ANNUAL REPORT
1994-95

Department of Scientific and Industrial Research
Ministry of Science & Technology
New Delhi - 110 016

CONTENTS

ANNEXURES

LIST OF FIGURES AND PHOTOGRAPHS

V.A.1.	Emission Control System in a Formaldehyde Plant
V.A.2.	Oil Free Rotary Screw Compressors
V.A.3.	Leaf Springs
V.A.4.	Wet Slip Type. Fine and Superfine Wire Drawing Machines
VI. 1	Information Today and Tomorrow-demo in Progress
VII.A.1.	Demonstration Plant of Copper Phthalocyanine Blue (CPB)
VII.A.2.	Space Worthy Passive Radiant Cooler for Very High Resolution of Pay Load of INSAT-2 Satellite Developed by ISRO, Bangalore
VII.A.3.	Pilot Plant for Production of Latex from Cactus Plant
VII.A.4.	Personal Braille Embosser Developed by Super Computer Education and Research Centre of IISc, Bangalore
VII.A.5.	Automatic Self Adjusting Spanner/Wrench on display at NRDC stall in WISITEX '94
VII.B.1.	Foldable Solar Photo Voltaic Modules for Charging the Batteries of Man-pack Radio Sets
VII.B.2.	Solar Power Generator at Veer Bhumi (Rajiv Gandhi Smadhi)
VII.B.3.	Sir John Maddox, Editor Nature Magazine seeing SPV application systems at CEL
VII.B.4.	Diffusion furnace with automatic loading/unloading and gas controlled facility at the SPV plant at CEL

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 is the Prime Minister Shri P.V. Narasimha Rao and the Minister of State for Science and Technology is Shri Bhuvanesh 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), 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 catagorised into four major groups viz. industry/economy oriented programmes, societal programmes, basic research programmes and research support activities.

CSIR has made efforts towards Globalisation of its activities. CSIR has entered into collaborative agreements, licensed its technologies, and signed MoUs with organisations and laboratories in countries like USA, China, South Africa, Netherlands, Japan, United Kingdom and Republic of Korea.

Among the major industry/economy oriented programmes of CSIR laboratories, those related to drugs, catalysis, chemicals, metallurgy, environment, petroleum refining, biotechnology, agrotechnology, food technology, electronics, leather, materials and transportation constitute a major chunk.

The laboratory scale know-how for production of Ondansetron, a drug to check emesis in chemotherapy for cancer, was licensed to CIPLA, by IICT. CIPLA upscaled the process technology and optimized process parameters in association with IICT. A promoted copper catalyst (a catalyst doped with copper), superior to the conventional catalyst, was successfully tested by NCL in the dehydrogenation of secondary butyl alcohol (SBA) to methyl ethyl ketone (MEK) in a pilot plant at Cetex Petrochemicals Ltd., Madras. IICT has undertaken the responsibility of developing the technologies for CFC substitutes. During the year, IICT was successful in optimising the know-how at semipilot scale for HFC 134a from trichloroethylene (TRI) and anhydrous hydrogen flouride, using an indigenously developed catalyst. Thin film composite (TFC) membrane development has been taken up by CSMCRI for the desalination of highly saline water/seawater by Reverse Osmosis. NML pioneered the development of Ni-free stainless steel for various applications involving ordinary and elevated temperatures. The main focus was to substitute nickel, which is an expensive alloying element, with less expensive alloying elements like nitrogen, manganese, etc. NEERI has

developed and demonstrated technology for reclamation of mine spoil dumps using pressmud, sewage sludge and biofertilizers. Over 1,00,000 plants of teak, shiwan, shishum, acacia, neem etc now occupy 45 hectares of manganese mine spoil dumps around Nagpur. The technology for the production of Aviation Turbine Fuel (ATF)/Sk, developed by IIP in collaboration with M/s Engineers India Ltd. and the Hindustan Petroleum Corporation Ltd., has been offered to the Digboi Refinery. A cost effective, pelleted fish feed using locally available, low cost materials but giving high growth rates of fish has been developed by CCMB. A remarkable achievement of IMTECH has been the development and commercialisation of a complete technology package, in collaboration with Vittal Mallya Scientific Research Foundation, for the production of ethanol. CLRI has succeeded in propagating the concept of "Leather Complexes" for environmental improvement in tannery clusters in Calcutta and Bombay. CLRI has also prepared and submitted a project report for the implementation of the world's largest leather complex in Calcutta. CSIO has entered into a Memorandum of Understanding (MoU) with the Special Design Bureau (SDB) of the Russian Academy of Sciences for the supply of Seismic Sensors, Triaxial Seismometer TS-1 and a Single Component Vertical Seismometer SM-3 KVM. The most significant achievement of NAL during this period was the successful flight of the experimental prototype of the all-composite aircraft, NALLA renamed as HANSA. The development of the Light Transport Aircraft (LTA), now renamed SARAS also registered significant progress. LTA is being developed jointly with Myasishchev Design Bureau (MDB), Russia . NPL has successfully developed the processing technique of high strength Al-Li alloy of composition: Al: 4.5%; Mg: 1.5% and Li. Red mud polymer (RMP) composite material developed by RRL, Bhopal was used for door shutters for elaborate performance tests and field trials.

Under societal programmes, ITRC continued to play a major role in the Rajiv Gandhi National Drinking Water Mission of the Ministry of Rural Development, Government of India. About 300 water samples from 1290 villages of Meerut, Doda, Udhampur, Rajauri and Jammu were analysed by ITRC to assess the quality of water. CIMAP accorded high priority to the popularisation of large scale cultivation and processing of medicinal and aromatic plants among growers and entrepreneurs. RRL Bhubaneswar has developed "Harsha", a portable high efficiency multiple Chulha which is well suited for rural as well as urban needs.

In the area of basic research, with the earlier success in resolving the carbon cage morphology of C-60 using scanning tunnelling microscopy (STM) technique further attempts were made to observe directly the defect carbon cage structure of C-60 at NPL. Extensive modelling studies at NGRI with the aid of synthetic seismogram computations for elastic as well as absorbing media provided for the first time a new insight into the detectability of low velocity layers by seismic technique. The study of magnetic data in the Laxmi Basin east of Laxmi Ridge (between 16-18 30'N) in the Arabian Sea, for the first time, revealed the presence of well correlatable NNW trending magnetic lineations. This evidence of sea-floor spreading in the Laxmi Basin implies the existence of a third episode of spreading (pre-A27) in the history of evolution of the Arabian sea. An environment-friendly, regiospecific benzoylation process has been developed at NCL making use of the commercially available zeolite catalyst HZSM-5 in place of the toxic aluminium chloride employed in the conventional process. Methodologies have been developed by NCL for some of the industrially important reactions such as selective alkylation using dialkyl zinc, reduction of x-keto imides, opening of cyclic sulphates, and nucleophilic addition on arene chromium complex. It had been shown earlier at CCMB that fluorescence spectroscopy offers a unique, noninvasive way to monitor membrane organisation and dynamics. Recent work showed that the slow reorientation of solvent molecules around a membrane bound fluorophore could be effectively utilised to reveal details of the environment of the fluorophore.

Under research support activities, IMTECH has created a facility of a state of the art 1500 litre fermentation pilot plant which is so far the only one of its kind in the whole of South East Asia. Under a collaborative research programme on tea

between CIMAP and Tea Research Association (TRA), Calcutta, a procedure for obtaining genetically transformed hairy roots of tea has been developed. With a view to reducing road accidents by improving road user behaviour, CRRI, under a sponsored study of the Ministry Of Surface Transport (MOST), successfully conducted training courses for traffic police personnel in metropolitan cities of Patna, Cochin, Coimbatore, Indore, Ludhiana, Madurai, Surat, Varanasi and Viskhapatnam. The Sports Authority of India has commissioned SERC-G to investigate the cause of distress and leakage in various buildings of the Indira Gandhi stadium complex and propose suitable remedial measures. The productivity of the 1.2m trisonic wind tunnel of NAL went up with a total of 1600 blowdowns this year as against 897 last year.

The Publications and Information Directorate (PID) of CSIR publishes twelve journals in English in different areas of science and technology. Special issues of Science Reporter on "Meghnad Saha", "Shanti Swarup Bhatnagar" and "Satyendra Nath Bose" and a "Festival Issue" were brought out. The section entitled "India Can Do It" in Science Reporter continued to focus on achievements of Indian Science. The Indian National Scientific Documentation Centre (INSDOC) of CSIR, New Delhi has started acquiring about 1000 core foreign journals, a majority being in electronic form.

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

I Research and Development by Industry (RDI) consisting of:

(a) In-house R&D in Industry.

(b) Scientific and Industrial Research Organisations (SIROs).

(c) Fiscal Incentives for Scientific Research.

II Programme Aimed at Technological Self-Reliance (PATSER) consisting of:

(a) Development of new or improved technologies.

(b) Development of special/custom built capital Goods.

(c) Absorption and Adaptation of imported technology.

(d) Studies and interactions concerning Technology Evaluation and pre-industry feasibility of major sectors/products.

III Scheme to Enhance the Efficacy of Transfer of Technology (SEETOT) consisting of:

(a) National Register of Foreign Collaborations (NRFC).

(b) Industrial Technology.

(c) Transfer and Trading in Technology (TATT).

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

(e) Promotion and Support to Consultancy Services (PSCS) which also include the Consultancy Development Centre (CDC).

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

V Public Enterprises include:

(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 1238 units having valid recognition as on 31 December 1994. 193 In-house R&D Centres incurred an annual expenditure of over Rs. 1 crore each. During the year, 68 In-house R&D centres were accorded fresh recognition and 538 centres were accorded renewal

of recognition. During the year 1994-95, 12 publications were brought out; Eighth National Conference on In-house R&D in Industry was organised; DSIR National Awards were presented to 12 industrial units. 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 28 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 20 certificates involving Rs. 3039 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. During the year, 4 such research programmes worth Rs. 44 lakhs were approved.

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 70 firms involving over 100 Research, Design, Development and Engineering projects in development and demonstration of new/improved product and process technologies, and absorption and upgradation of imported technologies. The projects in progress include those of Balmer Lawrie & Co. Ltd. concerning development of Conical Expanding Machines, Andrew Yule & Co. Ltd. concerning Heavy Duty Industrial Fans, KMML concerning recovery of heavy metals from effluents, BEML concerning upgradation of 50 Ton dumper and 200 HP front end loader, IBP concerning development of heat resistant explosives, TSL concerning 400 KV guyed transmission line tower, SCL concerning ASICs for line card, TCCL concerning development of process technology for manufacture of synthetic rutile, Litex concerning development of Xenon and Krypton filled lamps, OIL concerning development of chemical leaching technology, CS Zircon concerning development of Plasma based reduction process, ER & DC concerning development of controller for switched reluctance motor, CEL concerning development of hybrid solar photovoltaic power plant and Plasma Etching, MECON concerning development of 6 Hi-cold rolling mill, 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, PTL concerning development of electronic controller for fork lift drive and BEML concerning development of back hoe hydraulic excavator, computerised transmission control for off high way dump trucks and cast crank shafts.

Technology Evaluation Reports in sectors such as railway wagons, leather tanneries, bicycles, rubber processing, edible oils, industrial oils and fatty acids, paints, secondary steel refining, refractories, glass, waste recycling, home appliances, fertiliser granulation, decorative laminates, plastic furnitures, plastic tanks, industrial alcohols and secondary aluminium sectors have been finalised during the year.

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 1993 was brought out. Computerisation of data collected on foreign collaborations for the period 1981 to 1993 has been completed. During the year reports on technology status of various sectors/products like Springs, Welding Electrode, Acitic Acid, Copper and Wire Drawing Machine 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.

Under the scheme of Transfer and Trading in Technology, activities supported include: conducting studies related to technology profiles of select countries and technological capabilities in select industrial sectors; demonstration and commercialisation of exportable technologies. Technology profiles of Ghana and South Africa and technology export potential studies on Computers Software and Veterinary Formulations were completed. Technology demonstration and commercialisation projects on Cell Type Air Washer and Iono-Oxidation technique were carried on. An interaction meeting to finalise the draft report on Veterinary Formulations was organised during the year.

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); Registration scheme for consultants is being implemented at 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. It has organised the first meeting of the Advisory Committee of the ESCAP Technical Consultancy Development Programme for Asia and Pacific (TCDPAP) and an international training programme on Role of consultants in Export of manufactured products, at New Delhi, with the cooperation and support to ESCAP and APCTT. CDC has signed an MOU with BITS, Pilani in relation to its training programme to be recognised for its M.S. (consultancy management) degree.

1.8 National Information System for Science and Technology (NISSAT)

National Information System for Science & Technology (NISSAT) was conceived to interlink existing centres, systems and services into a network and facilitate the effective transfer of latest and most relevant information to users in all parts of the country. The thrust during the year was to promote resources sharing among libraries and information centres through library networks; Consultative Committee Mechanisms and Union Catalogue. The networks at Calcutta, Delhi, Bombay and Ahmedabad became operational and the networks in Pune initiated. The activities of existing 10 information centres were augmented and their services and revenue generation improved. CD-ROM facilities were established in 10 centres providing services from 41 CD-ROM databases.

The nine national access centres on international databases (NACID's) continued to provide services on full cost recovery basis. The promotion and utilisation of information technologies was implemented in 200 institutions. Training courses on information technology application were organised and the quarterly NISSAT Newsletter for dissemination of information activities was published.

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: invert sugar, gallic acid, phone -in programme system, glycol based automobile coolants, detergent grade zeolite, glucose bio-sensors, near net shape forging technology, antigens for diagnosis and immunotherapy of allergic disorder. The ongoing projects include: heart valve project at Shree Chitra Tirunal Institute for Medical Sciences and Technology, acid proof cement from rice husk ash, synthetic absorbable surgical sutures, precipitated silica, sandlime bricks and new range of rice husk board. The corporation has successfully transferred technologies for synthetic and natural dyes to Vietnam, and completed Project report for mini cement plant in Indonesia.

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 hi-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 Electronics 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 piezoceramics. Today, it enjoys the international status of being the fourth largest producer of single crystalline silicon solar cells in the world.

2.0 During the year 1994-95, there was an alround growth and progress in the activities of different programmes of DSIR.

DEPARTMENT OF SCIENTIFIC AND INDUSTRIAL RESEARCH

I (B). FINANCIAL SUMMARY

The financial summary giving the Actuals 1993-94, BE 1994-95, RE 1994-95 and BE 1995-96 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 1993-94			Budget Estimates 1994-95			Revised Estimates 1994-95			Budget Estimates 1995-96		
		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	122.00	194.07	316.07	140.00	198.50	338.50	141.36	215.00	356.36	161.00	223.85	384.85
2.	Technology Promotion Development and Utilisation Programme	9.22	0.00	9.22	14.10	0.03	14.13	12.74	0.02	12.76	13.91	0.04	13.95
3.	Research and Development	2.11	0.00	2.11	2.10	0.00	2.10	2.10	0.00	2.10	2.25	0.00	2.25
4.	Investment in Public Enterprises												
4.1	Central Electronics Limited	4.00	0.00	4.00	2.25	0.00	2.25	2.25	0.00	2.25	4.27	0.00	4.27
4.2	National Research Development Corporation	0.15	0.00	0.15	0.15	0.00	0.15	0.15	0.00	0.15	0.15	0.00	0.15
	TOTAL	4.15	0.00	4.15	2.40	0.00	2.40	2.40	0.00	2.40	4.42	0.00	4.42
5.	Loans to Public Enterprises												
5.1	Central Electronics Limited	4.00	2.31	6.31	2.25	0.00	2.25	2.25	2.67	4.92	4.27	0.00	4.27
5.2	National Research Development Corporation	0.15	0.00	0.15	0.15	0.00	0.15	0.15	0.00	0.15	0.15	0.00	0.15
	TOTAL	4.15	2.31	6.46	2.40	0.00	2.40	2.40	2.67	5.07	4.42	0.00	4.42
	Total Investment & Loans	8.30	2.31	10.61	4.80	0.00	4.80	4.80	2.67	7.47	8.84	0.00	8.84
6.	Secretariat Economic Services	0.00	0.86	0.86	0.00	0.92	0.92	0.00	1.14	1.14	0.00	1.14	1.14
	GRAND TOTAL	141.63	197.24	338.87	161.00	199.45	360.45	161.00	218.83	379.83	186.00	225.03	411.03

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.

Ever since the announcement of the new economic policy of the Government, CSIR has been orienting its R&D efforts to generation of technologies that are not only internally relevant but are also globally competitive. The sustained efforts of the national laboratories of CSIR in this direction have started yielding results. CSIR is now fully geared to take its place in the community of expert R&D systems of the world. The nexus between Indian industries and the CSIR laboratories has now been further strengthened. There are two principal reasons for this; first, the industrial sector has come to realize the enormous combined capability of CSIR -- a capability which when utilized will provide huge benefits to the industries at internationally competitive rates; and secondly the laboratories, far from attacking the fringes of problems are now providing complete solutions, technology packages and even turn-key plants.

CSIR is also fully conscious of its role in the application of Science & Technology for the economic and social betterment of the people of the country. It has a direct involvement in some of the major national missions. It has already contributed significantly to the fullfilment of the objectives of the national mission on drinking water and the technology mission on oilseeds. Some of the laboratories continue to participate in the further phases of these missions and other Societal Programmes. CSIR laboratories have also continued the Basic Research Programmes in several areas. Another area in which CSIR laboratories are actively engaged is providing wide-ranging technical services to a variety of users. These are in the nature of national facilities of hi-tech testing, and pilot plants, consultancies on upgradation of technologies, computational expertise and dissemination of information.

Thus the main thrust of CSIR programmes is aimed at globalisation, industry and economy, societal, basic research and research support activities.

2. GLOBALISATION

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

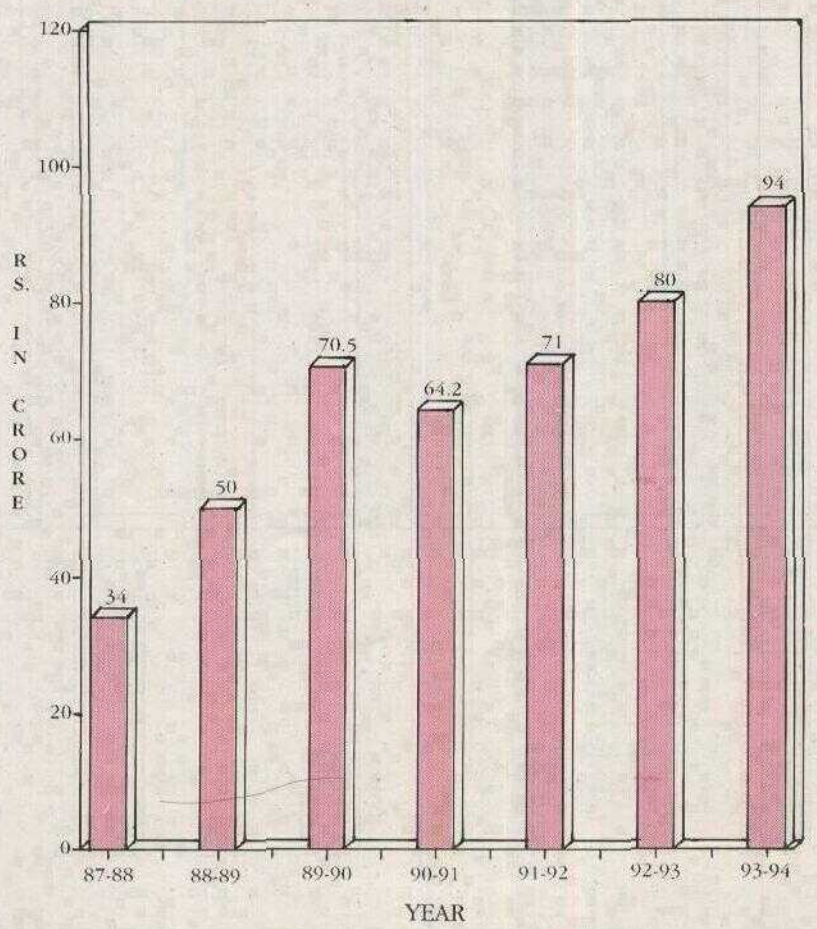
2.1 Drugs

IICT entered into collaborative agreements for: R&D for the synthesis of HIV (Human Immuno Virus) protease inhibitor compounds with M/S Abbot Laboratories, Chicago, USA and evaluation

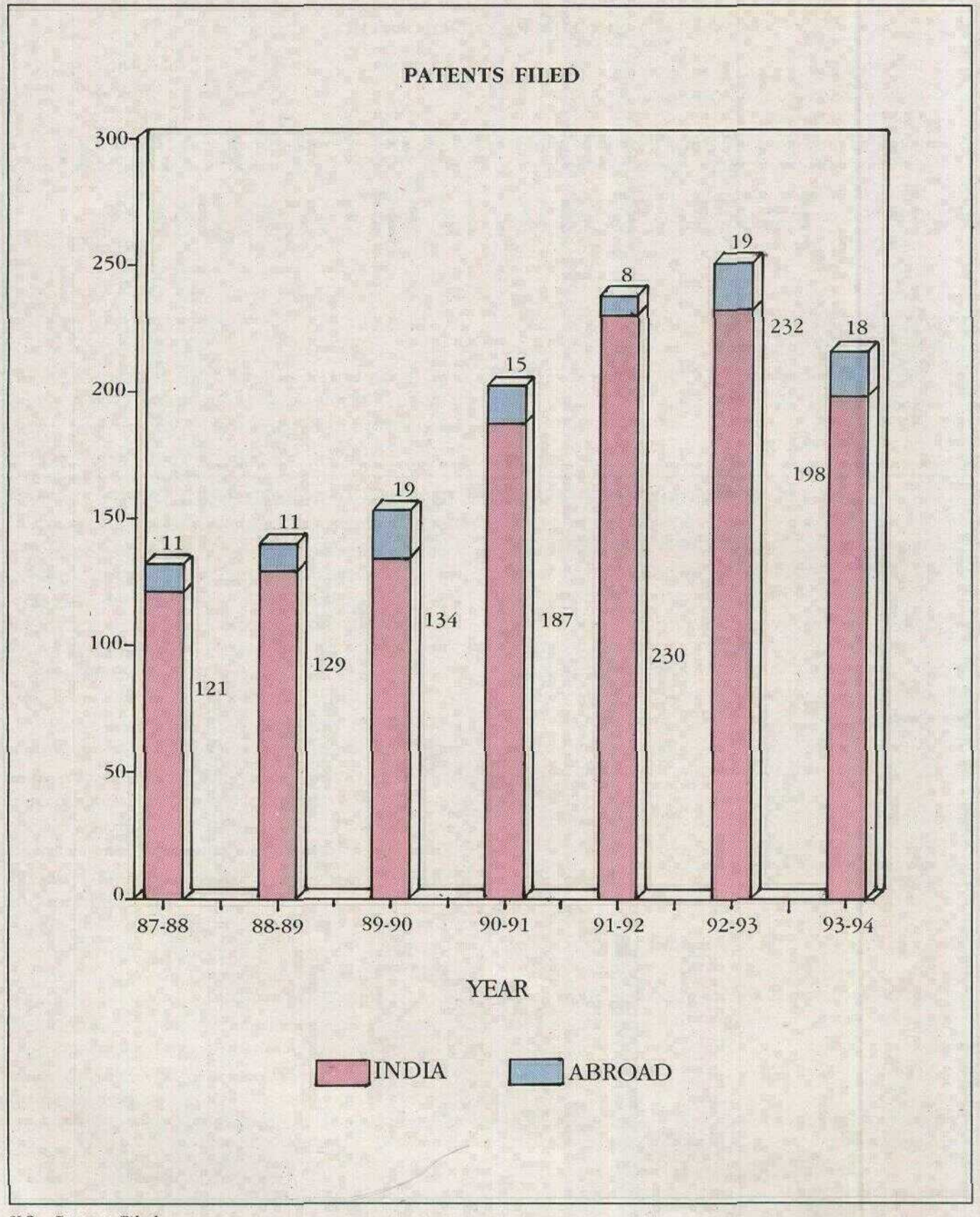
CSIR OUTPUT INDICATORS

Indicator	1993-94	Cumulative
Knowhow licensed (No.) (First time)	35	1975
Licence agreements	180	6112
Industrial production based on CSIR know-how (Rs. crore)	2250	15,650
Saving in productivity accruing through CSIR R&D efforts (Rs. crore)	200	2900
Patents filed (No.)	216	5891
in India	198	
in Abroad	18	
Contract value (Rs.crore) (of projects in hand)		
(a) Contract Research	190	
(b) Consultancy	20	
Cash flow (Rs. crore) through		
(a) Contract Research	78.9	
(b) Consultancy	15.2	

CASH FLOW THROUGH SPONSORED RESEARCH AND CONSULTANCY



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



II.2. Patents Filed

of Indian medicinal plants, with M/s Parke Davis, Philadelphia, USA.

CDRI signed an agreement with the US firm 'Zymogenetics' for development of Centchroman for its further use as a drug for Osteoporosis, restenosis and psoriasis'.

CDRI continued its collaborative agreements with M/s Du Pont De Nemours & Co., and the National Cancer Institute, USA and LVMH, France for the supply of CDRI products for activity testing.

2.2 Intermediates

IICT licensed its technology for preparation of 10- undeconic acid by pyrolysis of castor methyl esters to M/S Design & Research Institute for Petrochemical Engineering, China. Representatives of the firm were given a complete demonstration of the process at the 1kg/hr stage. The firm will be setting up a commercial plant of 300 tpa capacity. 10-undecenoic acid is an important chemical from castor oil, and its derivatives are valuable raw materials for the perfumery, drug and engineering plastics (especially nylon-11) industries.

2.3 Agrochemicals

IICT finalized negotiations with M/s Sanochem of South Africa for transfer of technologies for Chlorpyriphos (a pesticide) and Glyphosphate (an intermediate in the chemical industry) for a total sum of US $ 1.5 m.

2.4 Catalysis

A process for the manufacture of sodium pentasil zeolites has been successfully demonstrated by NCL to a company in the Netherlands, as a prelude to its subsequent transfer. These are used as catalysts in petroleum refining.

2.5 Environment

NEERI has signed a Memorandum of Undertaking (MoU) with Mitsui Environmental Engineering Trust (MEET), Japan, to undertake joint research and development studies of various measures relating to environmental protection, in collaboration with Japanese institutions.

2.6 Aeronautics

NAL bagged a £75,000 contract from the Civil Aviation Authority, (CAA), UK, to take up the second stage of the wake vortex modelling project. The second stage involved writing a computer code to predict wake vortex behaviour, based on the wake model proposed earlier by NAL. The first version of the code, tested extensively on a PC platform, has already been submitted to CAA. The NAL wake model is to be coupled with CAA's own encounter model to determine the optimal safe distance to be maintained between two successive aircraft landings at crowded international airports like Heathrow.

2.7 Roads

CRRI is restructuring its data on pavement performance studies to interface them with Long Term Pavement Performance (LTPP) studies of the US Strategic Highway Research Program (SHRP) now being implemented by the Federal Highway Administration (FHWA); this will provide access to SHRP data base, which has a global sweep. An announcement has appeared in UNIDO Newsletter about CRRI being a premier organisation to take up projects in roads and traffic & transportation.

2.8. Structures

SERC-M has organised an advanced training/ study tour programme for senior level officials including a minister from North Korea on sponsorship by the United Nations Commission for Human Settlements (UNCHS), Nairobi. This programme was tailored to impart the expertise of SERC in establishing a division of computer aided structural analysis and design, for the Construction Design and Calculation Centre of the Republic of Korea.

3. INDUSTRY AND ECONOMY ORIENTED PROGRAMMES

3.1 Drugs

3.1.1 Bacoside

A collaborative-cum-licensing agreement was

signed by CDRI with Velvette (International) Pharma Products Pvt. Ltd., Madras for development of Bacoside A&B as a memory improvement agent.

3.1.2 Ondansetron

The lab scale know-how for production of Ondansetron, a drug to check emesis in chemotherapy for cancer, was licensed to CIPLA, by IICT. CIPLA upscaled the process technology and optimized process parameters in association with IICT. Later, the firm carried out extensive field trials and launched the product under the trade name "EMESET" at a price much lower than the international price.

3.1.3 Process Technologies

Technologies for the following four drugs were developed and licensed by CDRI. (i) Acyclovir (an antiviral);- Ranbaxy Laboratories ltd., New Delhi (ii) Sumatriptan - (an antimigraine drug); Cipla Ltd., Bombay (iii) Palatable Herbal Laxative - Velvette (International) Pharma Products Pvt. Ltd., Madras and (iv) Norgestral (a drug for anti-implantation) for Pharmasia Ltd., Hyderabad.

CBT has been able to prepare a bioseed (liophilized bacterial culture) for determinatioin of Biological Oxygen Demand (BoD). The Central Pollutioin Control Board, Delhi has taken up this bioseed for validation in their laboratories.

3.1.4 Allergens

CBT is responsible for development of indigenous allergenic extracts for diagnosis of allergic disorders. The extracts are being supplied to a large number of patients and physicians all over the country. The technology has now been transferred to M/s. Bio-Diagnostics through the National Research Development Corporation (NRDC). The supply of allergens is being continued until the transfer of technology is complete.

3.2 Catalyst

A promoted copper catalyst (a catalyst doped with copper), superior to the conventional catalyst, was successfully tested by NCL in the dehydrogenation of secondary butyl alcohol (SBA) to methyl ethyl ketone (MEK) in a pilot plant at Cetex Petrochemicals Ltd., Madras. Subsequent commercial trials showed a satisfactory performance of the catalyst with regard to activity, selectivity and stability.

3.2.1 Synthesis of Pyridine Bases

Very active, selective and stable catalysts have been developed for the production of pyridine bases viz. pyridine, 2-picoline, 3-picoline and 4-picoline through cyclodehydrogenation reaction between aldehyde and ammonia. Process parameters viz. acetaldehyde ammonia molecular ratio, temperature, velocity, etc. have been optimised for the maximum production of these bases in laboratory scale. These products find wide application in a number of industries producing drugs and pharmaceuticals, herbicides and pesticides, rubber and textiles, organic intermediates, solvents and reagents, latex adhesives, dyestuff and dyeing agents. Presently, these products are imported. The current imports are of the order of about 3000 MT per annum. The demand is growing at the rate of at least 10% per annum along with a similar growth in the user industries.

3.3 Chemicals

3.3.1 CFC Substitutes

IICT has undertaken the responsibility of developing the technologies for CFC substitutes. During the year, IICT was successful in optimising at semipilot scale the know-how for HFC 134a from trichloroethylene (TRI) and anhydrous hydrogen flouride, using an indigenously developed catalyst. A pilot plant for producing 5kg/hr HFC 134a has been conceived, individual units have been sized, and control scheme and layout finalised. Efforts are on to produce the requisite quantities of the catalyst for the pilot plant runs. The Institute has obtained sponsorship of Rs. 40 lakh from two private industries, for this programme.

3.3.2 CO-Based Chemicals

Carbon monoxide (CO) is an important

building block for a variety of intermediates used for production of value-added drugs, pesticides and other speciality chemicals. CO- technology is a well guarded preserve of MNCs. IICT has been able to work in this area with success. As a first step towards development of tchnologies for chemicals through the CO route, IICT successfully completed the designing, fabrication, and installation of a 5kg/hr CO generation plant. The pilot plant which incorporates a novel gas distribution system for efficient reaction to get maximum yields of CO is complete with compression and filling facilities. IICT now has the expertise to offer technology for manufacturing CO.

3.3.3 Membrane Science & Technology

The protocol for producing vaccines against the foot and mouth disease (FMD) that affects farm animals was developed and demonstrated successfully to Bharatiya Agro Industries Foundation (BAIF) using a membrane module designed and made at NCL. Incorporation of the new membrane technology allows 30% more vaccine production with the existing fermentation line. NCL is interacting with BAIF with this objective. Besides maintaining the virus concentration at the desired level, the method minimizes the possibility of virus activation.

3.3.4 Electro-chemical Technique

A process for electrochemical preparation of monochloro toluenes has been developed by CECRI. The products find application as insecticides, dyes, herbicides, fungicides and pharmaceuticals. The process is pollution-free and selective for monochlorination. The process has been studied at 100 A cell scale and the yield is 1.2 kg per batch. The estimated demand for the product is 100 tpa.

3.4 Petroleum Refining and Petrochemicals

3.4.1 Aromatic Extraction

The technology for the production of Aviation Turbine Fuel (ATF)/Sk (developed by IIP in collaboration with M/s Engineers India Ltd. and the Hindustan Petroleum Corporation Ltd.,) has been offered to the Digboi Refinery. This technology is being further improved for processing full range kerosene by using a new solvent and incorporating re-extraction route for solvent recovery. This approach will make the process versatile and economically attractive.

3.4.2 Desulphurisation of Fuel Gases

Studies on development of technology for desulphurisation of fuel gases have been continued by IIP. The catalyst recipe developed has been successfully demonstrated to the Cochin Refineries Ltd. on bench scale and the level of hydrogen sulphide was brought down from 10 to 1 ppmv.

3.5 Metallurgy

3.5.1 Nickel-free Austenitic Steel

NML pioneered the development of Ni-free stainless steel for various applications involving ordinary and elevated temperatures. The main focus was to substitute nickel, which is an expensive alloying element, with less expensive alloying elements like nitrogen, manganese, etc. One such steel based on the Cr-Mn-N-C system was developed for high temperature applications. This steel possesses creep strength superior to 21-4N austenitic steel which is conventionally used for exhaust valve application in automotive engines. This provoked NML scientists to explore the suitability of Ni-free steel for application in production of exhaust valves. Accordingly, exhaust valves conforming to the specification of the Tata D1 engine and that of Diesel Locomotive Works (DLW), Varanasi, were successfully made from the laboratory heats of this steel. Field trials in railway diesel locomotives yielded encouraging results. The present steel, therefore, offers a superior alternative to 21-4N which is imported. The process has been released to M/s Star Wire (India) Ltd., Ballabgarh, for commercial production.

