through environmental impact assessment studies. This exercise also formed a part of the programme under COMAPS, funded by the Department of Ocean Development. NIO examined the waters of Mormugao harbour, Dabhol, Nagapattinam, Pipavav and the stretch between Ratnagiri and Mangalore, and found that by and large our coastal waters were still environmentally healthy.

## 3.6 Agro Technologies

### 3.6.1 Medicinal & Aromatic Plants

This year CIMAP released some of the best varieties of mints. A variety (called Gomti) of Japanese mint, superior to all the previous varieties and yielding about 180 kg of oil per hectare has been made available to the farmers. Another variety of peppermint called Kukrail which gives about 165 kg of oil per hectare has been discovered. The introduction of these two new varieties will improve the yield of mint oil by about 25% and result in value addition of more than Rs. 50 crores a year to the economy.





11.7. *Gombi*

CIMAP has also developed improved cultivation practices for mints. A fertilizer prescription equation for mint cultivation has been developed. Also a procedure for converting the mint spent material into compost has been made known to farmers. Intercropping of Japanese mint with onion has been worked out. The co-cultivation of mint and onion increases the land use efficiency by 31% and the net income by about Rs. 5000/- per hectare per year. On similar lines a co-cultivation procedure has been developed for sugarcane and peppermint which increases the land use efficiency by over 70%.

CIMAP released this year a variety of palmarosa called *Tripta*, a variety of chamomile called *Vallery* and a variety of pyrethrum called *Jhelum*. The oil of the *Tripta* variety is the best among the oils extracted from any previous palmarosa material. *Vallery* is the very first variety of chamomile released in India. *Jhelum* variety of pyrethrum is superior to existing varieties of pyrethrum in the country. The *Jhelum* variety gives double the yield or more pyrethrin as compared to the existing varieties.

RRL, Jammu has developed an eugenol-rich strain of *Ocimum gratissimum* Linn. Its essential oil can be a substitute for clove oil. The variety has been christened RRL-Og-14 and released for commercial cultivation to the farmers.

### 3.7 Food Technology

#### 3.7.1 Pulse Milling

The pulse milling equipment designed and the process developed at CFTRI for operating the same have the following attractive features: the machinery, with its capacity of 100-150 kg per hour is particularly suited for small scale sector and rural adoption. Its operation is simple and investment on it is cost-effective. The technology is streamlined and has proven to give an increased yield (higher by 10 per cent) of milled product as compared to traditional technology. The equipment has been designed to perform all three functions, namely, dehusking, aspiration of husk and separate delivery of clean pulses. The technology has been transferred to industry.

#### 3.7.2 Blue green Algae

A leading industrial group has availed of the technology for production of *Spirulina platensis*, the fresh water blue green algae. This single cell protein, a rich nutritious food resource has emerged on the international scene as a much sought after health food for all sections of society and in all age groups. It is also a supplementary source of vitamins and minerals with a host of therapeutic properties. Its production system has been scientifically developed and streamlined for adoption in any environment. Industrial production has been launched and the product conforming to international standards has been exported during the year.

### 3.8 Leather

#### 3.8.1 Modernization of the Biggest Beamhouse

Technically leather is made in the beamhouse and the related unit operations are of tremendous importance in achieving the ultimate quality of the leather. These operations in Indian tanneries are based on technologies with traditional practices. The recent developments



in biotechnology and leather processing have made it possible to achieve a high degree of modernization in beamhouse operations. The M A Khizar Hussain & Sons (KHS), Ranipet is the first large scale tannery in India to approach CLRI for total technological support for its beamhouse modernization efforts. The modernized beamhouse was successfully commissioned at KHS. The overall benefits include 40% reduction in process time, 2% chemical savings, quality consistency, smooth material movement and enhanced in-plant ecology and operational efficiency. In recognition of this remarkable achievement, MAKHS received the AISHTMA Platinum Jubilee National Technology Award (1994).

### **3.8.2 Ammonia Free Tanning**

CLRI under its UNIDO programme supported by the Swiss Government, has set up a full scale demonstration unit for ammonia free and cleaner wet tanning operations at M/s Tejoomals, Pernambut in Tamil Nadu. Process control and partial automation are integrated into the system operations. This is the first small scale tannery in the country to undergo modernization of its wet operations through the implementation of ecofriendly concepts coupled with modern process control instrumentation.

### **3.8.3 National Programme for Tannery Modernization**

Under the aegis of the National Leather Development Programme (NLDP) of the Government of India and UNDP, CLRI prepared a project report on Tannery Modernization for enhancing quality, productivity and sustainability through technology upgradation. The project has been funded by the International Banking Division of State Bank of India.

The report covers the global perspective of the technological changes in leather sector, the Indian leather scenario, opportunities, options and approaches for modernization, technology sourcing, action plan for a multilevel modernization, performance indicators for project monitoring and financial projections. A three

level modernization programme to meet the diverse technological requirements of small, medium and large scale Indian tanneries has been recommended. Replacement of highly traditional technologies and machinery, improvement of in-plant ecology, in-process controls, environmental pollution minimization and allied areas have been identified. The report is intended to sensitize the national and international financial institutions on modernization needs of Indian tanning sector.

### **3.8.4 Leather Product: Shoe Sole and Mould Design**

The sole mould design group has started providing technical service to the industry. A detailed project report was prepared for setting up a shoe sole mould design and production centre (1500 moulds/year) in private sector. The SDDC of CLRI is the only institution in India offering these specialised products to come out of the production line in April, 1995 through a sponsored project funded by M/s Farida Shoes, Ambur.

## **3.9 Electronics & Instrumentation**

### **3.9.1 Electronics**

CEERI has developed an S-band 2 MW Tunable Pulse Magnetron indigenously. This will be used as RF source in microtrons (electron accelerators), for radio active treatment of cancerous tumours and for X-ray radiography of metallic and non-metallic components of specific industries. The production of Magnetron will be taken up by CEERI with the Centre for Advanced Technology, Indore and other agencies. This magnetron is expected to save the outflow of a lot of foreign exchange from the country.

Six units of Digital Mapping System (DIGIMAP) have been supplied to the Survey of India. The total cost of the units, were they to be imported, will be about Rs. 120 lakh. CEERI plans to supply an additional 12 such systems, saving around Rs. 2.4 crore of foreign exchange.



### 3.9.2 Instrumentation

CSIO has developed a state-of-the-art Stepper Optical Lithography System. In this system, the light from a short arc mercury lamp is filtered by a set of broadband pass and narrowband pass filters to allow only a narrow band centred around 365 nm wavelength to illuminate the mask to be replicated. Suitably designed condenser subsystem assures bright and uniform illumination of the entire mask area of 100 mm x 100mm. The uniformity of illumination is better than 3%. This system finds use in the Integrated Circuit (IC) chip fabrication technology. The Optical Stepper is ready for transfer to M/s Semiconductor Complex Ltd (SCL), Mohali (Punjab).

A highly sophisticated state-of-the-art mm-wave radiometer has been developed over the past few years at NPL. This instrument has been successfully installed at MAITRI, Antarctica and is currently observing ozone on a continuous basis. The instrument observes the emission line of atmospheric ozone at 101.737 GHz and inverts the observed line data to obtain ozone density distribution as a function of height. Since this is an emission based instrument, ozone can be observed continuously during day and night, a feature which has been fully exploited in getting continuous observations of ozone over the Indian station MAITRI in Antarctica during the last Polar night period during March-September 1995. This is the first indigenous effort in the design, development and successful installation of such a high-tech equipment at Antarctica.

### 3.10 Energy - Coal

#### 3.10.1 Coal quality Assessment for (Central Mine Planning and Design Institute, Ranchi (CMPDI), Geological Survey of India, Calcutta (GSI) and Coal Controller (CC), Government of India)

Borehole core of 16,647 metres was processed and 25,959 samples were studied in

support of the exploration carried out by GSI, CMPDI and others in 38 coal and lignite fields. The studies were carried out by CFRI and its units at Raniganj, Ranchi, Bilaspur, Nagpur and Jorhat. In addition, 9,607 samples were analyzed for CC and other customers.



11.8. Mini-Flotation Plant at Tetulia, Nirsa (Dhanbad)

#### 3.10.2 Installation of coal slurry plant at Tetulia

The first mini-flotation Plant (with close water circuit) in the country to process 5 tonnes per hour waste slurry has been engineered and commissioned at Dhanbad. The plant based on CFRI-process produces superior metallurgical coal (13% to 15% ash) at 55% yield from slurry generated as waste from the existing washeries.

Consultancy services for two more such plants, one at Chirkunda for Arun Coke (P) Limited and the other at Mugma for Somnath Fuels are being rendered.

#### 3.10.3 Wind Energy

A demonstration wind farm of 2MW capacity is being set up for the Karnataka Government at the Kappatgudda range -a site which was discovered by NAL. The Samira wind mill and the wind powered battery charges were installed and tested at Jogimatti near Chitradurga which



has an annual average wind speed of about 8.4 m/s. This testing has given insight into the performance of the two machines and led to improvements. Under a CSIR sponsored project on rural development, a demonstration programme was undertaken by installing samira wind mills in a typical salt farm in coastal Tamil Nadu. The Group has also completed the design and fabrication of a 50m mast for comprehensive wind farm sitting evaluation.

### **3.11 Transportation-Roads**

#### **3.11.1 Life Safety Kit**

CMRI has developed a life safety kit for two wheelers. The kit is essentially an electro-mechanism to cut-off the ignition on a collision with an object that comes in its way and reduces the impact and damage to the vehicle.

Simultaneously, the dash shield incorporated in the device activates a wheel mounted emergency stand which prevents damage to the fittings of the vehicle.

The kit reduces the chances of injury to the rider on impact and minimises the damage to the vehicle. The kit can be mounted on mopeds, scooters and motor-cycles.

#### **3.11.2 Traffic Circulation and Parking Plan**

At the request of the International Airport Authority of India, CRRRI carried out a traffic management study for the proposed domestic terminal at the Indira Gandhi International Airport Complex, New Delhi. A comprehensive traffic circulation plan to be implemented in phases was recommended to ensure smooth flow of traffic and regulated parking of vehicles.

#### **3.11.3 Interlocking Concrete Block Pavement (ICBP)**

This is a newly emerging construction technique in India for pre-fabricated pavements. In

collaboration with the Border Roads Organisation, an experimental ICBP section along the inhospitable Zojila Complex stretch of Sonamarg-Kargil-Leh road in Jammu & Kashmir was constructed. The innovations introduced in the technique include the protection of concrete blocks and specially designed interlocking edge restraint blocks. The technique has proved to be more durable and less time-consuming and appropriate for high altitude areas. The road was opened to traffic in June 1994. At the end of the first-year, no distress of pavement due to traffic was noticed.

#### **3.11.4 Cold Mix Asphalt Technology**

The cold mix asphalt technology is environment-friendly and cost saving for new construction and rehabilitation of roads. In collaboration with the Indian Oil Corporation, R&D Centre, Faridabad, road test sections were laid by CRRRI near Patnitop (J&K), Silchar (Assam) and Hanumangarh (Rajasthan) using cationic bitumen emulsion. Monitoring of the test section is in progress.

### **3.12 Aeronautics**

#### **3.12.1 New Autoclave**

NAL's sophisticated computer controlled 3mx7m autoclave was put into regular operation for fabricating CFC spars for the carbon fibre wing, fin and rudder of LCA. The design and development of the 4m x 8m autoclave for HAL, a task that NAL is undertaking, registered significant progress. The detailed drawings for the fabrication of the autoclave vessel have been completed by BHEL who are sub-contractors to NAL on this project. The fabrication work has also started in right earnest. This autoclave, when completed will be the most sophisticated and the only one of its kind in the country.

#### **3.12.2 Light Combat Aircraft (LCA)**

The carbon fibre wing development, which is being undertaken by a National Team formed



under the leadership of NAL, also registered significant progress during the year. All the parts of the wings have been mounted on the assembly jig and the skins are also ready for assembly. The Composite Structures Group of NAL made a significant contribution by fabricating the 60 CFC spars required for the first set of wings in time. The Group has also taken responsibility to fabricate the landing gear doors and the wing fuselage fairings. NAL played a key role in the development of the fly-by-wire control law for the LCA Technology Demonstrator TD-1, as part of a National Team set up for this task. The base line control law for the TD-1 which almost meets all the requirements for the first flight standard is now ready. The real time "Engineer-in-the-Loop Simulator (ELS) set up earlier has played a key role as a control law design optimisation tool.

### 3.12.3 AVRA-Improved Version

An improved version of the automatic visual range assessor (AVRA Mk-2) was fabricated and field tested. This unit has been installed at the Air Force Station, Hindon. Improvements have been made in the software of the low level wind shear alert system, and the system is operating successfully at the Air Force Station, Tambaram. DGCA has shown keen interest in this system and has asked NAL to examine the feasibility of installing this system at the airports in Bombay and Delhi.

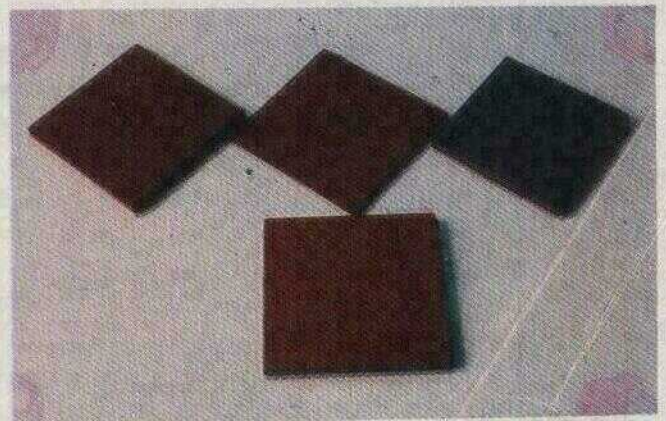
## 3.13 Materials

### 3.13.1 Glass-Ceramic Coatings

CGCRI standardized a process technology for coating mild steel reactors (40 litres) in the plant of M/s. Vani Fab Engineering Pvt. Ltd., Hyderabad. Technology transfer formalities are in process.

### 3.13.2 Ceramic tiles utilizing waste of iron and steel industries

NML has worked out a method to produce ceramic tiles utilizing three major waste materials of the iron and steel industries— ore slime, fly ash and blast furnace slag with some other alumino-silicate minerals. The tiles made by NML find industrial and domestic floor and wall applications in glazed and unglazed forms in different colours. The tiles have lower product cost, high strength and scratch hardness compared with commercially available tiles for similar applications. The technology was developed at laboratory scale and enough quantity of market size (4"x4") tiles were produced. The technology has also been scaled up to pilot scale. M/s Tata Iron & Steel Co. Ltd, and M/s Global Marketeers Ltd., Jamshedpur have sponsored this work.



II.9. Ceramic Tiles utilizing waste of Iron and Steel Industry

### 3.13.3 Refractory materials

Under the collaborative programme with Tata Refractories Limited, a project was undertaken for the manufacture of a 200 litres low



cement castables-based-ceramic pot for glass melting for Firozabad Glass Industries. Seven numbers of such pots have already been despatched to Firozabad for trial melting

Good quality superwhite and highly translucent bone china was developed at CGCRI, Naroda Centre, utilising exclusively the china clays available in the state of Gujarat. Whiteness and translucency of the developed body were comparable to those of the products made by the established manufacturers in the country and the body developed was found superior. The technology was transferred to M/s Madhusudan Tiles, Kadi, Gujarat, through a training-cum-demonstration programme conducted at the Naroda Centre.

#### 3.13.4 Materials Characterization

Consultancy was provided by NPL to the Department of Electrical and Computer Engineering, University of Waterloo, Ontario (Canada) in assessing stress levels in silicon single crystal wafers induced by polysilicon and low temperature oxide (LTO) films.

NPL has developed a chemical method to extract silver from waste hypo solution. The technology was transferred to two industrial units in Trivandrum and Faridabad.

#### 3.13.5 Metal Matrix Composites

A process for self lubricated aluminium alloy - graphite composites at 25 kg level developed in RRL(T) by the foundry route has been assigned to NRDC, New Delhi for technology transfer. Two private parties have approached NRDC for transfer. This composite can be used to replace phosphor bronze/brass in self lubricated applications and used for cylinder liners in automotive applications.

#### 3.13.6 Refractory Grade Magnesia from Bittern

Conventional technology for the preparation of this material uses sea water and limestone involving large quantity of sea water. In the CSMCRI process, bittern, which is otherwise a waste material of salt industry is used as the raw material. While refractory grade magnesia with MgO content of 97% had been reported developed earlier, the product could be improved significantly with MgO content upto 98.5%. An additional advantage of CSMCRI process is that down-stream recovery of potassium chloride of high quality is obtained as a by-product. Demonstration of the process for high quality magnesia to M/s Birla Percilase Ltd., Vishakhapatnam has been completed. The know-how is ready for transfer.

### 3.14 Building Materials

#### 3.14.1 EPS Door Shutters

EPS door shutters developed by CBRI are total replacements of wood shutters in buildings. The substitute looks like wooden flush type door is water-resistant, light weight, can be polished and painted in different colours to suit individual's requirements. They can be drilled, routed, planed and machined without splitting, splintering or chipping, with conventional carpentry tools. EPS composite is a sandwich consisting of modified medium density fibre sheet as facing material, medium density fibre sheet or rubber wood as framing material and self extinguishing grade expanded polystyrene sheet, or sheet developed by expanded polystyrene beads bonded with cashewnut shell liquid polymer as core material. The core along with facing and framing materials is bonded with the help of an adhesive developed at CBRI. EPS composite door shutters have been tested in the laboratory and have passed all the required tests. Twenty five door shutters were installed by the Central Public Works Department (CPWD) in their construction works at Delhi and a few by the



Institute at Roorkee to test their performance. All these door shutters were found to be performing satisfactorily and approved by CPWD for use in their construction activities.

### 3.14.2 Coir Fibre Reinforced Cement Board

The coir fibre reinforced cement board developed at CBRI is made of coir fibre — a by-product of the coir industry with ordinary portland cement as adhesive. The developed product is a wood substitute having superior water and fire resistant characteristics in comparison with commercially available resin bonded panels. The board can be used for partitioning, panelling and false ceiling. It can also be recommended for a number of other applications in building and furniture industries.

### 3.14.3 Coir-CNSL Board

This is a medium density fibre board with single layered flat, pressed class and a smooth surface, dark brown in colour and can be used in the building industry as a substitute for timber. The raw materials used are coir fibre and paraformaldehyde with cashewnut shell liquid as adhesive. The product (developed by CBRI) is environment friendly, cost effective, utilizes agro-wastes, and is a total replacement of wood. It has BIS: IS 3087 specifications for physico-mechanical properties, and has been patented.

### 3.14.4 Fibre Board

RRL(Jammu) transferred the technology for the production of 4tpd fibre board unit based on straw to a private party at Ludhiana. The unit set up at a cost of Rs.70.00 lakh went into production in May, 1994 with a capacity of producing 10,000 sq. ft. per day with an annual turnover of Rs.1.00 crore.

## 3.15 MACHINERY DEVELOPMENT

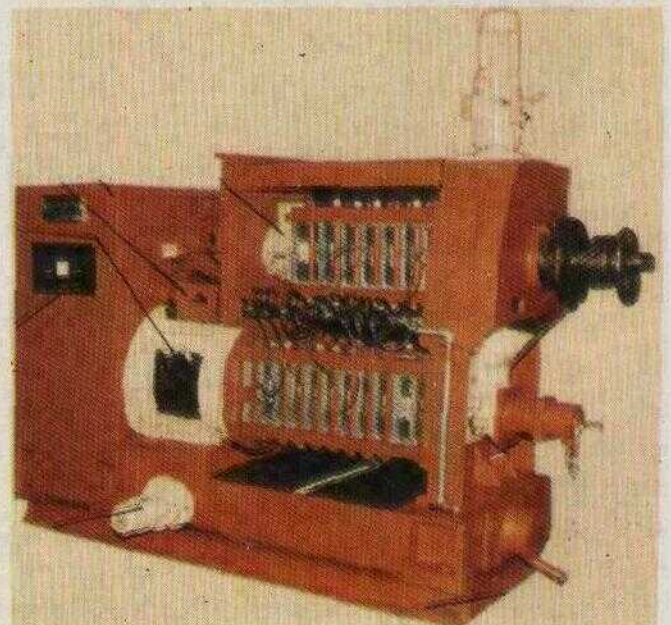
### 3.15.1 Modern Oil Expeller

Developed by the Ludhiana unit of CMERI, this machine comes in convenient capacities of

1/10/59 tpd for the efficient extraction of oil from mustard, groundnut, cotton and other oil-seeds. The design and manufacturing technology are ready for transfer.

Integrating a three stage continuous cooker, a variable speed quill worm gear box with hard faced worms, a water cooled chamber for efficient temperature control and high strength cage bars for greater wear resistance, the modern oil expeller enjoys performance features that are far superior in comparison to conventional expellers. The yield from the modern oil expeller is also better in terms of quality. Some of the outstanding features of the oil expeller are-

- Single pass crushing.
- High oil extraction efficiency and high oil recovery.
- Low power consumption and low operating costs.
- Lesser quantum of residual oil in the cake (6 percent with cooked and 7 percent with uncooked seeds).
- Improved pungency.
- Better quality of cake and oil.



11.10. Modern Oil Expellers



## 4. SOCIETAL PROGRAMMES

### 4.1 Rural Development

#### 4.1.1 Food Processing

The rural development programme of CFTRI envisages dissemination of simple agro and food conservation and processing technologies to the rural areas. Live demonstration and training in good manufacturing practices for economic and efficient utilization of locally available agro resources have been carried out. The trainees and beneficiaries included, over 2000 prospective young rural men and women drawn from 11 States. More than 60 technologies relevant to the respective areas were selected for the 65 programmes implemented during 1994-95.

#### 4.1.2 Slum Improvement Programme

NEERI adopted Ekatmata Nagar, a slum on the outskirts of Nagpur City, with a view to helping the weaker sections of the society in improving their quality of life. The slum provides shelter to about 1200 persons, most of whom are industrial workers. Deepening and desiltation of two existing dug wells, disinfection of water through pot chlorinators, construction of sanitary latrine with biomethanation system, construction of soak pit, medical check up, tree plantation, and environmental awareness programmes were carried out with the support of local social organisations.

A core group has been identified from the Institute and various voluntary organisations for effective implementation, follow-up, and regular monitoring of various activities undertaken in the project.

#### 4.1.3 Agro-economic Development

RRL Jorhat has taken up several societal programmes in different parts of North-East India, particularly amongst the weaker sections of the society, viz. among scheduled tribes, hill tribes etc. Mushroom is somewhat an unfamiliar

crop not very popular amongst the people of the region. RRL Jorhat has undertaken a series of training programmes on mushroom cultivation and provided high quality spawns for the growers. During the preceding year, 50 men and women were trained on mushroom cultivation resulting in generation of self employment and economic benefit to the growers.

#### 4.1.4 Java Citronella

RRL Jorhat continued to provide improved variety of Java citronella, Jorlab C<sub>2</sub> as well as other technical services to the interested growers. It is estimated that in North-East India about 450-500 tonnes of Java citronella oil is produced annually costing about Rs. 8-10 crore. The self-sufficiency in production of Java citronella oil in the country can be attributed to the efforts of RRL Jorhat. During the year, this agrotechnology was released to the Directorate of Horticulture, Nagaland and the Manipur Agro-Industries for large scale cultivation.

## 4.2 Allergens

CBT is a pioneer in making available extracts of indigenous allergens for diagnosis and immunotherapy of bronchial allergies. The allergen extracts are being provided to physicians and patients for diagnosis and immunotherapy. The Centre's scientists deliver lectures to create awareness about the diagnosis and treatment of respiratory allergies and effect of environmental pollution. The Centre has proposed the use of liposomes for safe and effective immunotherapy. Under a project from DBT, it was shown that liposome entrapped allergens protect the animals from shock after sensitization and challenge.

## 5. HUMAN RESOURCE DEVELOPMENT

### 5.1 Vocational Degree Programme in Footwear Technology

The CLRI and the Birla Institute of Technology & Science (BITS), Pilani have entered into a memorandum of understanding to launch

the Master of Vocational Science Programme in Footwear Technology with the following unique features:

- \* Modular in Structure
- \* Multiple entry and exit facilities
- \* Credit Accumulation
- \* Vocational training (1 year) as the foundation course
- \* Integration of Junior and Senior diploma courses into the degree module

The first batch of 12 students have been formally admitted into the course. This is the first degree programme in Footwear Technology in the country. The four years course curriculum consists of 42 modules covering mathematical, physical and chemical sciences, engineering, technology, humanities and management fields.

### 5.2 Industry Management Training Units

The Vaniyambadi Tanners Association (VTA) sought CLRI's accreditation and technical support for establishing a training facility for leather garments construction at Vaniyambadi. This is to provide training to the local youth before employment in the leather garment units. The National Leather Development Programme (NLDP) came forward to partially finance the equipment cost. The centre started functioning in December 1994 with a 2 module certificate programme. The annual intake of trainees is 48. The CLRI inputs include curriculum and syllabus formulation, training of trainers, technical supervision during the entire training period and holding examinations.

### 5.3 Rural Training Units for Women

As a special gesture to enhancing the employment potential to the rural women, CLRI has offered special technical assistance to leather goods training unit at Kundrakudi and tanning training facility at Kallupatti in Tamil Nadu. Both facilities are managed by non-governmental voluntary agencies. Partial financial support

is provided through NLDP and CSIR Action Programme for rural women.

## 6. BASIC RESEARCH

### 6.1 Physical Sciences

#### 6.1.1 Helium Studies

Detailed Helium emanometric studies were carried out by NGRI over the segments near Kadoli forming a part of the 15 km long NNE-SSW oriented set of fissures that were developed due to the Koyna earthquake. The studies show significant soil-gas helium anomalies right over the fissures. Also the anomalies were found to be unique, in that, many other fissures/fractures other than this set do not show any helium anomaly at all. Helium studies have thus thrown light on the fissures as an expression of the faulting associated with the Koyna earthquake.

#### 6.1.2 Gravity studies

Gravity survey around the Ramgiri schist belt conducted by NGRI shows the presence of parallel gravity 'high' axis to the west of Ramgiri schist belt suggesting probably the extension of the Sandur schist belt towards south parallel to Ramgiri schist belt. These studies will be useful for future minerals exploration.

#### 6.1.3 Velocity structure of NE Region

A detailed analysis of the seismic data from the NE region, collected by NGRI during Feb-May 1993 has brought out a comprehensive picture of the prevalent seismicity in this region. The studies reveal: (a) absence of seismic activity along the Dhauki fault, which was earlier considered as active seismic zone; and (b) presence of seismic activity along Chederang fault and Manipur region.

#### 6.1.4 Antarctica Expedition

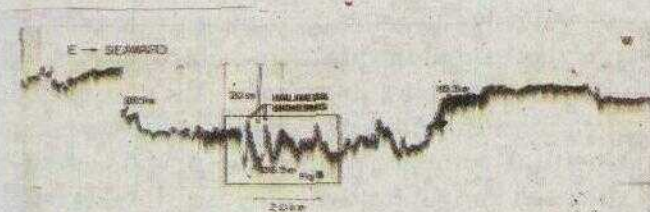
NPL has been a major participant in all the scientific expeditions to the Antarctica and has



carried out activities in respect of studies involving planetary boundary layer, greenhouse gas concentration and trends for  $\text{CO}_2$ ,  $\text{CH}_4$ ,  $\text{N}_2\text{O}$ ,  $\text{O}_3$  and UV-8 radiation. A microwave experiment to monitor the atmospheric ozone concentration round the clock was taken up. Atmospheric monitoring and budget estimate specially of greenhouse gases from different sources including biomass burning, paddy cultivation and wetland, is being carried out to assess their impact on atmospheric chemistry and global climate change under the International Geosphere-Biosphere Programme.

### 6.1.5. Geological Oceanography

On the western outer continental shelf, "the Fifty Fathom Flat-" a drowned carbonate platform of late Quaternary Halimeda Bioherms and aragonitic faecal pellet dominated sediments was discovered by NIO. This platform is unique because the carbonate depositional environment prevailed until early Holocene in spite of its proximity to major siliciclastic tidal embayment. Echograms revealed buried pinnacles and 2 to 14 m high pinnacles on the platform. This is the fourth discovery of Halimeda Bioherms in the world oceans, formed during the quaternary.



### 11.11. Halimeda

## 6.2 Chemical Sciences

### 6.2.1 Multiple Quantum and Solid State NMR Spectroscopy

Investigations were performed on multiple quantum NMR spectroscopy involving spin-1 nuclei and / or spin-1 mimics. It was established that one - spin double quantum coherence in such systems exhibits multiplet structure with

resolution enhancement ranging from 4 to 6.67, offering a unique possibility to measure unresolved couplings. Further, a novel scheme was developed to separate one -spin and two-spin double quantum coherences in such systems, based on their quadrature phase relationship under preparation and reconversion.