3.5.2 Smelting Studies on Ni-Cr-Co Bearing Magnetite from Nagaland

The north-eastern region of the country is

bestowed with vast natural resources. The reported occurrence of magnetite deposit at Pokphur in the Tuensang district of Nagaland is to due to the presence therein of nickel, chromium and cobalt. Exploration and subsequent utilisation of this ore body will contribute to overall development of this region. The characterisation studies on samples from this region were done by RRL Jorhat. Studies to explore the possibility of extracting metals from this deposit were undertaken at NML on the request of the Directorate of Geology & Mining, Govt. of Nagaland, Dimapur. Preliminary smelting studies were carried out in the electric furnace on a 25 kg. batch scale. It was possible to extract over 90% of iron, nickel, chromium, and cobalt present in the ore in the pig alloy form. The pig alloy obtained is suitable for the manufacture of alloy cast iron, Ni-hard and other wear and abrasion resistant alloys. It was possible to produce a low carbon pig alloy suitable for the manufacture of special alloy steel. Recently the sponsors have agreed for pilot scale testing of a 4-5 tonne pig metal/day in the existing 500 KVA submerged arc furnace at NML to establish the techno-economic feasibility of the smelting route and to produce sufficient quantity of the pig iron metal for having it evaluated by user industries.

3.5.3 Synthetic Rutile from Ilmenite

A 5 tpd pilot plant for the manufacture of high grade synthetic rutile has been designed and is due for commissioning at M/s. Travancore Cochin Chemicals.This process developed at RRL(T) has the dual advantage of being environmentally friendly and yields a higher value added exportable product. A commercial plant of 30,000 tpa at a cost of Rs. 60 crore is envisaged.

3.6 Mining

It was found that by implementation of the support system designed by CMRI for the depillaring operation at the West Bokaro Colliery of TISCO, the extraction of coal improved from 40 to 85 per cent. In this support system the technique of grouting the roof bolts by sand-cement mixture, instead of by phosrock capsules, reduced the cost of bolting by more than 50 per cent.

Stability of horizontal pillars and caprock at the Balaria Mine of the Hindustan Zinc Ltd., (HZL) was assessed and optimum thickness of horizontal pillars to be left for safe mining recommended by CMRI. It would help in extraction of about a million tonnes of lead zinc ore from the mine.

3.7 Environment

3.7.1 Reclamation and Development of Manganese Mine Spoil Dumps Using Domestic and Industrial Wastes/ Residues

NEERI has developed and demonstrated technology for reclamation of mine spoil dumps using pressmud, sewage sludge and biofertilizers. Over 1,00,000 plants of teak, shiwan, shishum, acacia, neem etc now occupy 45 hectares of manganese mine spoil dumps around Nagpur. Survival rates of plants on spoil dump increased by 65% due to pressmud amendment and inoculation with biofertilizers as compared to those on non-treated spoil dump alone. Over 1,10,000 mulberry plants are growing well on six hectares of dumps providing gainful employment to 15 families of mine workers.

II.3. Mulbery Plantation Developed on Mine Dump

3.7.2 Carrying Capicity of Damodar River Basin

The work on the first phase of the national

project on the Carrying Capacity of Damodar river basin has been completed by CMRI and secondary data like land use, meteorology, air quality, water quality, bio-diversity and other socio-economic parameters, resource potential, etc. have been collected and the hot spots which require immediate action delineated.

Noise level at various places of TISCO group of collieries has been assessed by CMRI and the areas of a noise level higher than the threshold limit have been identified. Suitable remedial measures have also been suggested to control and abate the problem.

3.7.3 Effluent Treatment

Spent liquor and chrome liquor effluents of leather industry were treated on lab scale for removal of sodium salts and retention of chromium salt by electrodialysis technique. This process will enable use of the chemicals and reduction of pollutants in the effluents of leather industry. The process is likely to be taken up on a demonstration scale with a view to commercialisation. The work was carried out by CSMCRI in collaboration with CLRI, as a part of CSIR(CLRI)/ TNO (Holland) collaboration.

3.7.4 Desalination

Thin film composite (TFC) membrane development has been taken up for the desalination of highly saline water /seawater by Reverse Osmosis (RO). TFC RO membranes of size 0.4m x 10m were shown to provide 500-600 ppm product water from a feed containing 35000 ppm salt in a plate-and-frame RO system of 750 L/day capacity. Efforts were concentrated on the development of spiral elements from TFC membranes. These membranes have also been shown to convert domestic sewage to provide reusable cooling tower water. A small prototype has been designed and fabricated using TFC membranes developed at CSMCRI. The unit has been installed at Madras Refineries Ltd. (MRL), Madras for obtaining data on tertiary treated sewage effluent under field conditions. Several other TFC membranes usable as nanofiltration membranes, equivalent in performance to commercial membranes available in the USA and Japan, could be made in the laboratory. Scale up of design of casting and coating machines for TFC is in progress.

3.8 Biotechnology

3.8.1 Energy Efficient Alcohol Technology

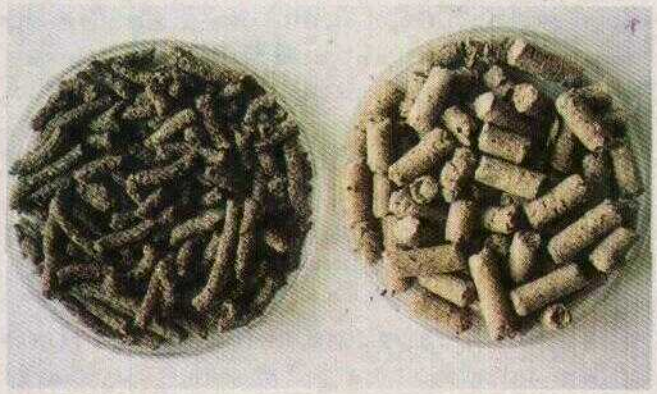
A remarkable achievement of IMTECH has been the development and commercialisation of a complete technology package, in collaboration with the Vittal Mallya Scientific Research Foundation, for the production of ethanol. IMTECH has produced by appropriate genetic manipulations an osmotolerant and ethanol tolerant strain of yeast. This strain, on extensive lab and pilot plant scale trials, yielded excellent results (12-16% volume/volume alochol from molasses in 36-48 hrs.). To develop a viable technology package, IMTECH tied-up with the Vittal Mallya Scientific Research Foundation. At the factory level about 12% alcohol could be produced using molasses as the starting material, but the level of 10% was found to be economical.

Assuming that a plant of capacity 30,000 litres per day operates for 300 days a year, the annual savings by utilizing the IMTECH technology has been calculated to be about Rs. 28 lakhs. The savings for a plant capacity of 1,00,000 litres per day can well be about Rs. 96 lakhs.

This package is now being offered for marketing and has already been implemented in five distilleries/breweries of the United Breweries Group; and many other distilleries, both in India and abroad are showing keen interest in acquiring this technology.

3.8.2 Development of Cost effective Fish Feed

A cost effective, pelleted fish feed using locally available, low cost materials but giving high growth rates of fish has been developed by CCMB. The feed costs less than half the price of commercially available feeds. Laboratory scale experiments indicate a requirement of 3 kg of feed per kg of



II.4. Fish Feed

fish compared to about 7 kg of feed per kg of fish, in case of conventional fish feed. Field trials of the feed have been successful. Preliminary data indicate a three- to four-fold higher growth rate with the experimental feed as compared to standard commercially available feeds.

3.8.3 Ribonuclease Inhibitor

Mammalian tissues have a potent ribonuclease inhibitor (RNasin) of commercial importance. The purified protein from human placenta is marketed by a number of foreign companies and is not available in India. It finds wide application in molecular biological research. The available process for the purification of RNasin has been modified and improved by CCMB to give superior quality protein. The technology has been given to an Indian firm for market evaluation and survey.

3.8.4 Alcohol from Starchy Substances

The decontrol of molasses has escalated its price from Rs. 150 to Rs. 4000 per tonne. This has altered the economics of the distilleries and the earlier concept of starch-to-alcohol has become economically attractive.

Utilization of cheap strachy materials for production of alcohol is one of the thrust areas of RRL (TRI.). An agreement has been signed with M/s Kedia Distilleries Limited, Bhilai to modify their existing infrastructure to produce potable alcohol from a variety of starch sources such as broken rice, sorghum, and deoiled sal meal. The laboratory has successfully designed a 1 lakh litre batch reactor for the hydrolysis of starch to glucose which subsequently can be fermented to alcohol. The technology has been demonstrated on a 15-25 tonnes of grains/batch. The distillery is producing 40,000-50,000 litres alcohol per day based on this process. The production cost of alcohol by this process using starch is Rs. 12/litre. In comparison the cost will be Rs. 15 per litre using molasses (with the existing market price of Rs. 3000/- per tonne). Several distilleries have now approached the laboratory to undertake similar projects for the production of alcohol using wasted grains.

3.9 Agrotechnology

3.9.1 Commercial Cultivation of Gladiolus

Under its ongoing programme to promote the floriculture industry and with a view to generating employment opportunities, a model layout plan on agro-technology of gladiolus cultivation in the north Indian plains was evolved and passed on by NBRI to growers of the region. About 80 hectares of land in and around Lucknow are now under gladiolus cultivation, yielding a return of over Rs. 2 crore, per annum.

3.10 Food Technology

3.10.1 Processing of Jackfruit

With an annual production of about 3 million tonnes, jackfruit, an important tropical fruit of the North Eastern states, is mostly used in the natural form. As such, 30 to 50% of its total production is wasted, because it is perishable. In order to improve its shelf life and develop internal as well as export markets, processes have been developed by CFTRI for:

* the preparation, packaging and storage of raw (tender) jackfruit curry;
* the preparation of carbonated/non-carbonated beverages from bulbs and other fruit parts (usable part 75% of fruit weight) excluding peel, core and seeds;

* the preparation (by partial flavour recovery) of beverage and jam or fruit bar from bulbs of ripe jack fruit; and

* the preparation of frozen as well as freeze dried jackfruit bulbs, and an alcoholic beverage from flavoured (recovered) syrup.

Export of processed products to neighbouring countries (South East and Middle East Asian countries) where the fruit is in great demand, is expected to bring in foreign exchange.

3.10.2 Dhal Mills

Five units of CFTRI mini dhal mills have been installed at four regional centres in Nagpur, Ludhiana, Lucknow, Hyderabad and one at PTC, Bhopal. In all, about 20 demonstrations were given to farmers and prospective millers. As a result, six fabricators have taken the design drawing of CFTRI mini dhal mill for fabrication and marketing.

3.10.3 Paddy Thresher

The power paddy thresher developed by RRL (Bhu) comprises a steel drum which rotates at 450 rpm through an electric motor. A number of 'U' shaped steel spikes are welded over the surface of the drum in a zig-zag manner. The paddy grains are threshed from the straw by the spikes as the paddy bundle is placed on the rotating drum. The grains are separated due to difference of relative velocity of the grain and the spikes.

The technology has been transferred to the Directorate of Agriculture (Engineering), Govt. of Orissa. The threshers are being sold with subsidy to the farmers of Orissa under the national programme of food production.

3.11 Leather

CLRI has succeeded in propagating the concept of "Leather Complexes" for environmental improvement in tannery clusters in Calcutta and Bombay. CLRI has prepared and submitted a project report for the implementation of the world's largest leather complex in Calcutta. The Maharashtra Government sought CLRI's technical expertise in designing two leather complexes at Ambernath and Chincholi.

The Common Effluent Treatment Plant (CETP) in the Jallandhar Complex set up by the Govt. of Punjab with CLRI technical knowhow is ready for commissioning.

3.12 Electronics & Instrumentation

3.12.1 Fabrication and Supply of Seismographs

CSIO has entered into a Memorandum of Understanding (MoU) with the Special Design Bureau (SDB) of the Russian Academy of Sciences for the supply of Seismic Sensors (Triaxial Seismometer TS-I) and a Single Component Vertical Seismometer SM-3 KVM. Based on the performance evaluation of Seismographs comprising Seismic Recorders developed by CSIO, the Indian Meteorological Department has placed an order for 20 numbers of CSIO Seismographs for strengthening and modernisation of the seismological network in India, particularly in the earthquake - prone Deccan Plateau.

3.12.2 Electronic Energy Meter

CSIO has developed an Electronic Single Phase Energy meter which replaces the conventional electro-mechanical, rotating disc energy meter or watt-hour meter. The sophisticated electronic circuit will provide better accuracy. M/s India Meters Ltd., Ambattur, Madras, had sponsored this project with the S&M Centre, Madras, and provided all mechanical engineering support. The instrument is under pilot production.

3.13 Energy

A recent significant achievement of CFRI has been the discovery of a large deposit of low volatile coals, measuring more than 20 billion tonnes hitherto considered as of medium coking variety. These coals, have, in fact, superior coking qualities because of balanced vitrinite composition that

would render, after washing, as good a coke that can be obtained even from imported coals. The technical superiority of the washed product has been conclusively established by washing 1000 tonnes of coal in the pilot plant of CFRI and using the product in blends to produce coke in the coke ovens of the Bokaro Steel Plant. Efforts are under way to commercially realise these benefits.

3.13.1 Mini-flotation Plants

CFRI has been appointed as a consultant for installation of slurry flotation plants (5 tph) for M/s. Tetuila Coke Plant Pvt. Ltd., and M/s. Arun Coke (P) Ltd at their coke-oven plant sites. The concentrates will be used in blends with raw coal with a view to improving petrographic make up and fluidity of the coke-oven charge, besides taming the ash content to 21 or 22%. Flotation cells, as per CFRI design, are being fabricated, and orders for other principal equipment like conditioner, filter etc. have been placed with reputed equipment manufacturers. It is expected that the plants will be commissioned within a year.

3.14 Transportation

3.14.1 Hansa

The most significant achievement of NAL during this period was the successful flight of the experimental prototype of the all-composite aircraft, NALLA. The maiden flight of the fibre glass plastic light aircraft took place in November 1993. Following the successful test flight, NALLA was rechristened HANSA. Its formal inaugural flight also took place in November 1993 subsquently.

HANSA later participated in the flying displays at the Bangalore Air Show, AVIA INDIA 93, held in December 1993 and attracted considerable attention from the visitors. HANSA has since done a number of test flights and cleared its full flight envelope.

During 1994-95 the production version of HANSA (HANSA-3), with an improved aerodynamic design and a more powerful engine, will be completed. HANSA-3 is expected to fly during the first quarter of 1995. This is being commercially produced by M/s Taneja Aerospace Ltd. (TAL).

HANSA is ideal for ab initio training, sport and hobby flying. It can also be used for surveillance, aerial photography and environment monitoring. Currently no such aircraft made indigenously out of FRP is available in the country. HANSA weighs just 850 kg, and its extremely clean lines ensure that the aircraft has excellent performance and handling qualities. The composite materials used makes the aircraft rugged, rust proof, and easy to maintain for flight training. Its cost-effectiveness is expected to match any aircraft of similar class in the world. The maximum speed of the aircraft is 115 knots with an endurance of four hours. It is fitted with a Continental engine which develops 125 BHP at 2800 rpm.

3.14.2 Saras

The development of the Light Transport Aircraft (LTA) (now renamed SARAS) also registered significant progress. LTA is being developed jointly with Myasishchev Design Bureau (MDB), Russia (LTA's Russian version has been named DUET). A formal agreement between MDB in Russia and NAL/CSIR for the joint development of SARAS-DUET was signed at New Delhi in November 1993.

A full-scale mock-up of the commuter version of SARAS-DUET was also exhibited at the Singapore Air Show held early in 1994. An NRI from the USA has shown keen interest in becoming a partner in the SARAS development programme.

II.5. Light Transport Aircraft - 'SARAS'

3.14.3 Autoclave

NAL bagged a major order from Hindustan Aeronautics Ltd. (HAL) to build a sophisticated 4m x 8m computer-controlled autoclave. The autoclave shell and the control system will be built by Bharat Heavy Electricals (BHEL), based on NAL designs; an MoU between BHEL and NAL in this regard was signed recently. NAL's 3m x 7m autoclave is now ready for regular operations.

3.14.4 Performance Evaluation of Concrete Roads

For the Municipal Corporation of Greater Bombay (MCGB), CRRI prepared a report 'Construction of Cement Concrete Roads in Greater Bombay: Suggestions and proposals regarding measures/inputs towards enhancing quality assurance and service'. Based on the suggestions and proposals given in the report and subsequent interactions, MCGB has appointed CRRI as its consultant on Concrete Roads for a period of 2 years and has presently given four assignments to CRRI.

3.14.5 Spectrum of Axle Loads on National Highways

A study on the spectrum of axle loads was taken up to determine the vehicle damaging effect of the commercial vehicles plying on NH-3 and NH-4. Recording of axle loads for the commercial vehicles plying on these national highways was done with a portable electronic weighing system.

3.14.6 Ceramic Fibre Preforms, Squeeze-cast Components

RRL, Bhopal has developed the process technology for the manufacture of fibre-preform of discontinuous alumino silicate short fibres of varying volume fractions, shapes and sizes. The preforms have been produced in a semi-commercial scale in association with M/s Orient Cerwool Limited (OCL), Lakhtar (Gujarat) a licencee of M/s Premier Refractories and Chemicals, Inc., USA. Samples of these fibre preforms of various thickness and size have been sent to the Indian Institute of Technology (IIT), Madras, the Indian Institute of Science (IISc), Bangalore and the Hindustan Aeronautics Ltd. (HAL) Bangalore for evaluation. IISc., has found the infiltrated preforms to be quite satisfactory and IIT, Madras has placed on order for 40 numbers of preforms.

RRL, Bhopal has entered into an agreement with M/s Atlas Automotive Components Limited (AAC), Pune, a manufacturer of automotive components, for upscaling of the applications in engineering industries. AAC, Pune and RRL Bhopal have jointly approached the Industrial Credit and Investment Corporation of India (ICICI) for scaling up of the squeeze casting technology with an estimated project cost of Rs. 1.41 crore.

BHEL, Bhopal has also evinced interest in utilizing the squeeze casting technology for aluminium alloy components used in electrical machinery with help from ICICI.

3.14.7 Fire Protection of Aircraft Seat Cushions

Aircraft seat cushions are made of easily ignitable and highly flammable flexible polyurethane foam. In the event of fire, the polyurethane foam ignites quickly and helps to spread the flame very fast. On burning polyurethane foam produces dense black smoke, toxic gases and vapours creating hindrance in fire-fighting. To confer a measure of protection and reduce the fire hazard to aircraft seat cushions, an innovative method of fire blocking layer (FBL) has been developed at CBRI. The fire blocking layer is a chemically treated fire retardant thick cotton fabric DENIM, used to make covers of aircraft cushions, but acts as a fire protection barrier between the polyurethane foam and the heat source. The main characteristics of FBL are: high flame resistance; carbonization in case of fire, no toxic gases and no melting. All the materials used in the process are indigenously available. FBL was evaluated and approved by SGS London and the Civil Aviation Authority of India. For the commercial production of FBL a manually operated pilot plant for fire retardant treatment of DENIM having a capacity of 400 m per day has been designed, fabricated and commissioned at the Institute. A total length of

4200 m of DENIM was treated for the Indian Airlines, New Delhi, for use as aircraft seat cushions.

3.15 Materials

3.15.1 Development of Light Weight Strategic Materials

Strategic high strength Aluminium (Al) alloys with additions of Lithium (Li) upto 2.5% have become important because of the need for special processing techniques. NPL has successfully developed the processing technique of high strength Al-Li alloy of composition: Al: 4.5%; Mg: 1.5%; Li. This alloy was supplied in ingot form by the Foundry & Forge Division, HAL, Bangalore, hot-extruded into 20 mm dia cylindrical rods and supplied to the Indian Space Research Organization (ISRO), Bangalore for use in the Satellite IRS - 1C/D. What is significant is that the properties achieved in this material were better than the *target properties desired*.

3.15.2 Fly Ash-based Wear-resistant Ceramics

Fly ash-based wear-resistant ceramics are harder than tool steel and close to diamond in hardness. These extremely dense, hard and impenetrable ceramics have superior resistance to both sliding and impact abrasion and erosion, and can be extensively used as lining material in material handling equipment of thermal power plants, steel plants, cement and other related industries. Application of such ceramic material substantially decreases maintenance cost and increases life of components. The process has been developed by NML on a laboratory/semi-pilot plant scale for production of various shapes of wear-resistant ceramics. The technology was transferred to M/s Tatanagar Bricks Ltd., Adityapur, Jamshedpur for the manufacture 600 MT of ceramic tiles/ annum. The plant is expected to start production by December 1994.

3.16 Building Materials

3.16.1 Wood Substitutes

Red mud polymer (RMP) composite material developed by RRL, Bhopal was used for door shutters for elaborate performance tests and field trials. The Central Public Works Department (CPWD) have approved the use of this material in their buildings and advised RRL, Bhopal to take necessary steps for commercialising the technology.

3.16.2 Polycoir

Polycoir is a thermoset mouldable natural fibre polymer composite in which coir fibre is used as the reinforcement. It has enormous potential as a wood substitute in building materials and consumer application. Ready-to-use parts for construction of door panels, panellings and partitions, chair shells, instrument panel covers, automotive interior trim parts etc. are a few of the products envisaged. Door panels and wall panellings (acoustic) have been tested under actual use for the last two years.

The process of polycoir follows a prepreg sheet processing route well known in automated production of fibre reinforced plastics. The process has been developed by RRL (TRI.) to the scale of 0.3 tonnes per day. The estimated cost of an economic size plant of 2.5 tpd capacity is of the order of Rs. 1.0 crore.

The technology has been transferred to M/s Saurashtra Cement & Chemical Industries, Bombay.

3.16.3 Improved Production of Quality Bricks in Fuel Efficient Kilns in Sri Lanka

Sri Lanka is faced with the problem of poor quality bricks due to poor quality of soil and scarcity of coal for burning of the bricks. Under a collaborative project of CBRI and the United Nations Centre for Human Settlements (UNCHS), attempts were made to improve the quality of bricks with higher production rate. The local soil was found contaminated with injurious grit and nodules which caused cracking of bricks at drying and firing stages. The raw materials were tested and a process technology was developed for bricks through sieving, grinding and admixing with suit-

able admixture. The hand moulding method was adopted for making 15,000 to 20,000 bricks per day. Bricks were dried safely in open sun.

The other major problem faced was the non-availability of coal for firing of bricks in Sri Lanka. This problem was solved by utilisation of biomass available in the locality. An efficient fixed masonry chimney kiln was also installed for firing of 20,000 -25,000 bricks per day. CBRI was involved from the very beginning of the project. Regular production of improved quality bricks has now started at the rate of 20,000 bricks per day. Before CBRI came on the scene, only 800 - 1,000 bricks per day were being produced.

3.17 Machinery Development

3.17.1 Remotely Operated Vehicle-200

CMERI has developed a remotely operated vehicle (ROV), named ROV-200. It is a modular designed open frame structure with hollow cylindrical buoyancy packages, landing pads and supporting thrusters. It is designed to operate at a depth of 200m with unlimited operational time. It is supported with six thrusters placed orthogonally for ROV motion along three cartesian axes. This sytem is also equipped with a high resolution underwater camera, and navigational sensor (for measurement of heading angle, X-axis tilt, Y-axis tilt and depth). The first phase of testing of ROV-200 has been started and it has successfully passed the requisite criteria on high static and dynamic stability, high manoeuvrability, straight forward motion, straight reverse, left turn, right turn, centre turn, hovering at a particular depth and floating in case of power shut down. This testing has been carried out in the shallow basin test facility (50m x 15m x 4m) of CMERI.

The specific areas where ROV services could be of importance, are: routine inspection of all underwater primary and secondary structures using camera and NDT methods for off-shore structures; pipeline inspection, debris cleaning, water jetting for removal of marine growth etc., and mapping and photo documentation in marine geological and marin life surveys etc.

4. SOCIETAL PROGRAMMES

4.1 Drinking Water

4.1.1 Water Quality Assesment

ITRC continued to play a major role in the Rajiv Gandhi National Drinking Water Mission of the Ministry of Rural Development, Government of India. About 300 water samples from 1290 villages of Meerut, Doda, Udhampur, Rajauri and Jammu were analysed by ITRC to assess the quality of water. Six hands-on work-shops were organized at Lucknow, Allahabad, Patna and Meerut for workers involved in water quality surveillance.

ITRC had developed "Amrit Kumbh", a simple device based on the filtration principle, for disinfection of water. The technology for this was commercialized earlier. This year it was taken up for commercialization by M/s Shipra Industries, Lucknow.

4.2 Rural Development

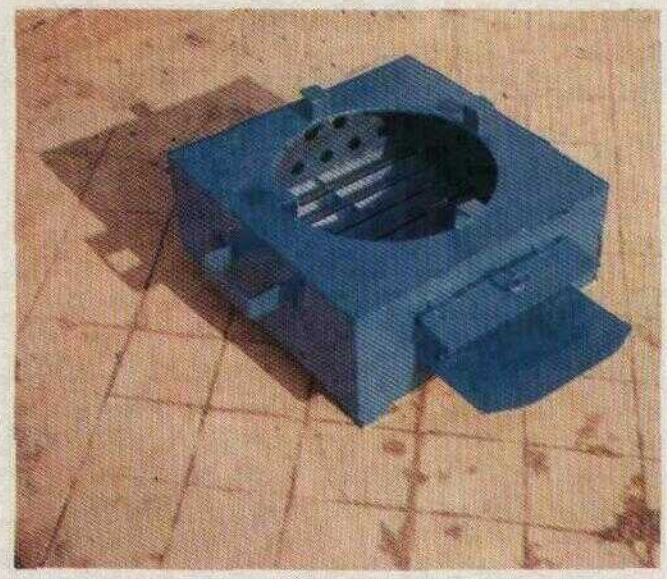
4.2.1 Medicinal & Aromatic Plants

CIMAP accorded high priority to the popularisation of large scale cultivation and processing of medicinal and aromatic plants among growers and entrepreneurs with the objectives of i) creating job opportunities in rural areas; ii) increasing the production of medicinal and aromatic crops for internal consumption and export; and iii) utilizing wastelands by economic cultivation of aromatic and medicinal crops.

To provide first hand knowledge of cultivation and processing technologies to the growers and entrepreneurs, the Institute organised various training programmes in Uttar Pradesh, Bihar, Karnataka, Tamil Nadu and Andhra Pradesh. More than 600 growers and entrepreneurs received training lasting for 2-5 days in these programmes.

4.2.2 Portable Chulha

RRL (Bhu) has developed "Harsha" a portable high efficiency multiple Chulha which is well



II.6. Portable 'Harsha' Community Size Multifuel Stove

suited for rural as well as urban needs. With reduced fuel consumption and smokeless operation, Harsha is an improvement over other chulhas developed in recent years as it can cater to burn different fuels and agricultural wastes available in villages, without choking the grate during the entire period of burning. The volatiles of the fuel burn inside the perforated combustion chamber and the fixed carbon of the fuel burns in the troughs of the corrugated grate at bottom in a two stage combustion process. The waste radiant heat from the chulha surface preheats the air and this air is sucked into the chulha both ways as primary and secondary air that helps complete combustion of the fuel. More than 60,000 stoves per year are being propagated. About 40 small scale units in the country are manufacturing "Harsha" metallic stoves. These stoves help to save fuel by about 40-50% over the traditional ones. In addition, the manufacture of this chulha can generate employment of about 2 lakh man-days per year.

4.2.3 Mud Clad Pottery Lined Fixed Chulha

This development of RRL (Bhu) has led to reduction of pollution and fuel consumption during cooking. Compared to traditional chulhas, a saving of 50% fuel can be effected and the kitchen becomes completely smokeless, which helps reduce health hazard and drudgery of women and childern. Presently 2 lakh pieces of chulha/year are being propagated in Orissa. The technology for such chulhas has been transferred to the Ministry of Non-conventional Energy Sources (MNES), Govt. of India and the Orissa Renewable Energy Development Agency (OREDA) under a National Programme on Improved Chulha.

4.2.4 Biosalinity

Desertification is a phenomenon not only in the arid areas but also in coastal regions where largescale sand dune movement occurs and occupies cultivable land rendering the land unfit for cultivation. CSMCRI has envisaged projects to grow plants on the coastal dune sand and saline land with a view to making these lands productive and thereby helping restoration of ecology of the region.

Jojoba 'Hohoba' *(simmondsia chinensis),* a native of Sonoran deserts of Mexico and the USA has been recently introduced into India and tried on dune sand of the semi-arid belt of Gujarat by CSMCRI. The species cultivation has been extended to other coastal regions and also some parts of the inland to find its suitability to various types of soils. The Ramanathanpuram Rural Development Agency under the Collectorate of Ramanathapuram in Tamilnadu has taken up a test plantation in Rameswaram Island on dune sand to grow jojoba.

Salvadora persica, a species which can thrive under highly saline conditions and yield seed oil to the extent of 38% rich in lauric and myristic acids has been introduced in the desert regions of Kutch where the salinity is very high. The oil finds application in the soap and detergent industry and also preparation of sodium laurylsulphate used in cosmetics and toiletries. M/s. Pilu Produce Company, Bombay has envisaged a massive programme to cultivate this plant on highly saline areas of Gujarat region with the help of CSMCRI. A model-cum-demonstration plantation of 150 ha. has been raised at Bhachau in Gujarat by the above agency. The technology has also been made use of by the Visakhapatanam Steel Project to convert the highly salt affected land in their premises to greener pastures.

5. BASIC RESEARCH

5.1 Physical Sciences

5.1.1 Defect Carbon Cage: STM Study

One of the challenges currently posed by the recent discovery of fullerenes is that how such a large size molecule as of C-60 is formed. Theoreticians are trying to answer this question through molecular dynamics simulation (MDS). The attempts made so far using MDS to recreate the ideal molecule of C-60 have instead led to the cage morphology that contains distinct anomalies or defects. These anomalies are (i) neighbouring pentagon pairs, (ii) an octagon with a lone atom at its centre, or two adjacent distorted hexagons with two shared sides, and (iii) heptagons. Also, the theory predicts a significantly diminished gap between the highest occupied molecular orbital and the lowest unoccupied molecular orbital resulting from the presence of the above defect structures in the cage morphology of C-60 molecule. With the earlier success in resolving the carbon cage morphology of C-60 using scanning tunnelling microscopy (STM) technique at NPL, further attempts were made to observe directly the defect carbon cage structure of C-60. These investigations have fully corroborated the theoretical predictions of the molecular dynamics simulations, through direct high resolution STM observations. These observations include neighbouring pentagonal rings, an octagonal ring with a long atom at the centre, two puckered hexagons with two common sides and the presence of heptagons. Scanning tunnelling spectroscopic studies have further corroborated the theoretical prediction that the energy gap is drastically lowered from 1.5 eV to less than 0.3 eV when the carbon cage has the above anomalies. This work has been published in the Proceedings of the Royal Society, London, (Vol 444, 1994, pp 325-332).

5.1.2 Modelling Studies to Detect Low Velocity Layers

Extensive modelling studies of NGRI with the aid of synthetic seismogram computations for elastic as well as absorbing media provided for the first time a new insight into the detectability of low velocity layers by seismic technique. The model results are well illustrated by an application to delineate a low velocity layer underlying a trap layer in the West Bengal basin.

5.1.3 Marine Geology and Geophysics

The study of magnetic data in the Laxmi Basin east of Laxmi Ridge (between 16-18 30'N) in the Arabian Sea, for the first time, revealed the presence of well correlatable NNW trending magnetic lineations. These anomalies suggest that the Laxmi Basin is underlain by an oceanic crust created by sea-floor spreading process about 65-84 million years ago. This evidence of sea-floor spreading in the Laxmi Basin implies the existence of a third episode of spreading (pre-A27) in the history of evolution of the Arabian sea.

Multibeam (Hydrosweep) swath bathymetric investigation revealed the presence of a NNW trending 250 km long linear seamount chain in the eastern Arabian Sea. This chain consists of three major edifices, named RAMAN, PANIKKAR seamounts and WADIA guyot. These seamounts are elongated in plan and have heights and base varying in the ranges 1068-2240 m and 300-1210 sq km respectively. Steep lower flanks, flat plateaus, terraces, secondary peaks, and extensive gully pattern are the important identified characteristic morphological features of these seamounts. The gullies observed over these seamounts with their dendritic pattern resembles a relict drainage pattern of subaerial erosional origin. The origin of these seamounts is attributed to the intersection of the Reunion hotspot with an extinct spreading centre.

High resolution seismic reflection data of eastern continental margin of India (ECMI) have been used to generate preliminary geomorphological maps of the basinal and non-basinal areas of ECMI. Some of the prominent morphological features observed of K-G river basins include sediment slumps, channel cuts, sediment traps, canyon features, and gas mixed sediments. The non-basinal areas like the Visakhapatnam - Kalingpatnam shelf include relict strandlines and buried channels.

Based on the results from marine magnetic data of ECMI and part of Bengal Fan, a tectonic lineament map has been generated.

5.1.4 Acoustic Tomography

An acoustic field experiment was successfully conducted by NIO for a duration of 10 days by deploying transceivers system separated over a distance of 270 km. Analysis to map the time evolution of the sound speed anomaly is in progress.

5.1.5 Global change

Depth profiles of the activity of respiratory electron transport system (ETS) have been generated by NIO at several locations in the northern Indian Ocean. The results reveal much lower ETS activity in the Bay of Bengal as compared to the Arabian Sea. Lower respiration rates in the Bay of Bengal are corroborated by the much weaker north-south gradients in oxygen and total carbon dioxide. These are, however, in conflict with the higher sinking fluxes of organic carbon measured with sediment traps. The observations support the view that particulate organic matter may undergo less oxidation in the water column through its incorporation into rapidly sinking matter as a result of the massive inputs of terrigenous matter in the Bay of Bengal. The differential respiration rates may cause changes in the distribution of suspended particulate matter and may also explain why the Bay of Bengal is not a water-column denitrification site in spite of an apparently slower renewal of the intermediate waters as compared to the Arabian Sea.

5.1.6 Two Hi-Tech Experiments at Antarctica to Study Ozone Depletion

Two experiments in atmospheric sciences pursued by NPL for monitoring ozone, deserve mention. The ozone depletion problem, demonstrated by the ozone hole over Antarctica, has caused world-wide concern. NPL took up two projects to monitor ozone profiles over Antarctica. The two experiments, the millimeter wave radiometer and the laser heterodyne system were designed, fabricated and installed at NPL and worked successfully before it was sent to Antarctica as part of the XIII expedition.