Work carried out on solid state NMR in a host lab resulted in the development of a novel experiment for investigation of quadrupolar nuclei; this results in resolution of double quantum chemical shifts and their sitewise correlation with quadrupolar couplings.

### 6.2.2 Polypyridyl Based Supramolecular Metal Complexes

Low temperature photolysis and stopped flow experiments with schiff base ligands revealed a reversible photoisomerisation and ligand centred photoreaction. A number of CO (III) -dipeptide complexes having pyridine/imidazole/2,2'-bipyridine, etc. in the coordination sphere have been synthesized and characterized. Photochemical properties on Ni (II)-porphyrin and Ni(II)- $\text{N}_2$  macrocyclic complexes have been studied. Photochemical studies of Mn (III) complexes were performed with a view to understanding the role of Mn-centre in Photosystem-II, while investigations on Co-complexes can help us to model Vitamin  $\text{B}_{12}$  and also to design new biologically important pepsidic ligands.

Photophysical properties of a new trinuclear photoactive (Ru-polyphridyl complex  $\text{A}_2\text{B}$  type) antenna molecule reveal an energy transfer path for emission quenching. A new mixed-ligand tetra-nuclear Ru(II)-polypyridyl complex using 1,10-Phenathroline derivative (having  $\text{N}_8/\text{N}_{10}$  co-ordination site) has been synthesised and characterized. The photoelectrochemical behaviour of a new photovoltaic cell, incorporating synthetic porphyrin and quinone in a stationary state on an optically transparent conducting glass, has been studied. It shows maximum efficiency with  $\text{K}_4\text{Fe}(\text{CN})_6$



as electrolyte. The polarity difference in O<sub>2</sub> atmosphere unveils a new mechanism for PEC behaviour.

A number of dinuclear Ru(III)- complexes have been synthesised with an aim to study the interaction between the two redox active centres and for designing molecular sensor. Dinuclear Rh(I)- complexes have been synthesised with a hexadentate ligand to study their reactivity towards small molecule and also to examine their oxidative addition reaction. This could be used to design important catalysts.

### 6.2.3 Solution Hydrogenation of Chloroprene Rubber using a Wilkinson Catalyst

Hydrogenation of elastomers bearing unsaturation is of both fundamental and practical interest, as it offers a unique method for the synthesis of polymers with unusual monomer sequences, which are otherwise difficult to prepare by direct polymerization. Hydrogenation also improves certain elastomer properties. The study at NCL of the catalytic hydrogenation of chloroprene rubber (CR) yielded a product with a predominantly linear polyethylene sequence with monomer proportions of alt(ethylene-co-vinyl chloride) copolymer. There is no prior report on the hydrogenation of CR.

### 6.2.4 Oxidative Coupling of Methane to Syngas and Reforming of Methane

A nickel-based catalyst was developed for the oxidative methane-to-syngas conversion, with very high conversion and selectivity, and productivity with respect to CO and hydrogen. The conversion process can be operated by the coupling of the endothermic steam and CO<sub>2</sub> reforming with the exothermic oxidative conversion reactions over the same catalyst. The process is highly energy efficient and safe, needing little external energy.

### 6.2.5 Selective Oxidation of Arylamines to Azoxybenzenes over Zeolites

A catalytic version of H<sub>2</sub>O<sub>2</sub>-TS-1 combination was shown to display a good reaction se-

lectivity in the liquid-phase oxidation of anilines to symmetrical azoxybenzenes. Most of the studies on this oxidation, reported so far, are non-catalytic and the product range corresponds to various oxidation states depending upon the nature of the reagent used. The catalytic study at NCL has demonstrated the novelty of TS-1 catalyst, which exercises unique selectivity in the oxidation of anilines with dilute H<sub>2</sub>O<sub>2</sub>.

### 6.2.6 Spontaneous self-organization and Ion Exchange in LB Films

The incorporation of anions in amine films showed their potential for use as precursors for ultrathin oxide films. Anions such as [PT(C1)<sub>6</sub>]<sup>2-</sup> and [So<sub>4</sub>]<sup>2-</sup> were successfully incorporated in long chain amine films. These films also showed a characteristic lamellar structure. Ultrathin TiO<sub>2</sub> and ZrO<sub>2</sub> films were grown from thermally evaporated Langmuir-Blodgett (LB) film precursors. Patterned ultrathin oxide films with potential industrial application were prepared by the thermal evaporation technique.

### 6.2.7 Studies Towards Vancomycin and Related Cyclic Peptides

Studies directed towards total synthesis of vancomycin and related glycopeptides resulted in several breakthroughs in basic research efforts. vancomycin, in recent years, has been of much interest to organic chemists in view of its structural complexity and biological activity. Although known for over 30 years, total synthesis of any member of this family has not been achieved. However, several reports on synthesis of simple segments of vancomycin have appeared. Major obstacles eluding success in the total synthesis of vancomycin, are the synthesis of biaryl diamino diacid constituting the AB segment and the methodology for the construction of CDE by biaryl ether cross linked amino acid segment. Several methods have been reported for the formation of biphenyl ether linkages, by adopting either Ullmann reaction or thallium trinitrate oxidative coupling. These approaches are not suitable for the synthesis of vancomycin.

IICT has developed a conceptually different process for the construction of biphenyl ether linkage suitable for the synthesis of isodityrosine derived cyclicpeptides such as K-13 (33) and biphenyl ether cross linked amino acid present in glycopeptides. Basically the approach features displacement of bromine atoms of 2,6-dibromo-1,4 benzoquinone with phenolic derivatives providing mono- or diaryloxy benzoquinone in good yield. Subsequent manipulations of the benzoquinone skeleton to the corresponding aryl amino acid has been achieved by palladium catalysed aryl triflate reaction with allyl or vinyl tributyltin and further functionalisation to complete the synthesis of K13 or the CDE segment of vancomycin.

Stereoselective synthesis of beta-hydroxyaryl aminoacids constituting the C and E rings of vancomycin has also been achieved by benzylic oxidation and asymmetric dihydroxylation as key steps. Finally vancomycinic acid moiety (CDE) of vancomycin was synthesised by making efficient use of nucleophilic displacement of halides 2,6-dibromobenzoquinone followed by a diastereoselective elaboration of the quinone into the arylglycin unit.

#### **6.2.8 Novel Route to Beta-Thymidine : A Precursor for Anti-AIDS Compound AZT**

Beta-thymidine is the key intermediate for the commercial synthesis of AZT (30) and other anti-AIDS drug, B. T.

Although several processes are reported for the production of beta-thymidine, only one approach starting from D-ribose is accepted. During studies on 2',3'- dideoxynucleosides, IICT discovered a novel rearrangement by serendipity leading to the formation of beta-thymidine starting from an inexpensive D-xylose. This approach was optimized on a bench scale. The process for AZT was given to M/s. CIPLA who have commercialised its synthesis in this country. IICT also carried out the conformational studies on AZT and its deuterated analogues.

#### **6.2.9 Chemical Oceanography**

Extensive observations were made on  $N_2O$  concentrations and of the dual stable isotopic composition of  $N_2O$  in the Arabian Sea and the eastern tropical North Pacific. In the suboxic waters of the studied regions, the values of  $^{15}N$  and  $^{18}O$  increased in a linear manner with one another with decreasing  $N_2O$  concentrations probably reflecting the effects of denitrification. Results suggest that the ocean could be an important source of isotopically enriched  $N_2O$  to the atmosphere.

#### **6.3 Biological Sciences**

##### **6.3.1 Molecular Basis of Cytoplasmic Male Sterility in Rice and Sorghum (NBRI)**

This project aims at understanding the factors governing cytoplasmic male sterility and fertility restoration in rice and sorghum through studies on the genome organization, gene expression and biochemistry of mitochondrial function in the sterile and fertile lines.

In the earlier studies, characterization of mt DNA of V20A (male sterile) and V20B (maintainer fertile) lines of rice showed polymorphism in gene location of *cox1*, *cob*, *atp6*, *coxIII* and *rps 14* genes. In the period under report, these studies were extended to other male sterile lines and their hybrids, viz., 62829 A, B and their hybrids CORH 1 and 58025 A, B and restorer lines. In all these cases the cytoplasm is WA type. In these lines also polymorphism in *atp6*, *coxIII*, *cob*, *rps 14* was observed by Southern analysis. In addition, polymorphism in *orf156* whose function is not yet known was observed. More interestingly, Northern analysis demonstrated differences in transcript sizes of *orf156* but not in case of other genes. For *orf156*, a transcript of 1.1 kb was observed in A lines of rice in addition to the transcript of 0.7 kb which is also present in the maintainer fertile lines. The 1.1 kb transcript is also present in the hybrid line. In order to determine if the additional 1.1 kb transcript of *orf 156* present in A



lines results in an altered orf156 polypeptide, a western blot of total rice mitochondrial proteins was probed with anti-orf156 antisera. An orf156 specific polypeptide in the 16-20 kDa region was observed. However, there was no difference between the A and B lines. Further studies at the flowering stage would be necessary to investigate if tissue specific differences in the expression of orf156 exist.

The polymorphic *atp6* gene was also cloned and sequenced from V20B.

In sorghum, studies on A2 and A3 groups have been initiated.

Polymorphism in *atpA* by Southern analysis and difference in transcript sizes by northern analysis were observed in the male sterile and fertile lines of A<sub>2</sub> types but not in the A<sub>3</sub> groups. Studies on the nuclear *atpB* gene in sorghum have shown the presence of two transcripts of sizes 3.0 kb and 2.1 kb for this gene. Work on the characterization of these transcripts is underway.

### 6.3.2 DNA Fingerprinting and Analysis of Biodiversity in Amaranths (NBRI)

The project envisages assessment of genetic diversity in plants in general and Amaranths and Neem in particular, using the powerful molecular techniques, such as, DNA Fingerprinting and Random Amplified Polymorphic DNA (RAPD). 15 to 20 different genotypes of each species will be analysed using the above mentioned techniques.

The studies in Amaranths with DNA fingerprinting have revealed the presence of several repetitive sequence families. The oligonucleotide fingerprinting probes have revealed specific patterns such that as many as 6 species and 8-10 cultivars of Amaranths can be distinguished from each other preliminary trials with (GAA)<sub>n</sub> as a primer in RAPD analysis have revealed distinct amplification profiles for 15 Amaranth DNAs. Similar studies have been initiated in case of Neem.

In another study, a survey was made to identify repeat families in Amaranths using restriction endonucleases. Two restriction enzymes, BamHI and EcoRI have revealed several prominent bands indicative of discrete repetitive families. Attempts are now being made to clone and identify species specific repetitive sequences from among these repetitive sequence families.

### 6.3.3 Development of Transgenic Cotton Varieties Improved for Resistance to Cotton Bollarworms (NBRI)

The aim of the project is to develop transgenic plants of cotton carrying *o*-endotoxin coding genes of *Bacillus thuringiensis* to impart resistance to feeding damage by the larvae of bollworms.

Nearly 50 Ro transgenic plants of tobacco carrying chimeric *cryIA(c)*-like gene were evaluated for resistance to feeding damage by the newly emerged larvae of *Spodoptera litura*. The promising plants were selfed to obtain F<sub>1</sub> seeds. Transgenic F<sub>1</sub> plants were then selfed to obtain F<sub>2</sub> seeds, on the basis of kanamycin resistance of resistance of F<sub>2</sub> seeds, homozygous F<sub>2</sub> plants were examined for insect resistance and for the amount of *o*-endotoxin in leaves by double sandwich ELISA. Plants that retarded the growth of *Spodoptera* larvae and caused mortality in newly emerged larvae were found to express *o*-endotoxin at leaves of 1 to 10 ng per g wet weight.

Several varieties of cultivated Indian cotton were screened for their ability to grow callus, induce organogenesis and somatic embryogenesis. A protocol was developed for multiple shoot induction from cotyledonary nodal axis of cotton.

### 6.3.4 The smoke-cataract connection (CCMB)

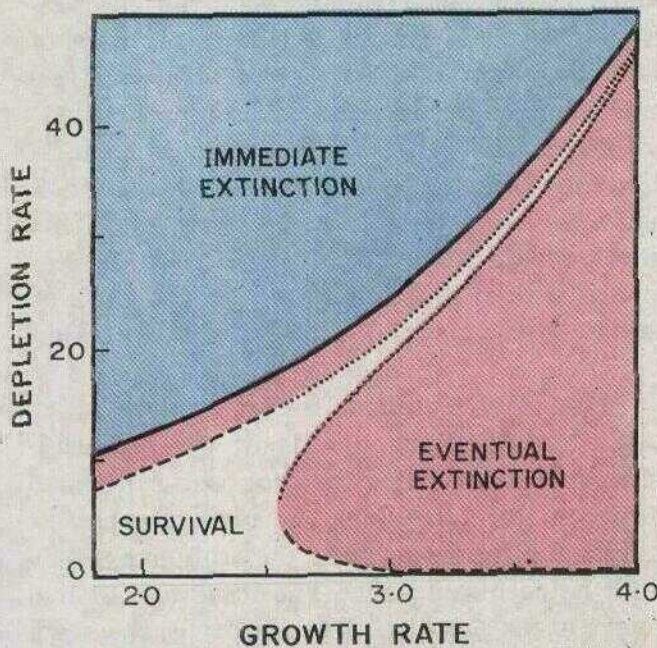
The connection between smoke and increased vulnerability to cataract of the eye lens has been established. Polycyclic aromatics and trace metals present in the smoke condensate



solutions are rich sources of reactive oxygen species which cause oxidative damage to the eye lens cell membranes, cytololic proteins and to the epithelial cell DNA, leading to accumulated damage and results in lens opacity. Smoke constituents also alter the transmembrane uptake of material by damaging the transport pumps therein.

### 6.3.5 Dynamics of Extinction in a Simple Ecological Model (CCMB)

Studies on natural populations and harvesting biological resources have led to the view, commonly held, that (a) populations exhibiting chaotic oscillations run a high risk of extinction; and (b) a decrease in emigration/exploitation may reduce the risk of extinction. An ecological model with emigration/depletion, developed at the CCMB, shows different behavioural patterns and indicates that population growing beyond a critical rate can persist within a band of high depletion rates, while extinction occurs at lower depletion rates. Though prior to ex-



II.12. Graph showing the Regions of Survival and Extinction Predicted by the Dynamic Ecological Emigration/Depletion Model, developed by the CCMB.

inction at lower depletion rates, the population exhibits chaotic dynamics with large amplitudes of variation and very low minima, at higher depletion rates the population persists at chaos, but with reduced variation and increased minima. For still higher values, the dynamics show period reversal, leading to stability. It appears that chaos per se does not necessarily lead to population extinction. These findings could have important implications in population growth studies and development of strategies for the management of dwindling biological resources.

### 6.3.6 Ribonuclease inhibitor (CCMB)

A cost-effective method has been developed for the production of the ribonuclease inhibitor, RNA sin. The material has been handed over to a commercial firm for marketing.

### 6.3.7 Detection of Hepatitis C virus (CCMB)

A reverse transcriptase polymerase chain reaction (RT-PCR) method has been developed to detect the presence of the hepatitis-C virus (HCV). Peptides for sensitive peptide ELISA assays have also been synthesised for detecting HCV antibodies. These techniques succeed where commercially available immuno-diagnostic kits are not of particular use.

## 6.4 Engineering Sciences (SERC-M)

### 6.4.1 Development of Parallel Processing Techniques for Dynamic analysis

A concurrent approach for nonlinear transient dynamic analysis employing implicit time marching scheme has been devised at SERC, Madras and implemented on transputer based message passing system. The approach is based on domain decomposition and the solution of semi-discrete equations are localised to individual subdomains. The computed results at the interface boundaries are suitably averaged out



employing 'weighted mass averaging scheme'. The significant advantage of this approach is the explicit nature of interprocessor communications. An alternative approach by imparting parallelism through matrix splitting for nonlinear transient dynamic analysis employing implicit time marching scheme has been devised and is being implemented on transputer networks. The concurrent approach also maintains the explicit nature of interprocessor communications. The 'greedy' algorithm and also the ANN algorithm for automatic mesh partitioning have been implemented in an user-friendly windows environment. Parallel algorithms/codes for sensitivity analysis with truss and shear panel elements have been developed and implemented on transputer networks. Buckling constraints conforming to different codal provisions have been added to truss and shear panel elements.

#### **6.4.2 Nonlinear Analysis of Reinforced Concrete Plate and Shell Structures (SERC-M)**

Using eight/twenty noded isoparametric solid element, a computer program for nonlinear dynamic analysis of reinforced concrete plate/shell structures is being developed at SERC, Madras. Newmark's method is used for time and the Newton-Raphson method for iterative solution. Facility for automatic discretisation of standard forcing functions for the specified number of time steps has been incorporated in the program. Facilities are also provided for modelling arbitrary time varying loads, such as, wind and seismic loads. Lumped as well as consistent mass schemes are incorporated to account for inertial forces and damping is represented by Rayleigh damping. The concrete material in compression is modelled using elasto-visco plastic constitutive law which takes into account compression softening. To account for the dynamic behaviour, the strain rate sensitivity and progressive degradation of compressive strength are included in the material model. This program is being validated by analysing standard problems reported in the literature. Eight/Twenty noded solid element can be used for

modelling ring beams, foundation mats and thick shell structures.

## **7. RESEARCH SUPPORT ACTIVITIES**

### **7.1 National Facilities**

#### **7.1.1 Strain Bank**

A strain bank has been established as a national facility in IICB for the cryopreservation of as many *Leishmania* strains as possible to serve as a resource base for fundamental and applied research on leishmania strains.

## **8. SURVEYS & ANALYTICAL STUDIES**

### **8.1 Geophysics**

For the Gas Authority of India Limited (GAIL) NGRI completed a feasibility study for laying submarine gas pipe line of 891 km length from Chah Bahar on the SE Iranian coast to Jhakau in India through Pakistan (outer boundary of the territorial waters). The bathymetry data from the National Geophysical Data Centre (NGDC), USA were collated with the bathymetry data picked up from hydrographic maps of the area. The NGDC Data alone will have less control for the preparation of detailed bathymetry maps. The data from Hydrographic charts filled the existing gaps and the resultant maps/charts are more reliable and improved. NGRI collected data from ONGC. The three dimensional sea floor maps prepared on the basis of the data give a clear cut idea about the terrain.

The final technical report submitted to GAIL, contained the details of the tentative favourable corridor for the proposed pipe line, the depth through which the pipe line has to traverse at different sections, the problems which might be accounted etc. The total cost of the project is Rs. 6 lakhs. The report is the seed document to start the process of planning for detailed work necessary for the actual laying of pipe line.



NGRI undertook an integrated geophysical survey in Saurashtra using: (1) Controlled Source Seismic Survey, (2) Gravity survey and processing of existing gravity data with ONGC, (3) Magnetotelluric method and (4) Deep electrical soundings.

NGRI played a significant role in: data acquisition in a large area of approximately 40,000 sq km under difficult field conditions; development of special processing and interpretational tools suitable for the specific geological problems; and integration of results from different geophysical methods in order to converge on a specific basement model.

The study was based on different geophysical data to understand structural and tectonic settings in the Saurashtra Peninsula, and to delineate the basement configuration and thickness of pretrappean sediments. The project is vitally important for oil exploration in the area.

As of now, the surveys completed include 3000 (out of a total of 10,000) gravity measurements, 200 line-km of seismics (out of 800 line km) 155 magnetotelluric soundings (out of 600), and 30 deep electrical soundings (out of 50). This special project was sponsored by ONGC at a cost of Rs. 690 lakhs. The survey will provide prospective zones delineating sediments below the trap where oil exploration can be undertaken in future.

## **9. TECHNICAL SERVICES, TESTING & EVALUATION and PRODUCT EVALUATION**

### **9.1 CAD (Footwear) Facility**

In order to extend the CAD services to its clientele in Kanpur, CLRI has set up new computer facilities from Microdynamics (USA) at its Kanpur Regional Centre with the financial support from NLDP. A three week awareness programme was launched in February 1995 for the local footwear industry. The technical services have since commenced. The CAD facility

consists of an engineering workstation for pattern generation and grading and a mini cutter for providing paper patterns to the users.

### **9.2 Food**

Samples of export oriented fruit and vegetable products ( 342 in number) were analysed for conformation to the FPO standards, buyers' specifications and export certification. This service was provided to the Ministry of Food Processing Industries, Govt. of India.

Technical information based on analysis of samples of food articles numbering 4850 referred by Customs and Trying Courts was provided to the judiciary. Particulars of adulterants and contaminants noticed in the samples were brought to the notice of the Director General of Health Services (DGHS) to ensure safety of customers. Samples of food and food products numbering 1383 were analysed for accurate nutritional labelling.

### **9.3 Trisonic Wind Tunnel**

The 1.2m trisonic wind tunnel completed a total of 20,000 blowdowns with the completion of about 1270 blowdowns during the year. Various tests in the tunnel provided valuable data for different national aerospace programmes. Notable among these are the studies carried out in combat aircraft models to investigate the effects of failure of leading edge slates and studies on PSLV models to assess effects of protrusion and aerodynamic characteristics. The calibration exercise on the 1.5m low speed wind tunnel continued during the year.

### **9.4 Vibration and Dynamic Response of Frame Structures of Two wheelers**

SERC (M) carried out investigations on vibration of ASTRA-VMX moped frame and XLS scooty frame (two wheelers), for M/s. TVS Suzuki Ltd., Hosur. Free vibration analysis and the dynamic analysis of engine induced vibration were carried out to determine the response of



the vehicle at various engine speeds. Experimental investigations were conducted at Hosur, using strain gauges for static loads and accelerometers for dynamic tests. Based on these investigations, SERC (M), gave recommendations for modifications in the frames of the two wheelers for enhancing their performance.



11.13. *Vibration Investigations on a Moped Frame (SERC, Madras)*

### 9.5 Concrete Quality of Structures of Kaiga Power Plant

SERC (M) conducted investigations on the quality of concrete in the containment of the Kaiga Plant under construction for the Nuclear Power Corporation. These included detailed insitu non-destructive tests and load tests; the wall portion had a surface area of approx. 150 sq. m. and the testing was carried out at 3000 locations. The floor slab of the turbine building was subjected to a load of 135 tonnes and analysed as per BIS codal guidelines. Based on these investigations an assessment report was given to the Nuclear Power Corporation.

### 9.6 Development of Software for Analysis and Design and Draughting of Transmission Line Towers and Foundation

M/s. Electrical Manufacturing Co. Ltd., Calcutta, requested SERC(M) to develop a software for analysis, design and draughting of three

types of transmission line towers, given the basic inputs of line voltage, conductor size, terrain category, etc. The work included developing modules for analysis, design and draughting, covering single circuit barrel, double circuit barrel and corset towers. The customised software developed with user-friendly interface features is portable on PC platform and will be of considerable help in generating efficient and economical designs and meeting specific needs.

### 9.7 Tower Analysis, Design, and Testing

SERC has developed expertise for the analysis and design of transmission line towers upto 800 kV capacity of the following types: self supporting towers, guyed towers, and chainette towers. During the year, 19 towers ranging from 3 kV to 400 kV were tested for the industry. This includes an 80 m Microwave tower with triangular base using tubular and angle sections. An MoU has been signed with M/s Triveni Structurals Limited, for the development of self-supporting and guyed towers for 400 kV and 800 kV transmission. Among the consultancy projects completed are: checking the design of a 400 kV single circuit guyed tower, investigations on the load-capacity of 80 m microwave tower, insulator strings, measurements of strain in the members of a 312 kV tower, and checking the design of 15 m and 40 m towers for the Telecommunications Department.

## 10. INFORMATION DISSEMINATION

### 10.1 INSDOC

SAARC Documentation Centre (SDC) set up at INSDOC for exchanging S&T information among SAARC nations, has started functioning. SDC is conducting training programmes for developing expertise in SAARC nations. Three participants from Bangladesh, Sri Lanka and Maldives have attended a 12 week attachment training programme. Another five participants from Bangladesh (2) Nepal (1) and Sri Lanka (2) have attended a 4 week short term course on computer applications to library and information activities.



During 1994-95, a total of 21084 document copy orders were registered and 14005 supplied as against 19913 orders registered and 16259 supplied during 1993-94.

The Scientific and Industrial Research Network (SIRNET) is registering a slow and steady growth. The number of nodes have risen to 126 as compared to 107 in 1993-94. A total of 71204 E-mail messages were passed on SIRNET.

Orders for online search of literature have been maintained at more or less the same level. The number of online literature search orders in 1994-95 was 478 as compared to 511 in the previous year.

The Contents Abstracts and Photocopy Service (CAPS) is slowly becoming popular among the R&D community of the country. The number of customers was 660 in 1994-95 as compared to 401 the previous year.

## 10.2 PID

PID publishes twelve scholarly journals in English in different areas of science and technology, viz. Journal of Scientific & Industrial Research (JSIR), Indian Journal of Chemistry-Sec-A (IJC-A), Indian Journal of Chemistry-Sec. B (IJC-B), Indian Journal of Pure & Applied Physics (IJPAP), Indian Journal of Chemical Technology (IJCT), Indian Journal of Engineering and Material Sciences (IJEMS), Indian Journal of Experimental Biology (IJEB), Indian Journal of Biochemistry & Biophysics (IJBB), Indian Journal of Radio & Space Physics (IJRSP), Indian Journal of Marine Sciences (IJMS), Indian Journal of Fibre & Textile Research (IJFTR) and Research & Industry (R&I).

These are front-ranking Indian journals and receive contributions from all over the country as well as abroad. They are a part of the mainstream of international scholarly communication network covered by leading abstracting current awareness services and databases.

During 1994-95, all the journals were brought out on or before their scheduled dates. A number of special issues on themes of contemporary relevance were also brought out. These are Conducting Polymers (IJC-A, June 1994), Man-Machine Interaction: Operation Support Systems (JSIR, July 1994), Condensed Matter Physics (JPAP, July 1994), Contemporary Indian Biochemistry (IJBB, August 1994), Recent Advances in Fabric Forming (IJFTR, September 1994), and Light Wave Systems (JSIR, January 1995). The journals collectively published 1502 articles running into 7851 pages.

A significant development was the signing of an agreement with the following information services for grant of non-exclusive rights to reproduce and distribute: Centre for Agriculture and Biosciences International, UK (for IJEB), Materials Information, USA (for IJPAP, IJT, JSIR and IJC-A) and Dynamic Information Corp. USA (for IJEB, IJMS, JSIR and R&I). In addition, an agreement was signed with Kessler Hancock Information Services, Inc. USA, permitting it to act as PID's non-exclusive agent for grant of licences for reproduction in print form for licencees' internal use, articles/chapters of all journals and monographs published by PID. PID is also continuing with the agreements signed earlier with: Institute for Scientific Information, USA; The Uncover Company, USA; University Microfilms Inc. USA; CAS Document Delivery System, USA; and REED Reference Publishing, USA.

Under a new scheme introduced during the year, Advance Abstracts of the forthcoming issues of the PID journals are sent to editorial departments of Nature, New Scientist, Chemistry in Britain, etc., for possible coverage in the "News and Views and equivalent sections of the respective journals, in addition to the various abstracting and current awareness services, for their early coverage.

PID also publishes a Hindi journal, Bharatiya Vaigyanik Evam Audyogik Anusandhan Patrika, which covers original

research work in all disciplines of S&T. This journal published 25 papers running into 170 pages during the year. The December 1994 issue was a special number on "Paryavaran Jeev Mandal Samrakshan".

#### 10.2.1 Wealth of India

The publication 'The Wealth of India - Raw Materials (WOI) series' has been a major activity of PID. So far, eleven volumes and two supplements (containing 1991 articles covering 5000 plant species, 48 animals and 74 minerals) of the original series and three volumes (covering alphabets A - Ci) have been brought out.

With the participation of PID in the IDRC (International Development Research Council, Canada) - sponsored international collaborative programme on 'Asian Health, Environmental and Allied Databases' (AHEAD), since 1993, Wealth of India has become the nucleus of PID's contribution on Indian raw materials to AHEAD.

#### 10.2.2 Popular Science Journals

The popular science journals of PID, viz. Science Reporter (SR, English monthly), Vigyan Pragati (VP, Hindi monthly) and Science Ki Duniya (SKD, Urdu quarterly) continued to enjoy good circulation (SR-47000, VP-80,000 and SKD-9000). Extra (in addition to 12 monthly issues) issues of SR and VP were brought out as 'Festival Issues', in November 1994, which in spite of their higher prices, had a good sale (SR-20,000 copies and VP-32,000 copies).

#### 10.2.3 Syndicated Feature Service

The PID Syndicated Feature Service aims at making the educated layman aware of the latest developments in S&T through the science columns of seven small and medium newspapers. A package of one article and 3-4 snippets is supplied to the subscribers of this service, every fortnight, against a nominal annual fee.