The two systems provided excellent data; the millimeter wave radiometer worked almost for a month from early January to early February 1994. The laser heterodyne system was installed in the end of January, 1994 and was collecting data upto 22nd February, 1994 except on days manifested with cloud cover. Preliminary analysis of the data shows that the experiments went on satisfactorily and will provide interesting results. However, some problems such as heavy electrostatic charge troubled the absolute performance of the experiments. Though these were anticipated, the most appropriate modification could not be introduced. As a result, the equipment were brought back for giving additional protection and for fine tuning to improve their sensitivity.

5.2 Chemical Sciences

5.2.1 Organic Synthesis

Benzophenones are key intermediates in the preparation of a variety of industrially important organic chemicals. An environment - friendly, regiospecific benzoylation process has been developed at NCL making use of the commercially available zeolite catalyst HZSM-5 in place of the toxic aluminium chloride employed in the conventional process.

A number of modified nucleosides (i.e., 3'-NH_2 3', 2' - anhydro, enamino) which are potential antiviral compounds, were synthesized by NCL and sent for testing. Amino modifications were introduced at different positions in the nucleosides and these modified moieties were incorporated in the oligonucleotide chains. Biophysical studies of these compounds revealed many new features about the conformation of DNA.

Novel routes to the synthesis of methyldopa, nitropyrroles, dialkoxy-benzaldehydes, optically pure carbyne complexes and beta-lactams were developed with an emphasis on economic viability. Methodologies have been developed by NCL for

some of the industrially important reactions such as selective alkylation using dialkyl zinc, reduction of x-keto imides, opening of cyclic sulphates, and nucleophilic addition on arene chromium complex.

5.2.2 Langmuir-Blodgett Films: Spontaneous reorganisation

It is found by NCL that when benenic (C_{22}) and steric (C_{18}) acids are used for sequential deposition, 25% of possible "heterogeneous" bilayers are converted to "homogeneous" bilayers. In sequentially deposited films of different metal ions, there is evidence for intralayer as well as interlayer mobility of cations leading to homogenization. These results suggest that the interlamallar cations are solvated as in clays. This renders the bilayers fragile and amenable to reorganization.

5.2.3 *Langmuir-Blodgett Films : Spontaneous Self-organisation and Cation Exchange of Fatty Acid Films in Aqueous Solution*

A method of deposition of films, which cannot be deposited by the conventional Langmuir - Blodgett technique, was developed at NCL. The technique involves treating the film with a solution of a lead salt. Mercury arachidate and lanthanum arachidate films were obtained by this technique.

Instead of using vacuum-deposited films of fatty acids, it was demonstrated that one can use a film obtained quite simply by spreading a solution with a microsyringe and suitable organic solvent. This extremely simple, quick and inexpensive method should be very useful when large or specially masked areas (such as micro-arrays) are required to be deposited with such films.

5.3 Biological Sciences

5.3.1 Cataract and the Loss of Molecular Ordering in the Eye Lens

While high crystallin concentrations are required for the formation of the eye lens material, it is surprising that the normal eye lens does not scatter light excessively. It has long been suspected that some sort of intermolecular order exists among the lens crystallins, which should be responsible for this property of the lens. Work during the last decade has shown that this is likely to be a glass-like, short-range order that arises out of intermolecular interactions as concentrations are raised to physiological levels. Work at CCMB has demonstrated that the crystallins, both separately and as mixtures, unfold as the concentration is raised, to reconfigure into an interconnected multimolecular assembly, characterised by a significantly increased exposure of aromatic amino acids and inter-aromatic interactions and an altered polypeptide backbone as well as side chain order. These findings shed new light on our understanding of how lens transparency develops, how it is maintained and how it may be lost during cataract formation, through oxidative destruction of the ability of these molecules to remain packed in an ordered manner.

5.3.2 Cytokines and Tumour Regression

Recent work at CCMB has shown that the regression of a tumour occurs in a bimodal manner, through necrosis (meaning cell death) and apoptosis (meaning falling apart). This is mediated by B lymphocytes which produce anti-tumour antibodies, activation of natural killer cells which kill the target and host macrophages which produce the tumour necrosis factor. We have now demonstrated the involvement of necrosis mediated by perforin and apoptosis resulting in tumour cell DNA fragmentation. It has also been found that interleukin-12, which maintains killer cells in an activated state and stimulates the production of interferon gamma by immune cells, is involved in the process.

5.3.3 Membrane Organisation and Dynamics

It had been shown earlier at CCMB that fluorescence spectroscopy offers a unique, noninvasive way to monitor membrane organisation and dynamics. Recent work shows that the slow reorientation of solvent molecules around a membrane bound fluorophore could be effectively

utilised to reveal details of the environment of the fluorophore. This approach has been used to study environments of membrane bound probes and peptides and could prove very useful in studies on membrane hydration, which controls many important cellular events.

5.3.4 Molecular Biology, Biochemistry and Immunology of Leishmania Parasites

Using Fiedel-Crafts acylation on indole with dichloroacetyl chloride as the acylating agent, a novel indoloquinoline analogue with potential, antileishmanial properties has been synthesized and its structure unequivocally established by IICB.

5.3.5 Toxicity

Studies in the area of biomodulation of toxicity by ITRC showed that immunostimulants like protein A can offer some protection from adverse effects of benzene. In experimental studies, Vitamin E was found useful in preventing the toxic effects of commonly used dye intermediate benzenthrone on humans.

Detailed studies on oxidative stress and calcium dynamics under different toxicological conditions indicated that free radical mediated prooxidative changes and deregulation of calcium functions are interrelated, as a common unspecific event in toxicity. This offers clues for designing intervention strategies.

6. RESEARCH SUPPORT ACTIVITIES

6.1 National Facilities

6.1.1 Fermentation Technology

IMTECH has created a state of the art 1500 litre fermentation pilot plant which is so far the only one of its kind in the whole of South East Asia. This plant provides scale-up fermentation facilities for shake flask or bench-top level know-how. Companies like Vam Organics, Dabur India, Ferment Pharma Biodil, Panjab Agro Industries Corporation and institutions like the International Centre for Genetic Engineering & Biotechnology, (ICGEB), New Delhi, the Indian Institute of Science (IISc.), Bangalore etc. have made use of this facility. This plant is very useful for optimising fermentation conditions for any low volume-high value or medium volume-medium value biochemicals. IMTECH is making all out efforts to attract users of this facility.

6.1.2 National Facility on Oiligonucleotides

The Centre for Biochemicals Technology (CBT) has a national facility on oiligonucleotides. Under this programme the Centre prepares and supplies oligonucleotides of desired sequence to various scientists in the country for work in molecular biology, DNA probes and diagnostics. It has also a facility to prepare peptides of desired sequences.

The Centre has also a facility for testing of pentachlorophenol (PCP). This particular testing facility was started with the help of CLRI for estimation of pentachlorophenol in leather samples to be exported and require certification. The Centre is authorised to certify the PCP content of leather samples for export.

6.2 Analytical Studies and Surveys

6.2.1 Transgenic Tea Roots

Under a collaborative research programme on tea between CIMAP and Tea Research Association (TRA), Calcutta, a procedure for obtaining genetically transformed hairy roots of tea has been developed. The seed leaves proved to be highly sensitive to transformation by the bacterium Agrobacterium rhizogens strain A4. High level of iron and low pH (4.5-5.2) in the culture medium proved conducive to the proliferation of the induced hairy roots. This is the first report of genetic transformation in tea. Efforts are now focused on inducing shoot regeneration from the transgenic roots to obtain useful variants for further selection.

6.2.2 Roads

For the benefit of the Border Roads Organisation, optimisation of design and construction of steel bridges upto a span of 25 meters designed for 70R loading and IRC loading were carried out by CRRI. These can be adopted for roads in hilly areas.

6.2.3 Road and Bridge Engineering

With a view to reducing road accidents by improving road user behaviour, CRRI, under a sponsored study of the Ministry of Surface Transport (MOST), successfully conducted training courses for traffic police personnel in metropolitan cities of Patna, Bhopal, Cochin, Coimbatore, Indore, Ludhiana, Madurai, Surat, Varanasi and Viskhapatnam. These four day training courses comprising lectures on various traffic management and safety related aspects were attended by about 700 police personnel of various ranks.

6.2.4 Harbour Development

For M/s Adani Chemicals Ltd., Bombay, NIO carried out studies on tides, current, waves and seabed surveys for deriving design parameters for development of a ship berthing jetty at Navinal in the Gulf of Kutch.

6.3 Testing and Product Evaluation

6.3.1 Fatigue Tests

A leading automobile manufacturer in India was facing frequent inservice failures of heavy duty dumper leaf spring. The problem was referred to SERC-M for experimental investigations. Full scale fatigue tests were carried out and the cause of the inservice failure was identified. Based on the results of the investigations, it was possible to make recommendations to enhance the durability of the component.

6.3.2 Structural Distress

The Indira Gandhi Stadium and other buildings of the complex in the capital have been found to be in a state of distress/degradation due to a variety of structural as well as non-structural causes. The Sports Authority of India has commissioned SERC-G to investigate the cause of distress and leakage in various buildings of the stadium complex and propose suitable remedial measures.

In the first phase of the work, an extensive survey was carried out by the Centre to identify the distressed locations and to assess the extent of non-structural distress such as leakage, cracking and corrosion. Based on this inspection, the Centre submitted a report with detailed recommendations for repair/rehabilitation of the distressed areas and for long-term preventive measures to inhibit such conditions in future.

In the second phase, conditons of structural distress would be investigated through design checks and complementary non-destructive field investigations. These investigations would provide the basis for appropriate recommendations for rehabilitation/retrofitting of the affected members.

6.3.3 Trisonic Wind Tunnel

The productivity of the 1.2m trisonic wind tunnel of NAL went up with a total of 1600 blowdowns this year as against 897 last year. The tunnel, which completed 25 years of operation last year now carries out two-shift operations to meet the pressing testing requirements of various national aerospace programmes.

6.3.4 Flosolver

The Flosolver team of NAL successfully parallelised the GCM (T-80 version) weather prediction code and ran it on a 4-processor Flosolver. Mk 3 Flosolver was also the first parallel computer in the country to run the T-80 code, which the Department of Science and Technology (DST) is bench-marking on the different parallel computing platforms available in the country. The CPU time taken by Flosolver to run the code is currently a little more than the 2-processor Cray at DST but the run time is likely to be reduced considerably

once the code is optimised and run on a 8-processor Flosolver version.

6.4 Information Dissemination

The Publications & Information Directorate (PID) of CSIR publishes twelve journals in English in different areas of science and technology.

During 1993-94, most of the articles of volume 4 (Cl-Cy) of the revised series of Wealth of India: Raw Matrials were completed. The volume includes a total of 187 articles of which 141 are plant genera, 4 on animals and their products and 5 on minerals.

The three popular science magazines, namely, Science Reporter (English, monthly), Vigyan Pragati (Hindi, monthly) and Science-ki-Duniya (Urdu, quarterly) recorded a substantial rise in circulation, with Science Reporter touching a mark of 47,000, Vigyan Pragati 80,000 and Science-ki-Duniya 9000. Special issues of Sciece Reporter on "Meghnad Saha", "Shanti Swarup Bhatnagar" and "Satyendra Nath Bose" and a "Festival Issue" were brought out. The section entitled "India Can Do It" in Science Reporter continued to focus on achievements of Indian Science.

Launched in 1990, the PID Science Feature Service aims at bringing science to the masses. During April 1993-March 1994, six regional newspapers, namely, the Deccan Herald (Bangalore), The M.P. Chronicle (Bhopal), The Hitavada (Nagpur), The Tribune (Chandigarh), Lokmat Times (Aurangabad) and Business Standard (Delhi) were regular subscribers to this service. The Free Press (Indore) was also being supplied with "exclusive packages". The feature service made available to its subscribers 48 full articles and 180 snippets during the period under report. In addition, exclusive articles and snippets were supplied to The Times of India under a special arrangement.

The Indian National Scientific Documentation Centre (INSDOC) of CSIR, New Delhi has started acquiring about 1000 core foreign journals, a majority being in electronic form. INSDOC has started an express photocopy service on the strength of these new procurements. The photocopies are delivered to the customer within 48 hours of the placement of the order.

The Government of India has decided to setup the SAARC Documentation Centre (SDC) at INSDOC for exchanging S&T information among SAARC nations. The 13th Session of the Council of Ministers of SAARC nations has approved the project report of SDC at INSDOC.

The Contents, Abstracts and Photocopy Service (CAPS) of INSDOC is also becoming popular slowly, but steadily. The number of customers has increased to 402 as against 200 the previous year.

The efforts of National Institute of Science Technology and Development Studies (NISTADS) on Science and Technology Archival Resources (STAR) have led to its getting an assignment of the American Institute of Physics to catalogue historical source material on Physics in India.

The Geographic Information System (GIS) developed to integrate science and technology with development plans through interactive mode of spatial information analysis was applied by NISTADS to micro-level planning of forests and wastelands.

Bio-informatics

As a part of the Biotechnology Information Systems (BTIS), of the Department of Biotechnology (DBT), operating through nine Distributed Information Centres (DICs) located in various institutions all over the country, the DIC-Bioinformatics facility at CCMB is fully operational. The principal objective of DIC at CCMB is to serve as a national network providing information in the areas of oncogenes, reproductive physiology, cell transformation, nucleic acid and protein sequences.

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; Weighted Tax Deduction for sponsored research; Accelerated Depreciation Allowance on plant and machinery setup 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 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

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 allowed 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

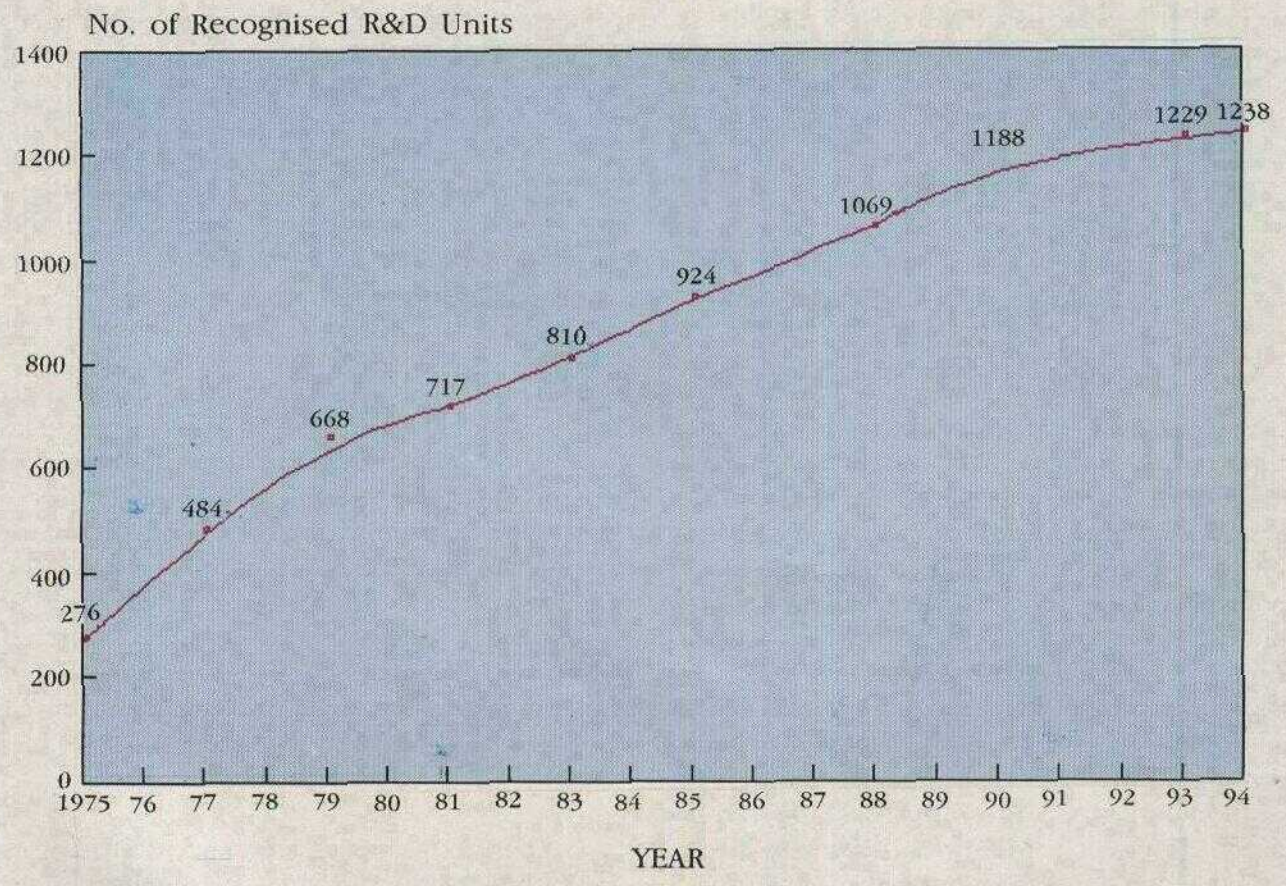


Fig 1. Growth of In-house R&D Units

located in a separate building. It is appreciated that In-house R&D activities are likely to be intermingled with the activities related to manufacturing in the factory and often part of the production equipment and infrastructure would be utilised to carry out certain aspects of their R&D activity. The In-house R&D units would have at least some staff exclusively engaged in R&D and there would be full-time Head for the R&D who would have direct access to the Chief Executive or to the Board of Directors depending upon the size of the unit.

Number of In-house R&D units recognised by DSIR has increased steadily from about 100 in 1973 to about 250 by 1975, to over 600 by 1980, over 900 by 1985, and 1238 as on 31 December, 1994. The growth is also represented in Figure III.A.I. Of these 1238 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 1994.

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 Joint Adviser (RDI), DSIR with members from Department of Chemicals & Petrochemicals, Department of Fertilizers, Department of Industrial Development, Ministry of Environment and Forests, Department of Coal, Department of Electronics, DOT, CSIR, DCSSI, and NRDC along with the DSIR officers. The Committee meets every month to consider the applications along with other relevant data put up and makes recommendations to the Secretary, DSIR for : (a) Granting recognition for a specified period ranging from 1 to 3 years, or (b) for rejecting the application, or (c) for deferring the case for obtaining further details, discussions with the company or visit to the unit for clarification of various points.

During the year 1994 the Screening Committee met 12 times and considered 117 applications for recognition; 68 R&D units were granted fresh recognition, 19 R&D units were endorsed on the existing letters of recognition in respect of other R&D units of their company and 8 applications were rejected.

The pendency at the end of December 1994 was 17. A statement giving monthwise receipt, disposal and pendency of applications for recognition of R&D units is given at Annexure III.A.1.

116 In-house R&D units were visited till the end of December 1994 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 3 years. The R&D units are advised to apply for renewal of recognition well in advance (3 months) of the date of expiry of the recognition. During 1994, 591 In-house R&D units were due for renewal of recognition beyond 31 March 1994. Based on the evaluation of the performance of the R&D units, renewal of recognition was granted to 538 units. Recognition granted to 53 units was allowed to lapse. All applications received for renewal were dealt with and there was no pendency by end of September 1994. 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 in the 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 estimated to be 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 1238 recognised R&D units is of the order of Rs. 1300 crores and about 45% of it is accounted by over 170 public sector and joint sector units and about 55% by about 1070 R&D units in private sector. 193 R&D units spend over Rs. 1 crore each on R&D, 326 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 Annexures 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 Corporation, 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 over Rs 1200 crores at present. Some of the sophisticated equipment facilities available are: Fourier Analyser Infrared Moisture Meter and control equipment Score Ratio Tester; Automatic Weight Classifier Binary gradient HPLC system; New measuring mixer W-50; Mass Spectrometer; Phase Contrast Microscope with Automatic Photographic System; Memoriser; Anaerobic Incubator Systems; Gas Chromatograph; Rheometer model Rheocord 90-200 along with accessories; Automatic Spray gun; Spectrophotometer; Mechanical stability test aparatus; One way disc plough, reversible square molded plough for tractors; UV-VIS Dual Beam Spectrophotometer; Brookfield Viscometer; Microsheen Digital Opacity Reflectometer; Haze Gloss with standards; Mitutoyo DRO system for MTR milling machine; SIM DIST Analyser; Saybolt Chromometer; Density Meter; Partical size analyzer; Mooney viscometer and moving die rheometer; Fourier Transform Infrared Spectrophotometer; Brightness meter; X-ray diffractometer; Exhaust emission analyser; LC-295 Programmable variable wavelength UV/VIS detector.

6. R&D MANPOWER

There has been 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 1238 In-house R&D units is over 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 Industries - 250

iv) Processing Industries (Metallurgical, Refractory, Cement, Textile, Paper 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 and commercialisation of novel process for manufacture of cyclopropylamine.
- Development and commercialisation of process for manufacture of domperidone.
- Development and commercialisation of novel process for manufacture of ondansetron.
- Development and commercialisation of novel process for manufacture of S - methoxy morphinan.
- Development and commercialisation of processes for loratidine, ticlopidine and fluoxetine.
- Development and commercialisation of high molecular weight dispersing agent (mol. wt. 7000).
- Upgradation of PVC extrusion technology.
- Development of technology for crude HCG.
- Development and commercialisation of indigenous catalyst for production of aromatic petroleum resins.
- Development of technology for conversion of hexa-methyl disiloxane to trimethyl chlorosilane, an import subtitute.
- Development of process for recovery of barium sulphate by selective precipitation.
- Development and commercialisation of a process for production of pectinase.
- Development of process for recovery of fibrous calcium sulphate from effluent streams.

- Development of technologies for advanced ceramic powders viz. barium titanate, alumina, zirconia and partially stabilised zirconia.

- Development of technology for rerefining of used lubricating oils.

- Commercialisation of technology for AOX free phosphorylated fat liquor, a semi synthetic product used in leather industry.

- Development of technology for food grade phosphoric acid.

- Development of technology for conversion of pivalic acid to pivaloyl chloride, an import substitute.

- Development of human typhoid vaccine based on Vi antigen.

- Upgradation of imported technology for manufacture of acrylic fibre.

- Development of anodic/cathodic gaskets made out of EPDM to use in bipolar electrolisers to fix membranes.

ELECTRICAL AND ELECTRONICS INDUSTRIES

- Development of Airborne Integrated Radio Communication System, Airborne identification friend or foe transponder, Solid state power amplifier for Insat-II, Strap down inertial guidance system for Prithvi Missile, Automatic management or Radio and intercom system.

- Design and development of Crystal and Synthesiser based 2x15 and 4x30 Multi Access Rural Radio System, Multi Access Mobile Radio for Mobile to Base & Base to Mobile.

- Development of Altitude encoder for MIG Aircraft, DC Distribution system for ALH, Fuel content gauging for ALH, Static inverter for ALH.

- Development of Power Series Communication Controller, Redundant Array of inexpensive disks for VME-Bus, Ethernet Terminal Concentrator Product Line, NetLabs NL/Manager and NL/Assist, Kubera, Thunder, Wipro - RUCSHAC, WX-PAD.

- Development of microprocessor based process controller, specially designed to suit Nuclear application; Electronic under voltage relay and under frequency relay.

- Development and indigenisation of Omega wind finding system, 2x5 KW FM Transmitter, 300 W Low power UHF TV transmitter, console unit for FM transmitter, Digital Radio 4M bit 400 MHz digital radio 8M bit 2GHz, 128 Port Electronic Rural Automatic Exchange (RAX) with C-DOT Technology.

- Development of 2 GHz Digital Microwave equipment, 34MB/s Optical line equipment, 8 Mb/s optical line equipment, Digital Answering Machine.

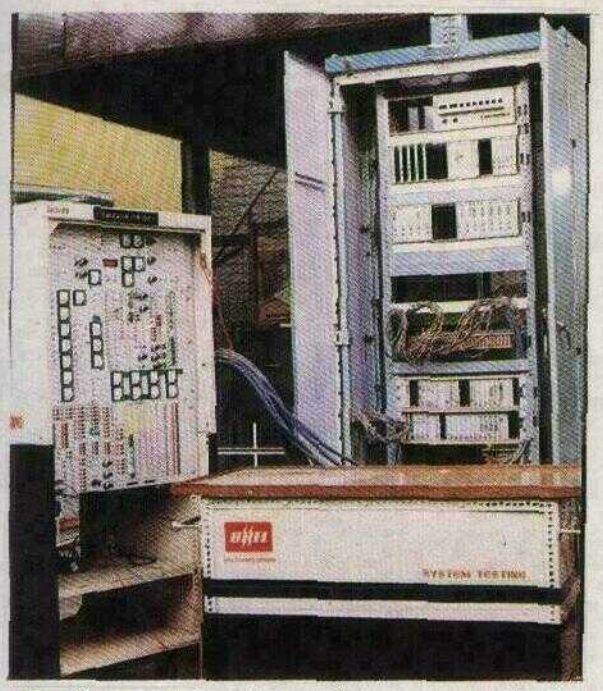
- Development of Satellite Receiver, Temperature Controlled Soldering Iron, Multichannel Modulators.

- Development of Power Line Carrier Communication terminal model, Mini digital exchange MDX-50, FAX over VSAT network of C-DOT, Data acquisition system for GTRE.

- Development of Evenness tester for sliver roving, Microprocessor based electronic yarn Clearer, yarn length measuring & control system for winding machine, Microprocessor based temperature programme model PC/600 with centralized computer control software.

- Development of 80 MW air cooled turbogenerator, Impulse test system for 220 KV.

- Design and development of Genset with



III.A.2. Electro Hydraulic Turbine Controller for Steam Turbines

brushless alternator and coupled alternator and Air cooled engines for 3-wheeler and Motor Cycle.

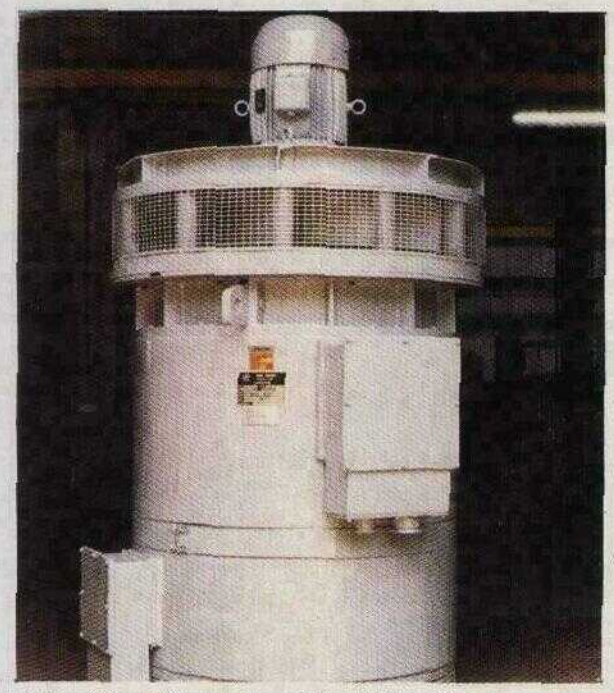
- Development of Solid State all Electronic Energy Meter (SALEM), DAM-8AAD, DAM-16, Data Link Interface.

Development of 121 Volts, 810 Amps Silver-Zinc primary battery, Nickel Cadmium battery, batteries for photovoltaic/UPS applications, higher capacity stationery cells 3000Ah and 4000 Ah SLI batteries in polypropylene container and EMU batteries for railways.

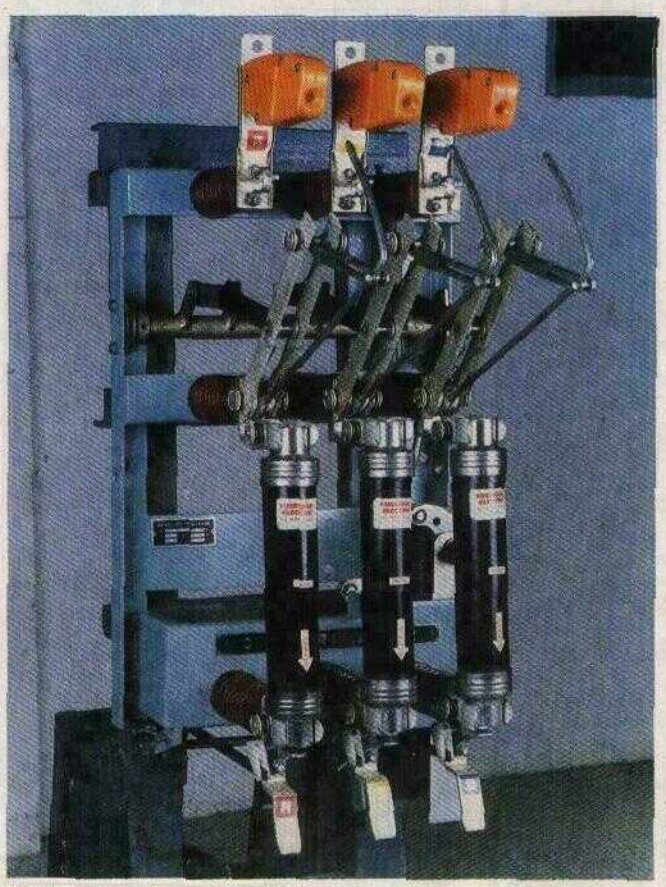
- Development of Multilingual electronic Teleprinter, CEPT Modems, Braille Typewriter.

- Development of computer softwares/ hardwares such as Meteor 50, Lansterm 1600.

Development of Automatic Test System, Electronic Speed Governor, Auto Synchronising Unit.



III.A.3. 4-Speed Sugar Centrifuge VCF-6 Motor



III.A.4. In-door Load Break Switch

- Development of Portable Ultrasonic Flaw Detectors, Micro Processor Controlled Multi Rail Testers.

- Development of 140L compression type chest deep freezer, 165L visi cooler, 90L icelined refrigerator, 80L solar photovoltaic refrigerator.

- Development of Locomotive simulators.

MECHANICAL ENGINEERING INDUSTRIES

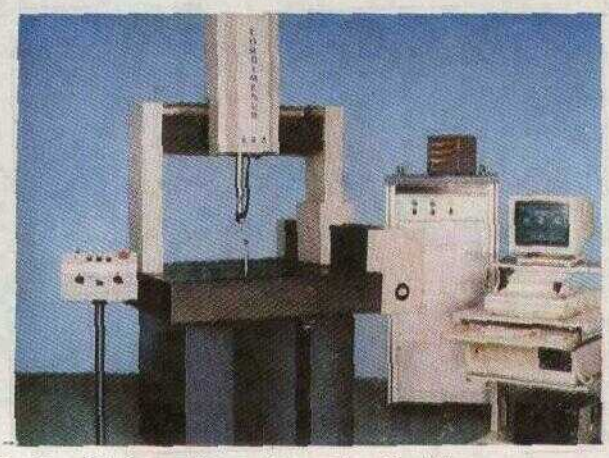
- Design and development of 3D Co-ordinate Measuring Machine; Static Torque Meter, Gear Rolling Tester, Tensometer (Electronic).

- Design and development of a value engineered version of 5012 photo copiers.

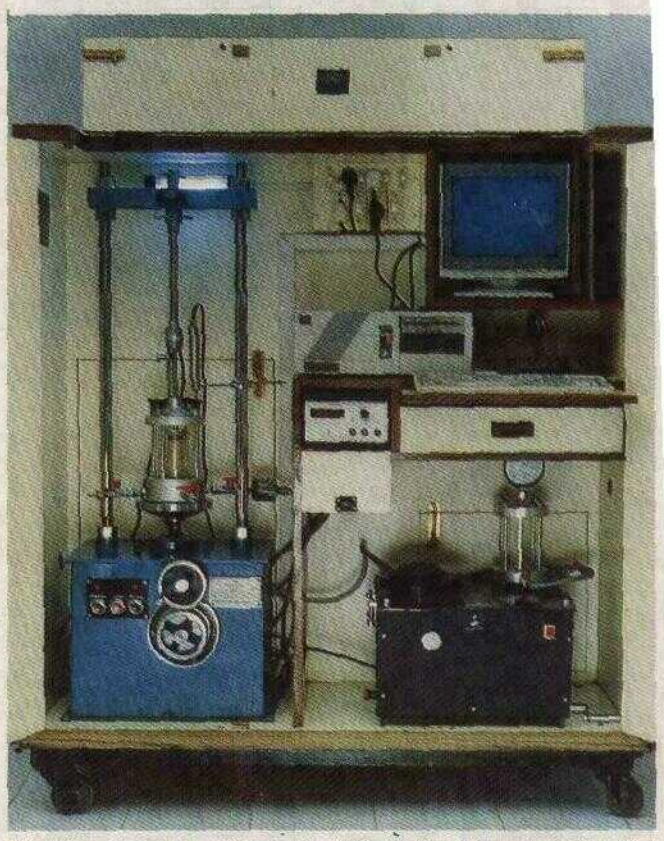
- Design and development of Horizontal Machining Centre HMC 320, CNC Lathe ECONOCNC 26; LT-20 CNC lathe and LT-2 CNC lathe for export, Special purpose internal face CNC controlled Grinding Machine, Remote controlled CNC three Spindles Drilling and Milling machine.

- Design and development of Plateau Honing Machine, Twin Spindle Precidor Honing Machine,

- Development of Broad Gauge Railbus, Roof mounted package AC for Indian Railways.



III.A.5. 3D Co-ordinate Measuring Machine



III.A.6. Computer Controlled Modular Mounted Triaxial Testing System

- Development of Compressor for high pressure pneumatic system in battle tanks.

- Development of Zirconium Tube Bore cleaning equipment.

- Development of Cerametallic & Metallic Discs for T-72 Tank.

- Development of low cost tractor, composite orchard system for mechanical horticultural operation, rough terrain forklift trucks, Toori attachment on Harvestor combine to recover Toori, a useful cattle feed.

- Development of 3.5 HP Light weight diesel engine, Fuel Efficient Biomass Stove, Solar Distillation System, Fuel Efficient 2 Tier Baking Oven.

- Design and development of Diesel Engine driven packaged fire fighting pump set for off-shore oil platforms.

- Design, development and productionisation of engines with cylinder having 3 ports and new 100cc motorcycle with Improvement in Fuel efficiency and reduction of emissions; Homologation of 2-wheelers.

- Design and development of New sizes of Bicycle.

- Tyre and Tubes for export, coloured Tyres Tubes, Butyl Tubes, Nylon Tyre, Bead wire insulating machine.

- Development of critical valves, parallel slide, gate valves, Sealed Valves, large size plug valve.

- Development of special package conveyor belt, special type of Vee belt; wire-mesh reinforced conveyor belt, Hot material conveyor belt for 200°C application.

- Design and development of Solar Photovoltaic Vacuum Laminator.

III.A.7. 750 mm (Class 150) Large Size Plug Valve

- Development of basic laser kit, advanced laser kit device, vision driver, special lenses for defence, telescope aperture meter.

- Development of Manuline-16 commercial Web Offset Printing Machine, Newsline 30 Newspaper Printing Machine, SHIVA-166 Sheet-Fed Offset Printing Machine and its Computer Software.

- Development of Lubra Strips for extra comfort during shaving with twin blade shaving system, automatic disposable Razor Handle Assembly machine.

- Development of Demineralised water plant and vacuum seal off system.

PROCESSING INDUSTRIES

- Development of technology for recovery of copper and nickel from anode slag, Recovery of platinum from the bleed electrolyte; Refining of crude gold, production of copper-tellurium master alloy, copper sulphate from smelter ESP dust.

- Development and use of dunite in place of dolomite in sintering of iron ore, application of physical simulation technique in commercial production of sophisticated steel grades through Hot Strip Mill, Cold Heading Quality Steels, Corrosion Resistant Reinforcing bars.

- Development and commercialisation of Tin Mill Black Plate Grade Steel, weather Resistant Steel, Steel for use at Moderate temperatures, Light Solvent Naphtha, Extra Hard Pitch.

- Development of an improved method of Bright annealing of Soft Iron Magnetic material components.

- Development of technology for special anti-corrosive lining for pipes and ducts, EPDM Gaskets for membrane cell chlorine plants.

- Development of methodology for thermal

II.A.8. Low Weight Bogie

studies of Mine Fires using Remote Sensing Technique in Jharia Coalifield.

Development of extrusion dies of H-13 grade special tool steel, charging bars, rail straightening machine rings, high tensile steel.

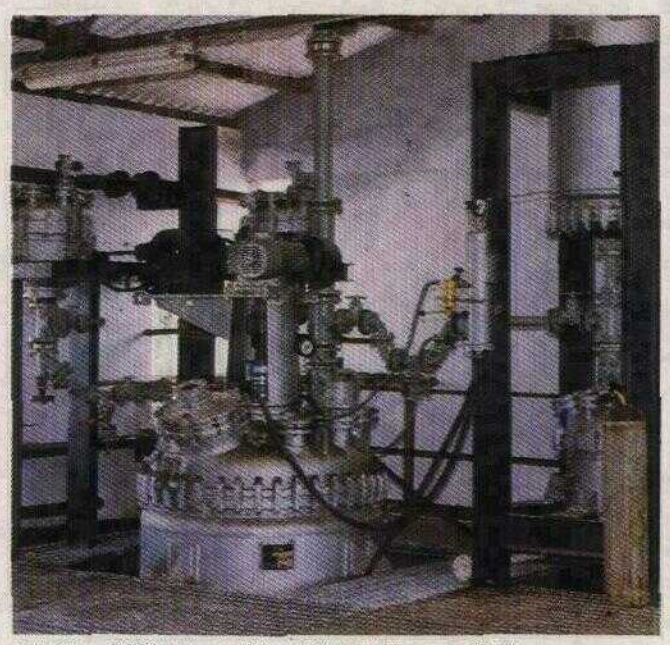
Development of aluminium forging of impeller of turbo charger for diesel loco works, aluminium alloy piston forging for railways, Titanium disc forgings for space programme.

Design and fabrication of thermoshrinkage line and achievement of zero waste percentage speciality fibres in acrylic fibre manufacturing plant.

Development of structural reconstituted wood-base composite from plantation wood, Glass Fibre Reinforced Plastic (GRP) underground petroleum storage tank.

Development of ultra filtration technique to remove effluent colour, bio-bleaching of pulp to reduce use of chlorine, improved biogas generation and technology for new speciality papers namely foam base paper, Medical grade papers, coating base paper.

Development of process for reclamation of rubber from waste latex products. Food grade rubber lining, Polyurethane adhesive for Footwear and leather goods industries.



III.A.9. 2000 Litres Glass Lined Reactor Unit

AGRO INDUSTRIES AND OTHERS

- Development of process for extraction of humic acid from lignite - a plant growth stimulant for agricultural crops.

- Development of commercially viable layer type of chickens suitable for Indian agro climatic conditions.

- Development of technology for Nimbecidine - a neem based pesticide containing active ingredient azadirachta.

- Development of various types of seeds/hybrid seeds of various crops for better yields

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 : Mettler analytical balance and weights set; Buchi aparatus; Electrostatic discharge simulator; Autocad Power Package 2.2D SDK Debug HIC 1.7; Fourier Transform Infrared Spectrophotometer; Perkin Elmer gas chromatograph; Laboratory dyeing apparatus & finishing apparatus; Cummins injection test stand; Fluke measurenment; Vibration

test system; Magnetically coupled stirrer assembly; Preparative High Performance Liquid Chromatography; Low Temperature Freezer; Shimadzu liquid chromatograph;

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 exempted from the Drug Price Control (DPCO) for a priod of five years after their introduction in the market. The Department examines the request of various In-house R&D Units for claiming exemption and issues certificate of indigenous development of technology/process, in deserving cases.

During the Year 1994, certificates of indigenous development of technology/process for manufacture of bulk drugs for claiming exemption from Price Control were issued in respect of 4 bulk drugs viz. Metaclopramide HCl (IPCA Laboratories, Bombay), Salbutamol Sulphate (CIPLA Laboratories Ltd., Bombay), Ranitidine HCl (Glaxo Laboratories, Bombay), Pentazocine (Ranbaxy Laboratories Ltd), New Delhi.

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 requiring remittance of foreign exchange for deputing experts to attend international symposia and seminars, exhibitions, trade fares, international R&D collaborations; 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 produce were examined and the decisions of the Department conveyed.

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

Names, addresses and also location 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 1994, there were 1238 In-house R&D units recognised by DSIR and whose data are entered in the computer.

13. CONFERENCES, AWARDS, PROJECT SUPPORT AND PUBLICATIONS

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

- bring In-house R&D into sharper focus;
- strengthen R&D infrastructure in industry and SIROs;
- promote R&D initiatives of the industry and SIROs;
- ensure that the contributions made by the In-house R&D Centres and SIROs dovetail adequately in the overall context of technological and industrial development.

Activities undertaken towards achieving the above are presented below:

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

Department of Scientific and Industrial Research (DSIR) organised the Eighth National Conference on In-house R&D in Industry in association with the Federation of Indian Chambers of Commerce and Industry (FICCI) during 2-3 December 1994 in New Delhi. Attended by over 600 delegates from industry, National Laboratories, IITs and Universities, Scientific and Industrial

test system; Magnetically coupled stirrer assembly; Preparative High Performance Liquid Chromatography; Low Temperature Freezer; Shimadzu liquid chromatograph;

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 exempted from the Drug Price Control (DPCO) for a priod of five years after their introduction in the market. The Department examines the request of various In-house R&D Units for claiming exemption and issues certificate of indigenous development of technology/process, in deserving cases.

During the Year 1994, certificates of indigenous development of technology/process for manufacture of bulk drugs for claiming exemption from Price Control were issued in respect of 4 bulk drugs viz. Metaclopramide HCl (IPCA Laboratories, Bombay), Salbutamol Sulphate (CIPLA Laboratories Ltd., Bombay), Ranitidine HCl (Glaxo Laboratories, Bombay), Pentazocine (Ranbaxy Laboratories Ltd), New Delhi.

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 requiring remittance of foreign exchange for deputing experts to attend international symposia and seminars, exhibitions, trade fares, international R&D collaborations; 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 produce were examined and the decisions of the Department conveyed.

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

Names, addresses and also location 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 1994, there were 1238 In-house R&D units recognised by DSIR and whose data are entered in the computer.

13. CONFERENCES, AWARDS, PROJECT SUPPORT AND PUBLICATIONS

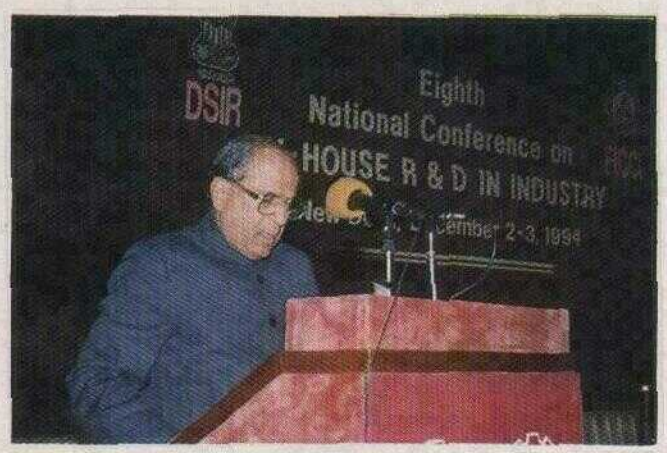
The EFC Memorandum for the plan scheme Research and Development by Industry for the Eighth Plan Period (1992-97) was approved in 1992 with an allocation of Rs. 4 crores. The broad objectives of the scheme are :

- bring In-house R&D into sharper focus;
- strengthen R&D infrastructure in industry and SIROs;
- promote R&D initiatives of the industry and SIROs;
- ensure that the contributions made by the In-house R&D Centres and SIROs dovetail adequately in the overall context of technological and industrial development.

Activities undertaken towards achieving the above are presented below:

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

Department of Scientific and Industrial Research (DSIR) organised the Eighth National Conference on In-house R&D in Industry in association with the Federation of Indian Chambers of Commerce and Industry (FICCI) during 2-3 December 1994 in New Delhi. Attended by over 600 delegates from industry, National Laboratories, IITs and Universities, Scientific and Industrial



III.A.10. Shri Bhuvnesh Chaturvedi, Minister of State (Prime Minister's Office and S&T) Addressing the Delegates at the Inaugural Session

Research Organisations (SIROs), Consultancy Organisations, Government Departments, the Conference was inaugurated by Shri Bhuvnesh Chaturvedi, Minister of State (Prime Minister's Office and S&T) in the Convention Hall, Hotel Ashok, New Delhi. The Minister also gave away the 1994 DSIR National Awards for Outstanding In-house R&D Achievements to twelve industrial units. The Hon'ble Minister also released the DSIR publications "Compendium on In-house R&D Centres - 1994" and "Wealth of Technologies Generated by In-house R&D Centres". The Valedictory address was delivered by Dr. Arjun K. Sengupta, Member Secretary, Planning Commission.

III.A.11. Dr. Arjun K. Sengupta, Member Secretary, Planning Commission Addressing the Delegates at the Valedictory Session

b) National Awards for R&D Efforts in Industry

In order to provide recognition to the efforts of the industry towards innovative research and technological development, the DSIR has instituted National Awards for R&D Efforts in Industry in 1987. These awards are in the form of trophies 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 and in 1994 to 12 firms for Outstanding R&D Achievements.

Following is the list of the award winners in 1994 :

Drugs and Pharmaceuticals Industries

1. Cheminor Drugs Limited, Hyderabad

Electrical Industries

2. Bharat Heavy Electricals Limited, Hardwar

Electronics Industries

3. Hindustan Aeronautics Limited, Hyderabad

Mechanical Industries including Capital Goods Development

4. Accurate Engineering Co. Pvt. Ltd., Pune

III.A.12. DSIR National Award Winners

Agro Industries

5. T. Stane and Company Limited, Coimbatore

6. Venkateshwara Research and Breeding Farm Ltd., Pune

New Materials

7. The Associated Cement Companies Ltd., Bombay

8. The Gurdit Institute Pvt. Ltd., Dharwad

Pollution Control and Environmental Protection

9. Sree Rayalaseema Alkalies and Allied Chemicals Ltd., Kurnool

10. Balmer Lawrie & Co. Ltd., Calcutta

Technology Absorption

11. Modi Xerox Limited, New Delhi

12. Pasupati Acrylon Limited, New Delhi

c) Compendium on In-house R&D Centres - 1994

At present there are over 1200 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 Centres" was brought out during 1985 covering 193 In-house R&D Centres, 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, the sixth one in 1990 in two volumes covering 448 centres, the seventh one in 1991 in two volumes covering 439 centres, the eighth one in 1992 in two volumes covering 384 centres, and the ninth one in 1993 covering 291 centres.

The Compendium on In-house R&D Centres - 1994 was compiled in two volumes by DSIR based on the information and material received from 491 In-house R&D Centres along with their applications for renewal of recognition beyond 31 March 1994. These two volumes were released during the Inaugural Session of the Eighth National Conference on In-house R&D in Industry on 2 December 1994 by Shri Bhuvnesh Chaturvedi (Prime Minister's Office and S&T).

d) Wealth of Technologies Generated by In-house R&D Centres

The publication "Wealth of Technologies Generated by In-house R&D Centres" aims at highlighting the technological contributions made by about 1100 In-house R&D centres during the past five years. The technologies developed and commercialised have not only contributed to the increased production but also towards export of products based on domestic technologies. This publication was also released during the Inaugural Session of the Eighth National Conference on In-house R&D in Industry.

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

As the number of In-house R&D Centres increased and 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 serves to disseminate useful and important information relevant to R&D in Industry.

During 1994-95, four issues of In-house R&D in Industry were brought out in April, July, October 1994 and January 1995. 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 are in high priority areas of importance to the nation.

The 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 software. Design and development of hardware and development of testing softwares like TMS320C30 assembler and disassembler will be the responsibility of CDES. The application software 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 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 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 through the National Research Development Corporation, New Delhi.

DSIR has provided a grant of Rs. 5.0 lakhs to Ankleshwar Rotary Welfare Trust registered at Bharuch, Gujarat for purchase of technical books for UPL - Rotary Library for use of over 1200 industries located in the Ankleshwar Industrial Estate for their technical and R&D needs.

g) Publications

Following 12 publications were brought out during the year 1994-95 :

i) Compendium on In-house R&D Centres - 1994
(Chemical, Processing and Agro Industries and Others)

ii) Compendium on In-house R&D Centres - 1994 (Engineering Industries)

iii) National Awards for R&D Efforts in Industry (1994)

iv) Research and Development in Industry - An Overview (1994)

v) In-house R&D in Industry - Information Update (April 1994)

vi) In-house R&D in Industry - Information Update (July 1994)

vii) In-house R&D in Industry - Information Update (October 1994)

viii) Directory of Recognised In-house R&D Centres (October 1994)

ix) Directory of Recognised Scientific and Industrial Research Organisations (October 1994)

x) Wealth of Technologies Generated by In-house R&D Centres (December 1994)

xi) In-house R&D in Industry - Information Update (January 1995)

xii) Proceedings of the Eighth National Conference on In-house R&D in Industry (March 1995)

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 if they wish to have donations from industries 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.

Through an amendment by the Direct Tax Laws (Amendment) Act, 1987, effective from 1st 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) in 1988 and Secretary DSIR is the authority for granting such recognition. SIROs recognised by DSIR are eligible for Customs Duty Exemption on import of equipment, spares and accessories for R&D; they are also eligible for notification under section 35 (1) (ii)/(iii) of the Income Tax Act for availing associated tax benefits.

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

Applications for seeking recognition under the SIRO scheme are considered in DSIR by an inter departmental Screening Committee with members from Council of Scientific and Industrial Research (CSIR), Indian Council of Medical Research (ICMR), Indian Council of Agricultural Research (ICAR), Indian Council of Social Science Research (ICSSR), and Central Board of Direct Taxes (CBDT). The Committee is presently chaired by Joint Adviser (RDI), DSIR. The recommendations of the Screening Committee are put-up for approval of Secretary, DSIR, for recognition or

otherwise of SIROs. The concurrence of Secretary, DSIR, is communicated to the Director General (Income Tax Exemption), Calcutta, for notification under section 35 (1) (ii)/(iii) of IT Act.

During the year 1994, the Screening Committee met 12 times and recommended 23 cases for recognition as Scientific and Industrial Research Organisations. List of these SIROs is furnished at Annexure III-B.1. and III-B.2.

At present, there are 497 SIROs duly recognised by DSIR. Of these, 212 are in the area of natural & applied sciences, 148 are in the area of medical sciences, 31 are in the area of agricultural sciences and 106 are in the area of social sciences.

III (C). FISCAL INCENTIVES FOR SCIENTIFIC RESEARCH

1. INTRODUCTION

Several incentives have been evolved for utilisation of the technologies based on the 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 imported 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)/(iii) of the IT act.

2. 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.

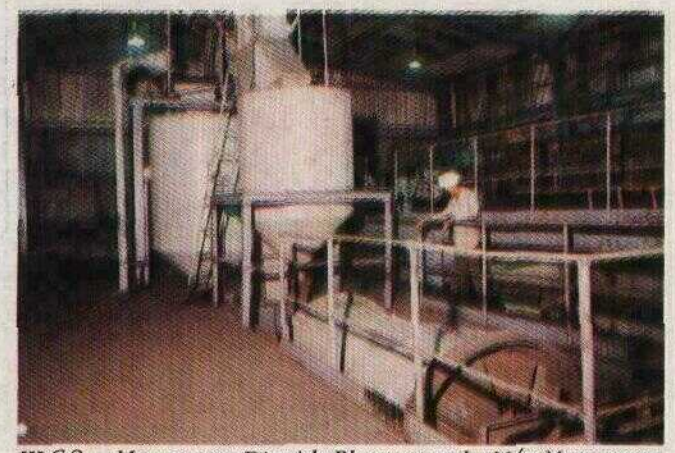
During the year 1994, 4 sponsored research programmes involving Rs. 43.85 lakhs were approved by DSIR. Details of these scientific programmes are given at Annexure III.D.

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.

Secretary, Department of Scientific & Industrial Research, Ministry of Science and Technology, is the Prescribed Authority for issuing certificates 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.

III.C.1. Chlorination Reactor/HCL Generator in Alpha Napthyl Acetic Acid Plant Set Up by M/s. Chemstar Organics India Pvt. Ltd., Bombay



III.C.2. Manganese Dioxide Plant set up by M/s. Manganese Ore India Ltd., Nagpur

During the year 1994, 20 certificates involving Rs. 3039 lakhs as cost of plant and machinery were issued. Details of these cases are given at Annexure III.C.

4. 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 which meets normally once a week to examine the proposals.

During the year around 700 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. 36 crores.

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

Work station CD-914H-12D, CPU + 32 MB RAM & 10 GB HDD; Alpha graphics work station DEC-3000 model 800; Perkinlmex model 2400 series analyser (230V); Nrishiqe micromanipulator; Stereoscan 440 computer controlled scanning electron microscope; DEC.3000 model 600 A&P work station; Perkin Elmer cetus DNA thermal cycler; Perkin Elmer model BDA 2s UV/VIS + B050 82724 spectrometer; software for geographical information system with A0 digitizer, X-terminator; 127098 GC/MS systems & data system; Ion Chromatograph;

Prefiltration systems; Multimedia filter 49 PM capacity; Plant growth chamber model LPIPH; Icematic flaker model F-90; Aliovert 100 inverted microscope 2000 C; CP-600 peristaltic pump; Rotary evaporators Rotavapor R-124/5 system; Beckman LS-6500 liquid scintillation spectrophotometer; Automatic tissue processor Histokinette 2000 with accessories; MD 120 wire rope recorder; Electronic sensor seismometer; INDY R 4400 operating system with 4 MB RAM/2GB disk video camera, colour monitor; Biosym application software;

Bio-Rad powerpac model 3000; Hetosicc free standing lab. freeze drying systems model no. FD-4-85; (bio sensors multichannel, monitor); DEC 3000 model 500 S Alpha Server, Computers, printers, fax/modems; Dyno-Mill type KDL, Micro & ultra filtration, Incubator shaker model G-24; CEPA High speed stainless steel Centrifuge; New generation particle size analyser model CIS 100; Gas chromatograph mass spectrometer (GCMS); Scanning electron microscope XL-20; Sun Spark classic workstation; Ultracentrifuge Beckman model Optima XL-80; Imaging densitometer model GS-670; Beckman model LS-6500 LS counter value system; Beckman model DU-640 Spectrophotometer;

Microscopes model Alphaphot-2; 50 Watt cell disrupter; 2045 multicut multi-purpose microtome; Forma scientific CO_2 incubator; Jasco model J-720 spectropolarimeter; Microprocessor controlled plant growth chamber; 64 Bit 100 MHz R 4000 PC processor; Temperature-humidity recorder model-THDX; Current probe model No.P6022; Stereo zoom optical microscope; Waters ion chromatography system; Waters performance liquid chromatography system; Buchi rotary evaporators; Hybridization oven; Portable leaf area meter.

Gas chromatograph mass spectrometer (GCMS); Bristol make compressor; FT-NMR

spectrometer advance; Pellicon ultra filtration system & components; Pack film holder; Imagestore-5000 image management system; Nicolet FT-IR spectrometer; Suntest CPS controlled power system; Biological microscope; Hitachi automatic high speed refrigerated centrifuge; Hyperdization oven with built in shaker model No.2510; Atomscan 25 sequential plasma spectrometer, nebulizer, power, units; Cyclone calibration chamber cat No. 22501-03; Hybridization incubator model 400; Laser particle sizer; pH Meters; M-9200 Hydrogen generator, nitrogen generator; Lancom 6500 portable gas analyser; FDDI Backbone network; Agitated high pressure autoclaves; Spray dryer; Sun sparc station 5 model 85; CD-ROM Database; Dell Omniplex computer model OM-566 etc.

5. SCIENTIFIC RESEARCH ASSETS AND ACTIVITIES 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 technical authority referred to as the Prescribed Authority (Secretary, DSIR) through CBDT/DG(ITE).

On receipt of the reference, the office of the Prescribed Authority 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

III.C.3. Safari Motorcycle & Assembly Conveyor set up by M/s Kinetic Engineering Ltd., Ahmednagar

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 in his capacity as the Prescribed Authority gives a final decision duly signed by him setting out a reasoned order.

During the year 1994, one case pertaining to M/s Miles India Limited, Baroda referred by CBDT/DG(ITE) was considered by Secretary, DSIR as the Prescribed Authority and Secretary's orders were communicated to the Director General (Income Tax Exemptions) Calcutta. Few other cases referred by CBDT are under examination in DSIR.

IV. PROGRAMME AIMED AT TECHNOLOGICAL SELF RELIANCE (PATSER)

1. OBJECTIVES

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 Research, Development, Design and Engineering (RDDE) 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 and 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, testing 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. The expenditure for 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.

During the year, a major thrust has been given to Technology Absorption, Development and Demonstration Projects and the studies in the pipe line are being completed. Recently, the Department has invited proposals for technology absorption, development and demonstration projects from industrial units having DSIR recognised in-

house R&D Units through advertisements in leading news papers. Consequently, about 100 project proposals have so far been received and are being evaluated.

The Department has supported nearly 70 companies involving over 100 projects under the PATSER Scheme. 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. The progress of various projects during the year is given below:

i) M/s Hindustan Machine Tools Ltd.(HMT), Pinjore

The project of HMT Ltd. concerned upgradation of diesel engines for 3511, 4511 and 5911 tractors based on technology imported for 25 HP diesel engine from M/s AVL, Austria. The project was approved for partial financial support of Rs.7.00 lakhs out of total project cost of Rs. 33 lakhs. The design engineering and prototype development are completed and the pilot batch of engines have also been tested. The project is completed.

ii) M/s Hindustan Organic Chemicals (HOC), Rasayani

The project of HOC concerned mathematical modelling and simulation studies undertaken by NCL for the Cumene distillation train in the Phenol plant at Cochin, set up in collaboration with Universal Oil Products Inc, USA. The project was approved for a partial support of Rs. 4.50 lakhs out of a total project cost of Rs. 13.50 lakhs. The project is completed.

iii) M/s Swaraj Mazda, Chandigarh

The project of Swaraj Mazda concerned design optimisation and reduction of emission and specific fuel consumption of the diesel Engines for their light commercial vehicles (LCVs) manufactured in collaboration with Mazda Motor Corporation, Japan. The project was approved for a partial support of Rs. 21.50 lakhs out of total project cost of Rs.76 lakhs. The project is completed.

iv) Electrical Research & Development Association (ERDA), Vadodara.

The project of ERDA concerned technology evaluation and demonstration of energy efficient motors. This project was approved with partial support of Rs 8 lakhs out of total project cost of Rs 10 lakhs. Under this project ERDA evaluated and tested indigenous and imported energy efficient motors of having capacities of 3.7 KW (2 poles and 4 poles) and 7.5 KW (2 poles and 4 poles) at 375 V, 415 V and 450 V. A technical report has been made by ERDA with the help of IIT, Delhi bringing out technological features and gaps, as well as, the related R & D programmes to bridge the gaps and this report has been finalised in an interaction meeting attended by Industry and other related organisations. The project has been completed.

v) Development of Packaging Machines

Indian Institute of Packaging, Bombay was assigned a project in association with Samarpan Fabricators Ltd., Bombay for the development of 2 nos. of packaging, viz., Form-fill seal machine for odd shaped articles, and special blister packaging machine, with a partial financial support of Rs 10.65 lakhs by DSIR. Both the packaging machines have been developed and supplied to the user industries. The project has been completed.

vi) M/s Balmer Lawrie & Co. Ltd., Calcutta.

Balmer Lawrie & Co. Ltd., Calcutta was assigned a development project for the indigenous development of a set of machines viz Conical Expanding Machine, Flanging and Curling Machine and material handling system for manufacture of Conical Open Top Steel Drums. A partial financial support of Rs. 18 lakhs was sanctioned from DSIR against an estimated total development cost of Rs. 72 lakhs. The project is in progress.

vii) M/s Praga Tools Ltd., Secunderabad

The development project of CNC cutter and tool grinder was assigned to Praga Tools Ltd., Secunderabad for a partial financial support of Rs. 15 lakhs from DSIR, as against a total development cost of Rs. 65 lakhs. The machine incorporates a very high degree of automation and precision with a positioning accuracy both on linear axis and rotary axis. The developed machine has been displayed at Indian Machine Tool Exhibition (IMTEX), 1995. The machine has generated considerable interest in users and a number of enquiries from users were received for the machine. The project has been completed.

viii) M/s Southern Pesticides Corporation Ltd., Hyderabad

The project related to Gamma BHC pesticides (collaborator: M/s Stauffers Chemicals, USA) was initiated with partial support of Rs. 19 lakhs, out of total project cost of Rs. 43 lakhs. The firm is being assisted by IICT, Hyderabad for reactor design, pilot plant work and debottlenecking of the plant. Pilot reactor is in the process of being installed in the plant. The project is nearing completion.

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

The project of Andrew Yule concerned heavy duty industrial fans(collaborator M/s Davidson & Co. Ltd., UK), was initiated with a partial support of Rs. 10 lakhs out of total project cost of Rs. 47 lakhs. The project deals with the improvement of energy efficiency of industrial and mining fans by undertaking know-why study and redesign of the fans. Detailed engineering and fabrication of prototypes were undertaken by the firm based on design support given by Indian Institute of Science (IISc), Bangalore and IIT, Madras. Development of prototypes has been completed and testing is in progress. The project is nearing completion.

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

The project of MECON(I) Ltd. envisages development of hydraulic AGC (Automatic Gauge Control) system by under taking simulation exercises, prototype development and commercial trials in a rolling mill. The DSIR support was for Rs. 10 lakhs out of total project cost of Rs. 75 lakhs. The project is in progress.

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

Two projects of KMML, (1) the recovery of heavy metals from the effluent of Titanium Dioxide in collaboration with BARC and (2) the reduction of ilmenite using Sodium Carbonate catalyst in collaboration with RRL, Trivandrum were approved. The DSIR support was Rs. 13 lakhs out of total project cost of Rs. 73 lakhs for the first project and Rs. 14.5 lakhs out of the total project cost of Rs. 75 lakhs for the second project. In the first project, the recovery of heavy metal Niobium and rutile from the effluent is in progress. In the second project, the pilot plant studies on ilmenite reduction using the catalyst are also progressing at RRL, Trivandrum.

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

The project of BHPV concerned with the development of flexible super insulted piping used as a part of cryogenic plants being manufactured in collaboration with L'Air Liquide, France. The project was approved for a partial support of Rs. 16 lakhs out of total project cost Rs. 35 lakhs. The project is nearing completion.

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

The approved projects of BEML relate to technology upgradation of 50 ton dumpers and 200 HP Front End Loader manufactured in collaboration with Westinghouse Air Brake Co. USA and Komatsu, Japan respectively. These projects will result in commercialisation of 'state-of-the-art' equipment. DSIR's support in the projects is Rs. 35 lakhs out of total project costs of Rs. 205 lakhs, towards the development of transmission, planetary axle and disc brake for the Dump truck and development of Front End Loader. The prototype

of Front End loader has been completed and the prototype for Dump Truck is in final stages. The projects are nearing completion.

xiv) M/s IBP Co. Ltd., Gurgaon

Four projects of IBP Co. concerned with : (1) Development of Site Mixed Slurry (SMS) Explosives for deep bore-hole applications. (2) Adaptation and upgradation of Emulsion Explosive Technology (3) Development of Detonating Card for shaped charges used for perforation of wells in oil fields and (4) Development of Heat Resistant Explosives for use in fire affected areas of coal fields (with the assistance of CMRS, Dhanbad). The projects were approved with a partial support of Rs 41.50 lakhs out of total project cost of Rs 137 lakhs. These projects are in progress.

xv) M/s Triveni Structurals Ltd., Naini

The project of Triveni Structurals Ltd. concerned with the development of 8 prototypes of 400 KV and 765 KV Self supporting and Guyed type transmission line towers. The project was approved with a partial support of Rs 20 lakhs out of the total project cost of Rs 86 lakhs. Structural Engineering Research Centre (SERC), Madras is assisting the firm in design and testing of the towers. One prototype of 400 KV guyed wire single circuit 0°-2° Transmission Tower have been developed and successfully cleared the trials at SERC, Madras. The project is in progress.

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

The joint project being executed by SCL and C-DOT is for the development of Application Specific Integrated Circuits (ASICs) for Line Card and Conference Card of the C-DOT switching system. This project was approved with partial support of Rs 20 lakhs out of total project cost of Rs 60 lakhs. The project is in progress.

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

The project of ERDA is for indigenous development of 7.5 KW Switched Reluctance motor drive system for variable speed applications having good torque speed characteristic with a potential for use in electric vehicle, textile industry, conveyor system and mining equipments etc. This project is undertaken by Electrical Research and Development Association (ERDA), Vadodra in association with Jyoti Ltd., Vadodara. The controller for the motor is being developed by Electronics Research and Development Centre, Trivandrum. The prototype of the controller is expected to be completed by May 1995 will be interfaced with SR Motor being developed by Jyoti Ltd. The project is in progress.

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

The project of MAMC is for development of Side Arm Charger to be used in Wagon Tippling Complex. DSIR's partial financial support in the project is Rs. 15 lakhs out of a total development cost of Rs. 70 lakhs. The project is in progress.

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

Travancore Cochin Chemical Ltd.(TCC), Cochin was assigned a project, in collaboration with Regional Research Laboratory, Trivandrum, for the indigenous development of process technology and a capital goods package for manufacture of synthetic rutile through an environment friendly route. DSIR's partial financial support is Rs. 35 lakhs out of an estimated total development cost of Rs. 90 lakhs. The project is to result in development of complete process know-how package and a design and engineering package for the plant and equipment for a commercial scale production unit to manufacture of Synthetic Rutile with a capacity of 20,000 to 30,000 tonnes per annum. The project is in progress.

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

The project of Litex Electricals Pvt. Ltd. is for

development of Xenon and Krypton filled lamps for laser pumping being undertaken in association with SAMEER. This project was approved with a DSIR's support of Rs.8 lakhs out of total project cost of Rs.25 lakhs. The project is in progress.

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

The project of APITCO concerns development and demonstration of technology to improve energy efficiency in the existing Down Draft Kilns for small scale refractory industry. This project was approved with DSIR's support of Rs.7.70 lakhs out of total cost of Rs.14 lakhs. The project is in progress.

xxii) M/s. Orissa Industries Ltd., Rourkela

The project of Orissa Industries Ltd. is for development of Chemical Leaching Technology to reduce Calcium Oxide (CaO) in Bauxite with a view to improve the refractories. This project being undertaken in association with IIT, Kharagpur, was approved for a DSIR's support of Rs.16.50 lakhs out of total project cost of Rs.75 lakhs. The project is in progress.

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

The project of C.S. Zircon is for the development of Plasma based reduction process to manufacture Zirconia in association with IPR, a research society under Department of Science and Technology. This project was approved with a DSIR's support of Rs.9.5 lakhs out of total project cost of Rs.60 lakhs. The project is in progress.

xxiv) M/s. ER&DC, Trivandrum

The project of ER&DC for development of controller for switched reluctance motor was approved with a DSIR's support of Rs.11.5 lakhs. The project is in progress.

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

The project of NFL and CSME for development and field testing of Zinc Polyphosphate based Slow and Controlled release fertilizers was approved for a DSIR's support of Rs. 1.25 lakhs out of total project cost of Rs. 2.50 lakhs. This project involves bench scale development and field trials by CSME, Calcutta. The project is in progress.

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

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

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

The project of CEL for development and evaluation of Plasma Etching and Edge Grinding System for Edge preparation was approved with a DSIR's support of Rs. 50 lakhs out of total project cost of Rs.130 lakhs. The project is in progress.

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

The project of GMDC 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 was approved with a partial support of Rs.10.00 lakhs out of total project cost of Rs.50 lakhs. The project is in progress.

xxix) M/s. FACT, Cochin

The project of FACT is for development of slow release fertilizers and their field applications on Paddy, Banana, Sugar cane and Coconut crops in association with Kerala Agricultural University, Trichur and Tamil Nadu Agricultural University, Coimbatore. This project was approved with a DSIR's support of Rs.12.00 lakhs out of total project cost of Rs.46.00 lakhs. The project is in progress.