During 1994-95, about 24 articles and 96 snippets were supplied to the subscribers of this service, viz. Business Standard (New Delhi), Deccan Herald (Bangalore), M.P. Chronicle (Bhopal), Hitavada (Nagpur), Tribune (Chandigarh) and Lokmat Times (Aurangabad). Also, an equal number of exclusive articles and snippets were supplied to Free Press (Indore), under a special arrangement.

#### 10.2.4 Co-publishing

As a step towards globalization of its publications, PID signed, in 1993, an agreement for co-publishing, marketing and translation of books and journals with Wiley Eastern Ltd. which has a well established marketing network in India and abroad.

#### 10.2.5 Status Report

A Status Report on Science & Technology in India: 1994 was brought out on behalf of CSIR. It was presented at the Association for Scientific Co-operation in Asia and the Commonwealth Science Council Conference held during the year.

#### 10.2.6 MAPA Database

The Medicinal and Aromatic Plants Abstracts (MAPA) database provides coverage of the world literature on all aspects of medicinal and aromatic plants. The data from 1988 onwards have been computerized and are available for on-line search. This database also forms one of the components of the PID contribution to the IDRC - sponsored international collaborative project on CD - ROMs of Asia Health, Environmental & Allied Databases.

An important information product of the database is the bimonthly abstracting journal Medicinal and Aromatic Plants Abstracts (MAPA), which is being brought out since 1979. During 1994-95, all the six issues of MAPA were brought out as per schedule, having collectively



published around 3800 abstracts. A cumulative index for 1994 was appended to the December 1994 issue.

#### **10.2.7 Production and Consultancy Services**

The designing, layout graphic art, composing, production and printing facilities available at PID enable the Directorate not only to carry out in-house jobs but also take up similar specialized jobs for outside agencies.

During 1994-95, apart from the production/printing of its own publications, PID undertook 113 jobs pertaining to the publication of other organizations of which 67 were from CSIR institutions and 46 from non-CSIR institutions. The total number of pages printed was around 35,400 (4 colour, 2 - colour, B&W). The non-CSIR institutions whose publications were printed at PID during the year, include: IAMR, ICAR, INSA, DST and DOD.

#### **10.2.8 Training Programmes**

With a view to augmenting the number of trained science communicators in the country, PID conducts, on a regular basis, training programmes on various aspects of science writing and publishing. The most recent programme was on 'Writing a Scientific paper' held from 17

to 21 November 1994. It focused on basic elements of a research paper and the various problems faced by the young research workers. Fourteen research workers from universities and R&D organizations attended the programme, faculty for which was drawn from PID.

As an off-campus centre of the Birla Institute of Technology & Science, Pilani, PID is running an M.Phil Course in Science Communication and Journalism viz, PID-BITS collaborative programme on Human Resource Development in the Area of S&T Communication. The first batch comprised of three students (all from PID) who had completed two semesters of study.

#### **10.2.9 CD-ROM of Asian Health, Environmental & Allied Databases (AHEAD)**

Launched in 1993, AHEAD is an IDRC-sponsored international collaborative project the aim of which is better dissemination of health, environment and natural resources-related information from Asian region and transfer of CD-ROM publishing technology of the participating organizations of the project. PID is the Managing Organisation of the project with the responsibility of management of the project, including marketing of the CD-ROM products.

# 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 centres, various R&D and 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 private sector 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; Customs Duty Exemption for SIROs; 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; International R&D collaborations; 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.

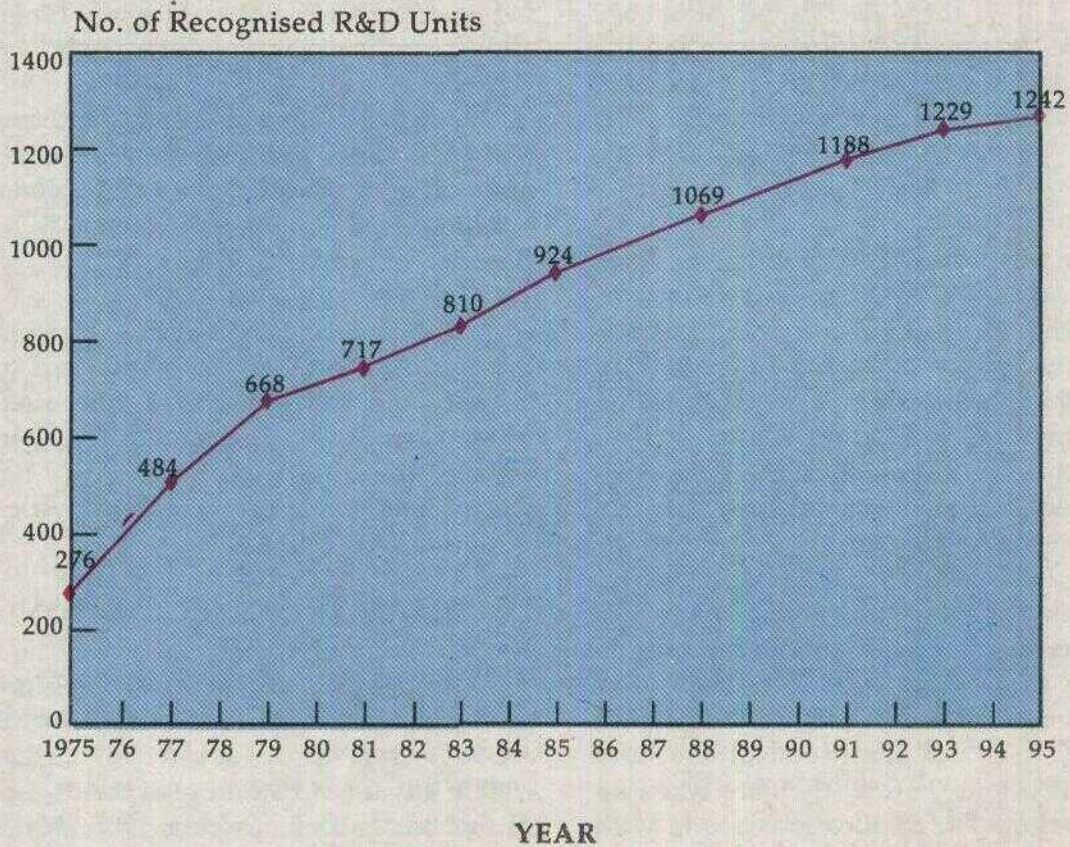
The In-house R&D units qualifying for recognition are expected to be engaged in research and development activities related to the manufacturing activity of the firm. For this purpose R&D would include: efforts for development of new technologies, design and engineering, process/product/design improvements, 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



## In-house R&D in Industry Incentives and Support Measures

- \* Income Tax Relief on R&D Expenditure
- \* Weighted Tax deduction for Sponsored Research
- \* Financial Support for R&D Programmes
- \* Accelerated depreciation allowance on Plant and Machinery set up based on Indigenous Technology
- \* Exemption from Price Control of bulk drugs manufactured based on Indigenous R&D
- \* National Awards for Outstanding In-house R&D achievements



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



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. The In-house R&D units should have some staff exclusively engaged in R&D and there should be full-time Head for the R&D who should 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 1242 as on 31 December, 1995. The growth is also represented in Figure III.A.1. Of these 1242 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 October 1995.

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, 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 Telecommunication, 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 5 year; 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 1995, the Screening Committee met 12 times and considered 102 applications for recognition; 69 R&D units were granted fresh recognition; 3 R&D units were endorsed on the existing letters of recognition in respect of other R&D units of their company; and 24 applications were rejected.

The pendency at the end of December 1995 was 23. A statement giving monthwise receipt, disposal and pendency of applications for recognition of R&D units is given at Annexure III.A.1.

94 In-house R&D units were visited till the end of December 1995 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 200 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 5 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. During 1995, 461 In-house R&D units were due for renewal of recognition beyond 31 March 1995. Based on the evaluation of the performance of the R&D units, renewal of recognition was granted to 421 units. Recognition granted to 40 units was allowed to lapse. All applications received for renewal were dealt with and there was no pendency by end of



August 1995. 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, etc.

Majority of the In-house R&D units are located in and around major cities. There are about 325 units in and around Bombay; over 100 in and around Delhi; over 100 around Madras, 75 in and around Bangalore, 75 near Hyderabad, nearly 50 in and around Ahmedabad.

### 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. It is estimated that the present R&D expenditure of the 1242 recognised R&D units is of the order of Rs. 1400 crores and about 45% of this is accounted by over 170 public sector and joint sector units and about 55% by about 1070 R&D units in private sector. 239 R&D units spend over Rs. 1 crore each on R&D, 387 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, Bharat Heavy Electricals Ltd., Bharat Electronics Ltd., Steel Authority of India Ltd., Indian Telephone Industries Ltd., Oil & Natural Gas Commission, Indian Petrochemicals Corporation Limited, Indian Oil Corporation Limited, HMT Limited. Some of the major R&D units in the private sector are Tata Engineering & Locomotive Company Ltd., Bajaj Auto Limited, Larsen & Toubro Ltd., MRF Limited, Hoechst India Limited, Ashok Leyland Ltd., Tata Iron & Steel Company Ltd., Lupin Laboratories Ltd., Ranbaxy Laboratories Ltd.

### 5. R&D INFRASTRUCTURE

The In-house R&D Centres have 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. 1200 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.

### 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 13,000 R&D personnel were employed by nearly 400 units. By 1981-82 the figure was over 41000 for about 750 units. The present estimated manpower for the 1242 In-house R&D units is around 50000. Of this, there are 2600 Ph.Ds, 8400 post graduates, 17000 graduates and 22000 other qualified personnel.

## 7. SECTORWISE BREAK-UP OF IN-HOUSE R&D UNITS

A broad sectorwise break-up of the recognised In-house R&D units is as below :

i) Chemical and Allied Industries	- 400
ii) Electrical and Electronics Industries	- 350
iii) Mechanical Engineering Industries	- 250
iv) Processing Industries (Metallurgical, Refractories, Cement, Ceramics, Paper, Leather and others)	- 160
v) Agro Industries and others	- 80

## 8. IN-HOUSE R&D UNITS : OUTPUT

a) 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.

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

### Chemical and Allied Industries

- Development of Process for manufacture of Ciprofloxacin Hydrochloride, Omeprazole, Naproxen, Lansoprazole, Fluconazole and Fluoxetine.

- Development of technology for Camylofin Dihydrochloride, Prenoxdiazone Hydrochloride and Cinnamionitrile.

- Development of processes for production of Chlorpheniramine Maleate, Mepyramine Maleate, Cetirizine Dihydrochlorine and Felodipine.

- Development and Commercialisation of Astemizole and Fluconazole.

- Development of Technology for manufacture of Dextromethorphan Hydrobromide.

- Development of process for Manufacture of crude HCG, Mianserin hydrochloride, Metoclopramide and its salts, Choleric drugs from OX bile and Glucosamine hydrochloride.

- Development of Nalidixic acid, Bromhexine HCl, Norfloxacin, Furosemide, Propranolol HCl, 4 Hydroxy Phenyl Acetamide, 2 Hydroxy Acetophenone and Methoxyl Ethyl Phenol.

- Development of tablet dosage for the peptic ulcer.

- Development of an Ayurvedic capsule for the remedy of uterine and Gynaecological disorders, Gentamicin sulphate.



Development of technology for manufacture of Tris (nonyl phenyl) phosphite, 4,4 Oxy bis (Benzene Sulfonyl hydride), 2,2-dibromo-3 Nitrilopropionsmide.



III.A.2. Production Fermenter

- Development of 3-4 dichloro nitro benzene, multiple mosquito repellent mat.
- Development of technology for Mancozeb, Dicofol, Carboxin, Phosphamindon and Dichlorvos.
- Development of technology for manufacturing of Zeolite Y.
- Development of manufacturing technology for Pt-Alumina Monometallic Reforming

Catalyst, UIP blend for car bumper, Catalyst for Para-Diethyl Benzene and Paraffin dehydro-generation catalyst.

- Development of coating agent for urea fertilizer.
- Development of process for producing Granular Ammonium Polyphosphate Fertilizer and Granular Urea-Nitric Phosphate Fertilizer.
- Development of High Purity Synthetic Ferric Oxide.
- Development of pigmented Epoxy-Phenolic Lacquer for package industry, weather resistant uncoat finish for motorcycle, Fire Retardant Paint to defence specification.
- Development and commercialisation of Polystron 2000-S1-Clear.
- Development of process for manufacture of titanium complex grease.
- Development of dyes for acrylic fibres, new disperse dye, new bifunctional reactive dyes and dyes for photographic chemicals.

#### Electrical and Electronics Industries

- Development of 2 GHz Digital Microwave Radio, 4/36 UHF MARR, 2 MB VLSI Mux, 4/36 VHF MARR.
- Development of IFF for Flycatcher Radar, 4.6M Transportable Earth Station Antenna System, 300W UHF TV Transmitter, Global Positioning System, Receiver and Satcom Encryptor.
- Design and development of very low profile transformers for Optical Fibre Equipment, Fibre optics transmitter/Receiver module, optical fibre splice box and Fibre Optic Technology system, Ruggedised Optical Fibre Communication system.





III.A.3. Frequency Based Meter and Data Collection Device.

- Development of Multi-Barrel Rocket Launcher (PINAKA).
- Development of Micro Processor based Electro Hydraulic Governor for Hydro Turbines, Micro Processor based Electro Hydraulic Turbine Controller for Turbo Generators and Micro Processor based Steam Temperature control system for Thermal Power Plants.
- Development of Micro Processor controlled small compact ultrasonic thickness gauge of high accuracy and Micro Processor controlled portable extra light weight ultrasonic flaw detector.
- Development of micro processor controlled process programmer for the textile industry .
- Design of sophisticated computerised interface for a 3-D Coordinate measuring machine.
- Development of Wireless Video Monitoring-cum-Video Conferencing System .

- Development of 5 KW Solid State UHF T.V. Transmitter, Digital Seismic Telemetry System and Data Collection Platform.
- Development of UV-VIS Spectrophotometer, Atomic Absorption Spectrophotometer and portable on line Micro Computer Controlled Gas Chromatograph.
- Development of Smart card operated payphone.



III.A.4. 4.6M Transportable Earth Station Antenna System

- Development of high frequency (400 Hz) generator, bell annealing furnace motor, wind generator, high speed motor for driving aviation fuel pump and dynamic braking resistor unit.
- Development of EHV XLPE cable up to 145 KV grade Geo-cable for seismographic measurement.
- Development of Phosphoric Acid Fuel Cell Power Packs.
- Development of Series 58 Medium duty Relay-1 pole; and Series 53 Power Relay.
- Development and commercialisation of Frequency based energy metering for Inter Grid Bulk Power Exchanges and Solid State all Electronic Energy Meter



- Development of PC Controlled Enzyme (ELISA) Reader
- Development of Satellite Money Order System
- Development of Marshal Enterprise Management System (EMS), Expert Mine Planning and Reserves Evaluation System, OPTIMA Fuzzy Control System and Classroom Electronic Warfare Simulator



III.A.5. Atomic Absorption Spectrophotometer

- Development of Solar Photovoltaic Vacuum Laminator.
- Development of power and small signal transistor chips.
- Development of Battery operated Electric Two Seater Vehicle "LOVE BIRD".

### Mechanical Engineering Industries

- Design and development of Pick & Place Robot - SH-100, Injection Moulding Robots - CR-400, Press Handling Robots - PM-2, Lathe Loading Robot - LL-100 and Cartesian Positioning Robot - CP-500, Gantry Robot, Automated Guided Vehicle (AGV) and Real Time X-Ray Imaging Systems.

- Design and development of high capacity CNC lathe-LT-25, LT-20 CNC and LT-2 CNC lathes for export, FLC-16 CNC and LCXT-16 CNC Chuckers.
- Design and Development of Twin Spindle CNC Internal Grinder and CNC Cam Grinder CG-CNC, 3AXES CNC Surface Grinder.
- Design and development of Coil Winding machine, Pipe Expander, Large Universal Grinder, Honing Machine and Slewing Ring Bearing.
- Design and development of Railbus, Soil Disposal Unit, Backhoe Loader and WL 30 Wheel Loader.
- Design and Development of fuel efficient 35 HP Engine and F 2 C 912 two cylinder aircooled fuel efficient engine (36 HP/2500 rpm) for export market
- Design and development of hydraulic cylinders, indigenously built machine Model 611 Inseam loader.
- Development of Injection Moulding Sleeves for Pliers, Cutters and Non-sparking Tools.
- Development of Roots Vacuum Pump with canned motor and High Vacuum Box Coater with Automation.
- Development of Quartz Analog Wrist Watch slim movement, and World Time Wrist Watch movement.
- Development and indigenisation of Web Offset printing machine.
- Design and development of Swing Arm Clicker for making components of leather



products, Band Knife Splitting Machine, Combined finishing machine and Beam Cutting Press.

- Development of prototype of selected machines for leather unit sole making.



III.A.6. LT-2 CNC Lathe

- Development of full Coloured Gum Wall, Transparent Tyres, Butyl Tyres, Tyre Expander Machines and Bead Wire Insulating Machine.
- Development and commercialisation of Distillation Column of Benzol Recovery plant, Grinding racers and hollow balls for C.P.P. Bowl Mills.
- Development and commercialisation of Aluminium-Bronze Slipper Pad, equipment and technological structure of Bell less top charging system of Blast Furnace.
- Design and development of Tristar and Continuous Tea Fermenting Machine.

## Processing Industries

Development of process for recovery of copper from waste slag tails of KCC concentrator plant and magnetite from ore tailings of KCC concentrator plant.

Development of process for Production of Bulk Concentrate from Rajpura-Dariba ore Beneficiation of Tungsten ore of Degana Cobalt Metal from Beta Cake and Copper Sulphate Solution from Copper Cement.

Development of process for recovery of Lithium from Enriched Mica Concentrate of Degana.

Development of process for Conversion of Ti scrap to Ferro- Titanium by melting method .

Development of technology for Magnesite Alumina Spinel bricks for Steel Teeming Ladles.

Development and Production of high grade Ferric Oxide from powdery Iron Ore.

- Development of high purity alumina aggregates for refractory application by sintering route.
- Development of magnaflux quality spring steel for Railways and Axle quality steel for Automotive industry with reduced inclusive level to meet Japanese specification.
- Development of an appropriate technology for producing high grade pig iron using sponge iron and waste char as feed back.
- Development of technology for Production of CR Coils of Stainless Steel high strength steel and Locowheel for Indian Railways.





III.A.7. Structure of Spinel Bricks

- Development of Liquid Phase Redox Process for Hydrogen Sulphide Removal.
- Development of new biobleaching process for achieving cost effective Elemental Chlorine Free (ECF) bleaching in pulp and paper industry.
- Development of neutral paper making, coloured base paper for laminates and Enzymatic prebleaching of Eucalyptus sulphate pulp to high brightness.
- Development of Rice Husk Particle Board Technology.
- Development of EPDM Gaskets for Membrane Cell Chlorine Plants, Food Grade

Rubberlining, Exhausted Steam curing NR Compound and Special Anti-corrosive lining for Pipes & Ducts for Desalination Plant.



III.A.8. Rotating Disc Contactor Lube Extraction Pilot Plant

- Development of technology for the manufacture of band knife splitting machine.
- Development of Process for the production of fire retardant plywood and marine hardboard.
- Development and manufacture process for Rail Straightening Machine Side Rings, Extrusion dies, charging bars for Steel Plant.
- Development of tyre evaluation systems for simulation of actual service condition such as noise rolling resistance, better traction skid resistance.



## **Agro and other Industries**

- Development of better varieties of seeds for Cotton, Okra, Chilli, Brinjal and Cucurbits.
- Development of improved hybrid seed of rice, corn, sorghum, pearl, millet and sunflower.
- Development of flavoured tea, processed tea, coffee bags, decaffeinated tea/coffee cubes, vermicompost.
- Development of methods for investigation of egg drop syndrome in poultry.
- Development of Immuno diagnostic kits for poultry diseases, coloured mycoplasma gallisepticum and inactivated vaccines for coryza.
- Development of Diagnostic kit for quantitation of Rheumatoid factors quantitation of anti-streptolysin, ELISA and qualitative determination of Glucose-6-Phosphate.
- Development of first indigenous entomopathogenic biopesticide .
- Development of Jet Grouting for deep well foundations on sloping rock.

## **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 : Digital Fibrograph with Fibrosampler; Mooney viscometer and moving die rheometer; Mechanical stability test apparatus; HPLC/GPC Instruments Shimadzu-10A; SIM DIST Analyser; Saybolt Chromometer; Perkin Elmer gas chromatograph; Control coaters with drives; Laboratory dyeing apparatus & finishing apparatus; Ultra centrifuge with rotor and Refrigerated table top centrifuge; Autocad Power Package 2.2D

SDK Debug HIC 1.7. LC-295 Programmable variable wavelength us/vis detector; Brightness meter; X-ray diffractometer; UV-VIS Dual Beam Spectrophotometer Brookefield viscometer; Microsheen Digital Opacity Reflectometer; Haze Gloss with standards, Partical size analyzer; Mettler balance; HPLC system; Metler autotitrator and balances; Buchi Rotary Evaporators; Cased leaf drier; Infrared Moisture Meter; Score Ratio Tester; Automatic Weight Classifier; Binary gradient HPLC system; Roto Visco RV-20 220V; Microprocessor controlled glass disc preparation unit; Laboratory attritor; Sedigraph particle size analyser with auto sampler; and Coulter particle size analyser.

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

The Department also examines the issues relating to the pricing for the products whose technology has been developed indigenously. The bulk drugs manufactured through process know-how developed through in-house R&D are exempt from the Drug Price Control (DPCO) for a period of five years after their introduction in the market. The Department examines the request of various In-house R&D Units for claiming exemption, through detailed discussions, technical visits by expert teams and based on detailed examination of the claims, issues certificate of indigenous development of technology/process, in deserving cases.

During the Year 1995, one certificate of indigenous development of technology/process for manufacture of bulk drugs for seeking exemption from Price Control was issued in respect of the bulk drug Mebhydrolin Napadisylate to M/s Bayer India 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: cases of industrial R&D units for



engagement of foreign experts for R&D and for maintenance/ commissioning of imported R&D equipment requiring such expertise; and allotment of special controlled materials for R&D 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 products were examined and the decisions of the Department conveyed.

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

Names, addresses and also locations of In-house R&D units as well as validity of recognition of all the recognised In-house R&D units are computerised and updated. As on 31 December 1995, there were 1242 In-house R&D units recognised by DSIR, 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) Ninth National Conference on In-house R&D in Industry

Department of Scientific and Industrial Research (DSIR) organised the Ninth National Conference on In-house R&D in Industry in association with the Federation of Indian Chambers of Commerce and Industry (FICCI) during 28-29 November 1995 in New Delhi. Attended by over 600 delegates from industry, National Laboratories, IITs and Universities, Scientific and Industrial Research Organisations (SIROs), Consultancy Organisations, Government Departments, the Conference was inaugurated by Shri Bhuvnesh Chaturvedi, the then Minister of State (Prime Minister's Office and S&T) in the



III.A.3. Shri Bhuvnesh Chaturvedi, the then Minister of State (PMO and S&T) addressing the delegates at the inaugural session.

Convention Hall, Ashok Hotel, New Delhi. The Minister gave away the 1995 DSIR National Awards for Outstanding In-house R&D Achievements to 15 industrial units. The Minister also released the DSIR publications "Compendium on In-house R&D Centres - 1995 and "Outstanding In-house R&D Achievements (1994 & 1995). The Valedictory address was delivered by Shri R.K. Sinha, Secretary, Department of Industrial Development and Public Enterprises.



## 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 and in 1995 to 15 firms for their Outstanding R&D Achievements.

Following is the list of the award winners in 1995 :

### Drugs and Pharmaceuticals Industries

1. SOL Pharmaceuticals Ltd., Hyderabad

### Chemical and Allied Industries

2. Cosmo Films Ltd., Aurangabad

### Biotech Industries

3. Wockhardt Limited, Aurangabad

### Electrical Industries

4. Kirloskar Electric Company Ltd., Bangalore & Mysore
5. Secure Meters Limited, Udaipur

### Electronics Industries

6. Bharat Electronics Limited, Ghaziabad & Bangalore

### Mechanical Engineering Industries including Capital Goods Development

7. Anupam Machine Tools Pvt. Ltd., Bangalore



III.A.10. DSIR National Award Winners

### Processing Industries

8. MPR Refractories Limited, Hyderabad

### Agro Industries

9. Indo - American Hybrid Seeds, Bangalore
10. Jain Plastics & Chemicals Ltd., Jalgaon

### Energy Conservation

11. Sponge Iron India Limited, Paloncha (A.P.)

### Pollution Control and Environmental Protection

12. Bharat Heavy Electricals Limited, Ranipet (TN)

### Technology Absorption

13. Madras Refineries Limited, Madras

### Successful Commercialisation of Public Funded R&D

14. Peninsula Polymers Ltd., Trivandrum
15. ELICO Limited, Hyderabad



**c) Compendium on In-house R&D Centres - 1995**

At present there are 1242 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, the 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 Centre 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 and the tenth one in 1994 in two volumes covering 491 Centres.

The Compendium on In-house R&D Centres - 1995 was compiled in two volumes by DSIR based on the information and material received from 376 In-house R&D Centres along with their applications for renewal of recognition beyond 31 March 1995. These two volumes were released during the Inaugural Session of the Ninth National Conference on In-house R&D in Industry on 28 November 1995 by Shri Bhuvnesh Chaturvedi, the then Minister of State (Prime Minister's Office and S&T).

**d) Outstanding In-house R&D Achievements (1994 & 1995)**

DSIR had brought out a 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 1993 covering the award winning achievements of 18 companies. A third publication "Outstanding In-house R&D Achievements (1994 & 1995)" covering award winning achievements of 27 companies during 1994 & 1995 was brought out in November 1995. This publication was also released during the Inaugural Session of the Ninth National Conference on In-house R&D in Industry. 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 increased and the activities of DSIR 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 expected to provide a 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 1995-96, four issues of In-house R&D in Industry were brought out in April, July, October 1995 and January 1996. These have been well received by the Industry, Government Departments and other concerned agencies.

**f) Support for Joint R&D Projects**

The 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 shall be in high priority areas of importance to the nation.

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 will be the responsibility of CDES. The applications softwares will be developed by M/s. Vi Microsystems Pvt. Ltd., Madras.

DSIR has approved financial support of Rs. 11.50 lakhs as project grant to M/s B.V. Patel Pharmaceutical Education and Research Development Centre, Ahmedabad, for development of indigenous process for large scale synthesis of 2, 4 - Dichloro fluorobenzene and 3 - Chloro - 4 fluoroaniline intermediates for the production of the broad spectrum anti-infective compound Ciprofloxacin.

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.

DSIR has commissioned a study to NRDC to bring out a status report on industry sponsored research programmes in government laboratories and other public funded institutions at a total cost of Rs. 3.0 lakhs. The study report is under finalisation.

## g) Publications

Following 12 publications were brought out during the year 1995-96 :

- i) Compendium on In-house R&D Centres - 1995  
(Chemical, Processing and Agro Industries and Others)
- ii) Compendium on In-house R&D Centres - 1995  
(Electrical and Electronics, Mechanical and Civil Engineering Industries)
- iii) National Awards for R&D Efforts in Industry (1995)
- iv) Research and Development in Industry - An Overview (1995)
- v) In-house R&D in Industry - An Information Update (April 1995)
- vi) In-house R&D in Industry - An Information Update (July 1995)
- vii) In-house R&D in Industry - An Information Update (October 1995)
- viii) In-house R&D in Industry - An Information Update (January 1996)
- ix) Directory of Recognised In-house R&D Centres (October 1995)
- x) Directory of Recognised Scientific and Industrial Research Organisations (October 1995)
- xi) Outstanding In-house R&D Achievements (1994 & 1995)
- xii) Proceedings of the Ninth National Conference on In-house R&D in Industry (March 1996).



### III (B). SCIENTIFIC AND INDUSTRIAL RESEARCH ORGANISATIONS

#### 1. INTRODUCTION

To promote the growth of research and development activities in industry and non-profit organisations, various measures have been evolved. Some of the provisions in the Income Tax Act have been designed to encourage research and development. The Department also considers modifications and amendments to various schemes and suggests amendments thereof to the Ministry of Finance in order to give stimulus to the growth of research in the country.

#### 2. SCIENTIFIC AND INDUSTRIAL RESEARCH ORGANISATIONS (SIROs)

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 seek donations from industry or other sources. The institutions notified under the section obtain benefit to the effect that any sum paid to them 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 making recommendations to 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 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 were 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.

The DSIR has launched a scheme of granting recognition to Scientific and Industrial Research Organisations (SIROs) 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 Science 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 concurred 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 1995, the Screening Committee met 11 times and recommended 32 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 5 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 IT Act, 1961.