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

The project of MECON (I) in association with Hero Cycles Ltd. is for development of 6-High cold rolling mills by converting existing 4-High cold rolling mills located at Hero Cycles plant. The project was approved with a DSIR's support of Rs.60.00 lakhs out of total project cost of Rs.380 lakhs. The project is in progress.

xxxi) Mishra Dhatu Nigam Ltd. (MIDHANI), Hyderabad

The project of MIDHANI for welding of Molybdenum wire to make 20 kg coil was approved with a DSIR's 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.

xxxii) Mishra Dhatu Nigam Ltd. (MIDHANI), Hyderabad

The project of MIDHANI for bulk filtration of liquid metal was approved with a DSIR's support of Rs.37.00 lakhs out of total project cost of Rs.74 lakhs. This will result in use of a cheaper alloy steel in place of Electro slag refined steels in applications such as blades and defence use. The project is in progress.

xxxiii) Mishra Dhatu Nigam Ltd. (MIDHANI), Hyderabad

The project of MIDHANI is for development of alloy steel wire with high surface finish was approved with a DSIR's 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. The project is in progress.

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

The project of TSP for development of Rubber Seal cladded with PTFE for use in hydraulic dam gates was approved with a DSIR's support of Rs.9.0 lakhs out of total project cost of Rs. 20 lakhs. The project is in progress.

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

The project of MECON related to development of Under Burden Probe for accurate analysis of hot gases inside the stack of a blast furnace is being undertaken by MECON in association with DSP. The project was approved with a DSIR's support of Rs.30.00 lakhs out of total project cost of Rs. 82.00 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 SCL and BHEL is for development of the Application Specific Integrated Circuits (ASICs) and ASIC based electronic energy meter for industrial applications. This project was approved with a DSIR's support of Rs.23.00 lakhs out of total project cost of Rs.43.00 lakhs. The project is in progress.

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

The joint project of CPRI and G.K. Electricals, Bhopal is for development of production models of 12 KV load break switches for use in Electrical Sub-Stations. This project was approved with a DSIR's support of Rs. 5.5 lakhs out of total project cost of Rs.50.00 lakhs. The project is in progress.

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

The project of PTL for development of 'state-of-the-art' electronic controller for forklift drives being undertaken in with CGL, Bombay, was

approved with a DSIR's support of Rs.10.00 lakhs out of total project cost of Rs.30.00 lakhs. The project is in progress.

xxxix) Bharat Earth Movers Ltd. (BEML), Bangalore

The project related to design and development of 10 T class Backhoe Hydraulic Excavator (Crawler version and Wheeled version models) is being undertaken by BEML. This project was approved with DSIR's support of Rs. 40 lakhs out of project cost of Rs.85 lakhs. The project is in initial stages.

xxxx) Bharat Earth Movers Ltd. (BEML), Bangalore

The project of BEML for the development of computerised transmission control for off highway dump trucks was approved with a DSIR's support of Rs.10.00 lakhs out of total project cost of Rs.30.00 lakhs. The project is in initial stages.

xxxxi) Bharat Earth Movers Ltd. (BEML), Bangalore

The project of BEML for development of Cast Crank Shaft used in their heavy duty engines was approved with a DSIR's support of Rs.27.00 lakhs out of total project cost of Rs.65.00 lakhs. The project is in initial stages.

2.2 Studies on Technology Evaluation on various Sectors/Products and Capital Goods

During the Eight 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. The reports finalised during the year cover sectors and products such as Railway Wagons, Leather Tanneries, Bicycles, Rubber processing, Edible Oils, Industrial Oils and Fatty acids, Paints, Secondary Steel Refining, Refractories, Glass, Waste Recycling, Home Appliances, Fertilizer Granulation, Decorative Laminates, Plastic furniture, Plastic tanks, Industrial alcohol and Secondary Aluminium sector. These reports have been discussed with industry and other related organisations before their finalisation. The reports covering 20 sectors and products are under finalisation.

Studies of requirements of Capital Goods in Pharmaceuticals industry, Automobile ancillary industry and Packaging Industry have been finalised.

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 such as the highly efficient dump trucks and loaders and the special packaging machines having good demands and commercial returns, the SPV systems of Central Electronics Ltd. leading to considerable energy savings in case of grid connected interfaces and the stand-alone SPV systems supporting power to remote and rural areas as well as in special applications, utilisation of heat resistant explosives leading to substantive savings of coal from burning in fire affected mines. In addition to these benefits, there have been useful interactions and linkages with other concerned Govenment 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 Collaborations" (NRFC) which is an ongoing plan scheme, continued its operations during the year 1994-95. It has completed a number of programmes that were targetted for the year.

2. OBJECTIVES AND ACTIVITIES

The objective of NRFC scheme is to gainfully facilitate acquisition of technology needed in the country. Following major activities are carried out under NRFC.

- Compilation and analysis of data on approved foreign collaborations.
- Undertaking financial, economic and legal analysis of set of data on Foreign Collaborations.
- Carrying out technology status studies covering state of the art technology in use in the country, international trends and other related issues.
- Providing assistance in the effective transfer of technology process.
- Providing the basis for a National Science Strategy wherever possible.
- Unpackaging of imported technology.
- Coordinating 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 study of basic data on approved foreign collaborations (FCs).
- Analytical study of technological, economic and legal aspects of foreign collaborations (FCs).
- Preparation of reports on technology status in identified sectors/products.

3. FOREIGN COLLABORATIONS DATA COMPILATION

The work of in-house compilation of primary data on approved foreign collaborations continued during the year. The compilation for the year 1993 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 1994 is in progress.

4. ANALYTICAL STUDIES

A project on "Implications of Applicable Law in Relation to Foreign Collaboration Agreements" was commissioned on the Law Faculty, University of Delhi. This project aims at analysing implications of applicable laws of India, as well as USA, UK and Germany (who are major suppliers of technology to India) to technology transfer agreements, in order to make the perspective Indian importers of technology aware of implications of these Laws. The draft reports relating to Applicable laws were received and has been discussed in Evaluation committee meeting wherein representatives from the concerned Govt. departments, Industry, experts from legal profession, consultants and others concerned, participated. The report has since been finalised.

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 on production value, foreign exchange and R&D activities in Indian industry. The study is in progress.

A project on 'Appraisal of the Indian Patent System and the Problem' was taken up. The study aims to undertake critical appraisal of the system and concentrates on policy, legal and practical aspects of the Indian Patent System. The study has been entrusted to the Indian Society of International Law, New Delhi. The report has been discussed by an Evaluation Committee. It is under finalisation.

A project on "Effectiveness of Import of Design & Drawings as a Mode of Transfer of Technology" has been commissioned to the National Productivity Council (NPC), Bangalore. The study aims to evaluate effectiveness of import of design 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 is under finalisation.

A project to study trade related laws of France and Japan with special reference to technology transfer has been commissioned on the National Law School of India University, Bangalore. The study would include analysis and implications of the various laws in these two countries vis-a-vis Indian laws. Special emphasis is on the laws relating to technology transfer agreements between the Indian, French and Japanese companies. The work on the project is in progress.

A project to study the market and development prospects of plastic processing industry in the Eastern and North-Eastern regions and Andemen & Nicobar Islands has been taken up. This has 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 is likely to be useful for industrial and technological

development particularly of the North-Eastern Region. The consultants had submitted the draft report which was discussed in an evaluation committee meeting. The report is now being revised by the consultant as per the recommendations of the evaluation committee.

5. TECHNOLOGY STATUS STUDIES

One of the main objectives of the NRFC scheme, is to carry out technology status studies covering state-of-the- art of technology in use in the country, international trends and other related issues. The task of preparation of status reports is entrusted to experts/organisations/ professionals/consultants in 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).

During the year, reports on technology status of 11 sectors/products were discussed by their respective evaluation committees. These are:

1. Trimethoprim
2. Butyl Acrylte
3. Methyl Ethyl Ketone
4. Carbon Tetrachloride
5. Hydraulic Equipment Systems
6. Bonded and Coated Abrasives
7. High Fructose Corn Syrup & Artificial Sweetener
8. Gears
9. Printing Ink
10. Soda Ash
11. Linear Alkyl Benzene

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.

The following are the major findings of some reports which have been completed during the year.

Formaldehyde

The report concludes that in India, both, Silver catalyst process and metal oxide process are being employed for formaldehyde manufacture. Out of 25 formaldehyde plants only 4 plants are based on metal oxide process, while the rest of the plants are based on silver catalyst process. Almost all the plants were setup based on foreign know-how. However, complete detailed engineering were done by domestic engineering consultants. Most of the domestic formaldehyde manufacturing units are found to be operating at

V.A.1. Emission Control System in a Formaldehyde Plant

approximately same level of performance, with minor variations.

The large formaldehyde plants based on conventional silver catalyst process could be revamped with the features available in the advanced silver catalyst process. The entire revamping process can be carried out in a phase wise manner. The industry should promote the use of indigenous catalyst and carry out necessary research work in collaboration with domestic catalyst manufacturers to improve indigenous catalyst. Domestic capital goods industry may make necessary efforts to manufacture desired quality of high capacity blowers, which are required to be imported at present by the units based on metal oxide process. In fact, domestic engineering consultants engaged in the detailed engineering of formaldehyde plants can make attempts and extend their expertise in developing reliable and suitable vendors for the supply of critical equipments indigenously.

Copper

The report brings out that, the production of Copper ore in India has remained stagnant over the years i.e. around 51 Lakh tonne during 1987-93. This is because of low level of ore deposit establishments. The capacity utilisation of Hindustan Copper Ltd. plants are high about 98% in mining sector and 100% in metallurgical sector during 1992-93. The demand of copper in India during 1992- 93 was of the order of 1.8 Lakh Tonne, which is expected to grow at a rate of 5-6% per annum. In order to meet the requirement, Copper was imported to the tune of 70% of the requirement. With a number of smelters being planned and executed in the private sector as well as at Malanjkhand by HCL, it is estimated that the imports could be reduced to a level of 35-40% by the year 2000.

Solvent. Exaction Electro Winning process (SX-EW) has great potential in India for Copper ore processing since India has huge dumps of low grade ores and low grade ore bodies of uneconomical dimensions for pyrometallurgical route. The process is at experimental stage in India and needs to be developed and commercialized. In the absence of strong R&D in the equipment design and availability of special materials of construction, technology/equipment imports are essential, but lately it has been observed that based on design and drawings provided by Foreign Collaborator/Technology Supplier even critical equipments i.e. smelters are being fabricated in India.

Methyl Ethyl Ketone

The report concludes that the production of Methyl Ethyl Ketone (MEK) within the country is of recent origin, the commercial production in the country commenced in the year 1991. The requirement of MEK till then was met by imports only. The two plants Cetex Petrochemicals, Madras and consolidated Petro-tech Industries. Baroda, have been commissioned in 1991 with a total capacity of 7,000 Tonne per year. Besides this a third project by Vam Petro- Products Ltd. is planned for production of 4,000 TPA of MEK at Mathura. MEK is a low volume consumption chemical in the country. The end use consumers are quite large in number, each consuming small quantities except for oil refineries where its consumption is significant as a dewaxing solvent.

The manufacturing process of MEK is corrosion prone in some areas and could result is operational difficulties. The metallurgy and instrument control system besides other operating parameters may be reviewed by production units and action initiated, wherever necessary, so as to achieve stable production and improve capacity utilization. The MEK production involves handling of hydrocarbons and acids in the process. The industrial units should ensure that adequate steps are taken, as per the prescribed safety standards, for environmental protection and safety assurance. The Bureau of Indian standards may consider formulation of Indian standards/Test methods for MEK.

VCRs and VCPs

Video Cassette Recorders (VCRs) and Video Cassette Players (VCPs) available today are sleek, portable, light- weight, compact, reliable and they

offer excellent picture and sound quality and have many user-friendly attractive features. All these developments have taken place in a span of just one decade. VCRs are now offered in 3 major formats as Video Home Systems (VHS), Betamax and Video 2000. The VHS format is the most popular format adopted by the global market. A large part of the domestic demand of VCR/VCPs is still being met through imports. There are 3 major manufacturers of VCR/VCPs in the country and several smaller ones who mainly assemble kits. Till 1991 there was a large indigenous production of VCRs/VCPs, of the order of 1,60,000 sets annually. Subsequently, production has shown a decline in trend. Most manufacturers are now stepping up their exports activity in a bid to participate in global markets. In the world scenario, the largest market share is held by Japan, followed by Korea and other manufacturers in Europe, Taiwan, Hongkong etc. A number of features that have been incorporated in sets available in the world market, which are yet to be incorporated in the indigenous sets are super VHS, hi-fi stereo sound, built-in world wide TV tuner, time base collection, digital VCR features, karaoke functions, user-friendly features and other special features like voice actuation, advanced digital and high definition techniques, full loading mechanism, use of 3rd video head for replay or slow motion, auto head cleaner, child proof lock etc. Regarding indiginisation efforts by the Indian industry current levels of around 40-45% of the bills of materials (BOMs) have been achieved. A giant percentage of the import content is attributed to the video head, imported ICS and a few critical mechanical parts. The report brings out that the large units can supply VCR/VCP kits to the assemblers in the country so that the indigenous utilisation capacity can be raised.

Energy Meters

Energy meters are used to measure consumption of electricity over a period. Though domestic and commercial energy meters account for about 70 to 80% of the total expenditure on energy meters by a State Electricity Board (SEB), they represent about 12 to 15% of the total revenue, the bulk of which is generated from industrial users. The major technical innovation is with reference to development of electronic energy meters. But even today in India induction type electromechanical energy meters are predominantly used. The world market of enery meters is dominated by Schlumberger of USA, Landis and Gyr of Switzerland and Siemens of Germany. Now these manufacturers are on the threshold of entering the Indian market. The total market for energy meters in the world is around 40 million pieces with India's share at 5.2 million (13%). R & D efforts of the indigenous manufacturers have been directed to a large extent at design modifications and raw materials substitution to reduce cost and to a lesser extent to improve quality and accuracy in industrial/bulk meters. Specifications have undergone very little changes and are not at par with international specifications. Some of the major differences in specifications relate to the use of thermo plastic materials for meter casing instead of sheet metal, magnetic suspension type lower bearing as against jewel type bearing and jumping figure type registering mechanism as against creeping type registering mechanism used in the domestic meters. As regards testing facilities, besides those available with the manufacturers, each SEB has its own testing laboratory. Some independent national and regional testing bodies are also existing in the country. The report brings out that the industry should examine methods by which the price of indigenous meters could be reduced further and yet improve consistency and efficiency.

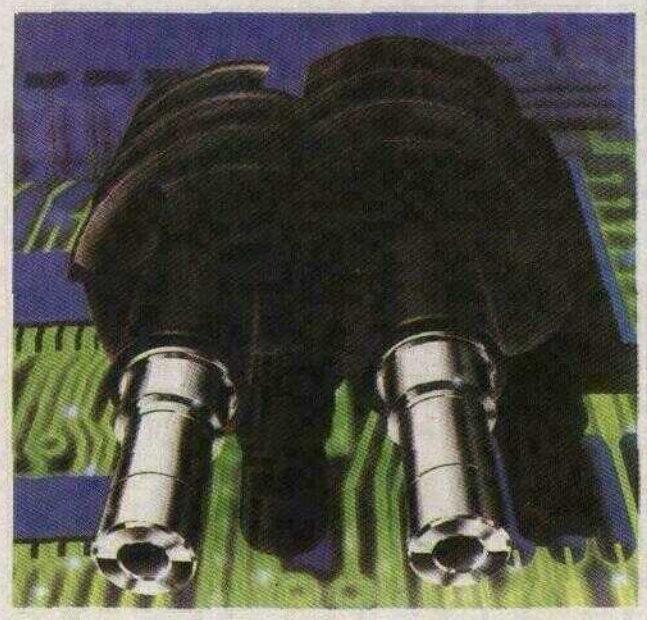
Paracetamol

Paracetamol is an important antipyretic & analgesic agent with weak anti-inflammatory effects. Being safe and low priced, it is very popular world wide. It is either used by itself or in combination and is even preferred over the established drug aspirin at times, as it has minimal side effects. Paracetamol in turn is facing competition from newer drugs.The Indian Paracetamol industry employs the Phenol and Para Nitro Chloro Benzene (PNCB) routes for the manufacture of paracetamol. Both of these are batch processes. The use of continuous processes employing Nitrobenzene and Para Hydroxy Acetaphenone

Hydrazine (PHAH) routes is found to be economically prohibitive for most of the domestic manufacturers as they are highly capital intensive. Morever, the last mentioned route has only very recently been used successfully for commercial production in USA. The report indicates that efforts have been made for complete indigenisation of important raw materials within the country and the basic equipment is available indigenously. National R&D efforts have been aimed at development of processes based on nitrobenzene and PHAH routes. In the world scenario, USA is the largest producer of paracetamol and Germany, Turkey and China are other leading producers. Exports of paracetamol from India to Germany, U.K., Malaysia, Bangladesh and Srilanka have been reported in the last 2 years. The manufacturers are convinced that the quality of paracetamol produced indigenously meets international standards. There have been no imports of paracetamol in the last few years. The report brings out that such input seems unlikely in the future too. The product assay of the indigenously manufactured paracetamol is around 90%. R&D efforts by domestic manufacturers are directed towards meeting end product quality, improving yield and reducing cost of production. The report stresses the need for concerted R&D efforts to develop a commercial process for the electrolytic reduction of nitrobenzene as well as catalytic reduction of the same. More effective pollution control and cost reduction efforts should also be directed to achieve creative utilization of the by-products.

Air and Gas Compressors

Compressors find wide application in virtually all sectors of industry like construction, cement, glass, plastics, chemicals, pharmaceuticals, foundries, textiles and automotive industries. Compressors act as sources of energy by compressing air or gas. The compressed air or gas is used for control applications to trigger, start, stop, modulate or act otherwise for controlling the motion or process. Gas compressors find application in industries where gases are used as a part of the manufacturing process, such as fertilizers, refineries etc. Manufacture of compressors upto 5 HP is reserved for the small scale sector. Such small



V.A.2. Oil Free Rotary Screw Compressors

compressors, of which there are around 30 to 40 manufacturers, are used for simple applications. There are many well known manufacturers in the medium and large scale sectors involved in the manufacture of higher HP compressors. Many of these companies have technical tie-ups with reputed manufacturers abroad. Of late there has been a focussed effort at exports by the compressor manufacturers. The growth of production of air and gas compressors in recent years has been fairly constant and is of the order of around 41,000 units. The Centrifugal air/gas compressors and Integral Gear type compressors are imported. Among the latest developments at the international level, apart from development of integral gear type compressors, flexible metallic couplings, extensive use of alignment techniques and high speed centrifugal compressors are predominant. The report brings out the gaps relating to compressor design, ranges of compressors, 3-D impellers and peripherals prevalent in the Indian industry. The analogue study technique is extensively used abroad to study the pulsations and design the piping system for different situations but in India the digital technique is still being used. The report stresses the need for research and development in the field of material sciences to improve the efficiency and performance of compressors. Specific areas identified relate to reduction of

internal losses, noise control, miniaturisation of compressors, thermo dynamics and fluid flow.

Polyols

Polyols are used to manufacture polyurethane which finds extensive use in the automotive, construction, refrigeration and other industrial sectors. Polyols produced in India are glycols of high molecular weight of Polyether, Polyester and Hydrocarbon types. Polythene glycols are primarly used in the manufacture of emulsifiers and surfactants. Polybutadiene based polyols are used as solid rocket propellant binders. But most of the polyether polyols like polypropylene glycol are used in the manufacture of flexible rigid foams. There are many industries in the country which have started manufacture of polyols for polyurethane. Polymer polyols made by graft polymerisation of monomers having a vinyl group are among the latest types of polymers which are indispensable in the manufacture of flexible polyurethane slab stock foams and semi rigid foams. Internationally, polymer polyol is preferred due to its lower viscosity, light colour and high load bearing characteristics. Work is being carried out at Indian Space Research Organisation (ISRO) Thiruvananthapuram and Vikram Sarabhai Space Centre (VSSC) Thiruvananthapuram for development of castor oil based polyols and hydroxy terminated polybutadiene polyols (HTPB). Indian Institute of Chemical Technology (IICT) Hyderabad proposes to develop substitutes for chloro fluoro carbons (CFCs) which are extensively used in the manufacture of foams, together with polyols. The report brings out that efforts in the country need be accelerated for the development of polyols which will be required for development of CFC free foams. Many required grades of polyols also need to be indigenously developed. New applications for polyols also need be identified.

Springs

The basic structure of the spring industry has changed over the years with the growth of the Railways, defence, automobile and other engineering industries. Imports have been resorted to only in a few specific cases involving specific

V.A.3. Leaf Springs

applications with stringent raw material quality considerations. Internationally, efforts are continuously being expended to increase the limits of safe operating stresses and operating temperatures, increase fatigue life and improve corrosion resistance of springs. The latest developments pertain to non round selection of wire for springs as against round wire, use of composite materials, automated computerised coiling machines etc. The major technology gaps exist mainly in respect of use of cost effective raw materials and sophistication in equipment. Long term measures need be initiated to incorporate technological improvements in the Indian industry through import of technology, designs & drawings, if necessary, to enable the industry keep pace with modern technological developments. Process automation and computerisation also need be introduced to yield better precision and improved quality.

Acetic Acid

Acetic Acid is an important carboxolic acid widely used in the chemicals, pharmaceuticals, food processing and textile industries. It is mainly used in the manufacture of Purified Terephalic Acid, Vinyl Acetate Monomer, Acetic Anhydride, Esters etc. There are around 20 companies manufacturing acetic acid in India with a total installed capacity of approximately 1,50,000 TPA. The technology to produce acetic acid using ethyl alcohol as the feed stock has been adapted successfully in India. The process used is acetaldehyde oxidation from which acetic acid is produced. World over, only a few units use ethyl alcohol as feed

stock and most of the large capacity plants are based on n-butane, naphtha or methanol as feed stock. The processes used internationally to manufacture acetic acid are oxidation of paraffin hydrocarbons and carbonylation of methanol. The report brings out that utilities consumption in India is of a fairly high order as compared to plants abroad. A number of Indian manufacturers have well equipped laboratories with sophisticated equipment. NCL, Pune has developed a low cost catalyst for carbonylation of methanol, which is to be commercialised. It has also developed a one step process to covert ethyl alcohol to acetic acid using a metal oxide catalyst. There are number of fabricators in India who supply equipment as per design requirements. There are also a number of technology suppliers in India, who have completely indigenised the design and the technology. It has been expressed in the report that a low energy comsumption process need be developed by integrating the steps taken by various companies world wide. In addition, improving the selectivity of conversion of acetaldehye to acetic acid from the present level of 86-90% to 94-97% is required.

Wire Drawing Machine

The report brings out that various type of wire drawing machines starting from block machines to intermediate rod break down machines and fine wire drawing machines suitable for drawing of both ferrous and non- ferrous wires are being manufactured in the country. Small scale units contribute around 35% of total wire drawing machine requirement and generally manufacture wire drawing machines for upto one mm dia in ferrous metal and 0.5 mm dia in non-ferrous metals. Machines for fine wire drawing are being manufactured in organised sector only. Report further suggests that machines capable of handling large take up spool weight, faster speed and ceramic, tungsten carbide or flame coated capstan rings need to be developed to improve productivity and quality of wire drawing machines and end products. A large take up spool weight not only improves the productivity of wire drawing machines but also improves productivity in subsequent operations. The report suggests thrust area for research and development such as processing line for the multiwire drawing, continuous annealing lines for inline operation, super fine wire drawing lines in the finishing range of 0.012 to 0.02 mm and reduction in power consumption by improving quality of drives, dies and capstan rings.

Welding Electrode

Welding electrodes are used in joining, surfacing and protective maintenance for varied materials. There are a number of units both in organised and small scale sectors involved in manufacture of general purpose electrodes, special electrodes, continuous welding wire, automatic submerged arc welding electrodes, mild steel welding rods (copper coated) and welding fluxes. The report brings out that the manufacturing capability for welding electrode of ordinary strength steel is well established in the country. However in the field of high tensile steels, special steels and special non-ferrous metals industry still has a long way to go. For certain applications special purpose electrodes are still being imported, however this import is estimated to be around only one percent of total production. World wide industrialised countries are using advance welding techniques like Submerged Arc Welding (SMAW), Tungsten Inert Gas Welding (TIG), Plasma Arc Welding, Electron Beam Welding for wider applications, but due to high equipment cost of these techniques and versatility and ease of handling of covered electrodes these techniques are less preferred for welding in the country. The report further suggests that in metal inert gas arc welding (MIG) wires, low and high alloy continuous filler material and fluxes both for joining and surfacing need to be developed.

Welding Equipment

The report suggests that the welding equipment industry need to be upgraded. Technology gaps exist mainly in the areas of electron beam welding equipment, laser welding equipment, electroslag welding equipment, welding joint sensing & scanning systems, water jet cutting equipment, ultrasonic welding equipment and inverted type welding power sources. Internationally the

V.A.4. Wet Slip Type Fine and Superfine Wire Drawing Machines

thrust is to develop "melt index" of traditional welding methods and change these methods for mechanisation and automation and to develop new joining methods and consumables for new structural materials. World over the trend of modern welding power sources has shifted from motor generator sets to static power sources with solid state devices (thyristor controlled, fully thyristorised). These power sources are based on invertor technology and by switching over to use of these power sources the users would be saving considerable amount of energy per year. Report further brings out that organised units have a sound manufacturing base in respect of production facilities and drawing and design capabilities. Their technology is based on imported technology which have been successfully absorbed. The report emphasizes that attention may be focussed on improving the design, manufacturing methods and use of quality input materials to produce efficient welding machines.

Toluene

Toluene is produced as a co-product alongwith Benzene in a Benzene/Toluene (B/T) production unit or in an integrated Benzene/Toluene/Xylene (B/T/X) Aromatics production units. The report brings out that the technology for production of Toluene has been fully developed and stat-of-art technologies are available in the country. The research and development activities are centered around catalyst development, development of design parameters for liquid-liquid extraction of aromatics using solvent such as sulfolane, process development for hydrodesulfurization and reforming of Naphtha and solvent extraction of Aromatics for production of Benzene/Toluene/Xylene (B/T/X). Toluene produced from the reforming of Naphtha is the most predominant source of its production world over. This involves Naphtha Hydro- Treatment (NHT) for desulfurisation of Naphtha and Catalytic Reforming Process for conversion of Paraffin and Naphthenes to Aromatics. A solvent exaction process is then employed for extraction of Aromatics, which are further separated to Benzene, Toluene and Xylenes, as required. Naphta Hydrotreatment (NHT) designed to reduce the sulfur content of naphtha from 200 to 1000 PPM to 0.5 - 0.1 PPM level. The report further reveals that the design/engineering capabilities need to be developed for Continuous Catalyst Regeneration (CCR) type of Cat Reformers for process plants involved in the production of Benzene/Toluene/Xylene (B/T/X) apart from efficient catalyst development for self reliance.

6. TECHNOLOGY STATUS REPORTS

The following technology status reports have been printed/are under printing :

1. Wire Drawing Machines
2. Springs
3. Acetic Acid
4. Welding Electrodes
5. Alpha Olifin & Alpha Olifin Sulphonate
6. Polyol
7. Air and Gas Compressors
8. Welding Equipment
9. Paracetamol

10. Vitamin 'C' & Sorbitol
11. Copper
12. VCR & VCP
13. Energy Meters
14. Toluene
15. Formaldehyde
16. Mehanical Seals
17. Methyl Ethyl Ketone

7. INTERACTION MEET

A one-day interaction meet on transfer of technology from abroad was organised at Pune on February 3, 1995 in association with the National Chemical Laboratory (NCL) and Maharashtra Industrial & Technical Consultancy Organisation Ltd. (MITCON). The main objective was to provide inputs to assist industrial units in enhancing the effectiveness of technology transfer from abroad. It was a well attended programme by senior executives from a large number of Organisations.

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. The Technical Evaluation Committee which met every week has been dissolved since March 1994.

2. INDUSTRIAL LICENSING

About 675 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. 42 meetings of Licensing Committee held by SIA were attended. The following is an illustrative list of products approved for grant of Letter of Intent based on indigenous development of technology.

1. Chloramphenicol Hemisuccinate
2. Imipramine Base
3. Ephidrine Hydrochloride
4. Quimalphos Technical and its formulations

3. FOREIGN COLLABORATION

During the year, the number of foreign collaboration and composite proposals exceeded 1000. Of these, the Department received around 350 proposals from Secretariat for Industrial Approvals as compared to 150 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 Technical Evaluation Committee (TEC) meetings for consideration of the above proposals and to send recommendations to Foreign Investment Promotion Board, Project Approval Board and Board of Approvals for 100% EO Undertakings. Consequent upon the closure of the Directorate General of Technical Development, the 'Technical Evaluation Committee' was dissolved and the meetings of the TEC were not held after March 1994.

The Department participated in the following meetings of the Approval Boards/Committees:

	No. of Meetings
Project Approval Board (PAB)	19
Board of Approvals for 100% EOU	11

4. INFORMATION/DATA PROCESSING

The Department has already created a database for Proposals for Letter of Intent, Foreign Collaboration proposals, Composite applications since 1988. The Foreign Collaboration Approvals data have been compiled since 1981.

The databases for proposals were updated for the year 1994 and for the approvals the database was updated for the year 1993.

The Department has also developed software for updating, 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.

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 the cell set-up for this purpose and also by way of initiating and completing a large number of programmes and projects aimed towards its objectives. Eleven meetings of the Technical Advisory Committee on TATT were held during 7th Five Year Plan. Three meetings were held during the period April 1990 to March 1992. Since reorganisation of the schemes, when TATT scheme became a part of SEETOT scheme, the Technical Advisory Committee was reconstituted. The thrust of the projects during the 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 shall be on commercialisation of exportable Indian technologies through setting up demonstration plants. Details of some of the projects/activities completed or in progress during the year under report are given below:

2.1 Technology Profiles of Developing Countries:

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. Few completed/ongoing projects during the year under report are described as under:

(i) Technology profile of Ghana:

A study on the subject was assigned to "M/s Dalal Consultants and Engineers Pvt. Ltd.". The final report has been submitted and is being processed for printing.Sectors identified for technology transfer from India are: agriculture, specifically in areas such as waste land development, development of hybrid seeds and agricultrual implements; fishery; mining; manufacture of wood based products; drugs and pharmaceuticals; packaging materials; chemical industry such as ceramics, fertilisers, dyestuffs; paints and varnishes; and services such as tourism, banking and financial services.

(ii) Technology profile of South Africa:

A study on the subject was assigned to National Research and Development Corporation and West Bengal Consultancy Organisation Ltd. A visit to South Africa was undertaken to collect primary data on economy, trade, infrastructure, industrial development etc.. Based on the information collected, a draft report was prepared, which was discussed in an evaluation committee meeting and finalised thereafter. Sectors identified for technology transfer from India are: 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 equipment; earthmoving equipment and hotel management services.

2.2 Technology Export Capability in Select Industrial Sectors:

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 / Departments, and Indian / Foreign missions. Additionally, the reports are available on sale (through National Research Development Corporation) for the benefit of industry at large. Few completed / ongoing projects during the year under report are described as under:

(i) Technology export potential of Computer Software Industry

A report on the above subject has been prepared through Tata Consultancy Services (TCS). The report is based on a survey of 82 software companies. According to the report, the domestic computer software industry has grown from Rs. 70 crores in 1985-86 to Rs. 680 crores in 1993-94. Exports touched a figure of Rs. 1050 crores (US $332 Million) in 1993-94. Indian software companies mainly provide three kinds of services i.e. (a) software development at site & training, (b) development of packages and (c) other services such as data processing & information service networks. A number of Software Technology Parks (STPs) have been set up to facilitate hardware facilities at nodal point, datacom links and accreditation of quality standards. The report projects that the estimated ratio of hardware to software in 1995 (worldwide) will be 40:60 implying a software spending of US $ 300 billion out of a total Information Technology (IT) spending of US $493 billion. The report contains profiles of 18 companies dealing in development of computer software for a variety of applications, manufacture of computer hardware and training.

(ii) Export of technology for Veterinary formulations, Biologicals and Feed Supplements

A report on the above subject has been prepared through M/s Eastern Enterprises, New Delhi and is being printed. The report identifies potential for export of vaccines and diagnostic technologies form India. Large scope exists for export of Ayurvedic based vertinary formulations in South East Asian Markets. The report recommends, increasing the share of herbal medicines, in which India enjoys the technology edge. Total animal health products (AHP) market in India is around Rs. 261.5 crores which is miniscule in comparision to world AHP market of Rs. 43,800 crores. The report contains profiles of over 15 leading organisations in AHP market such as Ranbaxy, BAIF, Indian Herbs, Hoechst, Hindustan Antibiotics etc. Indian companies can offer technology for a variety of products such as antibiotics, antihistaminics etc. Some Indian companies have exported technologies to countries like Italy, UK., Malaysia etc.

2.3 Demonstration of Exportable Indian Technologies

Under this activity, technical as well as partial financial support is extended to those industrial organisations which have developed technologies having potential for commercialisation abroad. Few ongoing projects during the year under report

are described as under:

(i) Pilot plant demonstration of Re-refining of used lubricating oil by the non acid process.

The pilot plant for re-refining of used lubricating oil based on non-acid process has been set up by M/s Balmer Lawrie & Co. in Calcutta. The plant capacity is 300 tonnes per annum on single shift a day and 300 working days a year basis. Trials have been conducted on the used oil obtained from Dubai and oil collected from a number of other sources in the country. The final product conforms to the Indian standard for rerefined base oil (IS 9048:1979). The yield of base oil is around 60-80% besides yield of gas oil (8-10%) and other lighter fractions. The cost of rerefined base oil by the process works out to approximately Rs.7.50 per litre as against the present market rate of re-refined base oil of Rs.13.00 per litre. The sludge/ filter cake and distillation residues left over in the process are non hazardous. A detailed analysis of the sludge (left over after treatment) has been done and its conversion into a viable by-product is being explored.

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

The project was commissioned, jointly to Ahmedabad Textile Industry's Research Association (ATIRA) and National Research Development Corportation (NRDC) at a total cost of Rs.30 lakhs. The project consists of the following elements: (a) Fabrication and commissiong of CTAW system in a textile mill abroad; (b) Preparation of promotional material, viz, video film and brochure on the CTAW; (c) Organisation of seminar in India to publicise the advantages of CTAW system of humidification; (d) Inviting foreign technical missions (the potential importers of CTAW system) for participation in seminar and taking them around Indian mills deploying CTAW system; and (e) Filing patents in India and abroad. Patents have been filed in India as well as 8 foreign countries and European patent office. Some of the countries where the patents have been filed are China, Malaysia, Indonesia, U.S.A., Australia and U.K. A video film and a brochure on the Cell Type Air Washer have been prepared. Negotiations are underway for commissioning a fully commercial CTAW system in a textile mill in Indonesia and Phillipines. Seminar to popularise the CTAW system is proposed to be organised in May, 1995 at Bombay.

(iii) Commercialisation of Iono-Oxidation technique for effluent treatment.

The project was commissioned, jointly to Ahmedabad Textile Industry's Research Association (ATIRA) and National Research Development Corporation (NRDC) at a total cost of Rs. 45 lakhs. The project consists of the following elements: (a) Filing patents in India & abroad; (b) Fabrication and commissioning of a 30 Kilolitre per hour capacity effluent treatment plant based on the Iono-Oxidation technique; (c) Fabrication of a mobile demonstration unit of an Iono-Oxidation effluent treatment plant. Patents have been filed in India as well as 8 foreign countries and European patent office. Some of the countries where the patents have been filed are China, Malaysia, Indonesia, U.S.A., Australia and U.K.. A demonstration plant has been commissioned at M/s Morarjee Goculdas mills, Bombay complete with structural modifications, civil works and electrical equipment. The demo plant is capable of removing the colour of the effluent and bringing down the levels of COD/BOD. The treated water can even be recycled in the textile processing house.

(iv) Export promotion of technologies/ products developed by ATIRA.

The project was jointly commissioned to ATIRA & NRDC for marketing of technologies/products developed by ATIRA, at a total cost of Rs 1.96 lakhs. The marketing mission includes exploration of export potential for sixteen items, such as Cell Type Air Washer, Iono-Oxidation technique for effluent treatment, Hydroxyethyl starch, Synthetic thickner, Yarn Evenness tester, Computer aided textile design packages etc. The mission would be conducted in the South-East Asian countries as

well as the African countries. The visit to Thailand Indonesia and Phillipines was undertaken in July, 1994. A total of 12 textile mills in these countries showed interest for Cell Type Air Washer and 3 mills wished to install the Iono-Oxidation technique of effluent treatment. Other enquiries received were for Synthetic thickner, Chemical auxiliaries and quality control and production measuring equipment.

2.4 *Interaction Meetings*

An interaction meeting was organised in collaboration with the "Indian Pharmaceutical Association (Delhi Branch)" on August 5, 1994 in New Delhi to discuss and finalise the draft report, "Export of Technology for Veterinary Formulations, Biologicals and Feed Supplements". The meeting was attended by around 100 delegates from Govt. Deptts., Institutions and the industry.

2.5 Directory of Technological Achievements of Indian Small and Medium Industry.

Confedration of Indian Industry was supported to bring out the above directory. The directory contain profiles of 100 small and medium scale companies in 11 sectors such as castings and forgings, electrical and electronics components, measuring instruments, material handling equipment, transportation equipment etc. The profiles give information on company's product-line, annual turnover, exports R&D capabilities and technologies and related services on offer.

3. TATT REPORTS

Since the inception of TATT scheme, a total of 27 reports have been completed and printed and another 11 were at various stages of completion. The reports printed during the year are listed below:

(i) Technology profile of Kenya

(ii) Technology profile of Egypt

(iii) Technology profile of Mauritius

(iv) Technology export potential of Chemical Process Industry

(v) Technology export potential of Two Wheeler Industry

(vi) Technology export potential of Mini Steel Industry

(vii) Technology export potential of Solvent Extraction Industry.

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 50th Annual Session of ESCAP held in New Delhi during 5-13 April, 1994.

The Host Country Agreement on the Headquarters of APCTT was signed on 7th April, 1994 during the 50th Annual Session of ESCAP. Shri Pranab Mukherjee, Minister of Commerce signed the agreement on behalf of Government of India and Mr. Rafeeudin Ahmed, Executive Secretary ESCAP signed on behalf of the United Nations.

Shri Ashok Parthasarathi, Additional Secretary, DSIR participated in the Tenth Technical Advisory Committee meeting of APCTT. The Technical Advisory Committee meeting was held in New Delhi on 29-30 November 1994. The 9th session of the Governing Board of APCTT was held in New Delhi on 1-2 December 1994 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.

Dr. V.V. Subba Rao, Joint Adviser, DSIR, attended the Asia Pacific Regional Workshop on "R&D Community-Enterprise Co-operation in Technological Research and Commercialisation/Application of Results" organised by ESCAP-APCTT.

Senior officers of the department also participated in various workshops/seminars conducted by the Centre during 1994.

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

2. ACTIVITIES

The activities under the scheme were reviewed in December, 1992 in the light of the new policy environment. It was decided that the emphasis should hence forth be on support for consultancy for development and commercialisation of indigenous technologies, besides continuing the ongoing acrivities. Some of the programmes/activities carried out during the year till December 1994, are briefly indicated below:

(a) Documentation of Consultancy Capabilities and Experiences

With a view to assess the status of consultancy capabilities in important sectors of economy as well as in almost each of the States in the country, studies have been commissioned through experts/ consultancy organisations and reports are prepared after detailed interactions and discussions with the concerned agencies. These reports include profiles of consultants, facilities and infrastrucutre available and recommendations for strengthening consultancy capabilities in the concerned sector or the State. Two studies relating to consultancy capabilities "Water Resources Development and Management" and "Energy Conservation and Management" were completed and final reports were printed. Another two studies relating to Consultancy Capabilities in the States of Gujarat and Tamilnadu were completed and the final reports were printed.

(i) Consultancy Capabilities in Water Resources Development and Management.

In the global scenario, the developing world, has to be helped to evolve appropriate site-specific strategies to harness their Water Resources to sustainably transform their economies through increased agricultural activity non-degeneratively for their eco-systems. There is, thus, a great need, to organise and mobilise the immense, yet distributed, expertise and specialisations in India and use them for indigenous purposes as well as for overseas markets.

Within India, the development strategy is per force on a new threshold of its second phase when sites and occasions, previously relegated as more complex,have to be tackled on the one hand, and management skills and information systems have to be more sharpened and automated to make the best use of the existing facilities on the other.

The study has dealt on the status of various projects in India such as ground water development, hydro-power generation, flood management, water logging areas, irrigation schemes and resources in which water management are

significant. The study has revealed that utilization of consultants and their services are still in a nascent stage as major functions are carried out by the Government. Engagement of consultants is merely optional and adhoc, though there is great potential to be benefitted by the rich experience of the consultants and professionals in the private consultancy sector. However there appears to be increasing need of engaging consultants and retired experts in various projects and also for interaction with them by R&D/academic institutions. The capabilities, achievements and accomplishments on one hand and upcoming opportunities on the other should have to be disseminated supportingly, and matchingly updated and promoted.

The expertise available in this sector including some fields of specialisation, is appreciable and generally comparable with that available in many parts of the world. However,some grey areas are seen in specific expertise such as system analysis of multiple projects, dynamic regulation of canal system, real time operation of reservoirs, sedimentation surveys, computer aided software packages, telemetry sensors and equipment development, sift proofgating etc.

Based on the response from the consultants and consultancy organisations, the annual turnover of Consultancy Services in the sector was estimated at about Rs. 20 crores. With an average growth rate of about 20% per annum and taking into account the projected investments by the government in water resources sector, the consultancy turnover is likely to reach Rs. 45 crores by end of the 8th plan period.

(ii) Consultancy Capabilities in Energy Conservation and Management in *Industrial Sector in India*

Large investments have been made in energy sector constituting about 30% of the total plan outlay. However, there is growing shortage of energy in all sectors of our economy. Of the total commercial energy produced in the form of electricity, about 69% comes from coal or thermal power, 25% from hydel power, about 4% from diesel and gas, 2% from nuclear power, and less than 1% from non-conventional sources of energy. The other source of energy production is petroleum and its products. There are four main energy consuming sectors, namely, industry, transport, household and agriculture. According to 1990-91 figures, the maximum energy consumption is in industry (51%) followed by transport (23%).

Inspite of increase in both energy production and energy consumption, eversince the first plan, there is a need to reduce the energy losses in generation, transmission, distribution and end-use of electricity as well as in petroleum products consumption. It is therefore necessary to concentrate on energy conservation and management, particularly in major consumer sectors like industry. In this endeavour, efficient consultancy services are important towards meeting the objective, particularly when we are striving for global competitiveness in exports.

According to the study, there are about 300 energy management consultancy organisations in the country. Besides, these organisations, there are R&D institutions, industrial associations, in-house cells in the industry and Government organisations offering energy management consultancy services to the industry. Over 390 energy experts are associated with 56 firms. Estimate of energy experts in energy management available in the country is of the order of 800. Very few firms are really well equipped with essential energy equipment and instruments.

The study reveals that consultancy organisations have taken up energy consultancy as one of the various services offered by them. Industry specific energy services are also provided by industry associations and research organisations. Energy audit is mainly the services offered by most of the consultants. Other services include studies related to system improvement, equipment efficiency, energy norms and consumption. Consultancy turnover in this sector is estimated at Rs.25 crores per year with the prospect of its reaching Rs.50 crores by the year 2000.

Strengths of Indian consultancy services

include availability of fairly large number of consultants, their diversified service profile, basic skills and knowledge and good linkages with industry. Major drawbacks refer to inadequate infrastructural support, specialised manpower, technology inputs and data base, equipment facilities, and linkages of consultants will R&D organisations.

(iii) Consultancy Capabilities in the State of Gujarat

Gujarat is an industrially developed state ranking second in the country in terms of industrial development. 70% of the nation's capital outlay involved in large scale on-going projects goes to Gujarat. Textile, chemicals, food products, non-metallic mineral products, machinery/machine tools form bulk of the industrial activity in this State. There are over 15,500 industries (Dec. 1991) besides SSIs reaching a figure of 1,43,500 in March 1993. Chemicals, pharmaceuticals, plastic processing and agro-based sectors have greater potential in future.

In view of the new industrial policy and liberalisation, the industrial growth may take a leap forward and consequently consultancy services would be required to meet the challenges ahead. According to the survey carried out, Gujarat houses 281 consultancy firms managed by 600 professionals which include 115 civil engineering consultants. Annual income of these consultants is estimated to be around Rs.6 crores. 85% of the consultancy firms have concentrated in Ahmedabad and Baroda. Supporting infrastructure include 28 testing laboratories and R&D organisations besides a number of research organisations, services institutions, academic institutions and Government promotional agencies.

The study revealed that majority of the consultants are active in preparing feasibility and project reports lacking their role in functional areas. Some of the sectors specific to Gujarat in which consultancy services are inadequate include cement, fisheries, gems & jewellary, salt refining & production, hosiery, brassware and spices and oil processing. Other areas in which consultancy base is required to be strengthened are electronics, food processing, and pulp and paper.

To upgrade the consultancy capabilities in the state, the study has proposed certain actions to be taken by the Government industry, consultants and R&D institutions. Some of the recommendations include manpower training and its upgradation, access to database, consortium approach by consultants and fiscal incentives to consultants.

(iv) Consultancy Capabilities in the States of Tamil Nadu and Pondicherry

Industrial activity in Tamil Nadu is significant in terms of rapid developments and industrial peace congenial to economic growth. It is the third industrialised state leading in engineering exports. The major industrial sectors in the state include leather, textiles, hosieries, electronics, drugs and pharmaceutical, fertilizers, petro-chemicals, engineering, and agro-based sector. The products manufactured include automobiles, lignite, tea, textiles, railway coaches, safety matches, iron and steel, motor vehicles, and bicycles. There are about 13,960 industrial units producing goods worth Rs.16.471 crores (1987-88), registering an annual growth rate of about 12% and providing employment to over 9 lakhs persons. According to the report, the small scale units as on June 1992, numbered around about 1.4 lakhs.

In Pondicherry, there are about 76 large and medium scale units in textiles, sugar, ceramic tiles, chemicals and pharmaceuticals, edible oils, paper, leather and steel etc. employing over 47,000 persons. The total exports were of the order of Rs.58 crores (1990-91).

The report has indicated that consultancy services are mainly available in chemicals, plastics, rubber, construction, and engineering which are served by nearly 50% of the consultants/consultancy organisations. Among the management consultants, services concentrate on preparing techno-economic feasibility reports, market survey, training and finance. The areas in which the consultancy services are required to be strengthened include

petro-chemicals, automobiles, paper, food processing and industrial rehabilitation. With the new projects proposed in Tamilnadu and Pondicherry, the consultancy business is expected to grow from about Rs.60 crores per year to about Rs.90 crores per year by end of the eighth plan (1992-97).

To upgrade the consultancy capabilities in the state, the study recommends: creation of sound data base, consultants accreditation, consortium approach, training, upgradation of expertise in specialised areas, more effective role of consultants in technology tie-ups, financial assistance to form consultant's association and greater interaction among consultants, R&D institutions and consultancy users.

(b) Technology Business Incubators

A technology Business Incubator (TBI) is essentially a shared physical facility to promote new technology based enterprises particularly the small ones by way of providing a package of low cost facilities and services for the first few year, thereby reducing the initial risk for the entrepreneurs. DSIR started an experimental programme for setting up of TBIs in the country, based on the recommendations of an UNFSTD supported study in 1990-91. Three TBIs, one each at Shri Ram Institute For Industrial Research at Delhi, CEERI at Pilani and Maharashtra Industrial and Technical Consultancy organisation (MITCON) at Pune: had been started on experimental basis. A Programme Advisory Committee had been constituted by DSIR to review and advise on the TBIs. The TBI at SRI, New Delhi was an attached model of TBI to promote enterprises in chemical and fine chemicals and seven incubatees have taken advantage of the facility. TBI at CEERI, Pilani was also an 'attached' model of TBI in the area of electronics and functioning of this incubator was reviewed closely. The third incubator at MITCON, Pune was an 'independent' model of incubator in general sectors of non-polluting manufacturing and services. 10 incubatees in the service sector have already taken advantage of this TBI facility. Each of the TBIs had set up its own Management Committee. A review of the TBI programme as a whole was undertaken and the support of DSIR is discontinued now since viable TBIs are on their own and the remaining ones closed.

(c) Institutional Programme Support

DSIR has been substantially supporting the capital and recurring needs of Consultancy Development Centre(CDC). Partial Programme support has been provided to Federation of Indian Export Organisations(FIEO) towards preparation and printing of a Directory of consultants engaged in exports.

(d) Interaction Meetings

Following interaction meetings were supported:

(i) Four interaction meetings to discuss and finalise the draft report on consultancy capabilities in the states of Kerala, Andhra Pradesh and in the North Eastern and North Western regions at Cochin, Hyderabad, Guwahati and Chandigarh respectively.

(ii) Interaction meeting on Consultancy Capabilities in Energy Conservation and Management.

(iii) Evaluation Committee Meeting for draft report on consultancy capabilities in Mineral based industry.

3. REPORTS/PUBLICATIONS

Following reports/publications were brought out during the period under reporting:

(i) A report on Consultancy Capabilities in Water Resources Development and Management in India.

(ii) A report on Consultancy Capabilities in Energy Conservation and Management for Industrial sector in India.

(iii) Two reports on Consultancy Capabilities in the States of Gujarat and Tamilnadu.

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

4. ADVISORY SERVICES

Advisory services were made available to various Departments and Organisations in relation to evaluation of their project proposals and other activities. Following are examples of participation.

4.1 Committees

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

ii) Consultancy Committee of FIEO

iii) Programme Committee of WASME.

iv) Board of Director of U.P. Industrial Consultancy Ltd., Kanpur, UP.

v) Management Committees of Technology Business Incubators

vi) Working Group and Task Force in Ministry of Defence for Non-conventional Energy Applications.

vii) Advisory Committee for the National Seminar on Pollution Control Techniques - Role of Consultants; to be organised by ACE & Institute of Environment Management, at New Delhi in 1995.

viii) DSIR representative was nominated to the

(a) Board of Directors of M/s. Water and Power Consultancy Services Ltd. (WAPCOS).

(b) Project & Consultancy Export Committee of EEPC

4.2 *Seminars/Workshops/Meetings*

i) International Meeting on Consultancy Engineering Services, organised by UNIDO at Geneva on 21-23 June 94.

ii) National Conference on Management of Cost, Efficiency, and Quality in Construction, organised by NICMAR and Planning Commission, at New Delhi in July 1994.

iii) A meeting on "Towards Global Competitiveness" organised by ACMA at New Delhi in August 1994.

iv) EFC meeting of Ministry of Water Resources, for their project proposal related to Solar Photovoltaic Applications for Minor Irrigation, drinking water and other rural applications.

v) ESCAP/WASME Asia Pacific Regional symposium on Development and Cooperation in Food Processing Industry, Nov. 94, New Delhi.

vi) CEU National Symposium on Role and Relevance of EOUs in liberalised Economy, Dec-1994, New Delhi.

5. CONSULTANCY DEVELOPMENT CENTRE (CDC)

(i) 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 organisations. 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), 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.

(ii) CDC came into being as a registered society in January 1986 and initially started operating from the premises of FIEO at PHD House, New Delhi , and was, subsequently shifted to rented apartments at Qutab Hotel, New Delhi in mid of 1987. CDC 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 120, 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.

(iii) 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.68.2 lakhs was provided as grant during 1993-94 and a release of Rs.15.00 lakhs is made during 1994-95 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 interior furnishing work at IHC was completed and CDC has moved form Qutab Hotel to IHC office in May 1994. 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, for training of engineering graduates and for small consultants. It is estimated that these investments have resulted in useful activities for nurturing consultants and users of consultancy for better returns on investments and enhanced earnings of foreign exchange directly and indirectly, besides several other qualitative advantages bringing long term benefits to the country.

(iv) 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 has initiated a 'Registration Scheme' for registering consultants based on certain criteria and then providing referral services to the users of consultancy. Such a scheme will be useful to improve the credibility and quality of consultancy services. Till December 1994 about 75 consultants have been registered.

(v) 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, have been developed and programmes have been arranged for consultants at national and international levels which have proved to be useful to promote consultancy businesses. CDC has been identified to be a nodal agency for Technical Consultancy Development Programme for Asia and the Pacific (TCDPAP) by ESCAP. Besides, ITC, ESCAP and other agencies have supported CDC training programmes in the past.

(vi) Some of the salient features of the activities carried out by the CDC during 1994 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 '1993' were given away and applications for Awards for 1994 were received and were scrutinised. Annual awards for 1994 were presented in January 1995.

- Use of Principal Consultants: Three consultants out of six consultants were retained at CDC. Their services were being utilised by some small units as well as for programmes at CDC.

- Support for participation in Seminars / Workshops / Conferences, Trade Fairs etc: Support was provided to two consultants / consultancy organisations to attend various overseas workshops, seminars, etc.

- Trainee Consultants: Nine engineers completed their one-year consultancy training at CDC during 1993-94 and another batch of eleven trainees was under going training at CDC during 1994-95 and more training programmes are being planned on continuing basis. Also, the number of trainees is likely to be increased. Efforts are being made for affiliation of this programme to a well reputed academic institution so that a recognised Post Graduate Degree could be awarded to the trainees.

- **Regional Training/Contact Programmes** : Following ten programmes were organised in association with consultancy organisations/ agencies.

(i) 07 March 1994 at New Delhi.

Technology Needs for Small Scale Industries.

(ii) 26-28 April, 1994 at Qutab Hotel, New Delhi.

"Awareness-cum-Implementation of ISO-9000 Quality Management System"

(iii) 09-11 June, 1994 at CDC Conference Hall, IHC, New Delhi. "Awareness-cum-Implementation of ISO-9000 Quality Management System"

(iv) 13-15 July, 1994 at CDC Conference Hall, IHC, New Delhi.

"Awareness-cum-Implementation of ISO-9000 Quality Management System"

(v) 13-15 July 1994 at India International Centre, New Delhi. Role of Consultants in Technology Transactions.

(vi) 24-26 October, 1994 at CDC Conference Hall, IHC, New Delhi. Documentation Course of ISO 9000 Quality Management Systems.

(vii) 05-06 December, 1994 at CDC Conference Hall, IHC, New Delhi. Internal Audit Course of ISO 9000 Quality Management Systems.

(viii) 13 December, 1994 at CDC Conference Hall, IHC, New Delhi. First Meeting of Technical Consultancy Development Programme for Asia & the Pacific.

(ix) 14-16 December, 1994 at CDC Conference Hall, IHC, New Delhi. International Training Programme on "Consultancy for Export of Manufactured Goods."

(x) 20 December, 1994 at CDC Conference Hall, IHC, New Delhi. Mechanism for Exchange of Technology Information (METI) Phase-II.

b) 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.

c) CDC has been designated as the coordinating agency for the implementation networking to the Data Base Programmes of the Asia and Pacific Centre for Transfer of Technology (APCTT).

d) A scheme for Registration of Consultants and Referral Services to help consultants and users was operationalised.

75 consultants were registered.

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.

g) Indian Renewable Energy Development Agency (IREDA) had entrusted a job of preparation of a Directory of Consultants in the area of New and Renewable Energy Sources which was satisfactorily completed. Another assignment relating to accreditation of consultants in the area of New and Renewable Energy Sources has been received by CDC from IREDA which was under progress.

h) CDC has 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 includes the occupation of some space by the cell at CDC, besides various kinds of services from CDC.

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. 7 lakhs during the year 1993-94 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 the purpose, the programme also contemplates experimentation with and introduction of modern information handling tools and techniques and the development of indigenous 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 in research & development, innovation 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 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 a nutilisation
- 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 to ensure better utilisation of S & T information resources through resource sharing, to moderate functional load of information centre management, and to take care of motivational factors to a large extent by better means of communication.

The implementation of Calcutta Library Network (CALIBNET) has been taken up 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, in collaboration with the CALIBNET Society and the RCC, Calcutta, NISSAT has taken up manpower development activities as well. 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. NISSAT signed an MOU with CMC Ltd. for future development of MAITRAYEE. Activities related to database creation and retrospective conversion are being carried out at Indian Association for Cultivation of Science and other participating institutions.

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. As in the case of CALIBNET, DELNET is now a registered society. NISSAT regularly organises computer courses for the operational level professional from the participating institutions.

NISSAT has established Bombay Library Network (BONET). BONET was formally inaugurated on November 6, 1992. Pune Library Network (PUNENET) is also operational in its initial phases. Similar metropolitan networks are contemplated for Ahmedabad (ADINET), Hyderabad (HYLIBNET) and Bangalore in the immediate future.

NISSAT has established E - Mail facilities through ERNET to the various NISSAT information centres, library network societies etc., in the country. 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 knowhow in these ventures.

3.2 NISSAT Card

It is extremely difficult for an end user to access or use resources located outside the library of her/his own institution. An information/literature search therefore gets restricted to the resources available within the institution and the

user would need to depend entirely on external courtesy. The concept of NISSAT CARD is to develop a Universal Library Card System that would facilitate utilisation of external library resources with due safeguards for protection of the interests of cooperating libraries. A feasibility study on this concept is completed. Initiated action for test launching of the card initially in 2 cities namely Delhi and Calcutta. The system will be evolved on commercial lines right from the beginning. NISSAT's involvement will mainly go towards organising mass communication support and creation of required infrastructural facilities.

3.3 Consultative Mechanisms for Rationalisation of Periodicals.

The cost of S & T periodicals increases at a rate of 15-20%. 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 delving into newer areas. Their activities naturally would demand acquisition of periodicals in those newer areas.

The aim of the consultative committees being promoted in 16 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.

Such mechanisms are already operational in Ahmedabad (NICTAS/ATIRA), Bangalore (NICMAP/CMTI), Bombay (IIT), Calcutta (NICAC/CGCRI), Delhi (DELNET), Lucknow (NICDAP/CDRI), Mysore (NICFOS/CFTRI), Nagpur (NEERI), Pune (NICHEM/NCL) and Trivandrum (KLA). Efforts are underway to set up these mechanisms in Bhopal, Chandigarh, Cochin, Hyderabad, Kanpur and Visakapatnam.

3.4 Union Catalogue

As a part of Consultative Mechanisms for Rationalisation of Periodicals, 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.

Table VI.1 : NISSAT CENTRES

Sl. No.	Subject Area (Acronym)	Host Institution
1.	Leather Technology NICLAI	Central Leather Research Institute, Madras
2.	Food Technology NICFOS	Central Food Technological Research Institute, Mysore
3.	Machine Tools & Production Engineering, NICMAP	Central Manufacturing Technology Institute, Bangalore
4.	Drugs and Pharmaceuticals NICDAP	Central Drug Research Institute, Lucknow
5.	Textiles & Allied Subjects NICTAS	Ahmedabad Textile Industry's Research Association, Ahmedabad
6.	Chemicals & Allied Industries, NICHEM	National Chemical Laboratory,Pune
7.	Advanced Ceramics NICAC	Central Glass and Ceramics Research Institute, Calcutta
8.	Bibliometrics NCB	Indian National Scientific Documentation Centre, New Delhi
9.	Crystallography NICRYS	University of Madras, Madras
10.	CD-ROM, NICDROM	National Acrospace Laboratory, Bangalore

4. NISSAT 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.

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. The centres have also developed information management tools like thesaurii, data collection and input procedures and so on.

These centres maintain several databases to cater to the information requirements of their clientele. For example, NICDAP maintains databases on Natural Products, Folklore database, Letters of Intent & Industrial Database, Research Projects database, Union Catalogue of periodicals in Lucknow city etc., NICLAI maintains database on Leather Science Abstracts (LESA), Periodical Holdings (PERHOL), Leather Thesaurus (LETHAS), Leather Catalogue (LEACAT) etc.; NICFOS maintains Food Science & Technology Abstracts (FSTA), Indian Food Technology Abstracts (IFTA), Food Patents; NICMAP maintains databases like Metal Working Abstracts, Patents, World Machine tool production statistics & Import/Export statistics; NICTAS maintains World Textile Abstracts and NICHEM publishes Monthly Indian Chemical Patents.

The centres like NICRYS, NCB, NICDROM also undertake the task of acquiring, evaluating, integrating, consolidating and analysing factual and numeric information. The National Information Centre for Crystallography (NICRYS) was 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, publishes a periodical CD FOCUS to keep the Indian users informed about developments on this new technology. The centre also provide information from NTIS database.

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 at 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.

The NACIDS use PSTN telephone lines upto the local Pocket Assemblers/Disassemblers of Videsh Sanchar Nigam Limited (VSNL) and there onwards, the international carriers via the Gateway Packet Switching Services (GPSS) at Bombay. Online access by Telex is a stand by. 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.

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

S.No.	Place	Host Institution
1.	Bangalore	National Aerospace Laboratory
2.	Calcutta	Indian Association for Cultivation of Science
3.	Madras	Central Leather Research Institute
4.	New Delhi	Indian National Scientific Documentation Centre
5.	Pune	National Chemical Laboratory
6.	Ahmedabad	Ahmedabad Textile Industry's Research Association
7.	Bombay	Victoria Jubilee Technical Institute
8.	Hyderabad	Centre for Cellular & Molecular Biology
9.	Thiruvananthapuram	Kerala State Industrial Development Corporation

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).

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 has organised the Third National Meet of CD-ROM/ ONLINE Users and Service Providers, during August 9-10, 1994 in Madras.

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

Sl. No.	Host Institution & Place	Database
1.	National Chemical Laboratory, NICHEM, Pune	CHEMBANK
2.	Indian Association of Cultivation of Science, Calcutta	INSPEC (Physics)
3.	National Physical Laboratory, New Delhi	INSPEC (Physics)
4.	Central Drug Research Institute, NICDAP, Lucknow	Drug Information Source
5.	CALIBNET Society Calcutta	BNB, Book Find Bibliofile Inside information
6.	Central Manufacturing Technology Institute, NICMAP, Bangalore	COMPENDEX
7.	Central Leather Research Institute, NICLAI, Madras	BIOSIS
8.	Indian Statistical Institute DRTC, Bangalore	LISA
9.	Indian Institute of Science NCSI, Bangalore	ADONIS
10.	National Aerospace Laboratories, NICDROM, Bangalore	Discovery Preview NTIS, World Fact Book, Grolier Encylopedia, and others
11.	Indian National Scientific Documentation Centre NCB, New Delhi	Science Citation Index
12.	PUNENET society, Pune	Inside Information
13.	BONET , Bombay	Inside Information
14.	DSIR, NISSAT, New Delhi	World Research Database, NTIS, ISDS and others.

6. MANPOWER DEVELOPMENT

The education and training of information personal was another arca 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 appliction of computers in library and information centres, use of personal computers & CDS/ISIS TQM in library services, Marketing of Information Products and services, AACR II & CCF, Bibliographic Database production and development. Technical communication etc., in various parts of the country.

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 :

Sl. No.	Activity	Institute
1.	Guidelines for the implementation of UNIMARC in India	CALIBNET Society, Calcutta
2.	Marketability of Information Products in India	INSDOC, New Delhi
3.	Use of Medlars CDROM database in Delhi	ISAC, New Delhi
4.	Citation Process-Theoretical Issues	IASLIC, Calcutta
5.	Directory of Abstracting Services, Indexing Journals and Databases in S&T Sector	SIS, New Delhi

7. INFORMATION TECHNOLOGY APPLICATION

The demand for use of computers varies from automation of routine management functions in libraries to information retrieval or analysis of global databases. NISSAT gives a high priority to all aspects of computer based bibliographic information processing.

NISSAT acquired proven software packages like CDS/ISIS for bibliographic information processing & retrieval and IDAMS for statistical data processing from UNESCO. NISSAT has been given the official rights for distribution of the two packages in India.

There are 1055 installations of CDS/ISIS in India and 23 installations of IDAMS (as on December 31st, 1994) in India. The implementation of CDS/ISIS in these institutions is monitored regularly through exchange of information, user's group meetings and periodic surveys.

In collaboration with Defence Scientific Information and Document Centre (DESIDOC), New Delhi, NISSAT developed a CDS/ISIS based software for Library Automation (called SANJAY). The package is capable of inter-linking two or more databases for a single application, handling numerical calculations and of carrying out several other library house-keeping activities.

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

The 6th National Meet of CDS/ISIS Users was organised during January 10-13, 1995 at Bio-Informatics Centre, Madurai Kamaraj University, Madurai, to assess the status of the package in the country, to provide technical solutions to the problems faced by the users and to facilitate the exchange of experiences.

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 the various NISSAT information centres have been given orientation courses on information marketing. The 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, services, systems and technology.

This covers wide ranging issues relating to information, development of information, 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:

(i) The NISSAT secretariat has executed a UNESCO contract to develop teaching aids and course materials for introducing the concepts and methodologies for computer communications and networks to library and information scientists. The course material and the teaching aids would be utilised by the 20 ASTINFO member countries. The task involves

   (a) preparation of course curriculum appropriate for short term continuing education training course of 3 to 5 days

   (b) preparation of course materials (100 - 150 pages)

   (c) preparation of teaching aids for imparting the training.

A pilot course on testing (b) & (c) above has been conducted in Delhi.

(ii) NISSAT secretariat has another UNESCO project for the establishment of the "Clearing House on CDS/ISIS software and creation of Database on library network experts in ASTINFO region"

(iii) NISSAT is coordinating the ASTINFO document supply service promoted and support by UNESCO. Under this scheme, the National Library of Australia would service overseas document requests at a cost of $3 irrespective of the number of pages. The service is open only to the ASTINFO member countries.

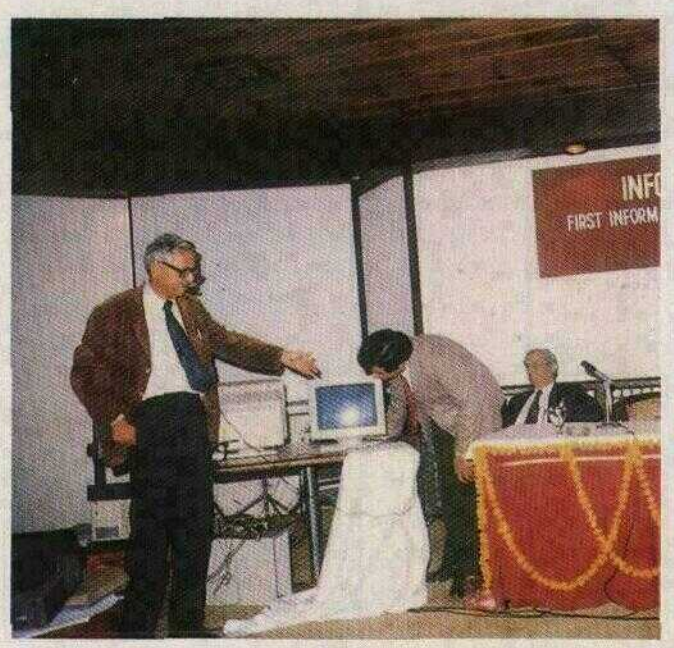
To handle the Indian requests for the services, NISSAT - as the ASTINFO national coordinating unit in India, has identified a set of institutions on considerations of logistics. The service is priced on cost-recovery basis. For future requirements of request forms, user libraries would approach NICTAS/ATIRA, Ahmedabad,

which is now an outlet for all NISSAT products and services.

10. DEVELOPMENT OF AN INTEGRATED INFORMATION MARKET

In quantitative terms, the expenditure to provide information support services to S&T activities might have been significant but most of it was perhaps utilized for augmentation of library services. The expertise to adapt, adopt and absorb modern information technology is however exists. Complementary activities especially those on indigenous database development did not come up as they should have. Factors like the availability of subject knowledge, information handling experience, computer hardware and software skills and low manpower costs could potentially foster a healthy growth of database production industry.

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.