At present there are 513 SIROs duly recognised by DSIR. Of these, 213 are in the area of natural & applied sciences, 156 are in the area of medical sciences, 35 are in the area of agricultural sciences and 109 are in the area of social sciences.



### III(C). FISCAL INCENTIVES FOR SCIENTIFIC RESEARCH

#### 1. INTRODUCTION

Several incentives have been evolved for utilisation of technologies based on indigenous research and development efforts. These incentives include 100 percent deduction of the expenditure incurred on scientific research, investment allowance at enhanced rate upto 31.3.1987 and customs duty exemption on the scientific equipment and consumables import by the non-commercial SIROs. 100% deduction of expenditure on scientific research on both revenue and capital expenditure is permissible and is availed of by many In-house R&D units in industry recognised by DSIR. Similarly, contributions made to approved scientific and industrial research organisations are also entitled to 100% deduction under section 35(1)(ii) and (iii) of the IT act.

#### 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.

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 detail, followed by discussions and /or technical visits to the plants by expert teams set up for verifying the claims made by the applicant company. After a careful consideration of information, the deserving cases along with all details are put up to the Secretary for his approval.

During the year 1995, 3 certificates u/s 32A (2B) of I.T. Act, 1961 involving Rs. 827.73 lakhs as cost of plant and machinery were issued by DSIR. Details of these cases is 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 1995, 23 certificates involving Rs. 3944 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, which 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.

During the year 1995, one sponsored research programme involving Rs. 10.00 lakhs was approved by DSIR. Details of this scientific programme are given at Annexure III.C.3

## 5. CUSTOMS DUTY EXEMPTION

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, around 650 certificates were issued for the import of scientific equipment, accessories and components, including

consumable items. The value of scientific equipment instruments and the consumables was over Rs. 34 crores.

Some of the major equipment for which essentiality certificates were issued include :

Gas chromatograph, Microprocessor based HPLC system, Tunable absorbance detector, Auto manual control low flow pumps, Refrigerated centrifuge micro computer controlled system Beckman; Scanning spectrophotometer, Liquid chromatograph system, Water's ion chromatography system; Topcount liquid scintillation counter, Lospec V correlation spectrometer system, Shimadzu analytical-cum-prep, HPLC Binary gradient system, Light element pulse processor, Brookfield digital viscometer, Autograv automated gravity meter; Perkin Elmer system, Controller, Monitor etc. for Thermal Analyzer, Yamoto homogenizer, FTIR spectrometer with accessories, Analytical-cum preparative HPLC, and Micro-analytical balance.

Mettler electronic precision balance, Freezer dryer, Digital pH meter, Low temperature freezer, Spectro fluorimeter, Laboratory fermenter, Rapid elemental analyser, Magnetic stirrers, shakers, stirrer, Digital multimeter, Nikon trinocular & stereoscopic research microscope, Perspiration tester, High performance liquid chromatograph, Compact fully automatic liquid nitrogen plant, and Dissolved oxygen meter/sampler.

LC Data-grade projector, Heat probe meter, SS Filter holder, vacuum pump, Convicon incubator-125 L with humidity control, Compact softner, mili Ro 12 plus reverse osmosis water purification system & compact mili QUF system, Dot blot Elisa apparatus for detection of plant disease causing bacteria.

High performance workstation, PC-AT Single user, Personal workstation, Compaq Prolinea enhanced 4/66, Apple Macintosh power PC, DAT drives and DAT cartridges, CD-Rom inside information, Electronic daughter board



for elemental analyser liquid TOC; High end computer aided design system, CD Net system (CD ROM networking system) model 556/Q Ethernet-14, Power indigo 2 server, ADAMS mechanical system software package Softwares for Structural analysis, heat transfer & field analysis; Data analysis software package; XILINK Software, programmer and adapters; Software modules (product designer package, FEM & analysis package); Reference update deluxe edition 1995; High speed computer service; LINUX CD ROMS, Apple macintosh power PC 7500/100, Sun Sparc Station 20 model 71; Hardware PC DELL 386 SX CPU/base units, DELL monitors, Pros. plus, ChemPlas, Miscellaneous, databases & software, CD-ROM & accessories; Personal workstation Compaq Prolinea 590 MT 5/5 model 720/W

Test apparatus for determining HOT MOR-  
"HMOR-2, Test apparatus for determining creep and refractoriness, Furnace for determining refractoriness NHD-02, Test apparatus for determining creep & refractoriness; Hydraulic Dead Weight Tester, Nafion membrane N-117, Gene Amp PCR system 2400, colour video copier for Image analysis system, pH Meter (model 620), Valve block assembly common reagent (K) for 380 DNA synthesis, Flow cell connector, pump connector, Radio meter assembly, spindle assembly J2-21, Lieco rotary microtome model 2035, Potter spray tower, manometer, SEIKO Simultaneous TG/DTA Thermal Analysis System.

Pellicon tangential filter system with pumps, 5017A Primary standard with remote control, Spares for GX planetarium projectors, ED Achromatic refracting telescope with Computer Drive System, Abrasive grain for determination of abrasion resistance, Upright type ultra deep freezer, X-Ray Generator System, Inhalation chamber, X-Ray powder diffraction system; Ultra low temperature freezer min. temp -85 Degree C, PHD Cell Harvester model 200A, Flameboy Automatic Flame-Sterilizing Pistol, Speedvac concentrator and freeze drying chamber, Spectronic Genesys 5 UV Visible spectrophotometer; COD Reactor, DNA Sequencer with accessories, UV-VIS spectrophotometer with

spares and laser printer, GC System with RON/MON dermination interface & programme.

Green House; Photo documentation system (Foto Dyne-Poto/UV 21 MP-ST), DMIRB Leica Inverted microscope, Incubator Shaker Labtherm LT-V, Cloning kit Oligo DT cellulose type, Multi Scan Video Projector & accessories; Audio Recorder, Sachtler 18 sensor system; Audio mixer, Quartz Cuvettes, Argon Ion Laser Optical Spectrum Analyser, Betacam equipment, Oligonucleotides for DNA analysis, Angle Rotor Shaft.

Schematic capture and PCB design, Digital tele thermometer and probes, Wavetek model 9100 Universal Meter calibration system, Yokogawa Digital power meter model 2533E, Moving die rheometer model MDR 2000, Yokogawa digital power meter; Microwave oven type AVM 914 Whirlpool code 580551 Philips make Zoom stereomicroscope for transmitted light with photomicrography model; Zoom stereo trinocular microscope EMZ-S-TR with camera attachment, Hydraulic press PHI model, high & low pressure gauge.

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

In the implementation of various incentive schemes for the promotion of science and technology, 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, DSIR 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 for the research work done at the premises of the company.

After receiving the appreciation from the technical 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 CBDT.

During the year 1995-96 one case relating to M/s Nuchem Plastics Ltd., Faridabad was dealt by DSIR.



# 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 financial support to the project is to be from industry's resources. The financial support from DSIR is mainly to meet part of the development expenditure, such as: the expenditure on raw materials, components and other development expenditures for making prototypes or building up of pilot plant and experimentation thereon, for upscaling or optimisation of processes; product/process simulation/know-why studies; consumables and other operational costs involved in experimental work; testing and evaluation, field trials / users trials and consultancy/technical assistance from National R&D organisations and Institutions.

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, electrical, electronics, instrumentation, mechanical engineering, earth moving and industrial machinery, chemicals and explosives.

During the year, a major thrust has been given to supporting Technology Absorption, Development and Demonstration Projects by providing partial financial support and completing technology evaluation studies in the pipeline. 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 250 responses from industrial units seeking further details about the scheme, indicating their technology development

projects were received by the Department during the year. 17 projects have been considered for partial financial support by DSIR.

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

**i) M/s. Southern Pesticides Corporation Ltd (SPEC), Hyderabad**

The project for absorption and upgradation of the technology concerning Gamma BHC pesticides being manufactured by SPEC, based on a foreign collaboration with M/s Stauffers Chemicals, USA, was undertaken by M/s SPEC with a DSIR support of Rs. 19.00 lakhs, out of a total project cost of Rs.43.00 lakhs. The firm was assisted by IICT, Hyderabad for an alternate reactor design, pilot plant work and debottlenecking of the plant. The project is completed. The benefits which would accrue due to commercial utilisation of the new reactor include avoidance of breakages of the glass reactors, reduced down time, lower loss of production and increase in the gamma content of BHC.

**ii) M/s Andrew Yule & Company Ltd., Calcutta**

The project for upgradation of the technology concerning heavy duty industrial fans which were manufactured by M/s Andrew Yule based on foreign collaboration with M/s Davidson & Co. Ltd., UK, was undertaken by the firm with a DSIR support of Rs. 10 lakhs out of a total project cost of Rs. 47 lakhs. In the project, the firm carried out know-why studies and redesigning of the fans at Indian Institute of Science, Bangalore and IIT, Madras; the firm thereafter undertook the detailed engineering and fabrication of prototypes. The project has been completed and has enabled the firm to achieve improved energy efficiency of industrial and mining fans.

**iii) 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 all the machines and most of the hardware has been fabricated. The machines are being assembled for commercial demonstration and the project is nearing completion.

**iv) 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.

**v) 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 a new 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. This project is nearing completion.

In the second project, the pilot plant work on ilmenite reduction using a new catalyst has been completed at a pilot plant scale at RRL, Trivandrum. This will now be followed by plant trials at KMML. 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 in progress.

**vi) M/s Bharat Heavy Plates & Vessels Ltd. (BHPV), Visakhapatnam**

The project for development of flexible super insulated piping which is a part of cryogenic plants being manufactured by BHPV based on a



foreign collaboration with L'Air Liquide, France was undertaken by the firm with a DSIR support of Rs. 16 lakhs out of a total project cost of Rs. 35 lakhs. Prototypes have been successfully developed and tested. The project has been completed.

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

The projects for technology upgradation of 50 ton dumper and 200 HP Front End Loader being manufactured by M/s BEML in collaboration with M/s Westinghouse Air Brake Co. USA and M/s Komatsu, Japan respectively, were undertaken by the firm with a DSIR support of Rs. 35 lakhs out of total project cost of Rs. 205 lakhs. The projects aim to develop and commercialise 'state-of-the-art' equipments. The prototype of Front End loader has been successfully developed and is being commercially introduced. The prototype for Dump Truck has been developed and is undergoing field trials. The first project on front end loader has been completed and the second project on Dump truck is nearing completion.



IV.1 WL30 Wheel Loader developed by Bharat Earth Movers Ltd.

**viii) 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. Struc-

tural 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 it successfully cleared the trials at SERC, Madras. The project is in progress.

**ix) 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 in progress.

**x) 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, Thiruvananthapuram. The prototype of the controller which is expected to be ready by May 1995 will be interfaced with SR Motor being developed by Jyoti Ltd. The project is in progress

**xi) M/s Mining & Allied Machinery Corporation (MAMC), Durgapur.**

M/s MAMC had taken up a project for the development of Side Arm Charger to be used in Wagon Tippling Complex, with a DSIR support of Rs. 15 lakhs out of a total project cost of Rs. 70 lakhs. The project has now been closed.



**xii) 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 the project is in progress.

**xiii) 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.

**xiv) M/s. Andhra Pradesh Industrial and Technical Consultancy Organisation Ltd. (APITCO), Hyderabad**

The project of M/s APITCO was for design, development and demonstration of an energy recovery system to improve energy efficiency in the existing Down Draft Kilns in the small scale refractory industry. This project involving DSIR support of Rs.7.70 lakhs out of total cost of Rs.14 lakhs has been closed.

**xv) 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 being undertaken in collaboration with IIT, Kharagpur, involving DSIR support of Rs.16.50 lakhs out of total project cost of Rs.75 lakhs is in progress.

**xvi) 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 is in progress.

**xvii) M/s. Electrical 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 was displayed in the exhibition organised during the International Conference on Power Electronics Drive Energy System 96 (PEDES-96) at New Delhi. The project is in the final stages.

**xviii) 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. In view of successful results in this project,NFL and CSME are now working at the details of a pilot plant.



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

The project for development of Hybrid Power Plant comprising of a Solar Photovoltaic System, was undertaken by M/s CEL, Sahibabad with DSIR support of Rs.14.00 lakhs out of total project cost of Rs.21 lakhs. The project is in progress.

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

The project for development and evaluation of Plasma Etching and Edge Grinding System for Edge preparation was undertaken by M/s CEL, Sahibabad with DSIR support of Rs.50 lakhs out of total project cost of Rs.130 lakhs. The project is in progress.

**xxi) 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 base metals have been successfully completed. The further experimentation work on column flotation is in progress.

**xxii) 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 Cord for shaped charges used for perforation of wells in oil fields and (d) Development of Heat Resistant explosives (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 Cord for shaped charges is completed and the firm has supplied to ONGC the detonating cords for field trials. Other projects are in progress.

**xxiii) M/s. FACT, Cochin**

The project for development of slow release fertilizers and their application on Paddy, Banana, Sugar-cane and Coconut crops was 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.

**xxiv) M/s Metallurgical and Engineering  
Consultants (I) Ltd. (MECON), Ranchi  
and M/s Hero Cycles Ltd., Ludhiana**

The project of M/s MECON (I) in association with M/s Hero Cycles Ltd. is for development of 6-Hi cold rolling mills by converting the existing 4-Hi cold rolling mill located at Hero Cycles plant involving DSIR support of Rs.60.00 lakhs out of total project cost of Rs.380 lakhs. As Hero Cycles Ltd. did not find shutting down their existing 4-Hi cold rolling mill for conversion feasible, the project is closed.

**xxv) M/s Mishru Dhatu Nigam Ltd.  
(MIDHANI), Hyderabad**

The project for welding of Molybdenum wire to make 20 kg coil was undertaken by M/s MIDHANI with DSIR support of Rs.10.00 lakhs out of total project cost of Rs.20 lakhs. These 20 Kg coils are to be used by electric lamp industry and are at present imported. The project is in progress.

**xxvi) M/s Mishru Dhatu Nigam Ltd.  
(MIDHANI), Hyderabad**

The project for bulk filtration of liquid metal was undertaken by M/s MIDHANI with DSIR support of Rs.37.00 lakhs out of total project cost of Rs.74 lakhs. This aims at development of a cheaper alloy steel in place of Electro slag refined steels in applications such as for razor blades. The project is in progress.

**xxvii) M/s Mishru Dhatu Nigam Ltd.  
(MIDHANI), Hyderabad**

The project for development of alloy steel wire with high surface finish was undertaken by

M/s MIDHANI with DSIR support of Rs.12.00 lakhs out of total project cost of Rs.36 lakhs. These wires are used in electrostatic precipitators, spark plugs etc. Diamond dies are under fabrication. The project is in progress.

**xxviii) 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 project is in progress.

**xxix) 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 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 is being installed in the blast furnace along with the related instrumentation.

**xxx) 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.

**xxxi) 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 drives

was 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 in progress.

**xxxii) 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.

**xxxiii) M/s Semiconductor Complex Limited,  
(SCL), Chandigarh and Electronic  
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.

**xxxiv) M/s Semiconductor Complex Limited,  
(SCL), Chandigarh and Electronic  
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. 36 lakhs. The project is in progress.

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

The joint project of M/s SCL and M/s IRDL is for development of ASIC and the related MPEG-2 Card involving DSIR support of Rs. 70 lakhs out of total project cost of Rs. 225 lakhs. The project is in progress.



xxxvi) **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 electronic energy meter for industrial applications, involving DSIR support of Rs.23.00 lakhs out of total project cost of Rs.46.00 lakhs. The project is in progress.

xxxvii) **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) was 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 and prototype is under fabrication. The project is in progress.

xxxviii) **M/s BEML, Bangalore**

The project for development of computerised transmission control for off highway dump trucks was undertaken by M/s BEML with DSIR support of Rs.10.00 lakhs out of total project cost of Rs.30.00 lakhs. The project is in progress.

xxxix) **M/s BEML, Bangalore**

The project for development of Cast Iron 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 project is in progress.

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

The project, being executed by M/s TPEL in collaboration with NAL, HAL Lucknow and Shakti 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.250 lakhs. The project is in progress.

xli) **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 project is in progress.

xlii) **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 were undertaken by M/s TPL, in collaboration with Indian Institute of Petroleum, Dehradun. These projects are in progress.

xliii) **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, involving financial support from DSIR and M/s Gas Authority of India Ltd. (GAIL), New Delhi each Rs. 11 lakhs out of a total project cost of Rs.30 lakhs. The project is in progress.

xliv) **M/s Electronic 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

Nuclear Based 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 use 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.

**xliv) M/s Hindustan Zinc Limited**

The project for simultaneously recovering cobalt and copper (as copper sulphate) has been undertaken by M/s Hindustan Zinc Ltd with DSIR support of Rs. 40 lakhs out of a total project outlay of Rs. 80 lakhs. The project is in progress.

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

The project for development of Pigment Grade Ferric Oxide from 'Blue dust' has been undertaken by M/s NMDC in collaboration with IICT, Hyderabad, involving a DSIR support of Rs. 54.5 lakhs out of a total project cost of Rs. 131 lakhs. The project is in progress.

**xlvii) M/s National Aluminium Company Limited (NALCO), Bhubaneswar**

The project of M/s NALCO is to develop, on a pilot scale, the technology for special grade alumina and hydrates involving a DSIR support of Rs. 100 lakhs out of a total project cost of Rs. 250 lakhs. The project is in progress.

**xlviii) 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 project is in progress.

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

The joint project 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 initial stages.

**1) 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 project is in initial stages.

**2.2 Proposals Being Processed for Approval**

Following Technology Development Projects are being processed for DSIR support.

- i) Development of Air Circuit Breakers by M/s JSL Industries Ltd., Vadodara in collaboration with Electrical Research & Development Association (ERDA), Vadodara.
- ii) Metal Recovery from Sodium Aluminate Liquor in the Aluminium Plant by M/s National Aluminium Co. Ltd. (NALCO), Bhubaneswar and NRDC, New Delhi
- iii) Pilot Plant Trials for Wire Drawing by M/s TISCO, Jamshedpur
- iv) New development of 6-Hi Cold Rolling Mill by M/s MECON (I) Ltd., Ranchi with Hero Cycles Ltd.
- v) Technology upgradation of Rice Husk Board plant and development of jute fabric reinforced board, and fire check doors based on Rice Husk and boards based on coconut/palm leaf/stem by M/s Padmavathy Panel Boards Ltd., Bangalore.



- vi) Development of Stampable Reinforced Thermo Plastics Sheets and their conversion to products by Glass Fibre Technology Centre (GFTC) of M/s FGP Ltd., Hyderabad.
- vii) Development of Resin Transfer Moulding (RTM) and moulds by GFTC of M/s FGP Ltd., Hyderabad.
- viii) Development of 14.5 KVA inverter using IGBT technology for Railways by Intra Industries Pvt. Ltd., Pune in collaboration with ER & DC, Thiruvananthapuram.
- ix) Development of a Bio-bleaching Process on Pilot Scale for application in Pulp and Paper industry by M/s Esvin Advanced Technology Ltd., Madras.
- x) Development and demonstration of Liquid Phase Oxidation Process for Hydrogen Sulphide Removal and Recovery of Sulphur from sour gases by GNFC-EIL-ONGC.
- xi) Technology Upgradation of Polyamide Resins and their application by M/s ABR Organics Ltd.
- xii) Technology absorption and upgradation of SPV Cell manufacture by M/s Central Electronics Ltd., Sahibabad
- xiii) Development of Bio-fertilizers by M/s FACT, Cochin with Cochin University
- xiv) Development of technology for Tartaric Acid, Pectin and Invert Sugar from Tamarind by M/s Indus Natural Products Ltd., Pune
- xv) Reduction in NO<sub>x</sub> and SO<sub>x</sub> emission in process furnaces using Natural Gas by M/s Gas Authority of India Ltd. (GAIL) and Engineers India Ltd. (EIL), Delhi
- xvi) Development of Micro Processor based ASIC for STD-PCO machine by SCL and ER&DC.

### 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, 14 reports were finalised for printing during the year covering sectors and products such as 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 6 products are under finalisation.

### 2.4 Technology Missions

Another initiative taken by the DSIR concerns with 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, will provide guidelines to the IITs and IISc in spotting the right industrial partner in these missions, for entering into the contracts for commercialisation of processes and products. 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.

## 2.5 PATSYS

An information system 'PATSYS' has been initiated in order to have a good data base on projects received, considered and supported under PATSER. This involves :

- a) creating structures for database files;
- b) data entry concerning projects and decisions taken on the same; and
- c) design and development of a suitable software for data entry, retrieval of information and updating of the database.

## 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) Linkages with International Organisations including Asian and Pacific Centre for Transfer of Technology (APCTT)
- E) 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 Collaboration" (NRFC), which is an ongoing plan scheme, continued its operations during the year 1995-96. It has completed a number of programmes that were targeted 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 process of effective transfer 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; and
- Organisation of Interaction meets to enhance effectiveness of technology transfer process.

### 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 1994 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 1995 is in progress.

#### 4. ANALYTICAL STUDIES

A project on "Impact of foreign collaborations on Indian Industry" was entrusted to National Council of Applied Economic Research (NCAER), New Delhi. The study aims to analyse the impact of foreign collaborations approved during 1984 in respect of production value, foreign exchange and R&D activities in Indian industry. The study has been completed.

A project on 'Appraisal of the Indian patent system and the problem' was taken up. The study aims to critically appraise the policy, legal and practical aspects of Indian patent systems. The study was entrusted to the Indian Society of International Law, New Delhi. The study has been completed.

A project on "Effectiveness of Import of Designs & Drawings as a Mode of Transfer of Technology" was commissioned to the National Productivity Council (NPC), Bangalore. The study aims to evaluate effectiveness of import of designs and drawings as a mode of transfer of technology in the areas of cost effectiveness, time effectiveness, production, quality, failure rates, merits, demerits, limitations, etc. The study has been completed.

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 the implications of the various laws in these two countries vis-a-vis Indian laws. Special emphasis would be on the laws relating to technology transfer agreements between the Indian, French and Japanese companies. The work on the project is in progress. The report in respect of the French Law was discussed by an evaluation committee.

A project to study the market and development prospects of plastic processing

industry in the 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 availability of plastic raw materials, performance of existing plastic processing units, demand estimates for different products, sources of availability of technology (local and foreign) export tie-ups, preparation of project profiles and other related issues. The study has been completed and is likely to be useful for industrial and technological development, particularly of the North-Eastern Region.

With a view to enhance capabilities in the area of Technology Management, a project has been commissioned to 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.

#### 5. TECHNOLOGY STATUS STUDIES

5.1 One of the main objectives of the NRFC scheme, is to carry out technology status studies covering state-of-the-art 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 the respective fields. More than 130 reports have been finalised. These reports have been priced and are now being sold through the National Research Development Corporation (NRDC).

5.2 During the year, reports on the technology status of a number of sectors/products were discussed by their respective evaluation committees.

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.

5.3. The following are the major findings of reports which have been discussed by their respective evaluation committees/completed.

### Trimethoprim

Trimethoprim is a broad spectrum anti-bacterial, which has been in commercial use almost over the last 30 years. It has been known to be of particular use in respiratory tract infections and urinary tract infections. Now many competitive anti-biotics have been developed; yet there is great demand for Trimethoprim on account of its low cost and broad spectrum applicability. The manufacture of Trimethoprim involves three stages starting from Gallic Acid, which is converted into 3,4,5 Trimethoxy Benzaldehyde, which in turn is converted into Trimethoprim. Demand in the country during the year 2000 is perceived to be of the order of 4500 TPA. Production in the country was commenced by Burrough's Wellcome (India), Bombay followed by others, like Standard Organics Limited, Hyderabad and Inventa Chemicals Pvt. Ltd., Secunderabad. The technological status of manufacture in the country is at par with international standards and the Indian product is compatible with international pharmacopoeial specifications like BP, USP and others. One major shortcoming is the high percentage of imported raw materials required for the manufacture of Trimethoprim. The report brings out, that in view of the tremendous scope for import substitution of such imported raw materials, suitable efforts need be expended both by industry and National R&D laboratories in that direction. At present, research work has been undertaken to replace Gallic Acid as the starting material with other more reliable and cheaper sources like Para-cresol. The report also brings out the need for developing a process for

the recovery of the solvent, Dimethyl Sulphoxide, used in the manufacture, to further minimize cost of production.

### Mechanical Seals

Mechanical Seals are rotary shaft seals used in pumps, mixing vessels and marine propeller shafts to prevent leakage or ingress of fluids.



V.A.1 Mechanical Seals

Earlier, gland packings were used for such purposes and have now been replaced with mechanical seals, specially in areas where even a small amount of leakage cannot be permitted. Such seals also require less energy and less maintenance efforts and are widely used in the chemical industry in pumps, mixers, agitators, compressors; water pumps of automotive vehicles and in water lifting pumps. There are two large



manufacturers in the country, namely Sealol Hindustan Limited, Pune and Durametallc India Ltd., Madras; apart from a few small scale units. Both the large units have foreign collaborations with EG&G Sealol, USA and Durametallc Corporation, USA respectively and their technological status is at par with those of the collaborators. John Crane International, EG&G Sealol, Durametallc and Eagle of USA, Feodor Burgmann of Germany and Flexibox of UK are among the world's major designers and manufacturers of engineered sealing systems. Worldwide, the development of this industry has been driven by considerations of reliability, operating life and safety. Metal Bellow Seals, Hydropads, Cartridge Seals, Bushing and Lipseals and Spilt seals are some of the major international developments in this industry. Some of the major gaps in technology in the Indian industry as highlighted in the report, include development of basic raw materials for seal rings like Nickel based Tungsten Carbide and Silicon Carbide; Hastelloy Springs required for abrasive conditions and good quality elastomers. Standards need be formulated for mechanical seals manufactured indigenously. In addition, development of seals for dry running, for high pressure and high temperature applications, for aeronautical, space and other such sophisticated applications, need be developed through appropriate research and development measures.

### Bonded and Coated Abrasives

Bonded and Coated Abrasives are widely used for achieving high finish and high work piece accuracy in industries such as Iron and Steel, Fabrication, Bearing, Auto and Auto-Ancillary, Machine Tool, Cutting Tool, Marble and Granite and several others. Abrasive grains are first sized, mixed with the bond, moulded to desired shapes and fired or baked at set temperatures to form bonded abrasives. Abrasive grains are sized and dropped on to an adhesive coat, then anchored and flexed, followed by trimming of the edges and cutting to sheets of re-

quired sizes to form coated abrasives. The market for bonded abrasives is estimated to be of the order of Rs.140 crores and that of coated abrasives to be of the order of about Rs.70 crores during 1995. Carborundum Universal Ltd., Madras and Grindwell Norton Ltd., Bombay are the two major manufacturers in the country, while there are a number of units in the small sector. Most of the manufacturers have foreign technical collaborations and receive R&D support for product/process upgradation and manpower training. The world market for abrasives is estimated at US \$ 2113 million and the major international manufacturers are Norton, Baystate and 3M from the USA, Tyrolit and Treibacher from Austria and Noritake from Japan. Abrasive manufacturers world wide have developed newer and stronger adhesives for product durability and better productivity, in addition to high speed vitrified wheels, diamond and CBN wheels and non-woven abrasives. The report brings out that quality of raw materials available in the country is not at par with international standards, specially in respect of Zirconia Seeded Gel, Cubic Boron Nitrite, Boron Carbide and Fine Grit of over 600 grit size. In respect of bonding and reinforcing agents, the Indian industry is at par with international standards.



V.A.2 Mounted Point Abrasives

### Bio Fertilizers

Bio Inoculants, popularly called Bio-fertilizers, are biologically active products containing active strains of bacteria, algae, and fungi as



a single or composite culture. In order to sustain increase in the agricultural output of the country Integrated Plant Nutrient Systems (IPNS) is the preferred concept to provide balanced plant nutrition, achieve high yield, sustain soil fertility and control nutrient losses. Bio-fertilizers together with organics, industrial wastes and chemical fertilizers are employed in IPNS. Bio-inoculants convert the elemental form of nitrogen present in the atmosphere into forms that become readily available to the plant. They also solubilize inorganic phosphorous from insoluble sources through the excretion of organic acids. The major bio-fertilizers include Blue-green algae, Azolla, Rhizobium, Azotobacter and Azospirillum. The estimated demand during 2000 for such fertilizers is of the order of 2.5 lakh tonnes. A large percentage of the manufacturers of Bio-fertilizers are in the Govt. sector, like the National Bio-fertilizers Development Corporation, Ghaziabad, Gujarat State Fertilizer Co. Ltd., Baroda and Maharashtra Agro Industries Corporation, Pune; mainly because net social benefits like reduced environmental costs, reduced fertilizer subsidies, and increased agricultural production; are higher than remunerative benefits. Legume inoculants have been very popular in countries abroad for the last four decades. Rhizocote Coated Seed Ltd. and Biological Laboratories Ltd. of New Zealand, Tropical Inoculants and Agricultural Laboratories of Australia, Nitrogen Sales Corporation of USA and Laboratories de Microbiologie of France are some of the major international manufacturers. The report brings out that endeavours should be made to develop a true self-sustaining market for bio-fertilisers, keeping in view the social net benefits that would be derived, calling for sustained R&D efforts, development of a suitable pricing policy and an efficient distribution system, among other measures.

### **Bio Pesticides**

Environment quality, sustainable agriculture, ecological considerations and pesticide resistance in the context of a high growth agricultural and plant protection scenario suggest a

strong need for environmentally safe pesticides like bio-pesticides. Chrysopids, Tichogrammatids, Chelonus Blackburni among others, have large potential for use as bio-pesticides in controlling aphids, white flies, mealy bugs, eggs and young larvae. The Indian Council of Agricultural Research (ICAR) and the Department of Bio-technology (DBT) have initiated many programmes for the development of bio-pesticides. Host specificity, speed of action, environmental inactivation, time of release and availability have been major factors affecting the commercialisation of such bio-pesticides. Bio-Control Research Laboratories (BCRL), Bangalore is the first commercial insectary in the country. Centre for Bio-Technology (CBT) Madras, Vector Control Research Centre (VCRC), Pondicherry, Gujarat Agricultural University, Anand and Central Food Technological Research Institute (CFTRI), Mysore are among the R&D institutes in the country involved in research in this field. In the global scenario, 0.5% of the pesticide market of US \$ 20 billion is composed of bio-pesticides. 90% of the bio-pesticides used there, are based on Bacillus Thuringiensis. Mycogen, Sandoz Crop Protection Corporation, Abbott, Dupont and Ecogen are among the international manufacturers. In the light of higher restriction on the use of chemical pesticides in our country, it is opined in the report, that bio-pesticides can be used in protection of cotton, vegetables, pulses, oilseeds and other crops against heliothis, spodoptera, diamond backmoth and other pests. Gaps perceived, as indicated in the report, include development of multi-gene copies, method of transfer of the toxic gene into plants, fermentation and scale-up and method of concentration of bio-mass. Continuous targeted research leading to development of proper formulation, capital equipment indigenisation and isolation of toxic proteins are among the various strategies suggested in the report.

### **Radiators for Automobile Applications**

The report brings out that all the units in the country excepting one unit manufacture



Copper/Brass radiators. These units are basically in small scale sector. The technology used in the industry is labour intensive and not state-of-the-art in comparison to contemporary technology available in developed countries. Most of the tube manufacturers use lock seam joining of tube ends instead of more material conserving butt welding process. This butt welding process known to reduce material consumption (brass) by nearly 12-14%. With the growing demand for lighter, sleeker and powerful vehicles, demand for lesser weight and good quality radiators has increased. Report further brings out that the technology gaps exist in the area of diffusion process to manufacture composite fins with Cu\_Zn outer surface and Cu\_Mg inner core, Beta weld process where in tube to header joints are possible with dual bond, butt welding process, new furnace process which uses exhaust gases for combustion and use of robots. The report recommends use of new plastic technologies such as fibre reinforced nylon 6/6 and welding machines which operates at much higher speed in place of existing slow speed welding machines to ensure good quality and increase in productivity by the Indian industry.



V.A.3 Radiator Application

### Hydraulic Equipments and Systems

The study brings out that the hydraulic products in the country are being manufactured mostly by the manufacturers based upon im-



V.A.4 Hydraulic Cylinders

ported technology to suit customer requirement. Industry has successfully adapted the imported technology and even has successfully improved production techniques to give better quality equipment. The total capacity of industry is over 5,50,000 units, out of which, four units together manufacture over 2,65,000 pumps specially for tractor industry only. The range of products manufactured in the country includes, various type of pumps, industrial valves for pressure, flow and directional control, mobile valve, power steering units, indicating devices, complete powerpacks and systems for all segment of industry. Since the Indian industry has to manufacture large variety of products with low volumes, the industry is not able to use modern high production lines. Most of the units, baring few which have SPMs & CNC machines, are using general purpose machines with special tooling and some special purpose machines for specialised metal cutting operations. Report further brings out that the new generation of hydraulic elements alongwith electronic interfacing have ushered a more advanced systems engineering, the emphasis being more on compactness, reliability and quicker response. Report further suggests that new range of products such as mobile valves, proportional valves, servo valves and piston pumps will require technological up-gradation of manufacturing to higher levels. Industry will require more sophisticated manufacturing facilities with Flexible



Machining Centers and in-process size control will be required for such products.

### Gears

The study concludes that the gear industry is well equipped with modern gear cutting facilities as well as testing equipment. The industry has also latest facilities to manufacture gear cutting tools for captive requirement as well as



V.A.5 Twin Gear

for outside sale. The technology available within the country is comparable with other advanced countries. Some technology gaps exist in the area of design & manufacturing of shaving cutters and plunge shaving cutters; automated unmanned manufacturing & material handling; powder metallurgy processes & special internal rolling process for synchrosleeve; cold, worm & hot forging technology for automotive applications and automatic cycle annealing process. It is suggested that to improve the quality of gears CAD/CAM software should be extensively used. The gaps that exist in production technology can be bridged by importing CNC gear cutting/finishing machines, machinery for gear cutting tools and gear inspection equipment.

### Shock Absorber

The study brings out that virtually all shock absorbers produced in the country are based on imported designs and these designs are being

continuously updated by manufacturers. The common features of indigenously produced shock absorbers are (a) all manufacturers produce mainly non-pressurised twin tube hydraulic types shock absorbers, (b) all of them use disc valve, and (c) all of them use same type of oil produced in the country. The technology for conventional i.e. non-pressurised twin tube hydraulic shock absorbers is well established in the country. The demand for gas filled and variable damping co-efficient shock absorbers is very small and technology may be required to be imported. Report further brings out that very little is being done in the area of Research & Development by the Indian Industry. The most promising emerging technologies for pressurised and non-pressurised type twin tube hydraulic shock absorber, to be adopted would be, pre-loaded valves to obtain linear variation of damping force with velocity and electrically adjustable and self adjusting variable damping co-efficient shock absorbers. Report suggests that there is an urgent need for optimisation and standardisation of the components and raw materials taking into account all aspects of installed plant & equipment at each of the unit. This will not only reduce the cost of production, but also help in identification of items to improve quality and reduce cost.

### Soda Ash

The report indicates that there are no natural resources of soda ash in the country and therefore the industry depends on synthetic route. Total installed capacity to produce soda ash is 17,40,000 TPA. In the year 1993-94, 15,24,000 T soda ash was produced and 13,93,000 T was consumed. Estimated demand for the year 1999-2000 is around 26,80,000 TPA which is planned to be met by adding additional capacity of 11,38,250 MT for which industrial licences/letter of intent have been issued to several parties. In the country more than 90% of soda ash is produced by solvay process and remaining is produced by Dual process. The constraints of Dual processes are :



- (i) It has to depend on the availability of carbon dioxide gas and ammonia from fertilizer unit.
- (ii) At times, the production is to be restricted for want of ammonium chloride market.

The report further brings out that though some soda ash units have imported technology; a few of the Indian soda ash units are capable of designing and engineering soda ash plants. The New Asahi (NA) process has not been adopted by the industry mainly due to high initial investment cost, and as investment has to be made in all sections, viz lime burning section, ammonia recovery section as well as in ammonium chloride crystallisation section. However, it would be worthwhile incorporating the improvement (section-wise) of New Asahi Process in Solvay/Dual process as the case may be. The report further suggests that choice of a particular technology would depend on plant location, availability of raw materials, marketability of products and other parameters.

### **Butyl Acrylate**

The report brings out that there are two producers of butyl acrylate in the country, and both use acrylonitrile as the raw material which is produced from propylene. The technology used by both the producers has been developed indigenously and successfully commercialised and well received by end users. To produce it, two methods are employed. In one method, acrylamide sulphate is first hydrolysed to acrylic acid, which in turn is esterified with butanol. In second method, butyl acrylate is produced by transesterification of either methyl or ethyl acrylate. Total capacity to produce butyl acrylate in the country is 13,000 TPA. Report further brings out that at present around 85% of the world capacity of acrylates is based on propylene as the raw material. All the new plants, being planned, are based on propylene as the starting point. In propylene process, propylene is

oxidised to acrylic acid via an intermediate, acrolein. The crude acrylic acid is directly used for esterification to produce acrylates. Also, after purification, the crude acrylic acid is converted into glacial acrylic acid which is used in polymeric form in super absorbents and detergents. Thus the propylene based plant can also be used to produce glacial acrylic acid. Report suggests that new capacity, if any, may be based on propylene as the raw material and since no technology base is available for this process, import may have to be considered.

### **Methyl Ethyl Ketone**

The report brings out that commercial production of methyl ethyl ketone in the country commenced in 1991 with imported technology. No technology gap appears at present as indigenous producer has successfully absorbed the imported technology. Total installed capacity of two plants Cetex Petrochemicals and Consolidated Petro-tech Industries is 7000 MT per year. The production has been increasing from 2,861 MT in 1991-92 to 4333 MT in 1993-94. The future demand projection of methyl ethyl ketone by the year 1999-2000, is estimated to be around 7800 to 9500 MT per year based on probable or optimistic estimates. Methyl ethyl ketone is a low volume consumption chemical. The main end users are oil refineries where its consumption is significant as a solvent in dewaxing plants apart from quite large number of end users who consume methyl ethyl ketone in small quantities. Methyl Ethyl Ketone world wide is primarily, produced with n-butene/2-butene as the raw material via secondary butyl alcohol route as 90-95% of secondary butyl alcohol produced is utilized for manufacture of methyl ethyl ketone. Report further suggests that to achieve stable production and minimise operational difficulties in the manufacturing process, the broad areas requiring attention are metallurgy and instrumentation in acid handling areas, process control parameters and scheduled inspection and maintenance.



## 6. INTERACTION MEETS

A one-day interaction meet on transfer of technology from abroad was organised at Ahmedabad on 16 November, 1995 in association with the Gujarat Industrial & Technical Consultancy Organisation Ltd. (GITCO). The main objective was to provide inputs to assist industrial units in enhancing the effectiveness of technology transfer from abroad. It was attended by senior executives from a large number of organisations.

A programme on Technology Management thorough effective Technology Acquisition, Transfer, Assimilation and Development was organised on 18 December, 1995 in association with the Administrative Staff College of India, Hyderabad. The main objective of the programme was to sensitize senior executives to the importance of technology management in a competitive

environment and discuss effective steps for aligning technology strategy in the overall business strategy. It was attended by senior executives and was found very useful.



V.A.6 Shri Ashok Parthasarathi, Addl. Secretary, DSIR delivering the inaugural address at the Interaction Meet on 'Acquisition of Technology from Abroad' at Ahmedabad on 16th Nov. 1995.

## V (B). INDUSTRIAL TECHNOLOGY

### 1. INTRODUCTION

The industrial technology group 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 project.

The broad activities of the group 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 / Boards such as Licensing Committees, Project Approval Board and Board of Approvals for 100% Export Oriented Units.

### 2. INDUSTRIAL LICENSING

About 780 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.

25 meetings of Licensing Committee were held by SIA during 1995. Almost all the meetings were attended by the IT Group.

### 3. FOREIGN COLLABORATIONS

During the year, the number of foreign collaborations and composite proposals exceeded 1300. Of these, the Department received around 400 proposals from Secretariat for Industrial Approvals as compared to 350 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 20 meetings of the Project Approval

Board and 13 meetings of the Board of Approvals for 100% Export Oriented Undertakings held by SIA during 1995.

### 4. INFORMATION/DATA PROCESSING

The Department has a database for Foreign Collaboration proposals and Composite applications since 1988. The data regarding Foreign Collaboration Approvals since 1981 data has been compiled. The databases for proposals were updated for the year 1995.

The group developed a software system, namely, Foreign Collaboration Approvals Database Search System (FORCADS) comprising of Foreign Collaboration Database for the year 1994 in the encrypted form and a search system software for quick retrieval of the same for aspects such as, Name of the applicant, Name of the collaborator, Country of collaboration, Foreign investment etc. The software comprising of two 5.25" Diskettes has been priced at Rs 400 and is sold by NRDC on behalf of DSIR.

The Department also updated the software for editing, preparing summary, processing and quick retrieval of the desired information. The software has been developed in-house for above mentioned proposals as well as approvals. Retrieval of information and updation of these databases are continuously done with the help of the above softwares.

The Department became a subscriber to X400 Message Handling System of NICNET, the Network of National Informatics Centre. The E-Mail Address for the Department is dsir@x400.nicgw.nic.in. In the year under review, the Department also became subscriber to the TCP/IP account of Videsh Sanchar Nigam Ltd. The E-Mail address for the Department is dsir@giasd101.vsnl.net.in.



## 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;
- Study and analysis of Indian Joint Ventures Abroad;
- Supporting demonstration of exportable technologies overseas as well as within India;
- Supporting activities leading to upgradation of technologies identified for export;
- Assistance for export of technology based services, such as, setting up R&D institutions, R&D collaborations, operation and maintenance of plants.

### 2. ACTIVITIES

The TATT scheme became operational during the year 1986-87 through a cell set-up for this purpose. A number of programmes and projects aimed towards its objectives were approved by the Technical Advisory Committee and 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 eighth plan is towards commercialisation of exportable Indian technologies through setting up demonstration plants and related activities. Details of some of the projects/activities completed or in progress during the year under report are given below:

#### 2.1 Demonstration of Exportable Indian Technologies

- (i) Global commercialisation and technology demonstration of Cell Type Air Washer (CTAW) system for humidification of textile mills.

The Cell Type Air Washer (CTAW) is a highly energy efficient humidification system compared to the conventional Spray Type Air Washer (STAW) system. The CTAW employs cells of fabric based material, reduces the overall energy consumption by 35% (minimum), brings down the requirement of water drastically since water is needed just to keep the fabric wet as against atomisation of water in the STAW system and does away with eliminators, which minimises the resistance to air flow. A textile mill of 100,000 cu.m per hour air flow capacity, fitted with a conventional STAW humidification system can be easily retrofitted with the CTAW system at a cost of Rs. 2-3 lakhs and the cost can be recovered through energy savings in around 2 years with the cost of power being Rs. 2 per Kwh.

The project has been completed jointly by Ahmedabad Textile Industry's Research Association (ATIRA) and National Research Development Corporation (NRDC). A seminar was

organised in May '95 at Bombay to popularise the energy efficient CTAW system. The seminar was attended by participants from industry, research institutions and consultants, including foreign delegates. One of the recommendations emerging out of the seminar suggested, bringing out an export quality brochure/pamphlet in several languages, highlighting the textile related technologies/products from various sources, available for export. A commercial order was secured during the year for setting up the CTAW system in a textile mill in Philippines.

### **(ii) Commercialisation of Iono-Oxidation Technique for Effluent Treatment.**

The technique consists of passing high amperage direct current at low voltage in a reaction chamber fitted with metal electrodes, which induces flocculation, followed by sedimentation and filtration. The technique besides being environment friendly results in cutting down the operating cost as the treated waste water can be re-used in the textile process house.

The project is being implemented jointly by Ahmedabad Textile Industry's Research Association (ATIRA) and National Research Development Corporation (NRDC). A demonstration plant is being set up in a textile mill in Bombay to help the mill in treating the effluent before disposal so as to meet the norms of Maharashtra Pollution Control Board (MPCB). A series of experiments were conducted at the demonstration plant as well as in the laboratory using the effluent from the mill to achieve the MPCB norms of treated effluent viz. COD level of 250 ppm, BOD level of 30 ppm and removal of colour. However, these levels are yet to be achieved and developmental efforts are being continued.

### **2.2 Annual Publication on Technology Exports.**

A publication providing ready information on export of technologies including overseas turnkey and construction projects, consultancy exports and export of capital goods

was proposed to be brought out on an annual basis. The publication would consist of two parts, one devoted to an in-depth analysis of export trends, covering relative importance of various industry sectors in exports, export destinations, rate of export growth and possible projections for the future and the other, providing a detailed statistics of exports, covering, name of exporter, export destination, items of export, FOB value of exports, royalty, lump-sum fees etc. The information for the publication is being collected from various sources, such as government departments, industry associations, EXIM Bank, RBI and other export promotion organisations.

### **2.3 Technology Profile of South Africa**

These reports highlight the country's economic structure, natural resources, government plans and policies, industrial growth pattern and infrastructure and technology development. The reports are disseminated to select export promotion organisations, R&D institutions and key industrial organisations so as to present to them the potential areas for promoting India's exports. Additionally, the reports are available on sale (through National Research Development Corporation) for the benefit of industry at large.

A report on South Africa has been prepared through National Research Development Corporation and West Bengal Consultancy Organisation Ltd. at total cost of Rs. 4.60 lakhs. The report has emerged out of information collected from various sources within the country as well as in South Africa. Sectors identified in the report for technology transfer from India include, Small scale and cottage industries such as stuffed toys, handicrafts, utility cum decorative items, home furnishings etc; construction of low cost housing complexes; public transport system; textile machinery and goods; computer software and hardware; drugs and pharmaceuticals; surgical and medical equipments; earthmoving equipment and hotel management services.



## 2.4 Technology Export Potential of Agro Based Industry.

These reports are primarily aimed towards assessing and projecting our technological activities and experiences in a particular industrial sector. These are disseminated to the concerned organisations including Ministries/Department, and Indian/Foreign missions. Additionally, the reports are available on sale (through National Research Development Corporation) for the benefit of industry at large.

A report on Agro based industry has been prepared through UP Industrial Corporation Ltd. at total cost of Rs, 1.85 lakhs. The report is a result of desk based research, visits to select industrial units in the sector for data collection and an analysis of the information vis-a-vis technology export potential. 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 and biscuit making plant, flour and rice milling plants, pasta production plants, maize processing complex, assorted animal feed making plants,

pasteurised fruit juice plants, fish meal and fish oil making plants, beer plants, solvent extraction and refining of soyabean oil, coir fibre corrugated roofing sheet, dehydrated green pepper, hand made paper etc.

## 3. TATT REPORTS

Since the inception of TATT scheme, a total of 32 reports have been completed and printed and another 5 were at various stages of completion. The reports printed during the year are listed below.

- (i) Technology Profile of Singapore.
- (ii) Technology Profile of Ghana.
- (iii) Status & Export Potential of Computer Software Industry.
- (iv) Technology Export Potential of Veterinary Formulations, Biologicals and Feed Supplements.
- (v) Export Potential of Conversion Technology for Packaging Materials.

## V (D). 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 51st Annual Session of ESCAP held in Bangkok during April, 1995.

Shri A. Parthasarathi, Additional Secretary, DSIR participated in the Eleventh Technical Advisory Committee meeting of APCTT. The Technical Advisory Committee meeting was held in New Delhi on 5-6 December, 1995. The 10th session of the Governing Board of APCTT was held in New Delhi on 7-8 December, 1995 and was 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. Shri A. Parthasarathi, Additional Secretary, DSIR was elected as the Chairman of the Governing Board.

Senior officers of the department also participated in various workshops/seminars conducted by the Centre during 1995.



## V (E). PROMOTION AND SUPPORT TO CONSULTANCY SERVICES

Promotion and support to Consultancy Services was one of the initiatives of the Seventh Five Year Plan and is a continuing activity 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.
- To support 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, including training.
- To support R&D efforts of consultancy organisations and commercialisation of indigenous technology.
- To organise Seminars, Workshops, etc.
- To document consultancy capabilities.
- To 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 henceforth be on support for consultancy for development and commercialisation of indigenous technologies, besides continuing the ongoing activities. Some of the programmes/ activities carried out during the year are briefly described here :

#### (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 State 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.

The following reports have been finalised and are under print.

#### (i) Consultancy Capabilities in the States of Haryana, Punjab & UT of Chandigarh.

The states covered in the study, have, for climatological, and other reasons, been traditionally predominantly agricultural. Haryana is forging ahead in industrial development with considerable locational advantages derived from its proximity to Delhi. There are more than 550 large and medium scale industries and over one lakh small scale units in the state, providing employment to more than 7 lakh persons. New industrial policy has been framed by the State Govt. to provide conducive environment/ climate for development and sustainable growth of industrial sectors/ activities in 8th five year plan.

Punjab, after the green revolution, has taken strides in the industrial sector, particularly in the SSI sector. The industrialisation in Punjab has grown at a constant rate of 7.0 % annually during 1970-91. There are over 390 large and medium scale and 1,76,000 small scale units in the state, providing employment to over 9 lakhs persons. Significant industries in Punjab are engaged in production of auto parts, LCVs, two-wheelers, bicycles, hosiery and textile products, chemical products and fertilizers, engineering

goods, machinery parts, tools etc. At Chandigarh, there are 15 large and medium scale industrial and over 3000 small scale units. Fixed investment involved in these units is of the order of Rs. 58 crores, out-put is worth around Rs. 147 crores and these are employing around 17000 persons. As the geographical area of Chandigarh is very limited, there appears to be limited possibility of further development of industries in the territory, except for modernisation, diversification and rehabilitation of existing units.

Some of the thrust areas identified, in which consultancy services are inadequate are agro-based/ food processing, electrical and electronics, energy conservation, technology upgradation, personnel management and productivity enhancement. Services are provided mainly in areas related to project management, energy conservation, pollution control, management training and HRD. These services are largely rendered to small scale sector. To upgrade the consultancy capabilities in the region, the study proposed certain actions to be taken by respective Governments, industry, consultants and R&D institutions.

The study was based on response to the structured questionnaires and contacts covering 142 out of 379 consultants/ consultancy organisations and 270 other organisations including industry, equipment manufacturers, R&D institutions and other concerned agencies. The study revealed that over 140 consultants/ consultancy firms are operating in Punjab alone followed by 115 in Haryana and 111 in Chandigarh. A conservative estimate projects a consultancy turnover of Rs. 55 crores regarding a growth rate of about 20% and providing employment to over 3000 persons in consultancy sector.

**(ii) Consultancy Capabilities in the states of Himachal Pradesh and Jammu & Kashmir.**

The states of Himachal Pradesh and Jammu & Kashmir are mountain-bound and major areas remain snow-bound for large parts of the year. Therefore, these states have exhibited very slow

growth in industry. There are 139 large and medium scale industries and 23,265 SSI units in H.P. with an investment of Rs. 1673 crores and employment potential of over 97,000 persons, while in J&K, 30 large and medium scale units and 32,258 SSI units are established providing employment to over 1.4 lakh persons. By and large, the major industrial activity remained confined to small scale, village and tiny industries.

The study has revealed that consultants/ consultancy organisations in the region are around 62, including 15 in J&K. Growth of industry and hence consultancy services largely depend on the thrust to be given by State Govts. It is estimated that consultancy turnover in the region is of the order of Rs. 6.2 crores per annum and around 400 persons are engaged in consultancy include 240 technical personnel. The consultancy business is likely to grow at little less than 20% per annum.

Majority of the consultants provide services in preparation of feasibility and project report, market surveys and research, pricing, advertising, organisational structuring, transportation of goods/ products, rehabilitation and other management and financial consultancy services. Other fields of services include agro-based/ food processing, horticulture, civil engineering construction and architecture and to same extent in chemical, drugs and pharmaceuticals. However services related with specialised fields are lacking.

According to study, the consultants are required to equip themselves to meet the demands of various industrial sectors. The need for competent consultants is more so in technology upgradation, modernisation and rehabilitation of sick industries and setting up of new industries or diversification of existing industries.

Some of the thrust areas identified in which consultancy services are required in qualitative terms are process technology in agro-based, food/ textiles/ sericulture, electrical and electronics, energy conservation, mining and mineral exploration, environment protection and



pollution control and productivity enhancement. To upgrade the Consultancy capabilities in the region, the study has proposed certain actions to be taken by the Govts. of respective states, industry, consultants and R&D institutions. The recommendations include manpower training and its upgradation, access to data base and financial assistance to consultants. The study was based on response from 40 consultants/consultancy organisations and 165 other organisations including industry, equipment manufacturers, R&D institutions and other concerned agencies.

### **(iii) Consultancy Capabilities in Gems & Jewellery Industry in India.**

Gems & Jewellery industry is one of the leading foreign exchange earners. India has been World's leading diamond producer and has a good reputation in the jewellery industry. This industry has been banking on the cheap labour force which has traditionally being able to carry out work to compete with the world market. Both Central and State Govt. have offered a number of incentives to encourage the industry for international competitiveness. Free Trade Zones have been set up for promotion of exports. It is estimated that in the liberalized growth oriented policies of the Govt., the export of jewellery articles from India should be gaining a further boost in the years to come. It is expected that in another five years time, the export earnings from Gems & Jewellery would be to the tune of Rs. 15,000 to 20,000 crores and the industry will also be providing employment for additional 4 to 5 lakhs persons in addition to the 8 lakhs of people gainfully employed by the industry today.

The study has revealed that there are about 100 consultants/consultancy organisations since the industry happened to remain a family business from the very inception. As such there were really no professional consultants available. With the passage of time, individuals retiring or resigning from R&D institutions and association or business houses have emerged as consultants

in view of the liberal support being offered by the Government to boost industry's immense export potential. However the concept of utilizing consultancy services has begun to be recognised with new entrepreneurs in this field.

The strength of the Indian consultants are built upon the traditional expertise and which is now going in for specialised qualifications. Technological gap in the high tech area such as irradiation, diffusion, heat treatment, synthesis and identification of gem stones, remain the weak areas.

The study has projected immense opportunities and with proper consultancy services, the export potential could be of the order of Rs. 20,000 crores by end of this decade from the present exports of about Rs. 12,942 crores.

#### **(b) Institutional Programme Support**

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

#### **(c) Interaction Meetings**

Three Interaction Meetings were organised to discuss and finalise the draft reports on consultancy capabilities in the state of Karnataka, Gems and Jewellery industry in India, and Market Potential for Export of Consultancy Services from India.

### **3. REPORTS/ PUBLICATIONS**

Two reports on Consultancy Capabilities in the States of Haryana, Punjab and Chandigarh and in the States of Himachal Pradesh and Jammu and Kashmir were completed.

A number of technical papers/reports were prepared and presented in various technical fora.

### **4. ADVISORY SERVICES**

Advisory services were provided to various Departments and Organisations in relation to evaluation of their project proposals and other

activities. Following are examples of advisory services provided.

#### 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 and Task Force in Ministry of Defence for Non-conventional Energy Applications.
- (vi) Project & Consultancy Export Committee of EEPC

#### 4.2 Participation in Seminars/Workshops/Meetings

- i) International Seminar on "First Consultation on Consulting Engineering Services", organised by UNIDO at Vienna, Austria on 4-7 July 95.
- ii) "Expert Group Meeting of ESCAP" organised in New Delhi in April, 1995.
- iii) UNIDO "Global Forum on Industry Perspectives for 2000," held in Oct. 1995.
- iv) IMCI Seminar on "Management Consultancy Client-Consultant Interaction" held at New Delhi in Oct. 1995.
- v) A meeting of Technical Committee of International Society of Soil Maintain and Foundation Engineering for the conference on "Consultancy Practices in Civil Engineering".
- vi) A preparatory meeting of Ministry of Non Conventional Energy Resources for their workshop on "Energy from Waste".

#### 4.3 Projects/ Proposals

Project documents of the Ministry of HRD mission on Communication Networking and Intelligent Automation were examined for possible participation and contribution of DSIR in the implementation of the project.

#### 5. CONSULTANCY DEVELOPMENT CENTRE (CDC)

5.1 Consultancy has been recognised as an important knowledge-based input for technical, industrial and economic development in the country. The Government has evolved various measures from time to time to support and encourage the consultants and consultancy organisation. The Technology Policy Statement of the Government of India and subsequently the Technology Policy Implementation Committee emphasized the need for evolving necessary measures and mechanisms to support and strengthen the consultancy capabilities in India. As a follow up of these recommendations, DSIR is implementing a scheme relating to "Promotion and Support to Consultancy" from April 1985. This scheme essentially aims to catalyse consultancy activities for domestic and export markets. Among the various programmes and activities undertaken by DSIR in this scheme, a Consultancy Development Centre (CDC) at New Delhi has come into being, with the support and active co-operation of Consultancy Promotion Organisations such as Association of Consulting Engineers (ACE), National Association of Consulting Engineers (NACE) and Federation of Indian Export Organisations (FIEO). The main objective of Consultancy Development Centre is to promote Consultancy Capabilities and to assist DSIR in implementation of some of its programmes relating to Consultancy and other related areas.

5.2 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 1987. CDC has now occupied 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 150, 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 and Promotion Assistance (CDPA)" Scheme.