VI.1. Information Today and Tomorrow-demo in Progress

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 has provided a forum to discuss the various aspects of information during December 7-8, 1994 in New Delhi. About 130 executives from industrial, financial & business information companies/organisations, institutions generating S&T information, Publishing houses etc. participated in the deliberations.

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 performance of the Corporation during 1993-94 has been quite satisfactory. With sustained marketing efforts, the Corporation has earned lumpsum premia of Rs.92.90 lakhs from licensing of indigenous technologies in 1993-94 as compared to Rs.85.5 lakhs in 1992-93. The Corporation also earned royalties amounting to Rs.90.21 lakhs during the year.

1. PROFIT

As a result of sustained efforts and hard work put in by its executives and staff, the Corporation has been able to earn a gross profit of Rs.64.06 lakhs as compared to Rs.61.43 lakhs during 1992-93 inspite of the highly liberalised policy frame to promote foreign investment and foreign technology and competition from several other domestic technology transfer organisations.

The gross income of the Corporation from all sources including premia and royalty, but excluding Grant-in-Aid was Rs.295.00 lakhs as compared to Rs. 306.73 lakhs in the previous year.

3. PROCESSES ASSIGNED AND LICENCE AGREEMENTS CONCLUDED

During the year, 40 new processes were assigned to the Corporation as compared to 51 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 the year were:

- Zeolite powder - detergent grade
- Biosensors
- Small capacity rice husk fired FBC boiler
- Refractory grade magnesia from seawater
- Energy saving device for welding sets

The Corporation signed 57 licence agreements during the year as against 66 in 1992-93 and 73 in 1991-92.

3. MAJOR TECHNOLOGIES LICENSED

Some of the major technologies licensed by the Corporation during the year were:

- Invert Sugar
- Gallic Acid

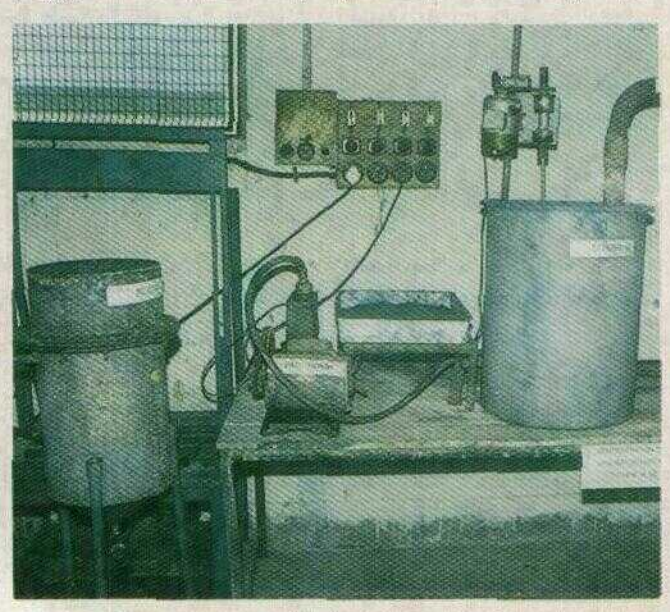
- Phone in Programme System
- Glycol based automobile coolants
- *Zeolite - A detergent grade*
- Glucose Biosensors
- Near net shape forging technology
- Antigens for Diagnosis and immunotherapy of Allergic disorder

4. TECHNOLOGY DEVELOPMENT PROJECTS

4.1 Projects Completed

Copper Phthalocyanine Blue (CPB)

CPB is a chemical intermediate used as pigment in the textile, paints, plastic,printing ink and rubber industries. The producers of CPB in the country are using raw CPB made using a costly organic solvent. The process developed at RRL Bhubaneswar obviates the use of the costly solvent. Therefore, the Corporation provided a grant of Rs.40,000/- to the Regional Research Laboratory, Bhubaneswar for upscaling the process to a 5 kg./batch level. The project has been completed.



VII.A.1. Demonstration Plant of Copper Phthalocyanine Blue (CPB)

The improved process is now being licensed by NRDC to industry.

4.2 On-going Projects

i. Heart Valve Project at Shree Chitra Tirunal Institute for Medical Sciences and Technology (SCTIMST), Thiruvananthapuram

NRDC had financed the development of the Artificial Heart Valve by SCTIMST over the period 1982 to 1991 at a total cost of Rs.18 lakhs. After approval by the Ethics Committee of the Institute in June 1990, human trials commenced at 6 leading cardiac hospitals w.e.f. Dec. 1990. At the end of the year 1993-94, 260 valves have been implanted in human beings. It is now expected that the company to whom NRDC has licensed the technology viz. M/s TTK Pharma Ltd. would commence pilot production of the first batch of 600 Heart Valves by March, 1995 in collaboration with SCTIMST. Concurrently, NRDC has taken up the work of patenting of the heart valves and over the last 12 months, patent applications have been filed by the Corporation in India, USA, Japan and the European Patent Office, Munich, Germany at a total cost of around Rs.15 lakhs. Meanwhile, NRDC has also received an enquiry from a leading Swiss Company for licensing the technology.

ii. Acid Proof Cement from Rice Husk Ash

Acid Proof Cement is essentially used as a mortar for binding and jointing of acid proof bricks; tiles, stoneware pipes etc. IIT Kharagpur had developed a process to make such cement on a laboratory scale of 2 kg per batch using rice husk ash as raw material.

The technology provides a good opportunity to effectively utilise a waste material and convert it into a usable product. To generate a commercially viable industrial process to make such cement from the laboratory scale process, the Corporation sanctioned in March 1993 a grant of Rs.2.34 lakhs to the IIT for upscaling the above process to a 20 kg/day scale. The pilot plant is to be used (a) optimise the process and then to generate techno-commercial documentation for

licensing to industry (b) demonstration of the technology to licensees of the Corporation and (c) thereafter to train licencee personnel. Scientists at IIT, Kharagpur have now produced few batches of acid proof cement which has been tested at the Department of Civil Engineering of the IIT. Samples of Acid proof cement have also been given to industry for user trial. It is now proposed to produce floor tiles and bricks from acid proof cement. The work is in progress and is likely to be completed shortly. Meanwhile efforts are being made to licence the process to industry.

iii. Synthetic absorbable surgical sutures

The Corporation has sponsored the development of Synthetic Absorbable Surgical Sutures at Shri Ram Institute for Industrial Research, Delhi at an estimated cost of Rs.11.00 lakhs. The work on the project has commenced and is expected to be completed shortly.

iv. Precipitated Silica

The process for the manufacture of Precipitated Silica from rice husk was licensed to M/s Unique Silica Development Pvt.Ltd., Cuttack in June 1986. While reviewing the project, it was found that the overall techno-economics of the process could be improved if two by-products viz. Calcium Sulphate and Activated Carbon could be recovered. To carry out technology development work for that purpose, the Corporation has provided a development loan of Rs.1.80 lakhs to M/s Unique Silica Development, Cuttack. The work is progressing satisfactory and is likely to be completed shortly.

v. Sand Lime Bricks

Sand Lime bricks also known as Calcium Silicate bricks are considered to be an advanced building material and are made from sand and hydrated lime. Keeping in view the need for developing alternate building materials to clay bricks to save topsoil, the Corporation licensed the process for the manufacture of sand lime bricks developed at Central Building Research Institute, Roorkee to M/s Periwal Bricks Pvt.Ltd., Dungargarh (Rajasthan) in Jan 1992. The licencee configured a project for setting up a plant with a capacity of 30 million bricks/year at a total project cost of Rs.5.5 crores. With equity investment by the promoter to the extent of Rs.109 lakhs, and financing from HUDCO of Rs.10 lakhs as equity and Rs.340 lakhs as term loan, the Corporation participated in the equity to the extent of Rs.30 lakhs. The plant has since been erected and commissioned. The project is expected to have a turnover of Rs.3 crores at full capacity.

vi. New Range of Rice Husk Board

This is a major technology with a large potential market. The Corporation has already licensed the technology to 7 parties in various parts of the country including the first licencee namely M/s. Padmavathi Panel Boards Ltd. (PPBL) who is running a plant of 600 TPA now under expansion to 2500 TPA (annual turnover around Rs.1.5 crores). A second licensee has come into production in Hyderabad in March 1993, and the third at Bombay has also commenced production soon. The fourth licencee is also making good progress.

NRDC is also promoting this technology in Malaysia, China, Thailand, Philippines and Vietnam as they are all major rice producing countries. However, if this technology is to continue to remain competitive, both the production process and the range of types of boards manufacturable with the technology have to be continuously updated. The Corporation's first licensee M/s. Padmavathi Panel Boards Ltd. (PPBL), Bangalore had demonstrated the capability to undertake both such types of upgradations viz. process improvement and product diversification. PPBL had also been able to take out 3 patents both on the improved process and the new range of products. However, the Company was unable to proceed further because of lack of funds. The Corporation therefore decided to provide additional funds to the extent of Rs.32 lakhs to PPBL for further technology development relating to both the production process and new types of Rice Husk Boards. In return PPBL has assigned all the 3 patents to NRDC and also agreed to supply to

NRDC all technical developments in documented form. Of that Rs.32 lakhs, Rs.16 lakhs was by way of equity and Rs.16 lakhs as developmental loan for the development of a new range of Rice Husk Boards viz. (i) Jute Fabric Overlay Rice Husk Board (ii) Paper laminated Rice Husk Board (iii) Other similar products with Rice Husk Board as the base materials. The Corporation has already contributed Rs.10.00 lakhs as development loan and Rs.12.00 lakhs as equity. The work is in progress.

5. ROLE OF NRDC IN DSIR SUPPORTED PROJECTS

DSIR has been supporting Technology Development Projects under its "Programme Aimed at Technological Self Reliance (PATSER)" involving Industry, Research Institutes and Consultants. The Corporation has been identified as the Agency to manage all matters connected with the Intellectual Property Rights, revenues accruing from the utilisation of the technology and the third party licensing. Under this programme some of the major projects undertaken were:

- Development of Zircon products through Plasma Dissociation route in collaboration with M/s CS Zircon Products Pvt.Ltd., Kala Amb (HP) and Institute of Plasma Research, Ahmedabad.

- Development of Chemical Beneficiation Technology for Refractory Grade Bauxite Ores in collaborationwith Orissa Industries Ltd. and Indian Institute of Technology, Kharagpur.

- Upgradation of Conventional Down Draft Kilns in collaboration with Pioneer Ceramics and Potteries manufacturing ICS Ltd. and Andhra Pradesh Industrial and Technical Consultancy Organisation Ltd., Hyderabad.

- Development of Technology for Laser Pumping Lamps of Constant Wattage and Flash Type in collaboration with M/s Litex Electricals Ltd., Pune and Indian Institute of Technology, Bombay.

6. MARKET SURVEYS

Market surveys are of considerable significance in the process of technology transfer. It makes the technology package more attractive to entrepreneurs.

During the year, market survey reports on the following items were got conducted by commissioning professional market survey agencies:

* Pectin
* Zeolite A - Detergent grade
* Investment castings
* Impedence Plethysmograph

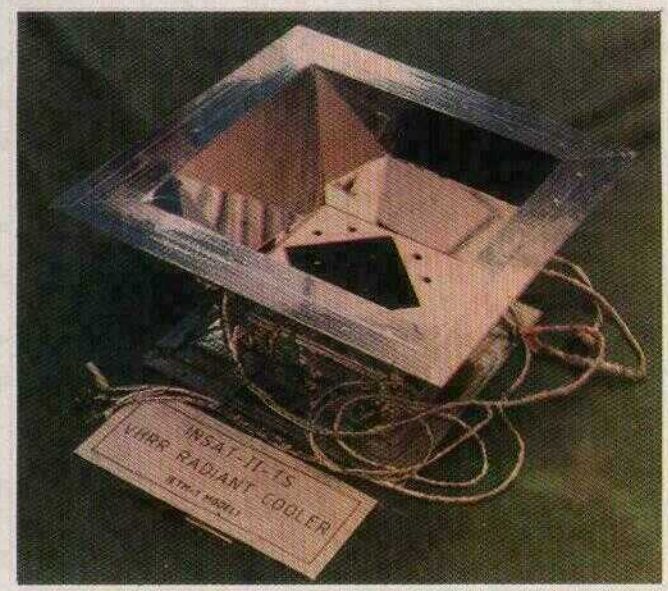
7. INVENTION PROMOTION PROGRAMME

Through its Invention Promotion Programme, the Corporation has been endeavouring to stimulate the spirit of inventivity among not only scientific and technical personnel but also amongst industrial workers, craft men, artisans etc. During the year, the Corporation received 70 proposals for prize awards and 30 proposals for providing financial assistance for prototype development.

The Corporation announced cash awards amounting to Rs.1.40 lakhs to 19 inventors for 4 inventions on Independence Day (1993) and cash awards amounting to Rs.3.50 lakhs to 28 inventors for 10 inventions on Republic Day (1994).

Some of the notable inventions recognised through such awards given during the year were:

* Colour Photowrite
* Thick film potentiometric sensor for flight control actuation system
* Personal Braille Embosser
* Automatic self adjusting spanner/wrench
* Chitra Heart Valve Prosthesis



VII.A.2. Space Worthy Passive Radiant Cooler for Very High Resolution of Pay Load of INSAT-2 Satellite Developed by ISRO, Bangalore

* Spaceworthy passive radiant coder for very high resolution of pay load of INSAT-2 Satellite

The Corporation also provided financial assistance amounting to Rs.29,200/- to three inventors for prototype development.

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 31 individual inventors for filing patent applications in India.

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

8. 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.

8.1 Rural Technology Demonstration-cum-Training Centre (RTDT Centres)

Besides reviewing the performance 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 6 new RTDT Centres in the different parts of the country during the year 1993-94:

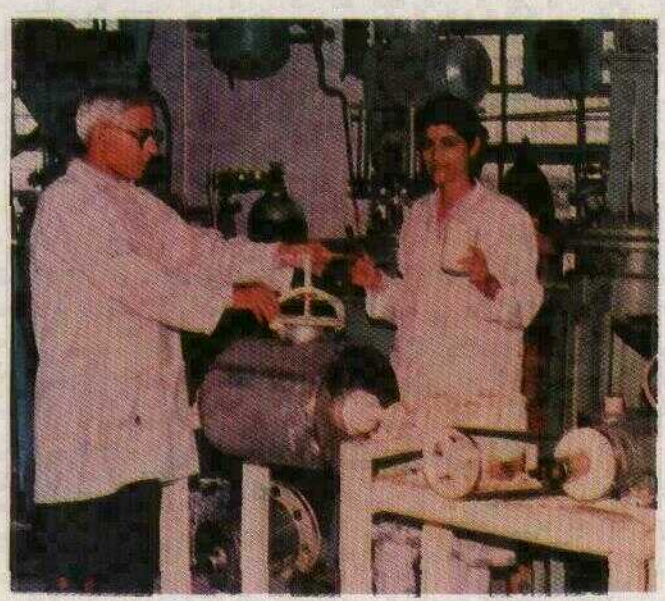
- Dumka (Bihar)
- Cuttack (Orissa)
- Tirupati (AP)
- Una (HP)
- Kumly (Kerala)
- Port Blair (Andaman & Nicobar)

With the above centres, the total number of Centres as on 31st March, 1994 was 48.

8.2 Rural Technology Development Projects

i. Latex Based Products from Cactus

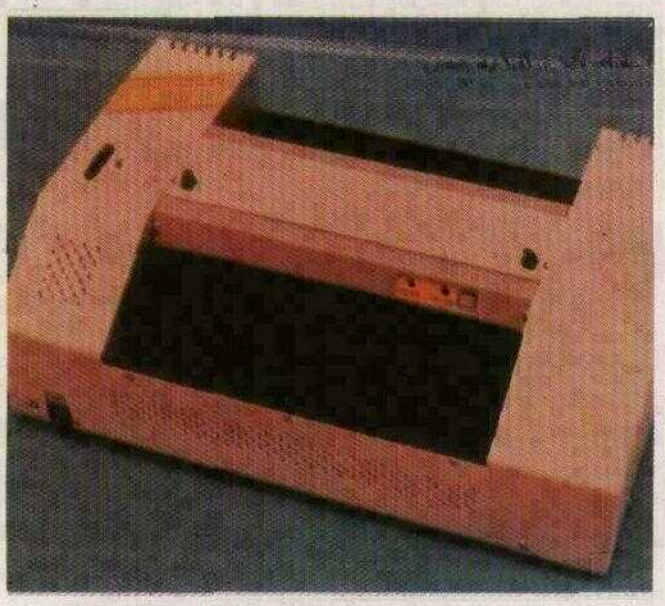
Latex bearing cactus plants such as Euphorbia Nevulie/Nonfolea are abundantly available in our arid and semi arid zones. The latex available from these plants is not put to any use at present. With this end in view, the Corporation funded a project for setting up a pilot plant for the production of latex based products from cactus plant at Shri Ram Institute for Industrial Research, Delhi at an estimated expenditure of Rs.3.00 lakhs. The work is progressing satisfactorily and is likely to be completed by March 1995. On successful completion of the project, a production-cum-demonstration Centre will be set up in a rural area where cactus plants are abundantly available.



VII.A.3. Pilot Plant for Production of Latex from Cactus Plant

ii. Independent Braille Interpreter System for the Blind

The Corporation funded the development of a complete Independent Braille Interpreter System for generation of employment amongst the visually handicapped in collaboration with the Bhabha Atomic Research Centre, Bombay. The system basically consists of a single chip micro controller based Braille keyboard interfaced with a standard IBM PC-AT with a PC compatible speech synthesizer. The complete system has been developed and the same is under testing.



VII.A.4. Personal Braille Embosser Developed by Super Computer Education and Research Centre of IISc, Bangalore

9. TECHNOLOGY AND PROJECT EXPORT

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

(Rs.in lakhs)

-	Synthetic and Natural Dyes in Vietnam for UNIDO	137.00
-	Project Report for Mini Cement Plant in Indonesia	3.10
-	Project proposal for food processing unit, Nigeria	2.17

The Corporation signed an agreement with M/s MHES, Malaysia for setting up of a 2500 TPA Rice Husk Board plant in Malaysia at an estimated cost of Rs. 120 lakhs. M/s MHES have already paid advance of Rs. 53 lakhs and have also opened a letter of credit in foreign exchange for supply of equipment. The work on the project is progressing satisfactorily.

Foreign Exchange Earnings

The foreign exchange earnings of the Corporation amounted to Rs. 16.90 lakhs during the year.

10. PUBLICATIONS

Dissemination of information on new processes to industry, entrepreneurs and the general public is of considerable significance for the promotion and commercialisation of technologies. One of the means of doing so is through publications of various types. During the year, the Corporation continued to bring out the following

regular publications:

Awishkar - (Monthly in Hindi)

Invention Intelligence - (Monthly in English)

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

- Process Diary
- Pre-Feasibility Report on Rice Husk Board
- NRDC at Your Service

10.1 Sale of DSIR Publications

During the year, 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/ Handbook of Foreign Collaboration Approvals (1981-90). The Corporation sold 1260 reports valued at Rs. 4,39,770/-.

11. EXHIBITIONS AND PUBLICITY

Participation in exhibitions, seminars, workshops, Entrepreneur Development Programme etc. are of vital importance for the popularisation of new processes and creation of awareness about the role of the Corporation in technology transfer. With this end in view, the Corporation organised a number of Tech-Trans (seminar-cum-exhibitions). The Corporation also participated in exhibitions, seminar and get-togethers organised by other agencies.

Tech-Trans Exposition-cum-Seminar

i.	Tech-Trans, 93, Thane	8-9 June, 1993
ii.	Tech-Trans, 93, Akola	7-8 July, 1993
iii.	Tech-Trans, 93, Kolhapur	18-19 August, 1993
iv.	Tech-Trans, 93, Sholapur	8-9 September, 1993
v.	Tech-Trans,'93, Ludhiana	20-21 January, 1994

VII.A.5. Automatic Self Adjusting Spanner/Wrench on display at NRDC stall in WISITEX '94

Exhibitions/Seminars/Get-togethers

i. Tech-Mart, '93
(14-23 Nov. 1993 at Pragati Maidan, New Delhi)

ii. Tech-Source '93 Technology Exposition of Processes Organised in collaboration with APITCO,Hyderabad
(16-17 Dec. 1993 at Hyderabad)

iii. Science & Technology Exhibition at the annual session of Indian Science Congress
(3-11 January, 1994 at Poddar Institute of Management, Jaipur)

iv. Exhibition on Technologies
(20-21 January 1994 at Punjab Agriculture University, Ludhiana)

v. WISITEX '94-8th International Exhibition and Technology Congress
(3-9 February, 1994 at Pragati Maidan, New Delhi)

vi. ARCHS, '94 Architecturals,Building Materials, Interiors/exteriors,Engg.Technologies
(12-14 March, 1994 at B.M.Birla Science & Technology Centre, Jaipur)

12. IMPLEMENTATION OF OFFICIAL LANGUAGE

The Corporation continued making efforts to implement the provisions of the Official Language Act and Rules framed there under to ensure the continued use of Rajbhasha in its day to day working. Significant progress has been made in the field of correspondence, noting and drafting in Hindi. The Annual Report of the Corporation is being published in diglot form in both Hindi & English since 1986-87. The Corporation also publishes a popular science and technology monthly in Hindi, entitled *Awishkar*. To popularise the use of Hindi, the Corporation celebrated the Hindi Week from Sept. 14 - Sept. 21, 1993. Five stenographers were sent for training in Hindi typing.

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, 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 fourth largest producer of Single Crystalline Silicon Solar Cells in the world.

2. PERFORMANCE IN 1993-94

2.1 Operating Results

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

	1992-93 (Rs. in lakhs)	1993-94 (Rs. in lakhs)
Production	49.75	47.46
Sales	46.91	46.76

2.2 Highlights of Operations

2.2.1 Solar Photovoltaics (SPV):

In the Solar Photovoltaics Group, 1450 KWp of solar cells were produced as against 1250 KWp in the previous year. A total of 8,000 SPV power sources (total value Rs. 17 crores) were supplied to DOT for its Rural Telecom Network.

The Company received an order from Doordarshan for the supply of 76 more SPV power sources for their Very Low Power TV Transmitters (VLPT). SPV modules and charge controllers for 32 no. of these systems were supplied during the year.

The Company received order from the Department of Rural Development (DRD) for the supply and installation of additional 32 no. of Deepwell Water Pumping Systems in identified sites in the states of Gujarat, Madhya Pradesh, Maharashtra and Rajasthan, and all the 32 systems were supplied during the year to the respective sites pending installation.

The stand-alone part of the 100 KWp power plant at village Saraisadi in Ghosi District was completed during the year against the earlier turnkey order from the Non-conventional Energy Development Agency (NEDA), UP.

200 no. of SPV Battery Charging Systems using lightweight foldable SPV modules for charging the batteries of Man-pack Radio Sets were supplied to the Indian Army against the order received during March, 1993. The last two units of this first commercial order from the Army were formally presented to the then Chief of Army Staff, late General BC Joshi at a formal function held in his office on February 9, 1994.

So far 14 no. of SPV power systems for Petrol/Diesel Dispensing units were supplied and installed on a turnkey basis at as many outlets against

VII.B.1. Foldable Solar Photo voltaic Modules for Charging the Batteries of Man-pack Radio Sets

the first commercial order for these systems from Indian Oil Corporation (IOC) Limited.

The first 10 KWp SPV power plant designed and developed by the Company for Dr. MS Swaminathan Research Foundation at Taramani Complex, Madras was fully installed and commissioned. This power plant was inaugurated on April 14, 1993 by the Chief Minister of Tamil Nadu along with the Minister of State for Non-Conventional Energy Sources (MNES), Government of India.

Two major highlights in the area of SPV activity having consequent bearing on the indigenous SPV market in the country were the National SPV Pump Programme and the Development of Solar PV Lanterns both of which were launched during the year. The National Pump Programme with an objective of large scale deployment of SPV Water Pumping Systems using DC Surface Centrifugal Pumps was launched during the 3rd quarter of 1993-94 by the Indian Renewable Energy Development Agency (IREDA) of the Ministry of Non-Conventional Energy Sources (MNES). This pump programme envisages supply of these pumps directly to end-users with a substantial (around 75%) subsidy by the Government (through MNES) and leasing mechanism through soft loans payable by easy long term instalments by the user for the balance 25% cost of the pump. In this nrst year of seeding programme, the Company in collaboration with M/s. Kirloskar Bros. Ltd. supplied 60 no. of pumps against the total order from IREDA for 80 no. of such pumps. The Company supplied about 700 no. of Solar PV Lanterns as per the MNES specifications during the first year of their introduction in the market.

The Company also supplied and installed 68 no. of SPV lights at Shri Satyasayi Institute of Higher Medical Sciences at Prashantigram in Andhra Pradesh. The Company designed and installed solar powered search lights and perimeter lights at Veerbhoomi, the Samadhi of Late Shri Rajiv Gandhi against an order received during January, 1994. The Company for the first time exported solar cells to USA during the year.

2.2.2 Systems Group

The System Group produced and supplied 8,000 no. of charge controllers for the SPV power systems for the DOT's Rural Telecom Network. In the area of Railway Electronics, the turnkey Colour Light Signalling (CLS) installation (total value Rs. 100 lakhs) in the Bina-Katni Section of Central Railway, was completed during the year. Block Equipment were installed and commissioned by the Company in the first three stations of the

VII.B.2. Solar Power Generator at Veer Bhumi (Rajiv Gandhi Samadhi)

Jhansi-Bina section of the Central Railway against an order from railways for intallation of 20 Block Stations. These were the first Block Systems using Axle Counters to be commissioned in the Indian Railways.

The turnkey installation of the Block System in the Aligarh-Chola section of the Northern Railway was also taken up during the year, since the safety clearance for the introduction of the Block Proving System was received only in April, 1993. Further major orders of Block Equipment were received during the year from M/s. Crompton & Greaves for 25 systems and from Indian Railway Construction Company (IRCON) for 26 no. of solar powered Block Equipment. The work on the latter was taken up during the year itself. 6 no. of the solar powered Gang Warning Systems were supplied. The Gang Warning Systems are fully cleared by RDSO, Lucknow and are modifications for the specific use of Railway's gangs of the Solar Powered Level Crossing Radio Warning System (SOLAGARD) developed by the Company for Railways and deployed in the different zonal railways for field trials. Axle Counters (2/4 devices models) continued to form a major Railway product in this year both as individual supplies and part of the Block Systems supplied/installed. A total of 107 axle counters were thus supplied during the year. 33 no. of the PTVs were also sold during the year.

2.3.3 Components Group

The first commercial order for high permeability ferrite cores were received from ITI for 10,000 pairs of the 22x13 type Pot Cores. These are special grade ferrites developed in the Ferrites Division of the Company during the previous year for use in the Digital Switching Exchanges. 1150 X-Band Phase Shifters were supplied against the first bulk order for 1200 no. of X-Band Phase Shifters from LRDE (of DRDO), Bangalore. These Phase Shifters are critical components for the Phased Array Radar which is a major constituent under the Integrated Guided Missile Development Programme (IGMDP) of the DRDO. The Company also received order for supply of 1000 no. of C-Band Microwave Ferrite Phase Shifters for supply to LRDE the following year under the same project. The Company also exported for the first time its ferrite cores to USA.

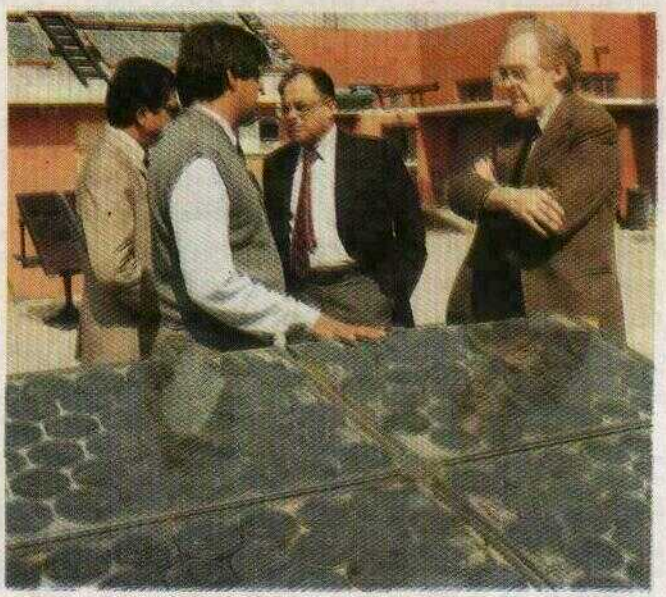
3. OTHER HIGHLIGHTS

3.1 MOU with the Government for 1993-94

The Company had been rated "Excellent" for its MOU performance in 1992-93, the first year of its signing MOU with the Government. The Company signed MOU for 1993-94 with the Government (DSIR) on July 20, 1993. The MOU was signed by Dr. SK Joshi, Secretary, DSIR on behalf of the Government and Brig. MR Narayanan, the then CMD of the Company.

3.2 Visits of Important Dignatories

As in the previous years, the Company continued to attract a number of VIPs visiting the Company particularly the SPV Plant. These include foreign delegations from Amman, Nigeria, Zimbabwe, Indonesia, Israel, Vietnam, Egypt, Japan etc. Notable among the visitors were : Sir John Maddox, - Editor, Nature, Dr. Arcot Ramachandran - Former Secretary, DST, Dr. Nguyon Van Hien - President of NCFS&T Vietnam, Prof. Ignacy Sach - School of Advanced Social Science Studies, France, Prof. Von



VII.B.3. Sir John Maddox, Editor Nature Magazine seeing SPV application systems at CEL

Over Straeton - Director, IMEC, Belgium, Prof. BM Udgaonkar - TIFR, Bombay.

4. TECHNOLOGY ABSORPTION, ADAPTATION AND INNOVATION

During the year, the Company initiated the necessary concrete steps for the establishment of Pilot Plant for the production of ultra high efficiency (16%-17%) silicon solar cells based on the laboratory level process developed at University of New South Wales (UNSW), Australia for the fabrication of solar cells using the Buried Contact Technology (BCT) and for which technology transfer agreement had been signed with UNSW. Major equipment such as Laser Grooving Machine, 3-Stack Diffusion Furnace, the indigenously fabricated Electrode-less Plating and the Chemical Stations etc. were received during the year, their installation in the Pilot Plant awaiting completion of the Clean Room for the Pilot Plant for which a contract had been given to M/s. Kirloskar Electrodyne, Pune. The Clean Room had almost been completed by end of the year.

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 completely automated indigenously designed chemical station fabricated at Bombay in collaboration with Bhabha Atomic Research Centre (BARC), Bombay was received, installed and put into regular production during the year. Critical equipment such as Laser Scriber and Anti Reflection Coating (ARC) Equipment were received during the year which on commissioning and regular usage are expected to push the efficiency beyond 13%. The optimisation of process parameters and streamlining of operations using the ARC was however carried out during the early part of the following year.

The activities on the development of a production worthy process for ultra high efficiency (UHE) Solar Cells based on the laboratory scale tenchique developed at University of New South

VII.B.4. Diffusion furnace with automatic loading/unloading and gas controlled facility at the SPV plant at CEL

Wales (UNSW), Australia continued during the year as already detailed at 4. above.

In the area of development of new photovoltaic applications, the activities continued in perfecting and take into regular production some of the work already done in relation to surface centrifugal pumps with M/s. Kirloskar, Passive Tracking System for use in SPV water pumps and special inverters to take on inductive loads for powering diesel and petrol dispensing units etc.

The major milestone in these operations during the year is the successful development of a 25 KW indigenous Power Conditioning Unit (PCU) for Grid Interfacing a SPV Power Plant of that capacity. This PCU was developed in conjunction with M/s. DB Electronics, Pune and was designed to handle the voltage and frequency fluctuations typical of the Indian Grid. The PCU

also incorporated Data Logger for measuring and storing various data related to the PV power plant. The PCU was successfully used for interfacing with the AC mains/grid in the 25 KW experimental/ demonstration plant set up in the Company's premises.

In the Railway Electronics area, the Company continued its development activities on a number of products for Signalling and Safety applications in the Railways and prototypes of these systems (such as Solid State Interlocking System, Data Logger System etc.) were made ready/offered for approval by RDSO, Lucknow.

The Ferrites Division also successfully developed, fabricated and supplied new large ferrites: EE-200 and UU-100 for power transformer application against specific user requirement.

The R&D Group of the MED carried out substantial improvement in the Hybrid Driver of the C-Band Ferrite Phase Shifters. The Group also developed, totally through inhouse efforts, a multi channel driver circuit capable of simultaneously driving a number of phase shifters as against the present practise of a driver to each phase shifter. This development is likely to lead to ease of accommodation of phase shifters in the radar assembly as also contribute to reduction in cost.

6. ROLE IN NATIONAL TECHNOLOGY MISSIONS

The Company's SPV group supplied about 8000 SPV Power Sources for the DOT's VHF Rural Telecommunication Network. In the second phase of the operations related to the National Drinking Water Mission, 32 no. of solar powered deepwell water pumping systems using submersible pumps were supplied to as many sites in the states of Gujarat, Maharashtra, Madhya Pradesh & Rajasthan against the order received from the DRD.

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 1994, the total number of employees in these categories were 243 which represents about 26.7% 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 the year 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. 11 meetings of the Shop Floor Committees and 11 of the Plant level Committees of the different divisions of the Company were held during the year as against 13 and 2 respectively in the previous year.

10. TARGETS FOR 1994-95

MOU Targets for 1994-95 are Rs. 54 crores of Production and Rs. 56 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 Department of Science & Technology.

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 lin Hindi Stenography and Hindi Typing.

(d) Mini Hindi Magazine Division has been organised in the Hindi Section of the Department. Two Hindi daily newspapers and 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 12th to 19th September, 1994 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 winning officers and officials of the Department were given prizes.

(f) During 1994 - two Hindi Workshops were organised in May, 1994 and September, 1994 for encouraging the Officers/Employees who possess the working knowledge of Hindi for using Hindi in their official work. Certificates are distributed after completion of the Workshop.

(g) Hindi version 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 and Consultancy Development Centre, New Delhi were inspected.

The sanctioned staff strength in the different groups in the Department of Scientific & Industrial Research as on 1.3.1995 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-BHO), Bhopal

Regional Research Laboratory (RRL-BHU), Bhubaneshwar

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

ANNEXURE III.A.1

STATEMENT OF RECOGNITION OF IN-HOUSE R&D UNITS

Month		Receipts	Cumulative Receipts	Disposals	Cumulative Disposals	Cumulative Pendency at the end of the month
December	1993					21
January	1994	11	11	5	5	27
February	1994	4	15	9	14	22
March	1994	7	22	10	24	19
April	1994	9	31	8	32	20
May	1994	7	38	7	39	20
June	1994	8	46	10	49	18
July	1994	8	54	6	55	20
August	1994	10	64	5	60	25
September	1994	6	70	9	69	22
October	1994	4	74	5	74	21
November	1994	7	81	4	78	24
December	1994	10	91	17	95	17

ANNEXURE III.A.2

STATEMENT OF RENEWAL OF RECOGNITION BEYOND 31.03.1994

Month		Receipts	Cumulative Receipts	Renewal applica-tions processed	Cumulative Renewals processed	Cumulative Pendency at the end of the month
December	1993	200	200	-	-	200
January	1994	200	400	-	-	400
February	1994	42	442	97	97	345
March	1994	49	491	92	189	302
April	1994	16	507	55	244	263
May	1994	14	521	113	377	144
June	1994	6	527	111	488	39
July	1994	12	539	16	504	35
August	1994	4	543	30	534	9
September	1994	-	543	9	543	Nil
		543		543		

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.	801
2	Alembic Chemical Works Co. Ltd.	194
3	Alfa-Laval (India) Ltd.	323
4	Altos India Ltd.	187
5	Apollo Tyres Ltd.	134
6	Asea Brown Boveri Ltd.	362
7	Ashok Leyland Ltd.	720
8	Asian Paints (India) Ltd.	309
9	Associated Cement Companies Ltd.	1038
10	Atic Industries Ltd.	150
11	Atul Products Ltd., The	284
12	BASF India Ltd.	105
13	BPL Limited	474
14	BPL Sanyo Utilities and Appliances Ltd.	194
15	BPL Systems & Projects Ltd.	154
16	Bajaj Auto Ltd.	917
17	Bajaj Tempo Ltd.	606
18	Balmer Lawrie & Company Ltd.	296
19	Baroda Rayon Corporation Ltd., The	128
20	Bata India Ltd.	165
21	Bharat Dynamics Ltd.	315
22	Bharat Earth Movers Ltd.	1650
23	Bharat Electronics Ltd.	4251
24	Bharat Heavy Electricals Ltd.	2936
25	Bharat Heavy Electricals Ltd.	184
26	Bharat Heavy Electricals Ltd.	4526
27	Boots Pharmaceuticals Ltd.	194
28	Brakes India Ltd.	299
29	Brimco Plastic Machinery Pvt. Ltd	150
30	Bush Boake Allen (India) Ltd.	110
31	CMC Limited	1366
32	Cadila Laboratories Ltd.	268
33	Camphor & Allied Products Ltd.	109

Sl. No.	Name of the firm	R&D Expenditure (Rs. in Lakhs)
34	Central Electronics Ltd.	194
35	Central Mine Planning & Design Inst. Ltd.	371
36	Cheminor Drugs Ltd.	158
37	Cibatul Limited	144
38	Cipla Limited	700
39	Colour-Chem Limited	224
40	Crompton Greaves Ltd.	601
41	D.C.W. Limited	153
42	DCM Data Products	123
43	Dhampur Sugar Mills Ltd., The	290
44	Dr. Reddy's Laboratories Ltd.	192
45	Dunlop India Ltd.	355
46	E.I.D. Parry (India) Ltd.	181
47	E.I.D. Parry (India) Ltd.	200
48	Eicher Tractors Ltd.	365
49	Electronic Research Ltd.	177
50	Electronics Corporation of India Ltd.	653
51	Engineers India Ltd.	442
52	Escorts Limited	105
53	Escorts Limited	117
54	Excel Industries Ltd.	173
55	Foseco India Ltd.	118
56	Garware Polyester Ltd.	123
57	Garware Wall Ropes Ltd.	109
58	Gharda Chemicals Ltd.	604
59	Glaxo India Ltd.	343
60	Godrej & Boyce Mfg. Company Ltd.	574
61	Godrej Soaps Ltd.	154
62	Goodlass Nerolac Paints Ltd.	140
63	Gujarat Communications & Electronics Ltd.	375
64	Gujarat State Fertilizers Company Ltd.	1047
65	HMT Limited	939
66	HMT Limited	195
67	HMT Limited	109
68	Haryana State Electronics Development Corporation Ltd.	191
69	Hindustan Aeronautics Ltd.	303
70	Hindustan Aeronautics Ltd.	9592

Sl. No.	Name of the firm	R&D Expenditure (Rs. in Lakhs)
71	Hindustan Aeronautics Ltd.	829
72	Hindustan Aeronautics Ltd.	624
73	Hindustan Antibiotics Ltd.	200
74	Hindustan Cables Ltd.	106
75	Hindustan Ciba-Geigy Ltd.	209
76	Hindustan Copper Ltd.	107
77	Hindustan Copper Ltd.	102
78	Hindustan Insecticides Ltd.	105
79	Hindustan Latex Ltd.	100
80	Hindustan Lever Ltd.	1133
81	Hindustan Motors Ltd.	255
82	Hindustan Photo Films Manufacturing Co. Ltd.	132
83	Hindustan Zinc Ltd.	266
84	Hoechst India Ltd.	870
85	IBP Company Ltd.	104
86	ICI India Ltd.	194
87	ICI India Ltd.	103
88	IDL Chemicals Ltd.	115
89	ITC Limited	127
90	Indian Aluminium Company Ltd.	452
91	Indian Drugs & Pharmaceuticals Ltd.	351
92	Indian Oil Corporation Ltd.	1580
93	Indian Petrochemicals Corporation Ltd.	853
94	Indian Telephone Industries Ltd.	3637
95	Indian Telephone Industries Ltd.	829
96	Indian Telephone Industries Ltd.	125
97	Ion Exchange (India) Ltd.	207
98	J.K. Industries Ltd.	160
99	J.K. Synthetics Ltd.	152
100	Jain Irrigation Systems Ltd.	155
101	Johnson & Johnson Ltd.	113
102	Jyoti Limited	142
103	K.C.P. Limited	107
104	Kegfarms Pvt. Ltd.	141
105	Kelvinator of India Ltd.	255
106	Khandelwal Ferro Alloys Ltd.	260
107	Kirloskar Brothers Ltd.	194

Sl. No.	Name of the firm	R&D Expenditure (Rs. in Lakhs)
108	Kirloskar Cummins Ltd.	470
109	Kirloskar Electric Co. Ltd.	147
110	Kirloskar Oil Engines Ltd.	123
111	Kirloskar Pneumatic Co. Ltd.	102
112	Kopran Limited	107
113	Lakshmi Machine Works Ltd.	504
114	Larsen & Toubro Limited	968
115	Lubrizol India Ltd.	419
116	Lucas-TVS Ltd.	335
117	Lupin Laboratories Ltd.	829
118	Lupin Laboratories Ltd.	765
119	MRF Limited	1080
120	Madras Refineries Ltd.	277
121	Mafatlal Industries Ltd., The	147
122	Maharashtra Hybrid Seeds Company Ltd.	239
123	Mahindra & Mahindra Ltd.	333
124	Manugraph Industries Ltd.	109
125	Maruti Udyog Ltd.	1962
126	Merind Limited	163
127	Modern Malleable Casting Works Ltd.	113
128	Modi Rubber Ltd.	213
129	Motor Industries Co. Ltd.	823
130	Mysore Kirloskar Ltd., The	160
131	National Mineral Development Corporation Ltd.	387
132	National Organic Chemical Industries Ltd.	701
133	National Rayon Corporation Ltd., The	171
134	National Telecom of India Ltd.	166
135	National Thermal Power Corporation Ltd.	1022
136	Neore Technology Pvt. Ltd.	126
137	Neyveli Lignite Corporation Ltd.	164
138	Oil & Natural Gas Commission	662
139	Oil India Limited	311
140	Optel Telecommunications Ltd.	185
141	Padmashri Dr. Vithalrao Vikhi Patel Sahakari Sakhar Karkhana Ltd.	317
142	Petrofils Co-operative Ltd.	180
143	Pfizer Limited	132
144	Philips India Ltd.	353

Sl. No.	Name of the firm	R&D Expenditure (Rs. in Lakhs)
145	*Philips India Ltd.*	106
146	Polyolefins Industries Ltd.	350
147	Premier Automobiles Ltd.	873
148	*Premier Instruments & Controls Ltd.*	137
149	Proagro Seed Company Ltd.	141
150	Procter & Gamble India Ltd.	274
151	*Projects & Development India Ltd.*	818
152	Punjab Communications Ltd.	763
153	Punjab Tractors Ltd.	193
154	*Rallis India Ltd.*	227
155	Ramco Industries Ltd.	113
156	Ranbaxy Laboratories Ltd.	534
157	*Rolta India Ltd.*	258
158	Sandoz (India) Ltd.	350
159	Sandvik Asia Ltd.	321
160	*Saraswati Industrial Syndicate Ltd.*	294
161	Semiconductor Complex Ltd.	871
162	Shalimar Paints Ltd.	108
163	*Shriram Industrial Enterprises Ltd.*	105
164	Siemens India Ltd.	486
165	Southern Magnesium & Chemicals Ltd.	795
166	*Southern Petrochemical Industries Corporation Ltd.*	258
167	Southern Petrochemical Industries Corporation Ltd.	219
168	Steel Authority of India Ltd.	3950
169	*Steel Authority of India Ltd.*	237
170	Sudarshan Chemical Industries Ltd.	115
171	Sun Pharmaceutical Industries Ltd.	252
172	*Tamil Nadu Petroproducts Ltd.*	111
173	Tata Chemicals Ltd	106
174	Tata Engineering & Locomotive Co. Ltd.	3077
175	*Tata Hydro-Electric Power Supply Co. Ltd.*, The	372
176	Tata Iron & Steel Co. Ltd., The	727
177	Tata Oil Mills Co. Ltd., The	109
178	*Tata Refractories Ltd.*	335
179	Tata Sons Ltd.	1042
180	Tata Tea Ltd.	282
181	*Thermax Limited*	308

Sl. No.	Name of the firm	R&D Expenditure (Rs. in Lakhs)
182	Torrent Pharmaceuticals Ltd.	513
183	Transpek Industry Ltd.	117
184	United Telecoms Ltd.	110
185	Venco Research & Breeding Farm Ltd.	212
186	Venkateshwara Research & Breeding Farm Ltd.	326
187	Vi-Microsystems Pvt. Ltd	371
188	Vidyut Metallics Ltd.	207
189	Vikrant Tyres Ltd.	168
190	Vintek RF Products Pvt. Ltd.	216
191	Widia (India) Ltd.	404
192	Wipro Infotech Ltd.	631
193	Wockhardt Limited	243

LIST OF IN-HOUSE R&D UNITS IN INDUSTRY REPORTING ANNUAL EXPENDITURE IN THE RANGE OF Rs. 25 LAKHS TO Rs. 100 LAKHS

Sl. No.	Name of the firm	R&D Expenditure (Rs. in Lakhs)
1	Adarsh Chemicals & Fertilisers Ltd.	48
2	Advani-Oerlikon Ltd.	39
3	Advani-Oerlikon Ltd.	30
4	Aerospace Systems Pvt. Ltd.	34
5	Afco Industrial & Chemicals Ltd.	29
6	Amar Dye Chem Ltd.	70
7	Ambalal Sarabhai Enterprises Ltd.	67
8	Amco Batteries Ltd.	48
9	Amphetronix Limited	48
10	Amrutanjan Limited	54
11	Andhra Sugars Ltd., The	56
12	Andrew Yule & Company Ltd.	30
13	Anil Starch Products Ltd., The	29
14	Anupam Machine Tools Ltd.	43
15	Applied Electro Magnetics Pvt. Ltd.	73
16	Applied Electronics Ltd.	68
17	Armour Chemicals Ltd.	27
18	Arvind Mills Ltd.	29
19	Astra-IDL Limited	34
20	Audco India Ltd.	42
21	Autometers Limited	36
22	Bajaj Electricals Ltd.	29
23	Bakelite Hylam Ltd.	46
24	Ballarpur Industries Ltd.	53
25	Bangalore Pharmaceuticals & Research Laboratory Pvt. Ltd.	54
26	Basik Breeders Pvt. Ltd.	70
27	Bayer (India) Ltd.	72
28	Bengal Immunity Ltd.	45
29	Berger Paints India Ltd.	62
30	Bharat Aluminium Company Ltd.	45
31	Bharat Forge Ltd.	26
32	Bharat Heavy Electricals Ltd.	62
33	Bharat Heavy Electricals Ltd.	40

Sl. No.	Name of the firm	R&D Expenditure (Rs. in Lakhs)
34	Bharat Heavy Plate & Vessels Ltd.	72
35	Bharat Petroleum Corporation Ltd.	57
36	Bharat Pumps & Compressors Ltd.	28
37	Bharat Starch & Chemicals Ltd.	51
38	Bhartia Cutler-Hammer Ltd.	84
39	Bhartia Electric Steel Company Ltd.	28
40	Bhoruka Gases Ltd.	38
41	Bicycle & Sewing Machine Research & Development Centres	72
42	Bimetal Bearings Ltd.	26
43	Binani Zinc Ltd.	30
44	Biochem Synergy Ltd.	29
45	Biocon India Pvt. Ltd.	28
46	Biological E. Ltd.	33
47	Blue Star Limited	45
48	Bombay Oil Industries Ltd.	25
49	Bombay Paints Ltd.	28
50	Britannia Industries Ltd.	44
51	Burroughs Wellcome (India) Ltd.	77
52	Cable Corporation of India Ltd.	59
53	Cadbury India Limited	85
54	Carborundum Universal Ltd.	78
55	Castrol India Ltd.	90
56	Catvision Products Ltd.	31
57	Ceat Limited	90
58	Ceat Limited	32
59	Century Textiles & Industries Ltd., The	99
60	Chemfab Alkalis Ltd.	71
61	Chemicals & Plastics India Ltd.	59
62	Chemoleums Pvt. Ltd.	28
63	Chloride Industries Ltd.	91
64	Citurgia Biochemicals Ltd.	32
65	Coats of India Ltd.	44
66	Cochin Refineries Ltd.	75
67	Concept Pharmaceuticals Ltd.	37
68	Continental Device India Ltd.	37
69	Cosmo Films Ltd.	51
70	Cyanamid India Ltd.	80

Sl. No.	Name of the firm	R&D Expenditure (Rs. in Lakhs)
71	DCM Shriram Consolidated Ltd.	55
72	DLF Universal Ltd.	28
73	Datapro Electronics Pvt. Ltd.	29
74	Daurala Sugar Works	31
75	Dey's Medical Stores (Mfg.) Ltd.	59
76	Dharamsi Morarji Chemical Co. Ltd., The	82
77	Divi's Research Centre Pvt. Ltd.	37
78	Dr. Beck & Company (India) Ltd.	25
79	Duke Arnics Electronics Pvt. Ltd.	78
80	Duphar-Interfran Ltd.	38
81	E.Merck (India) Ltd.	34
82	ESAB India Ltd.	35
83	EWAC Alloys Ltd.	84
84	East India Pharmaceutical Works Ltd.	44
85	Eimco Elecon (India) Ltd.	33
86	Elcot Power Controls Ltd.	86
87	Elgi Tyre & Tread Ltd.	52
88	Elin Electronics Ltd.	59
89	Escorts Tractors Ltd.	70
90	Eskayef Limited	94
91	Essen Deinki	60
92	Eternit Everest Ltd.	51
93	Ethnor Limited	34
94	Eureka Forbes Ltd.	72
95	FDC Limited	61
96	Fenner (India) Ltd.	44
97	Ferro Alloys Corporation Ltd.	47
98	Fertilizers & Chemicals Travancore Ltd.	57
99	Flakt India Ltd.	32
100	Flex Industries Ltd.	46
101	Fort Gloster Industries Ltd.	51
102	Franco-Indian Pharmaceuticals Ltd.	36
103	Fuller K.C.P. Ltd.	53
104	GEC Alsthom India Ltd.	92
105	Gajra Gears Ltd.	84
106	Gammon India Limited	25
107	Ganga Agri Seeds Ltd.	30

Sl. No.	Name of the firm	R&D Expenditure (Rs. in Lakhs)
108	Garware Paints Ltd.	31
109	Globe Organics Ltd.	45
110	Godfrey Phillips India Ltd.	57
111	Gokak Mills	32
112	Goodricke Group Ltd.	28
113	Graphite India Ltd.	48
114	Grauer & Weil (India) Ltd.	88
115	Greaves Limited	32
116	Grindwell Norton Ltd.	56
117	Gujarat Alkalies & Chemicals Ltd.	63
118	Gujarat Ambuja Cements Ltd.	33
119	HMT Limited	47
120	Hargovind Bajaj Research & Development Centre	44
121	Hawkins Cookers Ltd.	72
122	Heavy Engineering Corporation Ltd.	82
123	Henkel Chemicals (India) Ltd.	42
124	Herdillia Chemicals Ltd.	65
125	Hico Products Ltd.	78
126	High Energy Batteries (India) Ltd.	93
127	High Polymer Labs (HPL)	38
128	Himalaya Drug Company, The	56
129	Hindalco Industries Ltd.	31
130	Hindoostan Spinning & Weaving Mills Ltd., The	40
131	Hindustan Development Corporation Ltd.	52
132	Hindustan Development Corporation Ltd.	51
133	Hindustan Motors Ltd.	77
134	Hindustan Organic Chemicals Ltd.	44
135	Hindustan Teleprinters Ltd.	30
136	Hutti Gold Mines Company Ltd.	25
137	Hyderabad Allwyn Ltd.	70
138	Hyderabad Industries Ltd.	76
139	IBP Company Ltd.	68
140	IOL Limited	66
141	IPCA Laboratories Pvt. Ltd.	46
142	ITC Limited	51
143	ITI Equatorial Satcom Ltd.	51
144	Incab Industries Ltd.	39

Sl. No.	Name of the firm	R&D Expenditure (Rs. in Lakhs)
145	Indchem ATL Ltd.	41
146	India Foils Ltd.	36
147	India Meters Ltd.	30
148	India Pistons Ltd.	32
149	Indian Dyestuff Industries Ltd.	53
150	Indian Organic Chemicals Ltd.	91
151	Indian Rare Earths Ltd.	50
152	Indian Telephone Industries Ltd.	64
153	Indo National Ltd.	25
154	Indo-American Hybrid Seeds	62
155	Indofil Chemicals Company	42
156	Infar (India) Ltd.	52
157	Infotech Enterprises Pvt. Ltd.	56
158	Instrumentation Ltd.	73
159	International Computers Indian Manufacrures Ltd.	67
160	Jagatjit Industries Ltd.	25
161	Jaya Hind Industries Ltd.	41
162	Jaysynth Dyechem Ltd.	29
163	Jenson & Nicholson (India) Ltd.	51
164	John Fowler (India) Ltd.	26
165	K.E.C. International Ltd.	30
166	Kasila Farms Pvt. Ltd.	44
167	Kilburn Engineering Ltd.	40
168	Kinetic Engineering Ltd.	76
169	Kirloskar Brothers Ltd.	36
170	Klockner Windsor (India) Ltd.	74
171	L&T Gould Ltd.	51
172	L&T-McNeil Ltd.	68
173	L.G. Balakrishnan & Brothers Ltd.	30
174	Lakhanpal National Ltd.	33
175	Lakme Limited	50
176	Laxmi Boilers (South) Pvt. Ltd	26
177	Lectrotek Systems (Pune) Pvt. Ltd.	25
178	Lona Industries Ltd.	49
179	Lupin Chemicals Ltd.	44
180	Lyka Labs Limited	61
181	M.J. Institute of Research	30

Sl. No.	Name of the firm	R&D Expenditure (Rs. in Lakhs)
182	M.P. Electricity Board	28
183	Macmet India Pvt. Ltd.	49
184	Maharashtra Electronics Corporation Ltd.	60
185	Mahendra Hybrid Seeds Company Pvt. Ltd.	39
186	Mahindra Ugine Steel Co. Ltd.	28
187	*Malladi Drugs & Pharamecuticals Ltd.*	48
188	Max India Ltd.	40
189	Mazda Controls Ltd.	28
190	McDowell & Co. Ltd.	39
191	Metal Powder Company Ltd., The	27
192	Metallurgical & Engineering Consultants (India) Ltd.	33
193	Microcon Instruments and Systems	25
194	Micropack Limited	26
195	Modern Woolens Ltd.	35
196	Modi Xerox Ltd.	40
197	Modipon Limited	51
198	Modistone Ltd.	37
199	Monotype India Ltd.	35
200	Montari Industries Ltd.	85
201	Mukand Limited	68
202	Mytimasters' Engineering Pvt. Ltd.	45
203	NGEF Limited	40
204	*NICCO Industries Ltd., The*	45
205	Nalco Chemicals India Ltd.	79
206	National Peroxide Ltd.	55
207	National Radio & Electronics Company Ltd., The	65
208	Navdeep Chemicals Pvt. Ltd.	31
209	Navin Fluorine Industries	66
210	Nepa Ltd., The	47
211	Network Limited	77
212	Nippon Denro Ispat Ltd.	38
213	Nirlon Limited	30
214	Northern Digital Exchanges Ltd.	72
215	Northern Minerals Ltd	40
216	Nuchem Plastics Ltd.	29
217	O/E/N India Ltd.	28
218	Orissa Industries Ltd.	49

Sl. No.	Name of the firm	R&D Expenditure (Rs. in Lakhs)
219	Otis Elevator Co. (India) Ltd.	80
220	P.I. Industries Ltd.	53
221	PSI Data Systems Ltd.	25
222	Pace Elcot Automation Ltd.	87
223	Paharpur Cooling Towers Ltd.	27
224	Paper Products Ltd.	55
225	Parke-Davis (India) Ltd.	46
226	Pennwalt India Ltd.	25
227	Philips India Ltd.	80
228	*Phillips Carbon Black Ltd.*	95
229	Pidilite Industries Ltd.	66
230	Porritts & Spencer (Asia) Ltd.	67
231	Praga Tools Ltd.	50
232	Premier Polytronics Ltd.	35
233	Priyaraj Electronics Pvt. Ltd	80
234	Process & Products Development Centre	36
235	Pudumjee Pulp & Paper Mills Ltd.	33
236	Punjab Wireless Systems Ltd.	36
237	Purolator India Ltd.	39
238	Rainbow Ink & Varnish Manufacturing Co. Ltd.	27
239	Ralliwolf Limited	44
240	Rane (Madras) Ltd.	84
241	Raptakos Brett & Co. Ltd.	44
242	*Rashtriya Chemicals & Fertilizers Ltd.*	63
243	Rathi Industrial Equipment Co. Ltd.	31
244	Raymond Woollen Mills Ltd., The	41
245	Reckitt & Colman of India Ltd.	28
246	Reliance Industries Ltd.	77
247	Reliance Industries Ltd.	37
248	Renewable Energy Systems Pvt. Ltd.	68
249	Rhone-Poulenc (India) Ltd.	36
250	Rinki Industries Oils Ltd.	48
251	Rosemount (India) Ltd.	35
252	Roussel India Ltd.	35
253	Ruby Mills Ltd., The	28
254	S.D. Technical Services Pvt. Ltd.	33
255	S.H. Kelkar & Company Ltd.	26

Sl. No.	Name of the firm	R&D Expenditure (Rs. in Lakhs)
256	SAJ Froude Test Plant Pvt. Ltd.	58
257	SRF Limited	49
258	Samtel (India) Ltd.	26
259	Sapana Polyweave Pvt. Ltd.	34
260	Sealol Hindustan Ltd.	66
261	Searle (India) Ltd.	63
262	Secure Meters Ltd.	37
263	Shaw Wallace Gelatines Ltd.	32
264	Shree Synthetics Ltd.	28
265	Shyam Antenna Electronics Pvt. Ltd.	58
266	Siemens Telematik Ltd.	43
267	Simpson & Co. Ltd.	46
268	Siris Limited	46
269	Smithkline Beecham Consumer Healthcare Ltd.	33
270	Speck Systems Pvt. Ltd.	69
271	Sree Rayalseema Alkalies & Allied Chemicals Ltd.	35
272	Standard Industries Ltd.	56
273	Standard Industries Ltd.	45
274	Standard Organics Ltd.	29
275	Sumitra Pharmaceuticals & Chemicals Ltd.	87
276	Sundaram Clayton Ltd.	45
277	Sundram-Abex Ltd.	90
278	Swadeshi Polytex Ltd.	30
279	T. Stanes & Company Ltd.	70
280	TIL Limited	43
281	TIPPCO Industries Ltd.	36
282	TVS Electronics Ltd.	50
283	TVS-Suzuki Limited	80
284	Talbros Automotive Components Ltd.	32
285	Tamil Nadu Dadha Pharmaceuticals Ltd.	37
286	Tamil Nadu Electricity Board	42
287	Tamil Nadu Newsprint and Papers Ltd.	78
288	Tata Elxsi (India) Ltd.	60
289	Tata Telecom Ltd.	46
290	Tata-Robins-Fraser Ltd.	49
291	Television & Components Ltd.	28
292	Textool Company Ltd.	77

Sl. No.	Name of the firm	R&D Expenditure (Rs. in Lakhs)
293	Titanium Equipments & Anode Mfg. Co. Ltd.	35
294	Tractor Engineers Ltd.	37
295	Tractors & Farm Equipment Ltd.	80
296	Travancore Titanium Products Ltd.	35
297	Travancore-Cochin Chemicals Ltd., The	25
298	Triveni Structurals Ltd	25
299	Tube Products of India	29
300	USV Limited	90
301	Ugar Sugar Works Ltd., The	38
302	Unichem Laboratories Ltd.	78
303	Unique Chemicals	35
304	Unique Pharmaceuticals Laboratories Pvt. Ltd.	27
305	United Catalysts India Ltd.	44
306	United Phosphorous Ltd.	70
307	Universal Cables Ltd.	49
308	Uptron India Ltd.	50
309	VST Tillers Tractors Ltd.	52
310	VXL Engineers Ltd.	54
311	VXL India Ltd.	54
312	VXL Instruments Ltd.	30
313	Vam Organic Chemicals Ltd.	43
314	Venkateshwara Hatcheries Ltd.	57
315	Voltas Limited	29
316	Voltas Limited	42
317	W.S. Industries (India) Ltd.	32
318	Walchandnagar Industries Ltd.	61
319	Wander Limited	69
320	Webfil Limited	95
321	Wheels India Ltd.	64
322	Wipro GE Medical Systems Ltd.	30
323	Wires and Fabriks (SA) Ltd.	26
324	Wyeth Laboratories Ltd.	88
325	Yamuna Gases & Chemicals Ltd.	35
326	Zandu Pharmaceuticals Works Ltd.	36

LIST OF SCIENTIFIC AND INDUSTRIAL RESEARCH ORGANISATIONS APPROVED DURING 1994*

AGRICULTURAL, NATURAL & APPLIED AND MEDICAL SCIENCES

Sl. No.	Name of the Institution	Approval valid upto
1.	Shivsadan Renewable Energy Research Institute, Sangli	31.3.1996
2.	Indore Cancer Foundation, Indore	31.3.1996
3.	Trust for Fundamental Research in Space Dynamics and Celestial Mechanics, New Delhi	31.3.1996
4.	Society for Researches in Fundamental and Applied Sciences, Hanumkonda.	31.3.1996
5.	Central Coir Research Institute, Alleppey.	31.3.1997
6.	Pondicherry University, Pondicherry.	31.3.1997
7.	Deen Dayal Research Institute, New Delhi.	31.3.1997
8.	Jawaharlal Nehru Cancer Anusandhan & Nidan Samiti, Ajmer.	31.3.1996
9.	Shri Chhotabhai B. Patel Research Centre for Chemistry and Biological Sciences, Bombay	31.3.1996
10	Oil Technologists' Association of India, Kanpur	31.3.1996
11	Nowrosojee Wadia Maternity Hospital Sir Ness Wadia Research Society, Bombay	31.3.1996
12	The M.M.M. Heart Foundation and Research Centre, Madras	31.3.1996
13	Waterfalls Institute Of Technology Transfer, New Delhi	31.3.1996
14	Foundation for Innovation and Technology Transfer, New Delhi.	31.3.1996
15	Sheth Vadilal Sarabhi Medical Research Foundation Trust, Ahmedabad	31.3.1996
16	Blind Men's Association, Ahmedabad	31.3.1997
17	R&D Centre for Clay Roofing Tiles, Bricks and Other Ceramic Products, Srinivasnagar	31.3.1996
18	Aspee Agricultural Research and Development Foundation, Bombay	31.3.1996
19	Uttar Pradesh Krishi Anusandhan Parishad, Lucknow	31.3.1996
20	Sri Venkateswara Institute of Medical Sciences, Tirupati	31.3.1996
21	Bioved Research and Communication Centre, Allahabad	31.3.1997
22	The South Indian Sugarcane and Sugar Technologists' Association, Madras	31.3.1996
23	The Association of Surgeons of India, Chepauk, Madras	31.3.1997

* These organisations were also concurred in for Notification u/s 35(1)(ii) of the I.T. Act. 1961.

LIST OF SCIENTIFIC AND INDUSTRIAL RESEARCH ORGANISATIONS APPROVED DURING 1994*

SOCIAL SCIENCES

Sl. No.	Name of the Institution	Approval valid upto
1.	Madras School of Economics, Madras.	31.3.1996
2.	Sri Chandrasekharendra Saraswati Viswa Maha Vidyalaya, Kancheepuram	31.3.1996
3.	Lalbhai Dalpatbhai Institute of Indology, Ahmedabad	31.3.1996
4.	Indira Gandhi Institute of Development Research, Bombay	31.3.1996
5.	National Foundation for India, New Delhi	31.3.1997

* These Organisations were also concurred in for Notification u/s 35(1)(iii) of the I.T. Act. 1961.

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

Sl. No.	Name of the Company	Lab where know-how developed	Rs. in Lakhs	Item of manufacture
1.	Renewable Energy Systems Pvt Ltd., Hyderabad	DRDL	26	Lithium Sulphur Dioxide Cells
2.	Metchem Silicon Ltd., Madras	IISc, Bangalore & In-house	20	Polysilicon, Silicon ingots Silicon Wafers
3.	Jyoti Ceramics Industries Pvt Ltd., Bombay	In-House	136	High Density High Alumina Ceramic Grinding Media.
4.	Prestress(I) Pvt Ltd., Bombay	RDSO,Lucknow	4	Mono-block Concrete Sleepers
5.	Herdillia Chemicals Ltd. Bombay	In-House	291	Alkyl Phenols namely Para Octyl Phenol (POP), Para Tertiary Butyl Phenol (PTBP) and Para Cumyl Phenol (PCO)
6.	Kapricon Sleeper Works Pvt Ltd., Bombay	RDSO, Lucknow	19	Mono-block Concrete Sleepers
7.	Larsen & Toubro Ltd., Bombay	C-DOT	234	128 P EPABX and 128 P/512 P RAX
8.	Veejay Lakshmi Engg. Works (Pvt) Ltd Coimbatore	SITRA	188	Two for One Twistor
9.	Punjab Tractors Ltd. SAS Nagar	CMERI, Durgapur & In-house	719	Agricultural Tractors, Harvestor Combines, Gray Iron Castings and Industrial Fork Lifts.
10.	Chemstar Organics (I) Pvt Ltd, Bombay	In-House	351	Meta-Phenoxy Benzaldehyde Alpha Naphthyl Acitic Acid Phenyl Acitic Acid (Multi purpose plant).
11.	P.I.Industries. Ltd Udaipur	In-House	254	Dichlorovos, Monocrotophos

Sl. No.	Name of the Company	Lab where know-how developed	Rs. in Lakhs	Item of manufacture
12.	Manganese Ore India Ltd Nagpur	NML, Jamshedpur	349	Electrolytic Manganese Dioxide
13.	C.S.Zircon Products Pvt Ltd., Kala Amb	BARC, Trombay	50	Zirconium Oxide
14.	Kinetic Engineering Ltd., Pune	In-House	96	Safari Motor Cycle, Built Up Structure Wheel, Digital Colour T.V
15.	Hakatronics Pvt Ltd., Bombay	In-House	2	Microprocessor based Electronic Equipment
16.	Ventech Industry Ltd., Hyderabad	IICT, Hyderabad	244	Monocrotophos, Buta Chlor & Their Formulation
17.	Renewable Energy Systems Pvt Ltd., Hyderabad	DRDL & In-house	2	Thermal Batteries
18.	The Time Engineers Chandarpur	CBRI, Roorkee	2	Mini Climbing Crane
19.	Metkem Silicon Ltd. Madras	IISc, Bangalore	38	Polysilicones, Silicon Ingots, Silicon Wafers.
20.	Filtra Speciality Catalysts, Bombay	Filtra Material Research Pvt Ltd.	13	Catalysts

ANNEXURE III.D.

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

Sl. No.	Name of the Company	National Laboratory	Rs. in Lakhs	Scientific Project/Programme
1.	Cochin Refineries Ltd., Ernakulam	Indian Institute of Petroleum, Dehradun	3.85	Development of process for recovery of high BMCI (CBFS), waxes and low pour cutter stock from CLO produced from FCCU.
2.	Tetragon Chemie Pvt. Ltd., Bangalore	National Chemical Laboratory, Pune	10.00	To develop a process for manufacture of D(+) Biotin.
3.	Hindustan Organic Chemicals Ltd., Rasayani	National Chemical Laboratory, Pune	10.00	Recovery of cumene from cumene heavy ends by transalkylation.
4.	Cochin Refineries Ltd., Ernakulam	Indian Institute of Petroleum, Dehradun	20.00	Development of suitable catalysts and process for desulphurisation of fuel gases.

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 Planning & 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
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
PATSER	Programme Aimed at Technological Self Reliance
RDI	Research and Development by Industry
RRL	Regional Research Laboratory
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

PRINTED AT THE OFFSETTERS, NEW DELHI TEL. : 4698383, 4629696