5.3 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. 34.45 lakhs was provided as grant during 1994-95 and a release of Rs. 25.00 lakhs is made during 1995-96 till Dec. 1995. CDC has 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 system with peripherals and accessories as well as some software. This facility is used for collection, analysis and dissemination of data, training of engineering graduates and 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 equipped with Library facilities also.

5.4 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 recommends

.....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 including accumulation of reserves for future. DSIR's assured core fund releases should not be reduced or deferred on the pretext that CDC has "cash in hand".

CDC has sent its views on the Review Committee report. The recommendations of the Review Committee report were being examined in DSIR in totality.

5.5 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".

5.6 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 business. CDC has been identified to be a nodal agency for Technical Consultancy Development Programme for Asia and the Pacific (TCDPAP) by ESCAP. The first meeting of Advisory/ Promotional Committee of TCDPAP was held last year in New Delhi. Besides, ITC, ESCAP and other agencies have supported CDC training programmes in the past.

5.7 Some of the salient features of the activities carried out by the CDC during 1995 are:

- a) Under the Consultancy Development and Promotion Assistance (CDPA) Scheme; which 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 1995' were given away in January 1996.
  - Use of Principal Consultants: Three consultants were retained at CDC. Their services were being utilised by some small units as well as for programmes at CDC.
  - Trainee Consultants : Eight engineers completed their one year consultancy training at CDC during 1994-95. 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. By December 1995 six trainees were undergoing training at CDC under this programme.

- b) Under Shortterm Training/ Contact Programmes, Following programmes were organised.
  - Training programme on "System Design and Implementation for ISO-9000 Quality Management System was conducted at CDC on 9-13th May 1995 which was attended by 12 consultants from leading consultancy organisations.
  - Training programme on "System Awareness-cum-Implementation for ISO-9000 Quality Management System was conducted on 8-10th June 1995 at CDC which was attended by 9 participants from leading consultancy and manufacturing organisations.
  - Training Programme for "Chief Executives and Senior Level Managers on ISO-9000 Quality Management System was conducted on 30th August, 1995 at CDC, which was attended by 4 participants from consultancy service sector and other organisations.
  - Training programme on "System Design & System Implementation ISO-9000 Quality Management System for service sector was conducted on 26-30th Sept, 1995 at CDC which was attended by 5 consultancy service sector and other organisations. The significant feature of this programme was that two leading hospitals of Delhi participated in the programme.
  - Training programme on " Documentation for ISO-9000 Quality Management System on 19-21st December 1995 at CDC which was attended by 5 consultancy organisations.



- Training programme on " Overview of ISO-9000 Quality Management System for chief Executives , MDs and decision makers was held on 17th Nov,1995 at CDC which was attended by Medical Supdts of Dr Ram Manohar Lohia Hospital ,New Delhi and Safdarjung Hospital, New Delhi, besides others.
- A Training programme on " Overview of ISO \_ 9001 and 10011 parts I,II and III was conducted on 22-23 Nov,1995 at CDC.
- An Interaction meet on " Opportunities in Waste Utilisation " was held on 30th June 1995 at PHD House , New Delhi.
- An Interaction meet on "ISO -9000 for consultancy Organisation was held on 25th August 1995 at PHD house, New Delhi.
- An Interaction Meet on "Consultancy Services in Food Processing Industry was organised on 16.10.95, at IIC, New Delhi.
- c) 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.
- d) 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).
- e) According to an IDBI report on Technical Consultancy Organisation (TCOs), CDC had been identified to play a major role in their functioning and CDC would be closely intracting with TCOs.
- f) A computerized 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.
- g) Indian Renewable Energy Development Agency (IREDA) had entrusted an assignment relating to Accreditation of consultants in the area of New and Renewable Energy Sources which has been completed.
- h) 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 three years with effect from January 1996.
- i) Publications/Brochures of CDC
  - Brochure on Skill Upgradation
 

To encourage consultancy organisations for upgrading their technical and management skills, a scheme for support to attend training programmes organised by renowned institutions was introduced. A brochure giving details of the scheme and guidelines for availing such assistance was published. The scheme has been given wide publicity.
  - Brochure on CDC
 

A brochure about CDC giving its objectives, details of the programmes being done under Consultancy Development Promotion & Assistance Scheme, major tasks performed, types of membership etc. was published. The same has been distributed to all the members of the CDC and other concerned agencies.
  - First Decade of Activities of CDC
 

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

- **National Directory of Consultant**

The compilation of the National Directory of Indian Consultants/ Consultancy Organisations having information of about 1700 Consultants/ Consultancy Organisations was completed and was printed.

- **Brochures on "Consultancy Development Promotion and Assistance" (CDPA)**

Scheme, and "Consultancy Business Development" were under print.

CDC has made serious efforts to generate revenues on its own towards becoming almost self supporting in the long run. The above assignments have been received by CDC after considerable efforts. CDC has earned a record revenue of about Rs. 12 lakhs during the year 1994-95 from services rendered to various agencies.



# VI. 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, need 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

NISSAT functions with the following objectives :

- Provision of national information services to meet the needs of users, generators, processors and disseminators of information.

- Optimum utilisation of existing information services and systems and the development of new ones.
- Promotion of national and international cooperation and liaison for exchange of information.
- Provision of encouragement for the development of facilities for education and training in information science and technology.
- Promotion of application of information technologies and research & development innovations in information science & technology and communication to enhance both the efficiency of information services and quality of the information provided by these services.

The programme has the following broad components :

- Promotion of information resource sharing.
  - \* Development of metropolitan library networks.
  - \* Introduction of universal library access card.
  - \* Setting up of consultative mechanism for rationalisation of periodical acquisition and utilisation.
  - \* Development of union catalogue of various levels.
- Development of information centres.

- Establishment of online access centres to international database services.
- Manpower development and research in library and information science and standardisation .
- Promotion of information technology applications.
- Monitoring and coordination of S&T information market.
- Collaboration with international organisations and institutions.

### **3. PROMOTION OF INFORMATION RESOURCE SHARING**

#### **3.1 Library Networking**

NISSAT has taken the initiative for the development of metropolitan library networks. These initiatives would ensure better utilisation of S & T information resources through resource sharing, moderate functional load of information centre management and take care of motivational factors to a large extent by better means of communication.

The implementation of Calcutta Library Network (CALIBNET) has been in two phases. In CALIBNET Phase - I, the Network Services Center at the Regional Computer Centre (RCC), Calcutta and 7 participating library/information centres are networked. Meanwhile, NISSAT has taken up manpower development activities in collaboration with the CALIBNET Society and the RCC, Calcutta. CALIBNET was formerly inaugurated on September 22, 1993. The CALIBNET Society is functioning as the Network Coordinating Agency (NCA).

MAITRAYEE, the CALIBNET Library Automation and Networking Software, has been developed and demonstrated to the library and information professionals in the country. Recently, Maitrayee ver 3.0 has been launched.

On similar lines, the Delhi Library Network (DELNET) aims at connecting about 40 libraries in Delhi. So far, 39 library/ information centers have been connected through Electronic mail. DELNET is also a registered society. DELNET regularly organises computer courses for the operational level professional staff from the participating institutions.

NISSAT has established Bombay Library Network (BONET). BONET was formally inaugurated on November 6, 1992. Pune Library Network (PUNENET), Ahmedabad (ADINET) and Mysore (MYLIBNET) are also operational in their initial phases. PUNENET computer is connected to INTERNET through modems and PSTN lines. Presently PUNENET maintains a database of 10,000 books from ten different libraries and the Union Catalogue of city libraries from 1989 onwards. Similar metropolitan networks are contemplated for Bangalore and Hyderabad.

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 ventures.

#### **3.2 Consultative Mechanisms for Rationalisation of Periodicals.**

The cost of S & T periodicals increases at a rate of 15-20% per annum. As the library budget in most institutions tend to remain static, the net result would be a reduction in acquisition of journal titles. On the other hand, our scientists and technologists are dwelling into newer areas. Their activities naturally would demand acquisition of periodicals in those newer areas.

The aim of the Consultative Committees being promoted in 21 cities, is to get the librarians in a city together and to discuss their acquisitions especially renewal of subscriptions for



periodicals, and explore resource sharing possibilities. Such an exchange of notes is expected to lead to a rationalised acquisition effort and considerable savings to the group of cooperating libraries.

### 3.3 Union Catalogue

As a part of CCRP, NISSAT intends to promote & support development of *Union List of Current Scientific Serials* in major cities - Ahmedabad, Bangalore, Bombay, Calcutta, Delhi, Goa, Lucknow, Mysore, Nagpur, Pune & Ranchi. 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.

## 4. NISSAT INFORMATION CENTRES

### 4.1 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 - VI. 1) were established to create information awareness and to meet information needs of academicians, scientists, technologists, entrepreneurs, management executives and decision makers.

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. They conduct training programmes; organise

workshops and seminars to create awareness of modern tools and techniques; and also participate in exhibitions to publicise their products & services. In respective cities, they function as focal points for resource sharing.

TABLE - VI. 1 : NISSAT CENTRES

No.	Subject Area	Acronym	Host Institution
i)	Leather Technology	NICLAI	Central Leather Research Institute, Madras
ii)	Food Technology	NICFOS	Central Food Technology 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

Regular monthly publications from these centres include Current Awareness, Industry Highlights, Current Highlights, Patent Awareness, Current Indian Titles in respective sectors and also semi-technical and popular ones in the form of digests.

These centres maintain several databases to cater to the information requirements of their clientele. The National Centre for Bibliometrics (NCB), established at INSDOC, New Delhi in 1988, has been creating a S&T citation database on Indian contributions appearing in Indian periodicals. The NICDROM centre established in 1988, provides information on CD-ROM hardware, software and their suppliers, reference tools and databases available on CD-ROM and also publishes a periodical CD FOCUS to keep the Indian users informed about developments on this new technology. The centre also provides information from NTIS database.

#### 4.2 LISFORUM

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 on ERNET and other networks that have connectivity to ERNET.

#### 4.3 VAPIS - Value-Added Patent Information System

With the changing economic scenario in the country and the impending IPR regime, it is imperative that we strengthen the patents information activities in India on an urgent basis. Considering the expert manpower available in the national R&D systems and the increasing need from industries for technical information, NISSAT established a Value Added Patent Information System (VAPIS) on Chemical Sector at National Chemical Laboratory, Pune to offer specialized, value added information services using patent documents as the primary source of information. Another centre on Engineering subset would be established in Central Manufacturing Technology Institute at Bangalore. 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 orientation of the centres would be towards market needs with a clear indication of activities, target clientele and revenue earning projections.

### 5. SDI/CUSTOM SEARCH : ONLINE AND CDROM 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 - VI.2.

TABLE - VI.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 CDROM Based SDI Services

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

**TABLE - VI. 3 : NISSAT CD-ROM BASED SERVICES**

S.No.	Host Institution & Place	Database
i)	National Chemical Laboratory NICHEM, Pune	PESTCIDE DISC
ii)	Indian Association of Cultivation of Science, Calcutta	INSPEC (Physics)
iii)	National Physical Laboratory New Delhi	INSPEC (Physics)
iv)	Central Drug Research Institute NICDAP, Lucknow	Drug Information Source
v)	CALIBNET Society Calcutta information	BNB, Book Find Bibliofile Inside
vi)	Central Manufacturing Technology Institute NICMAP, Bangalore	COMPENDEX
vii)	Central Leather Research Institute NICLAI, Madras	BIOSIS
viii)	Indian Statistical Institute DRTC, Bangalore	LISA
ix)	Indian Institute of Science NCSI, Bangalore	ADONIS
x)	National Aerospace Laboratories NICDROM, Bangalore	Discovery Preview NTIS, and others
xi)	Indian National Scientific Documentation Centre NCB, New Delhi	Science Citations Index
xii)	PUNENET society, Pune	Inside Information
xiii)	BONET, Bombay	Inside Information
xiv)	DSIR, NISSAT, New Delhi	World Research Database, NTIS, ISSN Compact Disc (ISDS) and others

In order to assess the current national and international situation, the utility of CD-ROM services and to provide a forum for exchange of experiences, NISSAT organised the *Fourth National Meet of CD-ROM/ ONLINE Users and Service Providers*, during December 21 - 24, 1995 in Calcutta.

## 6. MANPOWER DEVELOPMENT

The education and training of information personnel 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 Documentation Research and Training Centre (DRTC), Bangalore; Regional Computer Centre (RCC) Calcutta and University of Poona, Pune. About 16 short-term courses were conducted during the reporting year.

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	IIFT, New Delhi
ii)	Study on strategies for the development of an Integrated Information Market	NISTADS, New Delhi

S.No.	Activity	Institute
iii)	Baseline study to ascertain status of information resources and infrastructure in Industries recognised by DSIR	Institute of Social Analysis & Communication (ISAC) New Delhi
iv)	Beyond Institutional Boundaries	NISTADS, New Delhi
v)	Study on "Making use of Govt. held tradeable information in India"	ISAC, New Delhi
vi)	Union Catalogue of S&T Conference Proceedings (Calcutta Region)	INSDOC, Calcutta

## 7. 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 has been released for marketing on September 1995.

Though the activities of NISSAT were earlier targetted 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.

## 8. MONITORING AND COORDINATION

### 8.1 Promotion of NISSAT Activities, Products & 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.

### 8.2 NISSAT Newsletter

NISSAT Newsletter gives an overall view of developments in information products, ser-



vices, 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 the Society of Information Science and Public Information Directorate, it is distributed to 5000 individuals and institutions. The NISSAT Newsletter enjoys user appreciation and high professional esteem in India.

## 9. 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 with NICTAS/ATIRA, Ahmedabad, which has outlet for all NISSAT products and services.

## 10. DEVELOPMENT OF AN INTEGRATED INFORMATION MARKET

NISSAT recognised the need to conceive a modern information market in India. However, this would require a shift from conventional value systems and traditional practices. In the new scenario, India's role should not be limited to consumption alone, but she should grow as an active contributor to information products and services in the international market. Indian industry should be encouraged to undertake activities of database development on national and nationally generated information, value-added products and supplemental inputs to the international ventures. At the same time, it should facilitate Indian users to access international sources of information and the foreign users to access Indian sources of information.

The market would not be able to sustain itself unless a commercial approach is adopted in all the activities of products/services development, distribution, pricing and promotion.

To conceive an information market in its totality, the information industry, promoters, users and all the potential players would need to discuss matters of common interest. As a first step, NISSAT provided a forum to discuss the various aspects of information during December 21-24, 1995 in Calcutta.

# VII. PUBLIC ENTERPRISES

## VII (A). NATIONAL RESEARCH DEVELOPMENT CORPORATION

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.

The year 1994-95 continued to be challenging for the Corporation. Nevertheless, the overall performance of the Corporation has been quite satisfactory. The Corporation has earned a record lumpsum premium of Rs.126.86 lakhs from licensing of indigenous technologies. With aggressive marketing efforts, the foreign exchange earnings have also increased from Rs.16.9 lakhs during 1993-94 to Rs.148.47 lakhs in 1994-95.

### 1. INCOME FROM LICENSING OF TECHNOLOGIES

#### 1.1 Lumpsum Premia

The lumpsum premia income from licensing technologies has increased to a record amount of Rs.126.86 lakhs as against Rs.92.9 lakhs during 1993-94. In addition, deferred lumpsum premia amounting to Rs.8.30 lakhs is payable to

the Corporation during 1995-96 against licence agreements already executed.

#### 1.2 Royalty

The income from royalty from the Corporation's licensees declined to Rs.54.69 lakhs during 1994-95 as compared to Rs.90.21 lakhs in 1993-94. The decline in income from royalty is due to the expiry of licence agreements on major royalty earning technologies licensed earlier. However, with some commercially important processes licensed during the previous 2-3 years coming into production shortly, the income from royalty is expected to show an upward trend in the coming years.

### 2. PROFIT

As a result of the hard and dedicated work by its executives and staff, the Corporation has been able to earn a gross profit of Rs.65.84 lakhs during 1994-95 as compared to Rs.64.06 lakhs during 1993-94.

### 3. PROCESSES ASSIGNED AND LICENCE AGREEMENTS CONCLUDED

During 1994-95, 38 new processes were assigned to the Corporation as compared to 40 in the previous year. The decline was due to the opening up of in-house technology transfer cells by a number of R&D laboratories, particularly those of CSIR. Some of the commercially important processes assigned to the Corporation during 1994-95 were :

- Neem-based Contraceptives.
- Neem-based Pesticide Formulations.



- Aluminium Graphite Composites.
- Aluminium Indium Zinc Alloy Anodes for Cathodic Protection.
- PZT-4 & PZT-5 Powder.
- Special Blister Packaging Machine.
- Form-Fill-Seal Machine for Odd Shaped Articles.
- Heat Resistant Explosives.

The Corporation signed 52 licence agreements during 1994-95 as against 57 in 1993-94 and 60 in 1992-93. The continuous decline in the number of licence agreements concluded was due to non-availability of commercially important processes from R&D institutes, as many are licensing their processes directly.

#### 4. MAJOR TECHNOLOGIES LICENSED

Some of the major technologies licensed by the Corporation during 1994-95 were :

- Rice Husk Fired Sheet Type FBC Boilers.
- Cyclosporin A .
- Invert Sugar.
- Glycol based Hydraulic Fluid 'PEGCOL 89'
- Diethyl Phenyl Acetamide.

#### 5. TECHNOLOGY DEVELOPMENT PROJECTS

##### 5.1 On-going Projects

##### i) Artificial Heart Valve

The Corporation had funded a development project for the pilot production of 300 Artificial Heart Valves for clinical trials at the Sree Chitra Tirunal Institute of Medical Science & Technology (SCTIMST), Thiruvananthapuram. Subsequently, the valves were approved by the Ethics Committee of the Institute for human trials. The 300 valves, produced on a pilot scale at SCTIMST have been successfully implanted in

human beings at 6 centres. It is now expected that M/s TTK Pharma Ltd., to whom NRDC has licensed the process, would undertake pilot production of its first commercial batch of 600 heart valves.

Concurrently, the Corporation filed the patent applications for the Valve not only in India, but also in the European Patent Office, Munich (UK), USA and Japan.

##### ii) Acid Proof Cement from Rice Husk

Acid proof cement is essentially used as a mortar for bedding and joining acid proof bricks, tiles, stoneware pipes etc. Keeping in view the market potential of acid proof cement, the Corporation provided in December 1992 a financial grant amounting to 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 on June 22-23, 1995 at IIT Kharagpur noted with satisfaction that the project had met the primary objectives to a considerable extent. The different varieties of acid proof cement products made, were tested in -house and found to meet ISI specification. 20 sample bags each of 5 kg have been prepared. It is further proposed to make requisite quantities of samples to determine market acceptability of the products.



VII.A.1 Thermal Conductivity measurement test for acid proof cement being conducted on Lee's apparatus at IIT Kharagpur.



### iii) Glucose Biosensors

Glucose Biosensors for the estimation of the blood sugar in human beings were developed at the National Physical Laboratory, New Delhi and Association for the Cultivation of Science, Calcutta as a Department of Science and Technology sponsored project. It was felt that in order to create confidence among entrepreneurs, it was necessary to conduct full scale field trials. With this object in view, the Corporation provided in March 1994, a financial grant of Rs.1.50 lakhs to NPL for the manufacture of 50 prototypes of glucose biosensors and 50,000 glucose biosensor strips. NPL has procured and installed a screen printing machine for the purpose. Several consumables have also been procured. The work is in progress and the project is likely to be completed by March 1996. The Corporation has also licensed the know how to two industrial units in Faridabad and Bangalore.



VII.A.2 Glucose Biosensor

### iv) Synthetic Absorbable Sutures

Absorbable surgical sutures made from mammalian intestines are being produced in our country. However, over the years, synthetic absorbable surgical sutures have been developed in industrially advanced countries. Synthetic absorbable sutures are definitely better than natural sutures in terms of flexibility, tie down and tie holding characteristics, tensile

strength etc. Keeping in view the potential of synthetic absorbable surgical sutures, the Corporation provided a financial grant of Rs.11.5 lakhs in March 1994 to Shri Ram Institute for Industrial Research, Delhi for the development of the technology. The work on the project is progressing satisfactorily and is likely to be completed by March 1996.

### v) Sand Lime Bricks

Keeping in view the need for developing alternate building materials, the Corporation licensed the technology for the manufacture of Sand Lime Bricks developed at the Central Building Research Institute, Roorkee to M/s Periwal Bricks Pvt.Ltd., Dungargarh, Rajasthan. The Corporation also participated in the equity of the Company to the extent of Rs.30 lakhs. A plant with a capacity of 30 million bricks per annum has been set up at Dungargarh at cost of Rs.5.5 crores. The plant has since been commissioned. However, due to low output of the brick making press, the production is far below the installed capacity. The Company is proposing to import a second hand press to achieve rated capacity.



VII.A.3 Sand Lime Bricks Plant of M/s Periwal Bricks Pvt. Ltd. Dungargarh

### vi) Carbon Fibre for Braiding Applications

Carbon fibre is the most technically advanced and cost effective successor to asbestos



as a gland packing material, due to its low coefficient of friction, anticorrosive nature and resistance to high temperature. The process for the manufacture of Carbon Fibre developed at the National Physical Laboratory, New Delhi was therefore licensed to M/s Machining Centre (India) Pvt.Ltd., Thane.



VII.A.4 Carbon Fibre Pilot Plant at NPL, New Delhi

The Company is setting up a 5 TPA semi-commercial plant in Bombay at a total cost of Rs.131 lakhs. Financial assistance to the extent of Rs.40 lakhs is being provided by a Technology Information Forecasting and Assessment Council (TIFAC) of DST, and Rs.20 lakhs by the Corporation in the form of a technology development loan. This is the first case where a major technology development has been financed jointly by NRDC & TIFAC.

## 5.2 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)" scheme, 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 those projects, as also the collection of the royalty revenues accruing from the utilisation of the technology by the Company concerned and third party licensing. Under this programme, some of the major projects undertaken were :

- Pilot Plant Production of Special Grade Alumina and Hydrates from Bayers Alumina/ Hydrate in collaboration with National Aluminium Company Ltd. (NALCO)
- Low Cost Gas Turbine of Multifuel Capability in collaboration with Turbotech Precision Engg. Pvt.Ltd., Bangalore and National Aerospace Laboratory.
- Development of Technology for design and manufacture of Improved Industrial Natural Gas Burners in collaboration with M/s Econ Thermal Engineers (P) Ltd. and Gas Authority of India Limited.
- Development of Technology for production of pigment grade Ferric Oxide from 'Blue Dust' in collaboration with National Mineral Development Corporation, Hyderabad.
- Development of technology for Bulk Filtration of Liquid Metals for producing clean steel in collaboration with Mishra Dhatu Nigam Ltd., Hyderabad.
- Design, checking and testing of transmission towers in collaboration with Triveni Structurals Ltd., Allahabad and SERC Madras.

## 6. MARKET SURVEYS

Supplying market information alongwith technical knowhow not only makes the techno-commercial 'package' more complete and attractive but also helps in assessing the realistic price of the technology for licensing. Continuing this important activity, professional market survey agencies were engaged to carry out detailed market surveys on the following items :

- Garlic Powder
- Potato Powder
- Anti Freeze Coolant
- Sodium Metal



- Recoating of Titanium Anodes
- Availability of Stainless Steel for Remelting
- Zinc Oxide, Zinc Sulphate and Zinc Chemicals from by product zinc components
- Insecticidal Chemical/Paint for killing cockroaches and other insects
- Ayush 64 (Antimalarial Drug)
- 777 Oil for treatment of psoriasis
- CAPD Bags
- Palatable Laxative
- Egg Powder

## 7. INVENTION PROMOTION PROGRAMME

To promote the spirit of invention among scientific and technical personnel, industrial workers, craftsmen, artisans etc., the Corporation continued its programme for awarding prizes for the development of novel products/processes/inventions.

During the year, the Corporation received 50 proposals for prize awards and 41 proposals for providing financial assistance for prototype development.

The Corporation announced cash awards amounting to Rs.3.15 lakhs to 22 inventors for 7 inventions on Independence Day (1994) and cash awards amounting to Rs.1.85 lakhs to 11 inventors for 4 inventions on Republic Day (1995).

Some of the notable inventions recognised through such awards, given during 1994-95 were:

- Development of High Strength Low Density Aluminium Lithium Aerospace Alloy
- X-Band High Bit Rate QPSK Modulator
- Intelligent Braille Interpreter
- Improved Software Package for Planar, Near-Field Antenna Measurement

## Development of Aeronautical Grade Cast Acrylic Sheet

The Corporation also provided financial assistance to four inventors for prototype development.



VII.A.5 Intelligent Braille Interpreter

## 8. PATENT ASSISTANCE

The Corporation continued to provide technical, legal and financial assistance to individual inventors and R&D institutions in filing patent applications at home and abroad and processing them till the stage of sealing of the patent.

During the year, the Corporation provided financial assistance to 23 individual inventors for filing patent applications in India.

14 patent applications were also filed abroad for processes assigned to the Corporation for commercial exploitation.

## 9. DEVELOPMENT & PROMOTION OF RURAL TECHNOLOGY

The Corporation continued to pursue its programme of Development and Promotion of Rural Technology to use modern science and technology to improve the living conditions of people in rural areas.



## 9.1 Rural Technology Demonstration-cum-Training Centre (RTDT Centres)

Besides reviewing the performance of some of the existing RTDT Centres to determine the additional needs and strengthening them in terms of a new technologies, organisational and management structure etc., the Corporation put up 3 new RTDT Centres in different parts of the country during the year 1994-95:

- Kota (Rajasthan)
- Brijraj Nagar (Orissa)
- Wangzing (Manipur)

With the above centres, the total number of Centres as on 31st March, 1995 was 51.

## 10. DEVELOPMENT PROJECTS

### 10.1 New Projects

#### i) Design and Development of Direction Finder to Locate Radio Distress Signals used by the Sea Fishermen

At present, in our country, fishermen go to sea in open boats without any form of safety equipment or means of communication for safe operation at sea. The Rural Electronic Group of the Electronic Research & Development Centre (ER&DC), Thiruvananthapuram of DOE has developed a sea proof floatable radio beacon device for use by such fishermen. The beacon can transmit a signal for about 20 hrs when activated. The device will be used by rescue agencies to detect the direction from which the SOS is emanating and so steer a course to the fishermen in trouble. Keeping in view the usefulness of the device, the Corporation provided a financial grant of Rs.5 lakhs to ER&DC for the design and development of Direction Finder under the Rural Technology Development Programme of the Corporation. The work is progressing satisfactorily.

#### ii) Consultancy Service to Govt. of Nagaland for setting up of Industries

The Government of Nagaland approached DSIR for a grant of Rs.5.5 lakhs to enable the State Govt. to have feasibility reports on High Tech Industries in order to promote entrepreneurship in the State. On the advice of DSIR, the Corporation has agreed to undertake this work and allocated a financial grant of Rs.5 lakhs out of which Rs.2.5 lakhs has been paid to the Govt. of Nagaland to prepare a report regarding the resources available, market, infrastructure availability and other details etc. The work is under progress.

### 10.2 On Going Projects

#### i) Latex Based Products from Cactus

Latex bearing cactus plants such as *Euphorbia Nevulie/Nonfolea* are abundantly available in our arid and semi arid zones. The latex available from these plants is not put to any use at present. The Corporation therefore funded a project for setting up a pilot plant for the production of latex based products from cactus plants at Shri Ram Institute for Industrial Research, Delhi at an estimated expenditure of Rs.3.50 lakhs. The work on the project has been successfully completed and a pilot plant having 50 litres per day latex processing capacity has been set up at SRI, Delhi. Latex-based products, such as, water emulsion paint, jute composites with latex as roofing material for mud housing, corrosion and moisture resistant coatings for metals etc. have also been taken up for techno economic evaluation. It is proposed to set up Production-cum-Demonstration unit in *Euphorbia* growing areas in collaboration with a voluntary agency.

## 11. TECHNOLOGY AND PROJECT EXPORT

11.1 The Corporation continued its efforts to export Indian technologies to other developing countries. During the year the Corporation completed the following export projects :



	(Rs.in lakhs)
- Rice Husk Particle Board in Malaysia	118.00
- Cell Type Air Washer System in Philippines	6.63
- Textile Instruments in Philippines	1.00

The Corporation has secured a contract valued Rs.75 lakhs for providing consultancy services for setting up 4 Science & Technology Entrepreneur Parks in Egypt.

The negotiations with M/s Hondish Company Ltd., Hongkong for setting up of 2500 TPA Rice Husk Board Plant in China are in an advanced stage.



VII.A.6 Rice Husk Particle Board Plant at Malaysia

## 11.2 Foreign Exchange Earnings

The foreign exchange earnings of the Corporation amounted to Rs.148.47 lakhs in 1994-95 as compared to Rs.16.9 lakhs during the previous year.

## 12. PUBLICATIONS

**12.1** 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 :

- Annual Report 1993-94
- Process Diary
- Pre-Feasibility Report on Rice Husk Board
- NRDC at Your Service
- Foreign Patent Protection Scheme
- Small & Medium Scale Innovation Programme
- ATIRA Developments.

## 12.2 Sale of DSIR Publications

The Department of Scientific and Industrial Research entrusted NRDC with the marketing and sale of their publications on Technology Status Studies/Tech. Evaluation Studies/Project Profiles/Consultancy and other Studies. During 1994-95, the Corporation sold 586 reports valued at Rs.2,19,650/-.

## 13. 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 the following exhibitions, seminar and get-togethers organised by other agencies.



VII.A.7 NRDC Stall at INDEXPO-94 Exhibition of Indian Products and Technologies at Johannesburg, South Africa

- i) Seminar on New Indian Technologies in Textile Industry, Indonesia (7th July, 1994)
- ii) Seminar on New Indian Technologies in Textile Industry, Philippines (10th-11th July, 1994)
- iii) Technologies for Telecommunication & Informatics, Bangalore (25th - 28th August, 1994)
- iv) INDEXPO-94 - Johannesburg, South Africa (22nd - 28th August, 1994)
- v) Tech-Mart, 94, New Delhi (14th - 27th November, 1994)
- vi) India International Trade Fair, New Delhi (14th to 27th November, 1994)
- vii) International Exhibition and Symposium, Bombay (22-25th November, 1994)
- viii) Industrial India Trade Fair, Calcutta (21st December - 1st January, 1995)
- ix) Indian Science Congress, Calcutta (1st - 8th January, 1995)
- x) Agro Tech, Chandigarh (1st - 9th January, 1995)
- xi) INTECH-95 on Instrumentation, Informatics & Telecommunications, Bombay (17th-20th January, 1995)
- xii) Symposium on Advance Plastics and Composites and S&T of Nanomaterials, Kharagpur (6th-7th February, 1995)
- xiii) Seminar on Moulding Sand, New Delhi. (24th February, 1995)
- xiv) MANTECH 94 (Manufacturing Technologies, Processes and Products), New Delhi (24th - 28th March, 1995)

#### 14. WORKING RESULTS

The paid up capital of the Corporation as on 1st April, 1995 was Rs.320.31 lakhs. During 1994-95, Government invested Rs.15 lakhs towards equity and provided Rs.15 lakhs by way of loan. The sum of Rs.15 lakhs received from the Government towards equity during 1994-95 has been shown as advance, pending allotment of shares.

The unsecured loans at the end of the financial year 1994-95 stood at Rs.115.82 lakhs as compared to Rs.117.9 lakhs at the end of 1993-94.

The gross income of the Corporation during 1994-95, from all sources including premia and royalty, but excluding Grant-in-Aid, was Rs.295.85 lakhs as compared to Rs.295.08 lakhs in the previous year.



## VII (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 applications.
- (ii) Selected Electronic Systems - Equipment for Railway Signalling & Safety, Block Proving System using Axle Counter, Cathodic Protection Equipment for Oil Pipelines 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 the fifth largest producer of Single Crystalline Silicon Solar Cells in the world.

### 2. PERFORMANCE IN 1994-95

#### 2.1 Operating Results

The details of division-wise production & sales achieved during 1994-95 as compared to the previous year are given below :

	(Rs. in Crores)	
	1993-94	1994-95
Production	47.46	46.79
Sales	46.70	40.50

The shortfall in both production and sales has been, particularly related to SPV with regard to :

- (a) Reduction in the Solar Photovoltaic Cells/ Modules/Systems prices with respect to the price for 1993-94 and that assumed while deciding the MOU target.
- (b) Shortfall in receipt of order to the extent of over 10,000 nos. of DOT systems.

### 2.2 Highlights of Operations

#### 2.2.1 Solar Photovoltaics (SPV)

In the Solar Photovoltaics Group, 1510 KWp of SPV Modules were produced as against 1450 KWp produced in the previous year. A total of 3200 SPV Power Sources were supplied to DOT for its Rural Telecom Network as against 8,000 SPV power sources supplied during the last year. The sales price per system during 1994-95 had been lowered to Rs.18,000/- than Rs.22,489.80 in the previous year. 89 nos. of Very Low Power TV Transmitters were also supplied to Doordarshan during 1994-95.

In the 2nd year of the National SPV Pump Programme of the Ministry of Non-conventional Energy Sources (MNES), the Company supplied 23 nos. of SPV Pumps to various users through Indian Renewable Energy Development Agency (IREDA). During the year, 348 nos. of SPV Lanterns as per the MNES specifications were supplied. A separate independent Moduling Line was set-up in the SPV Plant for the production of Lantern Modules using cut cells from the cells production plant in the Company. A 15 KWp grid interfaced Power Plant of totally indigenous content was installed and commissioned on a turn-key basis at Kayathar, Tamil Nadu against an order from the Tamil Nadu Energy Development Agency (TEDA).

The Company has also supplied SPV Modules of 30 W, 35 W and 15 W (total 47 KWp) to



Nodal Agencies and 80000 solar cells to other Module manufacturers.



VII.B.1 15 KWp Grid Interactive SPV Power Plant installed by CEL in Kayathar Wind Farm (Tamilnadu).

### 2.2.2 Electronic Systems

The System Group produced 8,200 nos. of Charge Controllers for the SPV power systems for the DOT's Rural Telecom Network. In the area of Railway Electronics, 20 nos. of Block Equipment were installed and commissioned in the Northern, Central and Western Zonal Railways. During 1994-95, a new design of Axle Counter (called Universal Axle Counter) was introduced into the production line, duly approved by the Railway Development and Standardisation Organisation (RDSO), Lucknow. 50 nos. of these Universal Axle Counters were sold out of total 100 nos. of Axle Counters produced during the year. 13 nos. of the solar powered Gang Warning Systems were supplied to various Zonal Railways. An order was received from Western Railway (of value Rs. 80 lakhs) for supply of materials, trenching, laying cables, foundation etc.

The Company for the first time supplied 28 nos. of 256 port Rural Automatic Exchanges (RAXs) after necessary know-how transfer and approval from Centre for Development of Telematics (C-DOT).

As a measure of diversifying into new product areas, the Company entered into an agreement with C-DOT for Technology Transfer for the production of VSATs. The Company plans

to produce 2 VSATs next year for obtaining C-DOT clearance before launching into bulk supply of VSATs against orders.

3 solar powered Pole Mounted Cathodic Protection Systems were supplied to Indian Oil Corporation (IOC), Barauni. These systems are expected to have a large future market. 24 PTVs were also sold during the year.

### 2.2.3 Electronic Components

In the Ferrites Plant, in addition to the production of normal mix of Ferrite Cores, 1000 C-Band Microwave Ferrite Yokes and Rods were successfully completed and supplied for the Phase Shifter Assemblies. The Company also supplied 7000 PZT Electric Systems to the Defence for their 84 mm Carl Gustaf ammunition. A further order for 6000 nos. of the same was also received for supply in the following year.

The Company received an order for 1000 C-Band Phase Shifters from Electronics Research & Development Establishment (LRDE), Bangalore of Defence Research and Development Organisation (DRDO). Production of these Phase Shifters were completed except for the Driver Module. The Company had also received first proto-type order for 3 Frequency/Phase Correlator from Defence Research Laboratory Organisation (DRLO), Hyderabad which was executed.

### 2.2.4 Exports

The Company exported to Cuba, a 10 KWp of SPV System consisting of Domestic Lights (118 nos), Street Lights (20 nos), Solar Lanterns (10 nos), a Water Pumping System, one Community Lighting System and a Solar Powered Refrigerator. The above power plant has been deployed to electrify a remote village Lamadgdelina in Cuba in March 1995 at a cost of Rs.60 lakhs. Also the Company for the first time exported 4000 Piezo Ceramic Rings with likelihood of further recurring export order of this component.





VII.B.2 SPV operated deep well pump installed by CEL in village La-Magalina, Cuba.

### 3. OTHER HIGHLIGHTS OF 1994-95

#### 3.1 Memorandum of Understanding (MOU) with the Government

The Company has signed MOU for 1994-95 with the Government (DSIR) on 7th Oct. 1995. The MOU was signed by Dr. RA Mashelkar, Secretary, DSIR on behalf of the Government and Shri D.V. Gupta, Chairman & Managing Director on behalf of the Company.

#### 3.2 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 China, Russia, South Africa and G-15 Countries. The other notable visitors were :



VII.B.3 Visit of Dr. P. Rama Rao, the then Secretary, DST to CEL.

Mr. Oscar Fernandes - M.P., Shri BB Chadha - CMD (ITI), Dr. Raja Ramanna - former Raksha Rajya Mantri (RRM) & Ex-Chairman (AEC) Vice Adm. V Bhagwat - Deputy Chief of Naval Staff, Shri Shyam Saran - High Commissioner of India in Mauritius, Dr. P Rama Rao - Ex-Secretary (DST), Shri BR Prabhakara - Secretary (MNES), Shri Ravi Kathpalia - Controller General of Accounts (CGA), Ministry of Finance etc.

### 4. TECHNOLOGY ABSORPTION, ADAPTATION AND INNOVATION

The Company had obtained technology transfer from C-DOT for the 256 port RAX for which necessary production and infrastructural facilities were established and first orders successfully executed and supplied to DOT.

The Laboratory know-how for the production of Ultra High Efficiency (UHE) Single Crystalline Solar Cells obtained from the University of New South Wales (UNSW), Australia earlier was successfully used to establish a Bench Scale Process in the SPV Plant of the Company and UHE solar cells were successfully fabricated and first modules made using these cells.

### 5. DESIGN & DEVELOPMENT

In the SPV area, the in-house development activities on the process improvement of the existing Screen Printed Technology (SPT) for the production of silicon solar cells continued. The Anti Reflecting (AR) Coating equipment procured in the previous year was commissioned and extensive trials for optimisation of the process parameters for AR coating of cells using this equipment was carried out. As a result of all the process improvements carried out and additional equipment inducted, average efficiency of around 13.5% was obtained in volume production from the Solar Cell Plant in the Company using SPT Technology.

The development project for the production of UHE Single Crystalline Solar Cells based on the Laboratory Know-how obtained from the UNSW was continued during the year. The Clean Room facilities for this were fully established



and various process equipment such as the Diffusion Furnace, Laser Scriber, Electroless Plating Station etc. were installed, commissioned and finally the Bench Scale Process for the production of UHE solar cells was demonstrated in this Pilot Plant. Further process engineering and optimisation of parameters were carried out for converting the Bench Scale Process into a commercial production-worthy technology in the Pilot Plant. Trial batches of solar cells were successfully produced with average efficiency of 16% and SPV modules fabricated using these cells.

In the Ferrites Division, a batch production facility was set-up for the production of High Quality and High Frequency Ferrites. The computer programmable and atmosphere controlled Top Hat Kiln, a critical process equipment for production of High Permeability Ferrites was installed in the batch production facility. The commissioning of the Kiln was in progress at the end of the year. A new range of EMI Ferrites were developed and sample trials carried out. These range of ferrites are expected to have a large market potential in the coming years, particularly for export.

In the R&D Group of MED, a modified C-Band Phase Shifter design was evolved with much reduced dimension, lower insertion loss and with substantially high yield of around 95%. The C-Band Microwave Ferrite Rods and Yokes with new material and new dimensions were also successfully developed and optimised in the Ferrites Plant for these Phase Shifters. The Group also undertook the activity for the fabrication of Phased Arrays and supplied the first 64 element Phased Array with successful demonstration at LRDE, Bangalore. Necessary array design hardware was also completed in-house. Towards opening up new product areas in this division, prototypes for 0.5-2GHz & 2-8GHz Frequency/Phase Correlator were fabricated & supplied to DLRL, Hyderabad against trial order.

#### **6. ROLE IN NATIONAL TECHNOLOGY MISSIONS**

The Company's SPV group supplied about 3200 SPV Power Sources for the DOT's VHF

Rural Telecommunication Network. In the second phase of the operations related to the Rajiv Gandhi National Drinking Water Mission, 83 solar powered deepwell water pumping systems using submersible pumps were installed at as many sites in the states of Gujarat, Maharashtra, Madhya Pradesh & Rajasthan.

#### **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 the year. As on 31 March 1995, the total number of employees in these categories were 234 which represents about 24.8% of the total strength of the Company.

#### **8. USE OF HINDI**

In accordance with the guidelines on the progressive use of Hindi, the various sections of the Company were encouraged to use Hindi in both internal and external correspondence and also in the in-house training programmes for employees.

#### **9. INDUSTRIAL RELATIONS AND HUMAN RESOURCES DEVELOPMENT**

The Company had fairly cordial industrial relations during 1994-95 as a result of the Management's continuous dialogue with the recognised Workers Union and with the Officers/ Executives Associations.

Employees' participation in management continued through the forums of Shop Level and Plant Level Committees constituted for the purpose. Meetings of the Shop Floor Committees and of the Plant level Committees of the different divisions of the Company were held during the year

#### **10. TARGETS FOR 1995-96**

MOU Targets for 1995-96 are Rs. 50.65 crores of Production and Rs. 52 crores for Sales.

## VIII. 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 & Industrial Research. Other house-keeping jobs are being performed by the 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 Prabodh, Praveen and Pragya courses. Employees of the Department

were also nominated for training in Hindi Stenography and Hindi Typing.

- (d) Mini Hindi Magazine Division has been organised in the Hindi Section of the Department. The Three Hindi daily newspapers and 13 Hindi Magazines have been made available for the Officers and employees of the Department in order to increase their working knowledge of Hindi.
- (e) From 14th to 29th September, 1995, combined Hindi Week was observed by the Department of Science & Technology and Department of Scientific & 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.

- (f) During 1995 - two Hindi Workshops were organised in March, 1995 and August, 1995 for encouraging the Officers/Employees who possess the working knowledge of Hindi for using Hindi in their official work. Certificates were distributed after completion of the Workshop.
- (g) Hindi versions of Orders, Notifications, letters, Standard Drafts, Annual Report and Performance Budget were provided.
- (h) 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. CSIO, Chandigarh, IMT, Chandigarh and RRL, Jammu were inspected.

The sanctioned staff strength in the different groups in the Department of Scientific & Industrial Research as on 1.3.1996 is given below:

	Number of Employees			
	General	SC	ST	Total
Group A (Gazetted)	31	3	1	35
Group B (Gazetted)	8	1	-	9
Group B (Non-Gazetted)	15	1	-	16
Group C (Non-Gazetted)	13	3	2	18
Group D (Non-Gazetted)	10	1	-	11

# **ANNEXURES**



**LIST OF CSIR ESTABLISHMENTS**

Central Building Research Institute (CBRI), Roorkee  
Centre for Biochemical Technology (CBT), Delhi  
Centre for Cellular and Molecular Biology (CCMB), Hyderabad  
Central Drug Research Institute (CDRI), Lucknow  
Central Electrochemical Research Institute (CECRI), Karaikudi  
Central Electronics Engineering Research Institute (CEERI), Pilani  
Central Fuel Research Institute (CFRI), Dhanbad  
Central Food Technological Research Institute (CFTRI), Mysore  
Central Glass and Ceramic Research Institute (CGCRI), Calcutta  
Central Institute of Medicinal and Aromatic Plants (CIMAP),  
Central Leather Research Institute (CLRI), Madras  
Central Mechanical Engineering Research Institute (CMERI), Durgapur  
Central Mining Research Institute (CMRI), Dhanbad  
Central Road Research Institute (CRRI), Delhi  
Central Scientific Instruments Organization (CSIO), Chandigarh  
Central Salt & Marine Chemicals Research Institute (CSMCRI), Bhavnagar  
Indian Institute of Chemical Biology (IICB), Calcutta  
Indian Institute of Chemical Technology (IICT), Hyderabad  
Indian Institute of Petroleum (IIP), Dehradun  
Institute of Microbial Technology (IMT), Chandigarh  
Indian National Scientific Documentation Centre (INSDOC), New Delhi  
Industrial Toxicology Research Centre (ITRC), Lucknow  
National Aerospace Laboratories (NAL) Bangalore  
National Botanical Research Institute (NBRI), Lucknow

National Chemical Laboratory (NCL), Pune

National Environmental Engineering Research Institute (NEERI), Nagpur

National Geophysical Research Institute (NGRI), Hyderabad

National Institute of Oceanography (NIO), Goa

National Institute of Science Technology and Development Studies (NISTADS), New Delhi

National Metallurgical Laboratory (NML), Jamshedpur

National Physical Laboratory (NPL), New Delhi

CSIR Complex Palampur (CSIR-CX-PAL), Palampur

Publications & Information Directorate (PID), New Delhi

Regional Research Laboratory (RRL-BO), Bhopal

Regional Research Laboratory (RRL-BHU), Bhubaneswar

Regional Research Laboratory (RRL-JMU), Jammu

Regional Research Laboratory (RRL-J), Jorhat

Regional Research Laboratory (RRL-TRI), Thiruvanthapuram

Structural Engineering Research Centre (SERC-G), Ghaziabad

Structural Engineering Research Centre (SERC-M), Madras



## STATEMENT ON RECOGNITION OF IN-HOUSE R&amp;D UNITS

Month	Year	Receipts	Cumulative Receipts	Disposals	Cumulative Disposals	Cumulative Pendency at the end of the month
December	1994	-	-	-	-	17
January	1995	4	4	9	9	12
February	1995	11	15	11	20	12
March	1995	6	21	6	26	12
April	1995	7	28	7	33	12
May	1995	11	39	11	44	12
June	1995	8	47	3	47	17
July	1995	8	55	11	58	14
August	1995	4	59	3	61	15
September	1995	12	71	8	69	19
October	1995	6	77	3	72	22
November	1995	10	87	6	78	26
December	1995	15	102	18	96	23

## STATEMENT OF RENEWAL OF RECOGNITION BEYOND 31.03.1995

Month	Year	Receipts	Cumulative Receipts	Renewal applications processed	Cumulative Renewals processed	Cumulative Pendency at the end of the month
December	1994	69	69	-	-	69
January	1995	231	300	-	-	300
February	1995	42	342	122	122	220
March	1995	35	377	159	281	96
April	1995	30	407	88	369	38
May	1995	15	422	24	393	29
June	1995	6	428	25	418	10
July	1995	-	-	7	425	3
August	1995	-	-	3	428	Nil
<b>Total</b>		<b>428</b>		<b>428</b>		



**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 (Rs. in Lakhs)
1	Advanced Radio Masts Ltd.	621
2	Advani-Oerlikon Ltd.	228
3	Alembic Chemical Works Co. Ltd.	221
4	Alfa-Laval (India) Ltd.	600
5	Altos India Ltd.	187
6	Apollo Tyres Ltd.	262
7	Asea Brown Boveri Ltd.	446
8	Ashok Leyland Ltd.	806
9	Asian Paints (India) Ltd.	387
10	Associated Cement Companies Ltd.	731
11	Astra-IDL Limited	218
12	Atic Industries Ltd.	155
13	Atul Products Ltd., The	180
14	BASF India Ltd.	180
15	BPL Limited	455
16	BPL Sanyo Utilities and Appliances Ltd.	288
17	BPL Systems & Projects Ltd.	111
18	Bajaj Auto Ltd.	1830
19	Bajaj Tempo Ltd.	1066
20	Ballarpur Industries Ltd.	111
21	Balmer Lawrie & Company Ltd.	141
22	Bangalore Pharmaceuticals & Research Laboratory Pvt. Ltd.	133
23	Baroda Rayon Corporation Ltd., The	173
24	Bata India Ltd.	170
25	Bharat Dynamics Ltd.	245
26	Bharat Earth Movers Ltd.	857
27	Bharat Electronics Ltd.	4762
28	Bharat Heavy Electricals Ltd., Tiruchy, Ranipet (TN)	10817
29	Bharat Heavy Electricals Ltd., Hyderabad, Bhopal	3282
30	Bharat Heavy Electricals Ltd., Hardwar	184
31	Bharat Heavy Electricals Ltd., (PCRI), Hardwar	5100
32	Bharat Petroleum Corporation Ltd.	105
33	Bicycle & Sewing Machine Research & Development Centres	112

Contd /-

Sl. No.	Name of the firm	R&D Expenditure (Rs. in Lakhs)
34	Boots Pharmaceuticals Ltd.	194
35	Brakes India Ltd.	360
36	Bush Boake Allen (India) Ltd.	130
37	CMC Limited	688
38	Cadila Laboratories Ltd.	267
39	Camphor & Allied Products Ltd.	185
40	Carborundum Universal Ltd.	103
41	Castrol India Ltd.	128
42	Central Electronics Ltd.	194
43	Central Mine Planning & Design Inst. Ltd.	383
44	Chemisor Drugs Ltd.	114
45	Cipla Limited	878
46	Coats of India Ltd.	159
47	Colour-Chem Limited	317
48	Continental Device India Ltd.	148
49	Core Healthcare Ltd.	202
50	Crompton Greaves Ltd.	2066
51	DCM Shriram Industries Ltd.	705
52	Dharamsi Morarji Chemical Co. Ltd., The	107
53	Dr. Reddy's Laboratories Ltd.	1053
54	Dunlop India Ltd.	504
55	E.I.D. Parry (India) Ltd., Melpattambakkam (TN)	166
56	E.I.D. Parry (India) Ltd., Bangalore	205
57	E.I.D. Parry (India) Ltd., Madras	147
58	East India Pharmaceutical Works Ltd.	105
59	Eicher Tractors Ltd.	549
60	Electronic Research Ltd.	140
61	Electronics Corporation of India Ltd.	760
62	Elin Electronics Ltd.	150
63	Engineers India Ltd.	408
64	Escorts Limited	105
65	Escorts Limited	167
66	Esvin Advanced Technologies Ltd.	148
67	Excel Industries Ltd.	200
68	FDC Limited	142
69	Ferro Alloys Corporation Ltd.	115
70	Foseco India Ltd.	168

Contd /-



Sl. No.	Name of the firm	R&D Expenditure (Rs. in Lakhs)
71	Fuller K.C.P. Ltd.	146
72	GEC Alsthom India Ltd.	111
73	Gajra Gears Ltd.	144
74	Gammon India Limited	128
75	Garware Polyester Ltd.	167
76	Garware Wall Ropes Ltd.	112
77	Gharda Chemicals Ltd.	750
78	Glaxo India Ltd.	485
79	Godrej & Boyce Mfg. Company Ltd.	574
80	Godrej Soaps Ltd.	323
81	Goodlass Nerolac Paints Ltd.	260
82	Grauer & Weil (India) Ltd.	127
83	Gujarat Ambuja Cements Ltd.	150
84	Gujarat Communications & Electronics Ltd.	541
85	Gujarat State Fertilizers Company Ltd.	1082
86	HCL Hewlett-Packard Ltd.	379
87	HMT Limited, Bangalore	541
88	HMT Limited, Bangalore, Srinagar, Tumkur	211
89	HMT Limited, Pinjore	124
90	Haryana State Electronics Development Corporation Ltd.	191
91	Heavy Engineering Corporation Ltd.	216
92	High Polymer Labs (HPL)	134
93	Hindustan Aeronautics Ltd., Lucknow	1339
94	Hindustan Aeronautics Ltd., Bangalore	8160
95	Hindustan Aeronautics Ltd., Nasik	624
96	Hindustan Aeronautics Ltd., Hyderabad	829
97	Hindustan Antibiotics Ltd.	350
98	Hindustan Cables Ltd.	445
99	Hindustan Ciba-Geigy Ltd.	146
100	Hindustan Copper Ltd.	117
101	Hindustan Lever Ltd.	1732
102	Hindustan Motors Ltd.	263
103	Hindustan Newsprint Ltd.	115
104	Hindustan Photo Films Manufacturing Co. Ltd.	250
105	Hindustan Teleprinters Ltd.	156
106	Hindustan Zinc Ltd.	138
107	Hoechst India Ltd.	919
108	Hyderabad Industries Ltd.	125

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Sl. No.	Name of the firm	R&D Expenditure (Rs. in Lakhs)
109	ICI India Ltd., Madras, Rishra (WB)	225
110	ICI India Ltd., Gomia (Bihar)	133
111	IDL Chemicals Ltd.	125
112	IPCA Laboratories Ltd.	310
113	ITC Limited	490
114	ITI Equatorial Satcom Ltd.	119
115	India Glycols Ltd.	192
116	Indian Aluminium Company Ltd.	566
117	Indian Drugs & Pharmaceuticals Ltd.	350
118	Indian Oil Corporation Ltd.	1884
119	Indian Organic Chemicals Ltd.	135
120	Indian Petrochemicals Corporation Ltd.	2419
121	Indian Telephone Industries Ltd., Bangalore	3498
122	Indian Telephone Industries Ltd., Naini (UP)	915
123	Indo-American Hybrid Seeds	250
124	Ion Exchange (India) Ltd.	142
125	J.K. Industries Ltd., Udaipur	160
126	J.K. Industries Ltd., Faridabad	508
127	J.K. Synthetics Ltd.	102
128	Jain Irrigation Systems Ltd.	369
129	Johnson & Johnson Ltd.	147
130	Jyoti Limited	145
131	K.C.P. Limited	105
132	KFA Corporation Ltd.	200
133	Kegfarms Pvt. Ltd.	143
134	Kelvinator of India Ltd.	252
135	Kinetic Engineering Ltd.	506
136	Kirloskar Brothers Ltd.	210
137	Kirloskar Copeland Ltd.	102
138	Kirloskar Cummins Ltd.	504
139	Kirloskar Electric Co. Ltd.	236
140	Kirloskar Oil Engines Ltd.	113
141	Kirloskar Pneumatic Co. Ltd.	108
142	Kopran Limited	424
143	Lakshmi Machine Works Ltd.	165
144	Larsen & Toubro Limited	1406
145	Lubrizol India Ltd.	455
146	Lucas-TVS Ltd.	233

Contd /-



Sl. No.	Name of the firm	R&D Expenditure (Rs. in Lakhs)
147	Lupin Laboratories Ltd.	2840
148	Lyka Labs Limited	123
149	MRF Limited	1250
150	Madras Refineries Ltd.	232
151	Maharashtra Hybrid Seeds Company Ltd.	240
152	Mahindra & Mahindra Ltd.	1645
153	Maruti Udyog Ltd.	972
154	Merind Limited	268
155	Microcon Instruments and Systems	140
156	Minda Industries Ltd.	110
157	Mirc Electronics Ltd.	406
158	Modern Malleable Casting Works Ltd.	113
159	Modi Rubber Ltd.	178
160	Modi Xerox Ltd.	232
161	Morris Electronics Ltd.	190
162	Motor Industries Co. Ltd.	1062
163	Mysore Kirloskar Ltd., The	200
164	National Mineral Development Corporation Ltd.	393
165	National Organic Chemical Industries Ltd.	867
166	National Radio & Electronics Company Ltd., The	135
167	National Rayon Corporation Ltd., The	160
168	National Telecom of India Ltd.	400
169	National Thermal Power Corporation Ltd.	1552
170	Ncore Technology Pvt. Ltd.	107
171	Neyveli Lignite Corporation Ltd.	119
172	Oil & Natural Gas Commission	640
173	Oil India Limited	311
174	Optel Telecommunications Ltd.	547
175	Otis Elevator Co. (India) Ltd.	115
176	Padmashri Dr. Vithalrao Vikhi Patel Sahakari Sakhar Karkhana Ltd.	310
177	Petrofils Co-operative Ltd.	190
178	Pfizer Limited	132
179	Pharmaceutical Products of India Ltd., The	150
180	Philips India Ltd., Calcutta	495
181	Philips India Ltd., Pune	148
182	Premier Automobiles Ltd.	962
183	Premier Instruments & Controls Ltd.	182

Contd /-

Sl. No.	Name of the firm	R&D Expenditure (Rs. in Lakhs)
184	Proagro Seed Company Ltd.	185
185	Procter & Gamble India Ltd.	327
186	Projects & Development India Ltd.	751
187	Punjab Communications Ltd.	189
188	Punjab Tractors Ltd.	138
189	Rallis India Ltd.	256
190	Ramco Industries Ltd.	430
191	Ranbaxy Laboratories Ltd.	4149
192	Rashtriya Chemicals & Fertilizers Ltd.	105
193	Recon Limited	228
194	Reliance Industries Ltd.	269
195	Renewable Energy Systems Pvt. Ltd.	128
196	Rolta India Ltd.	258
197	Samtel Color Ltd.	115
198	Sandoz (India) Ltd.	292
199	Sandvik Asia Ltd.	198
200	Saraswati Industrial Syndicate Ltd., The	263
201	Searle (India) Ltd.	103
202	Secure Meters Ltd.	163
203	Semiconductor Complex Ltd.	409
204	Shriram Industrial Enterprises Ltd.	110
205	Siemens Ltd.	486
206	Southern Petrochemical Industries Corporation Ltd.	411
207	Steel Authority of India Ltd., (RDCIS), Ranchi	4513
208	Steel Authority of India Ltd., Bokaro	237
209	Sudarshan Chemical Industries Ltd.	150
210	Sumitra Pharmaceuticals & Chemicals Ltd.	140
211	Sun Pharmaceutical Industries Ltd.	390
212	Sundaram Brake Linings Ltd.	250
213	Sundaram Clayton Ltd.	166
214	Tamil Nadu Dadha Pharmaceuticals Ltd.	110
215	Tamilnadu Petroproducts Ltd.	241
216	Tata Chemicals Ltd	106
217	Tata Elxsi (India) Ltd.	145
218	Tata Engineering & Locomotive Co. Ltd.	3077
219	Tata Hydro-Electric Power Supply Co. Ltd., The	783
220	Tata Iron & Steel Co. Ltd., The	1155
221	Tata Refractories Ltd.	225

Contd /-



Sl. No.	Name of the firm	R&D Expenditure (Rs. in Lakhs)
222	Tata Sons Ltd.	1388
223	Tata Tea Ltd.	291
224	Thermax Limited	305
225	Torrent Pharmaceuticals Ltd.	300
226	Tractors & Farm Equipment Ltd.	127
227	Travancore Chemical and Mfg. Co. Ltd.	204
228	Unichem Laboratories Ltd.	170
229	United Phosphorous Ltd.	127
230	Uptron India Ltd.	110
231	Venco Research & Breeding Farm Ltd.	329
232	Venkateshwara Research & Breeding Farm Ltd.	343
233	Vi-Microsystems Pvt. Ltd	450
234	Wheels India Ltd.	103
235	Widia (India) Ltd.	530
236	Wipro GE Medical Systems Ltd.	100
237	Wipro Infotech Ltd.	632
238	Wipro Limited	297
239	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**

<b>Sl. No.</b>	<b>Name of the firm</b>	<b>R&amp;D Expenditure (Rs. in Lakhs)</b>
1	Adarsh Chemicals & Fertilisers Ltd.	64
2	Advanced Micronic Devices Ltd.	37
3	Advani-Oerlikon Ltd.	30
4	Aerospace Systems Pvt. Ltd.	80
5	Alembic Glass Industries Ltd.	45
6	Alkem Laboratories Ltd.	30
7	Alkyl Amines Chemicals Ltd.	36
8	Alpha Drug India Ltd.	27
9	Amar Dye Chem Ltd.	92
10	Ambalal Sarabhai Enterprises Ltd.	70
11	Amco Batteries Ltd.	43
12	American Remedies Ltd.	45
13	Amphetronix Limited	43
14	Amrutanjan Limited	50
15	Andhra Pradesh Paper Mills Ltd.	26
16	Andhra Sugars Ltd., The	74
17	Anil Starch Products Ltd., The	34
18	Anupam Machine Tools Ltd.	74
19	Applied Electro Magnetics Pvt. Ltd.	99
20	Applied Electronics Ltd.	76
21	Armour Chemicals Ltd.	27
22	Arvind Mills Ltd.	65
23	Asea Brown Boveri Ltd.	32
24	Asian Cables & Industries Ltd.	60
25	Assam Company Ltd., The	41
26	Astra Microwave Products Ltd.	83
27	Audco India Ltd.	62
28	Automatic Electric Ltd.	39
29	Autometers Limited	64
30	Avery India Limited	26
31	BPL Sanyo Technologies Ltd.	37
32	Bajaj Electricals Ltd.	34

Contd /-



Sl. No.	Name of the firm	R&D Expenditure (Rs. in Lakhs)
33	Bakelite Hylam Ltd.	56
34	Basik Breeders Pvt. Ltd.	80
35	Bayer (India) Ltd.	49
36	Bells Controls Ltd.	25
37	Bengal Immunity Ltd.	45
38	Berger Paints India Ltd.	69
39	Bharat Aluminium Company Ltd.	50
40	Bharat Forge Ltd.	26
41	Bharat Fritz Werner Ltd.	34
42	Bharat Heavy Electricals Ltd.	62
43	Bharat Heavy Plate & Vessels Ltd.	50
44	Bharat Pumps & Compressors Ltd.	30
45	Bharat Starch & Chemicals Ltd.	30
46	Bhartia Electric Steel Company Ltd.	35
47	Bhoruka Gases Ltd.	33
48	Binani Zinc Ltd.	28
49	Biochem Synergy Ltd.	93
50	Biocon India Pvt. Ltd.	35
51	Biological E. Ltd.	53
52	Birla VXL Ltd.	46
53	Blue Star Limited	53
54	Bombay Burmah Trading Corporation Ltd., The	54
55	Bombay Paints Ltd.	34
56	Britannia Industries Ltd.	96
57	Burroughs Wellcome (India) Ltd.	94
58	Cable Corporation of India Ltd.	86
59	Cadbury India Limited	85
60	Ceat Limited	41
61	Cemindia Company Ltd.	50
62	Central Institute of Road Transport	78
63	Century Textiles & Industries Ltd., The	94
64	Chemfab Alkalis Ltd.	71
65	Chemicals & Plastics India Ltd.	50
66	Chemoleums Pvt. Ltd.	25
67	Chloride Industries Ltd.	95
68	Cibatul Limited	47
69	Citurgia Biochemicals Ltd.	32
70	Cochin Refineries Ltd.	63

Contd /-

Sl. No.	Name of the firm	R&D Expenditure (Rs. in Lakhs)
71	Concept Pharmaceuticals Ltd.	37
72	Cosmo Films Ltd.	41
73	Cureworth (India) Ltd.	30
74	Cyanamid India Ltd.	58
75	DCM Shriram Consolidated Ltd.	55
76	DLF Universal Ltd.	47
77	Dai-ichi Karkaria Ltd.	29
78	Datapro Electronics Pvt. Ltd.	37
79	Dave Paints Ltd.	32
80	Dey's Medical Stores (Mfg.) Ltd.	66
81	Dominant Offset Pvt. Ltd.	31
82	Dr. Beck & Company (India) Ltd.	28
83	Duphar-Interfran Ltd.	61
84	Dura Magnets Pvt. Ltd.	34
85	E.Merck (India) Ltd.	46
86	ESAB India Ltd.	71
87	EWAC Alloys Ltd.	84
88	Eimco Elecon (India) Ltd.	35
89	Elcot Power Controls Ltd.	90
90	Electro Pneumatics & Hydraulics (I) Ltd.	60
91	Electronic Systems Punjab Ltd.	26
92	Electronica Mechatronic Systems (India) Pvt. Ltd.	85
93	Electrotherm Machines (India) Ltd.	64
94	Elgi Equipments Ltd.	43
95	Elgi Tyre & Tread Ltd.	60
96	Ellora Steels Ltd.	31
97	English Indian Clays Ltd.	70
98	Escorts Tractors Ltd.	66
99	Eskayef Limited	73
100	Eternit Everest Ltd.	40
101	Eureka Forbes Ltd.	42
102	Fenner (India) Ltd.	53
103	Fertilizers & Chemicals Travancore Ltd.	36
104	Fisher-Rosemount (India) Ltd.	31
105	Flex Industries Ltd.	79
106	Forbesons Tech Centre Pvt. Ltd.	31
107	Fort Gloster Industries Ltd.	42
108	Franco-Indian Pharmaceuticals Ltd.	42

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Sl. No.	Name of the firm	R&D Expenditure (Rs. in Lakhs)
109	GTC Industries Ltd.	34
110	Gajra Bevel Gears Ltd.	50
111	Galaxy Surfactants (P) Ltd.	29
112	Ganga Agri Seeds Ltd.	33
113	Glenmark Pharmaceuticals Ltd.	54
114	Godfrey Phillips India Ltd.	51
115	Gokak Mills	35
116	Gontermann-Peipers (India) Ltd.	74
117	Goodricke Group Ltd.	30
118	Graphite India Ltd.	52
119	Grindwell Norton Ltd.	45
120	Gujarat Alkalies & Chemicals Ltd.	47
121	Gujarat Narmada Valley Fertilizers Company Ltd.	36
122	HMT Limited	47
123	Harbanslal Malhotra & Sons Ltd.	34
124	Hargovind Bajaj Research & Development Centre	40
125	Hawkins Cookers Ltd.	85
126	Henkel Chemicals (India) Ltd.	44
127	Herdillia Chemicals Ltd.	54
128	Hico Products Ltd.	85
129	High Energy Batteries (India) Ltd.	76
130	Himachal Futuristic Communications Ltd.	92
131	Hindalco Industries Ltd.	35
132	Hindustan Spinning & Weaving Mills Ltd., The	43
133	Hindustan Development Corporation Ltd.	48
134	Hindustan Dorr-Oliver Ltd.	30
135	Hindustan Insecticides Ltd.	76
136	Hindustan Motors Ltd.	76
137	Hindustan Organic Chemicals Ltd.	72
138	Hutti Gold Mines Company Ltd.	30
139	IAEC Industries Madras Ltd.	34
140	IBP Company Ltd.	81
141	IOL Limited	70
142	IVP Limited	29
143	IXL India Tele-Comp Ltd.	30
144	Imeco Ultrasonics	25
145	Incab Industries Ltd.	35
146	India Foils Ltd.	36

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Sl. No.	Name of the firm	R&D Expenditure (Rs. in Lakhs)
147	India Meters Ltd.	46
148	India Nippon Electricals Ltd.	43
149	India Pistons Ltd.	55
150	Indian Dyestuff Industries Ltd.	88
151	Indian Farmers Fertilizers Co-operative Ltd.	29
152	Indian Hume Pipe Company Ltd., The	34
153	Indian Rare Earths Ltd.	65
154	Indian Telephone Industries Ltd., Rai Bareilly (UP)	34
155	Indian Telephone Industries Ltd., Mankapur (UP)	36
156	Indian Yeast Company Ltd., The	42
157	Indo National Ltd.	26
158	Indofil Chemicals Company	41
159	Industrial Perfumes Ltd.	32
160	Infar (India) Ltd.	49
161	Infocom Digital Systems (P) Ltd.	70
162	Infotech Enterprises Pvt. Ltd.	33
163	Instrumentation Engineers Pvt. Ltd.	60
164	Instrumentation Ltd.	90
165	Intas Laboratories Pvt. Ltd.	31
166	International Computers Indian Manufactures Ltd.	67
167	International Instruments Ltd.	32
168	Ispat Alloys Limited	34
169	Jagatjit Industries Ltd.	32
170	Jagsonpal Pharmaceuticals Ltd.	37
171	Jaysynth Dyechem Ltd.	52
172	Jenson & Nicholson (India) Ltd.	50
173	Jyoti Ceramic Industries Pvt. Ltd.	58
174	K.E.C. International Ltd.	30
175	Kadevi Engineering Co. (P) Ltd.	58
176	Karnataka Telecom Ltd.	60
177	Kasila Farms Pvt. Ltd.	92
178	Kerala Electrical & Allied Engineering Co. Ltd.	44
179	Kerala Minerals & Metals Ltd., The	30
180	Kilburn Engineering Ltd.	52
181	Kirloskar Brothers Ltd.	41
182	Klockner Windsor (India) Ltd.	74
183	Kores (India) Ltd.	26

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Sl. No.	Name of the firm	R&D Expenditure (Rs. in Lakhs)
184	L&T Gould Ltd.	30
185	L&T-McNeil Ltd.	44
186	L.G. Balakrishnan & Brothers Ltd.	25
187	Lakhanpal National Ltd.	51
188	Lakme Limited	75
189	Laxmi Boilers (South) Pvt. Ltd	93
190	Lectrotek Systems (Pune) Pvt. Ltd.	55
191	Lona Industries Ltd.	35
192	Lupin Chemicals Ltd.	44
193	M.J. Institute of Research	26
194	M.P. Electricity Board	43
195	MAX-GB Limited	62
196	Machine Tool Aids and Reconditioning	61
197	Macmet India Ltd.	26
198	Mafatlal Fine Spinning & Mfg. Co. Ltd., The	25
199	Mafatlal Industries Ltd., The	85
200	Maharashtra Electronics Corporation Ltd., Nagpur	32
201	Maharashtra Electronics Corporation Ltd., Pune	60
202	Maharishi Ayurveda Products	40
203	Mahendra Hybrid Seeds Company Ltd.	42
204	Mahindra Sintered Products Ltd.	34
205	Mahindra UGINE Steel Co. Ltd.	27
206	Malhotra Shaving Products Ltd.	31
207	Manali Petrochemicals Ltd.	31
208	Marine & Communication Electronics (India) Ltd.	50
209	Max India Ltd.	40
210	McDowell & Co. Ltd.	69
211	Measurement Systems Pvt. Ltd	28
212	Meltron Semiconductors Ltd.	51
213	Metallizing Equipment Co. Pvt. Ltd.	26
214	Metallurgical & Engineering Consultants (India ) Ltd.	64
215	Metroark Limited	28
216	Metrochem Industries Ltd.	91
217	Microland Limited	53
218	Minota Aquatech Ltd.	81
219	Mishra Dhatu Nigam Ltd.	55
220	Modern Woolens Ltd.	40
221	Modipon Limited	55

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Sl. No.	Name of the firm	R&D Expenditure (Rs. in Lakhs)
222	Modistone Ltd.	44
223	Montari Industries Ltd.	86
224	Morarjee Goculdas Spinning & Weaving Co. Ltd., The	26
225	Mukand Limited	68
226	Mytimasters' Engineering Pvt. Ltd.	40
227	NGEF Limited	71
228	NICCO Industries Ltd., The	31
229	Nalco Chemicals India Ltd.	45
230	Natco Fine Pharmaceuticals Pvt. Ltd.	49
231	Nath Seeds Ltd.	26
232	National Aluminium Company Ltd.	42
233	National Peroxide Ltd.	69
234	National Textile Corporation (South Maharashtra) Ltd.	28
235	Navdeep Chemicals Pvt. Ltd.	31
236	Nepa Ltd., The	46
237	Network Limited	47
238	Nippon Denro Ispat Ltd.	38
239	Nirlon Limited	30
240	Northern Digital Exchanges Ltd.	44
241	Nuchem Plastics Ltd.	36
242	O/E/N India Ltd.	31
243	Oblum Electrical Industries Pvt. Ltd.	33
244	Organic Coatings Pvt. Ltd.	28
245	Orient Abrasives Ltd.	30
246	Orissa Cement Ltd.	40
247	Orissa Industries Ltd.	51
248	P.I. Industries Ltd.	73
249	PSI Data Systems Ltd.	25
250	Pace Elcot Automation Ltd.	50
251	Pacific Telecommunications & Instruments Ltd.	40
252	Paharpur Cooling Towers Ltd.	31
253	Parke-Davis (India) Ltd.	52
254	Penam Laboratories Ltd.	49
255	Pennwalt India Ltd.	25
256	Pest Control (India) Ltd.	36
257	Philips India Ltd.	94
258	Phillips Carbon Black Ltd.	55
259	Pidilite Industries Ltd.	54

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Sl. No.	Name of the firm	R&D Expenditure (Rs. in Lakhs)
260	Plasticemix Industries	32
261	Polychem Limited	57
262	Porritts & Spencer (Asia) Ltd.	55
263	Pradeep Drug Company Ltd.	40
264	Praga Tools Ltd.	60
265	Praj Industries Ltd.	34
266	Precision Fastners Ltd.	32
267	Premier Polytronics Ltd.	49
268	Priyaraj Electronics Ltd.	46
269	Process & Products Development Centre	36
270	Processor Systems (India) Pvt. Ltd.	52
271	Pudumjee Pulp & Paper Mills Ltd.	29
272	Punjab Wireless Systems Ltd.	55
273	Purolator India Ltd.	45
274	RES Photovoltaics Ltd.	84
275	Ragheer Machinery Pvt. Ltd.	30
276	Rainbow Ink & Varnish Manufacturing Co. Ltd.	64
277	Rajasthan Communications Ltd.	40
278	Rajasthan Electronics & Instruments Ltd.	89
279	Ralliwolf Limited	32
280	Rane (Madras) Ltd.	45
281	Rane Brake Linings Ltd.	57
282	Raptakos Brett & Co. Ltd.	50
283	Raymond Woollen Mills Ltd., The	70
284	Reckitt & Colman of India Ltd.	28
285	Reliance Industries Ltd.	75
286	Resource Technologies Pvt. Ltd.	72
287	Rhone-Poulenc (India) Ltd.	36
288	Rinki Industries Oils Ltd.	98
289	Roussel India Ltd.	39
290	Royal Enfield Motors Ltd.	26
291	Rubber Products Ltd.	44
292	Ruby Mills Ltd., The	28
293	S.H. Kelkar & Company Ltd.	35
294	S.K.Dynamics Pvt. Ltd.	32
295	SOL Pharmaceuticals Ltd.	27
296	SRF Limited	49
297	SSP (Pvt.) Ltd.	26

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Sl. No.	Name of the firm	R&D Expenditure (Rs. in Lakhs)
298	Samtel (India) Ltd.	30
299	San Engg & Locomotive Co. Ltd.	46
300	Sanmar Electronics Corporation Ltd.	52
301	Sapana Polyweave Pvt. Ltd.	38
302	Scientific Instrument Co. Ltd., The	34
303	Scooters India Ltd.	26
304	Sealol Hindustan Ltd.	81
305	Secals Limited	75
306	Shalimar Paints Ltd.	79
307	Shasun Chemicals and Drugs Ltd.	32
308	Shaw Wallace & Company Ltd.	26
309	Shree Synthetics Ltd.	25
310	Shyam Antenna Electronics Ltd.	63
311	Siemens Telematik Ltd.	75
312	Simpson & Co. Ltd.	60
313	Siris Limited	46
314	Smithkline Beecham Consumer Healthcare Ltd.	40
315	Solar Farmachem Ltd.	26
316	Solidaire India Ltd.	31
317	Speck Systems Pvt. Ltd.	40
318	Sree Rayaleseema Alkalies & Allied Chemicals Ltd.	46
319	Standard Industries Ltd.	75
320	Standard Organics Ltd.	29
321	Stangen Immuno Diagnostics	42
322	Star Precision Electronics (India) Ltd.	74
323	Star Spin & Twist Machinerics Ltd	43
324	Steel Tubes of India Ltd.	40
325	Structwel Designers & Consultants Pvt. Ltd.	40
326	Sundram Fastners Ltd.	50
327	Swadeshi Polytex Ltd.	30
328	TIL Limited	52
329	TIPPCO Industries Ltd.	38
330	TTK Pharma Ltd.	25
331	TVS Electronics Ltd.	50
332	TVS-Suzuki Limited	80
333	Talbros Automotive Components Ltd.	39
334	Tamil Nadu Electricity Board	42
335	Tamil Nadu Newsprint and Papers Ltd.	42

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Sl. No.	Name of the firm	R&D Expenditure (Rs. in Lakhs)
336	Tata Keltron Ltd.	38
337	Tata Oil Mills Co. Ltd., The	42
338	Tata Telecom Ltd.	92
339	Tata-Robins-Fraser Ltd.	61
340	Tata-Yodogawa Ltd.	25
341	Technicom Systems (India) Pvt. Ltd.	43
342	Television & Components Ltd.	30
343	Textool Company Ltd.	77
344	Thirumalai Chemicals Ltd.	30
345	Tide Water Oil Co. (India) Ltd.	79
346	Titagarh Steels Ltd.	34
347	Titan Industries Ltd.	66
348	Titanium Equipments & Anode Mfg. Co. Ltd.	36
349	Top Syringe Mfg. Co.	68
350	Tractor Engineers Ltd.	50
351	Transgene Biotek Ltd.	59
352	Transpek Industry Ltd.	61
353	Travancore Titanium Products Ltd.	52
354	Travancore-Cochin Chemicals Ltd., The	85
355	Triveni Sheet Glass Works Ltd.	45
356	Triveni Structural Ltd	25
357	Tube Products of India	47
358	Turbotech Precision Engineering Pvt. Ltd.	36
359	USV Limited	80
360	Ucal Fuel Systems Ltd.	65
361	Unique Chemicals	56
362	Unique Pharmaceuticals Laboratories Ltd.	32
363	United Catalysts India Ltd.	60
364	United Telecoms Ltd.	29
365	Universal Cables Ltd.	39
366	VXL Engineers Ltd.	26
367	VXL Instruments Ltd.	55
368	Vam Organic Chemicals Ltd.	73
369	Veejay Lakshmi Engineering Works Ltd.	31
370	Venkateshwara Hatcheries Ltd.	74
371	Vidyut Metalics Ltd.	28
372	Vikrant Tyres Ltd.	50
373	Vintek RF Products Pvt. Ltd.	75

Contd /-

Sl. No.	Name of the firm	R&D Expenditure (Rs. in Lakhs)
374	Voltas Limited, Bombay	29
375	Voltas Limited, Patancheru (AP)	55
376	Voltas Limited, (Allwyn Unit), Hyderabad	28
377	W.S. Industries (India) Ltd.	36
378	Walchandnagar Industries Ltd.	66
379	Wander Limited	46
380	Webel Crystals Ltd.	30
381	Webel Telecommunication Industries Ltd.	71
382	Webfil Limited	38
383	Wires and Fabriks (SA) Ltd.	26
384	Worthington Pump India Ltd.	26
385	Wyeth Laboratories Ltd.	97
386	Yamuna Gases & Chemicals Ltd.	45
387	Zandu Pharmaceutical Works Ltd.	86

**LIST OF SCIENTIFIC AND INDUSTRIAL RESEARCH ORGANISATIONS  
APPROVED DURING 1995\***

**AGRICULTURAL, NATURAL & APPLIED AND MEDICAL SCIENCES**

S.No.	Name of the Institution	Approval Valid upto
1.	Central Institute of Plastics Engineering and Technology	31.03.1997
2.	National Academy of Agricultural Sciences	31.03.1997
3.	GMDC Science and Research Centre	31.03.1997
4.	Dr. Ramazini Research Institute of Occupational Health Services	31.03.1997
5.	Dr. Baba Saheb Ambedkar Medical Research Society	31.03.1997
6.	Malladi Research Centre	31.03.1998
7.	Solar Energy Society of India	31.03.1997
8.	Institute for Autoparts Technology	31.03.1997
9.	Indian Institute of Foreign Trade	31.03.1998
10.	SIMA Cotton Development and Research Association, The	31.03.1997
11.	Y.R. Gaitonde Medical Educational Research Foundation	31.03.1997
12.	National Facility for Animal Tissue and Cell Culture (NFATCC)	31.03.1997
13.	Centre for Environmental Planning and Technology (CEPT)	31.03.1998
14.	Free Polio Surgical and Research Foundation	31.03.1997
15.	KCP Nephro-Urological Centre and Research Foundation	31.03.1997
16.	Schieffelin Leprosy Research and Training Centre	31.03.1998
17.	Institute of Child Health and Hospital for Children	31.03.1998
18.	Indian Society of Genetics and Plant Breeding	31.03.1998
19.	Hirabai Cowasji Jehangir Medical Research Institute	31.03.1997
20.	Cancer Centre and Welfare Home	31.03.1997
21.	Central Council for Research in Homoeopathy	31.03.1998
22.	Society of Nuclear Medicine, India	31.03.1997
23#.	Dr. D.Swaminadhan Research Foundation (DSRF)	31.03.1997

\* These organisations were also recommended to the Director General (IT Exemptions), Calcutta for issuance of Notification u/s 35(1)(ii) of the I.T. Act. 1961.

# This institution has also been recommended for notification under 35(1)(iii) of I.T. Act. 1961.



**LIST OF SCIENTIFIC AND INDUSTRIAL RESEARCH ORGANISATIONS  
APPROVED DURING 1995\***

**SOCIAL SCIENCES**

<b>S.No.</b>	<b>Name of the Institution</b>	<b>Approval Valid upto</b>
1.	Indian Heritage Research Foundation	31.03.1997
2.	Mudra Foundation for Communications Research and Foundation	31.03.1996
3.	University of Pennisylvania Institute for the Advanced Study of India	31.03.1996
4.	Shri Ram Charan Prachya Vidhya Peeth and Sangrahalaya Trust	31.03.1997
5.	Centre for Policy Studies	31.03.1997
6.	Centre for Economic and Social Studies	31.03.1998
7.	International Centre for Alternative Dispute Resolution	31.03.1997
8.	M.S.Chellamuthu Trust and Research Centre	31.03.1997
9.	Indian Youth Centre's Trust	31.03.1997

\* These Organisations were also recommended to Director General (IT Exemptions), Calcutta for issuance of Notification u/s 35(1)(iii) of the I.T. Act. 1961.

**CERTIFICATES FOR INVESTMENT ALLOWANCE ISSUED BY DSIR  
UNDER SECTION 32 A (2B) OF I.T. ACT. 1961**

No.	Name of the Company	Lab where Know-How Developed	Rs. In Lakhs	Item of Manufacturing
1.	Grindwell Norton Ltd., Bombay	Indian Instt. of Science, Bangalore	506	Silicon Carbide
2.	Jagatdhatri Bricks Industries, (24 Parganas West Bengal)	Central Fuel Research Instt., Dhanbad and Central Building Research Institute, Roorkee.	17.73	Fly Ash Bricks
3.	Amrit Banaspati Co. Ltd., Ghaziabad.	Forest Research Institute, Dehradun	304	Writing and Printing paper

**CERTIFICATE FOR ACCELERATED DEPRECIATION ALLOWANCE  
ISSUED BY DSIR UNDER RULES 5(2) OF I.T. RULES VIDE  
NOTIFICATION NO.133/342/86-TPL DATED 1.4.1988**

S.No.	Name of the Company	Lab where know-how developed	Rs. in Lakhs	Item of manufacture
1.	Larsen & Toubro Ltd, Bombay	C-DOT	7.13	EPABX and RAX
2.	Dharamsi Morarji Chemical Co, Bombay.	In-House	635.15	Sulphuric Acid
3.	Chemstar Organics (I) Pvt.Ltd. Bombay	In-House	108.32	Meta Phenoxy Benzaldehyde Etc
4.	Shimo Resins Pvt Ltd, Pune	In-House	5.01	Polyurethane based Semi-Rigid & Rigid Casting, Sealing, Potting Compound Etc
5.	Jyoti Ceramics Industries, Nasik	In-House	10.32	High Density High Alumina Ceramic Grinding media and wear resisting material
6.	Indchem Electronics Ltd. (A division of Sanmar Electronic Corporation Ltd.) Madras	C-DOT	178.02	EPABX & RAX, SBM RAX & MAX
7.	Punjab Communications Ltd, SAS Nagar	TRC	129.29	Pulse Code Modulation Equip.
8.	Punjab Communications Ltd, SAS Nagar	C-DOT	260.48	EPABX, RAX, MAX (switching equipment)
9.	Prestress(I) Pvt Ltd Bombay	RDSO, Lucknow	152.63	Concrete Sleepers
10.	Manganese Ore (India) Ltd, Nagpur	NML, Jamshedpur	17.90	Electro. Manganese Dioxide

Contd /-



S.No.	Name of the Company	Lab where know-how developed	Rs. in Lakhs	Item of manufacture
11.	Vaman Prestressing Company Ltd, Bombay	RDSO, Lucknow	46.50	Mono-block Concrete Sleepers
12.	NOCIL, Bombay	IICT, Hyderabad	562.95	Contd /- Monocrotophos
13.	NOCIL, Bombay	RRL, Hyderabad and Jorhat	7.46	DDVP Phosphomidon
14.	Veejay Lakshmi Engg. Works (Pvt)Ltd, Coimbatore	SITRA	182.93	Two for one Twister
15.	BASF India Ltd, Bombay	In-House	29.19	TAMOL NN8906 (Dispersing Agents)
16.	Herdillia Chemicals, Bombay	In-House	133.22	Diphenyl Oxide & Isobutylbenzene
17.	Filtra Speciality Catalysts, Bombay	Filtra Material Research (Pvt.) Ltd.	1.90	Catalysts
18.	E C I L, Hyderabad	In-House DLRL, TIFR	146.13	Electronic Products
19.	Sun Pharmaceuticals Industries Ltd, Baroda	In-House	431.48	Bulk Drugs
20.	E C I L, Hyderabad	In-House DLRL, TIFR	169.60	Electronic Equipment
21.	Punjab Tractors Ltd., SAS Nagar	In-House and CMERI, Durgapur	725.66	Tractor and Harvester
22.	Hakatronics, Bombay	In-House	2.50	Microprocessor Based Electronic Equipment

**SPONSORED RESEARCH PROJECTS APPROVED BY DSIR FOR  
125% WEIGHTED TAX DEDUCTION UNDER SECTION 35(2AA) OF IT ACT 1961**

<b>S.No.</b>	<b>Name of the Company</b>	<b>National Laboratory</b>	<b>Rs. in Lakhs</b>	<b>Scientific Project/Programme</b>
1.	HEG Limited Mandideep, M.P.	National Physical Laboratory (NPL), New Delhi	10.00	Development of activated carbon cloth.

## 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